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Utilization of the Bayesian Decision Model in Agri-Business Value Chain Intervention Projects in the Niger Delta

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Abstract: This research is aimed at Applying Bayesian decision model in Agribusiness value chain intervention project in Niger Delta. The objectives are: to determine Prior (Prototype) and Posterior (Model) Probability, Expected Monetary Value (EMV), Marginal Probability, Expected Value of Perfect Information (EVPI), Expected Profit in Perfect Information (EPPI), The problems the study solve were: inadequate funding of multipurpose scheme, inefficient economic benefits and losses. The methodology applied involves data which were collected from the beneficiaries (Incubators and Incubatess) in selected beneficiaries of LIFE-ND agribusiness cluster across the 98 selected local government across the Nine states , Nine LIFE-ND mandate State Offices of Abia, Bayelsa, Cross River, Akwa Ibom, Edo, Delta, Rivers, Ondo, Imo, and the National Coordinating Office in Port Harcourt and Federal Ministry of Agriculture and Rural Development. The methods used in this research for the Agri-business intervention projects were as follows: estimating the performance of economic efficiency of the multipurpose projects, estimating performance of the net benefits of the interaction between multi-purpose and the multi-objective, assembling the total net benefits of the interaction between multipurpose and the multi-objective, analyzing the data obtained as the total net benefits to ascertain the reliability and validation of the sources of data by using: Contingency coefficient and association, Pearson moment correlation coefficient and T- distribution test. The results of Bayesian model of expected monetary values of the Agribusiness multipurpose project are as follows: Economic efficiency which produces the Maximum Expected Monetary Value (EMV*) ₦8.16 Billion, Expected Profit in perfect information is (EPPI) is ₦20.34 Billion. Expected Value of Perfect Information (EVPI) ₦12.17Billion.

Keywords: *Modeling, Prior-Posterior, Probability, Value Chain, Agribusiness.*

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I. INTRODUCTION

Agricultural production plays an important role in economic development, food security, and rural livelihoods, particularly in regions with vast agricultural potential such as the Niger Delta of Nigeria. The area, known for its rich natural resources and favourable climatic conditions, has a diverse agricultural sector producing key crops like cassava, rice, cocoa, plantain, and oil palm. However, despite its potential, the efficiency and profitability of agricultural production in the Niger Delta remain largely underexplored, with challenges related to resource misallocation, productivity constraints, and market inefficiencies. Understanding these dynamics is crucial for formulating effective policies that can enhance agricultural sustainability and economic growth.(1)

Agribusiness plays a vital role in ensuring sustainability of Agricultural production, processing and marketing.It encompasses the economic sectors for farming and farming-related commerce. It involves all the steps for getting agricultural goods to the market, including production, processing, and distribution. The industry is a traditional part of any economy, especially for countries with arable land and excess agricultural products for export.Agribusiness, as a sector, is all the different aspects of raising agricultural products as an integrated system. Trading farm goods is among the oldest human undertakings, but advances in the last century have made it a high-tech industry(2).

The application of Bayesian Decision model in Agribusiness commodity value chain intervention project in Niger Delta offers a new and promising approach in overcoming the complex nature of decision making in commodity value-chain. This study tend to emphasize the application of Bayesian decision model within the Niger Delta context, Nigerian and the World at large recognizing the imperative for sustainable agricultural practices and management of optimal results.

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➢ *Background*

Probability theory plays a crucial role in decision-making processes, especially in fields that require statistical inference and predictive analytics. In this analysis, we explore the relationships between marginal probability, the product of prior probability and likelihood, and posterior probability, applying Bayesian inference principles. By assessing these key probability metrics, we aim to determine the significance of various economic processes in achieving specific objectives and benefits(4).

The study employs a Bayesian Decision Model to analyze different production and processing sectors, including poultry production, crop production, fish production, nutrition processing, retail & wholesale, fabrication, and marketing. The objective is to quantify the likelihood of these processes contributing to overarching economic and social benefits while identifying the most influential factors(4).

➢ *Objective*

The research objectives deals with the multi-objective value of LIFE-ND Agribusiness commodity value chain intervention project in the Niger Delta for its wide range of purposes such as crop production, crop processing, crop marketing, machine fabrication in the LIFE-ND agribusiness commodity value chain project in Niger Delta using Bayesian Modeling. The paper is aimed at achieving following:

- Provide insight into the importance of the Bayesian theory that gives more than point estimation and measures the magnitude of the difference between alternative actions and provides a various estimates for consideration,
- to evaluate the optimal strategy or cause of action that maximizes the expected benefit in the Agribusiness commodity value chain intervention project within the available limited funds over the planning period of a course of action or alternatives.
- to evaluate the trade-offs and opportunity losses associated with different economic and social objectives across various sectors. The analysis considers factors such as Economic Efficiency, Federal and State Economic Redistribution, Social Welbeing, Environmental Improvement, Gender Equality, and Youth Employment & Security. By examining the Conditional Opportunity Loss (COL), Expected Opportunity Loss (EOL), and Total Expected Opportunity Loss (ΣEOL), we can identify the most impactful areas for policy intervention and strategic investment.
- to determine how alternative commercial processes enhance economic outcomes while addressing critical socio-economic factor

The multi-objectives arising from the development that were optimized include: Economic Efficiency, Federal Economic Distribution, State Economic Redistribution, social wellbeing, Gender equality Youth Employment and Environmental Improvement, which are the primary objective of the IFAD/LIFE-ND Agribusiness commodity value chain intervention project in the Niger Delta region of Nigeria.

