Public Lecture Series

ADVANCED ENGINEERING MATERIALS: KEY TO MILLENNIUM DEVELOPMENT GOALS IN AFRICA.

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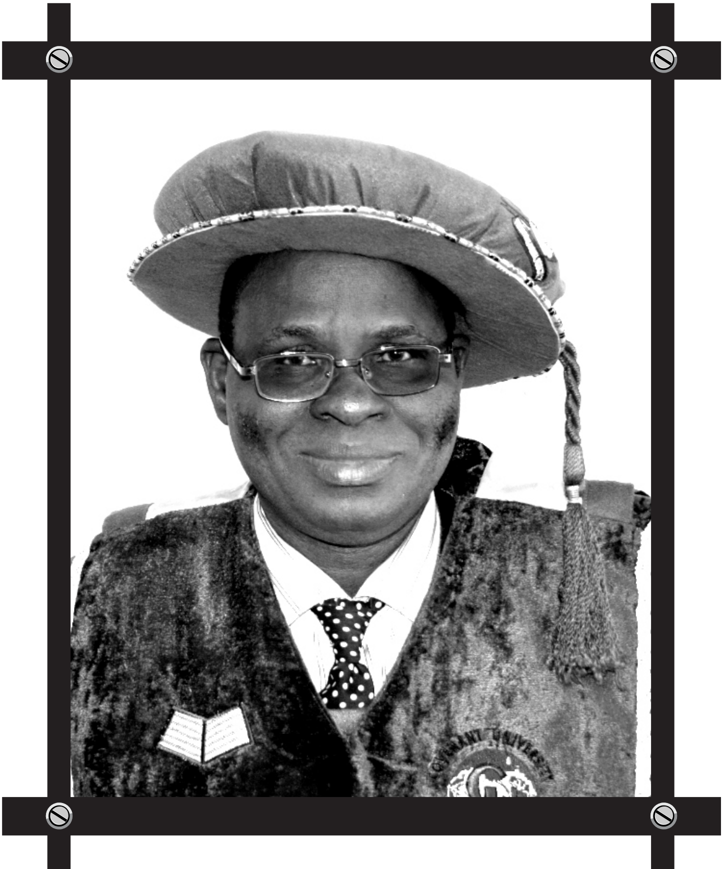

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INTRODUCTION

In Genesis 1:31, "God saw all that He had made, and it was very good. God's plan for mankind was perfect. Why then the Millennium Development goals (MDGs) in Africa.
This is part of the question this lecture intends to answer.

African nations have been characterized by conflicts, total war, slave trade, poverty of the highest order, corrupt leadership, undeveloped infrastructures, indisciplined society, we can go on to mention as many as the vices that estranged the continent. It is an irony to see all these in African continent, where civilization of the world began.

For all these calamities that befell Africa, I sometimes wonder, if that is why the observation of our God in Genesis 6:5 was made. "The Lord saw how great man's wickedness on the earth had become, and that every inclination of the thoughts of his heart was only evil all the time. It appeared to be true of Africa only. The other nations of the world are developing rapidly, when we are still walloping with diseases, poverty, corruptions and civil conflicts. Around the sixties, Malaysia and Nigeria was at the same level of development, Nigeria even seemed to have been more developed than Malaysia. Then Malaysia came to Nigeria to obtain oil palm seedlings from NIFOR, Benin in Edo-State in the fifties. Now Malaysia is well developed and exports its goods to Nigeria. For example, Dell Computers". What is wrong with Africa, where human and natural resources are in abundance? In order to wake up African countries from sleeping and get where God want them to be like other nations, there must be development in many aspects.

Recently, impetus came from the United Nation to Africa and other developing countries, that a magic year 2020, had been set for them to have rapid developments in all ramifications. This would equalize them to the developed nations in the developmental pedal. The government and the politicians had been singing loud on every occasion of this magic year 2020, all the bad vices in the continent would have been transformed or eradicated. That is, hunger, poverty, poor infrastructures, diseases, civil conflicts and others, would give way for better life. **What is this magic?** If we are going to unlock it. What must we do? This is the thrust of this lecture. This magic year had been packaged as The Millennium Development Goals (MDGs) aimed at poverty reduction over a stipulated period of time with globally defined measurable indicators of progress.

The Millennium Development Goal (MDGs)

At the Millennium Summit in September 2000 World leaders agreed on a vision for the future with the passage of the Millennium Declaration, which formally established the Millennium Development Goals.
Since then the MDGs have become the international reference standard for measuring and tracking improvements in the human condition in developing countries. Eight goals, eighteen targets (see Table 1), and forty-eight indicators have been accepted as a framework for measuring development progress. Together, the aspirations of the MDGs and their associated targets and indicators represent a powerful Framework for action. The goals are to be achieved not later than 2015. As noted by Zarki (2006), and Bamiro (2007), ("This is an ambitious vision of development; a

vision that has human development at its core to sustain social and economic progress. The MDGs include targets on issues such as poverty, hunger, primary education, gender equality, child and maternal mortality, HIV/AIDS, Malaria, TB and other major diseases as well as access to essential medicines).
In addition, the goals stress sustainable development, safe water, upgrading slums, open, rule-based trading systems and technology transfer: Implementing goals related to these themes will require, among other measures, the generation, use and diffusion of new knowledge as well as adjustments in related institutions (Dato Ir lee and Russel, 2005)

Table 1: The Millennium Development Goals and Targets.

Goal	Title	Target(s)
Goal 1	Eradicate extreme poverty and hunger.	Target 1: Halve between 1990 and 2015, the proportion of people whose income is less than one dollar a day. Target 2: Halve, between 1990 and 2015, the proportion of people who suffer from hunger.
Goal 2	Achieve Universal Primary Education.	Target 3: Ensure that, by 2015, Children everywhere, boys and girls alike will be able to complete a full course of schooling.
Goal 3	Promote gender equality and empower women.	Target 4: Eliminate gender disparity in primary and secondary education, preferably by 2005, and to all levels of education not later than 2015.
Goal 4	Reduce Child Mortality.	Target 5: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate.
Goal 5	Improve Maternal Health.	Target 6: Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio.
Goal 6	Combat HIV/AIDS, Malaria and other diseases.	Target 7: Have halted by 2015 and begun to reverse the spread of HIV/AIDS. Target 8: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases.
Goal 7	Ensure environmental sustainability.	Target 9: Integrate the principles of sustainable development into country policies programmes and reverse the loss of environmental resources. Target 10: Halve, by 2015, the proportion of people without sustainable access to safe drinking water. Target II: By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers.

