

# Does gender influence a person's environmental concern and pro-environmental behaviours?

J. Hidalgo-Crespo, M. Sc.<sup>1,2</sup>, F. Benítez-Troya, Mg<sup>3</sup>, J.L. Amaya-Rivas, PhD.<sup>4</sup>, M. Soto, PhD.<sup>2</sup>, A.F. Terán-Alvarado, M. Sc.<sup>1</sup>, and A. Hidalgo-Crespo, M. Sc.<sup>3</sup>

<sup>1</sup>Universidad Politécnica Salesiana, Ecuador, [jhidalgo@ups.edu.ec](mailto:jhidalgo@ups.edu.ec), [ateran@ups.edu.ec](mailto:ateran@ups.edu.ec), [ateran@ups.edu.ec](mailto:ateran@ups.edu.ec)

<sup>2</sup>Universidade da Coruña, Spain, [j.hidalgo@udc.es](mailto:j.hidalgo@udc.es)

<sup>3</sup>Universidad de Guayaquil, Ecuador, [fausto.benitez@ug.edu.ec](mailto:fausto.benitez@ug.edu.ec), [andres.hidalgo.crespo@hotmail.com](mailto:andres.hidalgo.crespo@hotmail.com)

<sup>4</sup>ESPOL Polytechnic University, Escuela Superior Politécnica del Litoral, ESPOL, Ecuador, [jlmay@espol.edu.ec](mailto:jlmay@espol.edu.ec)

**Abstract**— The following research work analyzes if gender influences the environmental concern and pro-environmental behaviours of a person in the city of Guayaquil. Additionally, the research seeks to establish if education level and civil status have any effect for both indicators in men and women. To analyze this, a survey was carried out to a sample 1210 people, who were chosen randomly, thus allowing responses from a variety of locations and settings to be examined. Based on the results of the hypothesis tests, it can be concluded that women in fact showed higher rates of both indicators, demonstrating that in fact gender influence environmental concern and pro-environmental behaviours, then both hypothesis were accepted. Finally, Guayaquil's respondents are aware of the existence of environmental problems, although their concerns do not always translate into responsible behavior with the environment.

**Keywords**—Gender, Pro-environmental Behaviours, Environmental Concern, Survey.

## I. INTRODUCTION

Solid waste is a problem traced from the times of congregation of tribes, villages and communities [1]. In the world more and more garbage is produced. In fact, according to a report from the World Bank (WB), an average of 1.2 kg of garbage is generated per day per person, but this varies greatly depending on the country or city. For several decades, Ecuador has been facing a deep crisis in the Comprehensive Management of Solid Waste [2], due to rapid urbanization, population growth and the increase in commercial activities and industries that have become the impellers for the generation of large amounts of garbage [3].

Ecuador generates about 375,000 tons of urban solid waste per year. From this generated waste, 96% is buried in various final disposal systems, while 4% is recovered by informal recyclers [4]. The National Municipal Information System (SNIM) reports that, as of 2018, in Ecuador from the total tonnage of daily solid waste generated, 35% is buried in sanitary landfills, 23.3% in controlled dumps and emerging cells, and 41.7% in open-air dumps, rivers and streams. Of the waste generated, 57% corresponds to organic waste and the remaining percentage to inorganic waste. As of 2020, and

within the framework of the socio-sanitary emergency derived from the COVID-19 pandemic, most municipalities reported an increase of at least 25% in waste generation [2].

In Ecuador, waste generation is directly related to population growth (See Figure 1); in this case the canton of Guayaquil, the largest in Ecuador, having the highest population density, due to the diversity and richness of its economic activity, with a population according to the last population census carried out by the Institute of Statistics and Censuses (INEC), of 2,671,801 inhabitants [5].

Guayaquil generates almost twice as much garbage as Quito and eight times more waste than Cuenca. Despite the fact that there are recycling campaigns and municipal ordinances on the correct disposal of garbage in the city, the adequate distribution of household waste for its subsequent processing continues to be an issue that many are not interested in tackling [6].

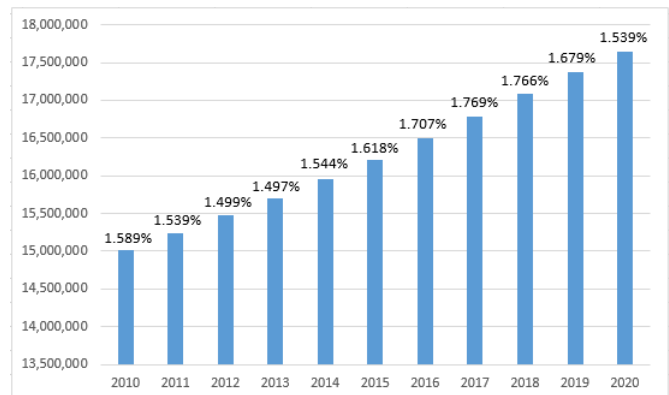


Fig. 1 Ecuador's population evolution and annual growth rate (Population Growth, The World Bank)

There are previous studies of quantification and characterization of the waste that have been carried out in the city of Guayaquil, such as the research by [7] in which they indicate that it is recognized that the information both in quantity and composition, it is important for the effective management of Domestic Solid Waste (DSW). In addition, the development of indicators can help identify influential parameters to better understand the behavior of residents and possibly model future waste generation, which would help

Digital Object Identifier (DOI):

<http://dx.doi.org/10.18687/LACCEI2022.1.1.673>

ISBN: 978-628-95207-0-5 ISSN: 2414-6390

improve planning and management of household solid waste with better infrastructure.