II. LITERATURE REVIEW

This paper effectively applies Bayesian decision model in Agribusiness commodity value chain intervention project in Niger Delta to provide insight into decision making.

Bayesian extreme value analysis has been applied in predicting the optimal point in agricultural commodity futures prices in the United States for cocoa, coffee, corn, soybeans and wheat. The estimation of extreme value which were empirically interpreted as representing crises or unusual time series trends, while the extreme optimal point is useful for investors and agriculturists to make decisions and better understand agricultural commodities future prices warning levels. Results from the Non-stationary Extreme Value Analysis (NEVA) software package using Bayesian inference and the Newton-optimal methods provided optimal interval values indicated extreme maximum points of future prices to inform investors and agriculturists to sell the contract and product before the commodity prices slumps to the next local minimum values. Thus, agriculturists can use this information as an advanced warming system of alarming points of agricultural commodity prices to predict the efficient quantity of their agricultural product to sell, and better ways to manage this risk(5).

Bayesian models have been used to link model calibration and uncertainty assessment. The most common approaches include the Bayesian Monte Carlo method (6), Markov chain Monte Carlo (7) and the generalized Likelihood Uncertainty Estimation (GLUE) pseudo-Bayesian method (8) which have been used, among other applications, to establish uncertainty bounds for simulated flows (9) .These have presented a new approach that combines a Bayesian Monte Carlo simulation with a maximum likelihood estimation.

Bayesian models have been developed and used for environmental flow decisionmaking considering the allocation of water for both agricultural and ecosystem processes. The approach was based on the conceptualization of water use conflicts and the utilization of BNs for determining and quantifying uncertainties in agriculture and ecosystems was determined by BNs under different water management strategies. The inflection point in the probability distribution of acceptable economic loss for different stakeholders was identified as the threshold of recommended environmental flows(10)

Bayesian Optimization-based Support Vector Regression (SVR) model have been developed which has successfully assisted in monthly river flow forecasting.This approach has significantly improved the model's performance by fine-tuning the SVR hyper-parameters, making it more accurate and reliable than the simple SVR model .The results demonstrated the effectiveness of this approach, suggesting its applicability in other river basins (11).

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Despite the numerous theoretical and empirical studies on application of Bayesian models to decision making, there appears to be a limited information or research on analyzing multi-objective and multipurpose agribusiness commodity value chain enterprise decision problems under uncertainty. Addressing this gap, involves involves investigating the dynamic relationship and interrelationships between different elements of agribusiness commodity value-chain enterprise with a view of understanding how alternative strategies might influence the overall goals of the intervention program.

III. METHODOLOGY

The methodology applied involves data which were collected from the beneficiaries (Incubators and Incubatess) in selected beneficiaries of LIFE-ND agribusiness cluster across the 98 selected local government across the Nine states , Nine LIFE-ND mandate State Offices of Abia, Bayelsa, Cross River, Akwa Ibom, Edo, Delta, Rivers, Ondo, Imo, and the National Coordinating Office in Port Harcourt and Federal Ministry of Agriculture and Rural Development. The methods used in the experiments for the Agri-business intervention projects were as follows: estimating the performance of economic efficiency of the multipurpose projects, estimating performance of the net benefits of the interaction between multi-purpose and the multi-objective, assembling the total net benefits of the interaction between multipurpose and the multi-objective, analyzing the data obtained as the total net benefits to ascertain the reliability and validation of the sources of data by using: Contingency coefficient and association, Pearson moment correlation coefficient and T- distribution test.

Method of computing posterior probabilities from prior probabilities using a mathematical formula called Bayes' theorem. A further analysis of problems using these probabilities with respect to new expected payoffs with additional information is called prior-posterior analysis.

➢ *The Bayes' theorem in General terms can be Stated as follows:*

- Let A1,A2, ……………… An be mutually exclusive and collective exhaustive outcomes.
- The probabilities P (Ai), P (A2),… P (An) are known.

There is an experimental outcome B for which the conditional probabilities P (B/A1), P (B/A2), ……..P (B/An) are also known. Given the information that the outcome B has occurred, the revised conditional probabilities of outcomes Aj, i.e. P (A1/B), i = 1, 2…n are determined by using following conditional probability relationship: A Bayesian Decision Theory Model will be used to simulate the Cross River Watershed for an optimum result.

➢ *The Mathematical Model is of the form:*

- P (A/DATA) = [P (DATA/A) X P (A)]/P (DATA) Equation 1
- Model Objective Optimization can be handled as follows:

➢ *Where:*

- P (A/DATA) = K [P (A/DATA) P (A)] Equation 2 and the constraints are as follows:

➢ *Constraints:*

- P (A/DATA) = 0 Equation 3
- P (DATA/A) = 0 Equation 4
- P (A) = 0 Equation 5
- P (B) = 0 Equation 6

A –Agribusiness commodity value chain Purpose [Poultry production/processing, crop production/processing, fish production/processing, nutrition production/processing, retail/wholesale, fabrication, marketing].

DATA- Values of the various Objective [Economic Efficiency, Federal Economic Distribution, State Economic redistribution, Social wellbeing, Environmental improvement,Gender equality,Youth empowerment and security] expressed as courses of action and likelihoods corresponding to the Agri business commodity value chain Purposes.

