GENDERED APPLICATIONS OF THE CARBON FOOTPRINT: THE USE OF CARBON MANAGEMENT TOOLS TO HIGHLIGHT THE EFFECT OF GENDER ON SUSTAINABLE LIFESTYLES

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Abstract: Discussion on the phenomenon of climate change has bombarded our society within recent times. Scientists are consistently doing research, which indicates that many decades of development has resulted in a rapid increase of greenhouse gases existing in the Earth's atmosphere. This has exacerbated the natural Global warming effect and climatic variability provides evidence that the Earth's climatic cycle is in fact being altered. In an attempt to reduce the percentage of greenhouse gases emitted, the concept of Carbon Management and the Carbon Footprint has been established. These tools are being introduced to promote more sustainable resource consumption patterns but in order to successfully initiate and sustain any new pattern of behaviour within a society, gender differences should be considered. The first and second waves of feminist theories have resulted in "gender" being given consideration in public policies and programmes in developed countries. Developing countries are slowly following. Even though gender equality is still a controversial issue, there is great need for gender to be included in all decision-making processes to ensure that sustainable development is achieved. For this study, a gender analysis was conducted on carbon footprint data to identify whether there is a difference in the response to sustainable lifestyles. The strengths and weaknesses within each sub-group were analysed. Emphasis was placed on how the

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socially-accepted behaviours of each gender affected their energy usage, consumption and waste management practices. The detailed findings can be used to develop public awareness campaigns and programmes specially designed to fit the needs of each gender, thereby promoting equal development opportunities and ensuring that national sustainable development objectives are achieved in a shorter period.

Keywords: *Sustainable Lifestyles; Gender Analysis; Carbon Footprints; Consumption; Efficient; Energy Usage; Carbon Management; Carbon Neutrality*

INTRODUCTION

Sustainable development can only be achieved through long-term investments in economic, human and environmental capital. At present, the female half of the world's human capital is undervalued and underutilized the world over (Organisation for Economic Cooperation and Development 2008). This gender difference has been seen as a hindrance to the achievement of holistic and by extension sustainable development. The climate change issues bombarding our society have increased the need to achieve sustainability at all levels. If sustainable concepts are utilized it will enable human beings to better manage the rate at which resources are consumed. Since it is the use of resources which result in the production of greenhouse gases, sustainable development will surely assist in the reduction of the same.

In an attempt to combat climate change issues and promote sustainability, Carbon Management principles and greenhouse gas inventories have been introduced to assist societies globally. The Carbon Footprint is a by-product of both these initiatives. This tool facilitates the analysis of carbon dioxide emissions for everyday activities such as transportation, electricity usage, material consumption and waste generation. An awareness of the resultswould assist individuals

or organizationsin reducing emissions in the affected areas thereby leading to a reduction in the total carbon footprint value. The main outcome of carbon footprint analyses is to reduce emissions to the smallest possible value, tending towards zero. A zero carbon footprint means that for every metric tonne of Carbon Dioxide emitted, one metric tonne of Carbon Dioxide is removed from the atmosphere. At this point, an individual or an organisation would have achieved carbon neutrality. However, moving towards a carbon neutral lifestyle would involve a conscious effort to use environmentally friendly transportation options, sustainable energy practises, sustainable consumption and waste management strategies. Immensely reducing the carbon footprint would include progressively implementing sustainable habits. It is impossible to live on the earth and utilize zero resources because a portion of resources is necessary for sustenance; however the promotion of minimum utility would lead towards an optimum carbon footprint. It will then be possible to become carbon neutral by investing in carbon offsetting programmes or actions that will further reduce one's carbon footprint to zero.

One carbon offset represents the reduction of one metric tonne of carbon dioxide or its equivalent in greenhouse gases from the atmosphere. Carbon offsetting is usually achieved by financially supporting programmes that reduce greenhouse gases in the short-term or long-term. Renewable energy programmes, such as wind energy generation, installation of solar, geothermal, small hydro and biomass energy, create carbon offsets by displacing fossil fuels (David Suzuki Foundation 2009). Other offsets may exist in projects such as methane capture at landfills or from livestock or carbon sequestration projects. For example, reforestation and agriculture programmes may assist in the absorption of carbon dioxide in the atmosphere, along with programmes which actively destroy some greenhouse gases in the atmosphere, such

as halocarbons. Decreasing the amount of greenhouse gases in the atmosphere, involves actively reducing man's total carbon footprint. This would lead to the gradual reduction of greenhouse gases being emitted as well as the concentration of these gases in the atmosphere. The outcome would be reduced heating effect of greenhouse gases on the Earth's surface. There is a strongpossibility that this can be achieved if each individual and by extension each organization commits itself to utilize sustainable concepts in their daily routine.

In general, the objective of sustainability is to curtail exorbitant consumption habits, manage the use of natural resources and ultimately control the rate at which greenhouse gases are being emitted into the atmosphere. As with all activities, there may be varying patterns of response due to the different roles men and women play in society. For the purpose of this study, gender is defined as the socially constructed roles of men and women, including expectations of their characteristics, likely behaviours and the roles that each sex is expected to fulfil as taught by society. As such, if a gender analysis is conducted on the carbon footprints of men and women, it should yield results that reflect the differences between the roles that men and women play in terms of carbon dioxide emissions[†]. Sources show that women tend to have lower consumption patterns and carbon footprints and consequently a lower impact on the environment.(Organisation for Economic Cooperation and Development 2008) This may be due to the varied view of the environment held by men versus women, as researchers believe that women have a deeper understanding and appreciation of nature and the environment. Feminists have developed a range of theories about the environment,

[†]A Gender analysis is defined by Vibrant Communities, Status of Women, Canada as a tool for examining the differences between the roles that men and women play, the different levels of power they hold, their differing needs, constraints and opportunities, and the impact of these differences on their lives.

commonly referred to as Eco-feminism, which encompasses connectedness and wholeness of theory and practice and asserts the special strength and integrity of every living thing (Mies and Shiva 1993). Eco-feminists agree that there are important connections between the unjustified dominations of nature and women. However, there is still disagreement on the nature of these connections, the category into whichthey should be placed and whether they are liberating or reinforcing harmful stereotypes about women (Warren 2000).

With sustainability and equality becoming forefront issues, carbon footprints have been implemented to promote sustainable usage of resources. In analyzing the amount of greenhouse gases an individual contributes to the atmosphere, it is possible to extrapolate the average amount emitted by the sample population or the national population. Carbon footprint assessments are therefore important not only for public awareness but also for public implementation. Conducting a gender analysis on these assessments will assist in highlighting the contrasting needs of various groups in society. The question to be answered is which programmes should be developed to address the manner in which women can further reduce their carbon footprint? What media can be used to encourage men to have a lesser impact on the environment? If a study such as this is conducted nationally, it can reap benefits for the nation, as sustainable development will gain popularity among citizens who take it upon themselves to consume responsibly. A transformed partnership based on equality of the existing genders is pertinent in obtaining sustainable development objectives. Progress of society is based on the progress of the most vulnerable member; hence catering to all vulnerable groups ensures that development occurs at a faster fate.

