

# **Computer Engineering Design as a Route to Economic Growth and Beyond It in a Third World Zone: The Case of South Eastern Nigeria**

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**Abstract:** *Computer Engineering is one of the numerous branches of Engineering. Other branches of Engineering include Mechanical Engineering, Civil Engineering, Electrical and Electronic Engineering, Agricultural Engineering, Aeronautical Engineering, Marine Engineering, Production Engineering, chemical Engineering, Metallurgical Engineering. Computer Engineering is defined as that branch of Engineering that uses the principles of Mathematics and Natural Science for the design, construction, maintenance, fabrication, laboratory work, consulting and contracting and other works related to the computer. The computer is defined as a device which accepts data and programs and mathematical and non mathematical instructions and manipulates them with numerous speed and accuracy to produce an output which could be used as information for managerial decision making. Computers which had their origin in antiquity had its formal origin when Babbage, a British mathematician that was a precursor of Taylor designed the Analytical Engine. After Babbage till date here have been five or more generations of computers each next generation having improvements in the inputs, transform and outputs of the computer system and he materials used in the construction. The objective of the study is to determine how computer Engineering Design could be a route to Economic Growth in Nigeria. This and other objectives were fully achieved in the paper.*

**Keywords:** *Analytical engine, Engineering design, Economic growth and Input.*

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## **I. Introduction**

Engineering is defined by Nwachukwu (2000) as the profession in which the knowledge of the Mathematical and Natural Science gained by study, experience and practise is applied with judgment to develop ways to utilize economically the material and forces of nature for the benefit of mankind. This definition explains that Engineering is based on mathematical and natural science but focused on the solutions of specific problems. Also the solutions, because they are needed or desired by society must meet certain legal, environmental and economic constraints.

The Engineering practise is highly interactive and constrained, which also means that it is very challenging because Engineering is interwoven in the fabric of modern society. This is why Engineers in general and Computer Engineers in particular engage in a very broad spectrum of activities which include:

- 1) Research and development;
- 2) Design
- 3) Production and construction;
- 4) Operations and maintenance;
- 5) Fabrication;
- 6) Sales;
- 7) Engineering, management, Engineering Economics and Engineering administration (Nwachukwu, 2000; Wikipedia, 2014).

There are many branches of Engineering including Mechanical Engineering, Civil Engineering, Electrical and Electronic Engineering, Computer Engineering, Agricultural Engineering, Aeronautical Engineering, Marine Engineering, Metallurgical Engineering. These branches in Engineering are regarded as very necessary in the operation of many of the industries in Nigeria such as the Brewing Industry, Food processing industry and oil and gas (Petroleum Industry) etc. No wonder, shell has the shell intension Training Programme in which they recruit young graduates in the 10 braches of Engineering, above, Geology, physics, Chemistry, and retain the for one year and the ones that do well in the Theoretical and practical Examinations are retained. Other companies such as Agip, Chevron, Totalfinaelf, Nigerian Breweries plc also remit trainees of the shell intensive Training Programme (shell Petroleum Development Corporation) (S.P.D.C of Nigeria Limited, 2012).

The Engineering, Branch of interest in this paper is Computer Engineering. The Computer Engineering activity of interest in the paper is Computer Engineering Design. It entails using the principles of Conceptual

Planning, Hardware Engineering Design, Software Engineering Design, Computer product Design, Fabrication, Construction to solve a multitude of Computer Engineering problems (Wikipedia, 2014). One of the benefits of Computer Engineering Design is the increase in the production of computer hardware products, computer software products, storage device, I.C.T products etc. This leads to an Economic Growth. If Economic Growth is backed with appropriate distribution of the proceeds of Growth and Spontaneous change, Economic Development results, if Economic Development is backed with social Development, Economic Development and Cultural Diversity Sustainable Development results (Jhingan, 2008).

