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A strategic sustainability model for global luxury companies in the management of CO_2 emissions

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Abstract

Luxury brands are at the forefront of sustainability efforts and carbon emission reductions to fight climate change. The goal of this paper is to analyze such climate change challenges in terms of cost efforts within large luxury conglomerates. In doing so, financial metrics have been gathered for the top 100 companies in the luxury sector and compared against CO_2 emissions metrics with regressive methods. This enables the study of relationships between sustainability and finance to explore if sustainability is expensive and if sustainability is explained by costs, sales, taxes, or investment. Such works allow the setting of conclusions on financial and managerial decisions and, moreover, set a new framework of analysis based on financial variables and the positive or negative impact on CO_2 emissions, such as which financial variables generate more CO_2 emissions (luxury sales, capital investment and financial cost) and which help to reduce such emissions (cost of goods sold, general expenses and taxes).

Keywords Sustainability · CSR · Strategy · CO_2 emissions · Luxury brands · Cost analysis

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Introduction

Climate change is one of the main challenges humanity has to face[1]; people are already experiencing the consequences due to increased CO_2 emissions measured in CO_2 tons (Huang et al., 2015; Kapferer, 2010) and other greenhouse gases (GHGs) as energy consumption in recent years has grown exponentially due to the wealth and prosperity of rich countries (IPCC, 2022). This state has led to numerous inequalities between countries and unsustainable consumption that directly affects the increase in these emissions (Cappelli & Di Bucchianico, 2022). To alleviate the situation, a change in behaviour is needed to optimize and respect available resources, as well as to transform supply chains to reduce emissions. This is where sustainability comes in as a driver of lifestyle change for individuals and companies (Brenot et al., 2019; Wren, 2022).

Moreover, sustainability is becoming increasingly important in companies to ensure the survival of businesses in such a way that the challenges of the future are integrated, considering the axes on which sustainability operates, namely, the economic, environmental, social, and governance areas (ESG). The United Nations (2015) established the 17 Sustainable Development Goals (SDGs) to achieve a better and more sustainable world and companies worldwide are communicating their activities related to the SDGs in their annual reports, specifically SDG 12 (responsible consumption and production) and SDG 13 (climate change).

The luxury industry is no stranger to the increased focus on the ecological impact of consumption (Aleem et al., 2022; Beckham & Voyer, 2014; Kunz et al., 2020). Holdings such as LVMH have had environmental departments since 1992 (Cavender, 2018), and even Kering changed the former name of the holding (previously PPR) and introduced an EP&L – Environmental Profit and Loss – statement to demonstrate, among other aspects, sustainability as a fundamental axis of its business model (Arribas-Ibar et al., 2022; Brenot et al., 2019). It is also striking that more and more luxury industry holdings are producing sustainability reports following Global Reporting Initiative (GRI) standards or incorporating ISO 26000 in their management; they are also being included in the Dow Jones Sustainability Index (Brenot et al., 2019; Galli & Bassanini, 2020; Wells et al., 2021). Moreover, the luxury industry has a strong influence on the market and its shift towards sustainability; beyond being considered a trend in the industry (Böhnert et al., 2023), it has been essential for other companies in other sectors and even low-cost companies to follow suit (Beckham & Voyer, 2014; Neumann et al., 2020).

Among all the challenges related to sustainability, the luxury industry is focusing on climate change (Pavione et al., 2016; López & Rangel, 2022; Wren, 2022) as it is mostly dependent on natural resources for its business continuity. This explains why many of the measures being developed by the luxury industry focus on the reduction of resources along the supply chain, such as energy or water reduction and optimization (Brenot et al., 2019), as well as the reduction of polluting emissions such as

[1] As commonly measured in CO_2 tons.

CO_2 or waste materials (Arrigo, 2018). In addition, to taking care of the environment to consume less and last longer, the investment made by the luxury industry also implies a reduction in costs derived from taxes or legal regulations, which in turn leads to efficiencies that can improve the competitiveness of these companies in the market (López et al., 2023; Pavione et al., 2016). It also helps to maintain its superiority over other brands in lower segments, thus ensuring the economic sustainability of the company and dedicating profits to social and environmental improvements (Arrigo, 2018; Brenot et al., 2019; Kapferer, 2010).

Considering that companies are reporting their activities related to sustainability, some studies show that there is no relationship between GRI reports and a lower impact on CO_2 emissions (Belkhir et al., 2017). However, other studies associate greater growth with increasing CO_2 emissions, because it represents a greater consumption of resources such as energy (Shahbaz et al., 2013a). Nevertheless, other studies show a relationship between higher financial development and lower consumption of carbon dioxide emissions (Godil et al., 2020; Shahbaz et al., 2013b). Consequently, the objective of this research is to show the relationship between activities and CO_2 emissions in the luxury industry to solve the gap in the literature about the measurement of sustainable activities from companies. To show it, this study focuses on studying whether the reduction in CO_2 emissions in the luxury industry can be analysed upon on financial metrics and, therefore, if such metrics can be used to assess climate change. In doing so, this research proposes a model useful for business decision-making linking finance and sustainability.

In sum, this paper contributes to the theory and practice in some respects based on the luxury industry analysis: first, to improve knowledge of how companies can measure their sustainable activities to fight climate change; second, to show how companies can reduce CO_2 emissions using financial metrics; and third, to better understand the impact of reducing costs and improving the competitiveness of companies.

This paper is structured as follows. First, a review has been conducted of the literature on sustainability in companies, its relationship with CSR, and the luxury industry to understand what companies are doing to reduce their CO_2 emissions. Second, the methodology followed, based on IPCC methodology, and the sample of companies used for this analysis is described. Third, the authors examined the results obtained for luxury conglomerates showing a contrasted model to understand the relationship between sustainability and finance variables. Fourth, there is a discussion with some implications for companies based on the model; then some limitations and some suggestions for future research are presented. Finally, some conclusions are included in this paper.

Literature review

Sustainability as a global challenge for companies

Sustainability is a concept connected to society's challenges and companies' strategies and is related to the Corporate Social Responsibility (CSR) of companies (Carroll, 2021), understanding this concept as "the responsibility that companies have for their

impact on society" (EC, 2011). In addition, sustainability refers to the company's ability to meet its needs without compromising future generations" (Holden et al., 2014; Maldonado-Erazo et al., 2020). In this sense, sustainability has become a crucial area for companies and society, among others, due to the concern identified with the problems derived from climate change (WEF, 2022, 2023).

Moreover, CSR and sustainability represent how companies report on their commitments to sustainability (Baronet & Tremblay, 2015; Carroll, 2021; Muñoz et al., 2020) considering the economic, social, and environmental dimensions. Thus, CSR is a stage prior to achieving sustainability and both terms evolve together because one of the main goals for companies is to be sustainable in their management with stakeholders (Sánchez-Teba et al., 2021). In other words, CSR is a business strategy that directly contributes to the sustainability of companies (Nave & Ferreira, 2019; Yu & Liang, 2020).

