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# Economic Evaluation of Ewanrigg Botanical Gardens in Zimbabwe Using an Individual Travel Cost Approach

Precious Mahlatini<sup>1</sup>, Kudakwashe Bryan Kusuwo<sup>1</sup>, Beaven Utete<sup>1</sup>, Nobert Tafadzwa Mukomberanwa<sup>1</sup>

<sup>1</sup> Chinhoyi University of Technology

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## Abstract

Economists face an environmental goods and services valuation dilemma as natural resources are considered to be common pool resources with no markets. If markets exist they are mostly imperfect which results in undervaluation or overvaluation of natural resources. This study estimated the imputed recreational use value of Ewanrigg Botanical Gardens in Zimbabwe from 2015-2017 using the Individual Travel Cost Method (ITC) which elicits the consumer surplus and deduces an optimum entry fee. It investigated key socioeconomic factors which influence visits to Ewanrigg Botanical Gardens. A questionnaire survey was conducted on 54 visitors to Ewanrigg Botanical Gardens during the period of the research to solicit for primary data. The primary data were analysed using the Ordinary Least Squares model to obtain a predictive model of visits to Ewanrigg Botanical Gardens. Using the ITC Method the total consumer surplus which equates to the recreational use value of Ewanrigg Botanical Gardens was USD19 142.16/peak period/year. Travel costs, income and employment status were the major factors driving visitation rates to Ewanrigg Botanical Gardens at an optimum entry fee of USD7.81. To maximise profits for self-sustenance of Ewanrigg Botanical Gardens, the Zimbabwe Parks and Wildlife Authority should concentrate on marketing efforts to individuals of higher income and solid employment status and those proximal to the botanical gardens as these incur less travel costs and can afford entry fees. For posterity, the use of ITC Method to ascertain economic value allows for the true valuation of natural resources and is justifiable for the allocation of funds by central government for the management and maintenance of artificial heritage sites such as Ewanrigg Botanical Gardens in developing African countries.

**Precious Mahlatini<sup>1</sup>, Kudakwashe Bryan Kusuwo<sup>1</sup>, Beaven Utete<sup>2,\*</sup> and Nobert Tafadzwa Mukomberanwa<sup>3</sup>**

<sup>1</sup> Chinhoyi University of Technology, Department of Environmental Science and Technology P. Bag 7724, Chinhoyi, Zimbabwe

<sup>2</sup> Chinhoyi University of Technology, Department of Freshwater and Fishery Sciences. P. Bag 7724, Chinhoyi, Zimbabwe

<sup>3</sup> Chinhoyi University of Technology, Department of Geoinformatics and Environmental Conservation. P. Bag 7724, Chinhoyi, Zimbabwe

\*Correspondence: [beavenu@gmail.com](mailto:beavenu@gmail.com)

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## Introduction

Botanical or botanic gardens or arboreta are man-made ecosystems focusing on propagation and cultivation of exotic plant species mainly to illustrate the relationships within plant groups for nature preservation, scientific research, recreation and mental and physical well-being of the public (GoZ, 2014; Carrus *et al.*, 2015; Chen and Sun, 2018). Like forests, aquariums, orchards, to name but just a few, botanical gardens have direct and indirect value uses which substantially contribute to human welfare (Gómez-Baggethun *et al.*, 2010; Mounce *et al.*, 2017). Botanical gardens facilitate protection of various plant communities and raise awareness about biodiversity values and have assumed an importance in the current climate change discourse (Hill & Gale, 2009; Mounce *et al.*, 2017; Ren and Duan, 2017). Thus, botanical gardens play an imperative role in drawing people and plants together (Demir, 2014). Globally, there are an estimated 2500 botanical gardens (Golding *et al.*, 2010) and these gardens assume an annual visitation rate of 300 million per year (Williams *et al.*, 2015). This implies that botanical gardens generate a substantial amount of revenue for national economies and most importantly for their own sustenance and continuity.

Nonetheless, environmental goods and services provisioned by man-made ecosystems such as botanical gardens are classified as common pool resources or public goods, and thus, they cannot be traded in conventional markets (Costanza *et al.*, 2014). This ultimately results in degradation or underutilization of such resources as the allocated entry fee might be too low which results in visitor congestion affecting the regenerative capacity of the gardens (Chacha *et al.*, 2013; Dixon *et al.*, 2013). Economic valuation is an effort to provide the quantitative monetary value of environmental goods and services whether market value is available or not. It is based on the theory that non-market values can be observed indirectly in consumer expenditure, and in prices of marketed goods and services (Dixon *et al.*, 2013). All decisions that involve trade-offs involve valuation, either implicitly or explicitly (Costanza *et al.*, 2014).

Outdoor recreation such as visiting botanic gardens is undertaken by individuals who anticipate deriving benefit from such. Partially reflected by the entry fee an individual is willing to pay, such benefits can only be comprehensively approximated through non-market valuation techniques such as the Individual Travel Cost Method (Mwebaze & Bennett, 2012) and those indicated in Appendix 1. For this study we used the ITCM Method which evaluates the recreational use value or consumer surplus for a specific recreational site by relating demand for that site (measured as frequency of site visits) to its price (measured as the travel costs) (Safitri, 2018). Hence, Individual Travel Cost Method (ITCM) simply defines the dependent variable as the frequency of visits to a recreational site by each visitor over a defined period as a function of socioeconomic variables inclusive of travel costs (Whitehead *et al.*, 2008; Das, 2013; Limaie *et al.*, 2014)).

Ewanrigg Botanical Gardens measuring 286 hectares is one of the three botanic gardens in Zimbabwe (the others being National and Vumba Botanic Gardens). Due to the garden's expansive nature, visitors partake in garden viewing (herb garden and water garden), scenic viewing along walking trails, sit and read in the natural serene environment, weddings,

barbeque, picnics (GoZ, 2014). Furthermore, the garden is globally renowned for its Cycad and *Aloe vera* species (Child, 2012). Annually, the garden attracts an average of 248 visitors at an average entry fee of USD3 and USD10 for local and foreign visitors respectively (ZIMPARKS, 2017). However, the entry fee does not reflect the full economic value of the botanical garden due to the informal means of pricing used by the Zimbabwe Parks and Wildlife Authority (Carpenter *et al.*, 2009; Islam & Majumder, 2015). Since the economic value of Ewanrigg Botanical Gardens is unknown, this risks its undervaluation or overvaluation by the Zimbabwe Parks and Wildlife Authority. Moreso, if no formal means are being used for allocating the current price, a question therefore arises on the quantitative magnitude of ecosystem service benefits generated from public access (Bishop & Pagiola, 2012; Demir, 2014).