Goal 8	Develop a Global Partnership for Development.	Target 12: Develop further an open, rule-base, predictable, non-discriminatory trading and financial system. Target 13: Address the special needs of the least developed Countries. Target 14: Address the special needs of landlocked Countries and small Island developing States. Target 15: Deal Comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term. Target 16: In co-operation with developing countries, develop and implement strategies for decent and productive work for youth. Target 17: In co-operation with pharmaceutical companies, provide access to affordable,! Essential drugs in developing countries. Target 18: In co-operation with the private sector, make available the benefits of new technologies.

In launching the MDGs, the then United Nations Secretary–General our Kofi A. Annan, noted:-

We will have time to reach the Millennium Development Goals Worldwide and in most, or even all, individual-Countries but only if we break with business as usual. We cannot win overnight. Success will require sustained action across the entire decade between now and the deadline. It takes time to train the teachers, nurses, and engineers; to build the roads, schools and hospitals: to grow the small and large businesses able to create the jobs and income needed. So we must start now. And we must start now. And we must more than double global development assistance over the next few years. Nothing less will help to achieve the Goals. It is pertinent to note that more than six years into the implementation of the MDGs, only a handful of African Countries have come close in any way to achieving the anticipated progress measured against the various indicators (Bamiro, 2007).

In January 2005, the UN Secretary – General launched the UN

Millennium Project's report "Investing in Development: A practical Plan to Achieve the Millennium Development Goals". The report is an ambitious effort to outline practical measures for implementing the MDGS. It represents the most comprehensive effort to address poverty and economic growth in the developing world ever mounted by the international community.

The report focuses on the practical approaches to meeting the MDGs. (Bamiro, 2007). Worthy of note, in regard to the issue of Science and Technology and development is the following submission of the report.

All nations, whether industrialized or developing, face a broad array of challenges that will require the application of up-to-date scientific knowledge and technology. Such challenges include stimulating economic growth, mitigating environmental problems, safely adopting new technologies, and quickly responding to sudden outbreaks of new diseases. No nation can now afford to be without access to a credible, independent science and technology research capacity that would help it to develop informed policies and take effective actions in these and other areas.

Consequently, international organizations, governments, and multinational corporations have coordinated their development work around the MDGs. The resulting increased cooperation and collaboration is expected to deliver the desired developmental gains. In the case of Nigeria NEEDS (National Economic Empowerment Development Strategy) was launched in 2004 with the goals of poverty reduction, wealth creation, employment generation and value – orientation. The long-term vision of NEEDS is to make Nigeria the largest and strongest African economy and key player in the World. (Katende, 2007).

However, different initiatives for African Development have been set up to complement the Millennium Development Goals (MDGs). They are as follows:

The World Summit on Sustainable Development (WSSD).
The Blair Commission Report
The New Partnership for African Development (NEPAD)

All these initiatives are targeted at re-positioning Africa in the World economy.

This lecture will not dwell on these initiatives, because my eminent colleagues had extensively talked about them in their previous public lectures of our great University.

The lecture is tied to Millennium Development Goals (MDGs) as the title suggests. The goal one of the (MDGs) is the platform to be used in launching to the other goals.

The Chancellor Sir, the lecturer believes that if the key to unlock goal one is found, the other goals would be unlocked. So, Sir, with your kind permission, I would like to concentrate on goal one in this lecture.

From goal one in table 1, eradicate extreme poverty and hunger in 2020.

What is this poverty?

Our own dear Bishop, Dr. David O. Oyedepo, graphically described what poverty is in one of his books, winning the War Against Poverty. It went like this:
“Poverty stinks, poverty bites, poverty humiliates, it makes her victim vulnerable to sicknesses and diseases.

Poverty kills. One of the most destructive social vices is poverty. Eating well makes healthy, Eating well makes strong. Eating well guarantees long life. But eating well takes good money.

The psalmist says: He continues.

He has satisfied my mouth with good things so that my youth is renewed like the Eagles. Psalm 103: 5.

Truly, no one enjoys poverty. All over the World, everyman wishes another long life and prosperity. No one wants to be wished long life and poverty. Poverty has no friend, poverty has no brother, poverty has no parents. Poverty is an orphan and no one wants to identify with it. No one in his right mind wishes to be poor. A poor man is an orphan indeed.

In fact, the Bible defines poverty as a curse. But thank God. The curse of poverty was averted on the cross, among others. This picture of poverty depicts the state of African nations. Why are we in this mess of poverty? The answer to this question can be tied to

the global economy. The global economy has become knowledge and technology-driven. While innovation and rapid technological changes are the reasons for unprecedented prosperity and growth in industrialized countries, many developing countries and countries with economies in transition are risking marginalization by being trapped in the technology-divided and investment gap (Ibhadode, 2006).
Research and development (R&D) and innovation – intensive products are increasingly driving world trade.

According to a UNIDO report in 1998, high – and medium – technology products accounted for 63.6%, 67.8% and 53.8% of manufactured (including advanced engineering materials) exports of world, developed economies and developing economies respectively. Regrettably they accounted for only 12.7% of manufactured exports form sub-Sahara African Countries (Ibhadode, 2006).
This poses serious industrial and economic development challenges to the Sub-Saharan region (Tommy, 2004).

Tables 2: Structure of Output for Group of 7 Industrialized (G.7) Countries compared with South Africa and Nigeria.

			% of GDP		
Country	GDP (2003) & Millions	Agriculture	Industry (excluding manufacturing)	Manufacturing (including Adv. Eng. Mats.)	Services
Canada	856,523	3	15	17	65
France	1,757,613	3	6	18	73
Germany	2,403,160	1	6	23	70
Italy	1,468,314	3	8	20	69
Japan	4,300,858	1	9	21	69
U.K.	1,794,8781	1	10	17	72
U.S.A.	10,748,547	2	8	15	75
Mean	3,361,413	2	9	19	70
South Africa	159,886	4	12	19	65
Nigeria	58,390	26	45	4	24
Source:-	**The Wyuorld Bank, 2005 World Development Indicators.**				