The board objective of the study is to determine how Computer Engineering Design could be used as a route to Economic Growth in Nigeria. The specific objectives are:

- 1) To determine how Computer Engineering Design would be used as a route to Economics Growth in south Eastern Nigeria.
- 2) To ascertain how Hardware Computer Engineering Design would be used as route to the increase in income aspect of Economic Growth in south Eastern Nigeria.
- 3) To find out how Software Computer Engineering Design would be used as a route to the increase in output aspect of Economic Growth in south Eastern Nigeria.

## **II. Computer Product Design**

The computer is the tangible product of interest in this section. The design of the products to be manufactured and the specification of which manufacturing process to adopt are critical considerations for the production and operations manager. Since the basic rationale behind most manufacturing or service activities is the satisfaction of some basic needs of the consumers, the design of the product most therefore aim at meeting setting customers' specifications. These specifications form the basis for other relevant decision that the productions and operations manager must take. For example, decisions such as the choice of raw materials, selection of equipment, workers, and even the manufacturing design are all related to customers' specifications (Unyimadu, 2008).

### **Product design**

The product design process begins with the generation or conception of series product ideas. These ideas are screened and every details properly looked into. For example, technical requirement of such product idea are examined in relation to the degree fit into available machine and human facilities. Next, the appearance and styling requirement are also evaluated on the basis of their appeal to prospective customers. Also at this stage, the design cost is of great importance since, in the final analysis, the product bears the design cost (Agbadud, 2008).

### **Preliminary Design Stage**

After going through the first phase as already explained, the best product idea, in terms of criteria earlier specified, is selected for preliminary design. At this stage, the "draft" design is again subjected to testing, calculations, model-making or such activities as may be appropriate. It should as far as possible conform to specifications. The preliminary design may be accepted or rejected as impracticable or modified in line with suggestions brought in by production or sales department. While the product design team cannot afford to overlook cost considerations, the most important consideration as at this stage is the technical aspect and likely appearance of the proposed product. The models should also clearly indicate the manufacturing feasibility or otherwise of the design (Banjoko, 2008).

### **Developmental Stage**

From the preliminary design stage, an improved design emerges. This improved design is again subjected to some developments. At this stage, most of the initiatives will be coming from the research and development team which, in most cases, is made up mostly of people from the production engineering department and other technical units of the organisation. The product feasibility, the costs, and the possible manufacturing problems that may be encounter are examined. Many relevant questions aimed at uncovering latent product defects are raised and possible corrective actions initiated where appropriate (Unyimadu, 2008).

At this developmental stage, co-operation between the parties involved is very crucial. Lack of co-operation between the development engineers, the production engineers, and members of the management can prove very costly in many respects. The final design, unless it emerges from the co-operative efforts of all involved, could be difficult to manufacture and any emergency redesigns could debase the product. Too often, management's reluctance of commit sufficient funds, or a sense of aloofness on the part of either the development or product engineer may result in poor product design (agbadudu, 2008).

### **Economic Growth**

#### **Mill's Theory**

Mill regarded economic development as a function of land, labour and capital. While land and labour are two original factors of production, capital is a stock, previously accumulated of the products of former labour. Increase in wealth is possible only if land and capital help to increase production faster than the labour force. Wealth consists of tools, machines, and skills of the labour force. It is productive labour that is productive of wealth and of capital accumulation. The rate of capital accumulation is a function of the proportion of the labour force employed productively. Profits earned by employing unproductive labour are merely transfers of income; unproductive labour does not generate wealth or income. It is the productive labourers who do productive consumption. Productive consumption is that which goes to maintain and increase the productive powers of the community. It implies that productive consumption is an input necessary to maintain-productive labourers (Anyanwu and Oaikhenan, 2000).

### III. Research Methodology

The research design chosen is a combination of a survey and oral interview. Both primary source of data by fieldwork and secondary source from books and internet material are used. A population size of 750 is got by aggregating the senior and junior staff of the ICT centres in the federal, state and private universities in the five states of south eastern Nigeria and also the academic staff in the department of computer centres and computer engineering in the universities in the state capitals above and some vendors or suppliers of computers and I.C.T products who have a knowledge of the topic.

