DEVELOPING ENTREPRENEUR ENGINEERS TO BRIDGE THE GAP BETWEEN TOWN AND GOWN IN EMERGING ECONOMY

Prof. Toyin Ashiru
Tricontinental Group
OUTLINE

INTRODUCTION
BEYOND THE CLASSROOMS
EMPLOYABILITY OF GRADUATE ENGINEERS
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WRAP-UP
Let me start with my personal experience
Tin-zinc alloys can be electroplated from an aqueous solution containing an alkaline metal zincate, an alkali metal stannate, and an alkali metal tartrate. The electropainting bath is alkaline with a pH of 11 to 13.5, preferably 12.0 to 13.5.

6 Claims. No Drawings
What is the most resilient parasite?

An idea.

A single idea from the human mind can build cities.
An idea can transform the world and rewrite all the rules.
1985-1987
UNIVERSITY B.SC PROJECTS-
RESEARCH AND INVENTION INITIATIVE

Students developed an electrochemical metallizing system for manufacturing and repairing of industrial components
1987-1990
PROJECT REJECTED AND MOCKED BY UNIVERSITY COMMUNITY IN NIGERIA
1991
Process accepted
Internationally and
sponsored
for improvement
Electrode impedance and the effects of additives on the electrodeposition of silver

J. P. C. Farr and O. A. Ashby

INTRODUCTION

The present investigation was carried out to determine the effect of additives on the electrodeposition of silver. The results of this work show that additives can significantly affect the properties of the deposited silver. The investigation was carried out on a purified terephthalic acid production plant.

CoRRD MONITORING BY ELECTROCHEMICAL NOISE PROBES IN A PURIFIED TEREPTHALIC ACID PRODUCTION PLANT

M. Mustaphi, O. A. Ashby, N. I. Jerobi, and T. A. Almud

Cemtro for Engineering Research
King Fahd University of Petroleum and Minerals

REINFORCEMENT CORROSION DUE TO CHLORIDES

S. A. Abd-Rahman

American University of Sharjah

1994 - 2003 PEER REVIEWED JOURNALS AND PUBLICATIONS
1997 FULLY COMMERCIALISED WORLDWIDE
Why did we miss this opportunity in Nigeria?

The reasons follow:
Science, Technology, Engineering and Mathematics—STEM: Vital to our future and shapes our everyday experiences.

- **Science** equips us with knowledge about our natural world.
- **Technology** covers computers and smartphones, television, radio, and even the first wheel.
- **Engineering** encompasses buildings, roads, and bridges, and also tackles today’s challenges like global warming.
- **Mathematics** is the cradle of all creations, it boosts our power of reasoning and problem-solving skills.
Need Policy For Developing Stempreneurs To Add Value By Creating Industry Solutions With Commercial Viability

When STEM meets entrepreneurship innovation happens

Nigeria needs Stempreneurs to develop from a consumer economy to a manufacturing economy

STEM graduates will develop sellable ideas, and build local industries

Harness talents by putting in place suitable policies that will encourage STEM innovations
Contribute to national development through high level relevant, manpower training

Develop the intellectual capability

Acquire skills for self-reliance and good citizenship
FACT

No nation rises beyond the level of its HUMAN CAPITAL

EXPECTATIONS

Universities are to nurture bulk of nation’s HUMAN CAPITAL

Universities are to remain relevant & responsive to the society
Engineering Education in Universities

138 Universities

- 40 Federal
- 39 States
- 60+ Private

47 offer COREN Accredited Programs
BEYOND THE CLASSROOMS:
EMPLOYABILITY OF NIGERIAN GRADUATES

Credits: brunel.ac.uk
LARGE NUMBER OF GRADUATE ENGINEERS ARE UNEMPLOYABLE

No employment requirements

Thus, unsuccessful in securing or keeping jobs

Highest rate of dissatisfaction observed by:

Consulting Firms

Oil and Gas Sectors
Engineering curriculum of 20th century no longer sufficient to address the engineering challenges of 21st century

• Competencies now needed:
  • Analytical thinking
  • Problem solving
  • Design
WHAT IS MISSING?

- Graduates Inability to Work Independently
- Low Critical and Analytical Thinking Skills
- Education and Skills Mismatch with Labour Market Needs
- Lag in Producing Resourceful Individuals
Training of Entrepreneur Engineers

Pedagogical Theories

Educational and Social Science Research Methods

Apply

Engineering:
Epistemology, Curriculum, Instructional Design, Assessment, Organizational Structures, Policies, Retention, Motivation, Outreach, Industrial Linkage, entrepreneurship, Leadership, innovation, etc.