It is imperative to value botanical gardens as this facilitates determination of optimum entry fees and key socioeconomic factors which influence visits and enhance their maintenance and or further development (Ten Brink, 2012; Paracchini *et al.*, 2014). The main objective of this study was to estimate the imputed economic value of Ewanrigg Botanical Gardens using the Individual Travel Cost Method which elicits consumer surplus and deduce the entry fee. The specific objectives were to i) examine the relationship between socioeconomic factors and number of visits, ii) estimate the economic value of Ewanrigg Botanical Gardens as a recreational site, and iii) estimate the optimum entrance fee to Ewanrigg Botanical Gardens in Zimbabwe.

## Study area and Methods

Ewanrigg Botanical Gardens (Figure 1) is located in Shamva District, Zimbabwe. The district lies in the north eastern part of Zimbabwe and shares its borders with Bindura, and Mt Darwin Districts. It is approximately 35km by road from the capital city Harare. According to ZIMSTATS (2012), Shamva District has a population of 119 530 with 60 099 females and 59 431 males. However, the botanical garden is a very popular recreational site in both Mashonaland Central and Harare Metropolitan provinces. The climate of Shamva District is warm and temperate. In winter, there is little or no rainfall with most precipitation in January. November is the warmest month whilst July experiences the lowest average temperatures annually. The average annual temperature and rainfall for Shamva District is 20.2<sup>0</sup>C and 887mm respectively. Furthermore, irrigation of Ewanrigg Botanical Gardens during dry months is facilitated by the perennial flows of Umfurudzi River.

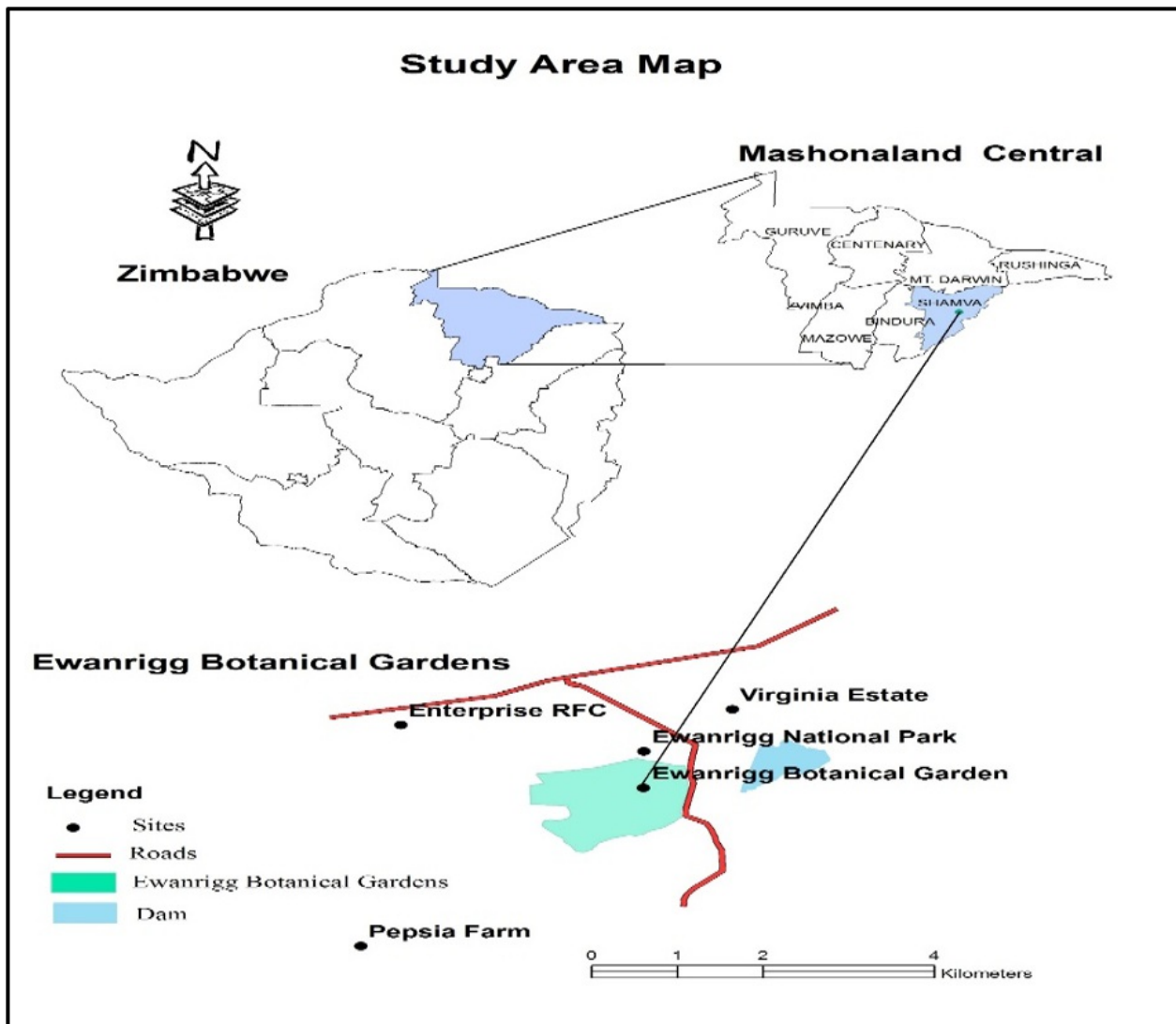
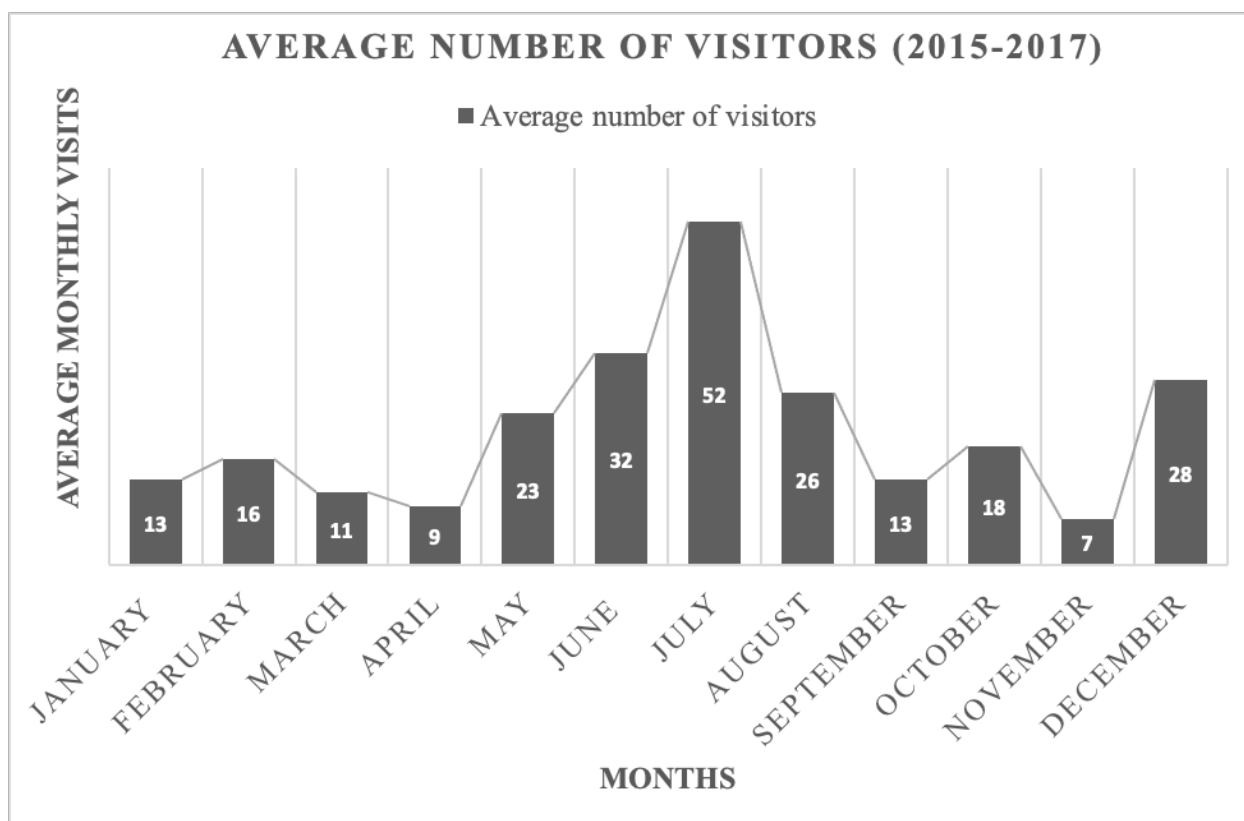


