

# Revitalizing Vocational & Technical Education to Prepare the Workforce for Disruptive Technologies: Nigeria as a Case Study

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# VTE & Economic Empowerment



- ▶ Education and job training program designed to improve individuals' general proficiency, especially in relation to present or future occupations
- ▶ Revitalizing VTE is a means of improving economic opportunities for the youth



# Disruptive Technologies/Innovations

- ▶ **A term coined by Harvard Professor Clayton M. Christensen**
- ▶ **Defined as a technology or an innovation that:**
  - **helps create a new market & value network and eventually disrupts an existing market and value network over a few years**, displacing an earlier technology
  - **transforms an existing market/sector by introducing simplicity, convenience, accessibility, and affordability**



# Key Disruptive Technologies/Innovations



- ▶ **New portable energy technologies**– mobile rechargers embedded into smart phones tablet cases, light weight pocket chargers that can recharge devices on the go
- ▶ **Autonomous vehicles**– driverless cars, drones deployed for public safety applications, environmental monitoring, package delivery, agriculture, et c;



# Key Disruptive Technologies/Innovations



- ▶ **Additive manufacturing, i.e., 3D printing**—building 3–D objects with machines using CAD software
- ▶ **The internet of things, i.e., everyday object becoming connected to the web**



# Key Disruptive Technologies/Innovations



- ▶ **Next generation interphase**– A new generation of Portable devices primarily in the form of wearable and embedded computers with non–touch interphase methods, e.g., voice, facial expression & gesture recognition
- ▶ **Next generation Genomics** – There are currently over 350 biotechnology products in clinical trial, many of which are based on genetic sequencing

# ASSESSING NIGERIA'S LEVEL OF PREPAREDNESS





# Steps in the Right Direction ■ ■

Nigeria currently has:

- ▶ 94 Technical Colleges
- ▶ 75 Polytechnics
- ▶ 13 Universities of Science & Technology & 3 Universities of Agriculture
- ▶ 55 Vocational Enterprise Institutions (VEIs)
- ▶ 80 Innovative Enterprise Institutions (IEIs), all established between 2008 & 2010)





# VTE in Nigeria Contd.



- ▶ 31 Colleges of Agriculture
- ▶ 13 Colleges of Health Science

*A National Board for Technical Education*  
(NBTE) that oversees VTE



# ITF and SIWES



- ▶ The Industrial Training Fund (ITF) supports the 3 – 6 months of Student Industrial Work Experience Scheme (SIWES) designed for in students in Polytechnics & Universities



# The UNESCO Project



- A cost-sharing project agreement between UNESCO and Nigeria Federal Ministry of Education was signed in December 2000 **to revise curricula for Technical Colleges and Polytechnics and establish a new system of continuing technical staff development and training**
- Project implementation commenced in February 2001 with a radical review of the curricula for 28 disciplines in electrical, mechanical and building disciplines at both levels



# UNESCO Project Contd.



- ▶ Seven Staff Development Centres (SDCs) were established in Federal Polytechnics
- ▶ Since February 2002, the seven SDCs have held more than 34 training workshop
- ▶ The project was designed to provide initial training to about 20% of the staff in Nigeria's technical and vocational education and training (TVET) system



# NASENI



Nigeria has a National Agency for Science & Engineering Infrastructure (NASENI) established in 1992, currently operating through **8 Development Institutes**, i.e.,

- ▶ Scientific Equipment Development Institute (SEDI), Enugu
- ▶ Electronic Development Institute (ELDI), Awka
- ▶ Hydraulic Equipment Development Institute (HEDI), Kano



# NASENI Development Institutes



- ▶ Engineering Materials Development Institute (EMDI), Akure
- ▶ National Engineering Design Development Institute (NEDDI), Nnewi
- ▶ Power Equipment & Electrical Machines Development Institute (PEEMADI), Okene
- ▶ Prototype Engineering Development Institute (PEDI), Ilesa
- ▶ Advanced Manufacturing Technology Project (AMT-P), Jalingo ([www,naseni.org](http://www.naseni.org))



# NASENI's Key Intervention Areas



- ▶ Developing capacities in:
- ▶ **Mechatronics** (integration of Mechanics & electronics with intensive computer programming in product & manufacturing system design)
- ▶ **Advanced Manufacturing Technology**
- ▶ **Reverse Engineering**
- ▶ **Nanotechnology/biotechnology**
- ▶ **Renewable energy**
- ▶ **Science kits development for Primary & Senior Secondary Schools**



# NABDA & Bioinformatics



- ▶ Bioinformatics is the application of Information Technology, computer software, statistical, and mathematical techniques to solve problems of interest to biology, **genomics, biotechnology, medicine, Agriculture**, et c.
- ▶ The National Biotechnology Development Agency (NABDA), Abuja has a centre for Bioinformatics that collaborates with the University of Ibadan Bioinformatics research group ([www.bioinformatics.ui.edu.ng](http://www.bioinformatics.ui.edu.ng))





