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Is gender a determining factor in environmental behavior?

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Summary:

The study of the relationship between gender and environmental behaviour is a topic that has received increasing attention in recent years. The purpose of this article is to analyze the role played by gender in the realization of practices related to environmental conservation. Through a comprehensive review of existing literature and analysis of empirical data, gender differences in the perception of environmental issues, participation in conservation activities, and the impact of these differences on environmental sustainability are explored. The results obtained indicate the existence of 7 factors that explain 62.05% of the total variability of the variables that condition the environmental behavior of individuals, demonstrating that gender is not a determining factor of environmental behavior.

Keywords: gender, environmental behavior, environmental attitude and factor analysis.

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1 Introduction

Environmental protection has become one of the most pressing challenges of the current century worldwide, where the time to take measures to reduce the significant implications that global warming causes on the present quality of life is running out. In recent years, Ecuador and Latin America have faced constant environmental problems due to climate changes generated as a result of man's anthropogenic activity, such as: the creation of new technologies, with excessive consumption and the lack of environmental awareness of its population, being the factors that have contributed to a greater degree to a progressive environmental deterioration that reflects high levels of pollution.

Based on the above, the evolution of the anthropocentric structure towards a biocentric perspective in the relationship between humanity and nature has been the object of study and reflection by various authors. In this regard, recent research includes in its studies the importance of an anthropocentric transition towards a biocentric approach, in which humanity coexists in harmony with nature.

Faria and Paez (2014) They maintain that anthropocentrism is born of humanism and gives way to the Modern Age, which is conceived in anthropocentric terms, and places the human being as a central figure in the domain of natural resources for his own development. In this context, Norton states that a transition to a biocentric vision implies a paradigm shift in the fundamental understanding of nature, which moves him away from the premise proposed by anthropocentrism, which states that nature exists mainly to serve human interests. (1984)

The transition to a biocentric vision implies the end of the period of the anthropocentric era, a period to which Amerigo called it the era of the domination and subjection of nature to the power of the human being. (2009) The biocentric vision was born in opposition to anthropocentrism, which states that human beings must adopt an environmental awareness and abandon that utilitarian and hedonistic doctrine that has turned them into egocentric beings without respect for the life of beings with instrumental value.

In relation to the above, Taylor in his work proposes biocentrism as a current that adopts an environmental ethic, in which all natural systems and living beings have value; therefore, they deserve respect regardless of the usefulness they provide to the human being. The contribution generated by Ereú de Mantilla indicates that biocentrism goes beyond the utilitarian position, in this sense, it seeks to reconstruct the nature-society relationship, and from its ethical approach it expresses that humanity is fully capable of understanding environmental complexity to propose solutions from individualism. For this reason, the need to move from the anthropocentric to a biocentric conception is imperative in order to combat and overcome the environmental crisis. (1981)(2018)

The United Nations (UN, n.d.) points out that the term sustainable development was first used in the Brundtland Commission of 1983, and defined as the capacity of society to meet present basic

needs, without compromising the satisfaction of the future needs of new generations. However, it was not until 1992 at the United Nations Conference on Environment and Development (UNCED) that this concept was formalized.

Since then, the UN has worked hard to establish a series of initiatives to promote sustainable development as a global goal. For this reason, in 2015 it presented the 2015-2030 Agenda, which is made up of 17 interconnected goals that address a wide range of global challenges, ranging from poverty eradication and gender equality to climate action. These objectives together seek not only to improve people's quality of life, but also to guarantee the protection of the planet. On the other hand, it is important to mention that most of the goals point to education as a vital tool for their fulfillment.

UN member countries carry out a number of commitments and actions that add individualistic efforts to meet these common goals, for example, many countries have taken the initiative to develop national plans that incorporate the SDGs. They also allocate more resources for the implementation of the SDGs; involve civil society and non-governmental organizations to implement and follow up on the initiatives proposed. They promote education as a tool to raise awareness in the population and encourage sustainable practices. The member countries, for their part, have decided to adjust their sectoral policies aimed at key economic sectors so that they contribute to the achievement of the objectives (UN, 2018).