Figure 1. Ewanrigg Botanical Gardens in Mashonaland Central Province

## Data collection and sampling plan

The research collected and analyzed secondary data of the monthly number of visitors to Ewanrigg Botanical Gardens for the period 2015-2017. A questionnaire (Appendix 2) with both open and close-ended questions was designed to obtain primary data from visitors to Ewanrigg Botanical Gardens. The former solicited detailed information about visitor attitudes whilst the later solicited information that is easy to statistically analyze. A questionnaire survey was used as it ensures high response rates (Tahzeeda *et al.*, 2018). The questionnaire was designed into two sections: 1) personal information on purpose of visit, final visit destination, number of visits per peak period per year, mode/means of transport and place of residence and 2) socioeconomic characteristics of visitors such as age, income, education, gender, marital status and employment status. A survey approach was employed for this study. All visitors to Ewanrigg Botanical Gardens during the study period were surveyed. The average visitation rates were as shown in Figure 2:



**Figure 2.** Average monthly visitors to Ewanrigg Botanical Garden for period 2015-2017.

High visitor turnouts were observed for May, June, July and August, save for December which is a festive period thus, high visitor turnouts are expected. High visitor turnouts for May, June and July and August were attributed to the full bloom of *Aloe vera* spp. and Cycad species in winter (Manvitha & Bidya, 2014). Thus, through vernalization, flowering of plants is promoted upon exposure to cold temperatures (Kim *et al.*, 2009). Hence, Ewanrigg Botanical Gardens is always aflame with vibrant colours during this period thereby attracting a considerable number of visitors. High visitor turnouts during the peak visitation period was considered representative of the total annual visits to Ewanrigg Botanical Gardens for this study.

Therefore, an onsite questionnaire survey was conducted from May 1<sup>st</sup> to July 27<sup>th</sup>, 2018 between 9am and 5pm on a daily basis. Only visitors over the age of 18years were considered for the survey as the questionnaire included quantitative information such as income and required analytical ability of the respondent (Tahzeeda *et al.*, 2018). Furthermore, the study focused on both frequent foreign (where possible) and local visitors so as to narrow down the research scope and eliminate once off non-traditional visitors to the garden.

## Data analysis

### Model specification

The ITCM model formulated by (Clawson & Knetsch, 2013) and modified by Twerefou and Ababio (2012); Demir (2014)

and Safitri (2018). The demand function of Ewanrigg Botanical Garden (EBG) was formulated as follows:

$$V_{ij} = f(TC_{ij}, E_{ij}, A_i, I_i, H_i, G_i, M_i)$$

| Table 1. Model specification for Ewanrigg Botanical Gardens. |  |
|--|--|
| Variable   | Explanation  |
| $V_{ij}$   | Total number of visits by visitor $i$ to site $j$ (EBG) during the past 12 months. |
| $TC_{ij}$  | Round trip travel costs to and fro site $j$ (EBG) incurred by visitor $i$ in \$USD |
| $I_i$  | Disposable monthly income of visitor $i$ in \$USD                                  |
| $A_j$  | Age of visitor $i$ in years  |
| $E_i$  | Visitor $i$ 's years of education  |
| $G_i$  | Sex of visitor $i$ , where 1 is Male and 0 is Female.                              |
| $M_i$  | Visitor $i$ 's marital status  |
| $H_i$  | individual $i$ 's employment status  |
| $\epsilon_{ij}$  | Unaccounted for variables.   |

Total travel costs were a summation of fuel costs and entry fees (ORTAÇEŞME *et al.*, 2002). The fuel cost was USD \$1.47 per litre, 11% higher than the global price as of July 27<sup>th</sup>, 2018. Therefore, assuming fuel consumption rate of 8litres per 100km (ZERA, 2017), the standard fuel cost was calculated as USD\$ 0.12 per km, based on the normal fuel costs as of July 27<sup>th</sup>, 2018.

