

氏 名	Shitindi Regnard Francis
本 籍 地	TANZANIAN
学 位	博士（経営学）
学 位 記 番 号	営博第8号
報 告 番 号	甲第28号
学位授与年月日	平成22年9月25日
学位授与の要件	学位規則第4条第1項該当
研究科・専攻名	経営・流通学研究科 経営・流通専攻 博士後期課程
学 位 論 文 題 目	FOOD SUPPLY IN TANZANIA BASED ON SYSTEM DYNAMICS APPROACH
論 文 審 査 委 員	主査 教授 朴 容寛
	副査 教授 宮下 國生
	副査 教授 原田 良雄
	副査 教授 新保 博彦（経済学研究科）

### 論文内容の要旨 (Abstract of Doctoral Dissertation)

This Study uses system dynamics modeling and simulation to develop a food supply-analytical tool for the Mpanda district and other rural areas in Tanzania. This is an essential component in the programmatic efforts for solving food supply and agricultural production problems to develop an integrated decision support program. Such a program would assist policy analyses, policy makers, decision makers, and regional resource allocation on food supply and agricultural management in the Mpanda district and other rural areas.

The primary original points and contributions of this study are, first, that my study fully and critically examines and addresses the problem of food supply in Tanzania. Previously the food supply problem was not thoroughly addressed, but this study has shown food supply problems so as to be able and in position to alleviate and eradicate the problems.

This study has contributed a new definition of food supply. Food supply refers to the

availability and accessibility of food at the individual, household, and national levels. The new definition is different from many other previous scholars who, such as Tara, focused on only the availability of food at the national level.

This study uses system dynamics analysis, which is an original analytical method for Tanzania. This study has developed a system dynamics model, the Mpanda system dynamics food supply model (MSDFSM). Based on the model, the study provides new analyses and findings from both the analysis and three Cases of Simulation Modal and analysis and findings of three Cases of Rural Household Agriculture.

This study introduces and argues the idea of forming strong small and medium sized famer groups in rural areas. These groups are unlike previous large cooperative unions and societies, which did not operate successfully. Earlier groups were inefficient and politically oriented and ultimately, they collapsed.

This study also introduces and emphasizes the idea of participation and involvement for both government and private sectors in resolving food supply and agricultural problems through promoting and encouraging domestics and foreign investment for injecting massive capital in the agricultural sector. Such investment avoids leaving all burdens to the government.

This study examines and defines the problem by focusing and emphasizing the impact of the population dependency ratio with relation to the food supply and agricultural problem. The study shows how the population dependency ratio is determined and how it influences the food supply and agricultural sector. The approach is unlike the work of other scholars, such as Michael Todaro, whose main focus is economic development and poverty in relation to the population dependency ratio.

In accordance with the analysis and findings of this study I recommend that in Mpanda district and other rural areas in Tanzania in general the aim is to apply affordable, productive methods of agricultural production. Whenever possible and manageable, mechanized agricultural production should be applied to enable cultivating a large area, applying scientific agricultural methods. Doing so will then improve and increase productivity per unit of land and per laborer.

Furthermore, I argue that to solve food supply and agricultural related problems, it is important and necessary to choose and start with Case II, and thereafter with Case III of the simulation model and marginal returns for rural household's agriculture production

analysis of this study. This is because of the many benefits from applying developed technology, capital accumulation and capital investment, and the combination of labor and land resources.

I stress that the rural transportation infrastructure should be the first priority of government policy implementation. It is because a rural transportation infrastructure will enable sustainable, reliable and effective food supply and resolve other agricultural problems.

Then, I argue that a specific plan for complex agricultural industries is necessary. The plan must address boosting all agricultural producers at all levels by assuring sustainable availability and supply of agricultural equipment, such as production, storage and processing equipment; marketing centers and facilities; and transportation infrastructure in different districts, regions or zones, depending on the potentiality and predicted demand of each area. Both government and private sector can invest in this endeavor.

Lastly I explain the need to identify and control internal migration in Mpanda district and other rural areas, which is caused by migration from neighboring districts, regions, and countries.

### 論文審査結果の要旨

#### (Summary of the Examination Result of Doctoral Dissertation Paper)

This paper, using the system dynamics analysis, examines the food supply problem in Tanzania, especially the food supply problem centering on Mpanda district in Rukwa Region. The results are as follows:

First, food supply is a critical issue in developing countries such as Tanzania. However, existing research, such as econometric and optimization models on the food supply, have not solved the problems and are without promising sustainable solutions. Different from existing research, this study introduces system dynamics to analyze and resolve the problem.

Second, this study reviews the existing research related to the food supply, agriculture, the environment, the social, and the economic and system dynamics modeling and simulation analysis such as the food availability decline (FAD) model of the Food and

Agriculture Organization (FAO) by the United Nations, the food entitlement decline (FED) model by economist Amartya Sen, the basic quantitative tool in agricultural production systems, and modeling techniques.

Third, this study shows through reviewing the existing research, that system dynamics analysis is more desirable to resolve the food supply problem in Tanzania and other developing countries. This study used Vensim software to solve the food supply problem in Tanzania and designed the Mpanda System Dynamics Food Supply Model (MSDFSM) of Tanzania, and performed the simulations. This study reflected changes of many variables that impact food supply in connection with population, agricultural production, and land resources.

