



**THE FEDERAL UNIVERSITY OF TECHNOLOGY,
AKURE**

**CLAY IN THE HAND OF THE POTTER:
THE MYSTERY OF PROBABILITY MODELING IN
STATISTICS**

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Delivered by

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PREAMBLE

I feel distinguished today with profound gratitude to God Almighty, the giver of life. All glory, honor and adoration be to him who has made it possible for me to attain this height in life and has granted me this unique opportunity to deliver the 198th inaugural lecture of this esteemed institution, the Federal University of Technology, Akure. The 198th inaugural lecture titled "Clay in the Hand of the Potter: The Mystery of Probability Modeling in Statistics" marks the second in the Department of Statistics and 13th in the School of Physical Sciences.

Madam Vice Chancellor Ma, the word "statistics" is commonly used in different senses. In everyday parlance, statistics refers to numerical records of any sort (Olubusoye, 2012). Nowadays in media houses, the internet, and the likes, even in inter-school quiz competitions, we hear the people in charge of scoreboards being referred to as statisticians. Statistics has become a part of everyday life. We are confuted with by them in magazines, on television and in general conversations. We encounter them when we discuss the core of living, unemployment, medical breakthroughs, politics, and the lottery programs. Although we are not always aware of it, each of us is an informal statistician. We are constantly gathering, organizing, and analyzing information as well as using this data to make decisions that will affect our actions.

In scientific discussions, on the other hand, statistics often stands for a discipline, a branch of knowledge. According

to Chattaju (2005), one could have used the phrase “statistical sense” to describe the discipline. Statistics is not a branch of science, as in other science and science-related disciplines. It does not have a specific domain - an aspect of nature and society- as its field of study, like those sciences. It is domain-neutral as pure mathematics is, and in our age, its concepts and techniques just like those of the latter, permeate and sometimes swamp all the natural and social sciences.

The plan of this lecture goes beyond distinguishing between who is and who is not a statistician. Rather, in the sense of everyday parlance, I shall be advocating the need for all citizens to be statistically literate to drive natural transformation. Similarly, from the scientific perspective, I shall be advocating the use of statistical models as engine to accelerate social and economic transformation of the Nigerian-economy.

“Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write”. This quote is often attributed to British future-looking writer- Herbert G.Wells. It is actually a beautifully compact paraphrase of a much longer sentence that Wells wrote in 1903 in his book- *Mankind in the Making*. The quotations are more relevant now than ever. Hitherto, ability to read and write have been regarded as the basic requirement for an efficient citizenship. For most of us, that day has come for every citizen to learn to think statistically, to acquire the capacity to reason with members and have the

skill to understand statistical representations. The importance of numbers to the modern world cannot be overstated. If you do not understand statistics, you can be fooled by media stories, advertisements, political claims, and even research output.

John L. Philips, in his book titled "How to Think About Statistics", said 'the culture of any industrialist society is suffused by quantitative information. Some quantitative messages are simple and direct, while others involve a relatively complicated process of inference. Knowing how to think statistically makes possible the comprehension of both'

Madam Vice Chancellor ma, in recent times, the term 'statistical reasoning and statistical thinking have appeared in the literature and have been used interchangeably. Statistical reasoning is the way people reason with statistical ideas, understand and be able to explain statistical process and fully interpret statistical results. It may involve connecting one concept to another or combining ideas about data and chance (probability) [Garfield, 2002]. Statistical thinking, on the other hand, involve an understanding of why and how statistical investigations are conducted, this include recognizing and understanding the entire investigative process, understanding how data are produced to estimate probabilities, recognizing how, when and why existing inferential tools can be used (Chance, 2002).

For instance, a governorship candidate, most of the time, reads out their agenda for the people: banish poverty, banish hunger, banish unemployment, restore healthy living, promote functional education, and enhance communal peace and progress. To a statistically conscious electorate, it is not difficult to see the imprecision of these agenda. Can poverty or hunger or unemployment be banished? Which country in the world does not have poor and unemployed people, no matter how small?

A credible agenda would state in quantitative terms the current situation and the anticipated target (Modeling).

Madam Vice Chancellor ma, ladies and gentlemen, it is a great honor and privilege to stand before you today to deliver this inaugural lecture titled: '**CLAY IN THE HAND OF THE POTTER: THE MYSTERY OF PROBABILITY MODELING IN STATISTICS**'.

The title of the inaugural lecture centers on a process from the start to the end. God is the porter (Amokoko) and we are the clay. The problem to solve is the 'the clay', probability modeling is the tool to use in proffering predictable solutions. The imagery of clay and the potter is a powerful biblical metaphor that illustrate the relationship between God and Humanity. The book of *Isaiah 64:8* established this fact by saying "But now, O Lord, thou art our father, we are *clay*, and thou our *potter*, and we are the work of thy hand".

Madam Vice Chancellor ma, my journey to the realm of statistics was accidental and eventful. *Jeremiah 18:2* says God sends "Jeremiah to the Potters house" the Potter reshaped the

spoiled clay into another Vessel. I do not intend to bore you with the story but I always remember with nostalgia, the confusion I had during my undergraduate studies in the university. Thank God, today, all is history.

1.0 INTRODUCTION

Modeling

This is the process of creating representative (models) of the real-world phenomena, systems or scenarios to understand simulate or predict behavior. Often involving or abstracting complexity into simpler forms. Models are assumptions (not truth). Modeling spans disciplines like science (climate/disease modeling), finance (financial modeling), art (sculpture/fashion) and even psychotherapy (behavioral modeling).

1.1 Scientific / Mathematical Modeling

- Creating equations or simulations (e.g weather, epidemic) to predict outcome
- Computing modeling: using softwares to visualize complex systems like disease spread or heat flow.
- Financial Modeling: using data to forecast financial performance.
- Commercial or Fashion Modeling: using one's body to display products or tell stories for the media.
- Artistic Modeling- creating preliminary sculpture (e.g in clay)
- Psychological Modeling- learning behavior by observing or emulating others.

We model to simplify reality, for better understanding, to test hypothesis (claim) and explore 'what-ifs' scenarios, make predictions about future events or system behaviors and to visualize abstract concept or impractical situations.

1.2 Modeling Process Entails:

- Defining the problem
- Collecting the data or quantitative information
- Choosing a model type (based on the objective of the study)
- Build the model to reflect representation in accordance with the rules and theory
- Analyze and interpret the result

1.3 Probability Modeling

Probability modeling in statistics is the process of representing real-world uncertainty using mathematical probability structures to analyze data, make predictions, and quantify risk. In probability, statistical modeling is an important process in the field of data science. It involves identifying the best statistical model to identify a relationship in a given data set such as Census data, public health, or a company's user data. It is a mathematical representation of a real process using probability distributions and assumptions. A model usually specifies:

- a random variable or a process
- a probability distribution
- Parameter (unknown quantity to be estimated).

Probability Modeling is a mathematical framework that uses probability distribution and statistics to estimate the likelihood of various outcomes in uncertain situations, moving beyond single point predictions to provide a range of possibilities with associated chances essential for fields like finance, weather forecasting, medical diagnosis, agricultural experiments and engineering. George Box in his submission said 'All models are wrong, but some are useful', choosing the wrong model can lead to misleading conclusions.