- P (A/DATA)-Probability of A occurring given the DATA [Objective-Likelihood].
- P (DATA/A)-Probability of the Data occurring given the A [Posterior]
- P (A) - Prior Probability of A
- P (DATA) - Probability of DATA occurring [Marginal Probability or Evidence of Objectives].

IV. RESULTS AND DISCUSSION

Table 1 Summary Table of Net benefits of All Objectives

Value chain/ Enterprises	**Objectives**						
	Economic Efficiency	**Federal Econ. Redistr.**	**State Econ. Redistr.**	**Social Wellbeing**	**Environmental Improvement**	**Gender Equality**	**Youth Employment and security**
Poultry prod. &process.	15.10	14.15	14.15	12.27	12.27	13.2	13.21
Crop prod. & process.	22.86	21.43	21.43	18.48	18.48	19.9	19.9

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Fish prod. & process.	0.50	0.47	0.47	0.41	0.41	0.44	0.44
Nutrition prod.& processing	0.50	0.47	0.47	0.41	0.41	0.44	0.44
Retail & Wholesale	1.64	1.54	1.54	1.34	1.34	1.44	1.44
Fabrication	2.36	2.21	2.21	1.92	1.92	2.07	2.07
Marketing	0.24	0.22	0.22	0.19	0.19	0.21	0.21

Table 1 showing the Summary of Net Benefits of All Objectives Obtained from the BEME on Benefit Distribution Under the various Objectives

Table 2 Marginal Probability

Marginal Probability of the Objectives/Benefits	**Processes**	**Prior x Likelihood**	**Posterior Probability**
0.142857578	Poultry prod. &process.	0.027142969	0.190000206
	Crop prod. & process.	0.017142871	0.119999731
	Fish prod. & process.	0.002857145	0.019999955
	Nutrition prod.& processing	0.025714361	0.179999979
	Retail & Wholesale	0.008571454	0.059999993
	Fabrication	0.030714393	0.215000095
	Marketing	0.030714385	0.215000041
0.14285757	Poultry prod. &process.	0.027142968	0.190000205
	Crop prod. & process.	0.01714287	0.119999729
	Fish prod. & process.	0.002857145	0.019999955
	Nutrition prod.& processing	0.025714361	0.179999986
	Retail & Wholesale	0.008571454	0.059999995
	Fabrication	0.03071439	0.215000089
	Marketing	0.030714383	0.215000041
0.142857297	Poultry prod. &process.	0.027142847	0.189999724
	Crop prod. & process.	0.017142852	0.119999836
	Fish prod. & process.	0.002857142	0.019999973
	Nutrition prod.& processing	0.025714278	0.179999752
	Retail & Wholesale	0.008571426	0.059999917
	Fabrication	0.030714376	0.215000402
	Marketing	0.030714375	0.215000397
0.142857297	Poultry prod. &process.	0.027142847	0.189999724
	Crop prod. & process.	0.017142852	0.119999836
	Fish prod. & process.	0.002857142	0.019999973
	Nutrition prod.& processing	0.025714278	0.179999752
	Retail & Wholesale	0.008571426	0.059999917
	Fabrication	0.030714376	0.215000402
	Marketing	0.030714375	0.215000397
0.142857452	Poultry prod. &process.	0.027142914	0.189999988
	Crop prod. & process.	0.017142862	0.119999777
	Fish prod. & process.	0.002857144	0.019999963
	Nutrition prod.& processing	0.025714327	0.179999898
	Retail & Wholesale	0.008571442	0.059999966
	Fabrication	0.030714382	0.215000209
	Marketing	0.03071438	0.215000198
0.142857497	Poultry prod. &process.	0.02714296	0.190000249
	Crop prod. & process.	0.017142857	0.119999704
	Fish prod. & process.	0.002857143	0.019999951
	Nutrition prod.& processing	0.025714359	0.180000065
	Retail & Wholesale	0.008571453	0.060000022
	Fabrication	0.030714362	0.215000003
	Marketing	0.030714363	0.215000006
0.14285558	Poultry prod. &process.	0.027142603	0.190000302

	Crop prod. & process.	0.017142704	0.120000241
	Fish prod. & process.	0.002857117	0.02000004
	Nutrition prod.& processing	0.025714031	0.180000187
	Retail & Wholesale	0.008571344	0.060000062
	Fabrication	0.03071399	0.215000283
	Marketing	0.03071379	0.214998885

The Table 2 presents data results on the **marginal probability** of various objectives/benefits, associated **processes**, the product of **prior probability and likelihood**, and the resulting **posterior probability**.

