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Abstract

Gender concerns and experiences, as well as those of policymakers and programme implementers, should be considered when formulating policies and programmes in all areas of public life, including politics, business, and society. This ensures that women and men benefit from policies and programmes in the same way, while preventing inequalities from being perpetuated. This should also be integrated in the designing of machines used in homes too. This research seeks to investigate the impact of gender design on the construction of a fuel-less generator for female artisans in Nigeria. Investing in the development of a female-friendly fuel-less generator will be a significant step forward in reducing the sufferings of female business venture owners in Nigeria while causing little or no environmental impact. For this paper only responses related to whether this research will be a step in the right direction in addressing gender bias to previous work, that female artisans will be comfortable operating and using the new device and that Gendered centre design will receive a boost in product design especially in Nigeria are considered. The result showed that gendered centre design will receive a boost as a result of this research.

Keywords: *Gender, Fuel-less generator, Artisans, Population*

INTRODUCTION

Currently, only 45% of Nigeria's population is connected to the energy grid whilst power supply difficulties are experienced around 85% of the time and almost nonexistent in certain regions. At best, average daily power supply is estimated at four hours, although several days can go by without any power at all (Aliyu, Ramil and Saleh, 2013). According to world Bank 2021, 85 million Nigerians do not have access to grid electricity. This represents 43% percent of the country's population and makes Nigeria the country with the largest energy access deficit in the world. The lack of reliable power is a significant constraint for citizens and businesses, resulting on annual economic losses estimated at $26.2 billion (₦10.1 trillion) which is equivalent to about 2 percent of GDP.

The gender perspective focuses particularly on gender-based differences in status and power, and considers how such discrimination shapes the immediate needs, as well as the long-term interests, of women and men.

In a policy context, taking a gender perspective is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres, so that women and men benefit equally and inequality is not perpetuated (SCHR, 1997).

In this case the research seeks to investigate the impact of gender design on the construction of a fuel-less generator for female artisans in Nigeria.

Problem Statement/Justification

Access to quality, adequate, reliable and affordable power is a necessity to enhance the standard of living in Nigeria, especially in the rural areas. Inadequate and epileptic power supply retards economic development and this has plagued the economic development of Nigeria for decades (Bello-Schumann and Porter 2017). The fossil fuel, which is the main source of electricity generation in the country is under criticism and scrutiny due to the hazardous environmental threats emanating from its usage.

Incessant electric power failures have forced Nigerians, especially the artisans into extensive use of alternative sources of power generation to support small, medium and large-scale businesses to boost their productivity. Over the years, the emphasis on the alternative sources of energy for powering their businesses has been on the fossil fuel supported power generators. This implicates a host of environmental livability glitches (Akin and Adejumobi, 2017). The females are particularly affected in the sense that the conventional generating sets are too bulky and heavy to carry, as a resulted are tempted to use these generators indoors creating serious air pollution inside the house or building which may result to death by inhaling Carbon monoxide. Another challenge is the fact that the technicality of operation may also be another disadvantage.

Gender parity is important because true progress cannot happen without a diversity of perspective roles. Any other model assures the perpetuation of the status quo with only inconsequential

modification. Harnessing the also 50 percent of the Nigerian population is key to our economic development

The construction of female gender friendly fuel-less generator will be a huge step in the right direction to alleviating the sufferings of female business venture owners in Nigeria with minimal or no environmental pollution.

Objectives of the Study

The overall aim of this project is to design and construct a fuel-less generator, capable of producing sustainable, inclusive, environmentally friendly and gender sensitive electrical power machine to support artisans operating in small and medium scale business ventures. The objectives of this study are:

1. To identify and evaluate the major operational and control requirement limitations of the conventional generator.
2. To construct an inclusive eco-friendly fuel less generator that accommodates gender mainstream.
3. The research will be a step in the right direction in addressing gender bias to previous work (conventional generators)
4. To get the perspective of respondents to the fact whether female artisans will be comfortable operating and using the new device
5. To find out if Gendered Centre design will receive a boost in product design especially in Nigeria with respect to the research

LITERATURE REVIEW

Most of the design processes are mostly anchored on implicit assumption from the general knowledge of the design team. A machine that addresses significant aspects of the needs of the users is likely to be used throughout the product life phase. In a society, like ours, that is consumption driven, this has an overall effect on the environment.

Real equality in the workplace, home and in every other area will make all of us better off. When we use the full talents of the population, our countries and companies are more productive. When men are 50/50 partners at home, marriages are stronger. When men are active fathers, their children are healthier, happier, and more successful (Takethelead, 2015).