### Relationship between number of visitors and socioeconomic variables

A correlation and linear regression analysis on the number of visits to Ewanrigg Botanical Gardens (dependent variable) against socioeconomic variables of visitors (independent variables) was done. Relative frequencies were also calculated to determine the descriptive statistics pertaining to the socioeconomic variables of the surveyed respondents. From the linear regression model, significant socioeconomic variables that explain the number of visits ( $V_{ij}$ ) at a significant level of 5% were obtained.

### Estimation of the regression model for EBG

A multiple linear regression analysis was performed on the significant socioeconomic variables (from objective 1) against number of visits to obtain a demand function for Ewanrigg Botanical Gardens:

$$V_{ij} = \beta_0 A_i + \beta_1 TC_{ij} + \beta_2 I_i + \dots + \dots + \epsilon_{ij}$$

Where:

$\beta_0$ ,  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ - are regression coefficients which measured the changes in the number of visits as a result of a unit change in the socioeconomic variable assuming *ceteris paribus*.

## Calculation of the Individual Consumer Surplus (CS)

The Individual Consumer Surplus was calculated as derived from Equation 2:

$$\text{Individual Consumer Surplus(CS)} = \text{mean } V2/-2\beta_{TC}$$

Where;

$\beta_{TC}$  was the coefficient of travel costs from the multiple linear regression analysis of significant variables and V was the total average number of visits by respondents during the past 12 months.

## Estimation of the economic value of EBG

The recreational value was obtained by multiplying the individual consumer surplus (CS) by the total number of visitors/peak period/year to Ewanrigg Botanical Gardens as shown below:

$$\text{Total consumer surplus} = \text{CS} \times \text{total number} \frac{\text{visitors of peak period}}{\text{year}}$$

## Determination of the optimum entrance fee to EBG

According to the empirical works of Fernando *et al.* (2016), the number of visits was regressed against the travel costs and a regression equation was obtained as follows;

$$V_{ij} = \beta_1 TC_{ij} + \text{intercept (k)}$$

By substituting hypothetical entry fees (P) for  $TC_{ij}$ , a demand curve was obtained relating  $V_{ij}$  (Q) and P. The equation was obtained as follows;

$$P = a - bQ$$

Hence, when P reached zero, Q was at a maximum and when P was at a maximum the number of visits was zero. The Revenue maximizing entry fee can be calculated as follows

$$TR = PQ$$

Substituting P;

$$TR = (a - bQ)Q$$

Thus,

$$a - bQ^2$$

When TR is maximum (TR<sub>max</sub>)

$$/ = 1 - 2bQ = 0$$

Then,

$$a = 2bQ$$

Therefore,

$$Q = a/2b$$

Once Q was calculated, it was substituted in equation 8 to get P which was the optimum entry fee.

## Results and discussion

A total of 54 visitors were recorded for the study. From these visitors a detailed analysis of their socioeconomic variables was done and follows.

### Socioeconomic factors of visitors to EBG

The average travel costs incurred to visit Ewanrigg Botanical Gardens was \$11.28 (Table 2). The average distance, years of education, age and income of visitors was 34.51km, 16.44years, 31.7years and USD\$622 respectively. Furthermore, the average number of individual visits per year from 54 respondents was 3.96 with a maximum value of 7 times of visit and a minimum value of 1 visit (Table 2).

| Table 2. Descriptive statistics of socioeconomic factors |         |                    |         |         |
|--|---------|--------------------|---------|---------|
| Variables  | Average | Standard deviation | Minimum | Maximum |
| Travel Costs (USD)                                       | 11.28   | 2.19               | 9.93    | 22.78   |
| Roundtrip Distance (km)                                  | 69.03   | 18.22              | 57.74   | 164.8   |
| Frequency of visits per year                             | 3.96    | 1.76               | 1.00    | 7.00    |
| Years of Education                                       | 16.44   | 3.12               | 22      | 7       |
| Age  | 31.7    | 11.3               | 18      | 57      |
| Income (USD)   | 622     | 342                | 200     | 1000    |

### The influence of socioeconomic factors on the number of individual visits to Ewanrigg Botanical Gardens

#### Travel costs

Our results indicated that groups with the least travel costs to Ewanrigg Botanical Gardens represented a higher number of visitors with 46.3% representing visitors who incurred costs less than USD11.00 whilst groups with the least number of visitors incurred higher travel costs with 1.9% representing visitors who incurred costs greater than \$17.00 (Appendix 3). The travel costs incurred had a significant negative effect ( $p < 0.05$ ) on the number of individual visits to the garden (Table



3). Therefore, an increase in the individual travel costs resulted in a decrease in the number of visits and a decrease in the travel costs resulted in an increase in the number of visits to Ewanrigg Botanical Garden. The results of this study agree with the results of Safitri (2018) which showed that travel costs incurred by individual visitors negatively influenced the frequency of visits to a tourist site, Lakey Beach Tourism Object in Dompu Regency. Zandi *et al.* (2018) showed similar results where costs of travel had an inverse relationship with the number of individual visits to Ghaleh Rudkhan Forest Park in northern Iran. Pratiwi (2016) indicated that travel cost has a very strong negative effect on the number of visits to Amal Beach.