Results in

Engineering Education Research (EER)
Need for Organizational Entity in Engineering Schools for Driving Sustainable Development

• Technology Innovation and Engineering Education/Entrepreneurship (TIEE)
• Innovations to focus on two main pillars of sustainable developments:
  • Transformative engineering and technology human talent sustainable development
  • Technologies, products, services, innovations, and startups for shaping sustainable
  • Socio-economic development
LOCAL CONTENT ACT

Formulated to enhance local content in the oil and gas industry

• To develop **indigenous skills** across the value chain
OUTCOME OF LOCAL CONTENT ACT

Slight growth from 4% in local content to 15% in the last few years

Still has not fulfilled the critical manpower needs in the sector
Most universities train students without the required practice opportunities in appropriate industries.

Difficult to get the best of professionals from Nigeria.

Dire need of Engineers with usable, practicable and modern skills to fill the spaces in the workforce.
WHAT IS THE WAY FORWARD?

UNIVERSITY/INDUSTRY COLLABORATION:
BRIDGING THE VOID BETWEEN THEORY AND PRACTICE
Evolution of University-Industry Linkages

<table>
<thead>
<tr>
<th>Phase</th>
<th>Success Factors</th>
<th>Drivers</th>
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<tbody>
<tr>
<td>Pre-linkage</td>
<td>• Leading to an agreement to work together</td>
<td>Communication</td>
</tr>
<tr>
<td>Establishment</td>
<td>• Leading to a contract</td>
<td>Understanding</td>
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<tr>
<td>Engagement</td>
<td>• Leading to delivery of project</td>
<td>Trust</td>
</tr>
<tr>
<td>Advancement</td>
<td>• Leading to an ongoing partnership and word of mouth</td>
<td>Individuals</td>
</tr>
<tr>
<td>Latent phase</td>
<td>• Potential future cooperation should a suitable project arise, with continuing personal linkage</td>
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INDUSTRY INVOLVEMENT IN CURRICULUM DEVELOPMENT

REVAMPING OF EXISTING INTERNSHIP PROGRAMS

RESEARCH & DEVELOPMENT COLLABORATION

CSR-MOTIVATED DEVELOPMENT SCHEMES
UNIVERSITY INDUSTRY COLLABORATION (UIC)

USA (EXTENSIVE)
- Successful Technological Innovation
- Huge Economic Growth

NIGERIA (MINIMAL)
- Token, Informal & Individual Efforts
- Negligible Technology Transfer
- Low Economic Growth
FORMS OF UIC
1. CURRICULUM DEVELOPMENT

- Course Planning, Design And Delivery
- Formal Members of Course Advisory Panels
- Encourage and Support inclusion of new areas of specialized skills
- Support Course Contents that are Relevant for Future Employment Prospects
- Ideas and Materials for Students’ Projects
- Guest Lectures
2. REVAMPING OF EXISTING INTERNSHIP PROGRAMS

Students’ Industrial Work Experience Scheme (SIWES)

After more than 40 years has not provided adequate avenues for acquisition of industrial skills and experience
**CHALLENGES OF SIWES**

**Misplacements of Students**
- Engineering student intern in for example a fashion house

**Lack of Proper Supervision by the Institutions**
- Students just get logbooks signed off without working

**Rejection of Interns**
- Due to lack of suitable and sustainable UIC
Internship needs to be focused on hands-on skills on handling equipment and machinery

- Close monitoring by university staff and industry staff
- Alumni Support for Internship Placements
- Proper placement of students in industries with the right technologies
3. RESEARCH & DEVELOPMENT COLLABORATION

R&D Collaboration requires a sustainable system

- University provides support and value for the business objectives of industries
- Industries in turn provide the universities with funding and market-tested skills transfer to help develop the students
Smart Aging Square

- Local older adults
- University faculties
- University students
- Research
- Development
- Commercializing
- Marketing
- Service providers
UIC: MOTIVATION FOR UNIVERSITIES

- Upgraded structures and grants for faculty members
- Spin-off companies that financially benefit researchers and university
- Enhancement of teaching
- Job offers for graduates
- Stimulation of entrepreneurial culture in the institution
Access to new ideas and technologies that create competitive advantage