Table 3: Structure of Output of 20 poorest countries compared with Nigeria

			% of GDP		
Country	GDP& Millions	Agriculture	Industry (excluding manufacturing)	Manufacturing (including Adv. Eng. Mats.)	Services
Burundi	595	49	19	0	32
Cambodia	4,228	34	8	22	36
Central Africa Republic	1,198	61	-	-	14
Chad	2,608	46	1	12	41
Congo. Dem. Rep.	5,671	58	15	4	23
Ethiopia	6,652	42	11	0	47
Eritrea	751	14	14	11	61
Gambia	395	30	10	5	55
Guinea Bissau	239	69	3	10	18
Liberia	442	-	-	-	-
Madagascar	5,474	29	1	14	55
Malawi	1,714	38	5	10	47
Mozambique	4,321	26	16	15	43
Nepal	5,851	41	14	8	38
Niger	2,731	40	10	7	43
Rwanda	1,637	42	11	11	36
Sierra Leone	793	53	26	5	16
Tajikistan	1,553	23	-	-	56
Tanzania	10,297	45	9	7	39
Uganda	6,297	32	12	9	46
Mean	3,172	41	10	9	39
Nigeria	58,390	26	45	4	24

Liberia	442	-	-	-	-
Madagascar	5,474	29	1	14	55
Malawi	1,714	38	5	10	47
Mozambique	4,321	26	16	15	43
Nepal	5,851	41	14	8	38
Niger	2,731	40	10	7	43
Rwanda	1,637	42	11	11	36
Sierra Leone	793	53	26	5	16
Tajikistan	1,553	23	-	-	56
Tanzania	10,297	45	9	7	39
Uganda	6,297	32	12	9	46
Mean	3,172	41	10	9	39
Nigeria	58,390	26	45	4	24

Source: The World Bank, 2005 World Development Indicators.

Table 4:- Wealth Indices for G7 Countries compared with South Africa and Nigeria

Country	Per Capita Gross National income($)		Per Capita, Value added in Manufacturing ($)	Longevity % population 65 years and above
	Value	World Ranking		
Canada	28,390	19	4,826	12.8
France	30,090	18	5,416	16.1
Germany	30,120	17	6,928	17.3
Italy	26,120	23	5,224	19.0
Japan	37,180	7	7,808	18.6
U.K.	33.940	10	5,770	16.0
U.S.A.	41,400	4	6,210	12.4
Mean	32,463	12/13	6,026	16.0
South Africa	3,630	67	690	4.4
Nigeria	390	145	16	2.6

Source: The World Bank, 2005 World Development Indicators

Table 5: Wealth Indices for World's Poorest Countries Compared with Nigeria.

Country	Per Capita Gross National Income (S)		Per Capita Value Added in Manufacturing (including Adv. Eng. Mats.)	Longevity % Population 65 years and above
	Value	World Ranking		
Burundi	90	171	0	2.5
Cambodia	320	153	70	3.2
Central African Republic	310	154	-	3.5
Chad	260	159	31	2.8
Congo. Dem. Rep.	120	168	5	2.6
Ethiopia	110	169	0	2.8
Eritrea	180	165	20	2.7
Gambia	290	156	15	3.2
Guinea Bissau	160	167	16	3.4
Liberia	110	170	-	2.8
Madagascar	300	155	42	3.0
Malawi	170	166	17	3.4
Mozambique	250	161	38	3.6
Nepal	260	160	21	3.8
Niger	230	162	16	2.3
Rwanda	220	163	24	3.0
Sierra Leone	200	164	10	2.6
Tajikistan	280	157	-	4.6
Tanzania	330	152	23	2.4
Uganda	270	158	24	1.8
Mean	223	162/163	22	3.0
Nigeria	390	145	16	2.6

Source: The World Bank: 2005 World Development Indicators.

Table 6 Structure of Output for some Oil – Producing Countries

Country	GDP (2003) Million	Agriculture	Industry (Excluding Manufacturing).	Manufacturing (including Adv. Eng. Mats.)	Services
Algeria	66,530	10	48	7	35
Gabon	6,057	8	8	5	30
Iran	137,144	11	11	13	48
Saudi Arabia	214,748	5	5	10	40
Venezuda	85,394	4	4	9	55
Mean	101,975	8	8	9	42
Nigeria	58,390	26	26	4	24

Source: The World Bank; 2005 World Development Indicators

Table 7:- Wealth Indices for Some Oil – Producing Countries.

Country	Per Capita Gross National Income		Per Capital Value Added in Manufacturing (8)	Longevity: % Population 65 years and above.
	Value	World Ranking		
Algeria	2,280	84	160	4.0
Gabon	3,940	62	197	5.5
Iran	2,300	83	299	4.7
Saudi Arabia	10,430	55	1,043	2.9
Venezuelan	4,020	61	362	4.7
Mean	4,594	56/57	412	4.4
Nigeria	390	145	16	2.6

Source:- The World Bank, 2005 World Development Indicators.

Table 8: Development Indicators (Mean Values) for certain Groups of Countries, South Africa and Nigeria.

Group/Country	GDP Millions (&)	% of Manufacturing to GDP (2003)	Per Capital GNI, & (2004)	Per Capital Value Added to Manufacturing	Longevity % of Population 65 years and above (2003).
G.7 Countries	3,361, 413	19	32,463	6,026	16.0
5 Oil-Producing Countries	101,975	9	4,594	412	4.4
20 Poorest Countries	3,172	9	223	22	3.0
South Africa	159.886	19	3,630	690	4.4
Nigeria.	58,390	4	390	16	2.6

Source: The World Bank: 2005 World Developments Indicators.

Tables 2 and 3, show the structure of output for the group of seven industrialized (G.7) Countries and that for the World's 20 poorest countries respectively. Table 4 and 5 show wealth indices for the G7 Countries and the World's 20 poorest countries respectively. According to (Ibhadode, 2006) the tables show that:-

(I) Mean GDP of G.7 Countries is over 1,000 times more than that of World's 20 poorest Countries.

(II) Mean per Capita Gross National Income (GNI) for G7 countries is over 145 times that of World's poorest Countries.

(III) Mean per Capital value added in Manufacturing including advanced engineering materials for G7 Countries is over 270 times that for World's 20 poorest Countries.

(IV) Mean longevity for G7 Countries is over 5 times that of World's 20 poorest Countries.

(V) Mean contribution of agriculture to GDP of G7 Countries is only 2% while that for world's poorest countries is 41%.

(VI) Mean contribution of industry: Mining, construction, water, electricity, gas, etc. (excluding manufacturing) is 9% for G7 countries comparable to 10% for World's poorest Countries. This suggests that these sectors of the economy may not be a decisive factor in determining whether a country is rich or poor.

(VII) Mean contribution of manufacturing including advanced engineering materials to GDP in G7 Countries is over 2 times that for World's 20 poorest countries.

