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Effects of Female Entrepreneurship on Sustainable Development Goals: The Moderating Role of Gender Gap

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Female Entrepreneurship (FE) is discussed and examined for its potential to support Sustainable Development Goals (SDGs). Recent economic literature has recognized that the contribution of FE to the achievement of the 2030 Agenda is a domain still scarcely explored. The aim of this study is to analyze if FE has a positive impact on Social, Economic and Environmental Development Goals. Our premise is that these impacts are negatively moderated by Gender Gap. To achieve this objective, the research conducts an empirical cross-country analysis with the Structural Equations Model (SEM) for 76 countries worldwide using different databases such as the SDG Index, FE Index, and Global Gender Gap Index, all of which are open access. Our findings show positive and significant effects of FE on social, economic and environmental development. Moreover, the Gender Gap plays a negative and significant moderating role in Environmental Development Goals. Although other studies have proven the relationship between female entrepreneurship and economic, social or environmental sustainability, the integration of all of them into a single model gives rigor to our results. Moreover, it is the first to include the moderating role of the gender gap in this relationship. Policymakers, business leaders and communities should work together to create an environment encouraging and supporting FE, and reducing the gender gap, for the positive consequences that this can have in the form of greater impact of FE on environmental sustainable development.

Keywords: *Female Entrepreneurship (FE); Women; Social SDG; Economic SDG; Environmental SDG; Structural Equations Model (SEM); Gender Gap.*

Introduction

Female entrepreneurship (FE) is increasingly examined for its potential to support sustainable development by addressing critical global challenges such as poverty reduction, societal adaptation to new conditions, and the promotion of economic and social progress. FE plays an important role in developing these changes by finding and exploiting new opportunities (Fernandez-Guadano & Martin-Lopez, 2023). The effects of FE on Sustainable Development Goals (SDGs) are interconnected and extend across economic, social, and environmental dimensions. By empowering women to become entrepreneurs and address the barriers they face, societies can leverage the potential of half the population to make significant strides towards fostering inclusive growth and social cohesion (Akinwale, 2023).

However, as different authors recognize, there is not yet enough empirical evidence and limited comparative cross-country empirical research (Barrachina-Fernandez *et al.*, 2021; Raman *et al.*, 2022). Combining FE with sustainability is a compelling and fruitful approach to advancing sustainable development Because women play a key role in driving social, economic, and environmental change, women entrepreneurs often address local challenges, foster inclusive growth, and promote innovation, which aligns with the Sustainable Development Goals (SDGs), but further research is required due to the novelty of the topic and also the existing gaps in knowledge (Barrachina-Fernandez *et al.*, 2021).

Recently, the Women's Entrepreneurship Report (GEM, 2023) has highlighted women entrepreneurs' significant and increasingly beneficial influence on society and economies. The insights from GEM emphasize the vital role of women entrepreneurs in not only advancing businesses but also in addressing broader societal challenges. Their impact extends beyond economic growth, encompassing social, environmental, and innovation-related effects, positioning them as key drivers of positive change within their communities and globally. Recognizing and supporting the endeavors of women entrepreneurs is essential for fostering inclusive and sustainable economic development worldwide.

The Sustainable Development Agenda was proposed by the United Nations (UN), defining 17 SDGs to end poverty (economic sustainability), protect the planet (environmental sustainability), and ensure prosperity for all (social

sustainability) (UN, 2015). Despite the efforts undertaken by the UN to engage all public and private organizations towards the achievement of the 2030 Agenda, the contribution of traditional businesses has proved to be insufficient so far (Diaz-Sarachaga *et al.,* 2022).

Women entrepreneurs have the power to overcome numerous challenges, including fostering a culture of equality, attaining balance, and ensuring sustainable socio-economic progress (Barrachina-Fernandez *et al.,* 2021). Increasing the participation of women in the workforce is defined as a corporate strategy aimed at advancing these SDGs (Sarıipek *et al.,* 2023). Nevertheless, despite the rapid growth in the presence of women in professional and managerial spheres and the strides made in FE (Startienė, & Remeikiene, 2008), the gender gap in entrepreneurship remains significant in many countries.

There are many studies on entrepreneurship and sustainable development (Apostolopoulos *et al.,* 2018; Fernandez-Guadano & Montes-Diez, 2023; Sreenivasan & Suresh, 2023), but few have analyzed this relationship from the perspective of women entrepreneurs (Mahajan & Bandyopadhyay, 2021; Criado-Gomis *et al.,* 2020). In fact, to the best of our knowledge, the impact of the FE activities on the fulfillment of the SDGs has been scarcely analyzed (Barrachina-Fernandez *et al.,2021;* Raman *et al.,* 2022), and the few papers that have studied it have considered only one of the SDGs dimensions, or have done it with methodologies that do not allow establishing a causal relationship. On the other hand, none of them has incorporated the study of the gender gap as a moderator in this relationship. In line with Lu and Herremans (2019), the different dimensions of sustainable development (economic, social and environmental) require different expertise and consequently need to be studied separately. This research aims to fill this gap and respond to the call for more research made by Criado-Gomis *et al.* (2020) and Al-Qudah *et al.* (2022), who highlight the need to develop research on this topic in order to adequately assess the influence of FE on sustainable development.

The objective of this study is to explore the effects of FE directly on sustainable development goals with a focus on how the gender gap moderates this relationship.

To achieve this goal, this study performs an empirical analysis with the Structural Equations Model (SEM) for seventy-six countries around the world. First, it analyzes the relationship between FE and sustainable development goals. Secondly, it tests the moderating effect of the gender gap. This methodology allows us to analyze the multiple relationships between the proposed variables, manage multivariate data across different countries and draw causal inferences.

Our paper contributes to the literature in different ways. First, the studies about the impact of FE on the fulfillment of the SDGs are mostly descriptive, and the most commonly used method is the case study. There are fewer papers based on causal research design, which highlights the interest and usefulness of our work. Moreover, it is tackled with an innovative approach that analyzes through PLS-SEM methodology, and based n a data set from multiple countries (76), the differential impact of FE in the SDG`s three dimensions (economic, social and environmental), and that includes the study of the gender gap´s moderating role in these relationships. Secondly, there are few data sets related to FE with comparable cross-country data (Meunier *et al.,* 2017). providing this study with new evidence regarding the limited comparative cross-country empirical research.

The paper is structured as follows: the next section reviews the main economic literature and sets out the different hypotheses; followed by the methodology section comprising the data source, the description of the main variables, and the Partial Least Square-SEM method together with the model approach. Then the results are discussed, and the last section provides the conclusions and future lines of research.

