

## **A Framework towards Technology Creation in Africa: Focusing on Ghana**

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### **Abstract**

Underdevelopment in Africa has been historical and a global concern coupled with the quest for good governance. Several efforts have been made in academia, national governments, the international community, and other institutional arrangements to reverse the trend. These efforts however are yet to produce a lasting result as Africa is still characterized by low productivity output, poverty and a widening technology gap when compared to other developing regions of the world. Conventional approaches used to address the African problem have consistently been devoid of indigenous technology development. Technology is here seen as paramount to every form of production on which an economy is based. This study is therefore aimed at developing a sustainable technology development framework for the production industry in Africa that focuses on Ghana for socio-techno-economic development. The study confirmed the absence of a framework for technology development in Ghana and therefore, proposed one for Africa. Using data from Ghana, the focus therefore is on manufacturing of production technologies for local industry.

*Keywords:* Africa, Ghana, socio-techno-economic development, technology creation.

### **Introduction**

This paper is part of an extensive work of a recently concluded PhD study that examined developing the African economy through the manufacturing of production technologies. Good governance is however the underlying factor when creating the required environment. Governance is indeed of utmost necessity to the development of any nation. As expressed by a one-time president of the World Bank, “Governance is linked to economic development” (Conable, 1991, p. 12). It provides the platform for dialogue, where development in commerce, science and technology can take place. Good governance is however extremely difficult in the face of poverty, deprivation and unemployment, especially among the youth (Barclay, 2010). This is however not to say that good governance is only possible in a prosperous economy, but rather, they augment each other.

Enhancing productivity for economic growth requires the application of technology at every stage. It is therefore the single most pronounced tool, cutting across all industries for the production of goods and services for wealth creation in any economy (AMT, 2013). However, the issue of technology is not treated with much significance in African countries’ policies (Lall &

Kraemer-Mbula, 2005). Indeed, historians have shown how Africa is historically known to eschew all forms of rotary mechanisms and is selective in adopting prevailing technologies for technical change (Austin & Headrick, 1983). On that note therefore, this paper seeks to contribute to the topic through the development of production technology in Africa for local industries. This is to create jobs for sustainable socio-techno-economic development of the continent.

Owing to the chronic and complex nature of the problem, this paper approaches the topic by developing a three-step methodological approach as a framework for implementing the development projects in Africa. This framework was derived from the concept of *rhythm* by Clemens and Dalrymple (2005). It allows the project to be culturally integrated with African society. To identify the three-step approach, a mixed-research methodology was employed (Johnson et al., 2007; Mackenzie & Knipe, 2006) consisting of ethnography (Wolcott, 1990), grounded theory (Corbin & Strauss, 2008, 1990) and case-study (Yin, 1984; Zainal, 2007).

The result of the study, among other things, confirmed the absence of a framework for technology development in Ghana, and the issue of technology creation for local industry was not given any priority attention. Government policies were rather geared toward obtaining loans from International Agencies to develop high-level technology to catch up with the technologically advanced countries. On the other hand, local producers and enterprises have craved the use of technology to enhance their production methods, but are unable to afford the cost of existing technology.

A technology development model was therefore proposed drawing on the work of Sagasti, (1992) as the framework for its construction. The model is to operate as a business entity to see to the manufacturing and to supply of production technologies to the local industry. It will adopt the operations of the Ghana Cocoa Board (Cocobod) as its model. This is to stimulate a drive towards the technology development in Ghana for economic growth. The model has the potential for application in other African countries and beyond.

### **Study Rationale and Literature Review**

The relevance of good governance is undisputable for any society. Africa, for centuries, has been engulfed by historical and modern encumbrances. The historical burdens, as in migration, adaptation, invasion, slavery and colonization (Charles & Mamattah, 1978; Davidson, 1992; Davidson et al., 1965), have been coupled with modern challenges inherent in efforts at maintaining good governance of a statehood (Davidson, 1991; Herbst, 2000) in the face of high competition driven by technological advancements and innovations (Lall & Pitroballi, 2002).

The work of Levine (2013) to come to terms with these challenges from the perspective of Ethiopia proposes a *structural opening*, which “requires disinterested analysis to identify the options available in a situation, in order to enable actors to transcend the inertia and passions of the moment...” (Levine, 2013, p. 5).

This is understood to imply taking on a neutral *objectivity* towards analyzing the African problem for its resolution to attain a *realist* outcome. It could be confirmed that such an approach is laudable by analyzing a specific situation like the African problem, and soliciting various

opinions, as such: it may begin with the concept of identification as a point of departure, as deduced from Levine (2013). However, for the chronic and complex nature of the state of African technological narratives (Austin & Headrick, 1983), some authors suggest it requires a combination of factors in addition to “identifying” to have a well laid out list of recommendations (Moges, 2013). This is in view of the highly diversified multicultural and ethnic backgrounds of African society (Lewis, 2009) coupled with its historical seeming avoidance of technological advancement or technical change (Austin & Headrick, 1983; Edgerton, 2008). Indeed, it is technical change that accounts for the revolutions in human civilization (Khalil, 2000), yet, it is underplayed in the African context. Austin and Headrick (1983) have blamed it on the African culture itself, a stance contested in this study.