Probability modeling allows for the quantification of risk and variability unlike deterministic models. In Probability modeling, we do not exactly know what will happen, but we do know the range of possibilities and how likely each one is e.g tossing a coin.

1.4 How it Works:

1. Identify Uncertainty: Recognize elements in a system that are unpredictable (e.g bus speed, stock price, disease spread)
2. Represent with distributions: Instead of fixed values, use probability distributions for uncertain inputs (e.g bus speed from 20-30mph)
3. Simulate and Calculate: run the model to generate a distribution of possible outputs showing the likelihood of different results (distribution of travel times)

1.5 Application

- Finance- risk management, portfolio optimization
- AI and Machine Learning- Fraud detection, autonomous driving, medical diagnosis
- Science- disease modeling, climate forecasting, equipment failure prediction
- Operations- traffic flow predictions, queue management
- Quality Control and operations

2.0 MYSTERY OF PROBABILITY MODELING IN STATISTICS

It is how we use mathematics to describe, explain and predict uncertainty in the real world. Probability modelling often feels mysterious because it centers on Randomness Versus Reality.

Real world events are not truly random, but they are too complex to measure completely e.g human behavior depends on countless factors, coin tosses depend on physics. So, we model them as random to make analysis possible.

2.1 Core Components Of A Probability Model

1. Random Variable- a numerical description of an outcome which can be discrete or continuous.
2. Probability Distribution- it describes how probabilities are assigned.

Table 1: Showing The Key Concept Of Some Probability Distribution Used In Modelling

Probability Distribution	
Bernoulli	Yes/No outcome
Binomial	Number of Successes
Poisson	Rare event over time
Normal (Gaussian)	Natural variation
Exponential	Waiting time

Each distribution encodes assumptions about the process.

1. Parameters- they define the shape, rate, size, weight, and height of the distribution, depending on the choice of interest. (Mean, Variance, Skewness, and Kurtosis).
Estimating these parameters is a key statistical task.
2. The Hidden Assumptions (where mistakes happen)- probability models often assume;
 - Independence
 - Identical distributions
 - Stationarity (no change over time)
 - No hidden variables

Violating these can silently break the analysis and leads to being biased.

3. Why Probability Models are still powerful- Despite their limitations, they allow us to:
 - make predictions
 - quantify uncertainties
 - test hypothesis or a claim
 - make decisions under risk

When used correctly, they turn uncertainty into actionable insight.

4. The Big Idea (Demystified)

Probability modeling is not about predicting the future perfectly. It is about making the best decision without incomplete information.

3.0 MY CONTRIBUTION TO KNOWLEDGE.

Madam Vice-Chancellor Ma, my research journey has been anchored on the belief that statistics must illuminate real-world problems and deliver practicable solutions. Guided and led by this focus, my research interconnects thematic areas that translate data into societal development. These include:

- Probability Distribution Theory and Modelling (Mathematical Statistics), applied to data from Health, Commerce, Agriculture, Engineering, Sport, and Banking operations.
- Stochastic Processes.
- Population and Health Studies.

3.1 Probability Distribution Theory and Modelling

A probability distribution describes how the values of a random variable are distributed and how likely each value (or a range of values) is.

Formally, it assigns Probabilities to outcomes such as:

$$0 \leq P(X = x) \leq 1 \quad (1)$$

The modelling aspect of probability is about choosing and fitting a distribution to real life datasets.

Madam Vice Chancellor Ma, my research team in this domain focused on leveraging statistical methodologies to address educational, industrial, commercial and health challenges. Akomolafe. et.al (2010) analysed and predict the percentage of Secondary School dropouts in some selected Local Government in South West, Nigeria using Beta Binomial distribution model. The Government's goal was to achieve less than 10% drop-out-rate, it is surprising to note that despite the extensive effort of the Federal Government, a chunk of local government still has more than 20% far above the government's target of less than 10%. It was proposed then, that the policy initiative and strategies of execution must be reformulated to change the narrative.

Beta-Binomial Distribution Model:

$$f_{BBD}(x; \alpha, \beta) = {}^n C_x \frac{b(\alpha+x; \beta+n-x)}{B(\alpha, \beta)} \quad (2)$$

Where α and β are positive constants and $B(\alpha, \beta) = \int_0^1 y^{\alpha-1} [1 - y]^{\beta-1} dy$ is a Beta function

3.2 Probability Distribution Model to Predict Customer Evolving Buying-Behavior Using Consumer Packaged Goods Data.

In a related study, **Akomolafe**, Amahia and Chuckwu (2010), Akomolafe (2011), and Akomolafe et.al., (2012), applied probability distribution model to predict customer evolving buying-behavior and depth of repeat purchasing pattern using consumer packaged goods data. We intended to capture:

- A timing process governing industries' rate of buying,
- A heterogeneity distribution that accommodates differences across people, and
- An evolutionary process that allows a given individual's underlying buying-rate to change one visit to the next

An exponential-Gamma timing distribution was used to capture the phenomena.

$$f(t_{ij}, t, \alpha) = \int_0^\infty f(t_{ij}, \lambda_i) g(\lambda_i, \dot{r}, \alpha) d\lambda = \frac{r}{\alpha} \left[\frac{\alpha}{\alpha + (t_{ij} - t_i(j-1))} \right]^{r+1} \quad (3)$$

The data available to us made it possible to study the evolution of visit behavior at a standard retail store. The model revealed that individual-level behavior pattern appears to contradict the perspective that one would obtain from examining the aggregate data alone. The result shows that the number of new customers increases over time, masking the slowdown that may be occurring for many old customers.

3.3 Stochastic and Habitual Nature of Communication Pattern, using Mobile Service Consumption in Nigeria.

In continuation of the above study, **Akomolafe**, Oloyede and Oseghale (2011), moved further to look at the stochastic and habitual nature of communication pattern, using mobile service consumption in Nigeria. This research checks the stochastic nature of repertoire market, subscription market and mobile service. The study tests whether Negative Binomial Distribution pattern of consumption exist in the mature and competitively saturated geographical market. It was discovered that products with stochastic profiles may be due to the strength of consumer's habit, rather than to underlying antecedents.

