

# **The Place of Technology Based Incubators in Ghana's Economic Development**

A Paper Presented by

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## **Abstract**

A persuasive argument can be made that economic development is the most important challenge facing the peoples of Africa and that Technology Based Incubators can play an important role in tackling that challenge. Despite the immense progress that has been made throughout the world in improving the quality of life through applications of technology, a large proportion of the peoples of Africa still live on less than \$1.00 per day income. Progress in education, health, nutrition and environmental protection, although not nil, has been slow in African countries. This presentation will deal with the role that Technology Based Incubators can play in enhancing the quality of life in Africa and its place in Ghana's economic development. The first part of the presentation will be a brief survey of recent advances in Technology Based Incubators with the potential for impacting the economic development of Ghana. The presentation will then proceed to outline specific applications of Technology Based Incubators and the contribution it has made to the economic development of some developed countries. Having made a case that Technology Based Incubators can be adapted to enhance Ghana's economic development, attention will be turned to specific recommendations pertaining to the role of universities, governments and industries *vis-à-vis* that of the international scientific community in nurturing the appropriate atmosphere for Technology Based Incubators to thrive in Ghana. Questions of intellectual property protection will also be discussed.

## Introduction

It is scientific and technological advances that manufacturing industry relies upon for much of the competitive edge it must have to be able to thrive, or simply survive, in the global markets of today. A persuasive argument can be made that development is the most important challenge facing the human race and that science and technology have the most important role in tackling that challenge. The seven most industrialised democracies of the world, without major resources, except in few cases, import minerals and other industrial and agricultural raw materials and process them through well managed technologies to produce virtually everything around us. On the other hand, Africa, with the largest mineral reserves, in many cases, and the largest biomass potential but without any significant knowledge in how to manage technology, contributes less than 2% of world industrial output and generates very poor gross domestic products.

To reverse this trend, African countries must build innovation-based economies using technology based incubators. This will stimulate industrialization and increase wealth. What needs to be considered is the current direction that our international thinking on economic development is taking.

At one extreme, advocates of the neo-liberal consensus hold that macroeconomic reform and economic liberalization are **all** that is necessary. However, **many** now recognize this is an incomplete recipe - there is a dynamic and a down side to this on-going paradigm. These do need attention. Nobody is calling into question the value of the current paradigm - only its claim to completeness as an economic and social remedy for Africa.

The typical dynamic is that the initial improvement following the introduction of structural adjustment programmes is not sustained. The surge of capital inflows in the form of aid and private capital, the improvements in growth of GDP, of manufacturing value-added (MVA) and export earnings proved temporary - later slipping back towards previous levels, or even lower. Ghana's experience illustrates this.

## Ghana's Economy: *Macro-Economic Context*

Ghana's economy is predominantly agrarian and commodity-based, with agriculture dominating in terms of employment, revenue and export earnings. It accounts for 50 % of the labour force and 42 % of GDP [1]. Other major exports are minerals (notably gold, diamonds bauxite and manganese). The Tourism industry is however becoming an important foreign exchange earner.

Ghana is one of Africa's leaders in engaging low tariff-based protection and free trade. Massive depreciation, removal of quantitative restrictions on imports, reductions in corporate taxes and capital gains taxes, removal of price controls, abolition of credit ceilings, privatization of state-owned companies, revision of the investment code and granting of incentives to exporters and investors in infrastructure, combined to give Ghana a stable, open and liberal economy by the early 1990s. Studies however showed that initially MVA did rise[2]. This was because imported inputs were suddenly available to industries that previously suffered excess capacity. Nevertheless, as liberalization spread to other imports, and excess capacity was used up, the exposure to world competition led to a steady deceleration of industrial growth.

The sharp, then less rapid, decline that followed the initial rapid growth meant that Ghanaian manufacturing was not taking off in response to the economic and trade reforms. Ghana's employment in manufacturing also peaked before dropping back to a third of its peak level. Equally, significant, foreign investment did not respond: Ghana saw no increase in annual FDI flows after the structural adjustment programmes[2]. In addition, what little there was went to mining and agriculture rather than manufacturing. Domestic investment did pick up slightly, but not enough to influence manufacturing growth. On the plus side the number of small firms did rise in response to adjustment. They were concentrated, however, in low-productivity activities aimed at local markets, sheltered from international competition. The industrial sector that actually suffered most was the modern, large-scale part. The reason: it depended on more complex technologies, and was therefore vulnerable to lack of in-house and in-sector technological capability needed to respond to increased competition. The generally low level of technological capabilities in Ghana at the time of the adjustment meant that rapid liberalization which was unaccompanied by supply-side measures to develop skills, capabilities and technical support, led to significant and costly de-industrialization.