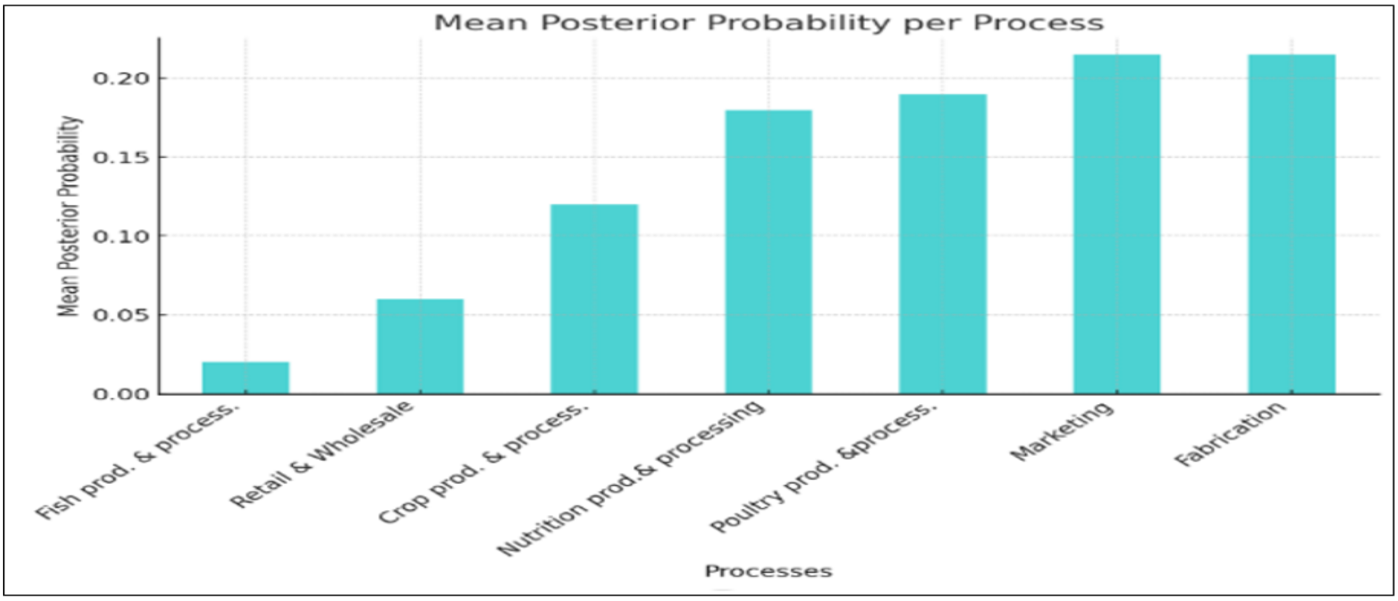

Fig 1 Mean Posterior Probability per Process

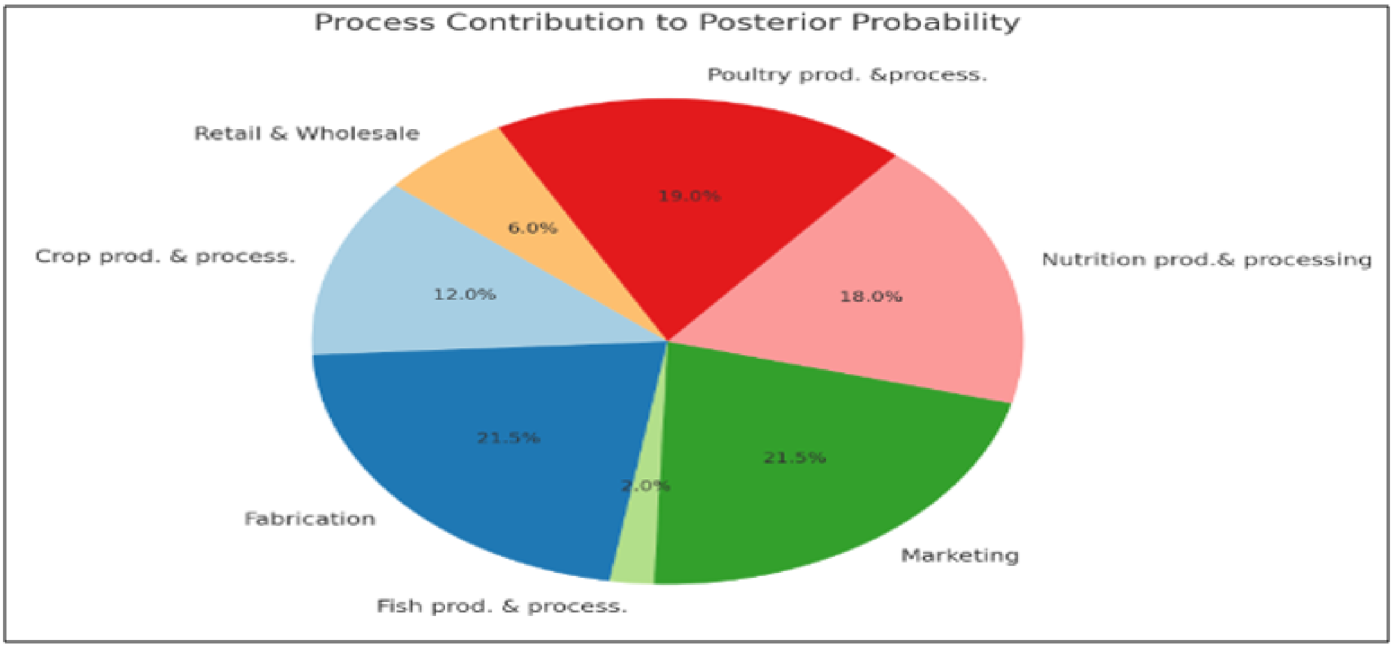

Fig 2 Process Contribution to Posterior Probability

The analysis highlights **Fabrication and Marketing** as the most significant processes based on probability calculations. Poultry production and nutrition processing also hold substantial weight, while fish production remains the least probable. The **marginal probability factor (~0.142857)** remains relatively stable across different objectives/benefits, indicating a balanced distribution of probability across the analyzed processes. The consistency between **Prior × Likelihood values**, **Posterior Probabilities**, and **Marginal Probability** confirms the robustness of the probabilistic model(Bayesian Decision Model) used in this assessment.

