INTERNATIONAL CONFERENCE ON ADVANCED WORKSHOP ON MODELLING AND SIMULATION OF COMPLEX SYSTEMS

AN INVENTORY MANAGEMENT FOR WORLD FOOD PROGRAM (WFP) BEANS DISTRIBUTION TO IDPS AND DETERIORATING RATE WITH PARTIAL BACKLOGGED UNDER BOKO HARAM TERRORISTS CALIPHATE IN NIGERIA.

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INTRODUCTION

- This study looks into the challenges of the critical situation of an Economic Order Quantity (EOQ) model faced on the inventory management for the World Food Program (WFP) under the stronghold of Boko Haram terrorist, in Northeast Nigeria.

- Insecurity and terrorism attacked by Boko Haram Insurgents in Borno State, Northeast Nigeria in particular has become a mobile phone ringing tune to the poor and less privileged masses over the recent decades from 2014 to date.

- Immediately, after the declaration of the Insurgents State Caliphate on the 7th of August, 2014 at Gwoza Local Government as their Headquarters, the Boko Haram terrorist became a thorn in the flesh of the entire Northeast–Nigeria.

- The World Food Program (WFP) is a non-governmental organization (NGO) that is saddled with the functions and responsibilities of humanitarian services of foodstuffs distribution in a society that are affected by conflicts or due to insurgency and those that are underserved or neglected by governments and other official institutions.

- This study aims to develop an evidence-based model for the prediction of inventory management and suggest an optimality condition for the World Food Program (WFP) on the foodstuff distribution to the Internally Displaced Persons (IDP's) Camps in Gwoza Community Borno State, Northeast-Nigeria.

OUTLINE

- Background

- Problem Formulation

- Objective

- Propose Outcomes

BACKGROUND

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- Gwoza is a local government area in Borno state of the Northeastern part of Nigeria.

- It is located about seven (7) kilometers from Camp Zero in the **Sambisa Forest**, the stronghold and armored headquarters of the insurgents, and was formally designated as the insurgents' base.

- According to security intelligence reports, the Gwoza Community is the most dangerous and unpredictable location, which has culminated in a high cost of World Food Program (WFP) inventory management and a special introduction of Military Escorts transportation cost of foodstuffs for the distribution to the IDPs (Internally Displaced Persons) who have been traumatized by armed conflict.

BACKGROUND CONT.

- Inventory refers to goods, products, and raw materials that are procured and ready for distribution to victims in crisis and disaster regions by the World Food Program (WFP). This involves the economics order quantity management of the required foodstuffs and other relevant materials, components, and their warehouses.

- This study proposed optimality costs in inventory management for the World Food Program (WFP) in crisis locations.

MAP SHOWING THE STUDY LOCATION (GWOZA)
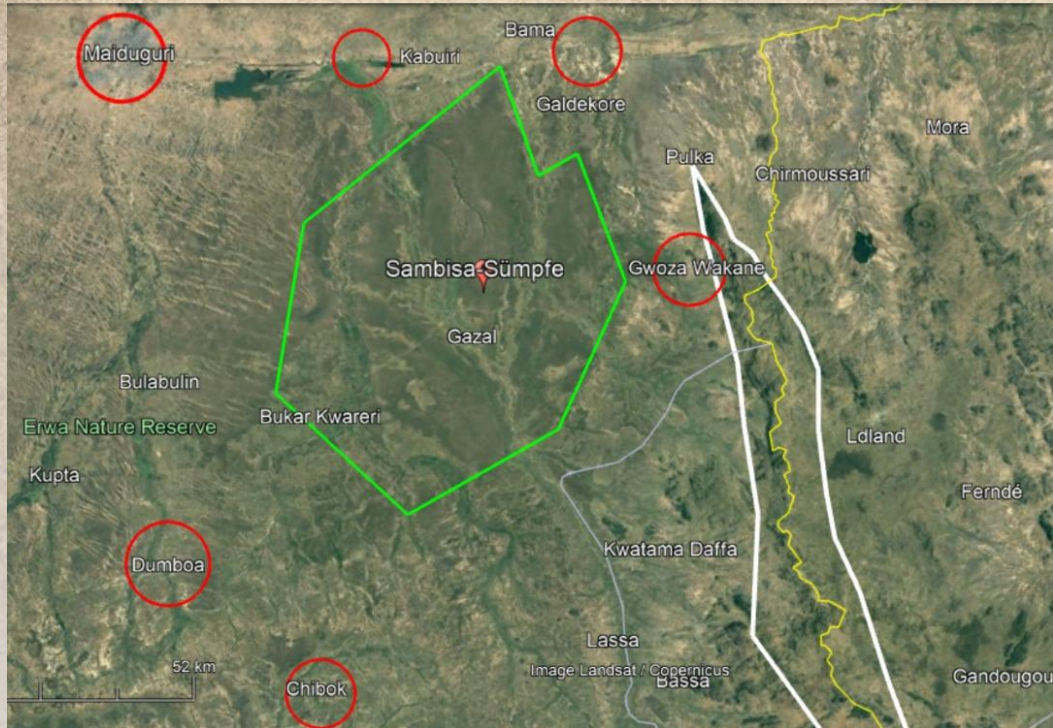
PICTURES SHOWING WORLD FOOD PROGRAM (WFP) STAFF DURING THE FOOD DISTRIBUTION TO IDPS.