In this context, identifying the determinants and factors that have a meaningful impact to predict waste generation for a country is of great importance and a key step towards the design and implementation of policies and laws. Many studies have shown that people with high environmental concern and fine pro-environmental behaviours are more likely to reduce their waste generation. Environmental concern can be defined as the degree to which people worry about the consequences of environmental problems for themselves, other people, and the biosphere [8]. On the other hand, pro-environmental behaviours include different kinds of operationalized behaviours, such as recycling, transport use, waste management, energy consumption, the purchase of green products, and electrical appliances [9].

Knowledge is commonly viewed as a necessary prerequisite for a person's behaviour. Environmental problems are complex and their understanding requires knowledge of their existence and of viable solutions and social behaviours that help mitigate a specific environmental problem [10]. A higher level of education is generally linked to a higher level of environmental knowledge, therefore, a key tool for a society seeking sustainability is education [11].

Environmental knowledge can be defined as the knowledge, skills and information necessary for residents to carry out waste classification and recycling, information such as: recycling methods, recycling channels, locations of recycling sites, recycling and recycling hotlines; publicity and education as what residents receive through the media, advertisements, school education and other methods on waste sorting and recycling [12].

The level of education affects the way people lead their lives. A person with a higher level of education is likely to be more articulate and engage in analytical reasoning. One research conducted research in China and stated that education should stimulate national awareness related to environmental protection [13]. Their research also recognized that ignorance and poverty were responsible for the acceptance of toxic/hazardous waste from industrialized countries.

Pro-environmental behavior refers to behavior that harms the environment as little as possible, or even benefits the environment [14]. Green consumer behaviours refers to consumer behaviors that reflect social responsibility and concern for the environment, and is often conceptualized as an ethically oriented form of consumer behavior. Past behavior can influence future behavior in two ways, firstly through habit formation and secondly through semi-automatic actions, especially for complex behaviors. It could also be influenced by situational factors such as perceived discomfort, the amount of effort involved, and access to recycling facilities [15].

Some studies have pointed out the need to take gender into account when analyzing behavior towards the environment because it could influence attitudes, beliefs, opinions, behaviors, etc., and in turn conclude that women show behavior

and concern for the environment relatively stronger than men [11]. In addition, women are more active only in a particular domain of pro-environmental action related to consumer behavior (purchase of organic products, reduction of vehicle use, sorting of recyclable materials) in the private sphere, but not in others that are linked to the public sphere (membership of environmental groups and the signing of petitions, for example, are considered more dominated by men) [16].

Several theories have been developed to explain gender differences in environmental behavior, within the framework of socialization theory. One, postulates that since women are directed towards the role of care giving, they are encouraged to be more compassionate, empathetic and cooperative than men and, therefore, more protective towards nature. However, male socialization emphasizes the role of economic provider and market activities, encouraging men to be more dominant, rational and competitive than women, and therefore more closely linked to anti-environmental attitudes [17].

In terms of gender, environmental behaviours can also be affected by the type of daily environment; in fact, one research has pointed out that women's greater involvement in pro-environmental behavior is linked to behavior patterns that can be undertaken in the course of regular daily routines, as women tend to take on more obligations in the environment home than men, even when working outside the home [18].

For this reason, the aim of this study is to examine the relationship between an individual's gender and his/her environmental concern and pro-environmental behaviours.

In the following sections, we first introduce our research model and preconceived. Following this, we describe the questionnaire items and how data was collected. Next, we present the main results and findings of our analysis. In the final section, we present the conclusions of the study.

## II. RESEARCH MODEL AND HYPOTHESIS

As pro-environmental behaviours and environmental concern have received increasing attention within most academics, different questions regarding the main factors which induce people to adopt greener behaviours and attitudes have constantly occupied researchers' interests. As shown in the previous section, gender has proven to be a significant predictor that influences both direct and indirect pro-environmental behaviours and environmental concern. Therefore, this study defines pro-environmentalism as two dependent variables for the two based on the gender. The following hypotheses are proposed (Figure 1):

- **Hypothesis 1 (H1).** An individual's gender will influence his/her environmental concern.
- **Hypothesis 2 (H2).** An individual's gender will influence his/her pro-environmental behaviours and attitudes.