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The data provides insight into which sectors—such as Poultry Production, Crop Processing, Nutrition Production & Processing, Retail & Wholesale, Fabrication, and Marketing—are most affected by different objectives. The ultimate goal is to recommend targeted actions to optimize economic and social outcomes while minimizing losses.

Table 3 Posterior Opportunity Loss (EOL)

OBJECTIVES/BENEFITS	STATE OF NATURE	POSTERIOR	COL	EOL	ΣEOL
Economic Efficiency	Poultry prod. &process.	0.190000206	0.00	0	
	Crop prod. & process.	0.119999731	0.95	0.113999745	
	Fish prod. & process.	0.019999955	0.95	0.018999957	
	Nutrition prod.& processing	0.179999979	2.83	0.50939994	
	Retail & Wholesale	0.059999993	2.83	0.16979998	
	Fabrication	0.215000095	1.90	0.40850018	
	Marketing	0.215000041	1.89	0.406350077	1.627049879
Federal Econ. Redistr.	Poultry prod. &process.	0.190000205	0.00	0	
	Crop prod. & process.	0.119999729	1.43	0.171599613	
	Fish prod. & process.	0.019999955	1.43	0.028599935	
	Nutrition prod.& processing	0.179999986	4.38	0.78839994	
	Retail & Wholesale	0.059999995	18.48	1.108799915	
	Fabrication	0.215000089	2.96	0.636400263	
	Marketing	0.215000041	2.96	0.63640012	3.370199786
State Econ. Redistr.	Poultry prod. &process.	0.189999724	0.00	0	
	Crop prod. & process.	0.119999836	0.03	0.003599995	
	Fish prod. & process.	0.019999973	0.03	0.000599999	
	Nutrition prod.& processing	0.179999752	0.09	0.016199978	
	Retail & Wholesale	0.059999917	0.09	0.005399993	
	Fabrication	0.215000402	0.06	0.012900024	
	Marketing	0.215000397	0.06	0.012900024	0.051600012
Social Wellbeing	Poultry prod. &process.	0.189999724	0.00	0	
	Crop prod. & process.	0.119999836	0.03	0.003599995	
	Fish prod. & process.	0.019999973	0.03	0.000599999	
	Nutrition prod.& processing	0.179999752	0.09	0.016199978	
	Retail & Wholesale	0.059999917	0.09	0.005399993	
	Fabrication	0.215000402	0.06	0.012900024	
	Marketing	0.215000397	0.06	0.012900024	0.051600012
Environmental Improvement	Poultry prod. &process.	0.189999988	0.00	0	
	Crop prod. & process.	0.119999777	0.10	0.011999978	
	Fish prod. & process.	0.019999963	0.10	0.001999996	
	Nutrition prod.& processing	0.179999898	0.30	0.053999969	
	Retail & Wholesale	0.059999966	0.30	0.01799999	
	Fabrication	0.215000209	0.20	0.043000042	
	Marketing	0.215000198	0.20	0.04300004	0.172000015
Gender Equality	Poultry prod. &process.	0.190000249	0.00	0	
	Crop prod. & process.	0.119999704	0.15	0.017999956	
	Fish prod. & process.	0.019999951	0.15	0.002999993	
	Nutrition prod.& processing	0.180000065	0.44	0.079200029	
	Retail & Wholesale	0.060000022	0.44	0.02640001	
	Fabrication	0.215000003	0.29	0.062350001	
	Marketing	0.215000006	0.29	0.062350002	0.251299989
Youth Employment and security	Poultry prod. &process.	0.190000302	0	0	
	Crop prod. & process.	0.120000241	0.02	0.002400005	
	Fish prod. & process.	0.02000004	0.02	0.000400001	
	Nutrition prod.& processing	0.180000187	0.05	0.009000009	
	Retail & Wholesale	0.060000062	0.05	0.003000003	
	Fabrication	0.215000283	0.03	0.006450008	
	Marketing	0.214998885	0.03	0.006449967	0.027699993

The data provides insight into which sectors—such as Poultry Production, Crop Processing, Nutrition Production & Processing, Retail & Wholesale, Fabrication, and Marketing—are most affected by different objectives. The ultimate goal is to recommend targeted actions to optimize economic and social outcomes while minimizing losses.

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The Table 3 presents different **objectives/benefits** (such as Economic Efficiency, Social Welbeing, and Gender Equality) across various **sectors of economic activity** (like Poultry Production, Crop Processing, Retail & Wholesale, etc.). It includes **probabilities (POSTERIOR)**, **Conditional Opportunity Loss (COL)**, **Expected Opportunity Loss (EOL)**, and **Total Expected Opportunity Loss (ΣEOL)**.

The analysis highlights that Federal Economic Redistribution (ΣEOL = 3.37) and Economic Efficiency (ΣEOL = 1.63) represent the highest risk areas, necessitating strategic planning and investment. Gender Equality, while less critical than these, still demands attention with a ΣEOL of 0.25.

