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Bayesian Expected Monetary Value of Bori-Ogoni Reclaimed Diesel Spill Multi-purpose/Multi-Objective Farmland Project

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ABSTRACT
Diesel oil spill has destroyed farm lands, plants and animals at Bori-Ogoni. United Nation Environmental Protection Agency (UNEP) identified grey areas and mandated impacting industries to reclaim the land. Implementation of clean up exercise has failed because there is no plan of recovering the cost of remediation works. This research focuses on applying Bayesian expected monetary value to optimally execute and recover expended fund in the reclaimed diesel spill multi-purpose/ multi-objective farm land project at Bori-Ogoni in Rivers State of Nigeria. The specific objectives are to develop payoff matrix from secondary data in reclaimed diesel spill farmland projects and analyze the expected monetary value from the payoff matrix for development and sustainability of farm projects. Bayesian decision theory was used to determine the EMV of the projects. Result showed that the EMV of the projects is 4.4 billion naira. The Bayesian expected monetary value provides adequate information that will enable Bori-Ogoni reclaimed diesel spill multipurpose multi-objective farm land project managers and directors to take informed decision in investing resources for sustained productivity and development of the organization. It is recommended that federal ministry of Environment and Agriculture should subscribe to useful tools like EVM in executing environmental and agricultural projects for sustainability and development of the Nation's GDP.

KEYWORD: Expected monetary value, decision theory, Bayesian modeling, payoff matrix

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I. INTRODUCTION

So many projects today have been abandoned because of incurred loss in project execution. A viable project is expected to be executed at minimum cost to maximize profit. To achieve this fit, informed decision has to be taken to obtain the expected monetary value of the project (David, Fabrizio, and Refik, 2019) and (Wei, 2019). In the view of Gupta, (2014) expected monetary value of a project requires the calculation of the expected value of each decision alternative which is the sum of the weighted payoffs for that alternative, where the weight are the probabilities assign to the state of nature that can happen. The expected monetary value (EMV) of a project is equivalent to the expected profit with perfect information. Therefore, good knowledge of the processes of a project will guide decision makers to optimally set hourly, daily, weekly, monthly and yearly task and targets that will yield huge profit at minimal cost (Arnaldo, Fernando, Comendador, Sanz., Ayra, Alberto Castán and Sanz, 2018).

So many scholars have worked in optimal project execution. Bayesian decision theory uses simplified instruction and reduced number of trials to assign job responsibilities at ease to young workers (Chambers, Sokhey, Gaebler-Spira, and Kording, 2018). The work of Mihali, Van Opheusden and Ma, (2017) showed that Bayesian decision theory could significantly improve a

controlled system. Resource managers need to make appropriate decisions in forecasting environmental conditions suitable for workstations (Fienen, Masterson,Plant, Gutierrez and Thieler (2013) . Their work showed that the resulting Bayesian Network is a valuable tool for exploring the response of groundwater conditions to sea level rise in decision support but did not take into account expected monetary value. According to Cook and Puri (2017) Bayesian decision-making can increase accuracy in job task involving field and laboratory test. It is reliable in making medical decision Binder, Krauss, Bruckmaier, Marienhagen (2018). Sadhya and. Singh (2018) produced improved performance Bayesian decision theory-based secure multimodal fusion framework. Francois, Guanlan, and Jiana (2016) applied Bayesian decision network to improve the process of data acquisition, analysis, design and validation of internal corrosion assessment of pipelines.

Scholars like Gbinu, Mahmud, Akpan, Badom, Nwiyor, and Letam (2022) focused on improving the performances of systems to minimize cost and maximize profit. They did not consider the expected monetary value of improving the performance of the system. Appropriate decision making in choosing the type of process, materials, workforce, workstations, environment, and services is necessary to optimally execute projects. This research focuses on applying Bayesian expected monetary value to optimally execute reclaimed diesel spill multi-purpose/ multi-objective farm project projects at Bori-Ogoni in Rivers State of Nigeria. The specific objectives are to develop payoff matrix from secondary data in reclaimed diesel spill farmland projects and analyse the EMV from the payoff matrix for sustainability and development of the farm projects.

II. METHODOLOGY

The materials used in this research were based on the thoughts of scholars who have worked on diesel spill reclaimed soil at Bori-Ogon in Rivers State, Nigeria. Amie-Ogan, Petaba, Leyira, Nwikina, Philip-Kpae, and Akpan (2022) and Petaba, Badom, Pepple, Amie-Ogan, Nwikina, and Akpan (2022) developed diesel retention and transportation models respectively used for reclamation of diesel spill soil at Bori-Ogoni . Their models were further used for cost benefit analysis used to develop profit maximization and cost minimization models for diesel spill reclaimed farm land projects by Gbinu et al., (2022) and Mahmud, Gbinu, Amie-Ogan, Ndam, Letam., and Akpan.(2022). Their thoughts were concern on investing in a multi-purpose/multi-objectives diesel spill reclaimed farm land projects to recover the fund used in the reclamation works and generate huge profit from it at minimum cost. Secondary data of the pay off matrix of Bori-Ogoni reclaimed diesel spill multipurpose multi-objective farmland project used in this research were obtained from the works of Gbinu et al.(2022) and Mahmud et al.(2022).