What Ghana's experience shows is that macroeconomic stabilization is not enough on its own. It needs to be prepared with complementary micro-economic policies and strategies. Ghana needs to build an innovation-based economy. In an "innovation-based economy", investment in R&D is the primary driver of business growth and success. Innovation-based companies invest 10% to 20% or more of their gross sales in human capital (R&D and training) [3]. In contrast, commodity-based resource businesses commonly invest less than 1% in R&D. Ghana's current level of investment in R&D is between 0.3–0.5% of GDP. This has left large investment in fixed capital and equipment and acquiring natural resources at risk from boom and bust cycles fuelled by global commodity market fluctuations.

## 2.1 Country Profile

**AREA 238, 537 sq. km**

### Demographic

Population (2000)	18.8 million
Population growth	2.6%
Rural Population	66%
Pop. Below 18 Years	46.9%

MACRO-ECONOMIC			
	1999	2000	2001
GDP per capita (PPP US\$)	1,881	n/a	n/a
Per capita income (US\$)	390	360	n/a
GDP Growth (%)	4.4	3.7	4.0
<b>GDP by Sector (%)</b>			
Agriculture	36.5	38.75	37.26
Industry	25.2	26.1	26.9
Services	29.2	30.7	32.3
Inflation (CPI) (%)	13.8	40.5	23.1
Depreciation (%)		91.5	3.6
Lending Rate (%)	36.5	43.5	35
BOP Deficit (US\$ mi)	93	195	38.4
External Debt (US\$ bi)	6.08	5.9	
Fiscal Deposit as % of GDP	6.5	3.5	2.6
Broad Money Supply (% increase)	16.1	47.6	34.5
Exchange rate	3,443	7,500	7,200
<b>MAIN RESOURCES</b>			
Cocoa, Gold, Timber, Diamonds, Bauxite, Manganese			

Source: UNDP in the Republic of Ghana



## HEALTH

Life expectancy	56.6 yr
Male	48.0 yrs
Female	53.8 yrs
HIV Prevalence Rate	3.0%
Fertility rate (1999)	4.5%
Mortality rate (Crude)	10.5 per1000
Infant Mortality	63 per 1000
Child Mortality	186 per 1000
Maternal Mortality	210/100,000
Pop with Access to sanitation Facilities	63%
Pop. With access to potable water	64%
Pop. With access to Essential drugs	44%
Public Exp. on Health as % of GDP	1.8%

Source: UNDP in the Republic of Ghana

## **EDUCATION**

Adults literacy rate	54%
Male	62%
Female	38%
Gross Enrolment Rate (Primary)	72.5%
Gross Enrolment Rate (Primary, secondary & tertiary)	42 %
Public Education expenditure As % of Govt. Expenditure	19.9%
HDI rank	119
HDI Value	0.542

**Source: UNDP in the Republic of Ghana**

## 3.0

### Recent Advances in Technology-Based Incubators

A business incubator is an economic development tool designed to accelerate the growth and success of entrepreneurial companies through an array of business support resources and services[4]. A business incubator's main goal is to produce successful firms that will leave the program financially viable and freestanding. These incubator "graduates" create jobs, revitalize neighbourhoods, commercialize critical new technologies and strengthen local and national economies. Critical to the definition of an incubator is on-site management, which develops and orchestrates business, marketing and management resources tailored to a company's needs[5]. A proven model, Incubators usually also provide clients access to appropriate rental space and flexible leases, shared basic office services and equipment, technology support services, and assistance in obtaining the financing necessary for company growth. It provides entrepreneurs with the expertise, networks and tools they need to make their ventures successful. Incubation programs diversify economies, commercialize technologies, create jobs and build wealth. Traditionally, non-profit organisations and universities ran business incubators. But now research scientists, lawyers, accountants and other business professionals are eager to get in on the action. Today, there are almost 3,000 of them worldwide, with more than 900 in the U. S. alone[6]. That is up from just 12 in 1980. In fact, more than half of all incubators have opened since 1992. About 40 percent of incubators today are focussing on technology, compared with 25 percent in 1998[7].