Literature Review and Hypotheses

Nowadays, entrepreneurship is recognized as one of the driving factors of economic growth and development in all countries (Galindo & Mendez, 2014). Entrepreneurs contribute to economic growth by creating new jobs, increasing economic activity, fostering innovation, increasing competition in markets, and attracting investors and capital, which have a positive impact on any region or country (Meyer & Hamilton, 2020). These positive impacts vary depending on elements such as quality, the nature of the business, and gender composition (Sarfaraz *et al.,* 2014). Women today represent an important agent for the socio-economic development of any economy, and consequently FE is recognized as a key contributor to economic growth. Many women view entrepreneurship as a way out of the unemployment they face (Santos *et al.,* 2018) and numerous successful firms around the world are owned and managed by women (Ambepitiya, 2016). They provide new perspectives, innovative ideas, and management (GEM, 2023).

Although women are exhibiting an increasing interest in entrepreneurship (Meyer & Hamilton, 2020), women´s involvement in entrepreneurship remains much lower than men's (Santos *et al.,* 2018). Compared to males, female entrepreneurs' growth ambitions remain low (or relatively low) across countries, potentially leading to a waste of women's talents and capabilities (Darnihamedani & Terjesen, 2022). According to the GEM report, women entrepreneurs are a diverse group operating in all sectors and product and service markets. However, the largest number of businesses created by them are often small and medium-sized and operate in less competitive sectors and industries (GEM, 2023).

Female entrepreneurs have distinctive features such as their motivation to create a business or the barriers they must overcome. The motivating factors tend to vary across countries and societies . According to Blanco and Domínguez (2019) different motivations for female entrepreneurship in social economy organizations are also observed. In this regard, researchers identify several push-and-pull motivational factors implied in the female entrepreneur. Among the push factors are the desire for economic independence and self-improvement (social status and self-esteem) (Walker & Webster, 2007), the desire for greater flexibility in the use of one's time and to maintain family life harmony (Kirkwood, 2009). Among the pull factors, it is worth highlighting financial needs, job dissatisfaction, lower pay compared to male peers, longer

career breaks, or unemployment (McGowan *et al.*, 2012, Santos *et al.*, 2018; Stefan *et al.*, 2021).

Entrepreneurship is not an easy venture. In the early stages, all entrepreneurs have problems securing the necessary funding. However, the barriers faced by women entrepreneurs are greater than those faced by men (Santos *et al.,* 2018). Among others, poor female entrepreneurial cognition (e.g., lack of competence and fear of failure) and the initial absence of high initial funding requirements (Wu *et al.,* 2019), work-family conflicts, as women must divide their time and resources between their careers and familial lives (Thebaud, 2015), gender discrimination and lower salaries (Ge *et al.,* 2022), lack of infrastructural assistance, adverse business and economic conditions, and lack of entrepreneurial training and education (Stefan *et al.,* 2021).

In the last decade, entrepreneurship as a way to create self-employment and generate value and economic growth has turned towards challenges related to sustainable development and the eradication of poverty, inequality and environmental degradation (Mahajan & Bandyopadhyay, 2021).

In 1972, the United Nations Stockholm Convention used the term "sustainable development" for the first time (Luna-Nemecio *et al.,* 2020). The Brundtland Commission pushed this concept in the report “Our Common Future”. According to this proposal, sustainable development is conceptualized as “development that meets the needs of current generations without compromising the ability of future generations to meet their own needs” (UN, 1987). Thus, a sustainable firm will be one that is committed to maintaining its activity while contributing to the sustainable development of the whole ecosystem of which it is a part (Parrish, 2010). The United Nations, in the scope of the 2030 Agenda, notes in resolution 71/221 the essential impact that entrepreneurship makes on sustainable development through innovation and the improvement of employment and environmental and socioeconomic conditions (UN, 2020).

Most of the studies that address sustainability and companies focus on established companies. According to Marconatto *et al.* (2019), the key factors that configure a sustainability-oriented company are the sources of capital, the size of the firm, social incubation, and the gender of the founder. Within them, some scholars have found that companies with female leadership are more sustainability-oriented (Barrachina-Fernandez *et al.,* 2021). In this vein, women's entrepreneurship is postulated as an excellent bridge for the transition to sustainable development (Agarwal *et al.,* 2020).

Although the literature is scarce, some studies assert that there is a positive relationship between women's entrepreneurship and the level of economic and social development (Ambepitiya, 2016; Criado-Gomis *et al.,* 2020; Al-Qudah *et al.,* 2022; Stefan *et al.,* 2021) and that women entrepreneurs can hold an essential position in the implementation of sustainable development (Mahajan & Bandyopadhyay, 2021).

These results can be grounded by theoretical frameworks such as Social Role Theory (Eagly, 1987) and Structuration Theory (Giddens, 1984). Eagly's Social Role Theory holds that the behavior of men and women is aligned with the role or stereotype assumed by them in the society in which they live, which reflects the social division of labor (Eagly, 1987). Based on this theory, Gupta *et al.* (2019) proved that entrepreneurships are more closely related to men or women, depending on the type. In this line, commercial entrepreneurs (more focused on maximizing profits) and high-growth entrepreneurs are perceived as being more similar to men than to women and conversely, low-growth entrepreneurs are perceived as more similar to women than men. On the other hand, social entrepreneurs - more focused on creating social value- are uniquely perceived as similar to both men and women. Structuration Theory (Giddens, 1984) considers men and women as different agents who are socialized differently and produce according to roles and practices inherited from the past. Women play different roles in several structures such as social institutions, the family (mother, daughter), and marriage (housewife), that influence their entrepreneurial behavior (Ambepitiya, 2016; Agarwal *et al.,* 2020). They view their businesses as interconnected structures of relationships between the economic organization, society and the family, trying to organize their time to avoid conflict between their different roles. Thus, they lead their businesses differently from men, are less interested in the company's earnings and more interested in childcare (Zambrano-Vargas & Vazquez-Garcia, 2019) and in the social and ecological impact (Diaz-Sarachaga *et al.,* 2022). Some research suggests that “women managers are key drivers of sustainable development, as they manifest greater social and environmental commitment due to different gender socialization circumstances” (Stefan *et al.,* 2021, p.6).

Over the last two decades, many academic scholars have discussed the sustainability concept in terms of these three common factors: economic, social and environmental (McDonald & Oates 2006; Abdur Rouf, 2012). Costanza *et al.* (2016) cluster the 17 SDGs under the three pillars of Sustainable Development, linking every goal to a single pillar. More specifically, they suggest that environmental sustainability is achieved through Goals 6, 13, 14, and 15; economic sustainability through Goals 7, 8, 9, 11, and 12; and societal sustainability through Goals 1, 2, 3, 4, 5, 10, 16, and 17.