However, statistics indicate that the achievements made do not reflect sufficient progress to safeguard the environment. In this regard, several authors state that the failure of the SDGs represents a threat to human survival, as it undermines efforts to promote sustainable development and protect the environment.

In 2013, Ecuador, in its eagerness to meet the sustainable development goals, implemented the National Plan for Good Living, which was an instrument that promoted change and defined the path to build a country with a view to sustainable development. In that same year, the project to change the energy and productive matrix in the country was proposed, which aimed to diversify national production; however, this did not happen due to dependence on natural resources (oil, raw materials) and lack of technological innovation.

For its part, the state has implemented a series of social inclusion policies that are aligned with eradicating poverty and are delivered to people with vulnerability, such as: human development bonus, pension for the elderly, disability pension, Joaquín Gallegos Lara bonus, among others, which are channeled through the Ministry of Economic and Social Inclusion [MIES], (2021). Ecuador has been working for the benefit of biodiversity conservation, which is why it has declared parks and nature reserves a national heritage of humanity, among which the Galapagos Islands stand out. At the same time, it has allocated more resources to improve the quality of education and guarantee its free access, as well as to promote democracy on issues of national interest.

In 2014, the National Secretariat of Planning and Development (SENPLADES, 2014) and the United Nations Development Program (UNDP) recognized Ecuador's compliance with the Millennium Development Goals, in which it stood out for the reduction of poverty, malnutrition, universalization of education, health, reduction of gender inequalities, and attention to sexual and reproductive health. Ratifying Ecuador's commitment to ensure the well-being of the population.

On the contrary, in the field of environmental preservation, the Ecuadorian state is a country that goes against the various types of measures implemented. According to the editorial *Primicias*, Ecuador was considered the third country in the region that imports the most plastic waste. According to the figures presented by the INEC - National Institute of Statistics and Censuses at the national level, the GADM - Municipal Decentralized Autonomous Governments collect around 13,652.6 tons of solid waste per day, where the per capita production of waste indicates that an inhabitant of the Ecuadorian urban area can produce up to 0.9 kg of solid waste per day. (2022) (2022)

Likewise, the report pointed out that 55% of the total waste collected and classified corresponds to organic waste and 45% to inorganic waste, a fact that is resounding is that even in the current century more than 50% of this waste from urban areas continues to end up in landfills causing great environmental problems in the country. It is therefore essential that central government authorities take action and assume their protection roles with greater responsibility and commitment.

Moreover, the relationship between gender and environmental conservation has become a fundamental area of research at the intersection of economics, ecology, and gender studies. Recent research has indicated that women and men often have different perceptions, priorities and forms of involvement in environmental issues. These differences can stem from entrenched power structures, social norms, and cultural expectations that affect how people interact with their natural environment (Annukka & Riikka, 2013; Fischer & Chhatre, 2013).

The findings made by Schahn and Holzer showed that it is women who are more concerned about the environment than their opposite gender. However, these findings tend to be somewhat contradictory and come to depend on the topic at hand. However, environmental studies carried out with a gender approach generally express that it is women who express greater concern about these issues. (1990)

The importance of this study lies in the need to deeply understand the relationship between gender and environmental conservation, in a world that seeks solutions to global environmental challenges. It is therefore essential to identify potential gender disparities in perception, participation and decision-making in environmental matters. This understanding can provide a solid basis for developing more effective policies and strategies for the benefit of environmental conservation.

The central purpose of this study is to analyze and evaluate the relationship between gender and environmental conservation from multiple perspectives. Within it, it seeks to examine gender differences in the perception of environmental problems, participation in conservation activities, decision-making related to the environment and the management of natural resources. In addition, it aims to answer the following question: To what extent does gender influence environmental conservation and the adoption of sustainable practices?