On the other hand, at the regulatory level, there is increasing pressure from supranational bodies such as the European Union to adopt ESG measures in all areas, including in the management of the entire value chain of companies (Baratta et al., 2023). In addition, there are other authors who link environmental innovation in companies with lower CO_2 emissions (Albitar et al., 2023), as well as the promotion of the circular economy in all processes to minimize these emissions (Yusuf & Lytras, 2023).

To analyze their contributions, companies publish an annual sustainability report communicating their commitments, strategic results, and global impacts through different measures. In this sense, sustainability is assumed by companies strategically considering the expectations of their stakeholders (Carroll, 2021). In this sense, companies worldwide follow the sustainable development goals (SDGs) (ElAlfy et al., 2020) promoted by the United Nations in its Agenda 2030 and summarized in the 17 SDGs and specific objectives, such as the reduction of CO_2 emissions, water, and waste, among other priorities for companies from all industries (Secinaro et al., 2020). The lack of objective measurement metrics and their evolution makes some companies reluctant to further engage in the SDGs and their contribution is better known as 'greenwashing' (Buonocore et al., 2019; Layaoen et al., 2023).

Despite this effort in reporting, it is worth highlighting other studies that show that there is no relationship between the measurement made in the GRI reports and a lower impact on CO_2 emissions (Belkhir et al., 2017). In terms of metrics, there are studies that relate greater growth to an increase in CO_2 emissions, given that it implies a greater consumption of resources such as energy (Shahbaz et al., 2013a). However, other studies show the relationship between higher financial development and lower consumption of carbon dioxide emissions (Godil et al., 2020; Shahbaz et al., 2013b).

Sustainability in the luxury industry

Luxury has evolved from the most basic associations with exclusivity towards a higher conception where sustainability, ethics, and respect for human rights are also integrated (Jaegler & Goessling, 2020; Pavione et al., 2016). All this without losing

the essence of true luxury related to quality, uniqueness, creativity, craftsmanship, or excellence (Ricca & Robbins, 2012). In fact, considering that sustainability goes beyond the environment and promotes fair development at an economic and social level (Kapferer & Michaut-Denizeau, 2019), the luxury industry has gone in search of the highest quality through the transformation of its supply chain. In this sense, authors such as Batat (2020) define luxury brand consumers as those who consume luxury products and/or services that do not compromise the needs of future generations for which they have high expectations (Kapferer, 2010). Moreover, this type of consumer would be more willing to purchase luxury products or services from brands that communicate their sustainability initiatives and progress (Amatulli et al., 2021).

There is a large debate in the literature on whether luxury and sustainability are compatible (Dekhili et al., 2019; Kapferer & Michaut-Denizeau, 2017, 2019; Osburg et al., 2022) or whether luxury itself can be sustainable. On the one hand, some scholars argue that those are antagonistic concepts because luxury is related to excess and prices that are far from their functional value, or who do not welcome the use of recycled materials, or those who understand sustainability efforts as mere greenwashing (Quach et al., 2022), something that would explain why some luxury brands do not communicate their commitments to sustainability (Böhnert et al., 2023). On the other hand, there is another current, which understands sustainability as the very heart of luxury, given that its products are made to last over time, and where quality takes precedence over quantity (Kapferer, 2010), hence luxury depends on sustainability (Arrigo, 2018). Faced with these tensions, generations such as Millennials and, above all, Generation Z, are leading a greater concern for the environmental impact of their purchases of luxury brands and services (Quach et al., 2022). For this reason, the growth of new business models related to the circular economy is increasing, such as the second-hand market in the fashion sector in which some luxury industry holding companies have also joined (Arribas-Ibar et al., 2022; Kelleci, 2022).

In fact, the luxury industry has been under great pressure from different stakeholders and new regulations (Hemonnet-Goujot et al., 2022; Jaegler & Goessling, 2020; Kapferer, 2010) to incorporate sustainability into the core of its business to ensure its survival and competitive advantage (Arribas-Ibar et al., 2022). What used to be a bet of a few, such as LVMH and Kering, is now being consolidated as a strategic factor in the protection of reputation, business development, and the search for new business models (Dekhili et al., 2019; Kapferer & Michaut-Denizeau, 2019; Lopez & Rangel, 2022). Indeed, consumers are increasingly receptive to initiatives that promote reducing their environmental impact through recycling, or the use of alternative materials (Aleem et al., 2022; Colella et al., 2022; Kunz et al., 2020; Quach et al., 2022; Sun et al., 2022). Indeed, beyond status, the consumption of sustainable luxury brands is seen as aspirational to demonstrate people's socio-cultural status and discernment (Currid, 2017; Kapferer, 2010).

Among other factors, one of the pillars of sustainability in the luxury industry is determined by its capacity for innovation (Hemonnet-Goujot et al., 2022; Pavione et al., 2016) throughout the supply chain, as well as its ability to transfer its sustainability efforts to society (Akrout & Guercini, 2022), as is being done by large luxury conglomerates (Quach et al., 2022). In terms of types of innovation, Varadarajan

(2017) distinguishes between: innovation aimed at being more efficient, in order to reduce the impact of climate change on the company's business by making better use of the company's resources; the innovation aimed at eliminating aspects that are harmful to health in terms of sustainability; and the innovation that seeks substitution with other materials or energy sources that are friendlier to the planet (Hemonnet-Goujot et al., 2022).

Given that luxury management is a long-term strategy, its involvement with sustainability ensures the protection of natural resources and the communities in which it operates (Donato et al., 2019). However, the sustainability challenge for the luxury industry is its impact on the environment; hence, the reduction of CO_2 emissions, water and waste are among the priorities for the entire industry (Brenot et al., 2019; Osburg et al., 2022). For example, Tiffany takes care of the conditions of the communities where the precious stones are mined; LVMH has been auditing its emissions since 2004 (Kapferer, 2010); Gucci aims to halve CO_2 emissions by 2050 (Kang & Sung, 2022); and Chanel has committed to using more efficient energy sources (Lo & Ha-Brookshire, 2018). In contrast, the luxury sectors that emit the most CO_2, and have the most work ahead of them, are aviation and private tourism, tourism, and large-scale housing (Cappelli & Di Bucchianico, 2022).

For all these reasons, an objective and replicable model is needed that relates the activity of the company as a whole and CO_2 emissions (Geng et al., 2022; Tao et al., 2023), so that the results allow companies and regulators to make management decisions in the interests of sustainability.

The hypothesis that represents the aforementioned objective is the following:

CO_2 emissions should be considered because of the company's sales, the cost of those sales, the company's overheads, taxes, financial costs, and capital investments.