According to Diaz-Sarachaga and Ariza-Montes (2022) the SDG indicators should be considered pertinent to any model of entrepreneurship. Accordingly, only limited research (Apostolopoulos *et al.,* 2018), and even less in the field of FE (Deng *et al.,* 2020), has examined the role that entrepreneurship plays in achieving the SDGs.

According to Kumari and Singh (2023), sustainability is a multifaceted concept, and social sustainability is the key component of sustainable development. Sustainable social development processes from an integral vision, considering humanity as a whole (Luna-Nemecio *et al.,* 2020), and focus on various dimensions of social development, including measures related to basic needs (no poverty (SDG1), the elimination of hunger (SDG2); social equity (gender equality (SDG5) and reduced inequalities (SDG10); the improvement of educational processes (quality education (SDG4)); quality of life, well-being, and healthy eating (Health and well-being (SDG3)); inclusive societies for sustainable development with strong and guaranteed institutions (Peace, justice and strong institutions (SDG 16) and partnerships (SDG 17).

Women entrepreneurs tend to prioritize social value over economic and environmental objectives when creating businesses (Hechavarria *et al.,* 2019; Rosca *et al.,* 2020; GEM, 2023). Some of the studies that focus on the social perspective of FE analyze the effectiveness of women-owned companies in addressing gender discrimination, including basic needs (food and housing), health care, and education and training, among other objectives (Lock & Lawton, 2016; Anderson & Mdemu Komba, 2017; Agarwal *et al.,* 2020; Fang *et al.,* 2022). In this vein, Ambepitiya (2016) examined the role of ~~sixty~~ 100 women (60 entrepreneurs and 40 executives) in establishing sustainable development in four developing countries and found that these firms are more concerned with social issues. Women interviewed in this study say that their businesses enable them to be financially independent and contribute to the family economy. In this way, they help to reduce poverty while trying to fight discrimination. However, this study was carried out in developing countries, which restricts the universality of the results. This leads us to formulate the following hypothesis:

***H₁**: FE has a positive impact on Social Sustainable Development.*

Economic sustainability involves goals related to affordable energy (SDG7), which as a result of the recent conflicts has become more expensive, and the number of people without access to electricity has increased (UN, 2022); promoting decent work (SDG8), as conditions and fair wages contribute to eradicating poverty and enhance growth; fostering sustainable industrialization, innovation (SDG9) and sustainable cities (SDG11) which generate ecosystems that support growth; and ensuring responsible consumption and production (SDG 12), because according to UN report (2022) "unsustainable patterns of consumption and production are root causes of the triple planetary crises of climate change, biodiversity loss, and pollution"**.**

According to the GEM report (2023), women entrepreneurs are contributing to sustainable development by creating jobs and innovation in different sectors and countries. There is evidence to justify that one of the critical factors in the innovative development of a country is the participation of women and, therefore, their engagement in entrepreneurship (Barrachina-Fernandez *et al.,* 2021). Mahajan and Bandyopadhyay (2021) studied eight cases of women-led companies in the renewable energy sector, finding the positive impact in order to demonstrate the role of women-led companies on sustainable development. Ambepitiya (2016) shows that women entrepreneurs support society and the country's economy by providing products and services as well as job opportunities (using traditional production methods, providing opportunities for disfavored producers, developing fair trade practices, and attempting to maintain a secure working environment).

Based on previous studies, the distinctive characteristics of FE make it a relevant factor to contribute to balanced economic development. So the second hypothesis posits that:

***H₂**: FE has a positive impact on Economic Sustainable Development.*

Environmental sustainability is difficult to explore because different aspects of the environmental sustainability discussion are continuing (Khan & Quaddus, 2015). In this study, environmental sustainability also covers a varied range of indicators related to water and sanitation (SDG6), climate change (SDG13), and life on land (SDG15) and below water (SDG14). Environmental development "enhances the well-being of both individuals and the planet in conjunction with business profits" (Moya-Clemente *et al.,* 2020: 4)

Empirical evidence shows that women entrepreneurs are more committed to addressing environmental issues and are more sensitive to developments related to climate change and its impacts (Zelezny *et al.,* 2000; Hunter *et al.,* 2004; Braun, 2010; Akinbami *et al.,* 2019). Therefore, including them in the sustainable development agenda enhances a country's future growth (Mahajan & Bandyopadhyay, 2021). In this line, Barrachina-Fernandez *et al.* (2021) state that women usually start firms founded on their skills, competence, and environmental effects.

Women are predominant in key positions both in formal and informal environmental organizations (Tindall *et al.,* 2003), and are central to many environmental movements (Zelezny *et. al.,* 2000).

Brush *et al.* (2009) defined FE theoretically using a framework of five elements, the "5M" framework. An entrepreneur needs to have access to the market, money, management, motherhood (household/family context) and macro/micro environment. Further research proposed a sixth element, "environmental thinking" that demonstrates the interest that female entrepreneurs normally show when starting their own company (Barrachina-Fernandez *et al.,* 2021). The previous evidence takes us to the following hypothesis:

***H₃**: FE has a positive impact on Environmental Sustainable Development.*

On the other hand, although women represent nearly fifty percent of the world's population (49,7%) (World Bank, 2024) the gender gap exists in basic areas such as education, healthcare, and participation in the economic and political system worldwide. Despite the measures agreed to by the United Nations and the governments, the gender gap is a fact. On the way to gender equality, the top 10 countries that have closed at least 80 % of their gap in recent years were: Iceland (91.2 %) which ranks first, followed by Nordic countries (Norway, (87,9 %), Finland (86,3 %), Sweden (81,5 %), and New Zealand (85,4 %). In Europe, Germany (81,5%) is in sixth place, followed by Lithuania (80 %) and Belgium (79,6 %). A country from Latin America (Nicaragua, 81,1 %) and another from Sub-Saharan Africa (Namibia, 80,2 %) complete this top 10 (Global Gender Gap Report, 2023).

This gender inequality in key areas like educational attainment (Levie & Autio, 2008; Van Der Sluis *et al.,* 2008) places women at a disadvantage compared to men when they become entrepreneurs (Guzman & Kacperczyk, 2019) because of various factors, including restricted financing options, women´s typically lower salaries than men´s, their smaller savings, their decreased ability to obtain loans (Manning & Swaffield, 2008), and their heightened challenges with finding investors and securing equity capital (Alsos, Isaksen & Ljunggren, 2006).