In 2020 according to statista.com, Nigeria's female population amounted to approximately 101.67 million, while the male population amounted to approximately 104.47 million inhabitants.

The trend has remained the same since 1991 census, the population for males are usually slightly higher than the females. The approximation is almost 50 percent males and 50 percent females. Imagining harnessing the 50 percent of the population comprising the female gender.

There is a fundamental need to raise awareness about the issues related to gender, as well as other social categories which are intersectional, and energy poverty. In order for gender issues to be more

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visible it is important to recognize that households are not a holistic entity (European parliament, 2017).

Women are the pioneers of nation. Cultures globally attaches great importance to women, comprising half of world's population. According to a report of secretary general of United Nations, women constitute 50% of human resources, the greatest human resource next only to man having great potentiality. Women are the key to sustainable development and quality of life in the family. The varieties of role the women assume in the family are those of wife, leader, administrator, manager of family income and last but not the least important the mother. Women are the key to sustainable development and quality of life. So, they should be members of community centre or club to disseminate knowledge about handicraft, cottage industries, food preservation and low-cost nutritious diet to people belonging low socio-economic status for their economic upliftment (www.yourarticlelibrary.com).

From the statement above it can be said that empowering women will be empowering the homes, societies and the nation. To this end it is important address the issue of gender centred design.

Design has only recently become aware of gender as an issue that influences not only the form and practice of design, but also the effects on the application, use, and purchase of design by women and men. Gender design is dedicated to the analysis of objects (object here being the general term for all designed products, signs, concepts, and processes) and the relationship between subject and object with regard to their genderization (Brandes, 2008).

Gender is an important part of our identity, so it concerns all of us—whether we are actively conscious of it or not. Gender-inclusive design is one important dimension of inclusive design because our design decisions in this area directly impact our users. Inclusive design is gaining attention across the industry as an approach that results in products that are more useful to even more people, and that reduces or eliminates the number of obstacles users encounter on their way to having a productive, easy, and even delightful experience. It's good for people, it's good for culture, and it's good for business (Querini, 2021).

Inclusive designing can be overwhelming, imagine designing a product or experience that is fully inclusive. We all have gaps in our personal knowledge or experience that leave us insensitive to the kinds of exclusion other people face on a daily basis. To overcome this will involve interfacing with the female artisans before, during and after construction to produce a high-fidelity prototype of the fuel-less generator.

METHODOLOGY

The methodology will involve the consultation of literatures and administration of questionnaires (appendix 1) to artisans in selected locations within Edo State. Structured questionnaires were deployed for gathering information from the artisans. The needs of the participants range from their expectation of the workings of the conventional power generator to difficulties experienced at the level of the

different parts of the power generator. The data were necessary to enable the research team identify the Voice of Customer (VOC), a key assessment requirement for the design of the product (fuel less generator).

During the study, four hundred and twenty-one participants comprising 309 females and 112 males participated in the study across the four locations. Responses were generated from seven demographic information, 20 questions items and 5 structured interview questions from the field across the four locations. At the conclusion of the user study, the raw data were pre-processed and data analyzed but for this paper only responses related whether this research will be a step in the right direction in addressing gender bias to previous work, that female artisans will be comfortable operating and using the new device and that Gendered centre design will receive a boost in product design especially in Nigeria are considered.

DATA ANALYSIS

The demographic information comprising gender, age, academic qualification, local government area of origin and religion were pre-processed.

Thereafter, the structured interview responses of the 421 participants were directly documented. The research team's emphasis at this phase was respondents' perception data as regards the effect of gender centred design required for the product design of the fuel-less generator as compared to the conventional one. The first part of the analysis was targeted at identifying the VOC, predominantly generated from the structured interview transcript of the participants. This information will enable the research team to develop the most optimum or tailor-made solution to the case study of the product design under consideration. The analysis was carried out using SPSS (Statistical Package for Social Sciences).

Research Hypotheses

The hypothesis One: deals with the fact that the research will be a step in the right direction in addressing gender bias to previous work

H_0: There is no significant difference in respondents' perception as regards gender centred designs of generator users

H_1: There is a significant difference in respondents' perception as regards gender centred designs of generator users

Hypothesis Two: deals with the fact that female artisans will be comfortable operating and using the new device

H_0: There is no significant reason in incorporating the comfortability of the operations of female artisans into the new device

H_1: There is a significant reason in incorporating the comfortability of the operations of female artisans into the new device

Hypothesis Three: deals with the fact that Gendered centre design will receive a boost in product design especially in Nigeria

H_0: There is no significant boost in Gendered centre design product designing especially in Nigeria by this research

H_1: There is a significant boost in Gendered centre design product designing especially in Nigeria by this research

The analysis is as follows:

The analysis is based on Statistical Package for Social Science (SPSS) software.