The hypothesis is expressed in this model and results will be presented in "Results" section.

$$CO2 = \beta 0 + \beta 1(LuxGoodSales) + \beta 2(COGS) + \beta 3(MktgExp) + \beta 4(Tax) + \beta 5(CAPEX) + \beta 6(FinExp) + Ui$$

The methodology that implements this hypothesis, and its results and conclusions, are set forth in the following sections showing the model used in this research.

Methodology

The work contained in this study compares financial metrics on the top 100 companies in the luxury sector, and CO_2 emissions metrics using IPCC methodology as a common standard for all companies on their climate impact as measured in CO_2 emissions (Downie & Stubbs, 2013; Hertwich & Wood, 2018). These top 100 companies have been determined upon worldwide revenue and are published by Deloitte annually in their report "Global Powers of Luxury Goods" (Deloitte, 2020).

These top 100 companies in the luxury sector are a mix of companies mainly from the fashion industry, wines, watches, jewelry, and cosmetics; yet also include some firms oriented to luxury in other industries, like aircraft services and computers. The

largest number of companies are from Europe (France, Italy, and Switzerland) and the United States, yet Asian markets (China and Japan) are growing in importance. Additionally, the top 100 companies represent an aggregate sales figure of 281 billion USD, as opposed to a total amount of sales for the sector of 305 billion USD (Statista, 2023). Therefore, these top 100 luxury companies represent 92% of the luxury sector, meaning this sample has a large coverage of the industry itself, this being one of its advantages. Other advantages would be traceability in time (given the sample is composed of specific companies) or access to additional information (given companies do publish data in addition to sustainability matters, such as financial, labour, import/export, etc.).

A relevant point in the same that is set forth for this analysis is that, as previously stated, it contains an array of companies that encompass different industries and, therefore, allows for the generalization of conclusions from the study. This is unusual in this type of sample for this variability is a characteristic of random sampling (non-selective sampling among all observations in the population) yet this is a cluster sample (top 100 observations in the population) (Wooldridge, 2003). Therefore, the disadvantages of this sample analysis are reduced to a minimum.

The data that has been obtained refers to the year 2019. This is the last year where data is available and not influenced by the Covid-19 pandemic. Therefore, any impact on costs generated by pandemic restrictions (international bans on imports, lack of consumer activity) is avoided in the methodology of this paper. Additionally, the Covid-19 pandemic has resulted in a change in customer behaviour in the following years (Roggeveen & Sethuraman, 2020). This means that a structural change will certainly show up in the data for any model or hypothesis. Structural change is a clear source of problems in the world of statistics. Specifically, forecast failure is mainly due to structural breaks (Castle et al., 2016) and, therefore it is only best to wait for structural changes, like those related to the Covid-19 pandemic, to settle so that they can be analyzed with statistical, and therefore empirical, relevance. Meaning: While using 2019 data may look like a limitation, it is only a provident approach to structural changes that would clearly bias any empirical conclusion.

The financial metrics used in this paper have been chosen discretionally: luxury goods sales, costs of goods sold, other general expenses, financial costs, tax, and capex. The reason these metrics have been chosen is that they cover all potential costs within an enterprise, except for those that are exceptional and that are not the object of this study. Additionally, they are commonly available in public sources. Specifically, this data has been obtained from each entity's publications and or those of the stock regulators who trade such company's equity. All of them have been measured by IFFS (International Financial Reporting Standards, 2023).

Additionally, metrics on CO_2 emissions have been obtained for each company upon IPPC standards as published by each company. This IPCC methodology sets a common standard for all companies to report on their climate impact as measured in CO_2 emissions (Downie & Stubbs, 2013; Hertwich & Wood, 2018).

In order to compare the aforementioned financial metrics and the data on CO_2 emissions, an initial descriptive analysis has been performed, specifically on the performance of each variable and the correlation between all variables. Regarding

Table 1 Summary statistics

	Mean	Median	S.D.	Min	Max
CO_2Scope12Tons	76722	48479	1.04E+05	2515	3.64E+05
LuxurygoodssalesM	17318	14894	13886	8043	54938
COGSM	1268	977.2	1486	40.52	5261
GeneralexpednsesM	711.9	538.8	849.9	29.95	3006
TaxM	527.9	356.4	639.7	17.37	2255
CAPEXM	2367	1683	2984	104.8	10523
FinancialcostsM	355.6	235.2	426.3	11.32	1503

Source: Self-elaboration based on Deloitte data (2020)

the performance of each variable, data shows that the population of entities within the scope of this paper is quite diverse in volume and heterogeneity.

As shown in the summary statistics (Table 1), the data on each variable is quite diverse, given the minimum data for each variable is very low in comparison to its mean (i.e. the average cost of goods sold is 1,268 million USD, whereas the minimum is only 40.52 million USD, which is 31 times less than the average). This variability reflects the diversity in the market and, also, the wide scope of the analysis in this paper.

Regarding the relationship between each variable, a correlation analysis has been performed:

The correlation matrix (Table 2) shows strong relationships between all variables at hand. All correlations are very close to the un-it in absolute value and none of them are below 0.9. This actually makes sense when it comes to financial metrics, for they are believed to be interconnected (i.e., the higher the cost of goods sold, the higher the sales, etc.). Yet the high correlation of all metrics with the CO_2 emissions reflects that the data at hand which is subject to our study does have a relationship that is worth studying (Tables 3 and 4).

Given the above descriptive analysis for the two sets of data at hand (financial and CO_2 emissions metrics), a comparison between variables has been performed upon regressive methods. Regression is a statistical technique used to analyze the relationship between two or more variables (Freedman, 2009). In regression analysis, one

Table 2 Correlation matrix

CO_2Scop~	Luxurygo~	COGSM	Generalex~	TaxM	CAPEXM	Financia~	
1.0000	0.9717	0.9897	0.9665	0.9830	0.9875	0.9851	**CO_2Scope12Tons**
	1.0000	0.9669	0.9720	0.9745	0.9760	0.9646	**LuxurygoodssalesM**
		1.0000	0.9963	0.9950	0.9957	0.9974	**COGSM**
			1.0000	0.9964	0.9966	0.9977	**GeneralexpednsesM**
				1.0000	0.9965	0.9983	**TaxM**
					1.0000	0.9954	**CAPEXM**
						1.0000	**FinancialcostsM**

Source: Self-elaboration based on Deloitte data (2020)

Table 3 Model results

	coeff.	std.err.	t-ratio	p-value
Const.	-56593.5	20414	-2.772	0.0694*
LuxurygoodssalesM	8.07454	3.29912	2.447	0.0919*
COGSM	-23.2183	66.3028	-0.3502	0.7493
GeneralexpednsesM	-201.46	134.137	-1.502	0.2301
TaxM	-719.846	317.691	-2.265	0.1085
CAPEXM	32.6929	27.3694	1.195	0.3181
FinancialcostsM	1318.26	659.731	1.998	0.1396
Mean dependent var	76721.58		**S.D. dependent var**	104045.1
Sum squared resid	5.87E+08		**S.E. of regression**	13986.39
R-squared	0.993977		**Adjusted R-squared**	0.98193
F(6,3)	82.5087		**P-value (F)**	0.002031

Source: Self-elaboration based on Deloitte data (2020)

variable (the dependent variable) is predicted or modelled based on the effects of one or more other variables (the independent variables).