Furthermore national sustainable development objectives will come to fruition at a faster pace as the needs of all groups

are included in national policies, resulting in the conservation of resources and achieving sustainability.

The following study will give the reader the opportunity to view carbon footprints from a different perspective by forming their conclusions of the following issues. Do women generally have a lower impact on the environment than men? Are women more conscious of their lifestyles, therefore subconsciously performing their routine in a more sustainable manner? Can these sustainable practices be linked to the stereotypical 'gender role' of women?

RESEARCH QUESTIONS

1. Is there a significant difference between the carbon footprint values of men and women?

2. What influence does gender play on sustainable lifestyles?

3. How can this data be used to promote increased sustainability amongst individuals of both genders?

Literature Review

In terms of resource impacts, women tend to leave a smaller ecological footprint than men due to their more sustainable consumption patterns. Men's lifestyles and consumer patterns, whether they are rich or poor, tend to be more resource-intensive and less sustainable than women's (Johnsson-Latham 2006). Impressing a more feminine footprint would result in a smaller impact on the environment as well as better access to goods and services that take into account the needs of both women and men (Organisation for Economic Cooperation and Development 2008). In terms of individual footprint analyses, "many behaviours that contribute to

emissions could be modified, for example, by purchasing compact fluorescent bulbs (purchasing behaviours), increasing one's refrigerator temperature (non-purchasing, one-time behaviours), regularly shutting off the lights (repeated behaviours or habits), or insulating one's hot water heater (complex behaviours that require expert assistance or are costly)" (Robinson and Armel 2008). It is said that changes in these individual-level behaviours can play a major role in slowing down climate change. "Reliable and valid tools for measuring the frequency, duration, or intensity of behaviours such as these, in conjunction with tools that provide accurate information about their Greenhouse Gas footprints, may help reduce emissions" (Robinson and Armel 2008).

The information obtained by evaluating one's carbon footprint, may lead to behavioural change. This was shown in approximately forty studies wherein providing individuals with feedback on their residential electricity use, resulted in reductions of 5-15%, with the greater reductions occurring with more frequent or disaggregated feedback (Darby 2006). One author, Mr. John Cossham described being green as "doing whatever you can. It is not about wearing hair shirts and spending vast amounts of money. You might invest some money...but you save in the long run". "Being a vegetarian or vegan is actually one of the best things you can do to lower your CO_2 emissions. If you have a diet that is heavy on milk, cheese and meat, then you have a much higher hidden carbon footprint – the emissions that are a by-product of the production of those foods" (Cossman 2009). He further describes being green as not solely based on sacrifices, but enjoying a better quality of life. Personally, he does not fly, he goes on local vacations, he is satisfied with his current vehicle, but would rather walk or cycle to most places. Many measures have been implemented by Mr. Cossman, for him to produce a carbon footprint of 0.45 tonnes of carbon dioxide annually. Be that

as it may, he does not expect persons to give up things immediately, but gradually and consistently, minimize their impact on the environment.

Carbon Footprint assessments are a relatively new concept which encourages individuals and organizations to manage their carbon output by initially analyzing what processes comprise their carbon output, calculating a value for this output, and then identifying methods that can be used to reduce this carbon output. Mr. Andrew Hoffman in his book Carbon Strategies: How Leading Companies are reducing their Climate Change Footprint states that, "Nearly all companies measure direct emissions and most measure indirect emissions... Companies can measure actual emissions or develop estimates using fuel- or material-based calculations. The former approach may be more expensive and labour-intensive but the latter is complicated by the variety of methodologies that exist for calculating emissions" (Hoffman 2007). Hence, since there is no fixed method in conducting a carbon footprint analysis also known as an emissions profile assessment, companies have either developed new systems for measuring and tracking emission reductions or hired a carbon management consultancy company to conduct a carbon management programme for their organization. These assessments usually involve the use of standard calculations, from systems such as the Greenhouse Gas Protocol or the Environmental Management System (EMS) under ISO14001.

Even though carbon footprint assessments are usually used in context with individuals and organisations, theoretically, a household, a business, a city, or even continents all have measurable carbon footprints. "In order to meet the emissions reduction requirements of the Kyoto Protocol, governments began to take inventory their countries' greenhouse gas emissions. The protocol requires member nations to

publish annual inventories according to the IPCC Guidelines for National Greenhouse Gas Inventories" (Institute for Global Environmental Strategies. 2006). On a national level, the Kyoto Protocol attempted to combat greenhouse gas emissions, and this is supervised under the United Nations Framework Convention on Climate Change. These national inventories are extensive and presently the most accurate counts of emissions that are available. Most authors believe however that, more information is needed to assist policy makers in their goal of reducing greenhouse gas emissions. It is necessary that the connection is made between emissions and the specific activities that cause them. Hence, in many instances these extensive inventories have not yet been fully utilized asindices to reduce greenhouse gas emissions.

On a national basis, it is simpler to focus on cities or urban areas, as most times, the largest concentration of greenhouse gas emissions are centred on activities in these areas. However, "only within the past forty years have cities been included in the overall discussion of sustainability" (Beatley 2009) "Many cities around the world have developed comprehensive green plans or sustainability plans. Copenhagen has recently declared its intention to become an "ecometropole" with ambitious targets (50 percent of home-to-work trips made by bicycle by 2015)" (Beatley 2009). The author further explained that the sustainable city, or green urbanism, has emerged as a compelling way to translate broad sustainability goals and aspirations into tangible physical and social outcomes. Varying cities such as Freiburg, Germany, Curibita, Brazil, and Daejeon, South Korea have made notable efforts in recognizing the need to take immediate steps to address compact urban form, sustainable transport, energy efficiency and green building, recycling and zero-waste techniques. Furthermore, to understand how each policy and planning sector can help strengthen and reinforce the rest through

inter-connectedness and team work. As a result, these places nowembrace a new culture of green governance which includes from procurement policies, to what gets built, how buildings, parks, and streets are managed, while attempting to reduce impacts and to set an example and tone for other sectors of society.

Locally, Trinidad and Tobago may be a 'few steps' behind when it comes to the inclusion of sustainability in policies, however, there is still much promise to achieve carbon management in the near future as a new offsetting phenomenon was proposed. According to Charles Percy, President of the South Chamber of Industry and Commerce, at the Commonwealth Business Forum, "Trinidad and Tobago is in a position to be a site for carbon capture and storage (CCS)". It was said that the island has all the conditions for CCS storage: the geology, large depleted reservoirs, both onshore and offshore, along with 100 years of production wherein the reservoirs are in close proximity to point sources of carbon dioxide (John-Lall 2009). Due to Trinidad and Tobago's oil and gas mining activities, many depleted reservoirs are available for capture and storage of carbon underground. Carbon Storage and Capture is appropriate as it includes a reliance on fossil fuels combined with growing trends for energy. However, CO_2 mitigation is still required and CCS is the only available technology which can remove up to 90% of the CO_2 emissions from the burning of fossil fuels.