### III. QUESTIONNAIRE DESIGN AND DATA COLLECTION

The study was conducted through a street survey in crowded places. The questionnaire included items on the measurement of the two dependent variables; environmental concern and pro-environmental behaviours and the independent variable as definition of the gender and other socioeconomic factors.

One researcher suggested that conducting a recycling survey at busy sites can cover a large part of the local population and both recyclers and non-recyclers. Therefore, the street survey was carried out in five main areas of Guayaquil. Shopping malls, markets, and parks were selected from the study of shopping mall tenant mix. The respondents were chosen randomly [19]. Conducting surveys at selected sites is considered stratified sampling, which allows responses to be examined in a variety of locations and geographic settings. The procedure that was carried out was to survey people randomly and then pass the information to an online form.

The procedure used to determine the minimum number of samples necessary to collect reasonably accurate data was based on the central limit theorem, also applied by [20]. The number of samples was determined with a confidence interval of 99% and a standard error of 3.7%, for a population that according to data from the National Institute of Statistics and Censuses (INEC), Guayaquil has 2,698,077 inhabitants, using the following equation:

$$n = \frac{n \cdot Z^2 \cdot P \cdot Q}{d^2(N-1) + Z^2 \cdot P \cdot Q} \quad (1)$$

Where n is the minimum number of samples, Z is a constant that depends on the confidence level (for 99% confidence Z is 2.53), and d is the sampling error (3.7%), P is the proportion of inhabitants that possess the characteristic we are looking for, and Q is the number of inhabitants who do not possess it (in this case it is 0.5 for each one). After using this equation, the number of respondents needed to obtain a standard error of 3.7% at a confidence level of 99% was 1,216.

Once the size of the study sample for the development of the survey had been defined, we proceeded with the design of the survey format. The items were measured by a Likert scale, which ranged from “strongly disagree” (Score 1) to “strongly agree” (Score 5). The survey consisted of 3 sections organized as follows (Table 2):

- Section 1.- Environmental Concern consisted of three subsections:
  - Conscience on the consequences of waste.
  - Responsibility conscience.
  - Conscience of the benefits of home recycling.
- Section 2.- Pro-Environmental Behaviours consisted in the measurement of six types of characteristics:
  - Activist.
  - Avoider.

- Green consumer.
- Utility saver.
- Recycler.
- Green passenger.
- Section 3.- Socioeconomic and sociodemographic factors:
  - Age.
  - Civil status.
  - Level of education.
  - Type of home.
  - Labor status.
  - Monthly income.

Calculations for environmental concern and pro-environmental behaviours were made as the average value of each of the answers in Likert Scale.

### IV. RESULTS

In total, the survey obtained 1210 responses, these were carried out at street level in busy places in the city of Guayaquil such as shopping centers, markets and parks. Table 1 lists the profile details of the respondents.

TABLE I  
PROFILE OF THE SURVEYED

Demographic Variable	N	Percentage (%)
Sex		
Male	564	46.61
Female	646	53.39
Age		
< 17	61	5.04
18 – 30	678	56.03
31 – 45	286	23.64
> 45	185	15.29
Civil Status		
Single	702	58.02
Single with children	50	4.13
Married / Free union	229	18.93
Married with children	185	15.29
Divorced	27	2.23
Widowed	17	1.40
Level of education		
Primary school or less	65	5.37
Not completed high school	38	3.14
Completed high school	587	48.51
Not completed university	174	14.38
Completed university	302	24.96
Master / PhD	44	3.64
Type of home		
Own	516	42.64
Lease	211	17.44
Family	447	36.94
Shared	36	2.98
Labor status		
Employed	555	45.87
Unemployed	153	12.64
Retired	32	2.64
Entrepreneur	135	11.16
Student	256	21.16
Work at home	79	6.53
Monthly income		
< \$400.00	600	49.59
\$400.00 - \$700.00	425	35.12
\$701.00 - \$1000.00	132	10.91
> \$1000.00	53	4.38