This hypothesis is expressed in the following algorithmic model:

$$CO2 = \beta 0 + \beta 1(LuxGoodSales) + \beta 2(COGS) + \beta 3(MktgExp) + \beta 4(Tax) + \beta 5(CAPEX) + \beta 6(FinExp) + Ui$$

A brief comment on potential disadvantages of regressive methods – multicollinearity and endogeneity – both being related to bias in the method itself. On the one hand, multicollinearity, which refers to several independent variables in the model being related to each other and may cause bias in the conclusions given the same effect is considered in several variables, therefore exaggerating that impact. For example, should there be a common devaluation of the USD – the currency that measures all financial variables in the data – that devaluation would be considered by all six variables in the model and, therefore, would exaggerate the impact in the results of such devaluation. Still, it is commonly accepted in statistics that this exaggeration or *bias* does not actually impact the regressors of the model (β) but rather the error only, as

Table 4 Contrast model results

	coeff.	std.err.	t-ratio	p-value
Const.	-20316.2	15924.6	-1.276	0.2427
LuxurygoodssalesM	2.05447	2.18288	0.9412	0.378
TaxM	116.421	47.3821	2.457	0.0437**
Mean dependent var	76721.58		**S.D. dependent var**	104045.1
Sum squared resid	2.92E + 09		**S.E. of regression**	20423.2
R-squared	0.970032		**Adjusted R-squared**	0.96147
F(6,3)	113.2907		**P-value (F)**	4.66E-06

Source: Self-elaboration based on Deloitte data (2020)

stated by Lindner et al. (2020), who claim that multicollinearity does not affect the validity of regression coefficients, meaning multicollinearity does not bias coefficients, but only inflates standard errors. Therefore, multicollinearity has been accepted as an acceptable characteristic in this methodology.

On the other hand, endogeneity, which refers to independent variables being related to the error in the model, and therefore implies bias, is commonly solved by the elimination of such endogenous variables in a model. Still, considering the problems of omitting variables, the main being the loss of information, it is always preferable to include the variable (Cameron & Trivedi, 2005).

Finally, this methodology does not refer to a clear control variable. This is actually due to the fact that this study is not theoretical but rather experimental, meaning it used data in the real world and not generated in an isolated laboratory. Therefore, control variables cannot be set by the researcher. Still, there are common grounds for the data in use, like the standard of measurement (IFRS, IPCC), or even the currency for independent variables (SD), all of which can be considered control variables from a strict point of view.

Results

The aforementioned model establishes which relation there is between CO_2 emissions and each one of the financial metrics quoted above for the year 2019. Results are shown in the following section.

The resulting model reflects several aspects regarding: (i) the impact of each financial metric on CO_2 emissions; (ii) the relevance of the model in general; (iii) the relevance of each variable independently; and (iv) further improvements in the relationship breakdown, as shown below:

$$\begin{aligned} CO2 = &- 56{,}593.5 + 8.07(LuxGoodSales) - 23.21(COGS) \\ &- 201.46(GeneralExp) - 719.48(Tax) \\ &+ 32.69(CAPEX) + 1.318.26(FinExp) + Ui \end{aligned}$$

Regarding the impact of each financial metric, results show two types of impact on CO_2 emissions (Downie & Stubbs, 2013; Hertwich & Wood, 2018): those that are positive and those that are negative. A positive relationship means that the higher the metric, the higher the CO_2 emissions in the sample of entities. Specifically, luxury goods sales, CAPEX, and financial expenses have a positive relationship with CO_2 emissions. That means that the higher the sales of luxury goods, the higher the CO_2 emissions by an average entity in the population of top luxury companies. For example, when luxury goods sales increase by one million USD, emissions increase by an average of 8.07 tons of CO_2; when investment in capital increases by one million USD, emissions increase on average by 32.69 tons of CO_2.

On the other hand, some variables have a negative impact on CO_2 emissions, which are costs of goods sold, general expenses, and taxes. Specifically, when the costs of goods sold increase by 1 million USD, emissions decrease by 23.21 tons of

CO_2; when general expenses increase by 1 million USD, CO_2 emissions decrease by 201.46 tons of CO_2.

Regarding the relevance of the model in general, it should be noted that the relationship between CO_2 emissions and finance has been studied recently by Saeed Meo and Karim (2022), yet such analysis has been focused on a large macroeconomic level, stepping into the data for the top ten economies that support green finance. Still, this research intends to set an analysis at the microeconomic level and, therefore, sets the frame at the level of companies/entities in the leading sector of luxury.

The results of the analysis in this research show that the relationship between the variables as set forth in our hypothesis is very strong, meaning the model is relevant. In detail, the above results show a coefficient of determination of 0.99 and a p-value of F of 0.002. This means that: (i) 99% of variations in CO_2 emissions are explained by variations in the financial metrics in the model, and (ii) the probability of financial metrics explaining variations in CO_2 emissions by mere chance or coincidence is very low. These two technical conclusions are the base of a strong model. Therefore, it can be concluded that the basic hypothesis in this paper is explained by a pertinent model.

The relevance of each variable in the model independently is an important analysis to be made to contrast the quality of the model results. In particular, when a model contains several variables, not all of them must be as relevant and, therefore, a proper method to test better results in a model is to eliminate from the model those variables that are not pertinent independently and measure the relevance of the new model with fewer variables. This would either lead to a new better and more relevant model or lead to the conclusion that, regardless of independent relevance, the initial hypothesis is the most relevant possible.

Following the above rationale, the authors have analyzed the relevance of each variable in our resulting model. In order to do so, the authors have used the t-statistic (Freedman, 2009), observing that only two financial metrics (luxury goods sales and taxes) have a value higher than 2 in absolute value. In statistics, this means that only those two variables are independently relevant and, therefore, the contrast analysis would lead to the removal of all other variables in our initial model and the calculation of a new contrast model where CO_2 emissions, as measured through the IPCC methodology, are explained by the sales of the company and the taxes. The algorithm for this contrast model will be the following:

$$CO2 = \beta 0 + \beta 1(LuxGoodSales) + \beta 2(Tax) + Ui$$

The results of this contrast model, upon the same regressive methods as described above, are as follows:

The results of the contrast model (Table 4) can be expressed with the following algorithm, where CO_2 emissions are dependent on luxury goods sales and taxes.

$$CO_2 = -20,316.2 + 2.05(\text{LuxGoodSales}) + 106.42(\text{Tax}) + \text{Ui}$$

The quality of the contrast model can be measured upon the same criteria as the basic hypothesis: the coefficient of determination, the p-value of F, and the independent relevance of each independent variable.