Just as sustainability is being introduced into development policies, so also is gender issues. Due to the constant research and lobbying of active feminists worldwide, policymakers are now being pressured to ensure that policies are gender sensitive. "Gender analysis is an innovative process that enables government and non-government organisations to analyse whether proposed and existing policies, programs

and services produce equally beneficial outcomes for diverse groups of women and men" (Gender Analysis: Making policies, programmes and services gender aware 2005). However, on a smaller scale a gender analysis is ideal to map the differences in attitude and behaviour between men and women when analyzing various social issues. The relationship between women and nature is such that there is a similarity between patriarchal violence against women, 'other' people and nature (Mies and Shiva 1993), hence, the development of eco-feminists and eco-feminism principles. Wherever women acted against ecological destruction, they realized that "in denying this patriarchy they were being loyal to future generations, to life and to this planet itself" (Mies and Shiva 1993). This eco-feminist principle also forms the basis of sustainable development. The Brundtland Report (Our Common Future) defined sustainable development as development that meets the needs of the present, without compromising the ability of future generations to meet their own needs. This concept propels a shift from the previous perception that development is equivalent to economic growth. Hence, this current development challenge "provides a promising momentum for feminist methodology, thinking and practice to fulfil a useful role" (Harcourt 1994). Since the beginning of the 1990s, feminist environmental researchers have been trying to make visible the ecological, social and gender-specific conditions of global production as well as the consumption of goods and services (Littig 2001). The importance of sustainable lifestyles grew in importance as sustainable development principles were promulgated to the forefront. Prior to this time, the comparison of women's consumer behaviour with those of men had only rarely been an object of social scientific analysis, even in the newer environmentally oriented studies (Nava 1992). Hence, this study serves as pioneering research in attempting to quantitatively analyse the effects that male and female behaviour have on the environment.

Methodology

The study incorporated research of both a qualitative and quantitative nature. Initially, secondary data on the Carbon Footprint was collected. Extensive research was conducted on the calculations used in analyzing greenhouse gas emissions and carbon footprint analyses conducted on individuals as well as organizations. Standard calculation bodies were examined; some included the Greenhouse gas Protocol and ISO14001 – Environmental Management Systems. After much research into the available standards, the Greenhouse Gas Protocol (www.ghgprotocol.org) was chosen. This body has created a wide range of spreadsheets, which enables the conversion of energy into the amount of carbon dioxide emissions in metric tonnes.

The questionnaire was then constructed to obtain data for the main sectors that contribute to greenhouse gas emissions. These areas include:-

1. Transportation

2. Energy Use at Home

3. Food

4. Waste

The first two categories are referred to as direct emissions, as energy is burnt when one uses their personal car, and electricity or other fuel types at home. Whilst the latter two are described as indirect emissions, as greenhouse gases are produced in producing food, and transporting it to the purchase point, and energy is also utilized in transporting and discarding waste. This was distributed to the sample and upon receipt, data was extracted to obtain values for the amount of carbon dioxide

emissions per sector. After the quantitative analysis, the data was separated by gender. A gender analysis was conducted consequent to this in both a quantitative and qualitative manner.

VALIDITY AND RELIABILITY

To ensure that the study possessed strong validity, a number of measures were taken. For example to reduce the margin of error presented by face validity, pretesting was conducted, where a test sample was utilized to analyse and complete the questionnaire to ensure proper interpretation.

To increase the content validity of the study, past research on the topic was thoroughly investigated, along with current expert opinions to ensure that the content was adequately analysed during the study.

The reliability of the project refers to the stability or repeatability of the work produced. The reliability of this study was assessed by testing and retesting the questionnaire. The questionnaire was analysed by approximately three groups of persons before being distributed to the sample. These persons included supervisors, fellow colleagues and groups of employees in the corporate environment. Internal consistency was analysed during the pre-testing phase, to assess the variability of answers obtained for each question. This variability was very small proving that the questions were relatively straightforward and easy to understand.

ASSUMPTIONS

It was assumed that the sample for the study was an appropriate representation of the study population. A greater proportion of students at the University of the West Indies live on or around campus, hence in utilizing students who live on campus, it is

symbolic of the average student having little to no vehicular fuel usage per day. However, for the average employee, commute from one place to the other is more common, that is from home to the workplace and back, and hence the vehicular fuel usage of a professional is usually much higher but varies depending on the proximity of the individual's most frequented locations.

In assuming that the main instrument used has validity, it is suitable for measuring the necessary constructs needed within the research analysis. It was also assumed that all answers obtained from respondents were answered truthfully and with the greatest accuracy.

TECHNICAL ASSUMPTIONS

In analyzing the calculations for each sector in the questionnaire, the following assumptions were made.

TRANSPORT

1. It was assumed that the fuel used in a maxi taxi was diesel, for persons who indicated use of public transportation in the questionnaire but were unsure of the type of fuel.

2. In cases where the distance travelled was unknown, it was assumed that the respondent utilized the most economic route, for example, the Bus Route to get from UWI, St. Augustine to D'Abadie.

3. It was assumed that the Havilland- Canada Bombardier Dash-8 aircraft was used for domestic and short haul flights, and that the gross weight was that of 27.33Tonnes

4. For long haul flights it was assumed that the Boeing-7 series aircraft was used (that is flights from Trinidad and Tobago

to North America), possessing a gross weight of 150Tonnes

5. The distance between any two airports was the straight line distance between both locations.

ELECTRICITY

1. In cases where the average monthly electricity bill was given, it was assumed that the usual residential block-rating system utilized by the Trinidad and Tobago Electricity Commission (T&TEC) was used to calculate the electricity bill, wherein:-

    - The first 400 units (in kWh) is TT$0.25 per unit
    - The next 600 units (in kWh) is TT$0.31 per unit
    - The next 1000 units (in kWh) is TT$0.36 per unit

2. In cases where the hours of usage for each main appliance were given, the weekly and yearly electricity consumption was extrapolated.

QUALITATIVE ASSUMPTIONS

FOOD

1. It was assumed that the respondents possessed a proper understanding of organic food and it was not confused with locally grown food.

2. In cases where students indicated the presence of a vegetable garden, it was assumed that these gardens whether it was located on campus or at home, contributed to the reduction of their grocery bill.

WASTE

1. In some instances the amount of waste was given in amount and size of garbage bags disposed per week. Hence, it was assumed that small garbage bags possessed a capacity of 8lbs, medium garbage bags, 12lbs and large garbage bags, 16lbs.

2. For this aspect of the study, the processes of recycling and reusing were considered as the same, as both serve to reduce the amount of waste generated by an individual and hence their overall greenhouse gas emissions in this category.