What may be referred to as culture is probably what Levine alludes to as “rationalizing personal conduct in everyday life” (Levine, 2013, p. 16). This personal rationalization of conduct could be fundamental to achieving any set of desired output, but culture, though not cast in stone, hence, not immutable (Beall & Ngonyama, 2009), determines the flow as in *acceptance* or *rejection* of a new idea (Adam & Cohen, 2009). Except, there can be a change in mindset. The collection of “programmed mindframe,” or behaviors that define a culture, (Hofstede, 1984) is not displaceable overnight. It is highly engrained in the structure of a society and defines its unique identity and dimensional traits (Hofstede, 1984, 2011). Thus, how to imprint a set of recommendations as the ideal response to a situation bordered within a rooted culture may be faced with the challenge of its practicability. It may be argued that the action (behavior, attitude, mindset) of a person is influenced by surrounding circumstances that invariably define the culture of the locality. This notion of culture, to a very large extent, elaborates on the technology stance in Africa as a means of discussion and analysis, but not as suggested by Austin and Headrick (1983) who portray African culture as the cause of its technological drawback.

The political atmosphere under which such aspiration could be achieved has however been very daunting. This can be seen from African history, where since the 1960s, the majority of sub-Saharan African nations gained independence (Davidson, 1992; Herbst, 1997, 2000). The indicators of good governance seen in the political atmosphere have been very unstable, impacting negatively on the economy. For example, Conable (1991) established that the development of many African countries has been unnecessarily constrained by their political instability, stating; “the political uncertainty and arbitrariness evident in so many parts of Sub-Saharan Africa are major constraints on the region's development” (Conable, 1991, p. 12).

Governance, undoubtedly, forms the defining mark in a nation’s development and poverty alleviation (Moges, 2013). The case of Ghana, as an example, demonstrates the direct relationship between political stability and economic growth.

### **Ghana’s Political History and the Economy**

The political history of Ghana serves as an example of the relationship between governance and performance of a national economy. Historians like Warner (1960), Davidson (1972), July (1968) and many more have praised Ghana’s pre- and post-colonial political and economic

progress. It can be seen that at the time of their writings, Ghana had just emerged from colonial rule in 1957 as a young nation gaining independence. As described by the authors, Ghana was the wealthiest African nation at that time with an impressive political and economic start. It was the leading producer of cocoa and gold, and had a good supply of timber reserves and satisfactory human resources (Warner, 1960). The story however did not remain that beautiful for very long. Ghana was soon plunged into a period of power struggles leading to a lengthy period of political upheavals, economic turmoil and social instability.

The following is a brief historic narrative of Ghana's political and economic struggles. After independence (6 March 1957) and under the rule of the first president, Dr. Kwame Nkrumah, the economy of Ghana was described as impressive as earlier indicated. It was registering a positive growth rate of about 4% until the country was declared a one-party Socialist State. The declaration coincided with an immediate economic decline (Figure 1) as the growth rate began to fall from 1964 to 1966. Dr. Nkrumah was overthrown in a coup d'état by the police and military joint forces (Botwe-Asamoah, 2005). A National Liberation Council was formed by the then leaders, Lt. Gen. Joseph Ankrah and Lt. Gen. A. A. Afrifa.

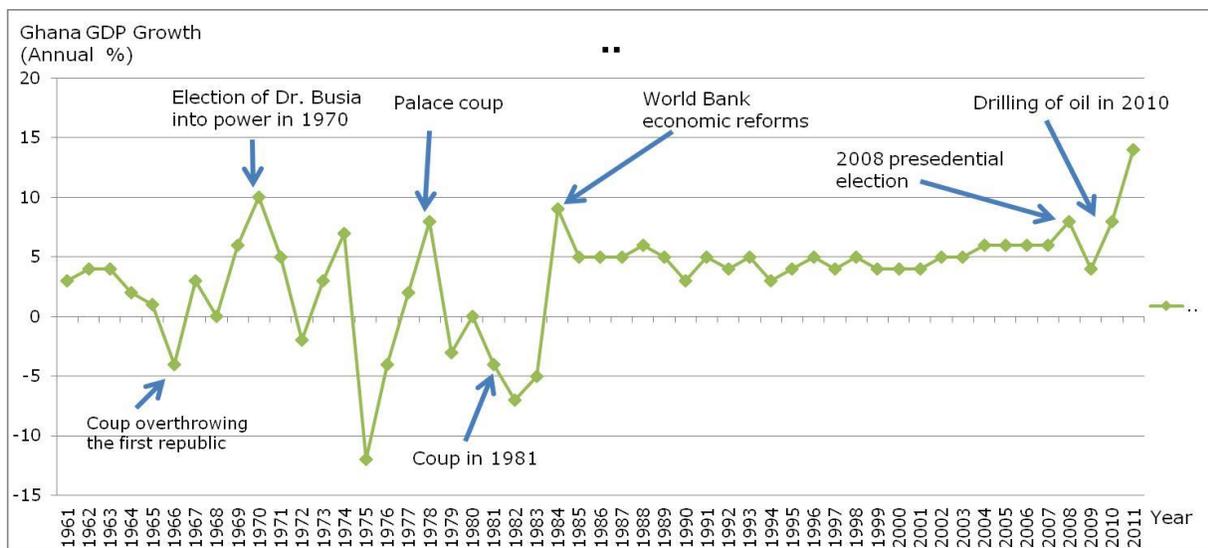


Figure 1: Annual growth rate in Ghana (Source of data: World Bank, 2012)