2 Theoretical foundation

This section presents the main contributions generated based on the themes that explain the effect of gender on environmental protection as shown below:

2.1 Environmental Management: The Effect of Gender on Environmental Attitudes

The term environmental attitude was defined by Hi like (1982)"the favorable or unfavorable feelings that one has towards some characteristic of the environment or towards a problem related to it" (p.15). About that Tafli and Ateş (2016)They point out that individuals with a positive attitude exhibit behaviors in favor of the environment by taking the necessary measures to prevent environmental problems. On the other hand, those who have a negative attitude are not able to react to the problems that arise, and even become part of it.

In addition to this, Gökmen (2021)It states that environmental attitudes are directly related to behavior. Hence the importance of the concept of attitude towards the environment. In recent years, environmental studies have grown and generated great contributions regarding the relationship it has with gender. The contributions generated by Davidson and Freudenburg point out that women tend to be more altruistic, cooperative and helpful; while men are socialized to be more independent and competitive within society. Making it clear that it is women who are most concerned about environmental issues. (1996)

In the same line of research, Xiao and Hong demonstrate (2010)In their study, differences in environmental attitudes are given in terms of gender (men and women). Their results showed that women are more willing to participate in conservation actions, such as recycling and reducing resource consumption, because they are associated with their daily household chores.

Recent studies indicate in general that women are more inclined to promote links with nature and have a higher level of concern for the environment than men. However Aoyagi-Usui, Vinken and Kuribayashi argue (2003)that the trend of analysis of the relationship between gender and the environment it is not universal and that it can vary according to the reality of each country.

2.2 Explanatory Factors of Environmental Behavior. A Gender Approach

There have been numerous theories that have tried to explain environmental behavior in recent years. Theories based on environmental psychology and environmentalism have mainly explored

the role of certain personal variables, such as attitudes, beliefs, norms, and values, in explaining pro-environmental behavior (Vicente-Molina, Fernández-Sainz, & Zagirre-Olaizola, 2018).

These theories have helped to demonstrate the importance of including personal variables in the study of environmental behavior prediction. However, little attention has been paid to theories that explain this behavior in terms of gender differences.

The findings of Zhao, Gong, Li, Zhang and Sun (2021) point to clear evidence that gender itself may not be the determining factor that induces a different environmental behavior between men and women. However, gender-related beliefs and norms in an individual's behavior deserve further exploration in the pro-environmental field.

Based on the above statements, Brough, Wilkie, Ma, Isacc and Gal add (2016) that participation in environmental activities is also affected by personal sensitivity about maintaining their gender identity. Because an individual's personal worth is determined by their socialization process and affected by the stereotype of their own social identity.

2.3 Environmental Education and Behavior: A little-studied relationship?

Many studies have addressed the returns of education, where the effect on income of increased education is the most researched area (Becker, 1962; Mincer, 1958; Schultz, 1960; among others). Analyses that have left aside the literature that deals with the non-pecuniary benefits of education, among which studies of pro-environmental behavior, reduction of the mortality rate, improvements in health, among others, stand out (Haddad, Carnoy, Rinaldi, & Regel, 1990).

Recent studies indicate that education has a positive correlation with pro-environmental behavior in a variety of contexts (De Silva & Pownall, 2014; Meyer, 2015). However, it is not clear that this is a causal effect. Because individuals choose how much education to attain and also choose how to behave in relation to the environment.

Given this premise, studies are presented that explain the relationship based on empirical evidence. About that Pérez and Camacho (2023) they demonstrated through a linear regression that the favorable behaviors of individuals towards the environment are associated with the level of education; that is, as education increases, the degree of environmental awareness also increases.

Estrada-Araoz, Gallegos, Paredes, Quispe and Mori for their part, (2023) They showed that education is positively related to pro-environmental behaviors such as: recycling, proper waste disposal and tree planting. These results express that environmental education can help create a more sustainable future by providing individuals with the knowledge, skills, and attitudes they need to take action to protect the environment.