PROBLEM FORMULATION

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- **2.1.1. Notations.**

- T   Length of each cycle (decision variable)

- C_o Ordering cost for the WFP per cycle

- C_p Purchase cost for the WFP per unit item

- C_h Inventory holding cost for the WFP per unit item

- θ   Deterioration rate; equals to $\theta = 0.03e^{0.084t}$

- t_l Stock exhausted level of the inventory.

- D   Demand rate, which is a function of price.

- M_f Military Escorts Transportation/logistics cost of each cycle

- S_c Shortage cost, which is a function of price and equals $e^{-\delta t}$

- TC   WFP total cost

PROBLEM FORMULATION CONT

- **2.1.2 Assumptions**

- (1) The deterioration rate (θ) is a function of the temperature (t), and $0 < \theta < 1$.

  The deterioration rate (θ) increases as the temperature (t) increases.

- (2) Shortage and back ordering are allowed in this model.

- (3) The time horizon is infinite.

- (4) Deteriorated products are not replaceable or repairable. (Foodstuffs)

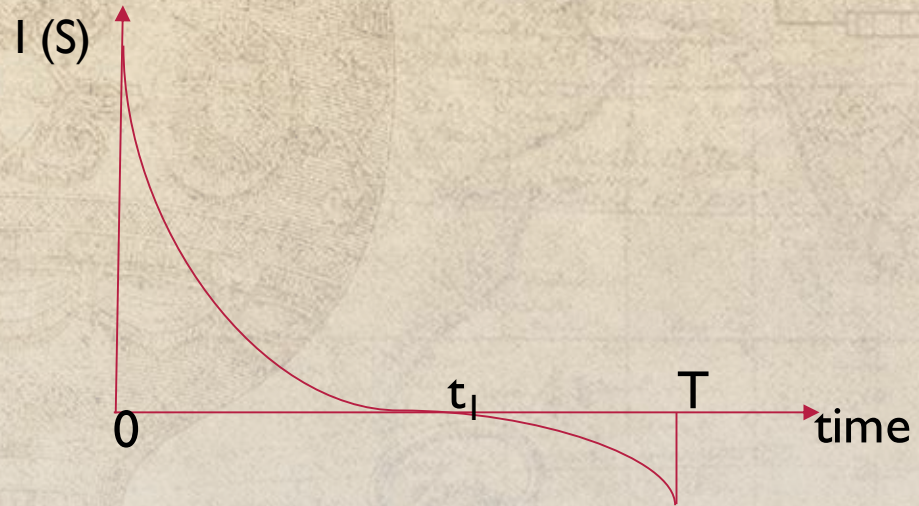- (6) The demand rate D depends on the foodstuff or items in stock.