After the coup, the economy began to register growth again, as can be seen from the graph in Figure 1, until the elections in 1969, which saw a return to civilian rule with Dr. Kofi Abrefa Busia elected as Prime Minister. From there came another decline. The military was dissatisfied with the performance of the civilian administration and staged yet another coup d'état on 13 January 1972 during which Lt. Col. Acheampong seized power. This period of military rule saw a brief rise in growth that reached its peak in about 1978. However, the Ghana Bar Association and Ghana Medical Association spearheaded demands for a return to civilian administration. Again, this interference in governance affected the economy, as it began another decline. At this stage,

Lt. Col. Acheampong was forced to resign in a palace coup in 1978, which brought another military regime into power led by Lt. Gen. F. Akuffo. The negative growth rate however continued, and in May 1979 there was another coup led by Flt. Lt. Jerry John Rawlings who seized power from the military and handed the power over to a civilian administration that same year. As such, the elections of 1979 saw a return to civilian rule when Dr. Hilla Limann came to power in June 1979. As can be seen in Figure 1, the economy registered a slight growth. The military, still not satisfied, ousted the new civilian government in 1981 making a comeback by Fl. Lt. Jerry John Rawlings to return the country to another military government, still with the economy in decline.

In 1983, the World Bank's supported economic reforms were implemented, thus, reversing the negative growth trend. This regime survived several failed coup d'états (Agyeman-Duah, 1987). The resilience of the regime was the start of a stable political atmosphere for the country. The political stability was also reflected in a much more stable economy as can be seen in Figure 1. Subsequent changes in government were no longer through coup d'état, and these changes did not lead to adverse economic downturns.

In 1990, however, there were calls for a return to democratic rule. The incumbent president, Fl. Lt. J. J. Rawlings, won the election in 1992 to retain power, but this time as a civilian president under the National Democratic Congress (NDC) party. He served two terms of four years each, but in the 2000 election, his party lost power to the main opposition, the New Patriotic Party (NPP) led by Mr. J. A. Kufuor. Kufuor also served two terms after which, in the 2008 election, his party lost power back to the NDC led by Professor Evans Atta Mills who ruled until his demise in 2012. The then Vice President, Mr. John Dramani Mahama, was sworn in as president to complete the term of office. The presidential election in that same year saw Mahama retain the presidency, and he is the incumbent at the time of writing this paper.

The political unrest of the first three decades of independence can be clearly seen reflected in the economic performance of the country. The Ghana economy, further boosted by the discovery of oil and gas, is again seen as impressive (CIA-WorldFactbook, 2013). The question that comes up however is: How can this new growth rate be sustained, especially as Ghana still imports almost all its technologies for its local production industries? This means that importation will have to increase to maintain the growth, thus, eroding the gains made. The growth is therefore seen as superficial. Indeed, observation of such growth as this has been described by economists as fragile (Aryeetey & Fosu, 2008) because it depends mainly on primary production (Juma, 2011) and diversification (Teal, 1998). Also, the industrialization incentives and strategies put forward by various Ghana government regimes failed to yield a corresponding growth in the economy (Lall & Pitroballi, 2002). This therefore calls for a new approach to establish a foothold in an industrialization agenda. The following section presents a prospective methodology for the implementation of technology focused projects for culturally diversified societies.

### **Overarching Methodological Approach**

The narrative of technology development drawback in Africa, coupled with the history of unsuccessful industrialization attempts in Ghana, requires caution in its discussion and search for

a remedy. In this regard therefore, this study has sought to establish an in-depth understanding of the Ghanaian society using the work of Clemens and Dalrymple (2005) as the framework to map out the cultural *rhythm* of the society to synchronize it with the development intent for cultural assimilation and subsequent growth before proposing a remedy.

This methodological approach has been seen as generic with potential suitability for a developing society like Ghana which has a mixed cultural background. The approach was indeed inspired by examining the development trajectories of selected countries like Germany, the US, China and Japan, who have been able to assimilate into their cultures the various technologies transferred from England and further developed by them, which has led to the current expanse of *innovation*. Comparing these countries to Ghana however revealed one major feature differentiating them; this being, monoculturalism and multiculturalism (Davidson, 1991; Davidson et al., 1965) when using language (Lewis et al., 2013) as the basis for cultural differentiation.

The overarching methodological approach was derived from the work of Clemens and Dalrymple (2005). The authors, coming from a business management background, demonstrated that *rhythm* is the beat in everything. They opine that “every individual has a rhythm, a customer has a rhythm, a client has a rhythm, an organization has a rhythm, this whole world has a rhythm” (Clemens & Dalrymple, 2005, p. 93-94). They continue by stating that everyone, every nation and individual, has its own peculiar rhythm and that is what accounts for the uniqueness one possesses. Indeed, the authors demonstrated that it is when different rhythms are brought together in the right note that an objective can be met. The question is how to synchronize different rhythms into a beat to achieve the set objective.