GENDER ANALYSIS

1. Gender, in this project is defined as the social behaviours of the male and female sex, that is, it was assumed that persons indicating a male sex in the questionnaire possessed characteristics indicative of the masculine gender.

2. Only two sexes were taken into consideration for this research analysis that is male and female.

3. The two sub-groups students and staff were studied with the predominant focus being on their sex and not their status in society, this promoted equality within the findings of the study.

Limitations

1. Completion time for the project was approximately two months, with the maximum time period being approximately three months. This posed a limitation as a wider sample may have been analysed if more time was available to conduct the study

2. Data on past research projects and factual expert data on

the topic were difficult to locate, seeing that the topic is still evolving and previous research papers done on the topic are not readily accessible.

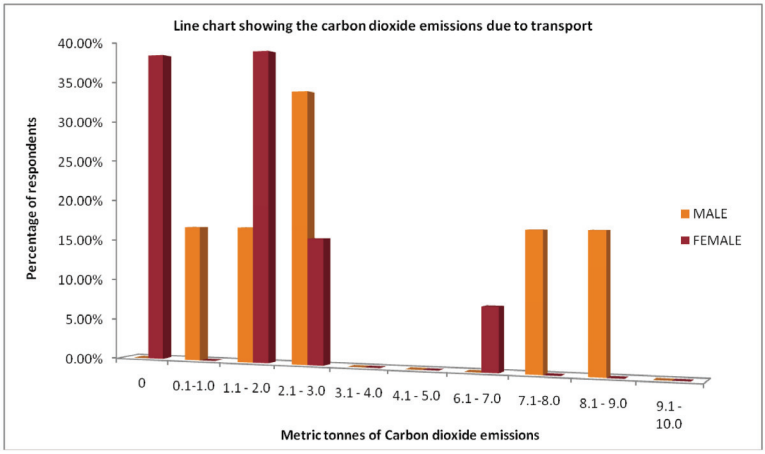
3. Gender analyses on scientific data are still rare. As a result, such an analysis on similar studies was unavailable. The definition of a gender analysis varies for each discipline, and as such, an inferred understanding of what such an analysis should highlight was used in this study.

RESULTS AND ANALYSIS

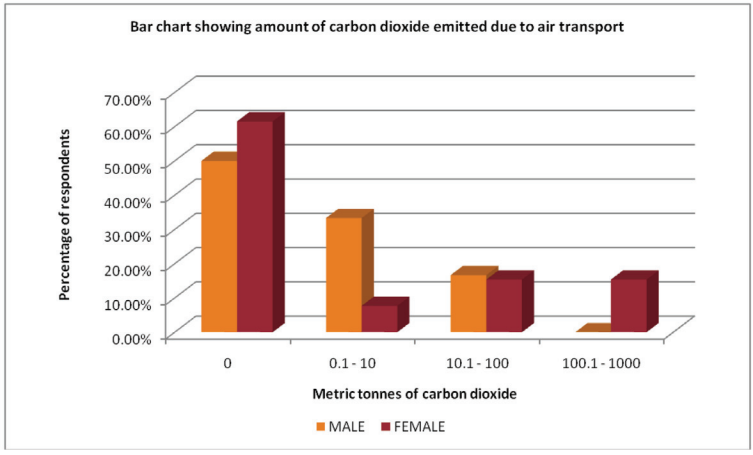
DIRECT EMISSIONS

From the data given in the questionnaires, values for carbon dioxide generated from each focal area was obtained. The following graphical presentations show the facts and figures obtained for the first two categories, Transportation and Electricity, and serve to answer the first research question, is there a significant difference between the carbon footprint values of men and women.

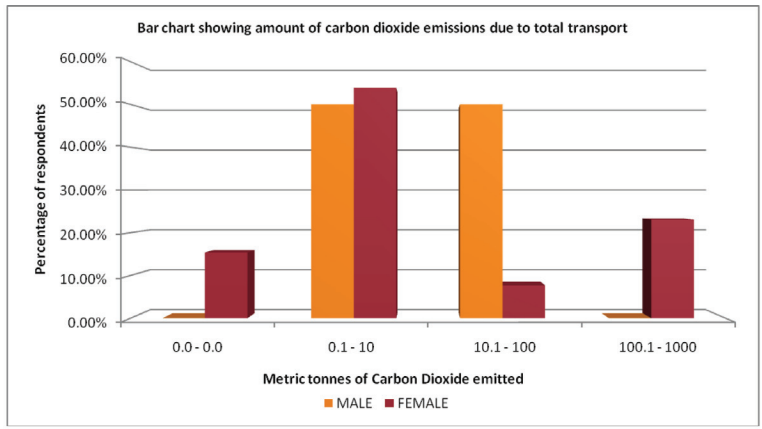
TRANSPORTATION



In this line chart, one can see that the higher proportion of females emit within the range of 0 and 2.0 metric tonnes of carbon dioxide with 38.46% possessing emissions of 0 metric tonnes, whilst another 38.46% possess emissions between 1.1 and 2.0 metric tonnes. However, a small proportion (7.69%) emitted in the larger range of 6.1 – 7.0 metric tonnes. For men, there is a maximum percentage of 33.33% emitting within the range of 2.1 – 3.0 metric tonnes of carbon dioxide per year. Despite a large portion emitting within this range, there are equal portions emitting within the 7.1 – 9.0 range.

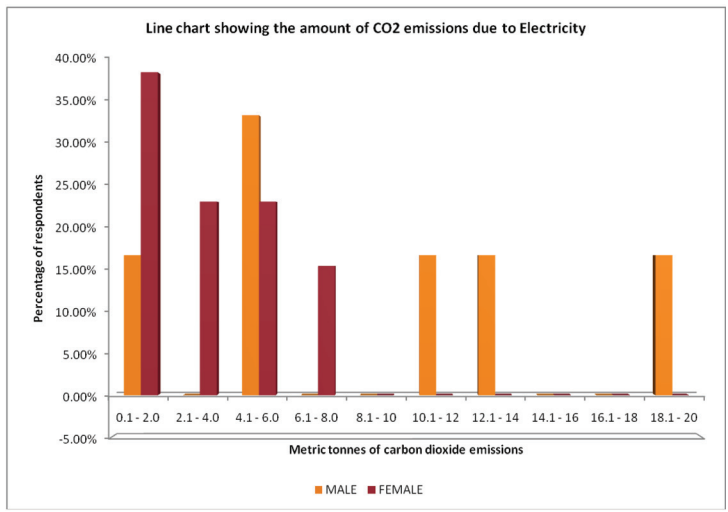


The bar chart shows that 50% of males contributing zero emissions due to air travel, whilst 33.33% and 16.67% contribute emissions within the 0.1-10 and the 10.1 – 100 ranges respectively. These smaller ranges are associated with domestic and short haul flights. For the females, the largest proportion, 61.54%, also contributed zero emissions. However, there were percentages of 7.7, 15.38% and 15.38% in the other ranges in increasing order.