These findings suggest that environmental education can play an important role in promoting pro-environmental behaviors in individuals and developing a sense of environmental responsibility.

3 Method

The methodological perspective used in this study is framed under the descriptive quantitative approach based on a non-experimental design that uses cross-sectional data. The research design was established based on the unit of analysis that involves the balanced study of men and women from the city of Guayaquil.

The methodological proposal proposes the application of an Exploratory Factor Analysis (EFA) as a research technique in order to reduce the total number of variables to a minimum of factors that can explain most of the variance of the variables, for the treatment of the data the statistical program SPSS version 22 was used.

The measurement instrument used to collect the information responds to a structured questionnaire. The selection of the sample was carried out in a stratified manner to guarantee its representativeness. It was made up of 110 people (50% women and 50% men) from the city of Guayaquil, so that gender differences can be compared and analyzed effectively.

The questionnaire was composed of more than 25 questions that sought to know the respondents' perception of environmental problems, participation in conservation activities and decision-making related to the environment.

3.1 Mathematical Equation of Exploratory Factor Analysis

Exploratory factor analysis is a multivariate statistical technique for data reduction, which allows explaining correlations between variables, which are compressed into a small number of unobservable variables called factors; this with the aim of clearly knowing the factorial structure of the data; also called observed variable constructs. (Spearman, 1927)

In the mathematical model there is no distinction between dependent and independent variables; since it determines factors that explain the correlations between variables, which can be expressed as a linear combination:

$$\begin{aligned} X_1 &= l_{11}F_1 + l_{12}F_2 + l_{1m}F_m + e_1 \\ X_p &= l_{p1}F_1 + l_{p2}F_2 + l_{pm}F_m + e_p \end{aligned} \quad (1)$$

In a matrix way, it can be expressed as: $X = Lf + e$ where: X is the vector of the variables used, in this case the determinants of carrying out environmental conservation practices; L includes the factor saturations; l_{ih} relates to the regression coefficient of the variables and the common factor; f indicates the burden of the common factor; finally, e represents the value not explained by the common factors in the model. X_i

4 Results and discussion

According to what was pointed out throughout the study, the factors that condition environmental behavior are given by 18 variables that were previously analyzed, through the correlation matrix prior to the application of the Exploratory Factor Analysis. The determining value of the correlation matrix was 0.04, a value close to 0, which generates indications about the existence of high intercorrelations between the variables.

In order to verify the relevance of the factor analysis, the Kmo index (Kaiser-Meyer-Olkin) was calculated as a complement, which indicated that the sample and the correlation between variables is adequate with a value of 0.617, on the other hand, Bartlett's sphericity test with a (p-value<0.05) leads us not to reject the null hypothesis that indicates the applicability of factor analysis.

In order to analyze the factor structure, the extraction of factors was carried out through the principal components method proposed by , in which the number of factors containing an eigenvalue greater than unity is defined. Finally, the Varimax rotation procedure was applied in order to facilitate the interpretation of the retained factors. (Morrison, 1987)

Table 1 shows the total percentage of the variance explained with its cumulative before and after the Varimax rotation, in which it is stated that the 7 factors selected based on the eigenvalue criterion (values greater than 1) explain 62.05% of the total variability of the data. For its part, Hair, Anderson, Tatham, and Black (1999)they recommend that for studies related to Social Sciences, a minimum of 60% should be used as a satisfactory threshold for the extraction of factors. However, in the rotated solution, new eigenvalue and different percentages of explanation are generated, but the total variability is maintained based on the factors obtained.

Board 1

Total variance explained

Factors	Initial eigenvalues			Rotation squared saturations		
	Self-Value	% Variance	% Accumulated	Self-Value	% Variance	% Accumulated
1	3,199	17,773	17,773	2,136	11,864	11,864
2	1,800	9,998	27,771	1,716	9,535	21,399
3	1,487	8,261	36,031	1,668	9,267	30,666
4	1,360	7,558	43,589	1,563	8,681	39,347
5	1,163	6,461	50,051	1,424	7,913	47,260
6	1,089	6,051	56,102	1,385	7,697	54,957
7	1,071	5,949	62,051	1,277	7,094	62,051

Prepared by: The authors.