In their work, ‘the process by which different rhythms fall into synchronization with each other and then work in a parallel manner’ is called *entrainment* (Clemens & Dalrymple 2005, p. 99). When, for example, everyone on a team operates at a pace that fits a situation and the tempo of everyone’s rhythm is synchronized towards an objective, *tempo-entrainment* is said to occur. This to a very large extent accounts for the seemingly “effortless” input leading to the success of a winning team. In the business world, it underlies the force that defines a leading business that sets it on edge over its competitors.

In summary, applying the power of entrainment in this study, therefore the rhythm of the development intent (i.e. the manufacturing of production technologies), is *entrained* with the rhythm of the Ghanaian society. This has been done by studying its culture in relation to the subject matter to map out the pattern of its natural rhythm. A three-step approach was therefore developed in this study to serve as the initial procedure for the application of the overarching methodology. Further work may be required to develop a business model for the framework. The work of Clemens and Dalrymple (2005) may however be inundated with inherent drawbacks in association with the topic under discussion. It may therefore be helpful to critically examine the rhythm concept as the framework for the overarching methodology of this study.

### **Critical Perspective of the Rhythm Concept**

The application of the rhythm concept as a sine qua non to success in business leadership as shown by Clemens and Dalrymple (2005) may be intriguing, but the authors themselves admit that ‘setting an effective rhythm can be tricky’ (Clemens and Dalrymple 2005, p. 97). The difficulty is in, like in a musical note, an event where any contributing factor (actor or player) introduces a wrong key, and the rhythm of the beat could be put into disarray. Just as in an orchestra, this could mean a fatal blow to an organization, or, in the worst scenario, a total collapse of a business entity or a system of operation.

The concept will require close coordination, like a conductor of the orchestra, with the full concentration of participating members. Achieving such in a real-life situation could be described as utopian when considered for application in the context of a developing country like Ghana, where issues of bureaucratic processes are deemed to be highly problematic when coupled with weak institutional framework (Price, 1975).

Moreover, the anticipation of the rhythmic concept as a total solution or an easy-to-implement philosophy could be misleading in the sense that the probable outcomes cannot be determined from the onset. This is partly because there may not be agreed upon rules or guidelines regarding its mode of application as every situation differs from the others. The non-standardization feature inherent in the concept leaves its implementation almost entirely to the discretion of the leading actors, or decision makers. The outcome of a possible failure or backlash cannot be overruled in relation to its subjectivity, hence, the need for support mechanisms. But the difficulty here is how to establish an efficient support mechanism without artificially changing the cultural setting.

### **The Three-Step Approach**

The three-step methodological approach of this study was developed as an alternative to the non-consultative conventional approaches used by both the International Community and National Governments for development projects in Africa. Indeed, authors have shown how the conventional approaches of sporadic injection of capital into the African economy (Aryeetey & Fosu, 2008) and importation of state-of-the-art high-technological solutions (Akubue, 2000) have persistently yielded disappointing results (Barclay, 2010; Sachs, 1992; Sagasti, 1992) to resolving the economic or technological needs of developing countries (Schumacher, 1974). The economies, for example of Ghana, have not responded with a corresponding growth (Lall & Pitroballi, 2002).

Though the application of this new three-step approach relies solely on data obtained from Ghana, it has the potential for applicability in other developing regions and projects other than the subject of discussion. The approach, in simple terms, consists of a three-step procedure designed to map out the rhythm of the society and to synchronize the development intent with the said rhythm through entrainment. The procedure may therefore be summarized as follows:

1. Study the culture of the society in question and any other aspects that may be of useful interest to the development intent. That is, study to map out the cultural rhythm of the society.

2. Identify a relevant “success project” of that society. This should be a project which is socially integrated and culturally assimilated for a sense of ownership and participation. It is also necessary to observe the difficulties associated with this identified “successful project.”

3. Model that project as a template for the development intended. In the case of this study, the project of intent is the manufacturing of production technology. This could simply be referred to as the SIM Approach.

To apply this methodology to the project, the Ghanaian society was studied to map out (understand) its cultural inclination towards technology creation and development. The study identified the Ghana Cocoa Board (Cocobod) as the most suitable culturally assimilated success story in Ghana’s history. Cocobod was therefore used as the template to model the project intent, here being the manufacturing of technology for local industry.

An appropriate methodology would need to be sought depending on the project and society concerned. In this discussion however, the methodology employed to carry out the three-step approach was a mixed research briefly discussed below.

### **Research Methodology for the Three-Step Approach**

In research, a strategy, or methodology, needs to be devised by the researcher (Bryman, 2012). A methodology search to carry out the three-step approach led to the application of the mix-research approach. Mix-research emerged as a distinct research approach to merge qualitative and quantitative approaches (Greene, 2008), though predominantly this approach belongs to the social sciences. This seemingly new approach indeed has a relatively long history of application. For example, in the work of Marcus and Cushman (1982) as shown by Bryman (2012), the interpretivist paradigm was combined with the positivist paradigm in the reporting of the emerging aspect of epistemological ethnography. This makes the argument for the phenomenon of mix research even stronger.