Fourth, this study provides three Cases of Simulation Model and Analysis: Case I assumptions are land resources are fixed without technological advancement; Case II assumptions are land resources are fixed with technological advancement; and Case III assumptions are land resources are not fixed with technological advancement.

Fifth, this study presents policy recommendations, which are based on modeling and simulations of the food supply to the various relevant stakeholders.

申請者氏名 シティンディ レギナルド フランシス

## 論文内容の要旨

## 論文審査結果の要旨

本論文は、システムダイナミックス (system dynamics analysis) を活用して、タンザニアにおける食糧供給問題、特にルクワ州ムパンダ県 (Mpanda district in Rukwa Region) における食糧供給問題を分析したものであり、その得られた結果は次の通りである。

まず、第一に、食糧供給はタンザニアのような発展途上国では重要な問題である。しかしながら、食糧供給に関する計量経済モデルや最適化モデル (econometric and optimization models) のような既存研究は、その問題を解決していないし、持続可能なソリューションを提供しているわけでもない。本研究は、このような既存研究とは異なり、システムダイナミックスに基づき、同問題を分析し、その解決策を模索したものである。

第二に、本研究はタンザニアにおける食糧供給、農業・環境・社会と経済問題に関する既存研究、システムダイナミックスモデリングとシミュレーション分析に関する既存研究をレビューしている。例えば、国際連合食糧農業機関 (FAO) の食糧利用可能量の低減 (Food Availability Decline) モデル、経済学者セン (Amartya Sen) に代表される食糧権限低減 (Food Entitlement Decline) モデル、農業生産システムにおける基本的な定量ツール (basic quantitative tool)、そしてモデリング手法 (modeling techniques) などがそれである。

第三に、本研究は、上記のような既存研究レビューを通して、タンザニアをはじめ、発展途上国における食糧供給問題を解決するためにはシステムダイナミックスを用いる方が望ましい結果が得られることを明らかにしている。本研究は、タンザニアにおける食糧供給問題を解決するためにシステムダイナミックスのモデリングソフトウェア Vensim を使い、タンザニアのムパンダ県システムダイナミックス食糧供給モデル (Mpanda System Dynamics Food Supply Model: MSDFSM) を設計すると同時に、シミュレーションを行っている。また、本研究は人口、農業生産、土地資源と関連して食糧供給への影響を与える多くの変数の変化を反映している。

第四に、本研究では三つのケースをシミュレーションモデルとして分析している。第1のケースは技術発展がないまま土地資源も固定されている場合である。第2のケースは技術進展があるが土地資源は固定されている場合である。第3のケースは技術進展があると

同時に土地資源も固定されていない場合である。

第五に本研究は上記の食糧供給に関するモデリング及びシミュレーションを行った結果に基づき、様々な利害関係者に諸政策提言を行っている。

## Findings of the Review Board

The public hearing and the review board were held twice for examination of this paper. The first time was January 19, 2009, and the second was April, 20, 2010. The following comments are from the first public hearing and review board; the food supply prediction in Tanzania is too simplistic because the paper has the somewhat unrefined design of Mpanda System Dynamics Food Supply Model (MSDFSM), and the simulation is too simplistic. More precise analysis about the uniqueness, validity, and practicability of the paper is necessary

Receiving such comments from the review board, Mr. Shitindi Regnard Francis strove for corrections in the paper. He validated his model and developed several scenarios: Case I, Case II, and Case III. The final product from Mr. Shitindi's work is policy recommendations to policy and decision makers based on his analysis and findings such as the requirement of the formation of very strong small and medium sized farmer groups; the importance of the rural transportation infrastructure; the necessity of a specific plan for complex agricultural industries and so on.

The review board accepted this paper as a doctoral dissertation (doctor of business administration) in view of the paper's valuable contributions to the rural economics and resolving the food supply and agricultural problems in developing countries such as Tanzania.

## 審査委員会の所見

本論文の審査のために、公聴会及び審査委員会をそれぞれ2回開催した。第1回目は、2009年1月19日に、第2回目は2010年4月20日に行った。第1回目の公聴会及び審査委員会では、次のようなコメントや意見が出た。本論文におけるモデリング (Mpanda Syatem Dynamics Food Supply Model: MSDFSM) やそのシミュレーションが単純であるので、同モデルやシミュレーションを通して予測したタンザニアにおける食糧供給予測

も単純すぎると言える。従いまして、より洗練されたモデリングやシミュレーションを通して、本論文のユニーク性、妥当性、実行可能性に関する緻密な分析が望ましいと言わざるを得ない。

このような公聴会及び審査委員会のコメントを受け、シティンディ・レギナルド・フランス君は次のように同論文の修正に努めた。すなわち、彼はより洗練されたモデリングを試みると同時に、三つのケースを検討した。また、彼は同分析結果に基づいて、タンザニアにおける食糧供給問題に関する政策担当者や意思決定者達に有効な政策提言をしている。例えば、中小規模の農業集団の形成の必要性とか農村地域における交通インフラの重要性とか複合農業（complex agricultural industries）育成のための特別計画の必要性とかがそれである。

上記のように、審査委員会では本論文が農村経済学の発展に寄与すると同時に、タンザニアのような発展途上国における食糧供給および農業問題の解決に寄与するところが少なくないと評価する。よって、本論文は博士（経営学）の学位論文として価値あるものと認める。