(VIII) Mean contribution of services to GDP in G7 countries is about twice that for world's poorest countries.

The contribution of services to GDP is significant for both groups of countries and is especially very significant for the G7 Countries – contributing about 70 percent. Thus, services include banking and financial services, tourism, education, etc. Services are rendered by means of facilitating goods which are in themselves manufactured. The higher the contribution of manufacturing the higher the contribution of services to GDP (Ibhadode, 2006).

Also, from Tables 2 and 3, we find that what makes the difference between the G7 countries, and the world's poorest countries is the level of manufacturing (including the advanced engineering materials). While agriculture contributes about 41% to GDP of World's 20 poorest nations (and they still remain hungry), agriculture contributes only 2% to GDP of G7 Countries (and they have surplus food which they destroyed).

Tables 6 and 7 show the structure of output and wealth indices respectively for some major oil-producing countries (excluding Nigeria). These tables further prove that manufacturing including advance engineering materials drives the economy. Comparing these tables with Tables 2 and 4, we find that despite the endowment of large reserves of oil in the major oil-producing countries, their GDP, per capital income, per capital value added in manufacturing and longevity are 3%, 14%, 7% and 28% respectively of those for the G.7 countries. The contribution of manufacturing to the GDPs of the major oil-producing countries (Tables 6) is at about the same level as for the world's 20 poorest countries (Table 3).

In Table 8, longevity is again lower in Nigeria than in the World's 20 poorest nations.

Looking through all these (Tables) on the world developmental indicators, we could see that Nigeria is less or equal to those countries ravaged by war such as Congo Democratic Republic, Liberia, Uganda and Sierra-Leone. This revelation tempts one to say, we have been living in war conditions in Nigeria without realizing it? (Ibhadode 2006). The question is how did we find ourselves in this mess of poverty?

It seems to me that things in Nigeria keep going from bad to worse. In the years gone by, morality was better; we had better maintained roads, railway, better educational system, better availability of electric power, better sanitary conditions, higher utilization of production capacities, disciplined workforce, greater sense of responsibility of person in leadership positions etc. We are reversing back instead of moving forward. This negative developmental attitude of the country, may depend upon our relationship with God. In God's words in Deuteronomy 28:1, says – If you fully obey the Lord your God and carefully follow all his commands that I give you today, the Lord your God will set you high above all the nations on earth.

The earth God gave Nigeria is endowed with abundant human and material resources. This material abundance could be turned into Advanced Engineering Materials, which would help this great country of ours to unlock the Millennium Development Goals (MDGs) on Goal 1, which is to eradicate extreme poverty and hunger in 2020. The Chancellor Sir, this is where this lecture will discuss how the Advanced Engineering materials can help our country to move into the developmental pedal as other nations of the World in 2020.

The critical role of advanced engineering materials in the building of a virile nation cannot be overemphasized. As in ages past, materials have remained pivotal to modern civilization and global development. For instance, the current information age driven essentially by microcomputers is made possible by rapid advances in the knowledge, development and application of advanced engineering materials.

Indeed, Materials Science and Technology is now widely regarded as the third leg of a tripod of technologies driving the world economy, the other two being biotechnology and ICT. In order to understand advanced engineering materials, it is necessary, to give brief details of materials.

2.0 <u>Materials</u>

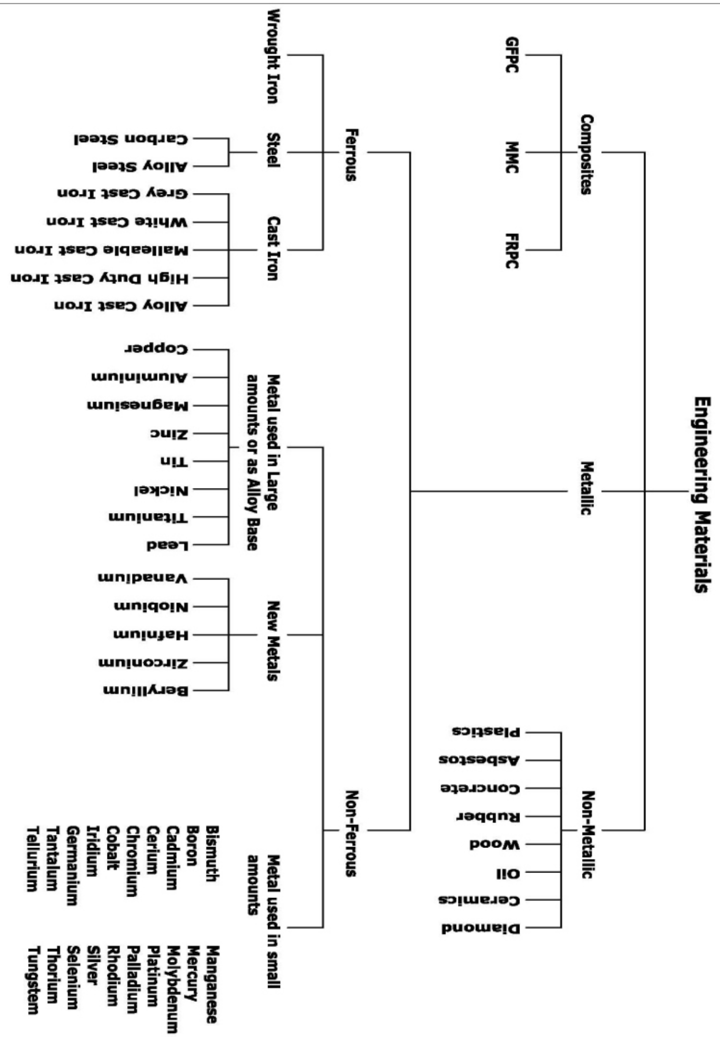
Materials are probably more deep-seated in our culture than most of us realize. Transportation, housing, clothing, communication, recreation, food production, medical care, indeed, virtually every segment of our everyday lives is influenced to one degree or another by materials. Without materials, nothing can be constructed.

From the early times man has been heavily dependent on materials for tools, clothing, shelter and others. On a typical day, the average modern man is in contact with hundreds of materials; wood, metals, polymers, glasses, ceramics and composites.

The properties of a material could be altered by heat treatment especially iron, clay, non-ferrous and steel. Also by the addition of other substances, for example, the properties of clay were greatly improved by mixing with straw and fibre, the very humble beginnings of composite materials technology (see Exodus 5:7-8).

Classes of Engineering Materials:

The classes of Engineering Materials is depicted in Figure 1.



