Institutional Capacity Strengthening for the promotion of Financial Mathematics and Financial Engineering in Africa

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"Humanity is going to need a substantial new thinking if it is to survive"

Albert Einstein

Abstract

The prosperity of Africa is superglue to the growth of her economy. Financial Mathematics (FM) and Financial Engineering (FE) are identified as engines for growth. In this paper, strengthening of inter-institutional collaboration is encouraged for effective promotion of the courses in Africa. Institutions should be sharing resources like financial data, library and laboratory facilities. Scholarship should be provided to students to pursue FM and FE courses. Institutions should have relationship with the industry for internship and job placement of their students. The financial industry should provide grants to students and researchers doing research on financial related problems. Above all, there should be a kind of lattice relation wherein the universities, financial institutions and research centres are bound together by institutional collaborations.

Keywords: Finance, Mathematics, Engineering, collaboration, research, economy, data and resources.

1. Introduction

Worldwide the demand for quantitative analysts and financial engineers are very high but the supplies are still very low. Therefore, there is the need for universities to produce more graduates to meet-up with the manpower needs in the financial industry in Africa.

Financial Mathematics is the application of mathematics methods to find solutions to financial problems. The course is all about production of professionals who will use the knowledge of mathematics and apply it in making rational decisions in capital and money markets. They are to formulate, analyse and estimate advances in market, use the econometrics, option pricing computations, and finance and microstructure model. Moreover, they are to solve problems arising from managing pension and endowments of funds, risk management, sale and buying of shares and bonds etc([4-7]).

Financial Mathematics prepare students for roles as "quarts" quantitative analysts specifically trained for analysis, structuring trading and investments on derivatives and income, hedging and managing of market and credit risks[11].

Financial Engineering (FM) is the use of technical tools in finance. Investopedia [6] explains FM as: the use of mathematical techniques to solve financial problems.FM uses tools and knowledge from the field of computer science, statistics, economics and mathematics to address current financial as well as to devise new and innovative financial products. From this it is obvious that the work of a financial engineer is to develop and manage hardware for solving financial problems e.g. applicable program interface (API) which are being use by banks and exchange markets to link them together to share resources[9].

2. Historical perspective on Financial Mathematics and Financial Engineering

The first quantitative finance master programme was offered by Illinois Institute of Technology[6] in 1990,the Institute offered master in 'quantitative finance' and masters in financial markets and trading, NYU [7] was second and offers Financial Engineering degree; master of computational was introduced by Carnegie Mellon in 1994[2].

The Financial Research University of Cambridge (FRUC) was founded in 1996[4] and was based in the statistical laboratory at the Centre. It offers a dynamic environment in financial mathematics using interdisciplinary approach with experts in stochastic control, numerical analysis, monte-carlo methods. FRUC is noted to be one of the institutions in the world which offers lively interactions between students and lecturers.

In Nigeria, the idea of introduction of financial mathematics was conceived in 2004 and the programme started in 2005 as joint collaboration between the National Mathematical Centre (NMC) Abuja and the University of Abuja (Uniabuja)[8].So far many M.sc and postgraduate diplomas in Mathematics of Finance of Uniabuja have being awarded to students.

In Africa very Institution offer FM and FE courses from information available on the web. The cluster of Institution offering FM and FE courses are around Nigeria and South Africa universities. Three encouraging

Universities are The Jomo Kenyatta University of Agriculture Kenya, Nigerian National Open University and the Nigerian Turkish Nile University Abuja that are offering Financial Mathematics at undergraduate level. Although there may be more universities offering the courses in Africa that not captured here because information on them are not available online [10].

Table 1: Some Universities in Africa offering Financial Mathematics and Financial Engineering Courses (see [9],[8],[11]&[13])

S/No	Country	University	Degree offered
1	Nigeria	University of Abuja	M.sc and PGD in Financial Mathematics
2	Nigeria	University of Ibadan	M.sc & Ph.D
3	,,	National Open University	B.Sc & M.sc
4	,,	Nigerian-Turkish University Abuja	B.sc
5	,,	Abia State University	M.sc & Ph.D
6	,,	University of Nigeria ,Nsukka	M.sc & Ph.D
7	South Africa	North-West University, Potchefstroom	M.sc Quantitative Risk management
8	,,	University of Cape town, Cape town	M.sc in Financial Mathematics
9	South Africa	University of Pretoria, Pretoria	M.sc Financial Mathematics
10	,,	University of Stellenbosch, Stellenbosch	M.Comm in Financial risk management
11	,,	University of Witwatersrand, Johannesburg	M.sc Financial Mathematics
12	Kenya	Jomo Kenyatta University of Agriculture	B.sc Financial Engineering

2. Institutional Collaboration

For effective running of financial mathematics and financial engineering in Africa, the Institutions providing services in these areas need to be strengthened. Some kind of lively interactions need to take place among the institutions; there should be some kind of well articulate synergies developed among them to form a lattice or triangular relationship.