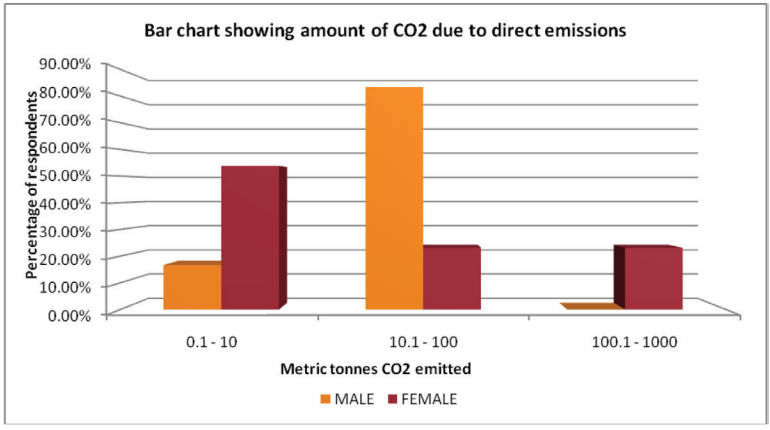
The bar chart shows that equal amounts of male respondents contributed emissions within the ranges of 0.1 – 10 and 10.1 – 100 metric tonnes of carbon dioxide per annum. For females, it was distributed over all the ranges, with the largest proportion of 53.85% emitting within the 0.1 – 10 metric tonne range.

ELECTRICITY

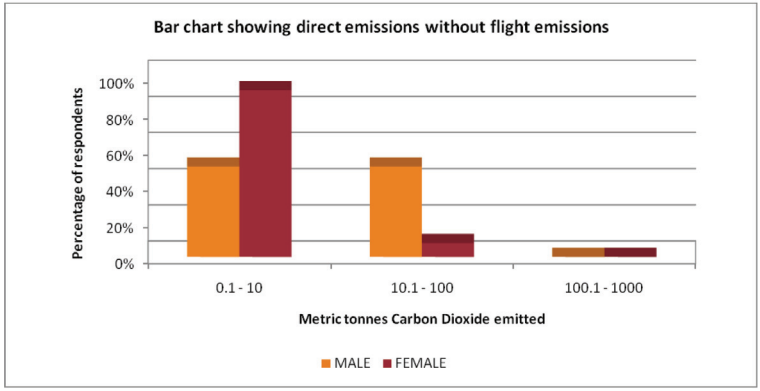


From the line chart, one can see that the highest proportion of males, 33.33%, contribute approximately 4.1 – 6.0 metric tonnes of carbon dioxide annually. However, there are percentages of males emitting throughout the entire range, with 16.67% emitting at the 0.1 – 2.0, 10.1 – 12.0, 12.1 – 14.0 and 18.1 – 20.0 ranges. However, for the females, there is an exponential decrease as the amount of metric tonnes of carbon dioxide increases. The highest proportion of carbon dioxide emissions, 38.6%, contributed by the females was in the lowest range of 0.1 – 2.0 metric tonnes. The values then decreased for each consecutive range until a minimum of zero emissions at 8.1 – 10.0 metric tonnes of carbon dioxide.

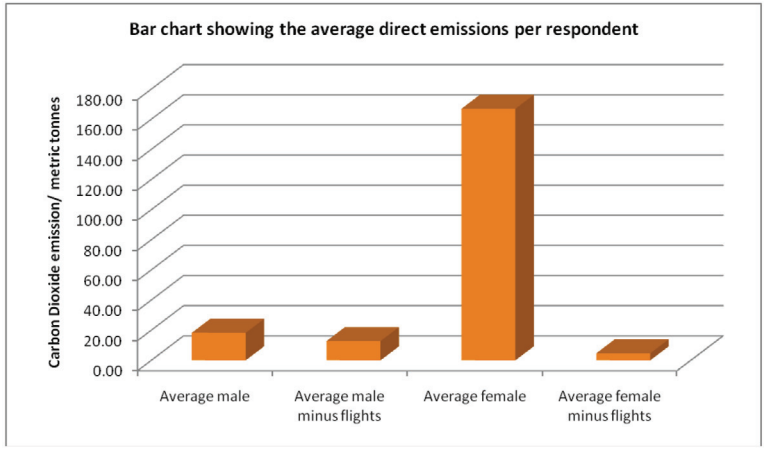
TOTAL EMISSIONS



The bar chart shows that the highest proportion of males contribute within the range of 10.1 – 100 metric tonnes of carbon dioxide annually wherein the highest proportion of females contribute within the range of 0.1 – 10 metric tonnes of carbon dioxide.



When the emissions due to air travel are removed, both sub-groups only emit within the two smaller ranges. Equal percentages of men emit within these ranges, whilst a higher proportion of women emit within the lower range of 0.1 – 10 metric tonnes of carbon dioxide.



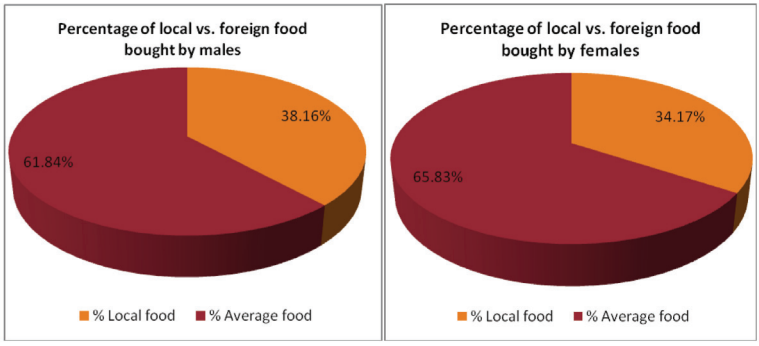
If the total direct emissions were compared with total local direct emissions, that is, with the elimination of air travel emissions, one would realize that the amount of Carbon dioxide would be reduced immensely. This is clearly seen in the

average emission per respondent in metric tonnes for females. The majority of the females on the campus were CARICOM nationals, seeing that the University is a regional campus. Their flight emissions were as a result quite exhorbitant due to their commute between the campus and their homes. This accounted for the large amount of emissions due to air transportation. However, once this was eliminated their total direct emission was reduced to an average of 4.668 metric tonnes.