3.4 Performance Rating of Kumaraswamy Transmuted Weibull Distribution (KTWD),

Oseghale and **Akomolafe** (2017) studied the performance rating of Kumaraswamy Transmuted Weibull Distribution (KTWD), due to the flexibility and the rate at which it captures the decreasing, increasing, and bathtub-shaped failure rate function in survival analysis - Insurance, Engineering, and Environmental Pollution study. The probability density function of the developed model is as shown in equation (4) below

$$\begin{aligned}
 f_{KTWD}(x; a, b, \alpha) &= \frac{ab \alpha}{\beta^\alpha} y^{\alpha-1} e^{-\left(\frac{y}{\beta}\right)^\alpha} \left[1 + \lambda - 2\lambda \left(1 - e^{-\left(\frac{y}{\beta}\right)^\alpha} \right) \right] \\
 &= \left[1 + \lambda \left(1 - e^{-\left(\frac{y}{\beta}\right)^\alpha} \right) \right] - \lambda \left[1 - e^{-\left(\frac{y}{\beta}\right)^\alpha} \right]^{\alpha-1} \\
 &= \left[\left[1 - (1 + \lambda) \left[1 - e^{-\left(\frac{y}{\beta}\right)^\alpha} \right]^\alpha \right]^\alpha \right]^{b-1}
 \end{aligned}$$

$$f(y) = 1 - [(1 - (1 + \lambda)(1 - e^{-\left(\frac{y}{\beta}\right)^\alpha}) - \lambda(1 - e^{-\left(\frac{y}{\beta}\right)^2})^a)]^b \quad \alpha > 0, \beta > 0, y > 0 \quad (4)$$

Several distributions useful for real life data application can be derived from the cumulative density function:

- I. when $a = b = 1$, it becomes transmuted Weibull;
- II. when $\lambda = 0$, it becomes Kumaraswamy Weibull;
- III. when $\lambda = 0, b = 1$, it becomes exponentiated transmuted Weibull;
- IV. when $\lambda = 0, \alpha = 1, b = 1$, it reduces to conventional Weibull density function; and
- V. when $b = 1$, it becomes exponentiated transmuted Weibull

The developed model (KTWD) was applied to an uncensored dataset from Nichols and Padgett (2006), considering 100 observations on breaking stress of carbon fibers (in Gba). . The new distribution is quite flexible and can have a decreasing, increasing, and bathtub-shaped failure rate function depending on its parameters making it effective in modeling survival data and reliability problems. In its comparative analysis with related mixed existing distribution, the developed model proved to be more efficient, and better fitting to the data used for illustration showcasing the efficiency and consistency of the newly developed model. The model can be applied to other areas like Insurance, Engineering, Survival analysis, and Environmental Pollution study.

3.5 Efficiency of Beta-Half Normal Distribution [BHND] to Model Statistical Behavior of Stochastic Processes

Akomolafe and Maradesa (2017) employed the efficiency of Beta-Half normal Distribution to model statistical behavior of stochastic processes such as the growth of tumor's cells in an oncology's study of benign transmogrifying to malignant tumor (Epidemiological and customer-buying behavior study).The model is as shown in equation (5)

$$\begin{aligned}
 f_{(BHND)}(x; a, b, \sigma) &= \frac{1}{B(a, b)} \left[\operatorname{erf} \left(\frac{x}{\sigma\sqrt{z}} \right) \right]^{\alpha-1} \\
 &= \left[1 - \operatorname{erf} \left(\frac{x}{\sigma\sqrt{z}} \right) \right]^{b-1} \frac{\sqrt{z}}{\sigma\sqrt{\pi}} e^{-\frac{x^2}{2\sigma^2}} \quad (5) \\
 &\quad \sigma > 0
 \end{aligned}$$

This model is quite flexible for analyzing positive real data. It provides a useful power series for the quantile function. Some new explicit expressions are derived for the mean deviations, Bonferroni and Lorenz curves, reliability, and entropy. It was demonstrated that the density function of the beta generalized half-normal order statistics can be expressed as a mixture of generalized half-normal densities. We obtain two closed-form expressions for their moments and other statistical measures. The method of maximum likelihood was used to estimate the model parameters censored data. The beta half-normal model is modified to cope with long-term survivors that may be present in the data. The usefulness of this distribution is illustrated in the analysis of four real data sets. The compounded model exhibits more flexibility, consistency,

sufficiency, stability and uniqueness, with more application to different fields of study, especially information (data) that shows stochastic act.

3.6 Consistency and Tracking Purchasing Pattern of Buying Behavior Data.

^(a)Maradesa and **Akomolafe** (2017), ^(b) Akomolafe and Yussuf (2018) used Dirichlet model (DM) and Dirichlet multinomial model (DMM), respectively to look at the consistency and tracking purchasing pattern of buying behavior data, thus providing a theoretical benchmark for price promotion, advertisement, and branding. The model used for each of the compounded hybrid model are shown in equations (6) and (7) below

$$f_{(DM)}(y, \alpha) = \frac{1}{B(\alpha)} \frac{\kappa}{\Lambda} x_i^{\alpha_i - 1} \quad (6)$$

$i = 1$

Where $B(\alpha) = \frac{\kappa}{\Lambda} \frac{\gamma(\alpha_i)}{\gamma(\sum_{i=1}^{\kappa} \alpha_i)}$

$i = 1$

the model was illustrated using real-life data

$$f_{(DMM)}(x|\alpha) = \frac{N!}{\frac{\kappa}{\Lambda} x_i!} \frac{\gamma(\sum_{i=0}^{\kappa} \alpha_i)}{\gamma(\sum_{i=1}^{\kappa} \alpha_i + x_i)} \frac{\kappa}{\Lambda} \frac{\gamma(\alpha_i + x_i)}{\gamma(\alpha_i)} \quad (7)$$

$i = 1$ $i = 1$

α can be estimated from a training set of count vectors. Parameters and Mean Vectors for Dirichlet Multinomial Distribution [DMD].

The parameters of the dirichlet multinomial distribution is represented by the vector

$\alpha_i = (2.9747 \ 0.5015 \ 0.1845 \ 0.1169)$, the corresponding mean vector is represented by

$m_i = (7.78745765 \ 1.3275625 \ 0.3094557 \ 0.4884053)$ which depict the generalized mean purchase or sales volume at the first ten period of production. It was discovered that throughout the period, the sale average purchase for trophy is significantly higher than the rest of the product while other product maintain relatively small uniform sales throughout the period, with a little bit increase in the sale of castle lager within the period of investigation. Bayes Factor Test for Goodness of fit

H_0 : the fit is not good for DMD ($\alpha = 0.05$) Versus

H_1 : the fit is good for DMD

Decision Rule: If the Bayes factor falls in the critical region ($10 < BF < BF$)

Table 2: The table shows the performance of the two models (DM, DMM)

Model	Bayes Factor (10 < BF < 30)	Precision Parameter (s < 1)	AIC	BIC
DMM	16.342 (A BETTER FIT)	0.00449 (HIGHLY CONSISTENT AND EFFICIENT)	1138.99	399.04
DM	25.988	1.46129	1473.23	431.453

Based on the above table, Dirichlet Multinomial Model can therefore be relied on for better, adequate, and consistent decision making and planning and this was also established by the value obtained based on comparative criterion

3.7 Generalization Version of Exponentiated Exponential Lomax Distribution

Maradesa, **Akomolafe** and Adebola (2018) study the generalization version of Exponentiated Exponential Lomax Distribution (EELD), the model was found to generalize some known distributing, thereby providing a great flexibility in modeling heavy tailed, skewed, and bimodal distributions. The model used is as shown in equation (8)

$$f(x; \beta, \lambda, \theta) = \frac{\lambda \alpha}{\beta} \left(\frac{\beta}{x+\beta}\right)^{-\alpha+1} e^{-\lambda \left(\frac{\beta}{x+\beta}\right)^{-\alpha}} \quad (8)$$

$$\beta, \lambda, \theta > 0$$

The model exhibits different pattern or shapes (λ) when fitted to simulated data that showcases different pattern and effects. The developed distribution provides a great flexibility in modelling heavy tailed, skewed, and bimodal distribution.