In Europe, America and Asia there are several Institutions offering FM and FE courses but very few are offering FM and FE courses. There several evidences of well galvanized inter-institutional relationship in the West and Asia. Africa needs to replicate such it here in their institutions (see [2],[4],[6]&[7]).

Some Nigerian and South African institutions have some evidences of well galvanized inter-institutional relationship, for Examples, National Mathematical Centre Abuja jointly run M.Sc financial Mathematics with University of Abuja (Uniabuja)which awards the degrees to the students[8]. Moreover, there is also BSc (Honours) in Mathematical Finance in South Africa. This honours degree programme is run jointly by Stellenbosch University (SU), and the African Institute for Mathematical Sciences (AIMS)[1]. Students will receive the degree from Stellenbosch University.
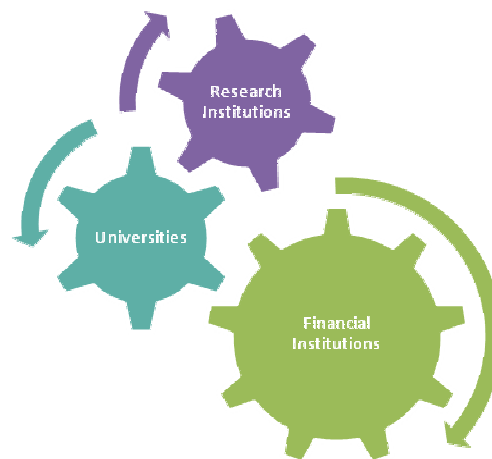
Fig.1: Inter-institutional collaboration

4.Areas of focus for interactions

- Academic mentoring of students
- The universities need to run the programmes using interdisciplinary experts in the universities, research institutes and financial institutions like banks, mortgage houses, and insurance brokers to train the students.
- Scholarships to Students: The government, research institutions and universities should provide scholarships to students to pursue degrees in financial mathematics and financial engineering. Such scholarships should cover tuition fees, living expenses or stipend and grants for buying books and payment of page charges for publications of journal papers.
- Recruitment of graduates into financial industry: The University should have a stand-by arrangement or plans with some selected financial institutions whereby their graduates can possibly take-up appointments after graduation. This will encourage more students to opt for financial mathematics as a career.
- Provision of grants for Research and Development: the financial institutions like banks, mortgage houses etc should offer grants to researchers working on finance related problems. Moreover, the government, research institutions and grant awarding institutions should be encouraged to offer grants to researchers working on specific or special research topics in financial mathematics and financial engineering.
- Inter-institutional research and support services: The universities, research Institutes/Centres and financial Institutions should be best of friends. They can jointly embark on a research problem; provide the funds, environment and support services to proffer solution to the problem. Staffs and students should be allowed to make use of their facilities such as laboratory and data for simulation without any hindrance. The use of information in individual library in form of printed and online resources should be accessible to other Universities/Centres from remote places in Africa.

Economists have long puzzled over why economies across much of Sub-Saharan Africa still lag behind. Two researchers, Stephen Broadberry and Leigh Gardner, have come up with a new explanation. Many economies across Sub-Saharan Africa resemble those of medieval Europe, they argue, not just because GDP per capita is comparable (adjusting to 1990 prices), but also because they lack the political institutions to sustain economic growth. And just like Medieval Europe, African economies experience sporadic spurts of growth, followed by economic reversals [12].

The World Bank has identified about seven countries in Africa among the ten fastest growing economies in the world. But the demographics, with young populations in most countries seeing increased urbanisation, are stacked in Africa's favour in attracting sellers of consumer products, especially as markets stagnate or shrink in some developed markets already saturated with products. According to management consultancy Accenture, consumer expenditure in sub-Saharan Africa is expected to grow from $600 billion in 2010 to nearly $1 trillion by 2020([3]).

Furthermore, the growth rate of economies in the African region is also expected to be double that of the global economic growth rate during the same period. Hence, financial mathematics and financial engineering must be encouraged in Africa to actualize the World Bank analysis and to develop institutional framework to manage investment and economies of the continent.

Let use this opportunity to quote Gorge Polya, a mathematician who once said "problem solving means finding a

way out of a difficulty, a way around an obstacle, attaining an aim which was not immediately attainable in the solving problem, he ended; it is specific achievement of intelligence, and intelligence is the specific gift of man" Polya mentioned intelligence being specific to man which is the acquisition of new knowledge and utilization of the knowledge to solve problems. Truly speaking, apart from health, next problem confronting Africa is finance. We must acquire new ways of thinking as Einstein said .For the nation of Africa to be financial autonomous from neocolonialism. We need to invest on education especially on financial mathematics and financial engineering courses.

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