Bridging the gap between Industry and Academia: Lessons from German Universities of Applied Sciences

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Abstract

Universities have played an active role in human capacity development and innovations, which are key to economic development and general knowledge-based societies. The 'Big Four Agenda' (whose main pillars are manufacturing, affordable housing, universal health coverage, and food security) is a well-thought idea, whose successful realization requires the input of all the sectors in the economy, including universities, whose purpose is to teach, research and community outreach. Universities in developed countries are the force behind successful innovation and research, which has resulted in great success in the industry, health, housing, and food security. About 20 years ago, Germany had a challenge of mismatch between training and industry needs, hence creating a skills gap. To address this problem, an idea of universities of applied sciences (UAS) was mooted and actualized. The main goal was to empower the graduates with the necessary skills and attitudes required for effective productivity in the industries.

An East Africa model of the University of Applied Science was initiated in the year 2015 when a delegation from Kenya led by the President Hon. Uhuru Kenyatta visited Germany. This climaxed in 2017 when the then Minister for Education and the German Ambassador in Kenya signed an agreement to establish an East African University of Applied Sciences. To actualize this, several consortia were formed by universities in Germany, one of which was the Technical University of Ingolstadt (THI) and the Technical University of New Ulm (HNU). Through this consortia, a call was made to Kenya Universities' faculty, amongst whom 17 from seven Kenyan universities were selected for training on the model of Germany Universities of Applied Sciences. Seven (7) Universities in Kenya (JKUAT, Moi, TUK, TUM, Machakos, KU and Mt. Kenya University) partnered with two (2) Universities of Applied Sciences in Germany and through a DAAD funding formed a network. The goal of this network is to have activities that would later lead to the formation of a University of Applied Sciences in Kenya for the East African region.

Four (4) workshops have already been held for the team in the two universities and the industry in Germany. From the workshops, it has been realized that the concept of Universities of Applied Sciences (UAS) links training and research in universities to activities in the industry and society. The academic programs developed in the Universities of Applied Sciences address the challenges and needs facing the industry. It is not in doubt that if the concept of universities of applied sciences is applied in Kenya, it will address challenges such as poverty, unemployment, food security among others, hence a means of realizing the 'Big Four Agenda' and accelerate the achievement of several sustainable development goals. The 17 faculty from Kenyan universities believe that this model is integrated into the existing Kenyan Universities or establish a new university of applied sciences if resources are availed for such or any other approach that will result in the application of the model of universities of applied sciences. Towards the end of the year 2018 another call was made for sensitization of non-teaching staff and 4 (four) were selected from network Universities.

1.0 Introduction

The introduction gives the historical background of the initiative and the justification for adoption of the model of the East African universities of applied sciences in Kenyan University education.

1.1 Initiatives towards Establishment of UAS

The idea of establishing an institution in East Africa using the German Universities of Applied Sciences model was first mooted in 2015 after a Kenyan delegation led by President Uhuru Kenyatta visited the European country [1]. This idea was mooted as a result of a skills gap in the graduates from local universities compared to the dynamic skills demand from the industry. This informed the intent to establish an East African - German University of Applied Sciences [2]. In February 2017, representatives of the German and Kenyan Governments, Jutta Frasch, the German Ambassador to Kenya, and Dr. Fred Matiang'i, the then Kenyan Minister of Education, respectively, signed a declaration of intent to establish a UAS [2,3,4]. This initiative has received wide support from various stakeholders, including CEO - Konza Technopolis Development Authority (KoTDA); CEO- Kenya Private Sector Alliance (KEPSA); Chairman of Sub-Saharan Africa Initiative of German Business (SAFRI), Linking Industry and Academia (LIWA), among others [5].

Dr. Matiang'I (Left) and Ambassodor Jutta Frasch signing declaration of Intent [4])

The idea of establishing the EAUAS was not to build a new university from scratch but to stage an open competition among existing Kenyan universities which would like to remodel their programs along with the principles of a university of applied sciences [3]. Likewise, on the German side, consortia were to be formed, which would compete amongst themselves. Ultimately, one Consortium from Germany would be identified to work with the selected University in Kenya. Following the above events, several German University Consortia were formed to compete for the project. Some of the consortia formed are listed below: The following are the consortia in Germany

1. Consortium comprising of [2]:
a)   Neu-Ulm University of Applied Sciences (NHU)
b)   Technische Hochschule Ingolstadt (THI)
2. Second Consortium of [5] universities:
a)   Rhein Waal University of Applied Sciences
b)   Mainz University of Applied Sciences
c)   Flensburg University of Applied Sciences
d)   Reutlingen University of Applied Sciences

e) Furtwangen University of Applied Sciences

In their fact-finding mission, the German consortia visited various Universities in Kenya to seek collaboration. The HNU/THI consortia visited Moi, Jomo Kenyatta University of Agriculture and Technology, Kenyatta, Mount Kenya University, Technical University of Kenya, Technical University of Mombasa and Kabarak University. In the quest to establish a working team, the consortium set to identify 15 persons from not less than five Kenyan universities. They made an open call for expression of interest. From all the applicants, the consortium identified 17 participants from Seven Kenyan Universities and subsequently 4 non-teaching staff. Three (3) workshops were planned, for October, November and December 2018. These workshops were held successfully. Other workshops for 2019 included April (which has already been held in Germany), and July and October which will be held in Kenya.

