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

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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
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;
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
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
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
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.
Seven Staff Development Centres (SDCs) were established in Federal Polytechnics.

Since February 2002, the seven SDCs have held more than 34 training workshops.

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.
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)
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
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)
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
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,
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 cetera.
Revamping VTE in Preparation for Disruptive Technologies
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).
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
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.
Encouraging all Universities, Polytechnics and Technical Colleges to establish and adequately fund Industrial Training & Coordination Centres.
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
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.
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
Training should embody:
- Technical support & skills upgrading/updating
- Apprenticeship placement and support
- Business studies
- Business ethics
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.
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
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
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**
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 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
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
Institute for Industrial Technology (IIT) (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.
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
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)
Training Model: the Dual Training System (DTS) of vocational training

Programme duration: 2 years

1st 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%.
2nd 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 trainee keeps a logbook which is reviewed by delegated school staff and forms an essential component of the final assessment
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
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.
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!