In fact, the number of female businesses is lower in the total share of entrepreneurial activity (Stefan *et al.,* 2021). According to the GEM report, the share of women entrepreneurs worldwide varies considerably but is consistently below the share of male entrepreneurs. Regionally, Latin America and the Caribbean (W/M 0,85)

and North America (W/M 0,85) present the closest parity situation in entrepreneurship. Meanwhile, in Europe (W/M 0.73) and the Middle East and Africa (W/M 0.75) there is a larger gender gap. At the country level, the largest gender gaps were found in Egypt (W/M 0,38) and Japan (W/M 0,39). In contrast, in Indonesia (W/M 1.30) and Togo (W/M 1.13) women mostly outnumber men.

In this context, we propose to test whether a country's gender gap has a moderating effect on the relationship between FE and sustainable development (social, economic, and environmental). Consequently, the following hypotheses are tested:

***H₄**: Gender gap moderates the impact of FE on Social Sustainable Development.*

***H₅**: Gender gap moderates the impact of FE on Economic Sustainable Development.*

***H₆**: Gender gap moderates the impact of FE on Environmental Sustainable Development.*

Methodology

Data and Variables

The empirical research was carried out using data from the SDG Index (SDG Index & Dashboards), FE Index, and Global Gender Gap Index. All data are available online[1]. The three databases have been crossed and filtered, leaving 76 countries, with data available in all of them (see appendix A).

Table 1 shows the indicators that have been assigned to each of the latent variables. These constructs were measured using various indicators. The FE Index, elaborated by the Global Entrepreneurship and Development Institute, has been used as the main latent variable. It measures the development of high-potential FE worldwide.

On the other hand, there is no single concept of sustainability, therefore there is no universally accepted way of measuring it (Khan *et al.*, 2016). The SDG Index provides a report card for the country's performance on the historic Agenda 2030 and the SDGs (Diaz-Sarachaga, Jato-Espino, & Castro-Fresno, 2018). The SDG Index establishes a world ranking that measures the progress of the SDGs in 193 countries. Its components have been retrieved from the database[2] prepared by the Bertelsmann Stiftung and Sustainable Development Solutions Network (Sachs *et al.*, 2022), available online.

Finally, the Global Gender Gap Index annually benchmarks the current state and evolution of gender parity across four key dimensions: Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment, providing country rankings that allow for effective comparisons.

Table 1

Variables and Indicators

Latent variable	Nomenclature and Definition
FEI*	**FEI:** FE Index
Social SDG**	**SDG1.** No poverty. **SDG 2.** Zero hunger **SDG 3.** Good health and well-being **SDG 4.** Quality Education **SDG5**. Gender equality **SDG10**. Reduce Inequalities. **SDG 16.** Peace, justice and strong institutions **SDG 17.** Partnerships for the goals
Economic SDG**	**SDG 7.** Affordable and clean energy **SDG8**: Decent work and economic growth. **SDG 9.** Industry, innovation and infrastructure **SDG 11.** Sustainable cities and communities **SDG 12.** Responsible consumption and production
Environment SDG**	**SDG 6.** Clean water and sanitation **SDG 13.** Climate action **SDG 14.** Life below water **SDG 15.** Life on land
Gender gap***	**Global Gender Gap Index**

*Source: Authors compilation based on: *****FEI available at: https://thegedi.org/research/womens-entrepreneurship-index/ . **Average score on each sustainable development goal. SDG Index. Available at: https://www.sdgindex.org/ . *** Gender gap. Available from World Economic Forum at: https://www.weforum.org/publications/series/*

[1] FEI available at: https://thegedi.org/research/womens-entrepreneurship-index/ This index is only available for 2015. SDG Index Data. Available at: https://www.sdgindex.org/ . World Economic Forum. Global Gender Gap Index. Available at: https://www.weforum.org/publications/series/

[2] We use the SDG scores for 2017, due to FE needing time to influence sustainable development goals. Also incorporating a lag of two years helps mitigate possible endogeneity.

Table 2 provides the descriptive statistics for all the variables introduced in the analysis of the model, although not all the SDGs appear in the final exploitation of the results because not all of them had sufficient factor loadings. It can be observed that the average FEI is 44.85 points with a high variability (+-15.92) while the average gender gap is much higher at 71.01 points but with a lower variability between countries (+-5.91). Regarding the SDGs, the highest average value is SDG1: Poverty alleviation (93.53) but also with a higher variability followed by SDG 6: Clean water and sanitation (86.09) and SDG11: Sustainable cities and communities (82.25), the latter with a higher standard deviation.

Method

The methodology used is the structural equation model (SEM), which is a second-generation multivariate data analysis technique that gives a higher level of confidence to research due to its statistical efficiency through robust and powerful software.

The approach used is PLS, which is based on the analysis of variance and implies a more flexible modeling methodology since it does not require rigorous parametric assumptions, mainly in the distribution of the data (Wold, 1980). PLS-SEM emerged as a technique for analyzing the complex relationships between latent variables that allow the observed data to be explained, and predictive analysis as a relevant element in scientific research (Martínez Ávila & Fierro Moreno, 2018). It should be noted that the PLS technique can be used for both explanatory (confirmatory) and predictive (exploratory) research (Hair *et al*., 2017).

The higher statistical power makes PLS-SEM particularly suitable, therefore, for exploratory research where theory is less developed, as in our case, and whose goal is to advance a possible relationship between different variables that has not been stated thus far.

The empirical model for this study is reflective, where a latent variable is hypothesized as the common cause of multiple observed variables (measurement items) while changes of observed variables do not exert causal effects on the corresponding latent variable; therefore, part of the observed variables can be removed for the model fit enhancement (Edwards & Bagozzi, 2000; MacKenzie *et al.,* 2005). The software used for the analysis was Smart PLS.

In the following sections, the model estimation for PLS analysis and the evaluations that PLS methodology demands have been carried out.