1.2 Justification

In Kenya, employers have complained about an existing gap between training at the University and desired skills by the industry. As such, there have been several challenges with companies feeling that training of graduates in Kenya does not meet their expectations. Some of the challenges include;

•   Graduates have difficulties integrating theory to the practice leading to the familiar slogan that Kenyan Universities produce half-baked graduates.
•   Graduates have poor soft skills including communication, leadership and time management.
•   Each window of student Internships/attachments takes a short period of at most three (3) months (limited on the job training).
•   There is little or no involvement of experienced industry personnel in graduate training.

Concepts learned from the University of Applied Sciences workshops in Germany can help address the above challenges, which would help kick-start the ailing manufacturing sector, which presently contributes less than 10% to the Gross Domestic Product (GDP).

Therefore, this report presents some lessons learned from a series of three (3) weeks workshops called 'East Africa Network of Excellence for Universities of Applied Sciences', attended in Germany. These consist of applied teaching and learning, conceptual seminars, internships, didactic training, applied research and technology transfer.

2.0 The Pillars of Model of University of Applied Sciences

There are three (3) pillars of the Model of University of Applied Sciences which include; applied training and learning, applied research and technology transfer. The following is an analysis of what these pillars entail.

2.1 Applied Teaching and Learning

The study programs at the Universities of Applied Sciences consist of bachelors, masters and Ph.D. courses. Bachelors take three and a half (3.5) years where a student accumulates 210 credit points. These are broken into seven (7) semesters, with a one-semester compulsory internship. The postgraduate training consists of a masters' program of 1.5 years of specialized academic education. It has three (3) semesters in which the student earns 90 credit points. The Ph.D. course is offered in collaboration with classical/traditional Universities and is carried out for 3-4 years. The professors of UAS must have a doctorate training and professional industry experience of at least 5 years. Some of the deviations from the Kenyan universities were noted in curriculum development and implementation, internships and didactic training as presented below.

2.1.1 Curriculum Development and Implementation

The University of Applied Sciences employ the following strategies in the development of curriculums.

i)   Each university of applied sciences has a niche determined by the ministry of education and tries to enhance what it is best known for without suffocating other existing programs. For example, HNU has its niche as Business Management, while THI is known for Engineering and Renewable Energy and has attracted lots of funds to implement renewable energy projects particularly in South African Countries.

ii)   Any new program developed in the universities should have a unique selling point, which makes it attractive to potential students. For example, the emerging social issues of employees are being addressed by integrating psychology into several university programs.

iii)   The key success factors for the academic programs in the German Universities of Applied Sciences include attractive content based on competencies and related requirements of the stakeholders, attractive design and structure of the programs, feasible time-tables (different modes such as weekends, evening, regular etc, to accommodate various work schedules of potential students) and reasonable fees.

iv)   Curricula for the University of Applied Sciences are developed based on the needs of the customers (employees and employers of the relevant regions). The main philosophy is to develop personality and create an 'out of the box' approach to solving problems. This is achieved by;

- Teaching fundamental concepts that give the learner basic know-how and expert knowledge.
- Application-oriented know-how that gives the learners necessary skills and transfer of know-how
- Development of competence for design, decision making and implementation of knowledge.

v)   A concept called the blue ocean strategy is used in the development of new programs. The main focus of the strategy is creating uncontested markets - not in existence today, thereby making the competition irrelevant. The red ocean strategy focuses on existing markets. Stakeholders from the industry participate in the curriculum development to offer insights on emerging trends and needs. Personnel developing the programs must avoid the cannibalization of existing programs by ensuring synergy between stakeholders and professors of various departments within the University. There are 3 stages in curriculum development;

- Initiation: Strategy meetings are held with key stakeholders. The participants provide key considerations based on market requirements.
- New bachelors' course: The structure of the curriculum is made with an interdisciplinary focus while broadening the key focus areas.
- Qualitative competencies: These are incorporated to help the learner understand and influence the markets. These include big data analysis training, among others.

vi)   In designing new courses, the following are considered:

- Economies of scale (a professor should have at least 30 to 40 students).
- Broad-based courses are preferred as opposed to the narrow-based tailor-made type of curricular.
- Its attractiveness to applicants
- No cannibalization of existing courses; instead they are enriched by infusing new modules, which then serve to determine the qualifications of the new professors to be hired.

vii)   During curriculum implementation, there are strategies geared towards the development of curiosity in the students, encouraging teamwork, imparting soft skills and interaction between the students and the professors both at the institution and industry level. Rote learning is not encouraged.

viii)   Most of the Universities have teaching libraries where most of the library resources are in electronic form. Outdated Library books are regularly sold and restocking with the current books done. At Technische Hochschule Ingolstadt, the library opens daily to the public (up to 9 pm) and students (up to midnight), The Library opens at 3 am and is unmanned. The libraries employ Radio Frequency Identification (RFID) Technology for:

- The fastest, easiest, most efficient way to track, locate & manage library materials
- Efficient Book circulation management
- Automatic Check-in and Check-out
- Library inventory tracking in minutes instead of hours
- Multiple books can be read simultaneously
- Unique ID of the RFID tag prevents counterfeiting
- Automated material handling using conveyor & sorting systems
- RFID enabled patron cards allows for easy patron identification
- Use of book drops & return chutes for returning library material, allows for flexible timings
- Reminders for due dates allows patrons to submit borrowed materials in time
- Taking inventory in an RFID based system doesn't require physical de-shelving & shelving of library materials.
- Ability to add newer products and features as finances and customer needs dictate
- Library item identification & security bit is combined into a single tag, thereby eliminating the need to attach an additional security strip
- Patrons find what they are looking for quickly & easily

2.1.2   Internships

Internships are an integral part of the degree programs. An internship is compulsory for the Bachelor degree programs. Additionally, students are supported before and after the internships. Some of the notable elements of internships include;

a)   It is up to the student to select a suitable internship. However, they can be assisted when searching for an internship through the provision of career service. The Career Service keeps in touch with companies and alumni of the universities and assists students in their search with its board for jobs and internships.

b)   Students can access, free of charge, the offers available there. They are updated regularly and contain not only job offers, but also career events and subjects for theses. The internship coordinators of the departments also support the students. They are responsible for approving the internship contract. In some of the degree programs such as Industrial Engineering, Industrial Engineering/Logistics, and Business Information Systems, students begin their internship as soon as they have passed the courses of the previous semester.

c)   The skills acquired during this period are broad and deep, that in most cases, the students end up with job offers at the same company before completion of their studies at university.

d)   Internships last for six months. During the internships, students have to identify an industry-related problem and write a thesis within a period of three months to come up with a tangible solution to the problem. Each student must be adequately prepared to fit in the work industry before they graduate.

2.1.3   Didactic training

There is the Centre for university didactics (pedagogy) which trains new lecturers for the Universities of Applied Sciences. The Centre is funded by the Ministry of Education and it regularly in-services the newly employed lecturers for the universities of applied sciences. As a requirement for recruitment as a Lecturer in the universities of Applied Sciences in Germany, he/she must have at least five (5) years industry experience

2.2 Applied Research

2.2.1 *Self-Sustaining Institutes*

Besides the academic division, most of the universities of Applied Sciences have institutes that are self-sustaining. For example, the Technische Hochschule Ingolstadt (Technical University of Ingolstadt - THI)) has three (3) institutes, namely:

- Centre of Automotive Research on Integrated Safety Systems (CARISSMA)
- Institute for Innovative Mobility (IIMo)
- Institute of new energy systems (InES)

The Institutes cut across faculties, meaning they are ad-hoc and composition depends on the focus of the research project. Research Administration supports an application for project funds, both from government and industry, costing of projects (activities, materials, etc) and final accounting with the final report.

2.2.2 *Link to challenges in the industry*

Companies in Germany especially the Bavaria (Bayern) region give information and orientation to pupils from secondary schools for their further education and give job offers and the products they deal with.

Besides, the industry is an active partner in the development of curricula of the universities and the professors and lecturers for the Universities of Applied Sciences have to have a relevant industry experience of at least five years. It is the individual professor who creates his industry linkage, not the university

2.2.3 *Funding support*

Support in terms of finances normally comes from industry, the state government, national government and donor agencies such as DAAD and the European Union.

2.3 Technology Transfer

This is done through well-established networks between the universities of applied sciences and industry. For effective transfer of technology, it is necessary that companies know the available budget and what their input is. Benefits to the companies are to be communicated adequately. Some of the benefits include;

- Improvement in public image
- Network and market positioning
- Improved transfer of knowledge

The following networks have been established by HNU and THI with companies in Germany;

- Transfer Innovation Strategy – HNU has joined with three other Universities to establish a network for technology transfer (funded by the government), which is composed of energy, biotechnology, mobility and transformation management. HNU took up transformation management to develop business models, sales/marketing and offer mixed reality concepts.