The population size is distributed to the institutions in the five state capitals at the rates of Enugu, Enugu states 225, Owerri, Imo state, 188, Awka, Anambra state, 150, Umuahia, Abia state, 112 and Abakiliki, Ebonyi state, 75 totaling 750. The Taro Yamane's formula is used to calculate the sample size. The formula is given as  $n = \frac{N}{1+N(e^2)}$  (Asika, 2004) where n is the sample size, N is the population size and e is the error term for a two-tailed test at 5% level of significance. For N = 750 and e = 2.5%, n = 511.

The sample size is distributed to the five states capitals using stratified sampling to get Enugu, 153, Owerri, 128, Akwa, 102, Umuahia, 77 and Abakiliki 51 totaling 511. The data presentation tools are tables. The data is analysed using SPSS and also for testing the three hypotheses. The test-retest method of Reliability of the instrument is used. The content validity of the research instrument is used.

#### Data Presentation And Analysis

Table 1 shows the summary of the distribution of the questionnaires.

**Table 1: The summary of the distribution of the questionnaires**

- a) Number of questionnaires administered 511
- b) Number of questionnaires returned 500
- c) Number of questionnaires not returned 11
- d) Response rate =  $\frac{b}{a} = \frac{500}{511} = 0.978$
- e) Non response rate =  $\frac{c}{a} = \frac{11}{511} = 0.022$
- f) Total response and non response rate =  $\frac{b}{a} + \frac{c}{a} = \frac{500}{511} + \frac{11}{511} = \frac{511}{511} = 1$

Source: the questionnaires returned are from the fieldwork (2014).

From table 1, it is showed that out of the 511 questionnaires administered 500 of them where returned. This gave a response rate of 0.978 out of the 511 questionnaires administered.

Table 2 shows the analysis of the response related to the three objectives.

**Table 2: The Analysis of the response related to the three objectives**

s/no	statement	Responses	f	%	Valid %	Cumulated%	Z calculated
1	Computer Engineering Design would be used as a route to Economic Growth by conceptual planning, Assembling, product Design and Fabrication	Strongly Agree	290	58.00	58.00	58.00	4.880
		Agree	110	22.00	22.00	80.00	
		Undecided	33	6.60	6.60	86.60	
		Disagree	33	6.60	6.60	92.60	
		Strongly disagree	34	6.80	6.80	100.00	
			500	100			
2	Hardware computer Engineering design is a route to the increase in income aspect of Economic growth through conceptual planning, Assembly, Hardware selection, procurement and E-procurement	Strongly Agree	292	58.40	58.40	58.40	5.885
		Agree	112	22.00	6.00	8.80	
		Undecided	30	6.60	6.60	86.80	
		Disagree	32	6.60	6.60	92.40	
		Strongly disagree	33	6.80	6.80	100.00	
			500	100	100		
3	Software computer engineering design is a route to the increase of the increase in output aspect of economic growth by conceptual planning, programme selection, computer	Strongly Agree	294	58.80	58.80	58.80	5.660
		Agree	114	22.80	22.80	81.60	
		Undecided	29	5.80	5.80	87.60	
		Disagree	31	6.20	6.20	93.60	
		Strongly disagree	32	6.40	6.40	100.00	

programming						
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Source: The statements, responses and frequencies are got from the questionnaires returned.

Table 2 shows that for the statement that Computer Engineering would be used as a route to Economic Growth by Conceptual planning, Assembling, Product Design, and fabrication, the responses are strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. They have frequencies of 290, 110, 33, 33, 34, respectively out of 500 giving percentages 58.00, 22.00, 6.60, and 6.80 respectively totaling 100 and a Z calculated of 5.880.