Table 2

Descriptive Statistics

Variable	Mean	Median	Observed min	Observed max	Standard deviation
Gender Gap	71.019	70.8	55.9	88.1	5.912
FEI	44.855	43.4	15.2	82.9	15.927
SDG1	93.536	99.243	16.984	100	15.326
SDG2	57.646	59.29	28.86	80.418	12.033
SDG3	79.817	83.215	27.561	97.576	16.119
SDG4	81.527	85.508	36.719	99.842	14.831
SDG5	66.136	67.775	28.674	92.604	13.517
SDG6	86.092	90.91	50.205	98.496	11.819
SDG7	77.513	84.4	2.073	99.912	19.445
SDG8	70.132	71.931	32.731	95.759	14.748
SDG9	47.088	46.182	9.707	93.861	24.272
SDG10	64.667	70.413	13.871	99.931	22.59
SDG11	82.258	90.565	13.967	100	19.725
SDG12	64.566	68.293	36.714	83.912	11.715
SDG13	78.599	81.92	30.144	92.302	11.376
SDG14	47.653	47.563	11.62	75.982	12.469
SDG15	60.373	60.717	26.187	84.12	14.594
SDG16	65.031	64.072	31.206	92.369	14.049
SDG17	64.77	63.228	28.697	100	15.964

Results: Data Analysis

Figure 1 (below) represents the relations of the model set out in the previous sections. The diagram contains the main results of the estimation. The proposed model is reflective, which is common in social sciences (Mendez-Picazo *et al.,* 2021). This model serves as the basis of the diagram that the *SmartPLS statistical software* needs to proceed to the calculations that the investigation requires.

Once the structural model is developed, two aspects are mainly observed: the sequence of the constructs and the relationship between them, which represent the hypotheses and their relationships according to the theory that is being tested. In addition to observing the latent and observable variables, it is also important to mention one aspect that can be embedded in the model in the constructs: moderation (Martinez Avila & Fierro Moreno, 2018).

Considering the indications that the authors point out for the analysis with SmartPLS, the results for this entire study will be presented starting with the evaluation of the calculation model for a reflective measurement model (outer model), and then the structural model (inner model) will be evaluated.

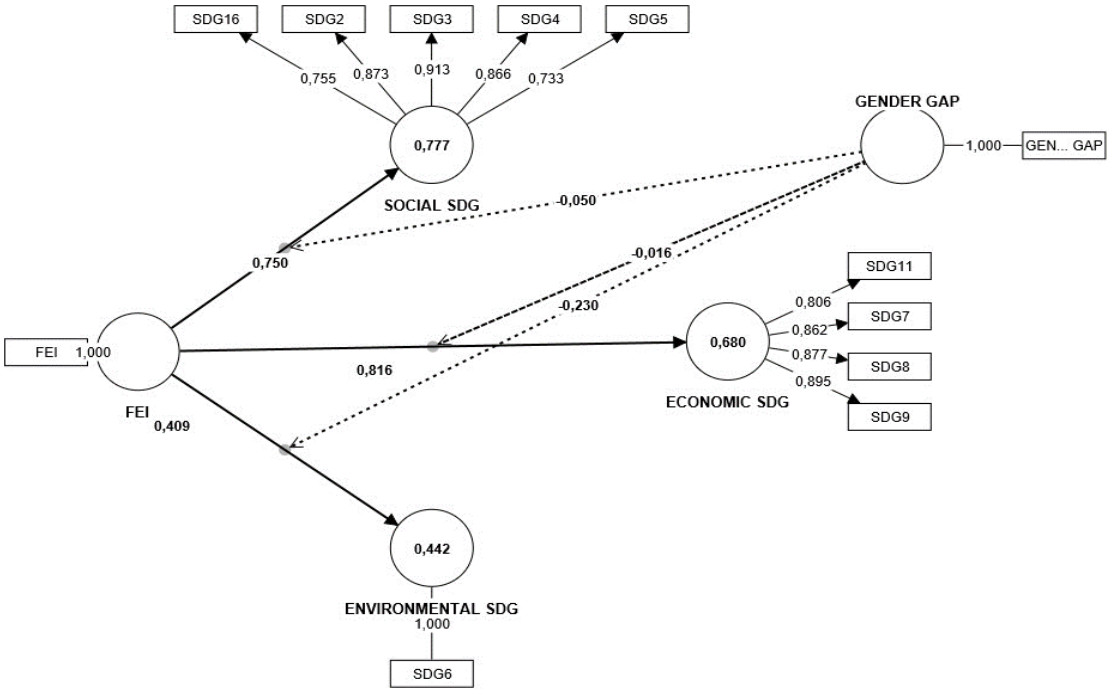

Figure 1. Model Research

Testing the Measurement Model

The *outer model* specifies the measurement model that represents the relations between the observed indicators and the latent constructs. The evaluation of the model began with reflective measures, which were assessed using both convergent and discriminant validity analyses. The factor loadings, composite reliability (CR), and average variance extracted (AVE) were required to assess convergent validity.

Following an examination of the outer loadings for all latent variables, different items were excluded from the research model due to unsatisfied loading values. Loadings above 0.7 are suggested (Hair *et al.,* 2019), as they indicate that the construct explains more than 50 percent of the variance of the indicator. From the Social SDG construct, the indicators SDG1, SDG10, and SDG17 were eliminated due to insufficient factor loadings. For the Economic SDG construct, SDG12 was eliminated, and, finally, for the Environmental SDG, SDG13, SDG14 and SDG15 were eliminated. For the items that remain in the model, their outer loadings can be seen in Figure 1 and Table 3. In the same table, the construct reliabilities and validities were also checked through the values of Cronbach's alpha, composite reliability, and average variance extracted.

The reliability of the construct is analyzed, and it is observed that all the values of Cronbach's alpha and the composite reliability are above the minimum cut-off point of 0.70 (Hair et al. 2019). In addition to this, the presence of convergent validity was also confirmed through the values of AVE, that the desirable values, suggested by Hair et.al. (2017), should be above 0.50. Table 3 depicts that all AVE values were higher than 0.50.

Table 3

Model Assessment

Variable	Indicator	Factor Loadings	Cronbach's alpha	Compositreliability (rho_a)	Compositreliability (rho_c)	Average variance extracted (AVE)
FEI		1.000	1.000	1.000	1.000	1.000
ECONOMIC SDG	SDG11	0.806	0.883	0.895	0.919	0.741
	SDG7	0.862				
	SDG8	0.877				
	SDG9	0.895				
SOCIAL SDG	SDG16	0.755	0.885	0.887	0.917	0.690
	SDG2	0.873				
	SDG3	0.913				
	SDG4	0.866				
	SDG5	0.733				
ENVIRONMENTAL SDG	SDG6	1.000	1.000	1.000	1.000	1.000
GENDER GAP		1.000	1.000	1.000	1.000	1.000

As a last step, discriminant validity was confirmed with the Fornell-Lacker criterion, the general assumption being that the values at the top of each column must be higher than those below them (Henseler *et al.*, 2015). Therefore, based on these results from Table 4, it can be concluded that discriminant validity existed within the proposed model.