The sectors of Retail & Wholesale, Nutrition Production & Processing, Fabrication, and Marketing emerge as key areas for improvement, as they contribute significantly to multiple objectives. Targeted investments in these sectors can drive substantial benefits across economic efficiency, redistribution policies, and social equity. Meanwhile, low-risk areas such as State Economic Redistribution, Social Welbeing, and Youth Employment & Security require maintenance rather than aggressive intervention. By focusing on high-impact sectors and aligning policies with key objectives, economic and social improvements can be optimized while minimizing opportunity losses.

Table 4 Expected monetary value at 1st iteration

	Alternatives[i]						
	Poultry prod. & process.	**Crop prod. & process.**	**Fish prod. & process.**	**Nutrition prod.& processing**	**Retail & Wholesale**	**Fabrication**	**Marketing**
[j]	**Prior Probability**						
Prior	0.190000108	0.119999869	0.019999978	0.179999994	0.059999998	0.215000053	0.214999999
Economic Efficiency	15.1	14.15	14.15	12.27	12.27	13.2	13.21
Federal Econ. Redistr.	22.86	21.43	21.43	18.48	18.48	19.9	19.9
State Econ. Redistr.	0.5	0.47	0.47	0.41	0.41	0.44	0.44
Social Welbeing	0.5	0.47	0.47	0.41	0.41	0.44	0.44
Environmental Improvement	1.64	1.54	1.54	1.34	1.34	1.44	1.44
Gender Equality	2.36	2.21	2.21	1.92	1.92	2.07	2.07
Youth Employment and security	0.24	0.22	0.22	0.19	0.19	0.21	0.21
EMV	8.162404653	4.832394715	0.805399119	6.2693998	2.089799933	8.060351989	8.062499978

The Table 4 presents a decision analysis framework evaluating different alternatives based on multiple criteria. Here's a breakdown of the analysis:

- *EMV (Best Expected Monetary Value)**

The highest EMV across all alternatives is N**8.16B**, which corresponds to **Poultry Production & Processing**.

EVPI (Expected Value of Perfect Information)

The EVPI is calculated as: EVPI = EPPI – EMV* EPPI = 0.19*22.86 + 0.21*21.43 + 0.02*21.43 + 0.18*18.48 + 0.06*18.48 + 0.215*19.9 + 0.215*19.9 = **20.34 billion Naira EPPI = 20.34 billion Naira** EMV* = **8.16billion Naira** EVPI = ₦**12.17** This value indicates the maximum amount a decision-maker should be willing to pay for perfect information.

Table 5 Expected Monetary Value and Expected Opportunity Loss

	Poultry prod. &process.	**Crop prod. & process.**	**Fish prod. & process.**	**Nutrition prod.& processing**	**Retail & Wholesale**	**Fabrication**	Marketing
EMV	**83.37956549**	**58.91300264**	**93.97898895**	**99.18367325**	**97.59036081**	**97.91068197**	**99.65761053**
EOL	16.62043451	41.08699736	6.021011048	0.816326751	2.409639194	2.089318032	0.342389474
CONSTANT	100	100	100	100	100	100	100