TABLE II  
QUESTIONNAIRE

<b>Environmental Concern</b>	<b>Conscience on the consequences of waste</b>	<p>1. Strongly Disagree</p> <p>2. Partially Disagree</p> <p>3. Neutral</p> <p>4. Partially Agree</p> <p>5. Strongly Agree</p>
	I believe that the waste problem is a threat for my health and my family. I believe that the excessive generation of waste and its disposal in the land could cause serious environmental problems. I believe that the risks associated with the waste problems are real and serious. The waste of resources will be a problem for me and my offspring. The waste of resources will be a problem for my whole country. The waste of resources will be a problem for other species of plants and animals.	
	<b>Responsibility conscience</b>	
	I believe I'm responsible of handling the waste a generate. I suppose that the whole world (people, homes, organizations, etc.) is obliged to solve the problems that provoke the residues. Every member of the society should cooperate to help resolve the waste problems.	
	<b>Conscience of the benefits of home recycling</b>	
	I believe that waste separation can help reduce the residues on earth. I believe that waste separation can help reduce the negative impacts on the environment. I believe that waste separation can generate economic benefits. My waste separation behaviours will have an important educative effect on my children. The waste separation has positive effects on the resident's perception on resource saves and environment protection.	
<b>PRO-ENVIRONMENTAL BEHAVIOURS</b>	<b>Green Consumer</b>	<p>1. Never</p> <p>2. Almost never</p> <p>3. Sometimes</p> <p>4. Frequently</p> <p>5. Always</p>
	I buy things that are produced with the less packaging possible. I use my own bag when going shopping, instead of the one given by the store. I search for containers that can be reused or easily recycled. I buy fruits and vegetables without packaging. I buy products that can be reused instead of single life products. I try to repair things before buying new products. I wash and reuse kitchen rags instead of using paper towels. I donate old stuff to benefic organizations or any other users. I reuse containers.	
	<b>Activist</b>	
	¿ Did you donate money to benefic organizations involved in environmental causes? ¿ Did you join a group that speaks for the protection of the environment? ¿ Did you participate in any protest o manifestation over an environmental subject? ¿ Did you offer your time as volunteer for pro-environmental subjects? ¿ Have you ever practiced the fabrication of your own compost at home?	
	<b>Avoider (Would you avoid buying a product if you knew it had the following characteristics?)</b>	
	It comes in a recipient that contains aerosols. The product was testes in animals. Materials were used from species of in danger animals. It is a well-known environmental pollutant. The packaging is noxious for the environment. The product was treated with pesticides.	
	<b>Green consumer</b>	
	¿ Do you buy products that come in a rechargeable packaging? ¿ Do you buy products packaged or fabricated with recycled materials? ¿ Do you buy products that are certificated as safe for the environment? ¿ Do you use energy saving lights? ¿ Do you buy aliments organically growth? ¿ Do you buy biodegradable products or that come in biodegradable packaging? ¿ Do you buy products produced by environmental responsible companies? ¿ Do you use less air conditioner to save energy? ¿ Do you buy energy efficient appliances? ¿ Do you use soaps and detergents without phosphates? ¿ Do you use biodegradable soaps and detergents at home? ¿ Do you reuse office paper? ¿ Do you used biodegradable plastic bags at home?	
	<b>Green passenger (¿What is your usual mean of transport?)</b>	
	Public transport, such as bus. You drive alone to work or school. Carpooling	
	<b>Recycler (¿In your home do you practice recycling?)</b>	
	¿ Do you recycle paper and products made of paper/cardboard? Do you recycle plastic bottles and packages / glass bottles and packages? Do you recycle cans and aluminum containers / tin? Do you recycle used batteries? Do you classify your waste with means of recycling?	

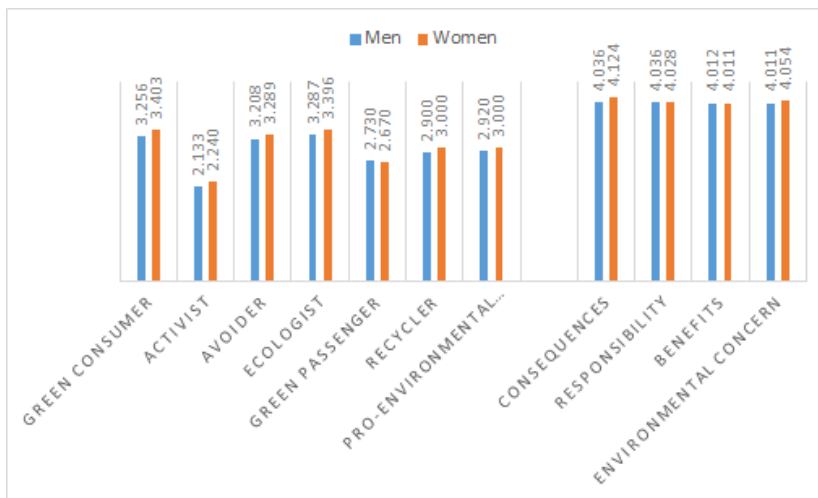


Fig. 2 Comparison of pro-environmental behaviours and environmental concern between men and women.