### *Educational level*

At least 68.5% of the visitors were educated up to the tertiary level whilst 11.1% represented the least number of visitors to the garden with at least a primary education. Appendix 3 showed a strong positive relationship between educational level and number of visits to Ewanrigg Botanical Gardens. It appears the more educated an individual is the more the propensity to visit the botanical garden. This agrees with results by Tiwari and Chatterje (2017) who ascertained a significant positive correlation between educational level and the number of tourist visits to environmentally protected areas of Nepal. Similarly, Islam and Majumder (2015) identified that the higher a person's literacy, the greater the probability they visited Foy Lake of Chittagong, Bangladesh. This is because the higher the education, the more stress there is in thinking thus, individuals preferably spend their leisure time refreshing in serene natural environments such as botanical gardens (Safitri, 2018). However, for this study educational level had no significant effect ( $p=0.24$ ) on the potential of an individual to visit Ewanrigg Botanical Garden (Table 3).

### *Age*

The group with the highest number of visitors (34.2%) was in the age class of 36-45years whilst the 46-55 years class had the least number of visitors (11.1%) as indicated in Appendix 3. It is also important to note that the 46-55 years and 56-65years classes were represented at levels very close to each other thus 11.1% and 12% respectively (Appendix 3). According to Table 3, visitor age ( $p=0.64$ ) had no significant ( $p>0.05$ ) relationship with the number of visits to the garden. This ultimately means, the older the visitor, the more likely they visited the botanical garden.

Mwebaze and Bennett (2012) indicated no significant relationship between age and the number of visits to Australian National Botanical Garden. However, for this study an increase in the number of visits was only observed up to the 36-45years age group (34.2%). The increase was attributed to the greater sense of safety and security amongst older groups even if they travel a long distance to Ewanrigg Botanical Garden unlike the younger age groups where safety and security could be compromised with increase in distance from areas of residence. The nature of activities at the garden could also explain the differences observed. Currently, the Ewanrigg Botanical Garden tends to attract middle aged individuals relative to the older and younger age groups.

### *Income*

Visitors earning \$500-\$1000 had the highest number of visits (33.3%) whilst 7.4 % and 9.3% represented the least

number of visitors with no monthly income and income of less than \$200 respectively (Appendix 3). There was a strong positive relationship between income and the number of visitors to the garden. The higher the visitor's income, the more frequent they visited Ewanrigg Botanical Gardens. Individuals earning less or no income (16.7%) could less likely afford the distant travelling expenses thereby preferably expend their income on other basic priorities. Income was significantly related ( $p < 0.05$ ) to the individual visits to Ewanrigg Botanical Gardens.

Individuals with a low socioeconomic status (income) are more likely to be physically inactive than their higher status counterparts, thus, the former are more likely to report less recreational activity (Kamphuis *et al.*, 2009). Results by Zandi *et al.* (2018) indicated a strongly positive and significant relationship ( $p < 0.05$ ) between income and the number of visits to Ghaleh Rudkhan Forest Park, northern Iran. Elsewhere Safitri (2018) concluded that individual monthly income had a positive influence on the number of individual visits to Lakey Beach in Indonesia. The results of this study were also supported by Heesch *et al.* (2014) where a strong positive association was ascertained between income and recreation/utility.

### *Marital status*

Married individuals had the most visits (55.6%) whilst no divorced visitors (0%) were identified during the time of the survey. The widowed also represented the second least proportion of visitors to Ewanrigg Botanical Gardens with only 3.7% identified during the survey (Appendix 3). There was a negative relationship between marital status and the number of visits to the botanical garden. The potential to visit followed the order: married > single > divorced > widowed. The fact that married couples made more visits to the garden could be because intimacy in general positively influence married couples to travel a lot to sites of recreation such as botanical gardens. However, marital status did not significantly ( $p > 0.05$ ) influence the potential of individuals to visit Ewanrigg Botanical Gardens in this study (Table 3;  $p = 0.08$ ).

### *Employment status*

A greater proportion of visitors (68%) were employed whilst the least number of visitors (7.4%) were retired. There was a strong positive relationship between employment status and number of visits to the garden (Table 3). Positivity in the employment status resulted in an increase in the number of visits to Ewanrigg Botanical Gardens. Employment status was also significantly ( $p = 0.004$ ) related to the potential to visit the gardens in this study.

It is interesting to note that Sen *et al.* (2014) observed higher levels of engagement in recreation from retired populations. Retired populations in Zimbabwe are mostly in their late 60's, thus, they are less likely to visit Ewanrigg Botanical Gardens during the cold months of winter as this might result in health ailments. Further, in developing countries such as Zimbabwe, retired populations constitute the inactive population which tend to resort to rural from urban setups once retirement age is reached. Therefore, it was highly likely to obtain few retired individuals (7.4%) during the survey.

### *Gender*

Females constituted the highest number of visitors (64.8%) whilst their male counterparts had the least number of visitors

(35.2%). There was a weak positive relationship between gender and number of visitors to the garden (Table 3). Further, gender did not significantly influence ( $p=0.13$ ) the potential to visit the gardens (Table 3). Similarly, Tiwari and Chatterje (2017), showed there was no significant relationship between gender and visitation rates of male and female counterparts to the protected areas of Nepal at 5% level of significance. Elsewhere Mwebaze and Bennett (2012) ascertained that there was no significant relationship between gender and the visitation rates to the Australia National Botanic Garden and Royal Botanic Gardens, Australia. It implies that whatever tourist attraction package that the ZIMPARKS develop for Ewanrigg Botanical Gardens must integrate both sexes.

