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Which Sustainable Development Goals and Eco-challenges Matter Most to Niger's Farmers and Herdsmen? A Best Worst Scaling Approach

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Abstract

The sustainable Development Goals proposed by United Nations are increasingly becoming integrated in socioeconomic and environmental projects. Eco-challenges have also been widely studied and documented. Several researchers have well defined and documented what is sustainable development and how can be it achieved. However, fewer studies have investigated farmers and herdsmen' preferences and awareness for United Nations Sustainable goals and eco-challenge. Based on Previous studies reported by United Nations Development Agency, seventeen sustainable development goals and nine eco-challenges were included in this study. In this study, the authors use the balanced incomplete block design to collect data from 136 respondents. For each question, respondents were asked to select their best and worst sustainable development goals, while they were asked to select their three best and their three worst eco-challenges. The conditional logit model and the count-based methods were used to model the sustainable development goals and eco-challenges respectively. Results show that gender equality, followed by industry; innovation and infrastructures, no poverty, climate action, reduced inequalities, clean water and sanitation, zero hunger and quality education are the most preferred sustainable development goals. Results also suggest that water, health and food are the most preferred eco-challenges. These findings may be useful to plan and implement sustainable development goals and eco-challenges and thereby stimulating economic growth and prosperity in the study

Keywords: Sustainable development goals; Eco-challenges; Count-based methods; Best worst scaling

Introduction and Background

The sustainable development has been defined as the capacity of the present generation to achieve their needs without preventing the future generation to achieve their needs. Several studies have indicated that concerted effort have been globally, regionally, nationally, and locally undertaken to increase public awareness for sustainable development goals and eco-challenges.

At global level, the 193 world leaders have e 1gathered at United Nations (UN) to adopt the seven (17) sustainable development goals to achieve several extraordinary things by 2030 namely ending poverty, promoting prosperity and well-being for all and protecting our environment (2015). It has been documented that for the goals to work, people need to know them and if goals are famous, they cannot be forgotten. The united Nation secretary stated that 2015 is year of historic opportunity for our generation to end poverty, to take a step to reduce climate change threats, to adopt a new development agenda and finally set the world on course for a better future [1]. He also stated that our generation can be the first to end extreme poverty, the most determined generation to end injustice and inequalities and the last generation to be threatened by climate change.

At national level, governments around the world have pledged to leave no one behind, meaning that working towards shared progress so that progress is equality shared amongst people on top of society and those on the margin of society. This is furthered illustrated by Gandhi saying that a nation's greatness is measured by how it treats its weakest members. The steps the international community needs to set on course to make sure no one is left behind have also been documented and disseminated. Previous studies have indicated that more and better data should be collected, policies and programs focusing on reaching vulnerable populations need to be developed and awareness must be raised in the community and beyond [1].

At regional level, sustainable development goals have integrated in all projects and programs. Projects such herd rebuilding, restoration of fragile ecosystems via tree planting and sustainable land management, income generating activities, cash and food for asset and support for crop production have been executed so as to guide farmers and herdsmen towards wise utilization of scare resources and thereby building sustainable communities. The water-energy-food nexus approach has great potential to increase the resilience of marginalized communities in southern Africa by contributing towards attaining the Sustainable Development Goals (SDGs 1, 2, 3, 6, 7, and 13). Studies have well-documented that climate change adaptation strategies and water-energy-food nexus should be integrated to achieve opportunities geared towards proper resource management, better harmonization of activities across all sectors, build resilience, and reduce vulnerabilities; thereby attaining regional development goals [2-4].

At local level, a grass root level movement aims at creating awareness around sustainable development has been initiated and reinforced. Local movement via farm and garden schools where a few farmers received training on human capacity building has been a success. These farmers once well-equipped are encouraged to train and share production experience with other farmers, thereby creating a wide learning networking. This technique has been increasingly experimented with a high-level adaptation rate. The saying thinking locally and acting globally as well as the bottom up approach in which farmers are encouraged to design the project and the project does the development are well shared and documented by keeping producing p successful stories.