As a relatively new approach, it suffers with inconsistencies in the use of its terminologies. Time and space will not allow distinguishing between the terminologies in this paper. Research scholars have produced extensive work in this regard (Bryman, 2012; Glogowska, 2011; Mackenzie & Knipe, 2006). The understanding espoused by Mackenzie and Knipe for such terminologies as research paradigms, methodology, method, philosophy, qualitative and quantitative research is adopted in this study.

### **Choice of Methodology Mix and Procedure**

This highly inductive study from operations management background seeks to contribute a solution to the perennial difficulty that Ghana, and indeed Africa, faces in developing a domestic technological base because its local and national economy requires a deep understanding of the problem. The situation here may be termed an ill-structured problem, which, in research cannot be approached using methods of statistical or numerical values (Holmstrom & Korkeakoulu, 2006;

Munoz-Seca, 2008; Simon & Newell, 1958). They require soft methods like the mix research approach, which is mainly qualitative and sociological (Flynn et al., 1990). The methodology combination in the mix research strategy adopted for this study includes; *ethnography*, *grounded theory*, and *case study*. The approach involved collecting data in Ghana from both the rural and urban settings. The following is a brief anecdote of each methodology employed.

### **Difference between Case Study and Ethnography**

Case study, like ethnography, requires fieldwork and employs the same set of methods for data collection. As a result, it could sometimes be confusing as to what their difference may be that should warrant their individual consideration in mix methodology. To clarify such confusion, Table 1 was produced as an attempt to highlight the main differences between the two as distinct research methodologies having different features and serving different purposes.

Table 1:

*Difference Between Case Study and Ethnography*

<b>Case Study</b>	<b>Ethnography</b>
Observes data at micro level	Observes data at a macro level
Focuses on single or multiple events	Focuses on cultural interpretations
Research question and hypothesis are required to determine fieldwork	Requires fieldwork before research question and hypothesis are formed
Describes real-life situation, e.g. communication in workplace	Describes the specificity or generality of a cultural setting
Focuses on a particular issue (event) in an organization	Focuses on the whole society or organization

### **Findings and Recommendations**

Significant findings were discovered from literature and fieldwork during this study. Some of the findings confirmed existing knowledge, thus, appearing as common information. Findings, nevertheless, lead to new interpretations and a broader understanding of the subject of discussion, i.e. technology drawbacks in Ghana (and Africa at large).

Inferences and deductions made from the narrative of findings, in summary, confirm that Ghana does not have a technology development framework for local industry. It was found, instead that Ghana was “locked” in an old framework of relying on importation of technological solutions. These technologies would soon become obsolete thereby creating a vicious cycle of constant replacement or upgrade.

This study attributes the observed failure mainly to the governance policy in Ghana, reflecting in the political and societal neglect to incorporate and develop indigenous technologies into mainstream modern technological solutions. As a recommendation, it could be done through the involvement of the academic and research institutions in indigenous technologies and production processes. The neglect has also led to a Ghanaian society unable to assimilate modern

technologies into its cultural structure for a sense of ownership and development, leaving the traditional technologies that are still as rudimentary as they have been through history. In addition, Ghana as a society has not been able to demonstrate the ability to generate and maintain a self-initiated approach to transform its traditional (indigenous) technology base. Indeed, it was found that there was a disconnection between education (i.e. educated Ghanaian elite) and the traditional indigenous sector.

Local industry was found to lack the technologies required for production. This is not to say the Ghanaian society lacks that ability or the technical prowess to manufacture technologies, but it simply has not proved its ability to retain the drive, as far as this study could find, and make these technologies available to local industry. For example, in Ghana and Nigeria, during the periods of economic hardship and the Biafra War, both Nations manufactured their technologies that sustained the societies throughout those periods (Edgerton, 2008; Price, 1975). But, when the incidences ended, the manufacturing activities ended. It can therefore be seen that the impetus to act as a springboard and the stimulation to sustain the drive are lacking. A fatalistic attitude towards technology creation was rather prominent as this study discovered.

It may therefore be concluded here that for Ghana to develop its technological capabilities in a consistent manner for growth, it requires a dedicated mechanism to maintain a consistent supply and creation of technology for local industry. This development should evolve from the cultural background of the society. In this way, it will become the product of the society, acting as a vehicle transcending all social barriers. Such a vehicle is one proposed in this paper as the model for the manufacturing of production technologies in Ghana. This is discussed in the following section.

### **The Model for Technology Manufacturing in Ghana**

Recall how the three-step approach in this paper seeks to synchronize the development intent with the cultural rhythm of the society through entrainment. The concept is applied here using the work of Sagasti (1992) as a framework to construct the manufacturing model for Ghana. The work of Dr. Francisco R. Sagasti, a onetime Head of Strategic Planning and Director for Planning at the World Bank, proposed new approaches to development planning (Sagasti, 1992), as a set of criteria to address the challenges in planning theory. This set of criteria was extrapolated to the rhythm of the Ghanaian society and modified by juxtaposing each criterion with its identified equivalent component for the technology framework in a multicultural society like Ghana.