The table 1, gives a summary of the analysis shows that there was no missing data. The total data entered was from the returned 421 questionnaires giving a 100% of the processed data.

Table 1: Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
The research will be a step in the right direction in addressing gender bias to previous work	421	100.0%	0	0.0%	421	100.0%
A female artisan will be comfortable operating and using the device	421	100.0%	0	0.0%	421	100.0%
Gendered centre design will receive a boost in product design especially in Nigeria	421	100.0%	0	0.0%	421	100.0%

The descriptive statistical information is given in table 2 including mean, median, variance, standard deviation etc. from the information these are broken down into the various questions the respondents' answered.

1. The research will be a step in the right direction in addressing gender bias to previous work.

The table shows the following information mean, median, variance and standard deviation of 4.40, 4.00, 0.398 and 0.631 respectively.

2. A female artisan will be comfortable operating and using the device.

    The table shows the following information mean, median, variance and standard deviation of 4.48, 5.00, 0.436 and 0.660 respectively.

3. Gendered centre design will receive a boost in product design especially in Nigeria.

    The table shows the following information mean, median, variance and standard deviation of 4.39, 5.00, 0.566 and 0.753 respectively.

Table 2: Descriptive statistics of questions administered

			Statistic	Std. Error
The research will be a step in the right direction in addressing gender bias to previous work	Mean		4.4014	.03075
	95% Confidence Interval for Mean	Lower Bound	4.3410	
		Upper Bound	4.4619	
	5% Trimmed Mean		4.4591	
	Median		4.0000	
	Variance		.398	
	Std. Deviation		.63087	
	Minimum		1.00	
	Maximum		5.00	
	Range		4.00	
	Interquartile Range		1.00	
	Skewness		-1.082	.119
	Kurtosis		3.089	.237

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A female artisan will be comfortable operating and using the device	Mean		4.4774	.03217
	95% Confidence Interval for Mean	Lower Bound	4.4142	
		Upper Bound	4.5407	
	5% Trimmed Mean		4.5437	
	Median		5.0000	
	Variance		.436	
	Std. Deviation		.66015	
	Minimum		1.00	
	Maximum		5.00	
	Range		4.00	
	Interquartile Range		1.00	
	Skewness		-1.239	.119
	Kurtosis		2.056	.237
Gendered centre design will receive a boost in product design especially in Nigeria	Mean		4.3872	.03668
	95% Confidence Interval for Mean	Lower Bound	4.3151	
		Upper Bound	4.4593	
	5% Trimmed Mean		4.4619	
	Median		5.0000	
	Variance		.566	
	Std. Deviation		.75260	

	Minimum	1.00	
	Maximum	5.00	
	Range	4.00	
	Interquartile Range	1.00	
	Skewness	-1.447	.119
	Kurtosis	3.097	.237

Table 3: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
The research will be a step in the right direction in addressing gender bias to previous work	.292	421	.000	.718	421	.000
A female artisan will be comfortable operating and using the device	.342	421	.000	.714	421	.000
Gendered centre design will receive a boost in product design especially in Nigeria	.305	421	.000	.731	421	.000
a. Lilliefors Significance Correction						

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The summary information for normality test is captured in table 3. The Kolmogorov-Smirnov and Shapiro-Wilk P-Values which in SPSS is known as Sig. gives the following values for the four's questions for all as 0.000.

It means the data is not normal, since the P-value is less than 0.050 level of significance.

Hence, the non-parametric test will be carried out.

Non-Parametric Tests Results

The non-parametric tests are used when the sample to be tested are not normally distributed and in this from the normality test the samples are not normally distributed. The Kruskal-Wallis test for k-samples is used for this.

Table 4, shows that the male respondents were 112 and the females 309.

Mean ranks for the gender are 195.21 and 216.72 for question one, 195.25 and 216.71 for question two and 191.96 and 217.90 for question three.

The mean rank is the average of the ranks for all observations within each sample. The mean rank is used to calculate the H-value, which is the test statistic for the Kruskal-Wallis test.