# University Training in Bioinformatics



- ▶ University of Ibadan and Covenant University, Ota offer M.Sc. and Ph.D. programmes in Computer Science with Bioinformatics option
- ▶ Universities of Ilorin & Benin are also following suit



# National Policy on Education



- The 2008 National Policy on Education contains promises by the Nigerian Government to take necessary measures to ensure that:
  - Teaching is **practical, activity-based, experiential and ICT-supported**
  - Education is **related to overall community needs**
  - Special provisions & incentives are made for the **study of the sciences at all levels of the educational system**



## The Verdict.....



- ▶ Nigeria has invested copiously in technical education (TE), but not as much in vocational education (VE)



# Fundamental Challenges of VE in Nigeria



- Less than 5% of secondary education is oriented towards **VE** skills
- Overall disinterest in **structured Vocational Education (VE)** in general
- Inadequacy of basic **VE** training infrastructure
- Dearth of qualified & experienced **VE** instructors
- Decline in enrolments in **VE** over the years

**Hence,**



# Fundamental Challenges of VE in Nigeria Contd.



- ▶ The “apprenticeship system” has become one of the principal media of VE, and there is a
- ▶ Shortage of **well-trained** artisans and technicians –auto mechanics, electricians computer, database and Web/Network technicians, medical technicians, et c



# Revamping VTE in Preparation for Disruptive Technologies



# Creating a National Vocational Training Board



- ▶ It may be necessary to establish a separate National Vocational Training Board/Authority
- ▶ Such Boards have been established in Botswana (Botswana Training Authority – BOTA), Mauritius (Industrial and Vocational Training Board – IVTB), Namibia (National Vocational Training Board – NVTB), Tanzania (Vocational Education Training Authority – VETA), and Zambia (Technical Education, Vocational and Entrepreneurship Training Authority – TEVETA)



# National Vocational Training Board



- ▶ The Board should be empowered to:
- ▶ Have the overall responsibility for skills development in the country
- ▶ Oversee apprenticeship training programmes & link non-formal, and informal vocational training to the formal VTE sector





# Enhanced Industrial Training



- ▶ Continuous Industrial training exposure for VE Teachers and students as is currently done in China
- ▶ Revamped Industrial Training Fund (ITF) to support training in preparation for the emergence of disruptive technology and attendant challenges in areas such as **supply of equipment and training facilities, VE staff & student exchange programmes, etc.**



# Industrial training Contd. ■ ■

- ▶ Encouraging all Universities, Polytechnics and Technical Colleges to establish and adequately fund **Industrial Training & Co-ordination Centres**



# Revamped Curricula



- ▶ University Departments of Engineering , VTE, Adult Education and Agric. Extension should be more involved in:
  - Curricula development for VE training programmes
  - Sharing of information and ideas on best practices in VTE & some form of VTE for adult learners
  - Development of technical textbooks based on the new curricula



# New Policies and Strategies ■ ■

- ▶ It is important to formulate policies develop strategies that address the cross-cutting issues of VTE quality and relevance of training, employability, **collaboration between training institutions and employers, accreditation of training providers (in the formal, non-formal and informal sectors), assessment, certification, internal and external quality assurance of training programmes, funding, and instructor training**



## Imperatives of Implementing New Policies and Strategies



- ▶ Sustainable source(s) of funding
- ▶ Globally recognised training programme with proven track records, i.e.,
  - Enhanced training facilities
  - Enhanced delivery
  - Mechanism for assessing training outcomes
  - Enhanced link with higher education system
- ▶ A resulting workforce of skilled technicians and craftsmen
- ▶ Enhanced opportunities for graduates of the programme



# Enhanced training facilities



- ▶ Provision of training tools
- ▶ Adequately equipped workshops, libraries and other training resources



# Enhanced delivery



- ▶ Proper staffing
- ▶ Flexible curricula
- ▶ Adequate and proper instructional materials
- ▶ Stakeholders/employers' involvement, et c.



## Mechanisms for assessing training outcomes



- ▶ Training needs assessment
- ▶ Labour market studies





# Enhanced opportunities for graduates of the programme



- ▶ Training should embody:
  - Technical support & skills upgrading/updating
  - Apprenticeship placement and support
  - Business studies
  - Business ethics



# Case Study of a Public University–Private Sector Partnership VE Programme



- ▶ The Distance Learning Centre (DLC) of the University of Ibadan (UI) in conjunction of the Department of Mechanical Engineering & a Private Auto–Mechanical Workshop developed a **Certificate Programme in Automotive Technology** in 2011



# VE by Distance Learning



- ▶ Programme Focus: skills up- grade, on-the-job training in 7 States – Oyo, Ogun, Osun, Ekiti, Ondo, Lagos & Kwara
- ▶ Entry qualification: working experience in auto-mechanics
- ▶ Class size– 2 cohorts/centre/year (30 participants/cohort)
- ▶ Programme duration– Three Months (weekends only)
- ▶ Tuition fee– N30,000 ( approx. USD 160)
- ▶ Funding– Training funded by participants