As espoused by Sagasti (1992), planning is a necessary futuristic determining factor in a development agenda. Every (minor or major) project is pre-proposed and eventually executed by the act of planning formally or informally, consciously or unconsciously. Indeed, the act of planning cuts across all fields of study. As such, it has a 'lopsided application' (Hudson et al., 1979) in a broad perspective. This may include analytical, conceptual, cultural, educational and others, thus, making planning an inevitable part of the process of development. Howbeit, it has rarely been applied from a sociological perspective (Portes, 1976), or in technology development discourse. Indeed, such discourse could not be found by this study as put by Portes (1976), nations

oriented toward development should explicitly abandon the models offered by already advanced societies and cut their own path.

The approach should however be capable of restructuring itself over time as suggested by Sagasti (1992). It would need to operate as an interactive and decentralized system, using cognition and compromise in decision making. He concludes that planning systems are designed and put into practice by people. It is therefore essential not to forget the role of humans. By this therefore, the system should consist of flexible, resourceful, resilient people who can tolerate a lot of surprises and ambiguity while continuing to work intellectually on complex issues (Trist, 1976).

### Constructing the Ghana Technology Model

The Ghana Manufacturing of Technology Model (GMTM), otherwise called, the Model, is constructed from the work of Sagasti (1992), shown in Figure 2. The constituent elements in the Model are the Manufacturing Technology Board, called the Board (like the Board in Cocobod). The Board will consist of a highly experienced and multidisciplinary team with broad knowledge and will be at the helm of affairs providing leadership. There would be Manufacturing Centers located throughout the country for the users in Local Industry.

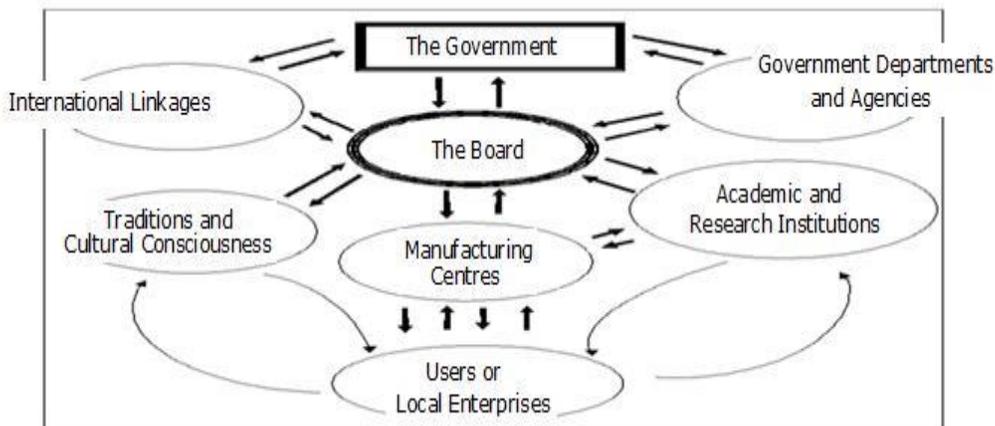


Figure 2: The Ghana Manufacturing of Technology Model

The Manufacturing Centers are to create the technologies to be manufactured. It is their magnitude that will determine the success of the Model. Others include: the Research and Academic Institutions, to focus on solving technical problems requiring research; Governmental Departments and Agencies, for the expanded market; the role of Government, to serve as the overlaying body responsible for setting up the Board and the regulations and other forms of control; the International Linkages, to keep up with best practices; and Traditional and Cultural Consciousness Unit, to be concerned with cultural interpretations and trade.

The Model is to be the transcending vehicle for technology development, cutting across cultural and social barriers. Amongst its elements is the vital component for cultural assimilation and interpretation, here called Traditions and Cultural Consciousness as shown in Figure 2. This

component provides the cultural *rhythm* of the society and is in conjunction with the Board and the Manufacturing Centers so a tempo-entrainment is obtained. Other elements within the Model go a long way to contribute their various functions for smooth operation of the whole system. In effect, the Model combines modern knowledge of science, technology and engineering in general, with indigenous knowledge to answer the technology quest of the society.

The Model works like Cocobod, which sources cocoa beans from the farmers onward for sale to the international market. Likewise, the Board will source technology from the manufacturers supply onward to local industries (or entrepreneurs). This is done by the Board coming to a decision, based on product viability, related to the specific technology to manufacture. It could receive input from the users or elsewhere. The Board then outsources the entire process, designs manufacturing, etc. to the appropriate setup or organization, which is referred to here as the Manufacturing Centers. The Board liaises with all the other components as may be required. There should be constant communication between the Manufacturing Centers and the users as well.

### **Conclusion**

Technology is required in every stage and form of production. Ghana, like the rest of Sub-Saharan Africa, is noted to lack a strong domestic technology base. As a result, it is unable to add value to its vast natural resources. It was observed in this study, among other things, that the policy attitude in Ghana seems to avoid the issue of technology development, especially for local industry. This observation is confirmed in existing literature as a common feature in African Nations.