The other important members of classes of materials which feature prominently in some classification systems are semiconductors, biomaterials and nano materials.

2.1 Materials and Geo-politics.

The developing nations of the world, by accident or design, nature had placed the bulk of most strategic materials in their soil. While the technologies to mine and process them into useful products are in the developed nations of the world. Table 2.1, shows Africa's share of the World's Materials Resources after Afonja, (2002).

Table 2.1 Africa's Share of the World's Materials Resources

Material Ores	South America	Africa	Middle-East
Iron	6.8	4.1	7.5
Copper	6.8	4.1	7.5
Aluminium	16.6	20.7	2.1
Chromium	19.5	5.8	1.5
Cobalt	0.4	55.2	0.8
Beryl	-	81.6	-
Antimony	39.2	33.5	-
Gold	14.8	21.4	26.8
Manganese	1.8	60.8	0.4
Platinum	1.9	85.6	-
Vanadium	-	52.6	?
Tin	-	10.2	14.7
Columbite	18.5	59.1	?
Tungsten	6.5	1.0	54.3
Lead	8.2	7.4	5.9
Uranium	-	20.0	6.0
Diamond	4.2	92.1	-
Titanium	-	39.0	33.0

According to Afonja (2002), some of the World's best iron ores are located in Liberia and Guinea. Zaire is one of the World's largest producers of germanium and cobalt; Zimbabwe produces 65% of the world's output of corundum and holds about a quarter of the world's reserves of lithium; Zambia is one of the world's most important sources of copper; Zambia is a major producer of Uranium; South Africa is the world's largest producer of antimony, gold, platinum, rubidium, chromium, Vanadium and gem diamond, second only to Russia in the production of Manganese and Palladium and third in the production of asbestos; Nigeria has a significant proportion of the world's reserves of tin, columbite and tantalum. Infact, Russia is the only other source in the world (columbite, a vital ferroalloy for the production of sophisticated alloy steels required for the manufacture of corrosion and heat resistant chemical plant equipment, or in superalloys for jet and aerospace engines.

Tantalum is also used as a powdered metal, mostly for the production of capacitors, which are found in many every day devices, such as mobile phones; video cameras, PCs and vehicle electronics. Afonja (2002) also stressed that the United States of America obtains 50% of her cobalt requirements from Zaire, and 66% of ferrochrome, 44% of ferromanganese (both vital steel alloying elements), 89% of Chrome Ore, 52% of antimony, 37% of Vanadium, 92% of Platinum, 85% of asbestos and 98% of Manganese, all from South Africa. It is inevitable therefore from the foregoing that Material Ore supply is a very potent factor in geopolitics. It is important also that the sources of vital minerals must be kept open at all costs. Despite the vital minerals discovered in Africa already, the continent is still in very poor state.

In the case of Nigeria the available minerals, if well developed and managed can drive the country to meet the millennium development goals one in 2020.

Table 2.1b, indicates some of these minerals in each states of the Country.

States	**Mineral Resources**
Abuja (FCT)	Marble, Clay, Tantalite
Abia	Gold, Salt, Limestone, Lead, Zinc, Oil and Gas
Adamawa	Kaolin, Bentonite, Gypsum, Magnesite Barytes, Bauxite
Akwa Ibom	Clay, Limestone, Lead, Zinc, Uranium (traces) Salt , Lignite (traces), Oil and Gas
Anambra	Lead, Zinc, Clay, Limestone Iron-ore, Lignite (partially investigated) Salt, Glass-Sand, Phosphate, Gypsum
Bauchi	Amethyst (violent), Gypsum, Lead, Zinc Uranium (partially investigated)
Bayelsa	Clay, Gypsum (partially investigated) Manganese (partially investigated), Limestone Uranium (partially investigated) Lignite (partially investigated Lead/Zinc (traces), Oil and Gas
Benue	Lead, Zinc, Limestone, Iron – ore Coal, clay, Marble, Bauxite, Salt Barytes (traces), Gemstone Gypsum Oil and Gas
Borno	Diatomite, Clay, Limestone Oil and Gas (partially investigated), Gypsum Kaolin, Bentonite

Mineral deposits in each state of the Country(cont'd).

Cross River	Limestone, Uranium, Manganese, Lignite, Lead, Zinc, Salt, Oil and Gas
Delta	Marble, Glass-sand, Clay, Gypsum, Lignite Iron-ore, Kaolin, Oil and Gas
Ebonyi	Lead, Zinc, Gold, Salt
Edo	Marble, Clay Lime stone, Iron – ore Gypsum, Glass-Sand, Gold Bentonite, Dolomite, Phosphate, Bitumen, Oil and Gas
Ekiti	Kaolin, Feldspar, Tatium, Granite, Syenites
Enugu	Coal, Limestone, Lead, Zinc
Gombe	Gemstone, Gypsum
Imo	Lead, Zinc, Limestone, Lignite, Phosphate Marcasite, Gypsum, Salt, Oil and Gas
Jigawa	Barytes
Kaduna	Sapphire, Kaolin, Gold, Clay, Serpentinite Asbestos, Amenthyst, Kyanite Graphite (partially investigated) Sillimanite (partially investigated)., Mica (traces), Aquamarine, Ruby, Rock Topaz, Flourspar, Tourmaline, Gemstone Tantalite
Kano	Pyrochlore, Cassiterite, Copper, Glass-Sand Gemstone, Lead, Zinc, Antalite
Katsina	Kaolin, Marble, Salt
Kebbi	Gold
Kogi	Iron – ore, Kaolin, Gypsum, Feldspar, Coal Marble, Dolomite, Talc, Tantalite, Kaolin Limestone, Gemstone, Bitumen

Mineral deposits in each state of the Country(cont'd).