3.8 Time-Dependent Analysis of Waiting and Service Time Behavior in Discrete Time Queue at the Automated Teller Machine (ATM)

Akomolafe (2018) examined the time-dependent analysis of waiting and service time behavior in Discrete Time Queue at the Automated Teller Machine (ATM). The data for the study was collected from the primary source and it is limited to ATM services point of a standard Bank. The data contained the attributes of queueing on the number of customers for four weeks.

Against this background, queueing process is employed with inter-arrival time and service-time. Assumptions made are as follows:

- I. Single channel queue
- II. There is an infinite population from which customers originate
- III. Poisson arrival (Random arrivals)
- IV. Exponential distribution of service time
- V. Arrival in groups at the same time (i.e bulk arrival) is treated as a single arrival
- VI. The waiting area for customers is adequate
- VII. The queue discipline First In First Out (FIFO)

The method used for data collection based on attributes is to capture a particular customer by labeling such client as shall be explained in the table below with the corresponding details and taken note the time at arrival on each ATM as categorized in the

design. We also went further to measure the traffic intensity (ρ) and to establish the indicators with its respective interpretation and this is expressed below:

when $\rho < 1$ is interprets as no queue is built up Traffic Intensity =

when $\rho = 1$ is interprets as service rate is equivalent to arrival rate

when $\rho > 1$ is interprets as queue is built up

The Model

A Poisson distribution is a discrete probability distribution that can be used to predict the number of arrival in a given time. It involves the probability of the occurrences and it is independent of what has happened in the

- Arrival model (Poisson Distribution)

$$f(x) = \frac{\lambda^x e^{-\lambda}}{x!} ; x > 0 \quad (9)$$

previous observation. The probability distribution function is given as It has $E(X) = \lambda$ and

$V(X) = \lambda$. The model for the arrival of customer is assumed to be a Poisson distribution.

Service time is the arrival between the commencement of service and its completion. Service time can be modeled as exponential distribution with mean $1/\mu$ and variance $1/\mu^2$. This model for service is assumed in this study. The probability density function is given as:

- Service Time Model (Exponential Distribution)

$$f(x) = \begin{cases} \lambda e^{-\lambda x} & , \quad x \geq 0 \\ 0 & , \quad x < 0 \end{cases} \quad (10)$$

Generally, arrivals do not occur at fixed regular intervals of time, but tend to be clustered for a duration of a week.

Table 3: Traffic intensity measurement for each week

Week	Arrival Rate (λ)	Service Rate ($\frac{1}{\mu}$)	Traffic Intensity (e)
1	3.9539	5.4922	0.7199
2	3.8387	7.4123	0.5179
3	3.8636	7.6137	0.5075
4	4.0317	7.5000	0.5376

It was deduced that queueing process employed with interarrival time and service time do not follow exponential distribution, hence in reducing queue problem, high routine maintenance regime should be actively implemented, backup staffs could be engaged during peak periods to handle any additional demands. Queue management should also be made an active part of the bank's overall strategic queue management processes.

3.9 Models Used to Capture Non-normal Real-life Phenomena

Akomolafe. et.al (2019_a), **Akomolafe. et.al** (2019_b), and **Akomolafe** (2020_c) in a related development succeeded in mixing hybrid distribution named Beta-Hjorth Distribution (BHD), Truncated Exponential Pareto Distribution (TEPD), and Beta-hyper Lindey Distribution (BHLD) respectively; all these developed models were used to capture non-normal real-life, skewed and complex situation tune. Their conventional properties were derived and checked based on some assumptions in tune with global standard and practices

$${}^{(a.)}f_{(BHD)}(x; \theta, \alpha, a, b) = \frac{(\alpha+ax)}{B(a,b)} [1 - e] \left[e^{-(\theta x + \frac{ax^2}{2})} \right]^b \quad (11)$$

This research shows the mathematical derivation of the hybrid Beta-Hjorth and the parameter of this distribution were obtained via numerical method. Some mathematical properties along with estimation issues were addressed. The model was illustrated using real life data where it fits better than the parent distribution. The distribution can be used in several different areas and will serve as a reference to advance future research in this area.

It is on this note that the significance of this distribution can be fetched in modelling countless of random phenomena, epidemiological, and economic studies.

$${}^{(b)}f_{(TEPD)}(x; \alpha, \beta, \theta) = \frac{\frac{a\theta}{\beta} \left(\frac{x}{\beta}\right)^{\theta-1} e^{-\alpha\left(\frac{x}{\beta}\right)^{\theta}}}{e^{-\alpha\left(\frac{a}{\beta}\right)^{\theta}} - e^{-\alpha\left(\frac{b}{\beta}\right)^{\theta}}} \quad (12)$$

for $\alpha \leq x \leq b; x > 0; \alpha, \beta, \theta > 0$

$${}^{(c)}f_{(BHL D)}(x; a, b, \theta_1, \theta_2) = \frac{1}{B(a,b)} \left(p \left(1 - \frac{e^{-\theta_1 x(1+\theta_1+\theta_1 x)}}{(1+\theta_1)} \right) + q \left(1 - \frac{e^{-\theta_2 x(1+\theta_2+\theta_2 x)}}{(1+\theta_2)} \right) \right)^{\alpha-1}$$

$$1 - \left(p \left(1 - \frac{e^{-\theta_1 x(1+\theta_1+\theta_1 x)}}{(1+\theta_1)} \right) + q \left(1 - \frac{e^{-\theta_2 x(1+\theta_2+\theta_2 x)}}{1+\theta_2} \right) \right)^{b-1}$$

$$p \left(\frac{\theta_1^2}{(\theta_1+1)} (1+x) e^{-\theta_1 x} \right) + q \left(\frac{\theta_2^2}{(\theta_2+1)} (1+x) e^{-\theta_2 x} \right) \quad (13)$$

The Beta-HyperLindley Distribution as in equation (13) was developed and some of its properties were derived while log-likelihood method of estimation was proposed for parameter estimation. The BHL D was developed and some of its properties were derived while log-likelihood method of estimation was proposed for parameter estimation. The developed distribution can be used to capture non-normal process because of its statistical significance in modeling and its vast shape ranging from bimodal, highly skewed and heavily tailed. The model provides a significant improvement in fit and modeling. It is an important model for analysis of lifetime data because of the wide usage of the lindley distribution and the fact that the

current generalization provides means of its continuous extension to more complex situations. We provide a comprehensive description of some structural properties of the proposed distribution with the hope that it will attract wider applications in several fields.