However, little is relatively known about the farmers and herdsmen awareness and preferences for sustainable development and eco-challenges and it is often based on merely simple speculation. The overall objective of this paper is to evaluate farmers and herdsmen's awareness and preferences for sustainable development goals and eco-challenges.

Synthesis of Previous Studies

Several studies related to sustainable development have been researched and documented. [5] have focused on the relevance of endogenous preferences in the explanation of consumer behavior and its role for sustainable development. The motivation for their study is based on their thought that demand side has received far less attention in the sustainability discussion than the production side. They feel that there seems, however little doubt that consumption is equally important to achieving sustainability. With reference to a specific type of local food market of community supported agriculture (CSA) groups, this study investigates consumer behavior and its relevance in sustainable development. This study is important in providing information on the change in preferences after interaction with the farmers and other market participants for several years. This learning aspect may, however, prove crucial to identify paths towards sustainable development.

[6] have also explored linkages between climate change and sustainable development from a "developing country perspective" in Brazil, India, the West African region, South Africa and South Asia. These authors reported that the central concerns about sustainability include economic, social and environmental dimensions and will necessary influence action in each of these areas. [7] have also reported that the main objective in the economic dimension of sustainability is the "economic use" of natural resources. Another cross-cutting sustainability issue relates to maintaining eco-system "health'. Climate change may threaten eco-system health in several important ways, including accelerating irreversible change such as through loss of species and of habitats (for example, coral reef systems). Such concerns lead decision-makers to focus on "durability" as opposed to optimization. The social dimension of sustainability raises a number of important "fairness" issues [8]. These authors have reported that fairness in the process of making climate policy including participation and access to decision-making, which will inevitably determine the perceived fairness of any policy and ultimately its effectiveness.

The application of Likert scale in ranking items has gained popularity in psychology before spreading in various academic fields. However, Likert scale does not give room for trade off amongst items being ranked and interpreting results from Likert scale estimation is still a big challenge. The application of best worst scaling (BWS) and count-based method has recently been gaining a momentum in the academic literature. The BWS application in agricultural sector include studies on evaluating consumers general and specific food values [9,10], [11] who studied preferences for sustainable agricultural production, [12] who evaluated Haitian's preferences for food and other basic commodities after the earthquake, [12] assessed improved cowpea seed attributes evaluation, [13] who evaluated US consumers preferences for agricultural and food policies and [14] who investigated Bangladeshi consumers' preferences for fresh vegetable. These studies have failed to document sustainable development goals and eco-challenges and their respective policy options.

Methodology and Data Collection Method

The authors have followed the methods developed by [9] stating that in a set of k elements, there are k(k-1) possible combinations. He further highlighted that the choice of a pair of strategies in the k(k−1) combinations corresponds to a maximum allocation of the choice difference. [9] also concluded that count-based approach and conditional logit used to model this process yield the same results. Thus, conditional logit model was used to analyze the best worst scale data. For each question, the eco-challenge selected as best is coded as 1, while those selected as worst is coded minus one and the remaining eco-challenges not being selected is coded as zero. The joint probability distribution is more appropriate to model this behavior. The probability that

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in each block one sustainable development goal has been chosen as the best and another as a worst is the probability that the difference between that of best and worst must be greater all k(k-1)-1.Thus, this probability can be mathematically represented as follows:

Prob (k as best and j as worst) =

$$\frac{\exp(\beta_k - \beta_j)}{\sum_{l=1}^{k}\sum_{m=1}^{k}\exp(\beta_l - \beta_m)} \quad (2)$$

Thirdly, the preference shares for each sustainable development goals were evaluated using the exponential function expressed as follows:

$$\text{Prob (goal j is selected)} = \frac{e^{X\beta_j}}{\sum_{k=1}^{j} e^{X\beta_k}} \quad (3)$$

Where $V_j = X\beta_j$ is the utility of the goal j, whilst $V_k = X\beta_k$ is the utility of the goal k.