Reduction in R&D budget

Access to highly specialized university facilities

Access to research and consulting services of the university

Improved public image

Less hassle with graduate (ready-to-go) recruitment
KNOWLEDGE EXCHANGE PATHS IN INDUSTRY-UNIVERSITY COLLABORATION

An effective communications framework can help bridge the gap between outcome and impact. It is important to have two-way knowledge transfer between the university researchers and the company’s project manager (green arrows), as well as between the project manager and others in the company (blue arrows). In addition, the project manager should keep groups inside the company abreast of progress on the research collaboration, and inform the university team of ideas from the company regarding potential linkages to other company activities (orange arrows).
THE GOVERNMENT FACTOR

Policy formulations should encourage participating industries

- Tax credits
- Waivers
- Incentives
- Preference profiling on projects
THE MESH
Enhancement of Social Prosperity

Collaboration between Industry and Academia

Training of Global Engineers

Creation of World-Class Research Fields

Computer Science and Systems Engineering

Fundamental Engineering

Creation of New Technology

Life Science and Systems Engineering

Kyushu Institute of Technology
4. CSR-MOTIVATED DEVELOPMENT SCHEMES

CSR projects that focus on undergraduate development schemes

- Crowd-Sourcing Program
  - Undergraduates develop solutions to typical industrial problems

- Innovative Projects Investment
  - Industries invest in the development of novel projects

- Scholarship
  - In specialized courses, e.g. Renewable Energy, Coating Inspection,
Global Approach
CASE STUDIES OF SUCCESSFUL PROGRAMS WORLDWIDE
A collaborative effort that developed a center of expertise in computer simulation called the UC Simulation Center.
Procter & Gamble and the University of Cincinnati: UC Simulation Center

Opened Sept. 22, 2008

Currently staffed with nine students from UC's College of Engineering:

Has seed funding for two years from three different organizations within P&G

UC students work side by side with P&G engineers, providing them with unusual opportunity of developing industry-ready skills and capacities that are in hot demand.
A $25 million annual investment by Dow Chemical Company at UC established the Dow Materials Institute (DowMI)
Researchers from across UCSB’s Chemistry, Materials Science, and Engineering departments work on fundamental challenges to world problems that are of interest to industry and academia.

Education and training of students and postdocs and their development in highly interdisciplinary, collaborative teams.

Students are prepared for careers in industry by instilling work practices and safety awareness levels consistent with those found in the private sector.
DOW Chemical Company and University of California, Santa Barbara

The Dow Discovery Fellowships for outstanding chemical engineering graduate students

Fosters a number of ties with students on campus through efforts such as the Dow-UCSB Safety Initiative

Engaging the campus’ entrepreneurial community through its funding of an entrepreneurial program for UCSB students
Outstanding Academic Achievements

Marketing Strategy
- Business Model Planning
- Technology Bundling
- Technology Announce

Technology Evaluation
- Technical Application Profiling
- Market Competitiveness Analysis

Department of Academic-Industrial Collaboration

Technology Transfer
- Contract Consultation
- Contract Negotiation
- License Planning

Intellectual Property
- Patent Search Analysis
- Patent Application
- Patent Consultation/Strategy
- Patent Map & Infringement Analysis

Commercialization & Industrialization
University of Yamanashi – Clean Energy Program

Goals of the Clean Energy Research Center

- New Science
- New Materials
- Clean Earth
- Reliable Society

- Improving the fundamental research level
- Establishing fuel cell engineering and “tunneling reaction” engineering
- Collaborative research

Manufactures, Research institutions

- Collecting and sending out technical information

Putting to practical use the outcomes of collaborative and fundamental research

- Division of Collaborative Research
- Division of Fuel Cell Research
- Division of Solar Cells

Energy problems  Global Environmental Pollution
WRAP-UP
Let’s **EDUCATE** our students for brilliant futures

Let’s **PREPARE** our students for the industry

Let’s **ENTHUSE** patriotic fervour & pride for our heritage in our students

Let’s **INSTIL** discipline, integrity and honesty in our students
Let’s **EMPOWER** our students with great communication skills

Let’s **INCULCATE** team spirit & camaraderie among our students

Let’s **FOSTER** civic engagement in our students

Let’s **ENCOURAGE** our students to think out of the box
Let’s **STIMULATE** scholarly energy and diligence in our students

Let’s **TEACH** our students to become globally competitive

Let’s **INFUSE** leadership skills in our students

Let’s **INGRAIN** spirit of entrepreneur among our students
Thank you