3.10 Modeling Epidemiological and Economic Non-normal Data.

Akomolafe et.al. (2020) examined the combination of exponential distribution, Pareto Distribution, and Negative Binomial Distribution in order to arrive at a hybrid model named Exponential Pareto Negative Binomial Distribution (EPNBD), in order to model epidemiological and economic non-normal data, without concealing the richness of the information.

$$f_{(EPNBD)}(x; s, \beta, \theta, \alpha, \lambda) = \frac{1}{[(1 - \beta)^{-s} - 1]} \left[(1 - \beta)^s - (\beta e^{-\lambda \left(\frac{x}{\alpha}\right)^\theta})^s \right] \quad (14)$$

$$s, \beta, \theta, \alpha, \lambda > 0$$

The distribution was found to generalize some distributions thereby providing great flexibility in modelling symmetric, heavy tailed, skewed, and bimodal distributions, the efficiency of the new lifetime distribution was illustrated using failure time life data.

3.11 GAYUF Transformed Exponential Distribution; A New Innovative Class of Robust Tools for Modeling and Analyzing data in Engineering and other fields.

Yusuff, Ajiboye and **Akomolafe** (2024) developed a hybrid model named GAYUF Transformed Exponential Distribution. Its conventional properties; probability density function and cumulative density function were derived. The validity of the model was checked, and the model was applied to the real-life dataset.

$$f_{GAYUF}(x; \lambda, \alpha, \theta) = \theta \lambda (x\lambda + \alpha(1 - e^{-\lambda x}))^{\theta-1} (1 - \alpha e^{-\lambda x}) \quad (15)$$

Where $\lambda, \alpha, \theta > 0$

The dataset is on tensile strength of glass fiber (1.5_{CM}), initially collected by employees in the United Kingdom. National physical laboratory used by Smith and Naylor (1987), while the second dataset was on the waiting time (in minutes) before service of 100 Bank Customers examined and analyzed by Ghitany et.al (2005), for fitting Linley Distribution. It was discovered that our newly compounded hybrid model performed better and fitted best, when compared with existing related hybrid models, thus validating our model as an advanced tool for precise data modelling, enhanced parameter estimation and reliable analysis of complex datasets. The findings suggested that the **Generalised Akomolafe Ajiboye Yussuf** (GAYUF) model is a new innovative class of robust tools for modelling and analyzing data in Engineering and some other fields.

4.0 POPULATION AND HEALTH STUDIES.

4.1 COVID-19 Pandemic and its Early Transmission Dynamics in Nigeria.

Akomolafe et.al (2022), examined the relationship between days and new cases of the Corona virus (COVID-19) in Nigeria, and also checked for the prediction of new cases. Linear regression model was fitted to check the best fit model to the data. Results indicate that there is significant relationships between days and the new cases, which implies that days had a positive effect on new cases and was found significant at 1% significant level, for both linear and non-linear regression model. It was suggested then that Government should take proper measures to reduce the spread of the infectious disease.

$$\begin{bmatrix} \text{new cases}_1 \\ \vdots \\ \vdots \\ \vdots \\ \text{new cases}_n \end{bmatrix} = \begin{bmatrix} 1 & \dots & \dots & \text{day1} & \dots & \dots & \text{day1}^m \\ \vdots & & & \vdots & & & \vdots \\ \vdots & & & \vdots & & & \vdots \\ \vdots & & & \vdots & & & \vdots \\ 1 & \dots & \dots & \text{day}_n & \dots & \dots & \text{day}_n^m \end{bmatrix} \begin{bmatrix} \beta_0 \\ \vdots \\ \vdots \\ \vdots \\ \beta_n \end{bmatrix} + \begin{bmatrix} e_1 \\ \vdots \\ \vdots \\ \vdots \\ e_n \end{bmatrix} \quad (16)$$

where new cases₁ indicates the case of Corona virus at March 23, 2020, when the death was recorded. New cases_n indicates the cases of Corona virus as at May 5, 2020.

$\beta_0, \beta_1, \dots, \beta_n$ are the coefficients of the number of days e_1, e_2, \dots, e_n in the error term or the random term.

$$\text{new cases} = \text{constant} + \beta - \text{days}_{(t)} + e_i \quad (17)$$

Table 4 presents the result of the box plots which include the minimum, 1st quartile, median, 3rd quartile and maximum. The summary of the fitted linear and loglinear model of residual was shown in Table 1. It was shown that loglinear model had the lowest minimum value of -1.76699; 1st quartile of -0.35940; median (-0.00118); 3rd quartile (0.43807) and maximum (1.23418) when compared with fitted linear model. It was shown that the log of the newcases was normally distributed when compared with the fitted linear model.

Log linear regression model is also used as part of the polynomial regression to establish the relationship and predict the new cases of coronavirus in Nigeria as shown in Table 5. Result of the log linear model revealed that 77% of the days (represented with time t) is being explained in the new cases. This showed the proportion or total variance of days being explained in new cases. The findings revealed that days show a positive effect on the new cases and it is significant (P-value = 1.42e-15 ***) with an estimated coefficient of (0.086095). The null hypothesis of the model was tested and the result showed that there is a statistically significant relationship between days and new cases. Also, log linear model predicted the new cases that might occur in Nigeria as shown in Model 2(a&b).

Model **2a**: $\exp(\hat{y}) = 0.086095(t) + 1.568430$ **(18)**

The log transformation is given as:

Model **2b**: $\hat{y} = 1.08991(t) + 4.799108$; where \hat{y} is the estimated new cases. (19)

Table 4: Box Plot Analysis

	Minimum	(1Q, 3Q)	Median	Maximum
Fitted Linear regression	-67.936	(-33,102, 32.491)	-4.639	86.768
Loglinear regression model	-1.76699	(-0.35940, 0.43807)	-0.00118	1.23418

Table 5: Fitted Linear Regression

	Estimate	Std.Error	t-value	Pr(> t)
Intercept	-41.7323	12.0586	-3.461	0.00123**
Days	4.8241	0.4565	10.567	1.58e-13 ***
Residual Standard error	39.77			
Multiple R-squared	0.722		Adjusted R-squared	0.7155
F-statistic	111.7		P-value	1.577e-13
DF	(1,43)			

Table 6 : Loglinear Regression Model

	Estimate	Std.Error	t-value	Pr(> t)
Intercept	1.568430	0.186172	8.425	1.20e-10 ***
Days	0.086095	0.007048	12.215	1.42e-15 ***
Residual Standard error	0.6141			
Multiple R- squared	0.7763		Adjusted R-squared	0.7711
F-statistic	149.2		P-value	1.424e- 15***
DF	(1,43)			

Where *** indicates P-value < 0.01 (1% level of significance), ** indicates P-value < 0.05 (5% level of significance and P-value – probability value.

Two different models were used to establish the relationship. The two models found a significant relationship between new cases and days (measured at time t) recorded in Nigeria. Several measures have been observed to reduce the disease pandemic worldwide. This study examined the effect of days (time) on new cases. It was found that days (time) had a positive effect on the new cases. The longer the epidemic was withheld the greater the catastrophe, provided that the population continued to increase, and the threshold density remain unchanged. Such a prolonged delay would have led to almost complete extinction

of the population. As time increases in Nigeria, new cases of Covid'19 increased and new deaths also increased meaning that proper measures should be taken in other to reduce the rate of corona virus in Nigeria. The governments and health facilities were urged to work together and also ensure that any patient visiting the hospital should be test on covid'19. People were to take proper measure by washing their hands, covering their nose, avoid contact with the affected person and lastly, government should be more active on contact tracing.