INDIRECT EMISSIONS

Indirect Emissions can be considered as other aspects of human operations that contribute to the overall concentration of greenhouse gases in the atmosphere but may not be viewed directly, hence there are no standard calculations for these types of emissions. For example, during the day you may purchase a meal from a restaurant. The contents used to prepare the meal may have been produced in a variety of places; some may have been imported items and so forth. Carbon dioxide was emitted to transport it to the restaurant, whether it is via plane, boat or a goods vehicle. Carbon Dioxide may have been emitted to produce the item. It is very hard to track these emissions, but as long as the item was purchased the purchaser bears responsibility for the amount of carbon dioxide emitted due to this item. If one considers waste, there are many items that are purchased, and discarded, thatcould have been used again. The amount of carbon dioxide that was generated to produce and dispose of this item, for example at a landfill or incinerator also increases our carbon footprint. Daily waste has to be transported to the nation's landfill before being recycled, reused or disposed of. A portion of the carbon dioxide emitted becomes a portion of one's carbon footprint. However, due to the complexity and variety of ways in which an item is produced and discarded, it is almost impossible to create calculations for the amount of carbon dioxide emitted

for these items. Hence, they are considered aspects of indirect emission. There are other aspects of daily living that may contribute toindirect emissions; however, for the purpose of this study, indirect emissions include the categories of Food and Waste only.



From the pie charts, one can see that on average 34.17% of the food items purchased by females are produced locally, as compared to males that purchase a larger proportion (38.16%) of local goods. This shows that males practice more sustainable food-purchasing habits as it provides more value for the dollar, as local food is not only more sustainable, but also tends to be cheaper. This may be so as males place less focus on food brands and so forth and are more rational or logical when it comes to decision-making. An item which performs the same function, but for less money is a better purchase. However, women are more influenced by media, for example advertisements, which cater to their senses. Despite knowing that a cheaper, local item performs the same function, their purchases are not only influenced by economics and rationale, but also by advertisements, friends' testimonials and

other external factors. Hence, they may tend to gravitate towards the prettier, more popular product as opposed to the cheaper, local product.

	MALES	FEMALES
VEGETABLE GARDENS	50.00%	38.46%
ORGANIC FOOD	50.00%	58.33%

Table 1: Showing The Percentage of Respondents That Utilise Sustainable Food Practices

The table shows a higher percentage of males (50%) cultivate vegetable gardens in their back yards than females (38.46%). This is more convenient for the male population as most of the females either live on campus with little to no backyard space, or are single (not married) and may not have the capacity to maintain a vegetable garden as opposed to the men. It also helps the men as bread winners to be more economical as the portion of the food produced in the garden offsets their cost of food per month. However, women were more aware of organically produced food, as a larger proportion included them when purchasing food items. Organically produced items sometimes tend to be more expensive but if advertised well on television will be marketed towards the young, fit individual, which all women aspire to be, thus applying to healthier eating habits.

	MALES	FEMALES
AVERAGE AMOUNT OF WASTE GENERATED PER MONTH/LITRES	50.00	37.31
% USAGE OF ORGANIC WASTE IN COMPOST HEAPS	16.67	23.07
% OF RESPONDENTS RECYCLING/ REUSING PRODUCTS	66.67	38.46

Table 2: Highlighting The Waste Generated By The Sample Population and The Amount Utilised For Compost Heaps

Females generated a smaller proportion of waste due to their lifestyle, wherein women are always on the go, from class to class, location to location, and extra-curricular activities and usually spend a smaller portion of time at their home base. Hence the waste generated through their daily activities may be distributed, and contribute to the University's waste concentration. However, for males, the larger proportion of their waste is generated at home, thus increasing their waste average. Factors attributing to this may be consumer habits, family structure, lifestyle and so forth. In terms of the percentage of respondents that developed compost heaps, a larger proportion of females (23.07%) also recycled their organic waste as compared to males. Development of compost heaps reduces one's carbon footprint, as it reduces the total amount of waste generated per individual per annum. It also ensures that resources are reused, thus reducing one's impact on the environment. The nutrients from organic waste are used to add nutrients to the soil, thus fuelling growth within seedlings and allowing the nutrient cycle to flourish.

In analyzing recycling or reusing habits, a much greater percentage of males practice recycling or reusing of resources, for examples plastic bottles, glass bottles and paper, as compared to females. Hence, in general, females practice better waste management behaviour than males.

Discussion

The accepted definition for Sustainable development is development wherein the current generation meets its needs without compromising the needs of future generations. This is important because at present, consumption rates have been increasing uncontrollably as evidenced by the increase of global warming and climate variability. As highlighted previously, all energy used results in the emission of greenhouse gases, wherein energy is in the form of fuel and resources used in transportation, electricity generation, consumption and waste disposal. As such, if consumption rates are reduced, it would decrease the amount of carbon dioxide emitted over a period. If this reduction occurs progressively for a number of years, the concentration of greenhouse gases in the atmosphere would decrease, thus decreasing the rate at which global warming is occurring. This strategy is however two-fold, as the reduction of consumption not only decreases the rate of global warming, it also increases the rate at which sustainable development objectives are achieved. This statement directly shows how the carbon footprint is used as a measure of sustainability, seeing that it measures the amount of carbon dioxide being emitted, less of which indicates closer proximity to sustainable practices.

Recent studies show that "sustainable development requires the full and equal participation of women at all levels....it is clearly inappropriate to address problems, identify the appropriate strategies, or to implement the solutions if only half of the people concerned are involved in the process.

Gender equity is an essential building block in sustainable development" (Hemmati and Gardiner 2002).

There have also been clear-cut gender differences when sustainability components were analysed. For example, in consumption analyses conducted, it showed that women generally earn less than men and had less money at their disposal (Organisation for Economic Cooperation and Development 2008). It is also estimated that while women make approximately 80% of consumer purchasing decisions, men spend over 80% of the household income (Yaccato 2007). Hence, men both earn and spend more than women, and their expenditure is reflective of large capital purchases, for example, vehicles, homes and electronics, while women's consumption is more reflective of family consumption as a whole. These claims were directly analysed through this study, as it compared the carbon footprint of both men and women.

During the study, a quantitative analysis was conducted on the data received for direct emissions, that is, in the subcategories of transportation and electricity, while a qualitative analysis was carried out on the indirect emissions, where food and waste practices were analysed. In summary, the largest proportion of females contributed the smallest range of carbon dioxide due to direct emissions annually. However, there were females that contributed to emissions throughout all the ranges. For males, however, the largest proportion emitted within the mid-range of 10.1 – 100 metric tonnes of carbon dioxide, with smaller proportions emitting within the other ranges. It was seen that respondents that contributed the smallest amount of emissions were respondents that barely travelled locally within the week and those from Trinidad and Tobago that have not been on flights for the past twelve months. For transportation, these respondents contributed negligible amounts of carbon dioxide into the atmosphere.

This is possible for persons that live on the campus, and thus stay within walking distance to all or most of their necessities. In addition, these respondents used minimum electricity due to the pace of their lifestyles. When considering the sample population, tertiary-level students primarily stayed on campus, as their classes span between 4 – 12 hours a day. Studying also occurs on campus, along with purchasing food and other leisure activities. Hence, for most students, a minimum amount of time is spent in their rooms or apartments. Hence, their electricity usage tends to exist at a minimum, with exceptionsof students that spend a lot of time in their apartments.