**Table 3.** *Effect of different socioeconomic factors on potential to visit Ewanrigg Botanical Gardens*

| Socioeconomic variable | R     | R <sup>2</sup> | F-Significance |
|------------------------|-------|----------------|----------------|
| Travel cost            | -0.77 | 0.58           | 0.03*          |
| Educational level      | 0.93  | 0.87           | 0.24           |
| Age                    | 0.49  | 0.08           | 0.64           |
| Income                 | 0.98  | 0.96           | 0.004*         |
| Marital status         | -0.92 | 0.85           | 0.08           |
| Employment status      | 0.84  | 0.70           | 0.04*          |
| Gender                 | 0.20  | 0.04           | 0.13           |

### The economic value of Ewanrigg Botanical Gardens as a recreational site

From Table 3 travel costs, employment status and income were significantly related to the potential of an individual to visit Ewanrigg Botanical Gardens. Using the multiple regression coefficients for the significant variables deduced in Table 4 below the predictive model as defined by equation 2 above was **Visits = 5.088I+0.487H-0.0175TC-72.647+E**; where H=employment status, TC =Travel costs and I=Income. Tazkia and Hayati (2012) ascertained travel cost and income as the major variables that influenced the number of tourism demand to Kalianget Hot Water Spring save for employment status. In contrast, the travel cost model for the recreational use value of the Royal Botanic Garden, UK by Demir (2014) was defined by travel costs and age. In the main differences in the importance of socioeconomic variables in determining visits can be explained on the basis of geospatial and temporal differences between different botanic gardens, level of affluence of surrounding communities, differences in plant species propagated and ancillary recreational activities offered which tend to attract different sets of visitors (Demir, 2014).

**Table 4.** *Multiple linear regression results on significant socioeconomic variables*

| Socioeconomic variables | R-Square | Regression Coefficient | F-statistic |
|-------------------------|----------|------------------------|-------------|
|                         | 0.82     | -72.65                 | 0.053       |
| Travel Costs            |          | -0.02                  | 0.002       |
| Employment status       |          | 0.49                   | 0.0001      |
| Income                  |          | 5.09                   | 0.004       |

Incalculating the Individual Travel Cost Method to estimate the economic value of Ewanrigg Botanical Gardens we first calculated the individual consumer surplus (CS) using equation 4 as indicated

$$\text{Individual Consumer Surplus (CS)} = (230 \div 54)^2 / -2(0.0175327)$$

$$= \text{USD } \$517.36$$

$$\text{Hence, Total Consumer Surplus} = \text{USD } \$517.36 \times 37 \text{ visitors/peak period/year}$$

$$= \text{USD } \$19142.16 \text{ /peak period/ year}$$

Therefore, the estimated economic value of Ewanrigg Botanical Gardens was USD \$19 142.16 /peak period/ year. This value represents the measurable aspect at peak where visitors pay. For most natural resources in Southern Africa, the onus, is rather to estimate the ecosystem value to the surroundings rather than the actual value of the concerned natural or artificial sites on its own to ascertain its true economic value (Zuze, 2013).

### Estimation of the optimum entrance fee to Ewanrigg Botanical Gardens

Using the unstandardised coefficients of the multiple linear regression Appendix D the roundtrip travel cost was statistically significant at 5% level of significance with 58.6% of the variation in visits to Ewanrigg Botanical Gardens being explained by travel costs. The equation was formulated as:  $V_{ij} = 125.3 - 8.4TC_{ij}$  following the equation 5 in the methods. Hence, hypothetical entry fees to Ewanrigg Botanical Gardens equated to the number of visitors or quantity demanded (Q) as calculated from equation 7-10 as shown in Table 5. Like most other tourist resorts it costs less for a bigger number of people to enter into the Ewanrigg Botanical Gardens (Table 5). It is easy to defray and pool expenses for a larger group of visitors rather than single visitors demanding a similar service as indicated in the trip generating function curve (Figure 3).

**Table 5.** Hypothetical entry fee against number of visits to Ewanrigg Botanical Gardens

| Number of visits (Q) | Hypothetical Entry fees (P) USD |
|----------------------|---------------------------------|
| 125                  | 0                               |
| 101                  | 3                               |
| 77                   | 6                               |
| 53                   | 9                               |
| 29                   | 12                              |
| 5                    | 15                              |
| 1                    | 15.5                            |

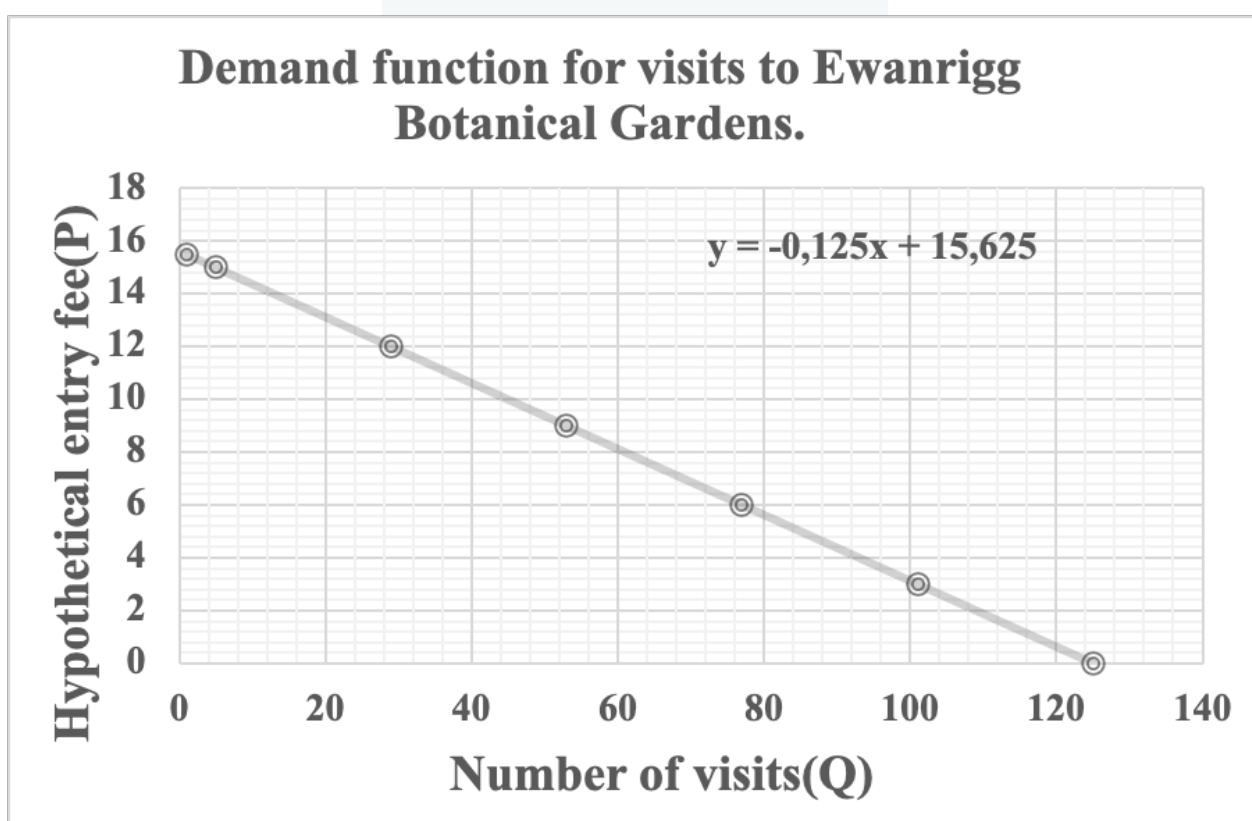


Figure 3. Trip generating function for Ewanrigg Botanical Gardens.