- BayFOR – Bavaria Research Alliance. This is a project which THI is involved in, whose mission is to help, guide, and support and advice. The alliance has the following five (5) arms: network; a foundation; patents; projects; and research. Alliance has two academic shareholders (one from UAS and one from classical university). It has project opportunities such as Horizon 2020 and other funds on climate change.

- Biogas 4.0 – has 1.3 million euros in funding from the EU while participating companies contribute 1500 Euros. The aim is to produce biogas, identify new markets, and improve processes while developing a long term perspective of biogas use.

- Warme and Wohnen – Another network project by THI and several companies in the construction industry. The project involves heating in new buildings and consists of 4 working groups; consumer demand forum, legal framework, system tuning (sector coupling) and heat networks for new buildings. The companies utilize local heating in addition to district heating to supply energy to buildings during the winter season.

3.0 A visit to Facilities and Industry

The following laboratories and workshops were visited at both THI and HNU which are dedicated to applied training and research:

a) Renewable Energy Laboratory
b) Institute of New Energy Systems (INeS)
c) Drone Laboratory
d) Hexapode Testing Laboratory
e) Virtual Reality Laboratory
f) Applied Teaching And Usability Laboratory
g) Centre of Automotive Research on Integrated Safety Systems and Measurement Area (CARISSMA)

Several industries were visited all of which work with the university of applied sciences in achieving the goal of applied training, research and technology transfer. These included

a) Evobus
b) Audi Factory
c) Solar Power Plant At Gelbelsee
d) Biogas Plant At Bga Zellerfeld
e) Substation At Oberottmarshausen
f) Grid Control Centre At Lew Lechwerke Augsburg
g) Technology Transfer Centre at Nordlingen (Technology Centre for The University of Augsburg)

4.0   Lessons Learnt

The following is an enumeration of lessons learnt from the model of universities of applied sciences

a) It is possible to construct curriculums and revise existing ones based on a smooth link with industry as we seek to address the gaps that the industry face.

b) It is necessary to ensure the practical experience of our students is more oriented to the needs of the industry either by consolidating internships to a longer period that prepares students adequately. Incorporating a one-week introductory course for preparing students. One week conclusion course for students to write reports and make presentations. Student internship should be more detailed with a specific purpose to fit in the student work environment and to make the programs more practical oriented

c) For university staff to have an effective link between the university and the industry, they should undertake regular internships in the industry to understand the needs and emerging trends.

d) There is a need to overhaul our didactic training by developing a policy that ensures every new member of staff undergoes a pedagogical workshop/training. Colleges need to set aside funds for didactic training. This can be done by establishing a center for didactics training, which will cover the needs of all universities in Kenya.

e) It is important to focus on selected research in core areas to define a clear research profile. There should be more focus on applied research to solve industry-related problems. Students' projects should be linked with the internships so that the students identify an industry-related problem during their internship and solve through a thesis or project

f) For successful knowledge and technology transfer (KTT), the transfer channel cooperation in R&D with the industry should be focused intensively, as in continuous strategic partnerships, innovation centers, technology campuses, business incubators, and publicly funded research programs. Concerning KTT "via people", special focus should be put on non-traditional study programs, and the support of cooperative PhDs. Concerning other transfer channels, further

support should be given to spin-offs and start-ups (if possible, using cooperation potential), topic-specific networking of professors, forums, seminars, dissertations, and participation in conferences.

g)   There is a need to know and continuously reassess the external factors that are of influence, to be able to react appropriately and adapt considering research, education and KTT aspects. A special focus should be put on regional conditions and effects.

h)   Focus intensively on network activities. Four kinds of networks are important to focus on: regional networks, topic-specific networks, and networking in education and study programs.

i)   There is a need to strengthen the existing directorates and centers in the universities to make them more realistic and actualize their dreams.

5.0 Conclusion

If Kenya is to meet the sustainable development goals (SDGs) and the Big Four Agenda of manufacturing, affordable housing, universal health care, and food security, there is an urgent need to embrace a more practical oriented teaching and learning through the University of Applied Sciences model. It is for this reason that the team suggests that the government adopts this model either by integrating these practices through the classical universities or purpose to establish a new University of Applied Science of Kenya. Both approaches have a monetary cost, therefore the planning should be done in a way such that there will be a good return on the investment.

The network developed, so far, through the interactions of the seven Universities has laid a good foundation for the Universities involved to harmoniously work together. When called upon, the team is ready to work with all parties to enable the fruition of a UAS in Kenya.

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