Quite a number of respondents were citizens of other Caribbean islands seeing that UWI is a regional university. The return flights taken to travel from their home country to the campus contributed immensely to the amount of carbon dioxide due to direct emissions. These persons contributed transportation emissions within the two highest ranges. Trips only occurred once or twice for the year and if emissions due to flights were subtracted, the emission values for 92.31% of the female respondents were reduced to the lowest ranges. This drastic change directly showed the impact that air travel has on the carbon footprint value. For males, the emissions lay between the two smallest ranges. Some respondents contributed within the smallest range due to their proximity to campus, whilst the majority emitted in the mid-range due to their local commute. It was seen that the further the respondents lived from the campus, the greater the amount of carbon dioxide emitted due to road transportation.

In comparing emissions, the largest amount of carbon dioxide emitted due to local transport was between 8.1 – 9.0 metric tonnes of carbon dioxide, significantly lower than emissions due to the shortest flights, a domestic flight to Tobago. The

majority of male respondents did not take flights within the past twelve months; however, for the percentage of respondents that did, it was clearly reflected in their carbon footprint value, as their emissions fell within the two highest ranges.

Table 3:
Showing Emissions Due to Air Transport

Air	0	0.1 - 10	10.1 - 100	100.1 - 1000
Male	50.00%	33.33%	16.67%	0.00%
Female	61.54%	7.70%	15.38%	15.38%

For air transportation, the largest proportion of respondents in both sub-groups contributed zero emissions, however, there were still smaller proportions contributingwithin larger emission ranges and these need to be addressed. As seen in Table 3, men contributed emissions within the mid ranges. In this study, the male respondents either took domestic flights or short-haul flights within the Caribbean region, hence, their emission contributions were still significantly lower than the respondents who took long haul flights. Females travelled more as they are enticed by a change in scenery, the wide range of shopping and other factors.In addition to regional flights, which accounted mostly for trips back to their homeland, there were also long haul flights to North America, which served as family vacations and shopping experiences. A small proportion of females contributed emissions within the two largest ranges, with 7.7% in the smallest range due to domestic flights. Thus, overall, male emissions lay equally within the two mid ranges, as compared to females whose emissions varied due to the diversity of flights taken across the sample.When air travel emissions were removed, all respondents contributed 10.0 or less metric tonnes of carbon dioxide.

Despite persons taking flights for leisure, the majority of students' flights were to return home. Even if some

individuals made an effort to travel locally as opposed to internationally to reduce the carbon footprint, some persons still need to travel. To combat the impact of flights on total greenhouse gas emissions, sustainable travel practices need to be implemented. For a number of airline carriers, the option of carbon offsetting is available for any flight taken. This cost may be included in the cost of a ticket and is usually between US$1 – US$10. The money is used to financially support carbon offset programmes throughout the world. Every metric tonne of carbon dioxide emitted will be accounted for by the investment made to these carbon offset programmes.

Despite flight emissions being the predominant contributor to the concentration of greenhouse gases in the atmosphere, focus must still be given to reducing emissions in the other areas. For the purpose of gender analysis, observations of which genders contributed more to which areas are pertinent. In road transportation for example, the majority of females contributed within 0 – 3.0 metric tonnes of carbon dioxide, with a minority producing within the 6.1 –7.0 metric tonne range, however, for men, despite the highest proportion emitting within the 2.1 – 3.0 metric tonne range, there was a large proportion emitting within larger ranges. This showed the diversity of the respondents' lifestyles. Most of the male respondents live in close proximity to the campus, and should have contributed emissions within the smaller ranges. Some respondents were responsible for transportation of family members, and others preferred to travel to varying locations for leisure activities, for example, 'liming' with friends and watch sporting events, thus having a more active social life than the average female.

When evaluating emissions due to electricity, the largest proportion of females contributed within the lowest range, with decreasing contributions in the following ranges. Hence,

females possess relatively low electricity needs. On the other hand, men contributed emissions across the entire range evaluated. The largest proportion, as seen in Table 5, contributed within the 4.1 – 6.0 range. This isthe optimum range associated with the average electricity use per individual within a household of approximately 3 -4 persons; however a number of respondents contributed within the larger ranges. This was due to the varying efficiency factors of household appliances, along with the length of time they were used daily.

CO_2 emissions	0.1 – 2.0	2.1- 4.0	4.1- 6.0	6.1 – 8.0	8.1 – 10.0	10.1 – 12.0	12.1 – 14.0	14.1 – 16.0	16.1 – 18.0	18.1 – 20.0
Male/%	16.67	0.00	33.33	0.00	0.00	16.67	16.67	0.00	0.00	16.67
Female/%	38.46	23.07	23.07	15.38	0.00	0.00	0.00	0.00	0.00	0.00

Table 4:
Showing Carbon Dioxide Emissions Due to Electricity Usage

Residential air-conditioning units in operation for the larger portion of the day resulted in a significantly higher amount of electricity usage, when compared to situations where only basic appliances were used. The male respondents contributing emissions within the lowest ranges were men who possessed a fast-paced lifestyle and utilized sustainable energy practices. However, the larger proportion of male respondents did not practice such. Many large energy utilizing activities are associated with male patterns of behaviour, for example, watching television for a long period of time, or leaving the television on, playing video games with a setup which requires large amounts of power for a long period of time, leaving the air-conditioning and other electrical devices running throughout the day and so forth. Hence, this contributed immensely to their energy costs and usage.

Carbon Dioxide Emissions	0.1 - 10	10.1 - 100	100.1 - 1000
Male/%	16.67	83.33	0.00
Female/%	53.85	23.08	23.07

Table 5: Showing Total Direct Emissions From Both Male and Female Sub-Groups

In general, the largest percentage of females contributed within the smallest range of carbon dioxide emissions per annum, with approximately one-quarter of the respondents in the two larger ranges. Whilst for males, the smaller proportion contributed to carbon dioxide emissions within the smallest range, with the remainder in the mid range. If the amount of carbon dioxide emitted due to flights were subtracted from the value of total direct emissions, all respondents' total values will be reduced to the two lower ranges, with 92.31% of females and 50% of males possessing emissions in the smallest range. This clearly showed that the largest proportion of direct emissions was due to flight emissions.

Mitigating strategies are used to decrease the amount of carbon dioxide emissions due to any one factor. For road transport, quite a number of options are available to reduce emissions in this sector. For example, one can utilize the option of car-pooling with neighbours who work in the same area. This will reduce the individual emissions by the number of persons involved in the car-pooling network daily. Another option is the use of public transportation, which also has the same effect on individual emissions. Others may take a more direct approach, by purchasing environmentally

friendly, hybrid vehicles which use renewable energy sources to fuel it, or make changes to their existing vehicle to accommodate usage of an environmentally friendly fuel, for example, Compressed Natural Gas. One can also evaluate the distances driven throughout the day and attempt to walk or cycle to some of these places as opposed to using a vehicle. All these options will immensely reduce the amount of carbon dioxide emissions due to direct transportation.