4.2 COVID-19 Pandemic And Its Economic Shocks In Nigeria

Akomolafe, Awogbemi, Oladimeji, Akomolafe and Yusuf (2020) considered that COVID-19 Virus was spreading shocks on the Nigerian economy and adopted a historical-analytical approach to study the interplay of factors deepening the impact of the shocks, the new phenomenon of demand-shock effect alongside a supply-side shock effect implies that the length and cost of these shocks could significantly inflict a colossal economic downturn on the economic outlook in emerging and developing economies like Nigeria especially in the North.

Analytical Approach Likely nature of the economic shocks is important to distinguish three sources of the shock, two of which are tangible.

- First are the purely medical shocks where workers in their sickbeds are not producing [GDP].

- Second is the economic impact of public and private containment measures – things like school and factory closures, travel restrictions, and quarantines.
- The third is literally 'all in our heads'. Belief-based economic shocks, individual behaviour depends upon beliefs

The **supply-side shocks** are more tangible. Tumbling oil prices Nigeria has already reduced its projection of 2.1 million barrels a day of oil production to 1.7 million and has cut a record \$35bn budget for 2020 based on an oil price of \$57 a barrel, down by about 15%. As the financial woes increase in oil-rich Nigeria, the country's main crude export, Bonny Light, fell below \$13 per barrel last week and millions of barrels remain unsold, while Brent stood at about \$28 per barrel on Friday.

Supply-side shocks, the direct supply-side impacts of human reactions to the virus are obvious and abundant; authorities and firms in several nations have shuttered workplaces and schools. Nigeria presents clear and early example. After sporadic reports of COVID-19 infections, many large Nigerian companies ordered their employees to work from home in late February. This practice is spreading rapidly.

Demand-side shocks When it comes to COVID-19's immediate aggregate demand shock, two aspects are worth distinguishing: practical and psychological. Practical since some consumers are or will be prevented from getting to stores, so their demand disappears from the market.

International banking, and exchange rates Economies are also connected – but not physically – by beliefs. All these things are also mechanism for the propagation of economic shocks. Some of these flows within nations are also likely vectors connecting the medical and economic aspects of COVID-19. Related linkages between medical and economic effects of the virus which are not necessarily international but are likely to be important are defaults or financial distress among firms that are not banks.

Deglobalisation policy reactions There are mechanisms of immediate transmission, but policy reactions might put in place policies that could hinder the flow of goods, service and especially people. As Weder di Mauro points in her chapter, this could well make the economic effects more persistent. Companies, individuals and governments are experiencing disruptions which may lead to sudden deglobalisation. Companies are learning the lesson that global supply chains can be abruptly broken by a health shock and will adjust accordingly

Table 7: Showing the Monthly Report of Covid 19 in Nigeria by Geopolitical Zones (April 25 - May 9, 2020)

	NORTH CENTRAL			NORTH EAST			NORTH WEST		
	CON	DIS	DEA	CON	DIS	CEA	CON	DIS	DEA
Week 1	0	0	0	0	0	0	0	0	0
Week 2	0	0	0	0	0	0	0	0	0
Week 3	0	0	0	0	0	0	0	0	0
Week 4	3	0	0	0	0	0	0	0	0
Week 5	17	0	1	2	0	0	1	0	0

Week 6	44	0	2	6	0	0	4	0	0
Week 7	60	11	2	6	0	0	11	0	1
Week 8	93	25	2	6	0	0	52	4	2
Week 9	153	37	3	72	5	2	123	8	2
Week10	298	38	3	249	6	12	502	20	23
Week 11	423	97	11	475	16	17	1094	63	45

Key- ***Confirmed Cases [Con], Discharged Cases [Dis], Death [Dea]***

Due to the weak economic productivity base of the Nigerian economy, it is difficult to predict the future spread-reduction variables of the pandemic.

4.3. Software Market in Nigeria: A Case Study of its Buying Behaviour Heterogeneity.

Akomolafe et. al. (2020), took a look at software market in Nigeria by studying the buying behavior heterogeneity of customers. Questionnaire method of data collection was used. Using 5-point Likert Scale mode, hypothesis or claim were tested based on the objective of the study and the available data at hand, it was discovered that in the software market, beside brand image, product feature or price; other factors could have influence in the buying choices. Network effect, sufficient cost, local network effect, lock-in, or consumer heterogeneity, all have influence in the buying decision.

This research evaluates the hypotheses in two categories of software, Operating Systems and Office Suites for PC, categories where the main competition is between Open Source Software and Proprietary software. This addresses the research question: "Which factors have influence on the buying process decision of Operating Systems and Office Suite for PC, considering Open Source and Proprietary software alternatives, and how these factors influence the consumer's choices?" Most of the hypothesis extensively considered in this research basically centered on consumer choices which is in two fold

- (i) The lower the probability that the consumer will choose the alternative standard against the incumbent standard
- (ii) (ii) The higher the probability that the consumer will choose the alternative standard against the incumbent standard

The null hypothesis

H₀₁: that goes with the first consumer choice are Ho1: the higher the network effect in the market H₀₂: the higher the switching cost in the market

H₀₃: the higher the lock-in weak and strong

H₀₄: the higher the network effect in the market

H₀₅: the better the perception regarding innovation, quality, security and support of the incumbent standard Also, the null hypothesis

H₀₆: that goes with the second consumer choice are H₀₆: the higher the heterogeneity of the consumer [the lesser the network]

H₀₇: the lesser the associated cost to adoption of the alternative standard

[licensing, support, training, compatibility e.t.c.]

This research provides a better knowledge of the consumer selection decision to help the supplier's managers in their marketing strategies while also helping the regulatory authorities regarding the search for market abuse of monopoly power due to specific factors that can easily allow it to the incumbent player. The main implication of this research is the conclusion that in a software market with a dominant incumbent (like the studied markets), it will be very difficult for a competitor to gain market share against the incumbent unless there is some kind of external intervention, like the Government using an alternative software standard, allowing it to reach a critical mass of users

4.4 The Dynamics of Inflation Rate in a Consumer-Driven Economy

In a related development, my research group on economic issues examined the dynamics of inflation rate in a Consumer-Driven economy [Umar et.al (2020)]. Co-integration and autoregressive error correction model approach was used to investigate the effect of money supply, fiscal deficit and export

on the relative effectiveness of fiscals' policy in Nigerian consumer-driven economy.

$$CPI_t = f(MS, MPR, EXR, RER, DOP)_t \quad (20)$$

Equation (17) can be written in econometric form as:

$$CPI_t = \beta_0 + \beta_1(MS)_t + \beta_2(MPR)_t + \beta_3(EXR)_t + \beta_4(RER)_t + \beta_5(DOP)_t + \Sigma_t$$

where *CPI – Consumer Price Index*

MS – Money Supply

MPR – Monetary Policy Rate

EXR – Exchange Rate

RER – Real Exchange Rate

DOP – Domestic Oil Price

The equation above was transformed to a log-econometric form.