As shown in Fig 3, when P reached zero, Q was at a maximum (125 visitors) and when P was at a maximum the number of visits was zero (0). The demand equation was formulated as follows:  $P = -0.125Q + 15.625$ . Hence  $Q = 15.625 \div (2 \times 0.125) = 62.5$ . Therefore P (optimum entrance fee) =  $(-0.125)62.5 + 15.625 = \text{USD } 7.81$ .

## Conclusions and recommendations

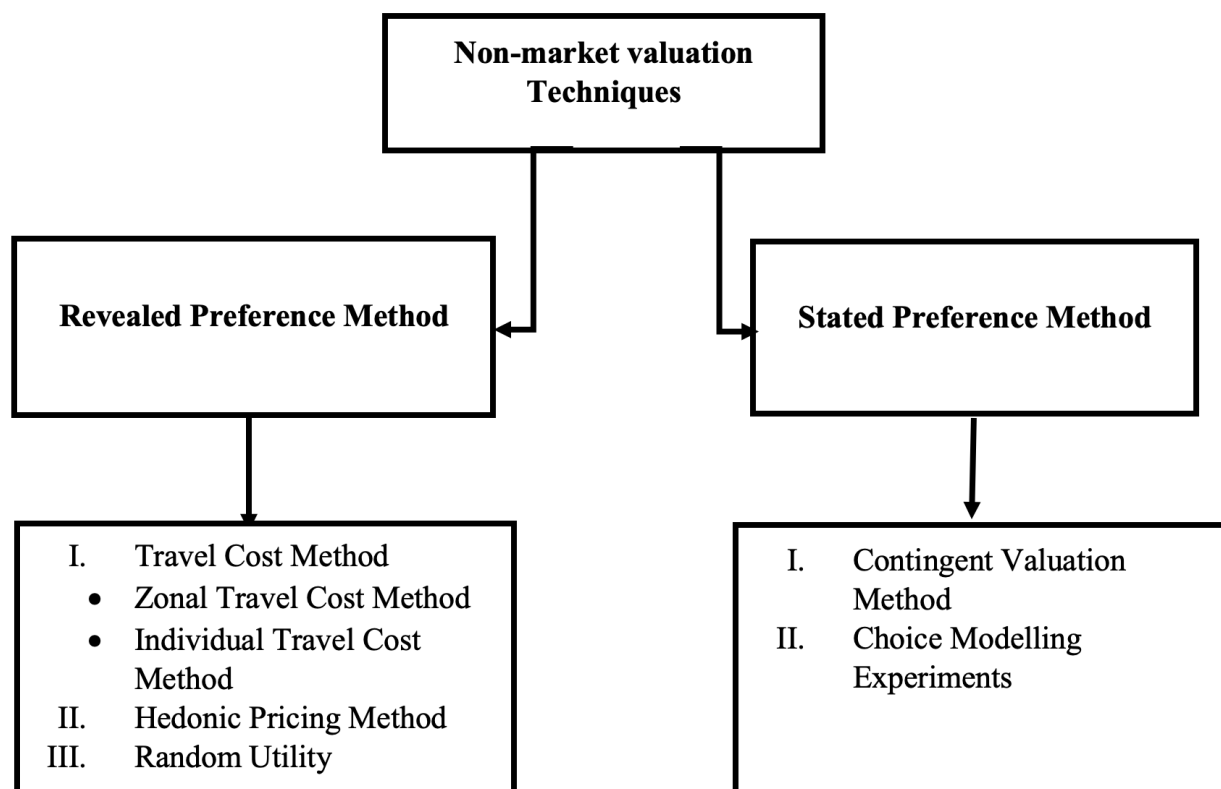
This study aimed to estimate the imputed economic value of Ewanrigg Botanical Gardens in Zimbabwe using the Individual Travel Cost Method which elicits consumer surplus and deduce the entry fee. Comparable with major tourist

destinations, travel costs, income and employment status were identified as the major factors through which visitation rates to Ewanrigg Botanical Gardens can be predicted. Using the Income Travel Cost Method the elicited economic value/peak period/year from recreational use of Ewanrigg Botanical Gardens was USD\$19142.16. However, the research established that the current local visitor entry fee (USD3) to Ewanrigg Botanical Gardens was not optimal and was less than the estimated optimum entry fee of USD7.81.

It is imperative for the responsible authorities i.e. the Zimbabwe Parks and Wildlife Authorities to concentrate marketing efforts of Ewanrigg Botanical Gardens to groups of higher income and employment status as well as individuals within the proximity of the garden as these incur less travel costs. Furthermore, marketing should be done through a plethora of platforms such as billboards and electronic means (television, radio, online) which equally can attract potential male and female visitors. The central government through responsible line ministries should allocate adequate funds for management and or further development of Ewanrigg Botanical Gardens so as to attract more visitors from diverse socioeconomic backgrounds. A gradual increase in the optimum entrance fee to USD\$7.81 will help maximize revenue for self-sustenance and continuity of Ewanrigg Botanical Gardens. On a regional and global scale it is imperative for responsible authorities to institute accurate economic valuation of the actual attraction site using formal means, and then afterwards value the ecosystem services and any other ancillary services. This will enable accurate estimation of the quantitative magnitude of ecosystem service benefits generated from public access.