I (S)

0   t$_I$ T

time

Fig: 1 Showing Inventory Level

- The inventory model is shown below with $S_1(t)$ as the inventory level and the demand rate, where T is the length of each cycle. Let $S_1(t)$ be the inventory level at time t $(0 \leq t \leq t_1)$, with partial backlogged as $S_2(t)$ at a time t $(t_1 \leq t \leq T)$, which the differential function can be represented as below.

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- $\frac{dS_1(t)}{dt} + \theta.S_1(t) = -\alpha P^{-\beta}; \ t \in [0, t_1]$ …(1)

- $\frac{dS_2(t)}{dt} = -\alpha P^{-\beta}.e^{-\delta t} \ ; \ t \in [t_1, T]$ …(2)

- $S_1(t) = \frac{\alpha P^{-\beta}}{\theta}\left[e^{\theta(t_1-t)} - 1\right];$ ...(3)

- $S_2(t) = \frac{\alpha P^{-\beta}}{\delta}\left[e^{-\delta t} - e^{-\delta t_1}\right];$ ...(4)

- $TC(t_1, T) = $ Ordering Cost + Purchase Cost + Holding Cost + Military Escorts transportation + Shortage Cost

- $TC(t_1, T) = \frac{1}{t_1}\left\{C_o + C_p S_1(0) + C_p S_2(t) + C_h \int_0^{t_1} S_1(t)\,dt + M_f S_1(0) + M_f S_2(t) - S_c \int_0^{t_1} S_2(t)\,dt\right\};$ ...(5)

- Shortage Cost is given as $S_c = -S_c \int_0^{t_1} S_2(t)\,dt$

- $S_c = S_c \alpha P^{-\beta}.t_1(t_1 - T)$ ...(6)

- Ordering Cost $C_o = A$

- Purchase Cost $C_p = C_p S_1(0) + C_p S_2(t)$

- $C_p = C_p \alpha p^{-\beta}(2t_1 - t);$ ...(7)

- Inventory holding cost $C_h = C_h \int_0^{t_1} S_1(t)\,dt$.

- $C_h = -C_h \frac{\alpha p^{-\beta}}{\theta^2} t_1(1 + \theta);$ ...(8)

- Military Escorts transportation $M_f = M_f S_1(0) + M_f S_2(t)$

- $M_f = M_f \alpha p^{-\beta}[2t_1 - t];$ ...(9)

PROBLEM FORMULATION CONT.

- $TC(t_1, T) = \frac{1}{t_1}\left\{A + C_p \alpha p^{-\beta}(2t_1 - t) - C_h \frac{\alpha p^{-\beta}}{\theta^2} t_1(1 + \theta) + M_f \alpha p^{-\beta}[2t_1 - t] + S_c \alpha P^{-\beta}.t_1(t_1 - T)\right\};$ ...(10)

- Hence, the total cost for the World Food Program (WFP) per unit of cycle under partially   backlogged.

- $TC(t_1, T) = \left\{\frac{A}{t_1} + \alpha p^{-\beta}(C_p + M_f) + \frac{\alpha p^{-\beta}}{2}.\theta t_1(C_p + M_f) + C_h \frac{\alpha p^{-\beta}}{2}.\theta + S_c D(t_1 - T)\right\};$ ...(11)

RESEARCH OBJECTIVES

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I. To establish the level of EOQ model for the World Food Program (WFP) on the best ways to handle foodstuffs distribution and the inventory management to the Internally displaced persons camps (IDPs Camps), in Gwoza community, Borno State, Northeastern, Nigeria and other crisis region.

PROPOSE OUTCOMES

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- These studies suggest the best EOQ model and a realistic inventory management of the World Food Program (WFP) on humanitarian services of foodstuffs distributions to various internally displaced persons camps (IDPs) camps in Gwoza Community, Borno State Northeast Nigeria, which is experiencing armed terrorist attacks.

- Further insights on the shortages and backlogged foodstuffs inventory management were seriously revealed in all the internally displaced persons camps in Gwoza Community, Borno State Northeastern Nigeria.

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Thank You!