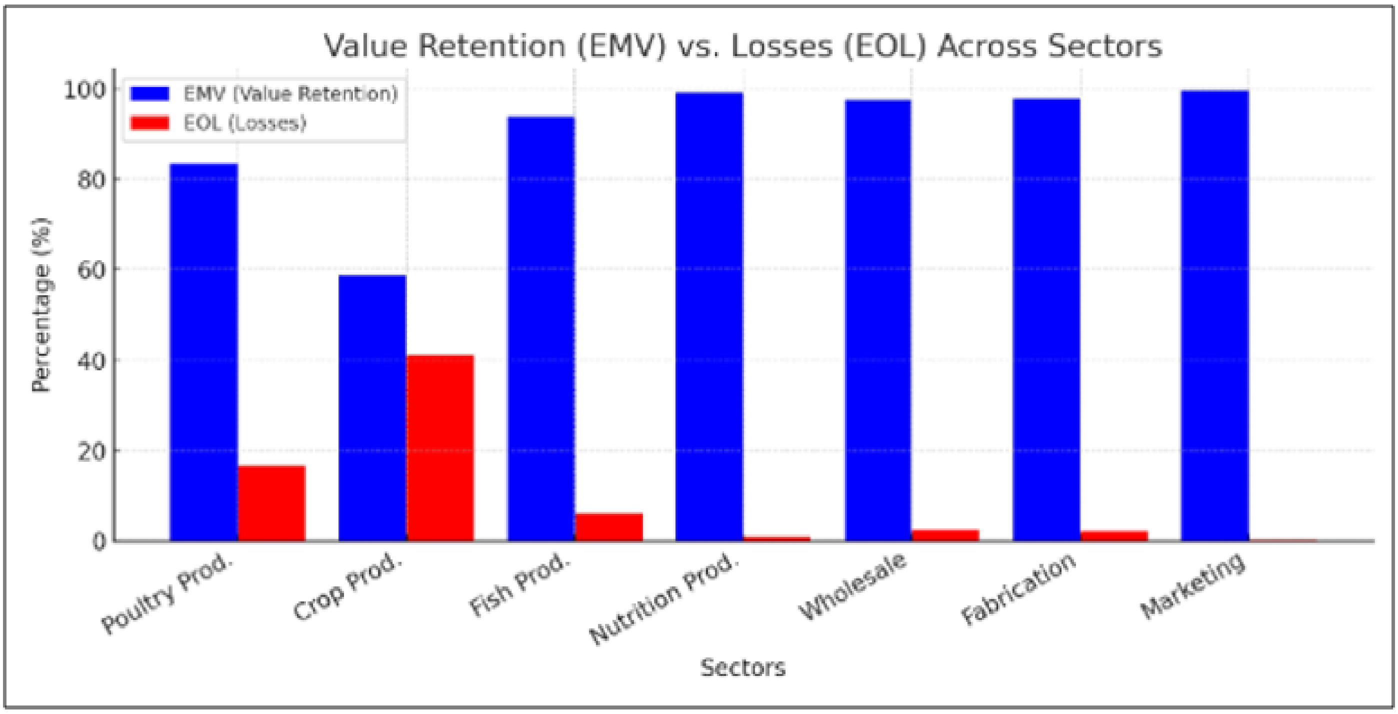

Fig 3 Value Retention(EMV) vs. (EOL) across sectors

The bar chart in Figure 3.3 visually represents the Expected Monetary Value (EMV) and Expected opportunity Losses (EOL) for each sector.This chart clearly highlights where value retention is strong and where inefficiencies exist.

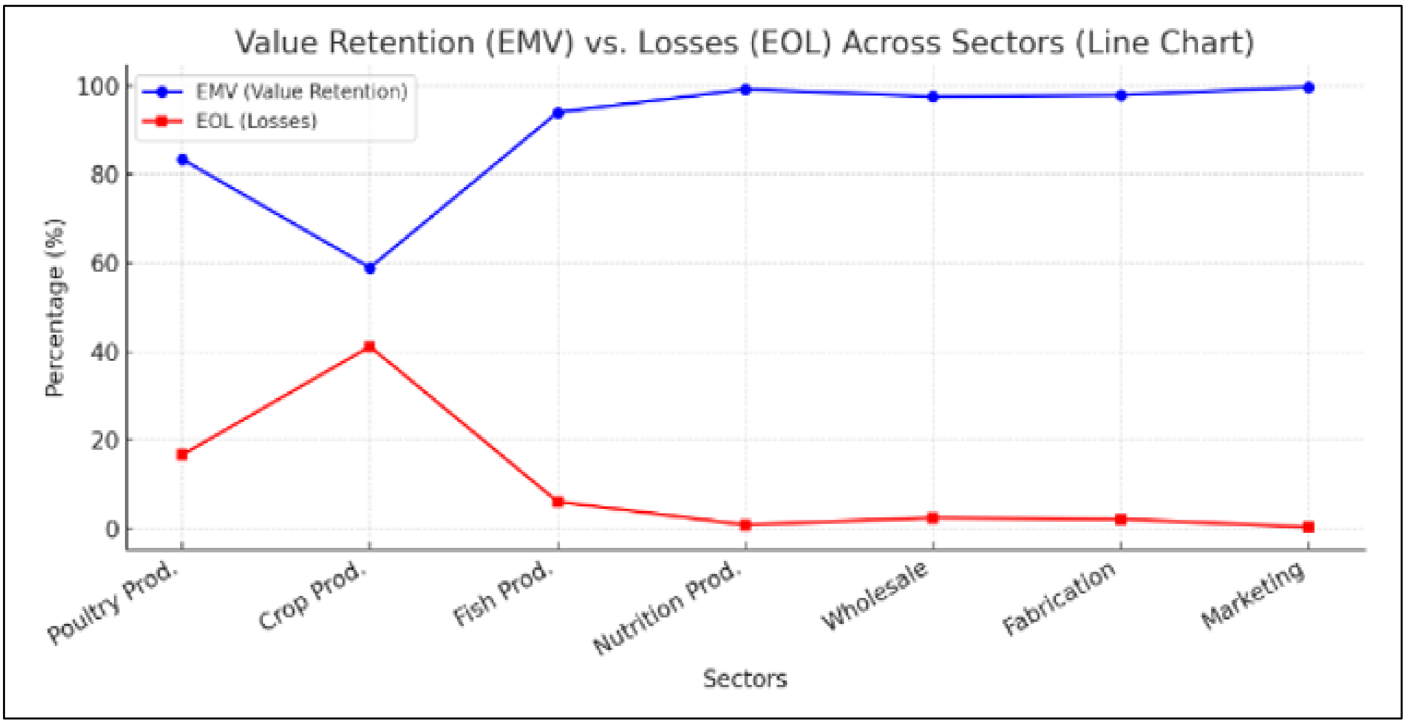

Fig 4 Line chart representation of the data:

The analysis highlights significant disparities in value retention across different sectors. Marketing, Nutrition Processing, and Fabrication emerge as the most efficient, with EMV values exceeding 97% and minimal losses. In contrast, Crop Production & Processing stands out as the least efficient sector, exhibiting the highest EOL (41.09%) and the lowest EMV (58.91%). The clear inverse relationship between EMV and EOL underscores the importance of strategic interventions to enhance efficiency, particularly in sectors with high losses. These findings provide a foundation for targeted improvements, ensuring greater sustainability and profitability across the production and processing landscape.