### **3.1 The Israeli Example**

Israel's development of an entrepreneurial high-tech economy over a few short years and against immense odds is a remarkable achievement. In its early years, the Israeli economy was micro-managed by the government, which not only controlled companies but also imposed strict rules on the capital markets, trade, land development and labour relations[8] - hardly the kind of environment in which free-wheeling high technology is supposed to flourish. Although there has been substantial liberalization in recent years, by Western standards, the Israeli government continues to be interventionist[8]. Why then has high technology thrived in Israel? The first reason is the application of a national policy of not merely focusing on the development of high technology by backing research programs, but positively encouraging the development of technology start-up companies and letting business people rather than bureaucrats set the R&D agenda. The government has a range of programs to support technology, from incubators to aid start-up companies, cooperative programs to foster basic R&D, and research subsidiaries for established companies[9]. For a few years, the state even operated a venture capital fund. What these programs have in common is an emphasis of letting the private sector set its own R&D agenda and insisting that it assume at least part of the risk.



<b>I. Impact/Outreach</b>	<b>II. Effectiveness</b>	<b>III. Sustainability</b>
<b>1. Enterprises created</b>	<b>7. Employment per net \$ subsidy</b>	<b>•Revenue surplus (6 years)</b>
<b>2. Survival rate of enterprises</b>	<b>8. Taxes paid per net \$ subsidy</b>	<b>•Services cost recovery</b>
<b>3. Jobs generated (6 years)</b>	<b>9. Income, sales &amp; exports generated</b>	<b>•University-business relations</b>
<b>A. in incubated/affiliated firms</b>	<b>10. Research commercialized</b>	<b>•Stakeholder satisfaction</b>
<b>B. in graduated firms</b>	<b>11. Disadvantaged groups addressed</b>	<b>•Tenant/graduate satisfaction</b>
<b>C. indirect jobs</b>	<b>12. Incubator expansion</b>	<b>•Changes in culture</b>
<b>4. Entrepreneur/enterprises reached</b>		<b>• Enhancement of skills</b>
<b>5. Replication of "pilot" model</b>		<b>20. Leveraging state policies</b>
<b>6. 'Extra-curricular' activities</b>		<b>21. Enhanced self-esteem</b>

*Source: International Labour Organization Employment Sector*

## 4.0

# Building An Innovation-based Economy in Ghana through Technology – Based Incubators

## 4.1 Ghana's Science & Technology Policy

### 4.1.1 Vision

The National-Science and Technology Policy of Ghana is to support national socio-economic development goals with a view to lifting Ghana to a middle income status by the year 2020 through the perpetuation of a science and technology culture at all the levels of society, which is driven by the promotion of innovation and the mastery of known and proven technologies and their application in industry, and other sectors of the economy.

The Science and Technology Policy Statement is based on the notion and view of the future where all Ghanaians, young and old alike, will enjoy a higher and sustainable quality of life, participate in a liberal competitive economy by means of a fulfilling employment, and share in a democratic culture that tolerates all views[11].

#### 4.1.2 Goals

In order to realize the Science and Technology Vision, it is essential to set achievable goals for the creative use and efficient management of science and technology in Ghana.

These goals include:

- i. The establishment of a well coordinated and integrated system of science, technological and social innovation within which:
  - a.) the private and public sectors can collaboratively forge partnerships and creative interactions to benefit themselves and the nation at large; and
  - b.) all stakeholders are part of a more inclusive and consultative approach to policy decision – making and resource allocation for science and technology activities;
- ii. the encouragement of a culture within which the advancement of scientific knowledge is valued as an essential component of national development; and
- iii. improved support for all kinds of innovation which are fundamental to sustainable economic growth, employment and socio-cultural development.



### **4.1.3 Objectives**

The basic objectives of the Science and Technology Policy are:

- i. to seek to master scientific and technological capabilities;
- ii. to develop infrastructures which will enable industry and other sectors of the economy to provide the basic needs of society and for the citizenry; and
- iii. to adopt a science and technology culture.

