A MATHEMATICAL MODELLING OF ECONOMIC RESTORATION THROUGH AGRICULTURAL REVITALIZATION IN NIGERIA
(Suatu Pemodelan Matematik bagi Pemulihan Ekonomi Menerusi Pengukuhan Semula Pertanian di Nigeria)

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ABSTRACT

Agricultural sector plays a major role in the economic growth of a nation. Apart from the provision of food which sustains human and animal life, the sector is the highest employer of labour in low income economies. The neglect of the sector due to the discovery of crude oil in Nigeria has led to the decline in the contribution of the sector over the years and an increase in the level of poverty. Based on that, a deterministic compartmental mathematical model was designed to study the least step needed to be taken by the government in the agricultural sector to revive the economy. Following the epidemic modelling approach, an analytic threshold that determined the effect of government effort on agriculture was derived. The model was studied qualitatively using the stability theory of nonlinear deferential equation and then quantitatively using hypothetical values for the model parameters to conduct the simulation. The qualitative result showed that the optimal agricultural output equilibrium of the model was locally asymptotically stable while the quantitative result showed that government effort to revive the agriculture was enough to restore the economy when the threshold quantity $R_I > 1$. The implication of both the qualitative and quantitative results was that a drastic step had to be taken by the government to promote agriculture by allocating enough funds and land to the sector as well as encouraging farmers which would activate economic boom in the long run.

Keywords: agriculture; crude oil; stability

ABSTRAK

Sektor pertanian memainkan peranan utama dalam pertumbuhan ekonomi sesebuah negara. Selain daripada penyediaan makanan yang menampung kehidupan manusia dan haiwan, sektor ini melibatkan pekerja paling ramai daripada kumpulan yang berpendapatan rendah. Berlaku pengabaian sektor ini adalah disebabkan oleh penemuan minyak mentah di Nigeria yang mendorong kepada penurunan sumbangan terhadap sektor ini selama bertahun-tahun dan menyebabkan peningkatan tahap kemiskinan. Berdasarkan isu ini, satu model matematik berpetak berketentuan direka bentuk untuk mengkaji langkah terkecil yang perlu diambil oleh kerajaan dalam sektor pertanian untuk menghidupkan kembali ekonominya. Mengikuti pendekatan pemodelan wabak, satu ambang analisis yang menentukan kesan usaha kerajaan terhadap pertanian telah diterbitkan. Model ini dikaji dengan menggunakan teori kestabilan persamaan pembezaan tak linear secara kualitatif dan kemudian menggunakan nilai hipotesis untuk parameter model secara kuantitatif bagi menjalankan simulasi. Hasil kualitatif menunjukkan bahawa keseimbangan hasil pertanian optimum model adalah stabil secara asimptotik sementara hasil kuantitatif menunjukkan bahawa usaha kerajaan untuk menghidupkan kembali pertanian sudah cukup untuk memulihkan ekonomi apabila kuantiti ambang $R_I > 1$. Implikasi daripada kedua-dua hasil kualitatif dan kuantitatif tersebut adalah bahawa langkah drastik harus diambil oleh kerajaan untuk mempromosikan pertanian dengan memperuntukkan dana dan tanah yang mencukupi untuk sektor ini serta menggalakkan petani-petani yang akan mengaktifkan ledakan ekonomi dalam jangka panjang.

Kata kunci: pertanian; minyak mentah; kestabilan

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