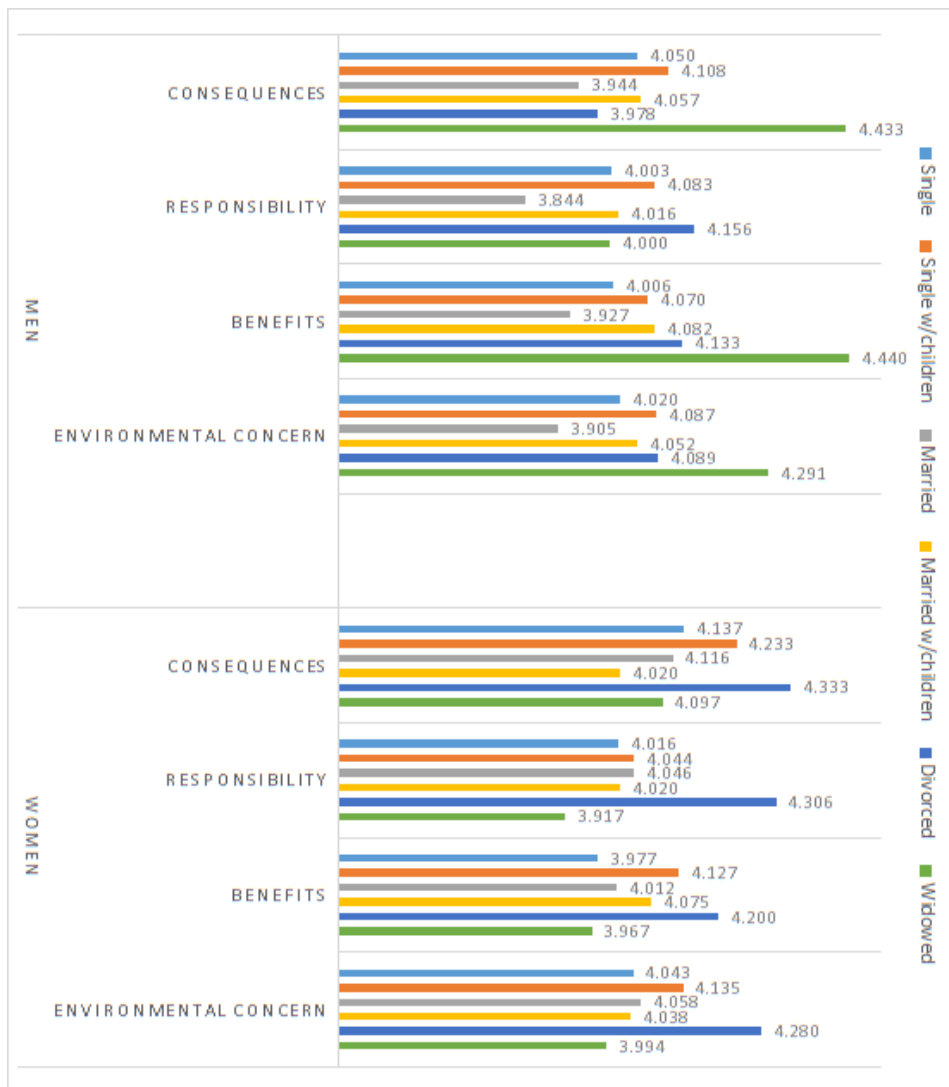


Fig. 3 Comparison of environmental concern among men and women and its relationship with civil status.