### **4.1.4 Long-Term Objectives**

In the long-term, the main objectives are to acquire endogenous science and technology capabilities appropriate to national needs, priorities and resources, and to create a science and technology culture whereby solutions to socio-cultural and economic problems of the individual, the community and the nation are recognized and sought within the domain of science and technology[11].

### **4.1.5 Medium-Term Objectives**

In the medium term that is within the first 10 years of implementation, the objective is to accelerate the promotion of innovation through the development and utilization of modern scientific and technological capabilities to provide the basic needs of the citizenry and to compete ably in the global market[11].

#### **4.1.6 Short-Term Objectives**

In the short term that is within first 5 years of implementation, the government will restructure the entire science and technology machinery, infrastructure and programmes in order to make them more responsive to national needs and priorities in all sectors of the economy. To that end, emphasis will be placed on:

- i. restructuring of the National Science and Technology Advisory system;
- ii. improving basic and applied research infrastructure;
- iii. restructuring the teaching of a critical mass of middle-level technical personnel to address the provision of basic needs to food. Shelter, health, clothing, energy, etc., and to enable the citizenry and the nation to participate in a competitive global economy;
- v. acquisition of skills in high technology areas and their integration in industry.
- vii. initiation of mastery of known technologies and their application in industry.

#### **4.1.7 Guidelines**

The effective implementation of the Science and Technology Policy will be guided by:

- i. the need to critically examine areas and programmes of relevance to the country's development and use the most cost-effective means to achieve the desired results;
- ii. a multi-disciplinary and cross-sectoral approach to problem-solving; and
- iii. a conscious collaboration and interaction with stakeholders as partners

#### **4.1.8 Policy Measures**

In order that science and technology will have the desired impact on society, it must be propelled by an unfettered commitment from Government, private sector and the population at large. Government will, therefore, take a number of actions to ensure that the nation derives maximum benefits from the application of science and technology.

Specifically, Government will:

- i. create the enabling environment and advocacy for the promotion of science and technology as key factors in Ghana's development process;
- ii. promote the development and utilization of science and technology capabilities, including entrepreneurial skills development;
- iii. promote science and technology capacity building;
- iv. encourage the improvement of the quality of research and development (R&D) activities, especially within private sector institutions;
- v. Strengthen national engineering design capacity activities;
- vi. strengthen the protection of intellectual and innovative property rights;
- vii. ensure environmental sustainability;
- viii. promote participation of women in science and technology;
- ix. safeguard the generation, use and application of science and technology;
- x. promote international and local co-operation and linkages;
- xi. promote a science and technology culture; and
- xii. establish mechanisms for the finance, management and evaluation of the performance of science and technology.

## 4.2 Technology based Incubators in Ghana

To date Ghana has not had any experience with the business incubator systems[12]. However, there are significant reasons why there should have been business incubators already. The economic regime as described earlier demands a conscious promotion of small-scale enterprises as the backbone of the industrialisation process. Incubators are also effective vehicles for the diffusion and commercialisation of technology. Moreover, there is an infrastructural base that can easily help in setting up incubators. A proposal for the establishment of a technology base incubator has been prepared and a large track of land for its establishment was acquired. Unfortunately, the grant for its establishment did not come from USAID as it was initially agreed on.

Ghana has been able to establish an industrial complex, which would absorb the newly hatched companies. The Nigerian experience makes this more important, where after the incubation period of three years some of the companies are left on their own. Due to lack of capital and isolation from other entrepreneurs and professionals the businesses fail. It is like leaving newly hatched birds to the mercy of the weather. So with the industrial complex in place and although being under utilized, Ghana is ready for the establishment of technology based incubators.

The businesses being incubated today are at the forefront of developing new and innovative technologies — creating products and services that improve the quality of our lives — on a small scale today, and on a much grander scale tomorrow, and Ghana cannot be left out. Ghana's future prosperity and quality of life must be built on an "innovation-based economy", founded on technology-based incubators.

The primary role of government in achieving this vision is to:

- a. provide an environment in which innovative businesses can thrive and grow,
- b. fund R&D infrastructure in strategically important niches,
- c. provide for trained people in strategically important niches, and
- d. support leading-edge, excellent research in Ghana universities.