Kwara	Gold, Marble, Iron-ore, Cassiterite, Columbite Tantalite, Feldspar (traces)
Lagos	Glass – Sand, Clay, Bitumen, Sand, Tar Oil and Gas
Nasarawa	Beryl (Emerald, aquamarine and hellodor) Dolomite, Marble, Sapphire, Tourmaline Quartz, Amethyst (garnet, Topaz), Zircon Tantalite, Cassiterite, Columbite, Ilmenite Galena, Iron-Ore Barytes, Feldspar Limestone, Mica, Cooking Coal, Talc, Clay Salt, Chalcopyrite
Niger	Gold, Talc, Lead, Zinc, Iron-Ore
Ogun	Phosphors Clay, Feldspar (traces)
Ondo	Bitumen, Kaolin, Gemstone, Gypsum Feldspar, Granite, Clay Glass-Sand Dimension Stones, Coal Bauxite Oil and Gas
Osun	Gold, Tack, Tantalite, Tourmaline, Columbite Granite
Oyo	Kaolin, Marble, Clay, Sillimanite, Talc, Gold Cassiterite, Aquamarine, Dolomite Gemstone, Tantalite
Plateau	Emerald, Tin, Marble, Granite, Tantalite Columbite, Lead, Zinc , Bauxites, Iron – Ore Kaolin, Cassiterite, Dolomite Gold (partially investigated), Bentonite Phosphorus, Clay, Coal, Wolram, Salt, Bismut Fluoride, Molybdenite, Gemstone, Banxite
River	Glass – Sand, Clay, Marble Lignite (traces) Oil and Gas

Mineral deposits in each state of the Country(cont'd).

Sokoto	Kaolin, Gold, Limestone, Phosphate Gypsum, Silica – Sand, Clay, Laterite Potash, Flakes, Granite, Gold, Salt
Taraba	Kaolin, Lead, Zinc
Yobe	Diatomite, Soda Ash (partially investigated).
Zamfara	Gold

Source: The punch Newspaper June 17, (2005), vol.17, quoted Federal Ministry of Solid Minerals, Abuja.

These minerals can be processed and transformed into useful products of Advanced Engineering Materials.

What is Advanced Engineering Materials then?

They are either traditional materials whose properties have been enhanced or they are newly developed, high-performance materials and may cut across wide spectrum – metal, ceramics, glass, and polymers. These advanced engineering materials are used in high technology. Such materials can stand up to the high –temperature, highly radioactive environment of a nuclear reactor, the appropriate wear and equipment for the astronauts, heat – resistant ceramic tiles to enable the space shuttle to re-enter the earth's atmosphere without burning up, and semi conductors and multi – million chips for sophisticated computer circuits and telecommunications equipment are examples of such materials.

Without them, some of the greatest achievements we are witnessing in the developed world today would not have been possible. The development has been possible through the use of advanced engineering materials in form of composites, superconductivities, super alloys, polymers, ceramics, optic fibres, and semi conductors have revolutionized the developmental process in the world. These products are used in communication, transportation, defence, building construction, medicine and dentistry, and sports.

The Asian countries use the advance engineering materials to develop rapidly, using modern technology. The examples of these countries are China, Singapore, India, South Korea, Taiwan, and others.

3.0 Advanced Engineering Materials in the service of modern technology.

The main propellant for human development is technology. The major development indicators – health care, social amenities, education, communication, transportation, etc., can only be realiasable through technology. Technology on the other hand is materials driven. Virtually every new technological development depends primarily on the availability of the appropriate materials. These mineral resources in our states listed in table 2.1b, can be transformed into developmental products resulting in millions of employments to our youths and others in the society. This can be made possible with our engineers and technologists.

The main factor that distinguishes the engineer from other technologists is design capability and this places him or her at the fore front of technological development. However, the engineer's design can only be transformed into useful product if the right materials are available. Inevitably therefore, every other engineer depends heavily on the materials engineer in order to function.

The development of inventions also depends primarily on materials. The above products of advanced engineering materials are the key to Millennium Development Goals in Africa. However, this lecture will dwell in details on advanced engineering materials in communication. This is because the whole world now is a global village, which is made possible by communication system.

3.1. Advanced Engineering Materials in communication (Electronic, Telecommunication and information technology)

The whole progress of human civilization and technological achievement depends on man's ability to communicate with his fellow men. We are continually searching for ways of transmitting more and more information at the highest possible speed, and we rely heavily on machines which store and process information. Infact, in many instances the human being in the link is unnecessary and machines communicate directly with each other.

3.2 Communication Systems

The technology of information transmission using an electric signal was invented at the start of the 19^{th} century when the first telegraphed messages were sent through Copper Cables laid underground. At first the cables were bare, because insulation was not introduced until 1938. The first insulating materials used were tarred rubber and pitch-covered yarn. Immediately after the telegraph was successfully established on land, attempts were made to produce a submarine cable.

In 1879 the first telephone exchanges were built in Britain and America. The cables were Copper and the Switches were made of nicked silver (Cu–Ni-Zn) because of its excellent wear and corrosion resistance. Copper cables for telephone systems have been in use ever since.

The most recent advances in telecommunications use optical fibres but this has not rendered copper cables obsolete. For transmission over long distances, the optical signal must be boosted at intervals, the repeater units require electrical power which is carried in copper cables. The copper not only carries power, but also helps to prevent hydrogen from migrating to the optical fibres where it can increase signal attenuation. Copper, Aluminium, Carbon, silicon and others played greater role in producing advanced engineering materials in communication systems.

3.3 The Phenomenal Development of the Electronics Industry

The phenomenal development of the electronics industry in the last 50 years or so is a direct result of progress in advanced engineering materials technology. The invention of the transistor in 1948 was a milestone in the history of technology. Ultra-high purity single crystals of silicon and germanium were required for transistors and commercial production of both metals was a result of years of intensive research on metal purification by zone refining and single crystal technology. It became possible to prepare metals, which are spectroscopically pure, with impurity level as low as 10^{-9} ppm. The development of Semiconductors has made possible the advent of integrated circuitry that has totally revolutionized the electronics and computer industries.

Other recent, outstanding examples of recent developments which were heavily dependent on advanced engineering materials technology are fibre optic telecommunications, wireless telecommunications and electronic mail, the internet, to name just a few. A phenomenal revolution is going on in the field of electronic materials which will continue to impact prominently on virtually all aspects of technological development. For example, research on the familiar light-emitting diode (LED) used in digital displays has led to the development of a new LED based on gallium nitride and related inorganic compounds, which is now being used in lighting systems. According to Afonja (2002), if a country like the United Kingdom were to switch from light bulbs and fluorescent tubes to LED lighting units, the country would save as much as 10% of its entire energy consumption. The only problem is that LED-based internal light “bulbs” would last for up to 60 years and, in the words of Professor Colin Humphreys of the University of Cambridge, U.K., people could forget how to change them!.

3.3.1 The role of Materials Engineers in developing advanced engineering materials.

The Materials engineer has been at the forefront of these developments and also in the development of the technology of fabrication and assembly of devices, manufacture of resistors, capacitors, insulators, transistors, diodes, etc. The phenomenal development of the computer in the last two decades or so would have been impossible without the development by the materials engineers of techniques of etching millions of transistor circuits of a small chip 2.5cm square called the processor chip which is the heart, of the computer. I would like to add here that this equipment has been acquired by the Covenant University, first in Africa.