The rotated factor matrix presented in Table 2 shows the items (variables) ordered by each factor in terms of correlation with each other, to facilitate the interpretation of the factors in terms of the

characteristics that explain the environmental behavior of the individuals, and we proceed to present factor loads with absolute value greater than 0.3.

Board 2

Rotated Factorial Matrix

Variables	Factors						
	1	2	3	4	5	6	7
RR	,710						
RA	-,617						
RDESP	,560						
NOT	,488						
G	-,477						
And		-,771					
AHE		,701					
AAMB		,525					
ICA			,815				
BOM			,761				
DPPE			,395				
DDOA				,780			
PCRO				,472			
CPTEMP					,704		
RCE					,505		
EDUC						,690	
IECARB						,676	
RCA							,864

Prepared by: The authors.

Table 3 contains the factors with their name and their contribution to the explanation of the model, based on the above, the first factor called *Environmental Behavior* is strongly correlated with 5 variables: recycles waste (RR), recycles water (RA), waste reduction routine (RDESP), has knowledge about acts related to the environment (TCAA) and gender (G); and consequently it is the factor that has the greatest variance (11.86%) and explains the most of the individualistic behaviors of the individuals analyzed, where the load coefficients of these variables were in absolute value greater than 0.4.

The highest scores for the first factor were in the variable recycle water (RA) with 4.13 points, followed by recycle waste (RR) with 3.5 and gender (G) with 3.3. On the other hand, the variables that presented the lowest score were: knowledge about acts related to the environment (TCAA) and waste reduction routine (RDESP) with 2.91 and 2.12 respectively. Thus, these variables could define the environmental behavior of the sample studied.

The research by Vicente-Molina et al. (2018) support the results of the factor analysis, pointing to gender as a determining factor of environmental behavior. This is the result of the significant differences found between men and women in terms of attitudes towards resource conservation and participation in pro-environmental activities.

In relation to the second factor, this was called *Environmental Responsibility* and explains 9.53% of the total variance, in addition, it presents a negative correlation with the age variable (E) and positive with the variables: energy saving measures (AHE) and participation in activities related to the environment (AAMB) whose coefficients were in absolute value greater than 0.5. The analysis reveals that as the years go by, we are more aware of environmental problems, for this reason, we expect to be more aware and active in environmental issues, to preserve the world for future generations.

These results are similar to those obtained by Carrier in which they mention that to a certain extent people become more aware of environmental problems over the years, due to factors such as the accumulation of experiences, the change of priorities and reflection on legacy.(2010)

The scores achieved by this factor range between 2.82 and 4.83 points, however; the variable with the highest score was the variable age (E), which generates indications that environmental behavior could be given to a greater extent by this characteristic of individuals.

The third factor explains 9.26% of the total variability of the data and is strongly correlated with the variables: Importance of environmental conservation (ICA), use of low energy consumption bulbs (BOM) and paying more for ecological products (DPPE), which is why it has been called *Environmental attitude* of individuals. Nevertheless; The loads of the coefficients of these variables were in absolute value greater than 0.3. According to the scores achieved by this factor, it is evident that the highest values of the same are given by the importance of environmental conservation (ICA) with 5.33 points; followed by the use of low energy consumption bulbs (BOM) with 4.74 points.

On the other hand, the fourth factor called *Environmental Activism* interprets 8.68% of the total variability and is composed of the variables donation of money to environmental organizations (DDOA) and participation in composting activities (PCRO), which maintain a positive correlation with absolute values greater than 0.4. On the other hand, individuals stated in a higher proportion that they did not donate money to environmental organizations, nor participate in these composting programs.