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Table 6 Expected Value of Sample Information

STATE OF NATURE/BENEFITS	Marginal Probability	ΣEOL	EVSI
Economic Efficiency	0.14	1.627049879	0.232436406
Federal Econ. Redistr.	0.14	3.370199786	0.481458552
State Econ. Redistr.	0.14	0.051600012	0.007371438
Social Wellbeing	0.14	0.051600012	0.007371446
Environmental Improvement	0.142857452	0.051600012	0.007371446
Gender Equality	0.142857497	0.172000015	0.024571492
Youth Employment and security	0.14285558	0.027699993	0.003957099
EVSI			0.764537878

The Table 6 presents an analysis of different states of nature/benefits using three key metrics:

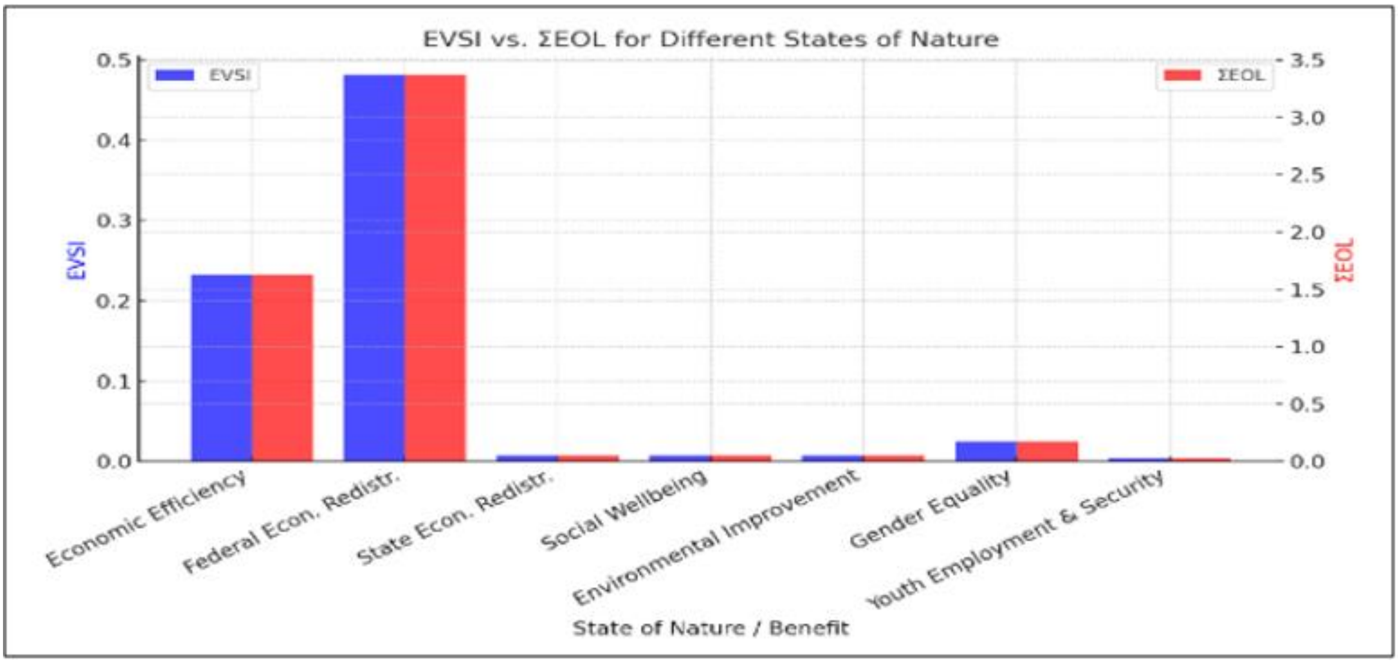

Fig 5 ESVI vs. ΣEOL

The EVSI analysis highlights that **Federal Economic Redistribution** is the most critical area for improved decision-making, with the highest **ΣEOL (3.37)** and **EVSI (0.4815)**. **Economic Efficiency** follows as another priority area for data collection. In contrast, areas such as **State Economic Redistribution, Social Wellbeing, and Youth Employment & Security** have low **ΣEOL and EVSI**, indicating minimal benefit from additional information. The total **EVSI of 0.7645** suggests that investing in better data is worthwhile if the cost is below this threshold. Ultimately, this analysis provides a data-driven approach to prioritizing information gathering, ensuring that decision-making is both efficient and impactful.

V. CONCLUSION

The paper has shown that LIFE-ND agribusiness commodity value chain intervention project in the Niger Delta provides significant economic benefit to the region, state, environment, security, job creation to the region.

The analysis highlights that Federal Economic Redistribution (ΣEOL = 3.37) and Economic Efficiency (ΣEOL = 1.63) represent the highest risk areas, necessitating strategic planning and investment. Gender Equality, while less critical than these, still demands attention with a ΣEOL of 0.25.

The EVPI of **₦12.17** Billion from the paper indicates the maximum amount a decision-maker should be willing to pay for perfect information.

The findings from the research shows significant disparities in value retention across different sectors. Marketing, Nutrition Processing, and Fabrication emerge as the most efficient, with EMV values exceeding 97% and minimal losses. In contrast, Crop Production & Processing stands out as the least efficient sector, exhibiting the highest EOL (41.09%) and the lowest EMV (58.91%). The clear inverse relationship between EMV and EOL underscores the importance of strategic interventions to enhance efficiency, particularly in sectors with high losses. These findings provide a foundation for targeted improvements, ensuring greater sustainability and profitability across the production and processing landscape.

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