The materials scientists and engineers have developed a new generation of modern ceramics in the pattern of the advanced engineering materials. These have made a significant impact on technological development in electronic, computer, communication, aerospace and a host of other industries rely heavily on their use. Current research on new ceramics by materials scientists and engineers focuses on a fundamental character of the unique properties of these materials.

In particular, electrical, magnetic and optical properties and property combinations unique to ceramics are being exploited in a host of new products, which find applications in internal combustion and turbine engines, as armour plate, in electronic packaging, as cutting tools and for energy conversion, storage and generation. The advanced engineering material in ceramics, such as silicon nitride, silicon carbide and zirconia are being developed for turbine blades, jet aircraft engines of particular significance are the relatively low densities of these materials, which will result in blades that are lighter than their super alloy counterparts, and which will also lead to other light weight components. Zirconia is also being used currently as surface coatings for super alloy aircraft turbine engine components in order to improve heat and wear resistance. The engineers have developed a new low-conductivity, low-density, low – coefficient of thermal expansion silica fibre insulation material (high – temperature reusable surface insulation, HRSI) specially for the tiles that cover the space shuttle. This protect and insulate shuttle from extreme temperatures during it's fiery re entry into the atmosphere and without which the shuttle structure could melt and disintegrate. Recently, a family of ceramic materials that are normally electrically isolative have been found to be superconductors in coordinately high critical temperatures.

Initial research centered on Yttrium barium Copper Oxide, YBa_2, Cu_3O_7 which has a critical temperature of 92k. New Superconducting Ceramic Materials with even higher critical temperatures have been and are being developed. The technological potential of these materials is extremely promising in as much as their critical temperatures are above 77k which permits the use of liquid nitrogen, a very inexpensive coolant, in comparison to liquid hydrogen and liquid helium. The product will be used in the hospitals, transportation and others. Supersonic train, which the speed will be around the speed of lighting is being developed using super conductivities materials.

4.0. The role of Covenant University in developing advanced engineering materials.

The vision of Covenant University is to raise new generation of leaders who will restore the dignity of our great nation and the black race all over the world. According to our Chancellor, Dr. David Oyedepo, our commitment is to raise the modern day Josephs, Moses, Esthers, Nehemiahs, and Deborahs for our great continent. He further stressed that our mission is to empower students towards national reconstruction, reconciliation, socio-economic development and restoration of human dignity by driving a change philosophy via the vehicle of higher education.

With this platform and encouragement and passion for research work from our Chancellor, Dr. David Oyedepo, silicon research group is formed in the Covenant University. The programme of the research group seeks to contribute to national economic development by research into advanced engineering materials through the use of the abundant sand over the country for technological use especially in communication and others (electronic, telecommunication and information technology). The cluster research group comprises mechanical, electrical, electronics and physics departments at present. There are opportunities for other departments to join the group. The groups also have external collaboration of scientists and engineers.

The top merits of silicon are many, only few will be mentioned here. Silicon has transformed the world interims of technology and social developments. It has found to be major components in the following:- system automation, robotics, instrumentations, remote measurements, social (securities and information technology) biometrics, mecatronics, environmental, ICT, etc.

The aims of silicon group is to carefully select pure sand, and process with the result to commercial brown metallurgical grade silicon of 97% purity or better for semi conductors production, it must be further purified to bring impurities below the parts-per-billion level. Then purified crystalline silicon when doped with elements such as boron, gallium, germanium, phosphorus or arsenic, are used in the manufacture of solid-state electronic devices such as mentioned above also in computer, integrated circuits, TV, Radio, Solar Cells, Light emitting diodes (LED), Microchips, Sensors PSOc etc.

By getting crystalline silicon, other useful compounds can be fused with it, like silicon carbide (SiC) which is as hard as diamond and used as an abrasive. It will be very useful in Metal Matrix Composite (MMC) in production of materials for transportation, defence, agriculture, construction etc. Sodium silicate (Na_2SiO_3), is used in the foundry, in the production of soaps, adhesives, an egg preservative, silicon tetrachloride ($SiCL_4$), used to create smoke screens, silicone, used as lubricants, polishing agents, electrical insulators and medical implants. We can see raw material as sand is developed into valuable items to be used in every day life.

The preliminary work result of the group on Nigeria sand is very promising. The equipment for the research work is very expensive. The promise of the management of the Covenant University to acquire these sophisticated equipments is very encouraging. The products from this research group will definitely lead Nigeria to be one of the competitive countries in the production of advanced engineering materials for high technology. This will translate to development in the country and Africa continent.

4.1 The Design model to eradicate extreme poverty and hunger in compliance to Millennium Development Goals in Africa 2020 in the platform of advanced engineering materials.

Figure 2, shows design model to eradicate extreme poverty and hunger in compliance to Millennium Development Goals in Africa 2020 in the platform of advanced engineering materials (A case study of Bauxite a raw material to produce aluminium and use for composite materials in platform of advance engineering materials).