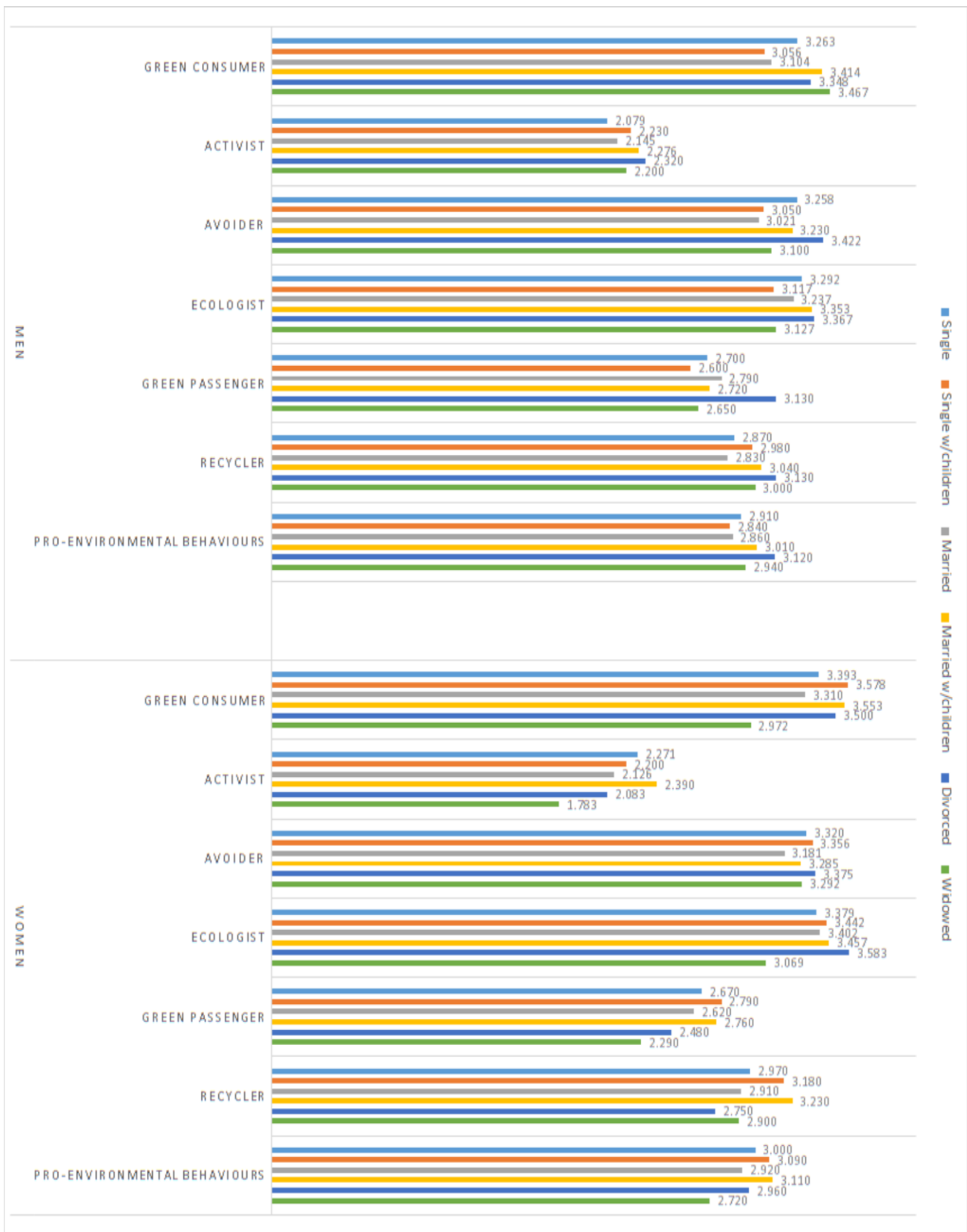


Fig. 4 Comparison of pro-environmental behaviours among men and women and its relationship with civil status.

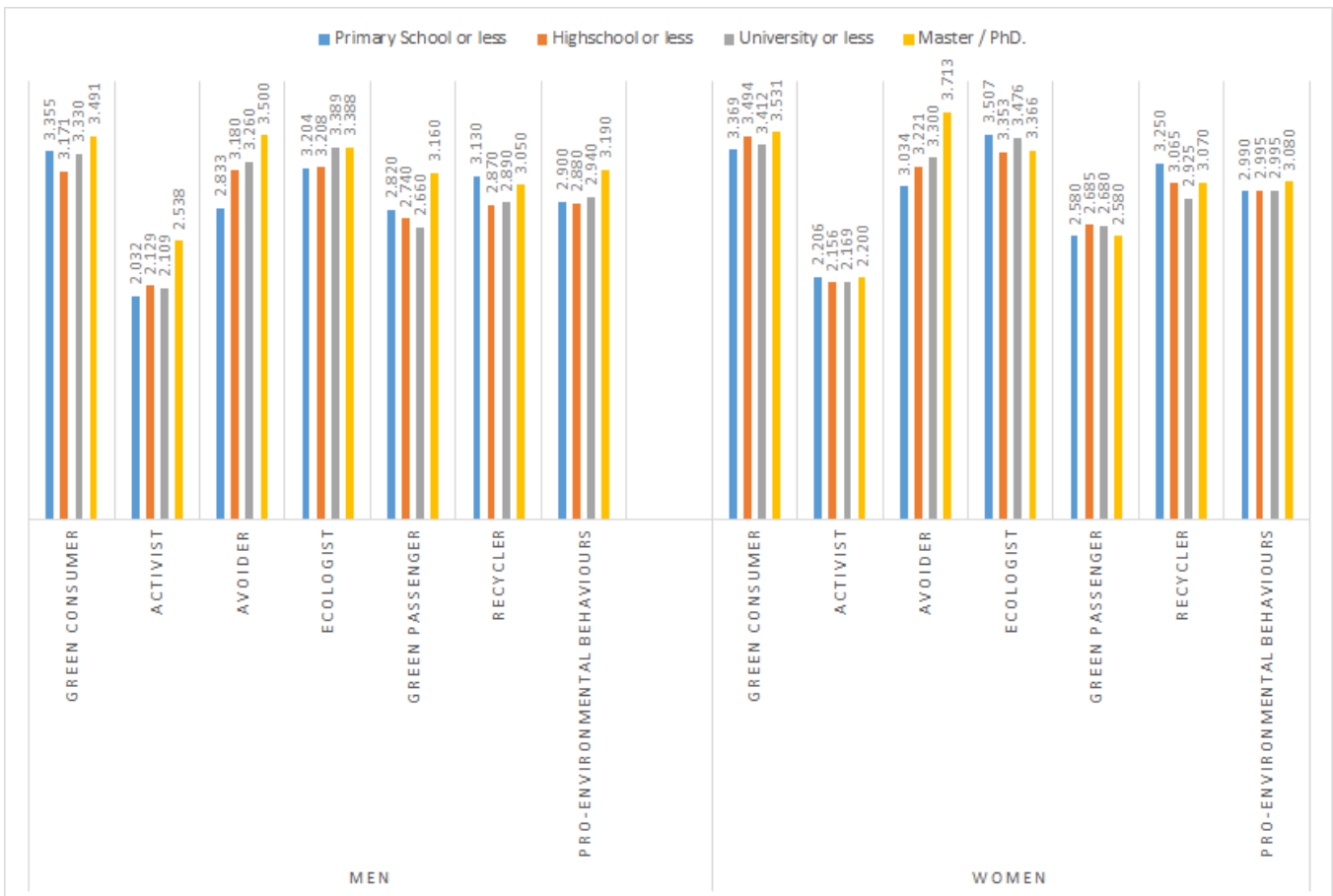


Fig. 5 Comparison of pro-environmental behaviours among men and women and its relationship with level of education.