For the statement that Hardware Computer Engineering design would be used as a route to the increase in income aspect of Economic Growth, the responses are strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. They have frequencies of 92, 112, 30, 33, 33 respectively out of 500. These give percentages of 58.40, 22.40, 6.00, 6.00, 6.00 respectively totaling 100 and a Z calculated of 5.855.

For the statement that Software Computer Engineering Design would be used as a route to the increase in output aspect of economic growth, the , the responses are strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. They have frequencies of 294, 114, 29, 30, 31 respectively out of 500. These give percentages of 58.80, 22.80, 6.20 and 6.40 respectively totaling 100 giving a Z calculated of 5.660.

All in all the statements have calculated Z scores more than the Table Z values at 5% level significance of 1.645. so it is shown that 80.00%, 80.80% and 81.60% of the responses either strongly agreed or agreed with the statements respectively. So most of the respondents in each case have agreed with the statements.

#### **IV. Summary Of Major Findings, Conclusion, And Recommendations**

##### **Summary Of Major Findings**

The specific objectives of the study were:

1. To determine how Computer Engineering Design would be used as a route to Economic Growth in South Eastern Nigeria.
2. To ascertain how Hardware Computer Engineering Design would be used as route to the increase in income aspect of economic Growth in South Eastern Nigeria.
3. To find out how software computer engineering design would be used as a route to the increase in output aspect of economic growth in south eastern Nigeria.

It was found that:

- I. Computer Engineering Design would by conceptual planning, assembly and product design and foundation be used as a route to Economic Growth in South Eastern Nigeria.
- II. Hardware Computer Engineering Design would by conceptual planning, assembly, hardware selection, procurement and e-procurement be used as a route to the increase in income aspect of Economic Growth in the area studied.
- III. Software Computer Engineering Design by conceptual planning, program selection and computer programming could be used as a route to the increase in output aspect of Economic Growth in the area studied.

#### **V. Conclusion**

That Computer Engineering Design was by conceptual planning, assembling, product design and fabrication would be used as a route to Economic growth in South Eastern Nigeria had some Computer Engineering implications. It implied that Computer Engineering Design by conceptual planning would be a route to Economic Growth in terms of Gross Domestic Growth which between the last quarter of 2013 and 2014 was 7.4% in Nigeria. It also implies that Computer Engineering Design by assembling, product design and fabrication would be used as a route to Economic Growth in terms of Gross National Product Growth which includes what Nigerians abroad like Dr. Philip Emeagwai are doing to design the faster computer in the United States of America.

The Hardware Computer Engineering Design by conceptual planning, assembling, hardware selection, procurement and e-procurement was a route the increase in income aspect of Economic Growth had some Computer Engineering implications. It implied that assembling through assembly line balancing was a route to the increase in income aspect of Economic Growth as Gross Domestic product Growth in the area studied. It also implied that Hardware Engineering Design through hardware selection, procurement and e-procurement would be a way to the increase in income aspect of Economic Growth measured by gross Domestic product for local products in the area studied.

That software Computer Engineering Design through conceptual planning, program selection, and computer programming could be a route to increase in output aspect of Economic Growth in the south Eastern Nigeria had some Computer Engineering implications. It implied that software computer engineering through conceptual planning could be a route to the increase in output aspect of Economic Growth measured by Gross

National product Growth when foreign nationals are included in the accounting. It also implied that software Engineering Design through program selection, computer programming and even systems Analysis would be a route to the increase in output aspect of Economic Growth where only local products are counted in the area studied.

## **VI. Recommendations**

It is recommended that the strategic Managers, Computer Engineering Experts, and Economic policy makers in south Eastern Nigeria backed by policy should:

- a) Continue to use Computer Engineering as a route to Economic Growth in South Eastern Nigeria.
- b) Continue to use Hardware Computer Engineering Design as a route to increase in income aspect of Economic Growth in South Eastern Nigeria.
- c) Continue to use Software Computer Engineering Design as a route to the increase in output aspect of Economic Growth in South Eastern Nigeria.

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