This paper, in view of such a lapse, proposes a technology development framework as a Model for manufacturing and supplying technologies to local industry in Ghana with the potential applicability in the rest of Africa and other developing societies or regions of the world. The Model is seen as a framework to local industrialization, which will strengthen the private sector of the economy to create wealth for local businesses and the nation at large. A base for socio-techno-economic development will therefore hopefully set in motion the drive towards national industrialization.

This study is not exhaustive on the topic. Future work may include a conceptualization of the development model for discussion and analysis.

## References

- Adam, B. & Cohen, B. A. (2009). Many forms of culture. *American Psychological Association*, 64, 194-204.
- Agyeman-Duah, B. (1987). Ghana 1982-6: The politics of the P.N.D.C. *The Journal of Modern African Studies*, 25, 613-642.
- Akubue, A. (2000). Appropriate technology for socioeconomic development in third world countries. *The Journal of Technology Studies*, 26.
- Association for Manufacturing Technology. (2013). What is manufacturing technology? Retrieved from The Association for Manufacturing Technology website: <http://www.amtonline.org/aboutamt/WhatisManufacturingTechnology/>
- Aryeetey, E. & Fosu, A. K. (2008). Economic growth in Ghana:1960-2000. In J. B. Nudulu, S. A.O'Connell, J. P. Azam, H. R. Bates, A. K. Fosu, J. W. Funning, & D. Nijinkeu (Eds.). *The political economy of economic growth in Africa, 1960-2000, 2<sup>nd</sup> Edition: Country Case Studies* (pp. 289-324). Cambridge: Cambridge University Press.
- Austin, A. R. & Headrick, D. (1983). The role of technology in the African past. *African Studies Review*, 26, 163-184.
- Barclay, A. (2010). Regional economic commission and intra-regional migration potential in Africa: Taking stock. In A. Adepoju (Ed.), *International migration: Within, to from Africa in a globalised world* (Chap. 2). Accra, Ghana: Sub-Saharan Publishers.
- Beall, J. & Ngonyama, M. (2009). *Indigenous institutions, traditional leaders and elite coalitions for development: The case of Greater Durban, South Africa*. (Working Paper #55). Retrieved from <http://www.lse.ac.uk/internationalDevelopment/research/crisisStates/download/wp/wpSeries2/WP552.pdf>
- Bluff, R. (2006). Grounded theory. In E. R. Cluett & R. Bluff (Eds.), *Principles and practice of research in midwifery* (2<sup>nd</sup> ed.) (pp. 153-170). Edinburgh: Elsevier.
- Botwe-Asamoah, K. (2005). *Kwame Nkrumah's politico-cultural thought and policies: An African centered paradigm for the second phase of the African revolution*. New York: Rutledge.
- Bryman, A. (2012). *Social research methods* (4<sup>th</sup> ed.). Oxford: Oxford University Press.
- Charmaz, K. (2003). Grounded theory. *Strategies of Qualitative Inquiry*, 2, 249.
- CIA-Worldfactbook. (2013). *Africa: Ghana: Background*. Retrieved from <https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html#top>.
- Clemens, J. & Dalrymple, S. (2005). *Time mastery: How temporal intelligence will make you a stronger, more effective leader*. New York: AMACOM.
- Conable, B. B. (1991). *Reflections on Africa: The priority of Sub-Saharan Africa in economic development*. Washington DC: The World Bank.
- Corbin, J. M. & Strauss, A. (2008). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (3<sup>rd</sup> ed.). Thousand Oaks, CA: Sage Publications.
- Corbin, J. M. & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology*, 13(1), 3-21.

- Cutcliffe, J. R. (2000). Methodological issues in grounded theory. *Journal of Advanced Nursing*, 31(6), 1476-1484.
- Davidson, B. (1991). *Modern Africa: A social and political history*, London: Longman.
- Davidson, B. (1992). *The black man's burden: Africa and the cure of the nation-state*. Oxford: James Currey Ltd.
- Davidson, B., Buah, F. K. & Ajayi, J. F. A. (1965). *The growth of African civilisation: A history of West Africa, 1000-1800*. London: Longman Group Ltd.
- Edgerton, D. (2008). *The shock of the old: Technology and global history since 1900*. London: Profile Books Ltd.
- Flynn, B. B., Sakakibara, S., Schroeder, R. G., Kimberly, A. B., & Flynn E. J. (1990). Empirical research methods in operations management. *Journal of Operations Management*, 9(2), 250-284.
- Gibbs, G. R. (2008). *Analysing qualitative data*. Thousand Oaks, CA: SAGE Publications Limited.
- Glogowska, M. (2011). Paradigms, pragmatism and possibilities: Mixed-methods research in speech and language therapy. *International Journal of Language & Communication Disorders*, 46(3), 251-260.
- Greene, C., J. (2008). Is mixed methods social inquiry a distinctive methodology? *Journal of Mixed Methods Research*, 2, 7-22.
- Grünbaum, N. N. (2007). Identification of ambiguity in the case study research typology: What is a unit of analysis? *Qualitative Market Research: An International Journal*, 10(1), 78-97.
- Herbst, J. (1997). Responding to state failure in Africa. *International Security*, 2(3), 120-144.
- Herbst, J. 2000. *States and power in Africa: Comparative lessons in authority and control*. Chichester, UK: Princeton University Press.
- Hofstede, G. (1984). Cultural dimensions in management and planning. *Asia Pacific Journal of Management*, 1. doi:10.1007/BF01733682
- Hofstede, G. (2011). Dimensionalizing cultures: The Hofstede Model in context. *Online Readings in Psychology and Culture*, 2(1), 1-26.
- Hudson, B. M., Galloway, T. D. & Kaufman, J. L. (1979). Comparison of current planning theories: Counterparts and contradictions. *Journal of the American Planning Association*, 45, 387-398.
- Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1(2), 112-133.
- Holmstrom, J., & Korkeakoula, T. (2006). *Operation management as a problem-solving discipline: A design science approach*. Working paper No. 2006/1. Laboratory of Industrial Management, Espoo, Finland.
- Juma, C. (2011). *The new harvest: Agricultural innovation in Africa*. New York, NY: Oxford University Press.