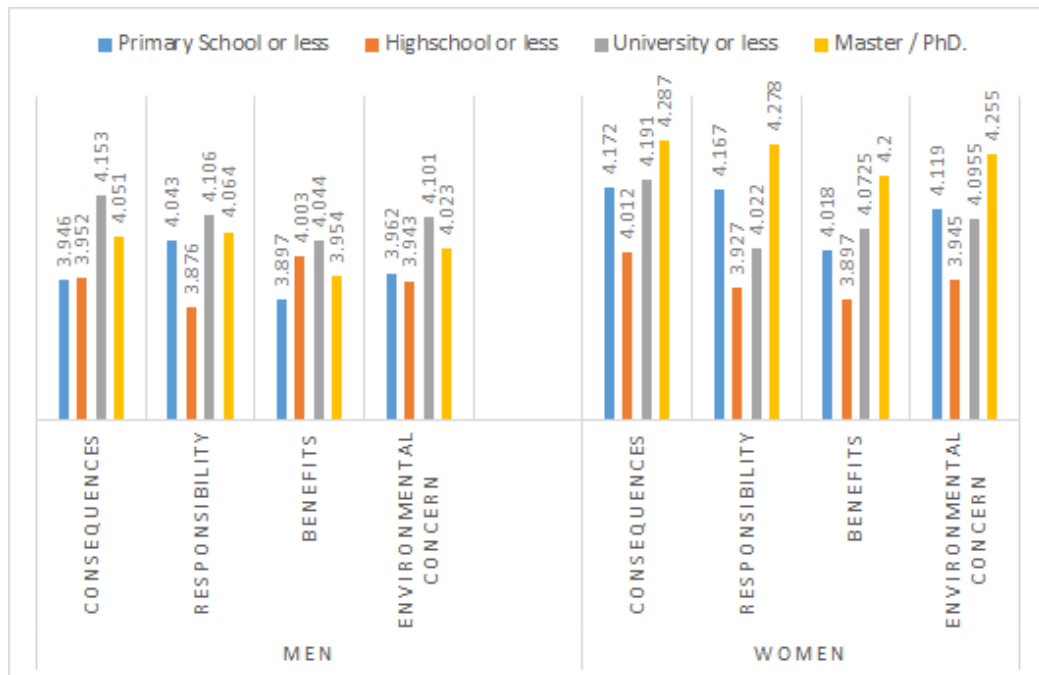


Fig. 6 Comparison of environmental concern among men and women and its relationship with level of education.

Figure 2 shows that women have higher average values of environmental concern and pro-environmental behaviours. Figures 3 and 4 show the environmental concern and pro-environmental behaviours for men and women separated by civil status. It can be observed that environmental concern and pro-environmental behaviours are higher for women when single or married with or without children than for men. However, for divorced and widowed population, men showed larger values than women.

Figures 5 and 6 show the relationship between pro-environmental behaviours and environmental concern with the education level for both men and women in the population of the study. One important result we can observe is the increment of environmental behaviours with the level of education, both for men and women. This demonstrates the importance of education when thinking on the development of good environmental moral values. On the other hand, environmental concern doesn't follow a linear increment with level of education, however it's observed much higher values for women than for men.

#### IV. DISCUSSION AND CONCLUSIONS

With the application of the random survey and in crowded places, it was possible to cover a large part of the population and obtain high heterogeneity of the sample, obtaining a wide variety of data from different types of individuals, knowing the factors that affect the environmental concern and pro-environmental behaviours.

Based on the results of the hypothesis tests, it can be concluded that women in fact showed higher rates of both indicators, demonstrating that in fact gender influence environmental concern and pro-environmental behaviours, then both hypothesis are accepted. Guayaquil respondents are aware of the existence of environmental problems, although their concerns do not always translate into responsible behavior with the environment.

The relationship between the education level variable and the environmental concern and pro-environmental behaviours affects the way people lead their lives. People with a high educational level, and consequently with access to more information, were expected to show greater concern and act more frequently in favor of the environment. However, with the results presented in this study we have demonstrated a relationship between education level and pro-environmental behaviours but not for the case of environmental concern.

The results of this research are useful for future studies focused on environmental social engineering, as well as for formulating environmental policies to improve people's sense of responsibility and moral obligation regarding waste generation, as well as to increase their perception of the opportunities to prevent and minimize waste, develop in them an environmental culture and follow ideals of a circular economy.