The best worst scaling (BWS) is increasingly used in various fields of study. It was used to collect data. In the field of agricultural economics, the use of BWS is still in its infancy and there is need to investigate the merit of several experimental design techniques. The balanced incomplete block design (BIBD) was used to design questionnaire served in the data collection. Thus, seventeen (17) sustainable development goals as documented in the United Nations Development Program (UNDP) agenda were used to create three goals per block. Each goal is randomly assigned to block in three times, thereby maintaining the equal probability principle. For each question, respondents were asked to choose his best and worst sustainable development goals and this behavior is consistent with random utility theory, which is well-rooted in the microeconomics theory.

The survey was conducted in two three villages namely Dakatche, Fonkoye and Tahoua city, all located in Tahoua State. Respondents were randomly selected and interviewed. To increase diversity in our sample, a specific gender is targeted within a given household, thereby creating opportunity for rural women get their voices heard. In total, 136 respondents consisting of 69 farmers and 67 herdsmen were selected and interviewed. As shown in Table 1, an example of a question related to sustainable development goals is presented.

Table1: A sample of the best and worst scaling method.

Most preferred	Sustainable development goals	Least preferred
[ ]	No poverty	[ ]
[ ]	Zero hunger	[ ]
[ ]	Climate action	[ ]

Note: Question asked to select the best and worst sustainable development goals.

Similarly, the count-based method was used to determine the nine (9) eco-challenge values. First the nine eco-challenges were presented and their meanings clearly explained to respondents. Secondly, the questionnaire was immediately administered by asking respondents to select his three most important eco-challenges and his three least important eco-challenges. Respondents have also received explanation that eco-challenge cannot be selected as best and worst at the same time, implying that selecting one eco-challenge as best excludes its chance to be chosen as the worst and vice versa. As depicted in Table 2, the questionnaire related how eco-challenges are presented to respondents:

Table 2: The questionnaire used to collect data on eco-challenges.

Three (3) most preferred eco-challenges	Eco-challenges	Three (3) least preferred eco-challenges
[ ]	Water	[ ]
[ ]	Health	[ ]
[ ]	Food	[ ]
[ ]	Nature	[ ]
[ ]	Community	[ ]
[ ]	Energy	[ ]
[ ]	Simplicity	[ ]
[ ]	Waste	[ ]
[ ]	Transportation	[ ]

The process of asking respondents to repeatedly ranking his best and worst eco-challenges is consistent with utility theory, which is deeply rooted in microeconomic theory. This implies that the difference between the number of times an eco-challenge being selected as best and the number of times being chosen as worst is underlying utility maximization.

Thus, the utility function for eco-challenge can be mathematically expressed as follows:

$$V_i = \mu_1(WA)_i + \mu_2(HEA)_i + \mu_3(FO)_i + \mu_4(NA)_i + \mu_5(CO)_i + \mu_6(EN)_i + \mu_7(SI)_i + \mu_8(WAS)_i + \mu_9(TRA)_i \quad (4)$$

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Where V_i is utility for person i, WA is for water, HEA is for health, FO is for food, NA is for nature, CO is for community, EN is for energy, SI stands for simplicity, WAS stands for waste and TRA stands for transportation. The preference shares were also computed by taking the exponential function of each coefficient, summing them up and calculating the weight of each eco-challenge. The analysis of the literature indicates that the count-based and conditional logit estimates are quiet similar [9,12].

Results and Discussion

This section presents results from summary statistics of surveyed respondents, conditional logit estimates and the best worst scaling. Table 3 reports summary statistics of respondents. Table 3 reveals that most of the respondents were men (96%), married (99%), uneducated (38%) and had an average income (37500 FCFA) with an average age of 42 year. Table 3 also shows that most respondent had 10 persons, 30ha and 5 animals for family size, farm size and herd size respectively. The question related to awareness indicates that 80% of farmers are not aware of sustainable development goals, implying that awareness exercise should be carried out among uneducated farmers and herdsmen to increase the understanding of the sustainable development goals.

Table 3: Summary statistics of surveyed respondents (N=136).