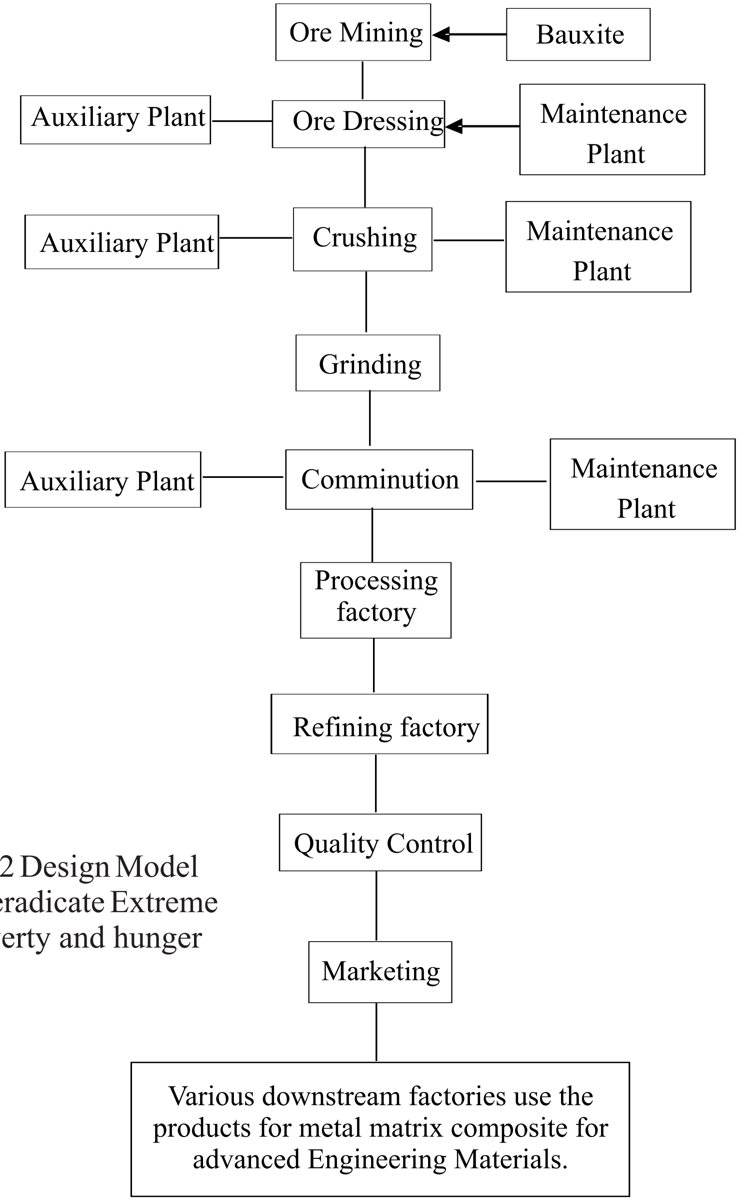


Fig 2 Design Model To eradicate Extreme Poverty and hunger

This design model, assume each ore mining industry employs 500 people in ore mine. In Africa there are many mineral ores (see table 3.1) to be explored and processed in the continent.

If there are about 1000 mining sites, more than 500,000 people would be gainfully employed using the employment assumption of the model. In each stage of the flow chart of the model there is employment. There are auxiliary factories attached to these stages to maintain the plants, and marketing their by-products. More people will be engaged to work in them.

The downstream factories where many products are being manufactured would employ many workers which invariably add to employment number. If the model employment system is carried out as suggested, it will take many families in the continent away from the extreme poverty and hunger level. With this the Millennium development goals in eradication of extreme poverty and hunger will be met in 2020. All the other goals of the millennium development depend mostly on this first goal.

3.0 Conclusion

(1) To all intents and purposes the quest to rapidly attain the Millennium Development Goals (MDGs) in 2020 in Africa is very possible. If we first all repent of the sins of our corrupt leaders, injustices, indiscipline etc. We live within the continent, shun the devilish ways, like ritual killing, murders, armed robbers and other bad vices that are common. We then sincerely in our minds seek God for forgiveness, and thereafter key in to His words in Deuteronomy 28:1-2. Which says; "if you fully obey the LORD your God, and carefully follow all His commands I give you today, the Lord your God will set you on high above

all the nations on earth". All these blessings will come upon you and accompany you if you obey the LORD your God.

(2) If we confess our sins sincerely and not to go back to them again, according to His words in **2nd Chronicles 7:14**, which says:- **"If my people, which are called by my name, shall humble themselves, and pray, and seek my face, and turn from their wicked ways; then will I hear from heaven, and will forgive their sin, and will heal their land".** The Chancellor Sir, I then believe that our God will raise up people like modern day, Josephs, Moses, Esthers, Nehemiahs, Deborahs in our great continent in the local, state and Federal level, who will pilot and lead people for the rapid attainments of the Millennium Development Goals (MDGs) in 2020 in Africa.

(3) There must be a revolutionary approach in our educational system in the continent current like the Covenant University Model to raise up new generational leaders, who will depart from presently legalism in doing things to realism and have the spirit of possibility mentality in solving the problems of lives this will help in attaining the Millennium Development Goals (MDGs) in 2020 in Africa.

(4) Energy is the most strategic infrastructure for national development and requires a lot of attention from all concerned with a view to making energy available to urban and rural areas. This will help the continent to develop the abundant mineral resources into advanced engineering materials for use to realise the dreams of the Millennium Development Goals (MDGs) in 2020 in Africa.

(5) Science and technology must be placed at the heart of

policies to promote sustainable development. Adequate funds must be made available in support of the 60:40 Science/arts students ratio recommended for tertiary institutions so as to provide adequate laboratory space, workshop and laboratory equipment. If this is done more practical, many material scientists and engineers will be produced and help in transforming our mineral resources into high technology products of the Advanced Engineering Materials. Their products will help the continent, to achieve the Millennium Development Goals (MDGs) in 2020 in Africa.

(6) To be relevant and to be certain that the 2020 target of becoming the 20th largest economy in the world is achieved, starting from now, hundreds at least, of different types of foundry complexes, for both ferrous and non-ferrous casting must be established (India has over 2,500 foundries, the U.S.A. over 6,000). The Steel plants at Ajaokuta and Alaja in Warri must be upgraded and expanded to accommodate the products of special steels which can be used in Advanced Engineering Materials. Also as a matter of urgency, composites of metal matrix, polymer and ceramics industries should be established, which are the major part of Advanced engineering Materials for manufacturing components for transportation, communications, defence, Agriculture, and etc.

(7) The design model in this paper if it is followed and implemented the eradication of poverty and hunger as reflected in the Millennium Development Goals one, will be attained. Again the realization of all other MDGs goals is intrinsically dependent on goal one.

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The Lord God has been wonderful to me at every moment of my life. Without Him, I have no life. With Him everything is possible for me. Therefore, I acknowledge Him most in this lecture, glory, honour and adoration to Him alone in Jesus name, Amen.

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I am very thankful and full of appreciation to my lovely and most beautiful wife of my youth for her love and care. Dr. (Mrs) Adedayo Ibijoke Inegbenebor. You are a wonderful woman and a beautiful gift of nature that one will always desire. I appreciate you.

To my wonderful children – Dr. (Miss) Ebahili Diana Olubunmi and Emmanuel, I appreciate the Lord God for your lives and for blessing me with you all. I thank you for your support always.

I wish to appreciate all the academic and non-academic staff of this great University and especially those from my department for their co-operation.

I enjoy the cooperation and friendship of all principal officers of the University, Deans and eminent Professors for which I am deeply grateful.

Finally to all the audience, our dear students, Kings and Queens of Hebron, distinguished guests and friends, members of the press, ladies and gentlemen, thank you all for making today so colourful and worthwhile and for your patiently listening.

May God bless you all and grant you journey mercies in Jesus Name.

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