The method used in this research was based on the thoughts of Gupta and Hira (2014), Gbinu et al., (2022) and Mahmud et al.(2022). Pay off matrix of Bori-Ogoni reclaimed diesel spill multipurpose multi-objective farmland project was used to analyse and determine the expected monetary value of the projects using Bayesian decision theory.

To determine the EMV of the projects, construct a conditional pay-off table listing the alternative decisions and the various state of nature, enter the conditional profit for each decision event combination along with the associated probabilities, calculate the EMV for each decision alternatives by multiplying the conditional profits by assigned probabilities and adding the result conditional values, and finally select the alternative that yields the highest EMV (Gupta and Hira, 2014).

III. EXPECTED MONETARY VALUE ANALYSIS

The conditional pay-off table listing the alternative decisions and the various state of nature, the conditional profit for each decision event, and the benefit of investing in a multipurpose/multi-objective reclaimed diesel spill farmland projects for five different projects on five plots of land result in a pay-off matrix as shown below was based on the works of Gbinu et al.,(2022) and Mahmud et al.(2022).

3.1. Payoff matrix of accrued benefit farm produce on five hectares of reclaimed diesel spill on five hectares of land in Bori per billion naira

	Maize	Cassava	Yam	Oil Palm	Fishery
Hectare A	0.100	0.200	0.500	0.500	4.400
Hectare B	0.100	0.200	0.500	0.500	4.400
Hectare C	0.100	0.200	0.500	0.500	4.400
Hectare D	0.100	0.200	0.500	0.500	4.400
Hectare E	0.100	0.200	0.500	0.500	4.400

Calculating for the EMV for each decision alternatives, multiply the conditional profits by assigned probabilities and add the result conditional values. Since diesel spill occurred on 10%, 32%, 10%, 23% and 25% of land in Hectare A,B,C,D,E and F at Bori-Ogoni respectively, to minimize the cost of investments or production, the new payoff matrix is formed shown in table 4.1.

IV. RESULTS AND DISCUSSION

Table 4.1. Expected Monetary Value Table (billion naira)

State of nature (Lands)	Probability	Expected profits from different Farm types (billion naira)				
		Maize	Cassava	Yam	Oil Palm	Fishery
Hectare A	0.10	0.010	0.020	0.050	0.050	0.440
Hectare B	0.32	0.032	0.064	0.160	0.160	1.408
Hectare C	0.10	0.010	0.020	0.050	0.050	0.440
Hectare D	0.23	0.023	0.046	0.115	0.115	1.012
Hectare E	0.25	0.025	0.050	0.125	0.125	1.100
Total expected profit		0.100	0.200	0.500	0.500	**4.400**

V. DISCUSSION OF FINDINGS

i. Selecting the alternative that yields the highest EMV
ii. The investor must therefore, invest on fishery to earn the highest possible average annual profit of 4.4 billion naira.
iii. This is the best he can do because the choice of investing on other four farm types will result in lesser annual profit.
iv. The Expected Monetary Value of the investment is 4.4 billion naira, and this agrees with the thought of Gupta and Hira,. (2014).

VI. CONCLUSION

The expected monetary value of Bori-Ogoni reclaimed diesel spill multipurpose multi-objective farmland project is 4.4 billion. This return of investment (RI) was for fishery. It means that more money should be invested in fish farming than other farm types. However more studies on how to improve other farm types to generate more profit will help increase the overall return of investment of the farm projects.

Hectare B generates the highest RI compared to other farmland projects. More resources should also be channeled to it and proper investigation on other hectares of land should be carried out to find out if traces of diesel in them affected their various farm produce.

Hence, Bayesian expected monetary value provides adequate information that will enable Bori-Ogoni reclaimed diesel spill multipurpose multi-objective farmland project managers and directors to take informed decision on investing resources for sustained productivity and development of the organization.

VII. RECOMMENDATION

It is recommended that federal ministry of environment and agriculture should subscribe to the used of useful tools like EVM in executing environmental and farm projects for sustainability and development on the Nation's GDP.

VIII. CONTRIBUTION TO KNOWLEDGE

This research work applies Bayesian decision theory in generating more returns of investment to recover the cost of carrying out diesel spill land reclamation works at Bori-Ogoni and agrees with environmental management system requirement as per ISO 14001:2015.

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