Variables	Definitions	Mean	Standard Deviation
Age	Years	42.28	11.62
Gender	1 for male, 0 for female	0.96	0.24
Marital Status	1 for married , 0 0therwise	0.99	0.43
Education	1 for educated, 0 otherwise	0.38	0.16
Income	Monthly income in FCFA	35700	2570
Family Size	Numbers	9.99	8.19
Herd size	Numbers	29.98	43.38
Farm size	Hectare	5.2	5.41
Awareness	Yes	0.2	-
	No	0.8	-

Table 4 reports results from conditional logit estimates. Results from likelihood ratio test indicate that the null hypothesis was rejected and the authors concluded that data from farmers and herdsmen could be pooled and therefore only the pooled model was reported and interpreted. Coefficients with positive signs are considered as the most important, while coefficients with negative sign are considered as the least important. Table 4 reveal that gender equality (0.736), followed by industry, innovation and infrastructures (0.611), no poverty (0.378), climate action (0.362), reduced inequalities (0.341), clean water and sanitation (0.323), zero hunger (0.210), quality education (0.190) are positive and significant, indicating that these sustainable development goals were most commonly selected as the most important policies for farmers and herdsmen relative to partnerships to goals. However, affordable and clean energy, responsible production and consumption and life on land are negative and significant, showing that these sustainable development goals were least preferred by farmers and herdsmen. Table 4 also provides results for relative scores. The relative importance of each sustainable development goals is calculated relative to partnership. Results revealed that 11% and 9% of farmers and herdsmen consider gender equality and industry, innovation and infrastructures as the most and second most important sustainable development goal policies respectively. Similarly, 11% and 10% of farmers consider gender equality and industry, innovation and infrastructures as the most desirable polices respectively; while 10% and 9% of herdsmen view gender equality and industry, innovation and infrastructures, respectively. This implies that farmers' preferences for these sustainable development goals are higher than those of herdsmen. In addition, no poverty, clean water and sanitation, reduced inequalities and climate action were viewed by 7% of farmers and herdsmen as the third most important sustainable development goals in the study area.

Table 5 presents results from the count-based method analysis related to eco-challenges. Coefficients with positive signs are considered as the most important, while coefficients with negative sign are considered as the least important. Table 5 shows that water (0.309), followed by health (0.257) and food (0.252) are positive, implying that these eco-challenges are the most preferred by farmers and herdsmen. However, nature (-0.020), community (-0.032), energy (-0.108), simplicity (-0.135), waste (-0.164) and transportation (-0.184) are negative, revealing that these eco-challenges are least preferred by farmers. The relative importance as shown in Table 3 indicate that water as eco-challenge has the highest share (14.58%), against health (13.84%) and against food (13.77%). However, transportation as eco-challenge has the lowest share (8.90%), followed by waste (9.08%) and simplicity (9.35%). This implies that water, health and food are the most preferred

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eco-challenges that should be promoted in the study. Results reveal that the sum of best (422) is greater than that of worst (350), implying that best options are more likely to be chosen that worst options. These results are consistent with studies by Flammini et al (2017) and Beddington [2] concluding that water, energy, and food resources are important for human well-being, poverty reduction, and sustainable development and their management is vital to achieving the Sustainable Development Goals (SDGs). Furthermore, FAO [4] stated that understanding and managing water, energy and food are essential for human well-being, poverty reduction and sustainable development [15-17].

Table 4: Conditional Logit Model Estimates and Share of Preferences.