Regarding the coefficient of determination, the contrast model shows a value of 0.97, meaning that 97% of the variations in CO_2 emissions are explained by the two single variables: luxury goods sales and taxes. Additionally, and regarding the p-value of F, the contrast model shows a value of 0.000004, meaning the probability of the variations in CO_2 emissions being explained by mere coincidence is very low. Finally, an analysis of the independent relevance of each variable leads to the conclusion that luxury goods sales are not relevant, as the t-statistic result for that value is lower than 2 in absolute value.

Given the above results of our contrast model, it can be clearly understood that the better model is that of our initial hypothesis, which has been explained in this section,

$$CO2 = \beta 0 + \beta 1(LuxGoodSales) + \beta 2(COGS) + \beta 3(MktgExp) + \beta 4(Tax) + \beta 5(CAPEX) + \beta 6(FinExp) + Ui$$

where higher variations of CO_2 emissions have been explained by financial metrics (99% as opposed to 97% in our contrast model), more variables explained variations in CO_2 emissions and the probability of mere coincidence was negligible in both models.

Discussion

Sustainability promotes a global mindset shift so that individuals and companies become more conscious of the planet's resources so that our behaviour and consumption will secure the future for generations to come (Brenot et al., 2019). Fortunately, there are more and more consumers interested in the economic, social, and environmental impact of their consumption, and it is also growing in companies and, specifically, in the luxury sector (Arrigo, 2018). In this context, sustainability is becoming a priority for luxury firms (Akrout & Guercini, 2022; Böhnert et al., 2023). Among the main challenges that luxury brands are addressing today are those related to climate change. For that, the luxury industry is trying to consume less throughout the value chain to generate efficiencies in the company, among other measures, reducing the environmental impact of its operations, whether in CO_2 emissions (Aleem et al., 2022; Kunz et al., 2020; López et al., 2023), water consumption, or polluting waste (Brenot et al., 2019). Moreover, luxury brands need sustainability to maintain their superiority over other Fast Moving Consumer Goods (FMCG) brands (Kapferer, 2010; Osburg et al., 2022) and to connect with their stakeholders in a relevant way for the whole society (Pai et al., 2022).

Although there is an academic debate about the compatibility of luxury with sustainability (Kapferer & Michaut-Denizeau, 2017, 2019; Dekhili et al., 2019; Osburg et al., 2022), although some authors state that they are antagonistic concepts and, therefore, what is being produced in these firms is greenwashing to serve the market (Quach et al., 2022). However, there are authors who associate luxury with the long-term durability of products (Arrigo, 2018), which is manifested above all in the luxury consumption behaviour of the younger generations (Quach et al., 2022). Therefore, this sector is

bringing innovation to its processes, as well as the development of a circular economy, being a trend in luxury (Arribas-Ibar et al., 2022; Kelleci, 2022), as well as in other business industries. In this sense, the luxury industry is following the recommendations of the United Nations to implement the SDGs and report their impacts on different areas of business, SDG 12 (responsible consumption) and 13 (climate change), among others, and fight against climate change as a priority for business (WEF, 2022, 2023). Moreover, the connection between luxury and sustainability is expressed in the capacity for innovation (Hemonnet-Goujot et al., 2022), as well as the reporting of sustainability efforts to society in this industry (Quach et al., 2021); all this with the objective of reducing climate impact (Secinaro et al., 2020; Varadarajan, 2017) while managing company resources more efficiently (Hemonnet-Goujot et al., 2022).

Therefore, the theoretical contribution of this paper is to show through a model the relationship between sustainability and luxury firms, which is expressed in the analysis of specific financial variables that reduce the CO_2 emissions in their activities through an innovative process useful for other industries. Therefore, the efficiency of the company is shown in some financial variables and measures that also contribute to the fight against climate change. Then, from a managerial perspective, companies in all sectors can reduce CO_2 emissions using some financial variables and by reducing costs.

Upon the data at hand and the methodology described in this paper, a practical implication of this work is that there is a strong relationship between CO_2 emissions and the financial metrics of the top 100 companies in the luxury sector. Additionally, this strong relationship can be broken down into two types of relationships: some variables generate more CO_2 emissions, like higher sales of luxury goods, higher investments in capital, and higher financial costs; yet some financial metrics help to decrease CO_2 emissions, like higher costs in goods sold, general 'expenses and taxes.

The above is only reasonable from a logical perspective: the more a company sells, the more the company pollutes; the more capital a company invests, the more pollution it generates. Yet on the other hand, when the company decreases its CO_2 emissions, it must face higher costs of the goods that are sold or higher costs in general. Even taxes have an impact since only when taxes increase do companies decrease their CO_2 emissions.

The results on the costs of goods are especially relevant: reducing CO_2 emissions implies that costs in the production of goods should increase, meaning that when companies try to reduce their carbon footprint to fight climate change, they should assess their chains of production. As stated previously in this research, it has already been proven in previous research that companies are investigating seeking more efficiency by making better use of the company's resources or by the replacement of raw materials with other ones or energy sources that are friendlier to the planet (Brenot et al., 2019; Osburg et al., 2022).

Moreover, as reflected in the literature review, the results also respond to the need for an objective and comprehensive model that incorporates the different financial metrics when explaining an organisation's CO_2 emissions (Geng et al., 2022; Tao et al., 2023). Such a model can be replicated by different organizations when taking or analysing CO_2 emissions, something that the luxury industry has been working on for decades (Akrout & Guercini, 2022; Böhnert et al., 2023) given its dependence on raw materials and their transformation to be transported for subsequent sale.

Conclusions

Sustainability is a priority in the strategy of companies in today's world. This means that companies must explain what they do and how they operate to be more efficient in the fight against climate change. In this study, the authors of this research show how companies can use financial metrics to reduce the environmental impact of operations in the luxury sector. Based on the literature, companies should improve their measures to explain how they contribute to society from a sustainable perspective. Based on empirical results, the authors explain in this study how luxury companies are measuring their impacts to be more efficient, and the proposed model can be adapted to different industries. Consequently, this work contributes to theory and practice to understanding the effects of measuring sustainable activities and the competitiveness of companies reducing its impacts. Then, it represents a step forward in knowledge about sustainable management, compared with previous studies when society should advance with a certain speed towards sustainable development, following the recommendations of the 2030 Agenda by the United Nations.