In attempting to reduce emissions due to electricity usage, more sustainable energy practices can be attempted, which include switching off lights and appliances when not in use, as opposed to leaving them on or in the idle mode. A more direct approach would be to analyse all household appliances and ensure that they are all energy efficient. If some are not energy-efficient they can be replaced for more energy efficient models either immediately or when they are no longer functional.

For indirect emissions, the data received was analysed to identify trends of sustainable consumer habits and waste management practices as two sub-categories, food and waste, were used. For food, males and females purchased a similar percentage of local food as opposed to foreign goods. The purchase of local foods instead of foreign foods decreases the footprint, as more carbon dioxide is emitted in transporting the food from a foreign country to the local supermarket.Local food, in comparison, is transported from the area where it was produced to the public's supplier. It was perceived that males were more rational, and made more economical decisions as opposed to females that were more influenced by external factors such as advertisements, live-marketing which cater to the senses of touch and taste and so forth. Hence, females, on average purchased approximately 65.83% of foreign goods per grocery trip as compared to males which purchased

approximately 61.84% of foreign goods. These values are still relatively close which show that men's purchasing habits may be driven by other factors which affect their rational. Some of these habits may include their salary, these consumers are budget-driven and hence, the amount of money they make influences the amount of money they are prepared to spend on food. In addition, men tend to purchase items that they have been purchasing for years even though they price may appreciate greatly, due to the habit of purchasing that one item of a specific brand. The proportion of local food versus foreign food purchased may also reflect the manner in which persons view local goods. In previous times, the market was saturated with more foreign goods than local goods, however, with the increase in local entrepreneurial activities, there is now a surplus of local produce on the market. As reflected in the data, this has not significantly affected the percentage of local produce purchased by consumers.

When the percentage of organic food purchased by each sub-group was analysed, a larger proportion of females purchased organic food. Females, in some cases, tend to be more informed, and were more willing to make healthier choices, even if they were more expensive. This, when compared to males who were more focused on purchasing affordably to appropriately support their families, and thus, may have been less willing to purchase organic food if more expensive, even though it reduced their carbon footprint.

The cultivation of a vegetable garden also reduces the carbon footprint, as food is grown in the back yard and no vehicular emissions aregenerated for its transportation. In evaluating the respondents' production of a vegetable garden, 50% of males indicated having a garden as opposed to 38.46% of the females. It appeared to be more convenient for males to cultivate a garden as they possessed a larger living space, when

compared to females that lived in rooms or apartments with little to no backyard space or land area. Furthermore, males had a greater capacity and need to produce the gardens as most of them lived with their immediate family as opposed to the young predominantly single women. However, a few females managed to cultivate vegetable gardens, for example those who lived with their families or those with balconies which allowed the cultivation ofa seasoning garden. This contributed to a small portion of their food needs.

In terms of waste, females possessed on average, a lower amount of waste generated per month when compared to males. This was due, once again, to the female's lifestyle, wherein most time was spent on campus and as such waste generated was disposed of on the campus and absorbed as the institution's waste generation as opposed to a personal waste generation. Males, however, possibly purchased more, had a more integrated family life,spent more time at home hence producing a higher waste average per person. For compost heaps, a larger proportion of females used their organic waste to develop a heap at home. It was seen that all respondents possessing a compost heap also possessed a vegetable garden and hence, it can be assumed that the compost heap was used to fertilise the crops being nurtured in the gardens. As a result, the nutrient cycle was continued through recycling of waste. The development of these compost heaps, also aided in decreasing the overall carbon footprint. Reducing waste involves the reduction of overall consumption, along with reusing and recycling material regularly. As such, the amount of emissions due to disposing personal waste will decrease as the amount of waste generated decreases.

From the overall findings, no respondent conducted a carbon neutral lifestyle, that is, no one operated at a net zero carbon footprint value. Hence, all respondents need to

implement mitigation measures to further reduce the carbon footprint value and account for the remaining metric tonnes of carbon dioxide being emitted.

RECOMMENDATIONS

MITIGATION MEASURES

Attempts should be made by each individual to decrease the footprint to the smallest possible value. This can be done through a number of ways as discussed earlier. Some specific mitigation measures for the sample population, due to the sectors in which their largest emissions existed are as follows.

1. To negate the quantity of emissions due to air travel, individuals should opt to allocate a portion of funds towards a carbon offsetting programme or the carbon offset programme chosen by the airline.

2. Quite a portion of the sample practiced car-pooling and alternative modes of transport, for example, walking and cycling;therefore, to further reduce emissions, this can be done on a larger scale.Public transportation can be used especially for persons who live within the 15 kilometre radius of the campus.

3. For electricity usage, simple steps can be exercised, for example switching off lights, ensuring that appliances, such as the television which are not in use, are not left on for the entire day. In the home, a few times a week, the air conditioning unit can be switched off, especially during cooler periods of the day, to decrease the amount of electricity used by the unit/s.

4. In terms of food practices, the individuals should purchase

local substitutes to the foreign items they usually purchase.

5. Individuals should also attempt to purchase food items at local food stores closest to them.

6. Reduce, Reuse, Recycle should be implemented daily in each individual's life, as little as possible should be wasted.

7. A compost heap is a very efficient method for recycling organic waste, and where convenient, should be developed within one's living space.

GENERAL AWARENESS

1. There is the need for further awareness within the population ofthe link between purchasing habits and carbon dioxide generation. Hence, carbon management awareness programmes should be implemented within institutions and organizations to educate individuals and impress on them the importance of being ever mindful of their consumer habits.

2. It is important that the need for sustainable lifestyles be instilled in individuals at an early age, so that they develop sustainable habits while young. Environmental education programmes within the school system should be established so that by the time children reach adulthood; these values will already be embedded in them.

RECOMMENDATIONS TO FUTURE RESEARCHERS

1. An increase in sample size, spanning more variedage groups of society, for example the elderly and teenagers, can be attempted to get a better idea of the carbon footprint across a wider range of the population.

2. In an attempt to standardize the calculations for indirect emissions, that is, food and waste, all possible calculations can be explored, to produce one with the smallest range of error, in order to obtain values of carbon dioxide emissions due to these sectors.

Research on this topic is evolving daily, so one can also attempt to explore the technical basis of the topic and develop methods to increase its credibility.

BIOGRAPHY

Nolana E. Lynch is a national of Trinidad and Tobago actively engaged in achieving environmental and sustainable development objectives at the local, regional and international levels. She holds a BSc. Honours degree in Environmental and Natural Resources Management and Physics and is currently pursuing her MPhil in Tropical Earth and Environmental Science. Since 2006 she has passionately conducted extensive research on individuals' impact on the rate of climate change, the use of carbon management tools and the significance of gender in sustainable development. In light of this, she was one of ten persons selected as a Caribbean Climate Champion for the British Council's International Climate Generation programme. Ms. Lynch is currently engaged in Sustainable Ecological and Land Management programmes at the CNIRD/ PISLM Support Office where gender mainstreaming is a key component of projects being implemented throughout the region.

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