- Khalil, T. M., (2000). *Management of technology: The key to competitiveness and wealth creation*. New York, NY: McGraw Hill.
- Lall, S. & Kraemer-Mbula, E. (2005). *Industrial competitiveness in Africa: Lessons from East Asia*. Bourton-on-Dunsmore, UK: ITDG Publishing.
- Lall, S. & Pitroballi, C. (2002). *Failing to compete: Technology development and technology systems in Africa*. Cheltenham, UK: Edward Elgar Publishing.
- Levine, D. N. (2013). Ethiopia's dilemma: Missed chances from the 1960s to the present. *International Journal of African Development*, 1(1), 3-18.
- Lewis, M. P. (2009). *Ethnologue: Languages of the world* (16<sup>th</sup> ed.). Dallas, Texas: SIL International. Retrieved from <http://www.ethnologue.com/>
- Lewis, M. P. P., Gary, F. S., & Charles, D. F. (Eds.) (2013). *Ethnologue: Languages of the World* (17<sup>th</sup> ed.) Dallas, Texas: SIL International.
- Luck, L., Jackson, D., & Usher, K. (2006). Case study: A bridge across the paradigms. *Nursing Inquiry*, 13(2), 103-109.
- Mackenzie, N., & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. *Issues in Educational Research*, 16(2), 193-205.
- Mamattah, C. M. K. (1978). *The Ewes of West Africa (Vol. 1): Oral traditions*. Accra, Ghana: The Advent Press.
- Moges, A. G. (2013). Political economy of poverty reduction. *International Journal of African Development*, 1(1), 19-39.
- Munoz- Seca, B. (2008). *An approach to facilitate problem solving: Individualizing the proposition* (IESE Business School Working Paper No. 768). Retrieved from [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1315289](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1315289)
- Perren, L., & Ram, M. (2004). Case-study method in small business and entrepreneurial research mapping boundaries and perspectives. *International Small Business Journal*, 22(1), 83-101.
- Portes, A. (1976). On the sociology of national development: Theories and issues. *American Journal of Sociology*, 82(1), pp 55-85.
- Price, M. (1975). *Society and bureaucracy in contemporary Ghana*. Berkeley, CA: University of California Press.
- Ragin, C. C., & Becker, H. S. (1992). *What is a case?: Exploring the foundations of social inquiry*. Cambridge, UK: Cambridge University Press.
- Roberts, T. (2008). Understanding grounded theory. *British Journal of Midwifery*, 16(10), 679-681.
- Sachs, I. (1992). The elusive interdisciplinary of development planning. In J-M. Choukoun & M. R. Snow (Eds.), *Planning for Human Systems: Essays in Honour of Russel Ackoff* (pp. 307-319). Philadelphia, PA: University of Pennsylvania Press.
- Sagasti, R. F. (1992). National planning in turbulent times: New approach and criteria for institutional design. In J-M. Choukoun & M. R. Snow (Eds.), *Planning for Human*

- Systems: Essays in Honour of Russel Ackoff* (pp. 320-339). Philadelphia, PA: University of Pennsylvania Press.
- Schumacher, E. F. (1974). *Small is beautiful: Economics as if people mattered*. New York, NY, Abacus.
- Simon, H. A. & Newell, A. (1958). Heuristic problem solving: The next advance in operations research. *Operations Research*, 6(1), 1-10.
- Teal, F. (1998). *The Ghanaian manufacturing sector 1991-1995: Firm growth, productivity and convergence*. (The Centre for the Study of African Economies Working Paper Series, Paper 81). Retrieved from <https://www.csae.ox.ac.uk/workingpapers/pdfs/9817text.PDF>
- Trist, E. (1976 July 21). *Some concepts of planning* (Paper). Seminar on Long-range Planning sponsored by the Extension Service of the University of Western Australia. University of Western Australia.
- Warner, D. (1960). *Ghana and the new Africa*. London, UK: Frederick Muller Ltd.
- Wolcott, H. F. (1990). Making a study "more ethnographic." *Journal of Contemporary Ethnography*, 19(1), 44-72.
- Yin, R. K. (1993). *Application of case study research*. Thousand Oaks, CA: Sage Publication.
- Yin, R. K. (1984). *Case study research: Design and methods*. Beverly Hills, CA: Sage Publications.
- Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan*, 9, 1-6.