- [1] Tchobanoglous, G. (1994). *Gestión integral de residuos sólidos* (Vol. I). Madrid, España: McGraw-Hill/Interamericana de España, S.A.
- [2] Solíz, M., Durango, J., Solano, J., & Yépez, M. (2020). *Cartografía de los residuos sólidos en Ecuador*. Quito: Universidad Andina Simón Bolívar. Obtenido de <http://hdl.handle.net/10644/7773>
- [3] Kawai, K., & Tasaki, T. (2015). "Revisiting estimates of municipal solid waste generation per capita and their reliability". *Journal of Material Cycles and Waste Management*, 1 - 13. doi:10.1007/s10163-015-0355-1
- [4] El Universo. (30 de Diciembre de 2020). El Universo . Obtenido de <https://www.eluniverso.com/noticias/2020/12/30/nota/9111586/ecuador-genera-375-mil-toneladas-residuos-solidos-urbanos-ano-solo/>
- [5] Tigua, J., & Borja, R. (2015). "Análisis de Desechos Sólidos Domiciliarios Generados en el Sector Isla Trinitaria de la Ciudad de Santiago de Guayaquil". Guayaquil: Escuela Superior Politécnica del Litoral.
- [6] Diario La Nación. (Abril de 2019). Diario La Nación. Obtenido de <https://lanacion.com.ec>
- [7] Hidalgo, J., Amaya, J., Jervis, F., & Moreira, C. (2019). Influence of socio-economic factors on household solid waste (HSW) generation of the city of Guayaquil, Ecuador. Paper presented at the Proceedings of the LACCEI International Multi-Conference for Engineering, Education and Technology, 2019-July. doi:10.18687/LACCEI2019.1.1.24
- [8] Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, 21, 327e339. doi:10.1006/jevp.2001.0227.
- [9] Li, D., Zhao, L., Ma, S., Shao, S., & Zhang, L. (2019). What influences an individual's pro-environmental behavior? A literature review. *Resources, Conservation and Recycling*, 146, 28–34. doi: 10.1016/j.resconrec.2019.03.024
- [10] M.A. Vicente-Molina, A. Fernández-Sainz, J. Izagirre-Olaizola. Does gender make a difference in pro-environmental behavior? The case of the Basque Country University students, *Journal of Cleaner Production*, Volume 176, 2018, Pages 89-98, ISSN 0959-6526, <https://doi.org/10.1016/j.jclepro.2017.12.079>.
- [11] Xiao C, McCright AM. A Test of the Biographical Availability Argument for Gender Differences in Environmental Behaviors. *Environment and Behavior*. 2014;46(2):241-263. doi:10.1177/0013916512453991
- [12] Meng, X., Tan, X., Wang, Y., Wen, Z., Tao, Y., & Qian, Y. (2019). Investigation on decision-making mechanism of residents' household solid waste classification and recycling behaviors. *Resources, Conservation and Recycling*, 140, 224–234. doi:10.1016/j.resconrec.2018.09.0
- [13] Afroz, R., Tudin, R., Hanaki, K., & Masud, M. M. (2011). Selected socio-economic factors affecting the willingness to minimise solid waste in Dhaka city, Bangladesh. *Journal of Environmental Planning and Management*, 54(6), 711–731. doi:10.1080/09640568.2010.527472
- [14] De Groot, J. I. M., Schubert, I., & Thøgersen, J. (2016). Morality and green consumer behaviour: A psychological perspective. In D. Shaw, A. Chatzidakis, & M. Carrington (Eds.), *Ethics and morality in consumption: Interdisciplinary perspectives* (pp. 57–74). Routledge/Taylor & Francis Group.
- [15] Vassanadamrongdee, S., & Kittipongvises, S. (2018). Factors influencing source separation intention and willingness to pay for improving waste management in Bangkok, Thailand. *Sustainable Environment Research*, 28(2), 90–99. doi:10.1016/j.serj.2017.11.003
- [16] Dietz, T., Stern, P. C., & Guagnano, G. A. (1998). Social Structural and Social Psychological Bases of Environmental Concern. *Environment and Behavior*, 30(4), 450–471. doi:10.1177/001391659803000402
- [17] Blocker, T. Jean, and Douglas Lee Eckberg. "Gender and Environmentalism: Results from the 1993 General Social Survey." *Social Science Quarterly*, vol. 78, no. 4, [University of Texas Press, Wiley], 1997, pp. 841–58, <http://www.jstor.org/stable/42863735>.
- [18] Xiao, C., & Hong, D. (2010). Gender differences in environmental behaviors in China. *Population and Environment*, 32(1), 88–104. doi:10.1007/s11111-010-0115-z
- [19] Wan, C., Shen, G. Q., & Yu, A. (2015). Key determinants of willingness to support policy measures on recycling: A case study in Hong Kong. *Environmental Science & Policy*, 54, 409–418. doi:10.1016/j.envsci.2015.06.023