These conclusions, as simple as they may appear to be, are useful for decision-makers from a managerial perspective since they guide top managers in their decisions towards CO_2 emissions reduction and, therefore, CSR and sustainable strategies. Financial metrics play an important role in assessing the impacts of CO_2 emissions on climate change. Top luxury companies have been under increasing pressure to reduce their emissions and shift to more sustainable forms of energy. Financial metrics provide a useful way to measure the progress of these companies in reducing their emissions and transitioning to cleaner forms of energy. By tracking these financial metrics, investors and other stakeholders can evaluate the extent to which a company is contributing to climate change and make informed decisions about its investments.

This is a time of high technological development that should be conducive to fostering the creation of solutions that promote sustainability, start-ups, or developing new business models that help reduce and optimize the consumption of natural resources. To this end, the matters described in this paper intend to provide proper tools for decision-makers, to assess better and more efficient decisions to reduce the impact of climate change.

Some limitations of the study refer to the period of analysis, referring to a specific year, and for the luxury sector, in which the results of the luxury firms were prior to the global pandemic. This means that the global pandemic has had an influence on consumer behaviour. In this sense, future research can analyse the relationship between financial variables and sustainability to know the evolution of this industry considering the recent changes in the global market because of COVID-19 and considering that sustainability is a priority for companies in all sectors.

This limitation is also an opportunity for future work. For example, how can company decisions, related to sustainability, influence others? Would it work to measure the impact of these activities on different stakeholders (consumers, employees, suppliers, among others)?

Another approach to implement in the future could be that of the accounting figures at hand: can a fixed cost vs. variable cost analysis reach the same conclusions as those set forth in this research? Would economies of scale be measured properly? Would they be detectable?

Finally, and connected with the previous idea, researchers can carry out new studies into the impact of regulations in the companies to investigate if sustainability is extending at different levels in organizations. All this research is to better understand how companies can provide solutions to the global problem of global warming.

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References

Akrout, H., & Guercini, S. (2022). Sustainability in fashion and luxury marketing: Results, paradoxes and potentialities. *Journal of Global Fashion Marketing, 13*(2), 91–100. https://doi.org/10.1080/20932685.2021.2017320

Albitar, K., Borgi, H., Khan, M., & Zahra, A. (2023). Business environmental innovation and CO 2 emissions: The moderating role of environmental governance. *Business Strategy and the Environment, 32*(4), 1996–2007. https://doi.org/10.1002/bse.3232

Aleem, A., Loureiro, S. M. C., & Bilro, R. G. (2022). Luxury fashion consumption: A review, synthesis and research agenda. *Spanish Journal of Marketing-ESIC*. https://doi.org/10.1108/SJME-06-2021-0105

Amatulli, C., De Angelis, M., & Donato, C. (2021). The atypicality of sustainable luxury products. *Psychology & Marketing, 38*(11), 1990–2005. https://doi.org/10.1002/mar.21559

Arribas-Ibar, M., Nylund, P. A., & Brem, A. (2022). Circular business models in the luxury fashion industry: Toward an ecosystemic dominant design? *Current Opinion in Green and Sustainable Chemistry, 37*, 100673. https://doi.org/10.1016/j.cogsc.2022.100673

Arrigo, E. (2018). The flagship stores as sustainability communication channels for luxury fashion retailers. *Journal of Retailing and Consumer Services, 44*, 170–177. https://doi.org/10.1016/j.jretconser.2018.06.011

Baratta, A., Cimino, A., Longo, F., Solina, V., & Verteramo, S. (2023). The impact of esg practices in industry with a focus on carbon emissions: Insights and future perspectives. *Sustainability, 15*(8), 6685. https://doi.org/10.3390/su15086685

Baronet, J., & Tremblay, S. (2015). Sustainable development and social responsibility (SDSR): A longitudinal study of large Canadian companies' web-based communication practices. *Journal of Global Responsibility, 6*(1), 45–64. https://doi.org/10.1108/JGR-07-2014-0027

Batat, W. (2020). Pillars of sustainable food experiences in the luxury gastronomy sector: A qualitative exploration of Michelin-starred chefs' motivations. *Journal of Retailing and Consumer Services, 57*, 102255. https://doi.org/10.1016/j.jretconser.2020.102255

Beckham, D., & Voyer, B. G. (2014). Can sustainability be luxurious? A mixed-method investigation of implicit and explicit attitudes towards sustainable luxury consumption. *ACR North American Advances*, *NA-42*. https://www.acrwebsite.org/volumes/1017922/volumes/v42/NA-42

Belkhir, L., Bernard, S., & Abdelgadir, S. (2017). Does GRI reporting impact environmental sustainability? A cross-industry analysis of CO $_2$ emissions performance between GRI-reporting and

non-reporting companies. *Management of Environmental Quality: An International Journal, 28*(2), 138–155. https://doi.org/10.1108/MEQ-10-2015-0191

Böhnert, A., Blaschke, F., & Biewendt, M. (2023). Impact of sustainability on the strategic direction of luxury companies. *European Journal of Marketing and Economics*, *6*(1), 69–82. https://revistia.org/index.php/ejme/article/view/6043

Brenot, A., Chuffart, C., Coste-Manière, I., Deroche, M., Godat, E., Lemoine, L., Ramchandani, M., Sette, E., & Tornaire, C. (2019). Water footprint in fashion and luxury industry. In *Water in Textiles and Fashion* (pp. 95–113). Elsevier. https://doi.org/10.1016/B978-0-08-102633-5.00006-3

Buonocore, J. J., Choma, E., Villavicencio, A. H., Spengler, J. D., Koehler, D. A., Evans, J. S., Lelieveld, J., Klop, P., & Sanchez-Pina, R. (2019). Metrics for the sustainable development goals: Renewable energy and transportation. *Palgrave Communications, 5*(1), 136. https://doi.org/10.1057/s41599-019-0336-4

Cameron, A. C., & Trivedi, P. K. (2005). *Microeconometrics: Methods and applications*. Cambridge University Press.

Cappelli, F., & Di Bucchianico, S. (2022). *Exploring the theoretical link between profitability and luxury emissions* [SSRN Scholarly Paper]. https://doi.org/10.2139/ssrn.4172004

Carroll, A. B. (2021). *Corporate Social Responsibility: Perspectives on the CSR Construct's Development and Future*. Business & Society.

Cavender, R. (2018). The marketing of sustainability and CSR initiatives by luxury brands: Cultural indicators, call to action, and framework. In C. K. Y. Lo & J. Ha-Brookshire (Eds.), *Sustainability in Luxury Fashion Business* (pp. 29–49). Springer Singapore. https://doi.org/10.1007/978-981-10-8878-0_3

Castle, J. L., Clements, M. P., & Hendry, D. F. (2016). An overview of forecasting facing breaks. *Journal of Business Cycle Research, 12*(1), 3–23. https://doi.org/10.1007/s41549-016-0005-2

Colella, G., Sestino, A., & Amatulli, C. (2022). The role of consumers' individual differences and perceived product quality in sustainable luxury marketing: An experimental study in a social media context. *International Journal of Marketing Studies, 14*(1), 34. https://doi.org/10.5539/ijms.v14n1p34

Currid, H. E. (2017). *The sum of small things: Theory of the aspirational class*. Princeton University Press.