# VE by Distance Learning: A Partnership that Works



- ▶ Curriculum include training modules on:
  - Diagnostics– troubleshooting, tools & equipment
  - Vehicle electronics
  - Hybrid engine systems & modern vehicle engines
  - Work ethics & practice for engineering technicians
  - Customer Service
  - Health & Safety
  - Business Communication
- ▶ Curriculum developed by the University and the collaborating Private Mechanical Workshop



# VE by Distance Learning: The UI Model Contd.



- ▶ Theoretical aspects of training is handled by **Academic & Technical Staff** of Mechanical Engineering Department, UI
- ▶ Administrative processes handled DLC, UI
- ▶ Hands-on training handled in designated workshops across the 7 training centres
- ▶ Training conducted in both **English and local languages**



# VE by Distance Learning: A Win-Win Situation



- ▶ Trainees are keenly interested in the programme & are happy to pay for training & obtain certificate of a prestigious university-UI
- ▶ Many graduates of the programme have secured employment overseas using their certificate



# Plans for programme expansion

- ▶ Plans afoot to bring on board Electrical & Electronic Engineering Department, UI
- ▶ Talks on-going with the National Automotive Council to develop a full-fledged programme on automobile engineering



## VE by Distance Learning: Key Lessons from UI Experience



- ▶ Ill-trained auto-mechanics can be re-trained, on the job as evidenced by the good performance of trainees and the eagerness with which many (> 700) apply for training annually
- ▶ Participants are willing & able to pay for training when there is value-for-money
- ▶ Skills up-grade expands job opportunities beyond borders





# VE by Distance Learning: Key Lessons from UI Experience



- ▶ University–Private–Partnership works
- ▶ Universities can be involved in VTE training particularly using the Distance Learning mode



# IIT, Lagos: Case Study of an NGO– Private Sector VE Initiative



- ▶ Institute for Industrial Technology (IIT) ([www.iit.edu.ng](http://www.iit.edu.ng))– a non–profit, single sex technical vocational school in Lagos– Nigeria was established by *African Development Foundation*
- ▶ It started operations on March 27,2000 and was approved by the Lagos State Ministry of Education in May 2006
- ▶ It offers top–quality hands–on practical skills training to Nigerian youths and adults mainly from the lower income stratum of society



## ITT Training programmes



- ▶ **Electromechanics**, targeted at young secondary school leavers
  - ▶ **Mechatronics**, targeting fresh graduates of tertiary institutions, experienced technicians and engineers
  - ▶ **Electrotechnics**, designed to develop technical professionals for the power sector
- Short Term refresher courses** targeted at Technicians & Engineers from industry



# IIT Admission Requirements



▶ Candidates must:

1. Be Male Secondary School leaver
2. Be at least 17 years at the commencement of the program
3. Submit a copy of birth certificate, a recommendation letter from school principal or testimonial and a passport photograph
4. Have credits in Mathematics and Physics at SSCE/GCE/NECO exams.
5. Pass IIT entrance examination and Interview.
6. Be fit to undertake training (Medical report is required)



# IIT Curriculum



- ▶ Training Model: the Dual Training System (DTS) of vocational training
- ▶ **Programme duration: 2 years**
- ▶ **1<sup>st</sup> year** –Theoretical Courses on: Ethics, Technical communication, Engineering drawing, Mechanical fitting, Shaping, Milling, Electrical installation, Motor controls, Electro–pneumatics, Programmable logic control (PLC), Computer aided communication, Welding, etc.
- ▶ Practical content of these courses is as high as 70%.



# IIT Curriculum contd.



- ▶
- ▶ **2<sup>nd</sup> year**– Trainees spend 10 Months in a selected partner company for the in-plant training
- ▶ Every week, the trainees work in the company for 4 days following a pre-planned training program and attend school for 1 day
- ▶ Each trainees keeps a logbook which is reviewed by delegated school staff and forms an essential component of the final assessment



# A Partnership that Works



- ▶ Companies are encouraged to pay stipend to the trainees for transportation and feeding
- ▶ Trainees return to school for the last two months for final assessment and curriculum review workshop
- ▶ This also gives interested companies the opportunity to interview them for possible employment
- ▶ Over 500 participants go through one program or the other every year and the graduates have always secured employment shortly after graduation



# Programme Certification



- ▶ First year, students are prepared and sit for the modular National Technical Certificate (NTC) of the National Business and Technical Examination Board (NABTEB) examination
- ▶ They qualify as Machinist after sitting for the Turning, Shaping, Milling & Fitting modules of Mechanical engineering craft practice
- ▶ Second year, the students may be prepared, and sit for the Diploma examination of City & Guilds of London in applied Electrical Engineering





# Overall Lessons from the Two Case Studies



- ▶ **Universities, NGOs & the Private sector** can play major roles in supporting the government to prepare workforce for emerging disruptive technologies
- ▶ Appropriate strategies can be devised for both **pre-employment & on-job training**
- ▶ Programme certification can be handled by tertiary institutions, national VE regulatory boards, e.g., NABTEB, & international certification bodies, e.g., City & Guilds of London



Thank you for your attention!