Table 4

Discriminant Validity. Fornell-Larcker Criterion

	ECONOMIC SDG	ENVIRONMENTAL SDG	FEI	GENDER GAP	SOCIAL SDG
ECONOMIC SDG	0.861				
ENVIRONMENTAL SDG	0.629	1.000			
FEI	0.824	0.581	1.000		
GENDER GAP	0.555	0.544	0.664	1.000	
SOCIAL SDG	0.826	0.646	0.829	0.681	0.831

Testing the Structural Model

The principal analyses performed in order to assess the structural model are path coefficient sign and magnitude, the significance of path coefficient, determination coefficients and effect size, and the effect of a moderate variable.

Table 5 shows the results of testing the structural model. This study found that FE has a positive and significant impact on Social SDG ß=0.7750, with p-value ≤ 0.01), Economic SDG (ß=0.816, with p-value ≤ 0.01) and Environmental SDG (ß=0.409, with p-value ≤ 0.01). The effect on Economic SDG is greater, followed by Social SDG and, finally, on Environmental SDG. Hypotheses 1, 2, and 3 are therefore confirmed.

On the other hand, it can be observed in Figure 1 how the gender gap moderates the relationship between FEI and the SDGs. Its effect is negative on the Social, Economic, and Environmental SDGs (see Table 5) but only significant for the Environmental SDGs (p-value 0.012), so only hypothesis 6 is supported: the greater the gender gap in the country, the lower the FE impact on the Environmental SDGs. Negative moderation implies that the positive relationship between FE and environmental sustainability is adversely affected when the gender gap in the country is wider. In other words, in countries with a wider gender gap the positive impact of FE on environmental sustainability is smaller compared to countries where the gender gap is narrower.

Table 5

The Regression Coefficient of the Structural Model

	Original sample (O)	**Sample mean (M)**	**Standard deviation (STDEV)**	**T statistics (|O/STDEV|)**	**P values**
FEI -> ECONOMIC SDG	0.816	0.814	0.069	11.842	0.000
FEI -> ENVIRONMENTAL SDG	0.409	0.418	0.151	2.709	0.007
FEI -> SOCIAL SDG	0.750	0.755	0.063	11.933	0.000
GENDER GAP x FEI -> ECONOMIC SDG	-0.016	-0.024	0.060	0.266	0.790
GENDER GAP x FEI -> ENVIRONMENTAL SDG	-0.230	-0.249	0.092	2.514	0.012
GENDER GAP x FEI -> SOCIAL SDG	-0.050	-0.050	0.056	0.880	0.379

*Note: Significant at r-value *< 0.1; **<0.05; ***<0.01*

R2 indicates the construct's variance explained by the model. All the endogenous latent variables exhibit reliability and an adequate fit, with values of between 0.777 and 0.442 (see figure 1). According to Hair *et al.* (2019), R2 values above 0.5 represent the moderate explanatory power of the model.

Discussion

This study has made it possible to test the impact of FE on sustainable development through the fulfillment of the different SDGs. Our findings, analogously to those obtained by Ambepitiya (2016), reveal a positive relationship between FE and sustainable development, which proves that women entrepreneurs play an important role in promoting sustainable practices in economics, social systems and ecology, and ultimately in achieving sustainable development. However, while the findings of Ambepitiya (2016) addressed the joint impact of FE on the sustainable development in developing countries, and with a methodology that does not allow us to establish a causal relationship, our results allow us to differentiate between environmental, social and economic sustainable development. In fact, Ambepitiya analyses by means of a survey of 100 women (40 executives and 60 entrepreneurs) of 4 developing countries (Sri Lanka, Maldives, Nigeria and India) and subsequent frequency analysis, their engagement with environmentally friendly activities, their capability to become philanthropists later to serve societies, or to provide employment opportunities. But the impact on sustainable development is addressed jointly, in a single hypothesis: "female entrepreneurs who are engaged in social, ecological and economical business practices support sustainable development in developing nations", and through a t-student test between support or non-support of this hypothesis, a methodology that do not allow us to state a causal

relationship. Our results (Figure 2) are also in line with those obtained by Mahajan & Bandyhopadhyay (2020) who using a case study methodology proved the influence of women-led enterprises on "SDG 1 (poverty), SDG 2 (zero hunger), SDG 3 (good health and well-being), SDG 4 (quality education), SDG 5 (gender equality), SDG 6 (clean water and sanitation), SDG 8 (decent work and economic growth), SDG 10 (reduced inequalities), and SDG 13 (climate action)".