The result of the analysis is based on the data culled from the Central Bank Bulletin revealed that fiscal policy have a significant influence on the output growth of the economy surveillance the group recommended that the Central Bank should as a matter of urgency then guarantee a stable exchange rate and sound monetary surveillance, look inward for ways to regulate interest rates that will encourage local and foreign investors to transform our consumer driven economy.

4.5 Modeling Random Sample of 128 Bladder Cancer patients Using Complementary Generated Transmitted Poison Lomax Distribution

Taiwo and **Akomolafe** (2023) modeled Complementary Generated Transmitted Poison Lomax Distribution (CGTPLD), which is a recent renewed interest in generating a four parameter-skewed distribution, all the necessary conventional properties and procedures were checked and confirmed. The model was applied to a random sample of 128 Bladder Cancer patients. The descriptive Statistics of the dataset on the remission time (in months) is given below;

Table 8: Descriptive Statistics of 128 Bladder Cancer Patients

Me an	Medi an	Varia nce	S. D	Skewn ess	Kurto sis	1 st Qu	3 rd Qu	Mi n	Ma x
9.3 66	6.396	110.4 25	10.5 08	3.287	15.48 3	3.3 5	11. 84	0.0 8	79. 05

The parameter estimation for the model as shown in equation (21) was carried out using the maximum likelihood estimation method

$$f_{(x;\alpha,\beta,\gamma,\varphi)} = \frac{e^\gamma - e^{\gamma(1+\beta x)^{-\alpha}}}{e^{x-1}} \left[1 + 4 \frac{e^{\gamma(1+\beta x)^{-\alpha}} - 1}{e^\gamma - 1} \right] \quad (21)$$

$$x > 0, \quad \alpha, \gamma >$$

$$0, \quad \text{and } |\varphi| \leq 1$$

The performance of the distribution is as shown in the table 9 below:

Table 9: Measure of AIC, BIC, HQIC, AND CAIC Comparative Criterion

Distribution	-log L	AIC	HQIC	CAIC	BIC
CGTPLD	409.56	827.13	831.76	827.45	838.53
EXT PLD	413.84	831.67	837.14	833.86	842.22
TE Lomax	410.43	828.87	833.51	829.13	840.28
MC Lomax	409.91	829.82	829.13	830.14	844.09
KUMG Lomax	409.95	827.90	832.54	828.23	839.31

Since the new compounded model shows minimum value, this indicates that it performs better, when compared with existing related models.

4.6. Identification of Problems Associated with Open defecation and its Related Solutions using Principal Factor Analysis

Also, our research group identified problems associated with open defecation and its related solutions, (Ayanlola et.al (2025)). It was discovered that this is a persistent sanitation challenge in south-west Nigeria, especially in the rural areas and inner urban areas. The quantitative study surveyed 500 respondents across Lagos, Ogun, Oyo, Osun, Ondo, and Ekiti, using structured questionnaires.

The result obtained is as shown below in table 10:

Table 10: Relevance of Open Defecation in South-West Nigeria

State	Number of open defecation %	Occasional %	Frequent %	Total %
Lagos	83.6	12.1	4.3	100
Ogun	68.2	20.4	11.4	100
Oyo	55.3	28.2	16.5	100
Osun	60.7	26.1	13.2	100
Ondo	62.9	23.6	13.5	100
Ekiti	51.7	27.1	21.2	100

Principal factor analysis was used to determine the essential elements which affects open defecation through an examination of key factors. The analysis revealed that five (5) fundamental components accounted for 42.2% of the total variance. The most significant factors include strong economic influence, sanitation investment behavior, inadequate government oversight, unawareness of sanitation laws and financial obstacles (poverty). Conclusively, it was discovered that community-driven initiatives, supported by policies are essential to enhance sanitation and good public health.

4.7. Network Analysis on Phase 1B Building of the University Health Centre, FUTA, Using the Critical Path Method (CPM) and Program Evaluation Review Technique (PERT)

Oladimeji, **Akomolafe**, Akomolafe, Lasisi, Sojobi and Oloja [2023] examined Network Analysis on Phase 1B Building of the University Health Centre, FUTA, Using the Critical Path Method (CPM) and Program Evaluation Review Technique (PERT). Project planning and scheduling plays a vital role in estimating the time and cost angle of a project. Finalizing a project on time and within the budget is challenging. This study focused on finding the shortest possible time required to complete the phase 1B Building project of the University Health centre, FUTA and also to evaluate the probability of completing the project within the stipulated time, Data analysis was carried out and all the possible route of the activities involved in the building project was found, and location of the critical path of the building project was also found, the expected duration for every activity in the building project was determine, the probability of completing the project within the stipulated time was evaluated.

CPM (Critical Path Method) and PERT (Program Evaluation and Review Technique) are two commonly used network analysis methods in construction project management. They help project managers to understand the interdependencies between different activities and resources and to plan and execute construction projects more effectively. A network diagram would be drawn to show the activities relationship, and

also CPM AND PERT would be performed/ carried out to show the critical path of the building project and to estimate the project completion time. Materials: Fig 1: Shows the program of work for the building project

Table 11: Shows all the activities and the activities code.

ACTIVITY	ACTIVITY CODE
MOBILIZATION	A
SUBSTRUCTURE	B
SITE CLEARING	C
FRAME	D
WALLS	E
ROOF AND ROOF COVERING	F
WINDOWS AND DOORS	G
FLOOR FINISHES	H
WALL FINISHES	I
CEILING FINISHES	J
PAINTING AND DECORATION	K
ELECTRICAL INSTALLATION	L
MECHANICAL INSTALLATION	M
EXTERNAL WORKS / SERVICES	N
CLEANING AND HANDING OVER	O

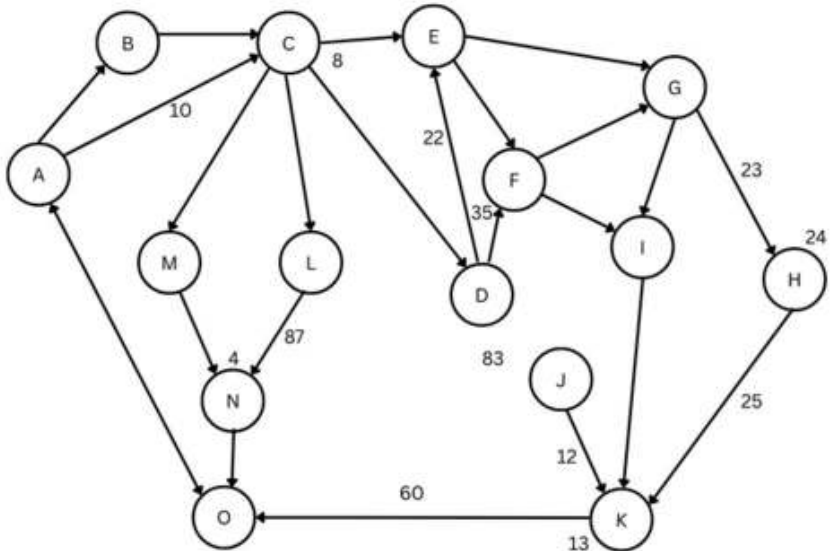


Fig 1: A Network diagram showing all activities involved in the process of construction for the University Health centre phase 1B

Based on the program of work chart all compound activities were extracted for the analysis of this study, Table 12 below shows the Activity Description, Activity code and their immediate processor, estimated duration and Days Interval of each activity on the program of work chart. The project was estimated to be completed in 100days.