## Appendix

### Appendix 1. *Non-market valuation techniques*



*Appendix 2. Questionnaire used to solicit information on socioeconomic characteristics of visitors to Ewanrigg Botanical Gardens*

This questionnaire was designed to obtain personal and socioeconomic information of visitors to Ewanrigg Botanical Gardens, Shamva, Zimbabwe. The survey was carried out by Kusuwo Kudakwashe Bryan in partial fulfilment of the requirements of the Bachelor of Science Honours degree in Environmental Science and Technology at Chinhoyi University of Technology. The obtained information were used for economic valuation of the garden only and did not discriminate any respondent. Feel free to answer the questions, your cooperation is greatly appreciated.

NB: Tick in the boxes ☐ and fill in your information in the spaces provided.

**Personal information**

1. Is Ewanrigg Botanical Gardens your final visit destination?

A. Yes ☐ A. No ☐

2. Place of residence? .....

3. How did you get to Ewanrigg Botanical Gardens?

A.Road ☐ B.Walking ☐ C. Cycling ☐ D.Air E. Railway ☐

4. What is your purpose of visit?

A. Recreation ☐ B. Education ☐ C. Function ☐

5. How many times have you visited Ewanrigg Botanical Gardens in the last 12 months?

.....

### **Socioeconomic characteristics**

6. Age .....

7. Gender

A.Male ☐ B. Female ☐

8. Marital Status

A.Married ☐ B. Single ☐ C. Divorced ☐ D. Widowed ☐

9. Employment Status

A. Retired ☐ B. Student ☐ C.Unemployed ☐ D. Employed

10. Educational level

A. Primary ☐ B.Secondary ☐ C.Tertiary ☐

11. Monthly income

A.Less than \$200 ☐ B. \$200-500 ☐ C. \$500-1000 ☐ D.above \$1000 ☐

THANK YOU FOR YOUR TIME!

### **Appendix 3. *Frequency tables of socioeconomic factors***



| Travel Cost (\$)          | Frequency             | Cumulative Frequency | Relative frequency     |
|---------------------------|-----------------------|----------------------|------------------------|
| ≤11                       | 25                    | 20                   | 46.3                   |
| 11-13                     | 20                    | 45                   | 37.0                   |
| 13-15                     | 5                     | 50                   | 9.3                    |
| 15-17                     | 3                     | 53                   | 5.6                    |
| ≥17                       | 1                     | 54                   | 1.9                    |
| Educational Level (years) | Frequency of visitors | Cumulative frequency | Relative Frequency     |
| Primary                   | 6                     | 6                    | 11.1                   |
| Secondary                 | 11                    | 17                   | 20.4                   |
| Tertiary                  | 37                    | 54                   | 68.5                   |
| Age (years)               | Number of visits      | Cumulative frequency | Relative Frequency     |
| 18-25                     | 8                     | 25                   | 14.8                   |
| 26-35                     | 14                    | 22                   | 25.9                   |
| 36-45                     | 19                    | 41                   | 35.2                   |
| 46-55                     | 6                     | 47                   | 11.1                   |
| 56-65                     | 7                     | 54                   | 12.9                   |
| Income groups             | Number of visitors    | Cumulative Frequency | Relative frequency (%) |
| Less than \$200           | 5                     | 2                    | 9.3                    |
| \$200-500                 | 16                    | 21                   | 29.7                   |
| \$500-1000                | 18                    | 39                   | 33.3                   |
| 1000-1500                 | 11                    | 50                   | 20.4                   |
| >1500                     | 4                     | 54                   | 7.4                    |
| Marital Status            | Frequency of visitors | Cumulative Frequency | Relative Frequency     |
| Married                   | 30                    | 30                   | 55.6                   |
| Single                    | 22                    | 52                   | 40.7                   |
| Divorced                  | 0                     | 52                   | 0                      |
| Widowed                   | 2                     | 54                   | 3.7                    |
| Employment status         | Frequency             | Cumulative Frequency | Relative Frequency     |
| Retired                   | 4                     | 4                    | 7.4                    |
| Student                   | 5                     | 9                    | 9.3                    |
| Unemployed                | 8                     | 17                   | 14.8                   |
| Employed                  | 37                    | 54                   | 68.5                   |
| Gender                    | Frequency             | Cumulative frequency | Relative frequency (%) |
| Male                      | 19                    | 19                   | 35.2                   |
| Female                    | 35                    | 54                   | 64.8                   |

Appendix 4. Results of linear regression analysis of the socioeconomic variables against the number of visits to EBG.

Travel Costs against number of visits of EBG

#### Regression Statistics

|                          |           |
|--------------------------|-----------|
| <b>Multiple R</b>        | 0,7652938 |
| <b>R Square</b>          | 0,5856745 |
| <b>Adjusted R Square</b> | 0,5166203 |
| <b>Standard Error</b>    | 18,107168 |
| <b>Observations</b>      | 54        |

#### ANOVA

|                   | <i>df</i> | <i>SS</i> | <i>MS</i> | <i>F</i>  | <i>Significance F</i> |
|-------------------|-----------|-----------|-----------|-----------|-----------------------|
| <b>Regression</b> | 1         | 2780,7827 | 2780,7827 | 8,4813692 | 0,0269004             |
| <b>Residual</b>   | 52        | 1967,2173 | 327,86955 |           |                       |
| <b>Total</b>      | 53        | 4748      |           |           |                       |

|                     | <i>Coefficients</i> | <i>Standard Error</i> | <i>t Stat</i> | <i>P-value</i> | <i>Lower 95%</i> | <i>Upper 95%</i> | <i>Lower 95,0%</i> | <i>Upper 95,0%</i> |
|---------------------|---------------------|-----------------------|---------------|----------------|------------------|------------------|--------------------|--------------------|
| <b>Intercept</b>    | 125,25285           | 35,352048             | 3,5430154     | 0,0121744      | 38,749506        | 211,7562         | 38,749506          | 211,7562           |
| <b>Travel costs</b> | -8,3662756          | 2,8727589             | -2,912279     | 0,0269004      | -15,395664       | -1,3368877       | -15,395664         | -1,3368877         |

## Competing interests

The authors declare no conflict of interest whatsoever for this manuscript.

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