The scores achieved by the environmental activism factor are high and range between 5.5 and 2.45 points. However, the variable donation of money to environmental organizations maintains the highest score, which leads us to infer that this type of act has a lot to do with the performance of pro-environmental activities.

For their part, the empirical evidence of Smith and Johnson found a positive correlation between donating money to environmental organizations and participating in pro-environmental activities, such as recycling and reducing resource consumption. These findings suggest that monetary donation may be associated to a high degree with greater environmental awareness and a greater commitment to sustainability. (2018)

The fifth factor has been called *Environmental habits* and this refers to the performance of activities in favor of the environment and factor explains 7.91% of the total variability of the data. This factor presented absolute values greater than 0.5, demonstrating a strong correlation with the variables purchase local products to reduce the carbon footprint (CPTMP) and carry out environmental conservation activities (RCE). For its part, the variable that achieved the highest score was buying local products to reduce the carbon footprint with 5.62 points.

In relation to the sixth factor, it explains 7.69% of the total variability of the data and is strongly correlated with the variables: education (EDU) and carbon emissions associated with daily activities (IECARB) and was called *Environmental awareness*. These variables as a whole present loads greater than 0.6 in absolute values. An important aspect to consider is that more than 50% of those surveyed are aware of the carbon emissions associated with their daily activity, therefore, they stated that they reduce the use of vehicles, control the consumption of water, energy, among others, to reduce the impact on the environment.

The score obtained by this factor ranges between 5.36 and 4.99; within which, the education variable (EDUC) presents the highest value, that is, this variable contributes to a greater extent to the total weight of the factor, highlighting the importance of this variable in the environmental behavior presented by individuals.

Finally, the seventh factor was called *Good Environmental Practice*, which did not generate any degree of interaction with the other variables used in this study. Nevertheless; this factor explained 7.09% of the total variability of the data, which allows us to infer that the reduction of water consumption (CAR) is a very important factor in the environmental behavior of individuals, as it is constituted as a vital resource for the development of life. For its part, this factor reached a score of 7.02, a value that is considered the highest compared to the rest of the factors.

Board 3

Naming of factors

Factor	Factor name	% Variance Explained
1	Environmental performance	11,864
2	Environmental Responsibility	9,535
3	Environmental attitude	9,267
4	Environmental activism	8,681
5	Sustainable habits	7,913
6	Environmental awareness	7,697
7	Good environmental practice	7,094

Prepared by: The authors.

5 Conclusions

The use of the statistical technique of multivariate analysis turned out to be a useful and versatile tool when describing the information of the variables that predict the environmental behavior of individuals. In this sense, this article describes the 7 factors that determine 62.05% of this behavior.

In the conformation of the factors, the existence of variables with high saturations (greater than 0.8) was verified, which determine in greater proportion the pro-environmental practices of the individuals; within which, the variable Reduce Water Consumption turned out to be the most determining variable with a saturation level of 0.86. On the other hand, the descriptive analysis showed that about 47% of the individuals do contribute individually to the protection of the environment in the efficient management of this resource.

In the same hierarchical order, it was observed that the variables environmental conservation and donation of money to environmental organizations with a saturation of 0.81 and 0.78 respectively; They are also of great importance in achieving environmental protection. However, the variable that presented the lowest saturation was the variable willingness to pay more for organic products with 0.395; indicating that this variable is not so relevant, despite the fact that more than 40% said they did agree, because in practice organic products are the least sold in the country.

The results obtained by her made it possible to recognize with 83% the female gender as the most aware of environmental protection than her counterpart with 65%. It also allowed us to conclude that gender attitudes are significant because they affect environmental issues and create repercussions on the protection of the environment.

Finally, it was determined that gender in general does not influence the performance of environmental practices; however, this does have a strong negative correlation with the activity of recycling waste. The data showed that it is women who tend to recycle their waste with 75%, compared to 53% of men. Empirical evidence, on the other hand, allows us to infer that the relationship between the development of these activities and gender is associated with the work of housewives that they perform.

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