Dekhili, S., Achabou, M. A., & Alharbi, F. (2019). Could sustainability improve the promotion of luxury products? *European Business Review, 31*(4), 488–511. https://doi.org/10.1108/EBR-04-2018-0083

Deloitte. (2020). Global Powers of Luxury Goods 2020. The new age of fashion and luxury. https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Consumer-Business/gx-consumerbusiness-gplg-2020-report.pdf

Donato, C., Amatulli, C., & De Angelis, M. (2019). Responsible luxury development: A study on luxury companies' CSR, circular economy, and entrepreneurship. *Sustainable Luxury: Cases on Circular Economy and Entrepreneurship*, 21–38. Springer.

Downie, J., & Stubbs, W. (2013). Evaluation of Australian companies' scope 3 greenhouse gas emissions assessments. *Journal of Cleaner Production, 56*, 156–163. https://doi.org/10.1016/j.jclepro.2011.09.010

ElAlfy, A., Palaschuk, N., El-Bassiouny, D., Wilson, J., & Weber, O. (2020). Scoping the evolution of corporate social responsibility (CSR) research in the sustainable development goals (SDGs) era. *Sustainability, 12*(14), 5544.

EC. (2011). 681 final. A renewed EU strategy 2011–14 for Corporate Social Responsibility. https://www.europarl.europa.eu/meetdocs/2009_2014/documents/com/com_com(2011)0681_/com_com(2011)0681_en.pdf

Freedman, D. A. (2009). Statistical models: Theory and practice. *Cambridge University Press*. https://doi.org/10.1017/CBO9780511815867

Galli, D., & Bassanini, F. (2020). Reporting sustainability in China: Evidence from the global powers of luxury goods. *Sustainability, 12*(9), 3940. https://doi.org/10.3390/su12093940

Geng, L., Hu, J., & Shen, W. (2022). The impact of carbon finance on energy consumption structure: Evidence from China. *Environmental Science and Pollution Research, 30*(11), 30107–30121. https://doi.org/10.1007/s11356-022-24303-y

Godil, D. I., Sharif, A., Agha, H., & Jermsittiparsert, K. (2020). The dynamic nonlinear influence of ICT, financial development, and institutional quality on CO_2 emission in Pakistan: New insights from QARDL approach. *Environmental Science and Pollution Research, 27*(19), 24190–24200. https://doi.org/10.1007/s11356-020-08619-1

Hemonnet-Goujot, A., Kessous, A., & Magnoni, F. (2022). The effect of sustainable product innovation on the consumer–luxury brand relationship: The role of past identity salience. *Journal of Business Research, 139*, 1513–1524. https://doi.org/10.1016/j.jbusres.2021.10.070

Hertwich, E. G., & Wood, R. (2018). The growing importance of scope 3 greenhouse gas emissions from industry. *Environmental Research Letters, 13*(10), 104013. https://doi.org/10.1088/1748-9326/aae19a

Holden, E., Linnerud, K., & Banister, D. (2014). Sustainable development: Our common future revisited. *Global Environmental Change, 26*, 130–139. https://doi.org/10.1016/j.gloenvcha.2014.04.006

Huang, K.-T., Wang, J. C., & Wang, Y.-C. (2015). Analysis and benchmarking of greenhouse gas emissions of luxury hotels. *International Journal of Hospitality Management, 51*, 56–66. https://doi.org/10.1016/j.ijhm.2015.08.014

International Financial Reporting Standards. (2023). https://www.ifrs.org/

IPCC. (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Summary for Policymakers. Retrieved from https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf

Jaegler, A., & Goessling, T. (2020). Sustainability concerns in luxury supply chains: European brand strategies and French consumer expectations. *Business Strategy and the Environment, 29*(6), 2715–2733. https://doi.org/10.1002/bse.2531

Kang, E. Y., & Sung, Y. H. (2022). Luxury and sustainability: The role of message appeals and objectivity on luxury brands' green corporate social responsibility. *Journal of Marketing Communications, 28*(3), 291–312. https://doi.org/10.1080/13527266.2021.1874482

Kapferer, J.-N. (2010). All that Glitters is not Green: The challenge of sustainable luxury. *The European Business Review*. https://www.researchgate.net/journal/European-Business-Review-0955-534X

Kapferer, J.-N., & Michaut-Denizeau, A. (2017). Is luxury compatible with sustainability? Luxury consumers' viewpoint. In J.-N. Kapferer, J. Kernstock, T. O. Brexendorf, & S. M. Powell (Eds.), *Advances in Luxury Brand Management* (pp. 123–156). Springer International Publishing. https://doi.org/10.1007/978-3-319-51127-6_7

Kapferer, J.-N., & Michaut-Denizeau, A. (2019). Are millennials really more sensitive to sustainable luxury? A cross-generational international comparison of sustainability consciousness when buying luxury. *Journal of Brand Management, 27*(1), 35–47. https://doi.org/10.1057/s41262-019-00165-7

Kelleci, A. (2022). Key determinants of luxury marketing accordant with sustainability-oriented value perspectives. *Sustainability, 14*(10), 5916. https://doi.org/10.3390/su14105916

Kunz, J., May, S., & Schmidt, H. J. (2020). Sustainable luxury: Current status and perspectives for future research. *Business Research, 13*, 541–601. https://doi.org/10.1007/s40685-020-00111-3

Layaoen, H. D. Z., Abareshi, A., Abdulrahman, M.D.-A., & Abbasi, B. (2023). Sustainability of transport and logistics companies: An empirical evidence from a developing country. *International Journal of Operations & Production Management, 43*(7), 1040–1067. https://doi.org/10.1108/IJOPM-12-2021-0799

Lo, C. K. Y., & Ha-Brookshire, J. (2018). Opening: Sustainability and luxury brands. In C. K. Y. Lo & J. Ha-Brookshire (Eds.), *Sustainability in Luxury Fashion Business* (pp. 1–7). Springer Singapore. https://doi.org/10.1007/978-981-10-8878-0_1

Lindner, T., Puck, J., & Verbeke, A. (2020). Misconceptions about multicollinearity in international business research: Identification, consequences, and remedies. *Journal of International Business Studies, 51*, 283–298. https://doi.org/10.1057/s41267-019-00257-1

Lopez, B., & Rangel, C. (2022). How luxury fashion brands contribute efficiently to sustainable development: In A. Pérez (Ed.), *Advances in Human Resources Management and Organizational Development* (pp. 139–161). IGI Global. https://doi.org/10.4018/978-1-7998-8065-3.ch007