## 5.0

### **Nurturing the Appropriate Atmosphere for Technology – Based Incubators to Thrive in Ghana**

#### **5.1 The Role of the Government**

For Ghana to build an innovation-based economy founded on high-tech incubator system the nation will have to:

1. Implement tax and regulatory policies to ensure that Ghana is:
  - a.) competitive with leading countries and other African countries in attracting, growing and retaining R&D intensive, high-knowledge businesses, and
  - b.) the home to a vibrant, effective venture capital industry;
2. Increase support for the education and training of the highly qualified people necessary to meet the needs of businesses in the "innovation-based economy";
3. Ensure sufficient industry funding for sustainable resource development and resource value added R&D for the industries developing crown resources: energy and forestry.
4. Actively recruit key companies of sufficient size to create critical mass in R&D intensive clusters such as agro-food, information technology and telecommunications

5. Expand and target Government investment in Science and Research to:

- a.) renew and expand the country's R&D infrastructure,
- b.) increase support for university-based science and research,
- c.) increase the level of targeted national R&D investments to promote the development of sustained, world-class research excellence in strategically important areas, which include,
  - \*information technology
  - \*telecommunications and wireless technology
  - \*energy production
  - \*chemicals and plastics
  - \*sustainable forestry and value-added forestry products
  - \*agriculture and value-added agriculture products
  - \*life science, biotechnology, health, and medicine
  - \*environmental technologies
- d.) increase the effectiveness of the technology linking and commercialization infrastructure; This includes expanding the network of public and private institutions that support industry requirements for applied R&D, technology transfer, and knowledge prospecting and acquisition.



## 5.2 The Role of the Universities and R&D Institutions

Across the U.S., universities are becoming an increasingly powerful force in today's high-tech economy -- producing graduates who set up companies near campuses and attracting far-away firms intent on tapping into local talent[13]\*. Experts say that the incentives for universities to think commercially are manifold -- from their share of licensing payments, to the jobs created for graduates, to industry grants for research and even the ability to recruit professors who want a chance to get rich outside the classroom[14]\*. Ghanaian universities can do the same. The benefits are two-fold; helping to build and nurture technology based incubators and also stop the over reliance on government for funding by generating their own income.

The role of R&D institutions are of increasing importance. Over the years the R&D institutions have performed their functions in a rather conservative manner. The restructuring of the CSIR – the core institution for R&D–has given rise to a re-orientation to demand-driven activities. Commercialization has become the the cornerstone of its functions. Thus there is the need for more business-like promotion of CSIR technologies, and this could be achieved effectively only through the use of incubators.

### **5.3 Intellectual Property Protection**

In today's dynamic and competitive business environment, Intellectual Property (IP) rights are key elements needed to maintain a competitive edge in the market. Intellectual property is a business asset, an integral part of the business process[15]. Effective acquisition, management, and protection of intellectual property can mean the difference between success and failure in businesses today. However, the administration and enforcement of intellectual property rights in developing countries must be seen in another dimension to the administration of intellectual property rights and their enforcement in developed countries. We in the Third World also should not see the observance and enforcement of intellectual property rights as merely protecting the interests of the developed world, but rather as a powerful tool to galvanize our domestic industry while retaining national culture, national inventiveness, and national creativity. To build an innovation-based economy intellectual property rights protection is paramount.

## 6.0 Conclusion

Innovation-based economy and prosperity are strongly linked. Investment in science, research and technology development is critical to the success of Ghana within the global economy. Research and development sustain and propel economic activity to higher levels by improving efficiencies, production and profitability.

Technology based incubators will have an important impact on the lifestyles and well being of Ghanaians. Economic growth based on the innovation system stimulated by science and research has many benefits to society including increased employment opportunities and improved social services. In addition, many significant advances in areas such as health and environmental protection are based on Ghana's long-term investment in science.

Science and the technology flowing out of research have already had a significant impact on the development of the economy of the nation and the overall welfare of Ghanaians. Although Ghana has abundant natural resources, successful resource development depends on technological advances to overcome significant barriers. Ghana's future prosperity depends on the nation's ability to develop her most important resource, **knowledge** and people. Science and Research will play an even more critical role in the development and building an innovation based economy in the country through the establishment and proper management of "Technology Based Incubators".

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