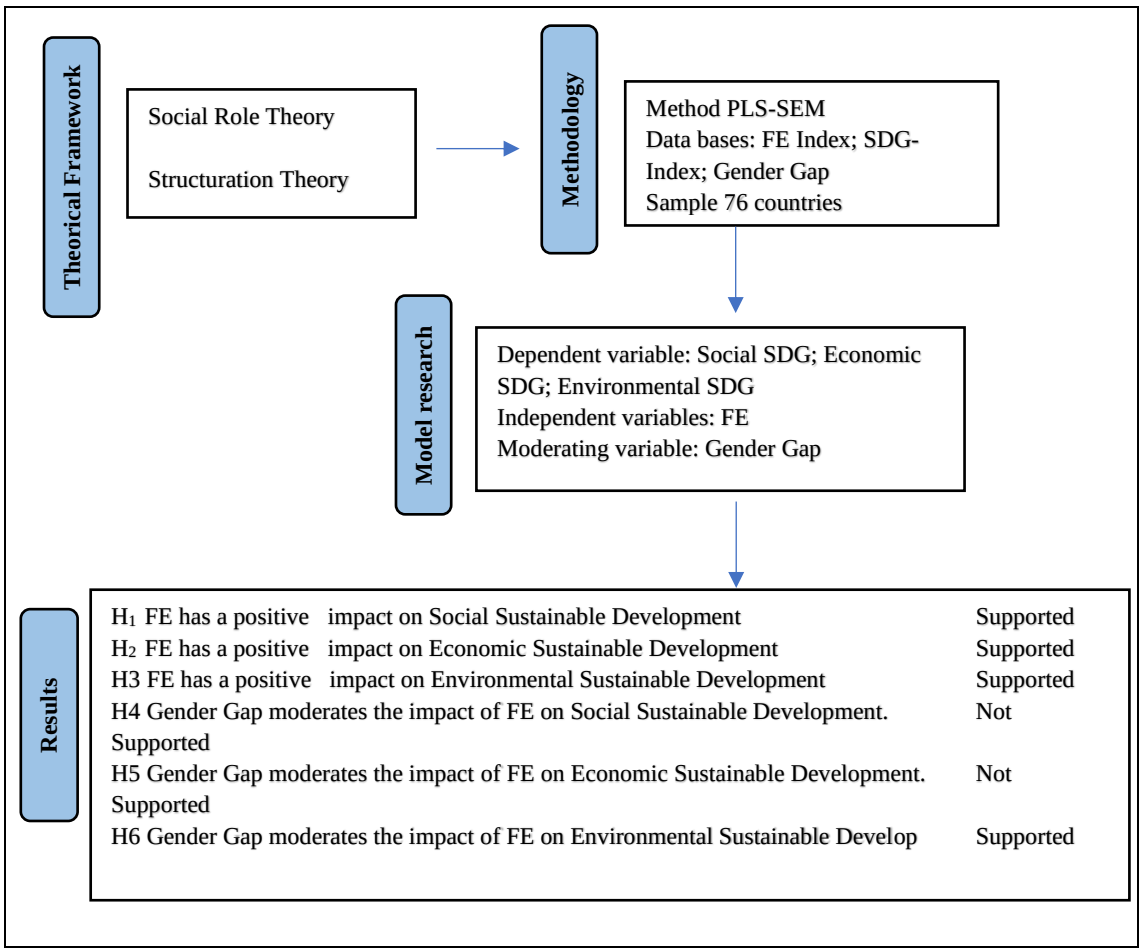

Figure 2. Structure and Research Results

Firstly, these results confirm a positive impact of FE on social sustainable development through the consecution of SDG 2, 3, 4, 5, and 16, which has led us to confirm H1. This impact is a consequence of the commitment of women to social value when creating business (Rosca *et al.*, 2020; Diaz-Sarachaga *et al.*, 2022; GEM, 2023; Meliá-Martí *et al.*, 2024). In this regard, Hechavarria *et al.* (2019) proved that females are more likely than males to emphasize goals of social value creation when pursuing an entrepreneurial activity, and that this translates into a greater weight of women compared to men in these ventures.

Particularly in the field of social development objectives, our results prove the importance of FE in reducing poverty and with it hunger (SDG 2), which is important, especially in developing countries, where it has proven to be a largely successful model, which women and their families use to lift themselves out of poverty (Lock & Lawton Smith, 2016), enabling them to fulfill their dependents' basic needs (Anderson & Mdemu Komba, 2017).

Similarly, the results confirmed its impact on SDG 3 (health) and SDG 4 (education) achievement. This is a consequence of the economic development these ventures generate, proved in H1, as poverty relates negatively to health and well-being (Currie & Goodman, 2020) and greater economic development allows countries to invest more in both areas. Nevertheless, beyond this fact, other elements associated with women can justify this impact. In its 2018 report titled "Fostering Women's Entrepreneurship in the ASEAN region", the United Nations reported that women devote 90 cents of every dollar they earn to their children's education and health compared to 30-40 cents by men (Quagrainie *et al.*, 2021). According to Ge *et al.* (2022), who studied the determinants of female entrepreneurial contribution toward household income, 'when women earn money they are more likely than men to spend it on household needs, which facilitates better-quality care for children. In the field of education, multiple studies have contrasted its role as a key element in the success of entrepreneurship in general, and in particular in FE (Bates *et al.*, 2007; Lock & Lawton Smith, 2016), which has led to an increase in the number of entrepreneurship education programs worldwide over the past two decades at all levels of education (Jardim, 2021). In this regard the existence of FE enables access to educational programs for women, in

some cases intended for previously marginalized groups, which may have an impact on the further achievement of SDG 4, especially in developing countries.

Concerning the positive impact of FE and SDG 5 (gender equality), multiple precedents point to the relationship between FE and more gender equality (Fang *et al.*, 2022). FE can help overcome gender inequality issues because it is assumed that gainful economic activity can alter household power relations and enable women's participation in the public domain (Altan-Olcay, 2016). On the other hand, entrepreneurship allows women to access monetary resources, and as a result they gain the ability to challenge gendered cultural practices and renegotiate social and political inequalities (Ge *et al.*, 2022).

Our results prove, in the second place, the positive impact of FE on sustainable economic development (H2), through the achievement of SDGs 7 (affordable and clean energy), 8 (decent work and economic growth), 9 (industry, innovation and infrastructure), and 11 (sustainable cities and communities). These results are consistent with previous literature, as female-run enterprises are steadily growing all over the world, contributing to household income and the growth of national economies (Ambepitiya, 2016).

A positive impact of FE on environmental development has also been obtained (H3). Different studies have reported with enough consistency that women have stronger environmental attitudes and commitment to green issues than men (Zelezny *et al.*, 2000; Hunter *et al.*, 2004; Braun, 2010). Stefan *et al.* (2021) argue that women managers are key drivers of sustainable development, as they manifest greater social and environmental commitment due to different gender socialization circumstances. However, greater commitment does not necessarily mean greater impact. Scientific evidence of the attitude-behavior relationship points to a lack of support for the view that people's actions are guided by their attitudes (Smith & Louis, 2009), so attitude alone does not lead to behavior change (Barr *et al.*, 2001).

According to Akinbami *et al.* (2019) female entrepreneurs demonstrate a heightened awareness of climate change events and their repercussions, making it essential to support their endeavors for the advancement of rural economic growth. Additionally, research by Bawakyillenuo and Agbelie (2021) affirmed that female entrepreneurs and local business owners exhibit a greater propensity for environmental conscientiousness.

Our findings allow us to affirm that this greater commitment of women to environmental issues (SDG 6) gives women's entrepreneurship a differential character and manifests itself in the form of a positive impact on the environmentally sustainable development of the regions in which they are established, which has led us to confirm H3: FE has a positive impact on Environmental Sustainable Development.

In addition to the study of the impact of the FE on sustainable development, the moderating effect of the gender gap in this relationship has been analyzed. The results obtained show that when there is a greater gender gap, the impact of FE on sustainability development is lower (negative sign), although only with a significant effect in the case of environmental sustainable development, which led us to confirm H6, while H4 and H5 have not been supported. Our results differ from those obtained by Sarfaraz (2014), who concluded that female entrepreneurial activity is not significantly correlated with gender equality. This paper, unlike ours, does not consider the moderating role of the gender gap, but analyzes the impact of gender equality (or its inverse gender gap) on the female entrepreneurial activity. Moreover, it does not consider the social and environmental dimension of development, being a preliminary study based on a correlation analysis. Even so, its results go in the opposite direction to those obtained in our work, since over all, there appears to be an inverse relationship between the tendency for women to start an entrepreneurial venture and gender development equality, although only significant in the case of Latin American and Caribbean low/middle-income countries. It is argued that it is possible that progress in gender equity, greater access to education, health benefits and in general a satisfactory economic level, makes women less interested in entrepreneurship, opting to a greater extent for contracting for third parties, which does not imply a lesser contribution of women to the country's economy.