López, B., Rangel-Pérez, C., & Fernández, M. (2023). Sustainable strategies in the luxury business to increase efficiency in reducing carbon footprint. *Journal of Business Research, 157*, 113607. https://doi.org/10.1016/j.jbusres.2022.113607

Maldonado-Erazo, C. P., Álvarez-García, J., Del Río-Rama, M. D. L. C., & Correa-Quezada, R. (2020). Corporate social responsibility and performance in SMEs: Scientific coverage. *Sustainability, 12*(6), 2332. https://doi.org/10.3390/su12062332

Muñoz, R. M., Fernández, M. V., & Salinero, Y. (2020). Sustainability, corporate social responsibility, and performance in the Spanish wine sector. *Sustainability, 13*(1), 7. https://doi.org/10.3390/su13010007

Nave, A., & Ferreira, J. (2019). Corporate social responsibility strategies: Past research and future challenges. *Corporate Social Responsibility and Environmental Management, 26*(4), 885–901.

Neumann, H. L., Martinez, L. M., & Martinez, L. F. (2020). Sustainability efforts in the fast fashion industry: Consumer perception, trust and purchase intention. *Sustainability Accounting, Management and Policy Journal, 12*(3), 571–590.

Osburg, V.-S., Yoganathan, V., McLeay, F., & Diallo, M. F. (2022). (In)Compatibilities in sustainable luxury signals. *Ecological Economics, 196*, 107430. https://doi.org/10.1016/j.ecolecon.2022.107430

Pai, C.-Y., Laverie, D., & Hass, A. (2022). Love luxury, love the earth: An empirical investigation on how sustainable luxury consumption contributes to social-environmental well-being. *Journal of Macromarketing, 42*(4), 640–654. https://doi.org/10.1177/02761467221125915

Pavione, E., Pezzetti, R., & Dall'ava, M. (2016). Emerging competitive strategies in the global luxury industry in the perspective of sustainable development: The case of Kering group. *Management Dynamics in the Knowledge Economy*, *4*(2), 241–261. https://www.managementdynamics.ro/index.php/journal/article/view/162

Quach, S., Septianto, F., Thaichon, P., & Nasution, R. A. (2022). The role of art infusion in enhancing pro-environmental luxury brand advertising. *Journal of Retailing and Consumer Services, 64*, 102780. https://doi.org/10.1016/j.jretconser.2021.102780

Ricca, M., & Robbins, M. (2012). *Meta-Luxury: Brands and the culture of excellence*. Palgrave Macmillan.

Roggeveen, A. L., & Sethuraman, R. (2020). How the COVID-19 Pandemic May Change the World of Retailing. *Journal of Retailing, 96*(2), 169–171. https://doi.org/10.1016/j.jretai.2020.04.002

Saeed Meo, M., & Karim, M. Z. A. (2022). The role of green finance in reducing CO_2 emissions: An empirical analysis. *Borsa Istanbul Review, 22*(1), 169–178. https://doi.org/10.1016/j.bir.2021.03.002

Sánchez-Teba, E. M., Benítez-Márquez, M. D., Bermúdez-González, G., & Luna-Pereira, M. D. M. (2021). Mapping the Knowledge of CSR and Sustainability. *Sustainability, 13*(18), 10106. https://doi.org/10.3390/su131810106

Shahbaz, M., Hye, Q. M. A., Tiwari, A. K., & Leitão, N. C. (2013a). Economic growth, energy consumption, financial development, international trade and CO_2 emissions in Indonesia. *Renewable and Sustainable Energy Reviews, 25*, 109–121. https://doi.org/10.1016/j.rser.2013.04.009

Shahbaz, M., Solarin, S. A., Mahmood, H., & Arouri, M. (2013b). Does financial development reduce CO_2 emissions in Malaysian economy? A time series analysis. *Economic Modelling, 35*, 145–152. https://doi.org/10.1016/j.econmod.2013.06.037

Secinaro, S., Brescia, V., Calandra, D., & Saiti, B. (2020). Impact of climate change mitigation policies on corporate financial performance: Evidence-based on European publicly listed firms. *Corporate Social Responsibility and Environmental Management, 27*(6), 2491–2501.

Statista. (2023). Revenue of the luxury goods industry Worldwide 2015–2028. https://www.statista.com/statistics/1063757/global-personal-luxury-goods-market-value-forecast/

Sun, Y., Wang, R., Cattaneo, E., & Mlodkowska, B. (2022). What influences the purchase intentions of sustainable luxury among millennials in the UK? *Strategic Change, 31*(3), 323–336. https://doi.org/10.1002/jsc.2501

Tao, M., Sheng, M. S., & Wen, L. (2023). How does financial development influence carbon emission intensity in the OECD countries: Some insights from the information and communication technology perspective. *Journal of Environmental Management, 335*, 117553. https://doi.org/10.1016/j.jenvman.2023.117553

United Nations. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*. https://documents-dds-ny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement

Varadarajan, R. (2017). Innovating for sustainability: A framework for sustainable innovations and a model of sustainable innovations orientation. *Journal of the Academy of Marketing Science, 45*(1), 14–36. https://doi.org/10.1007/s11747-015-0461-6

Wells, V., Athwal, N., Nervino, E., & Carrigan, M. (2021). How legitimate are the environmental sustainability claims of luxury conglomerates? *Journal of Fashion Marketing and Management: An International Journal, 25*(4), 697–722. https://doi.org/10.1108/JFMM-09-2020-0214

WEF. (2022). *The Global Risks Report 2022* (17th ed.). World Economic Forum.https://www.zurich.com/knowledge/topics/global-risks/the-global-risks-report-2022

WEF. (2023). *The Global Risks Report 2023* (18th ed.). World Economic Forum. https://www3.weforum.org/docs/WEF_Global_Risks_Report_2023.pdf

Wooldridge, J. M. (2003). Cluster-sample methods in applied econometrics. *American Economic Review, 93*(2), 133–138. https://doi.org/10.1257/000282803321946930

Wren, B. (2022). Sustainable supply chain management in the fast fashion Industry: A comparative study of current efforts and best practices to address the climate crisis. *Cleaner Logistics and Supply Chain, 4*, 100032. https://doi.org/10.1016/j.clscn.2022.100032

Yu, S.-H., & Liang, W.-C. (2020). Exploring the determinants of strategic corporate social responsibility: An empirical examination. *Sustainability, 12*(6), 2368. https://doi.org/10.3390/su12062368

Yusuf, N., & Lytras, M. D. (2023). Competitive sustainability of Saudi companies through digitalization and the circular carbon economy model: A bold contribution to the vision 2030 agenda in Saudi Arabia. *Sustainability, 15*(3), 2616. https://doi.org/10.3390/su15032616