Sustainable Development Goals	Pooled			Farmers			Herdsmen		
	Estimates	SE	PS	Estimates	SE	PS	Estimates	SE	PS
Base: Partnerships for the goals	0	0	0	0	0	0	0	0	0
No poverty	0.378**	0.087	7%	0.349*	0.122	7%	0.410**	0.123	7%
Zero hunger	0.217*	0.092	6%	0.293*	0.13	7%	0.14	0.131	6%
Good health and well being	0.148	0.086	6%	0.136	0.121	6%	0.161	0.122	6%
Quality Education	0.190*	0.092	6%	0.08	0.13	6%	0.302*	0.131	7%
Gender equality	0.726**	0.097	11%	0.776**	0.139	11%	0.685**	0.136	10%
Clean water and sanitation	0.323**	0.086	7%	0.308**	0.121	7%	0.341**	0.122	7%
Affordable and clean energy	-0.241*	0.095	4%	-0.305**	0.134	4%	-0.178	0.134	4%
Decent work and economic growth	0.051	0.092	5%	-0.017	0.131	5%	0.121	0.131	6%
Industry, innovation and infrastructures	0.611**	0.088	9%	0.630**	0.125	10%	0.595**	0.125	9%
Reduced inequalities	0.341**	0.092	7%	0.290*	0.13	7%	0.392**	0.13	7%
Sustainable cities and communities	-0.066	0.085	5%	-0.274	0.122	4%	0.138	0.121	6%
Responsible production and consumption	-0.239**	0.093	4%	-0.330*	0.132	4%	-0.147	0.132	4%
Climate action	0.362**	0.086	7%	0.340**	0.121	7%	0.387**	0.122	7%
Life below water	0.147	0.094	6%	0.09	0.133	6%	0.206	0.133	6%
Life on land	-0.434**	0.095	3%	-0.583**	0.137	3%	-0.289*	0.134	4%
Peace, justice and strong institutions	-0.015	0.093	5%	0.038	0.132	5%	-0.067	0.133	5%
N	136			69			67		
Log likelihood function	-3927			-1959			-1957		

*, ** denote significant level at 5% and 1% respectively. SE and PS stand for standard error and shares of preference respectively.

Table 5: Count-based Estimation and Share of preferences for Eco-challenges.

Eco-challenges	Best	Worst	Weight	SE	PS
Water (WA)	129	3	0.309	0.092	14.58%
Health (HEA)	112	7	0.257	0.077	13.84%
Food (FO)	109	6	0.252	0.076	13.77%
Nature (NA)	13	21	-0.02	0.006	10.49%
Community (CO)	20	33	-0.032	0.01	10.37%
Energy (EN)	14	58	-0.108	0.032	9.61%
Simplicity (SI)	14	69	-0.135	0.04	9.35%
Waste (WAS)	7	74	-0.164	0.049	9.08%
Transportation (TRA)	4	79	-0.184	0.055	8.90%
Total	422	350	0.176		

PS stands for shares of preferences.

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Conclusion

Several studies have investigated the impact of sustainable development goals and eco-challenges on the economic growth in both developed and developing nations. The definition and goals of sustainable development as well as eco-challenges have been increasingly becoming harmonized and widely accepted by United Nations. Tremendous efforts and strategies have been undertaken both at local, regional, national and global level to achieve the sustainable development goals and eco-challenges. However, relatively little is known how farmers and herdsmen's values these sustainable development goals and eco-challenges. This paper sought to determine farmers and herdsmen's preferences for sustainable development goals and eco-challenges.

Results suggest that young male and married farmers and herdsmen having large family size and herd size should be identified and trained to successful implement the sustainable development goals and eco-challenges in the study area. Results reveal that gender equality, followed by industry, innovation and infrastructures, no poverty, climate action, reduced inequalities, clean water and sanitation, zero hunger and quality education are the most preferred sustainable development goals. Results also indicate that water, health and food are the most desirable eco-challenges.

In this study, the authors have attempted to determine farmers and herdsmen's preferences for sustainable development goals and eco-challenges as documented by United Nations Development program. The findings of this study should be fully integrated in the sustainable development agenda, thereby providing baseline information for policymakers to strategically plan and guide local development program by considering sustainable development goals and eco-challenges as suggested by farmers and herdsmen. Future direction for research is to assess sustainable development goals and eco-challenges across counties, regions, nations and continents. It could be important to track a panel of people to study the stability of farmers and herdsmen's preferences for sustainable development goals and eco-challenges over time. It is also important to determine the influence of farmers and herdsmen socioeconomic characteristics on the sustainable development goal and eco-challenges values. Finally, the use of a BWS approach to explore not only Niger's Farmers and herdsmen preferences for sustainable development and eco-challenges policies, but also to enrich the existing literature would provide strong basis for various policy evaluations in the future.

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