Table 12: Showing the estimated duration and time interval

ACTIVITY	ACTIVITY CODE	Immediate predecessor	Estimated Duration	Days Interval
MOBILIZATION	A	-	10	1-10
SUBSTRUCTURE	B	A	8	2-10
SITE CLEARING	C	B	35	7-42
FRAME	D	C	22	34-56

WALLS	E	C,D	40	34-74
ROOF AND ROOF COVERING	F	D,E	23	51-74
WINDOWS AND DOORS	G	E,F	24	60-84
FLOOR FINISHES	H	G	25	74-99
WALL FINISHES	I	F,G	25	69-94
CEILING FINISHES	J	I	12	88-100
PAINTING AND DECORATION	K	H,I,J	13	87-100
ELECTRICAL INSTALLATION	L	C	83	15-98
MECHANICAL INSTALLATION	M	C	87	13-100
EXTERNAL WORKS / SERVICES 7	N	L,M	60	40-100
CLEANING AND HANDING OVER	O	K,N	4	96-100

The Result of the Critical Path: From the above Routes, the critical path of the building project is the route; With Activity Description: Mobilization, Site Clearing, Substructure, Frame, Walls, Roof and Roof Covering, Windows and Doors, Wall Finishes, Ceiling Finishes, Painting and Decoration,

Cleaning/Handing over Note: Some activities are not present on the critical path. This means that with or without some activity on the critical path, the project will still come to completion. Also we would notice that there are overlaps in the work program, which means that before some activities end another activity as ready begun in other to save time, therefore in finding our Critical path; the days interval between our first activity and last activity taking the overlapping time of all activities in the critical path into consideration is still 100days.

Thus; our critical path ; A – B – C – D – E – G – H – I – J – K – O
 With days interval; (1 – 10) (2 – 10) (7 – 42) (34 – 56) (34 – 74)
 (51- 74) (60 – 84) (69 – 94) . (88 – 100) (87 – 100) (96 – 100).
 Total days in critical path is 100days; which means the shortest possible time to complete the project is 100days.

Project length Variance = 0.44 + 0.44 + 0.44 + 0.44 + 0.44 + 0.44 + 0.44 + 0.44 + 0.44 + 0.44 = 4.884

Standard Deviation = $\sqrt{4.884} = 2.2s$

Probability that the project will be completed on the scheduled time is given by

$$p(z \leq D) = \text{Probability } ([z \leq Ts - Te] / \sigma)$$

$$D = [Ts - Te] / \sigma$$

where **Ts** = Scheduled time

Te = Expected time of the critical path **Ts** = 100, **Te** = 100,

$(z \leq 0) = 0.5$ which implies that the probability of completing the project in 100days is 0.5 That is there is a 50% chance that the project would be completed in 100days.

The result shows that there is a 50% chance for the project to be completed within the stipulated time. With the information gather on the building project, the project was delayed due to some factors such as low circulation of money, inadequate equipment, loss of some weeks due to a change in plan, and inadequate manpower, thus; there was a two-month difference between the initial completion time and the actual completion time. In conclusion, a project is a task with a specific beginning and end, aimed at producing a unique product, service, or result. Without proper planning and analysis and a good project management, project work might experience so many difficulties such as; Time loss (which would lead to delayed in project completion time), loss of focus and concentration of the labourers, money cost in materials and inadequate manpower.

5.0 CONCLUSION

Madam Vice Chancellor Ma, distinguished audience, esteemed colleagues, friends and students, today's inaugural lecture has been a reflective exploration of how probability modeling in statistics transforms data into insights that drive national progress. Today's lecture demonstrated that probability modeling in statistics quantifies the likelihood of events and makes informed decisions based on data. It allows statisticians and would-be-users to evaluate risks and choose optimal

actions based on expected outcomes. It helps in predicting future occurrence as it may be; concepts concerning Type I and Type II errors are well defined and catered for. Probability modeling in statistics is the backbone of statistical analysis and it plays a critical role in virtually all scientific and professional fields. It has been explained that as it transforms uncertainty into measurable quantities enabling researchers, policy makers and professionals to make rational and informed decisions. Without probability modeling, modern data analysis, forecasting and risk assessment would be impossible.

The most important question is not whether the model is true, but rather whether the model is adequate for the purpose at hand. Modeling is a continuous process that eventually leads to a good approximation of the real world phenomena. The real world economic, social, environmental, and governance "DOMAIN" were enormously complex but the goal of modeling is to simplify and explain the complexity. In the course of the lecture, I have explained how probability modeling helps to isolate chain of causes, effect and influence so as to provide a logical template that can be used for policy evaluation, or to experiment with by considering different policy scenarios.

Finally, I must remark that the patronage for statistical counseling is ridiculously low in this university. It is a common knowledge that scientific results are only validated and considered useful when statistical methods and principles are applied appropriately. We have seen many research proposals

and developmental projects without inputs from statisticians. The inclusion of statisticians should be made mandatory in all observational and experimental studies. Statisticians are supposed to be collaborators from the planning to the dissemination stage.

Laboratory for Interdisciplinary Analysis (**LISA**), similar to what exists in Virginia Polytechnic Institute and State University, USA domiciled in the Department of Statistics, FUTA, has been in existence for more than seven years. The laboratory was established to provide a meeting point for meaningful interaction among researchers within and outside the department with experienced and seasoned statisticians to provide statistical advice on design of experiments, data collection, software usage, result interpretation, and communication of statistical results. This will promote the value of statistical thinking in all phases of scientific research and serve as a training ground for the university students.

6.0 RECOMMENDATION

Madam Vice-Chancellor Ma, based on the evidence presented in this lecture, below are my specific recommendations for targeted implementation by key stakeholders, with the aim of translating statistical innovation into measurable national impacts.

- Institutions should emphasize probability theory in statistics and related programs. All this 'Obj method' of

evaluating students stands to kill the mastery of this area of statistics.

- More emphasis must be laid on the encouragement of practical applications by engaging the students in real life case studies and data analytic projects.
- Probability modeling should be integrated across disciplines such as economics, medicine, agriculture, engineering and computer science.
- Modern software packages should be encouraged and procured by the institution for students' easy access across their laboratories to enhance modeling accuracy.
- The government should incorporate predictive probability models in our national planning for strict monitoring of our anticipated risk in every sector of our economy.
- The government should re-energize TETFUND to activate its initial vision and focus on funding innovative research in our higher institutions.

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