The disparity of results and significance confirms the point made by Sarfaraz (2014), in the sense that female entrepreneurship in each country has its own characteristics and needs to be studied in its own socio-economic context. More research is needed on the role of the influence of greater or lesser gender equity in female entrepreneurship, and its impact on sustainability, differentiating the economic and social reality of the countries and the three dimensions of sustainability (economic, social and environmental).

The dimensions used to establish the Global Gender Gap Index (Work Economic Forum): Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment, shed light on the reasons that can explain the negative moderating effect of this indicator. In general, the same factors that determine the existence of a gender gap in a country cause the impact of the EF on sustainable development to be smaller. Among them, a higher Gender gap implies lower Economic Participation and Opportunities for women, because of different aspects such as limited possibilities of financing, as women's salaries are usually lower than men's and women have fewer savings, fewer possibilities of obtaining loans (Manning & Swaffield, 2008) and greater difficulties raising equity capital and attracting investors (Alsos, Isaksen, Ljunggren, 2006). This lower initial investment capacity makes it more difficult to recruit skilled labor and generates smaller enterprises, with more difficulties in dealing with eventualities throughout the life cycle of the company, which may justify the lower impact of FE.

Another of the elements that determines the gender gap, educational attainment, also has a major impact on FE. Thus, although there are conflicting opinions about whether entrepreneurship can be learned or not, numerous studies point to education (Levie & Autio, 2008; Van Der Sluis *et al.*, 2008), especially in the field of entrepreneurship (Galindo *et. al.*, 2014; Bauman & Lucy, 2016;), as a key element in their success. Consequently, it is expected that a larger gap in educational attainment will lead to a lower impact of FE in the form of sustainable development.

Therefore, the greater constraints of women compared to men in different areas of society, visible in the gender gap

in different areas (Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment), trigger the lower impact of FE on sustainable development, which has been proved in the case of environmental development. The reason why it only emerges significantly in the case of environmental development may be due to the fact that of the three SDGs, environmental commitment is the one that emerges most strongly in gender studies, as opposed to economic or even social (GEM, 2023; Hunter *et. al*, 2004; Braun, 2010).

Conclusions

Nowadays, progress towards the Sustainable Development Goals has become a strategic issue for the government of any country. Thus, it is key for nations to know which drivers can contribute to better sustainable social, economic and environment development. The Women´s Entrepreneurship Report has recognized that FE has a positive impact on society and economies (GEM, 2023). Promoting sustainable development on a worldwide basis requires recognizing and assisting women entrepreneurs. Empowering and supporting female entrepreneurs is not only a matter of social justice but also an economic imperative. When women have equal opportunities to participate in the economy, it can lead to more robust and sustainable development, benefiting entire communities and societies.

To further sustainable development, combining female entrepreneurship with sustainability is an appealing and successful strategy, but more research is needed because of the topic's novelty and the information gaps that currently exist. In response to studies calling for more research on this issue, such as Criado-Gomis *et al.* (2020) and Al-Qudah *et al.* (2022), we explored the effects of FE goals on a sample of 76 countries worldwide. We conducted an empirical cross-country study with a structural equations model to determine how FE influences the fulfillment of the sustainable development goals in the three dimensions (social, economic and environmental) and whether gender gap could have a moderating effect on this relationship.

Our findicate that women who develop entrepreneurial activities are drivers of sustainable development in its three forms: economic, social, and environmental. Thus, these results attempt to provide some more evidence to the gap previously established. These results offer significant practical implications for policymakers. Firstly, about the usefulness of developing public policies to promote FE, especially in less developed countries, and therefore more in need for economic impulses. Secondly, to reduce the gender gap, for the positive consequences of FE on SD.

Interpreting the moderating effect of the gender gap implies understanding that the relationship between FE and environmental sustainability is not constant and may vary depending on the level of the gender gap in the country. This highlights the importance of addressing gender inequalities in order to enhance the positive impact of FE on environmental sustainability. The reasons behind this negative moderation can be explored. For example, in countries with a wider gender gap, women entrepreneurs may face greater challenges in accessing resources, funding or supporting networks, which may hinder their ability to impact environmental sustainability positively.

This study contributes to the existing literature in two diverse ways. First, the existing research has analyzed the contribution of entrepreneurship to the fulfillment of SDGs (Apostolopoulos *et al*., 2018; Diaz-Sarachaga & Ariza-Montes, 2022), but very few have done this in the area of FE (Deng *et al*., 2020). Moreover, although the literature analyzes the different entrepreneurial motivations and engagement of men and women in social, economic, or environmental issues, the analysis of the real impact stemming from that commitment has received less attention from scholars. This study allows us to establish, beyond women's commitment to different SDGs, the FE impact on social, environmental, and economic development. Second, there is very little research using a causal study design, which makes this paper more useful. Third, this research adds additional evidence to the limited cross-country comparative empirical studies available on FE (Meunier *et al.*, 2017). Finally there is no previous work, as far as we are concerned, that analyzes the moderating role of gender gap on FE–sustainable development relationship, the results obtained here being useful in this respect.

These results must be interpreted with caution, as they are not without limitations. The first limitation is the database itself. Temporal analysis was not possible because the databases do not provide panel data. Future studies should focus on time series data likely to capture higher variance across years. Second, the sample of countries has resulted from cross-checking the availability of data in the different databases used. In future research, additional data - countries, years, factors - are likely to provide more robust estimates and richer discussions, especially in terms of cross-country analysis.

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Annexes

COUNTRIES			
Algeria	Ecuador	Jamaica	Slovakia
Angola	Egypt	Japan	Slovenia
Argentina	El Salvador	Latvia	South Africa
Australia	Estonia	Lithuania	South Korea
Austria	Ethiopia	Macedonia	Spain
Bangladesh	Finland	Malawi	Sweden
Barbados	France	Malaysia	Switzerland
Belgium	Germany	Mexico	Thailand
Bolivia	Ghana	Montenegro	Trinidad & Tobago

COUNTRIES			
Bosnia and Herzegovina	Greece	Netherlands	Tunisia
Botswana	Guatemala	Nigeria	Turkey
Brazil	Hungary	Norway	Uganda
Chile	Iceland	Pakistan	United Arab Emirates
China	India	Peru	United Kingdom
Colombia	Iran	Poland	United States
Costa Rica	Ireland	Portugal	Uruguay
Croatia	Israel	Romania	Venezuela
Czech Republic	Italy	Russia	Zambia
Denmark	Saudi Arabia	Singapore	

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