Table 4: summary of questions administered and their ranks

	Gender	N	Mean Rank
The research will be a step in the right direction in addressing gender bias to previous work	Male	112	195.21
	Female	309	216.72
	Total	421	
A female artisan will be comfortable operating and using the device	Male	112	195.25
	Female	309	216.71
	Total	421	
Gendered centre design will receive a boost in product design especially in Nigeria	Male	112	191.96
	Female	309	217.90
	Total	421	

Table 5: Kruskal-Wallis H Test Statistical results[a,b]

	The research will be a step in the right direction in addressing gender bias to previous work	A female artisan will be comfortable operating and using the device	Gendered centre design will receive a boost in product design especially in Nigeria
Kruskal-Wallis H	3.271	3.302	4.637
df	1	1	1
Asymp. Sig.	.070	.069	.031

a. Kruskal Wallis Test

b. Grouping Variable: Gender

The Kruskal-Wallis H Test Statistical results (Table 5), shows the Kruskal-Wallis H Test values for the questions and their corresponding Asymptotic Significance values. Respectively the values are 3.271, 0.070; 3.302, 0.069; and 4.637, 0.31.

DISCUSSIONS

The standard error of the mean, also known as the standard error of the sample mean, indicates how different the population mean is likely to be from a sample mean in a given population. Using it, you can find out how much the sample mean would change in the event that you repeated a study with new samples drawn from inside a single community (Bhandari, 2020). Sample data helps statisticians comprehend bigger populations. So, you can assess how well your sample data represents the population. A high standard error indicates that sample means are widely distributed around the population mean. A low standard error indicates that your sample's mean is closely correlated with the population's mean. The standard mean error of samples in this study are 0.03075, 0.03075 and 0.03075 respectively the low ME is an indication that the mean is closely correlated with the population's mean.

The Kruskal-Wallis H test is a nonparametric rank-based test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. The Kruskal-Wallis H test can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable (Laerd statistics, 2018). The level of significance is set at 95% for this study. The significance threshold for this example is 0.05, which represents a 5 percent chance of determining that a difference exists when there is not actually a difference. If the p-value is

less than or equal to the level of significance, you reject the null hypothesis and conclude that the medians of all the groups are not equal in all ways. The other theory is then accepted by you.

The p-value which corresponds to the Asymp. Sig for hypothesis one is 0.07 as shown in table 5. And since the p-value is greater than the level of significance of 0.05, the null hypothesis for one is accepted and the alternate rejected as highlighted below.

Hypothesis One:

H_0: There is no significant difference in respondents' perception as regards gender centred designs of generator users

H_1: There is a significant difference in respondents' perception as regards gender centred designs of generator users

The p-value which corresponds to the Asymp. Sig for hypothesis one is 0.069 as shown in table 5. And since the p-value is greater than the level of significance of 0.05, the null hypothesis for two is accepted and the alternate rejected as highlighted below.

Hypothesis Two:

H_0: There is no significant reason in incorporating the comfortability of the operations of female artisans into the new device

H_1: There is a significant reason in incorporating the comfortability of the operations of female artisans into the new device

The p-value which corresponds to the Asymp. Sig for hypothesis one is 0.031 as shown in table 5. And since the p-value is lesser than the level of significance of 0.05, the null hypothesis for three is rejected and the alternate accepted as highlighted below.

Hypothesis Three:

H_0: There will be no significant boost in Gendered centre design product designing especially in Nigeria by this research

H_1: There will be a significant boost in Gendered centre design product designing especially in Nigeria by this research

CONCLUSION

In particular, the gender perspective looks at inequalities in status and power that exist between men and women, as well as how such discrimination affects both the immediate needs of women and the long-term interests of men and women. Discriminating against the female gender in terms of product designs will have a negative impact on the overall performance of the society and nation's development considering that the population ratio is almost 50-50. Harnessing the also 50 percent of the Nigerian population is crucial to our economic development and hence the need to develop a fuel-less generator that will be gender inclusive to provide the needed essential power and electricity for

small business holdings comprising of females (artisans) to contribute their quota to the development of the economy.

The analysis to the responses from the questionnaire administered was done using the Kruskal-Wallis H nonparametric non-parametric test since the sample data was not normally distributed. Three hypothesis were tested relating to (1) the fact that the research will be a step in the right direction in addressing gender bias to previous work (2) the fact that female artisans will be comfortable operating and using the new device and (3) the fact that Gendered centre design will receive a boost in product design especially in Nigeria.

The results showed that the null hypothesis for (1) and (2) were accepted since the p-value was greater than the level of significance and the null hypothesis was rejected for the third hypothesis and the alternate hypothesis accepted.

Acknowledgement

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