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The editor is greatly indebted to all the people who contributed to the compilation of this issue of the UVCF Bulletin. Those who did the typesetting of the Bulletin and supervised the printing process. The UVCF underwrote all the expenses of producing this Bulletin.

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EDITORIAL

The current 8th volume of the *UVCF Bulletin* focused mainly on the university training and employability of university graduates.

The Uganda Vice Chancellors' Forum held its eighth annual conference on the 5th of October 2018 at the International University of East Africa. The conference was guided by the theme "Competitiveness in Ugandan Universities*"*. In the absence of the Chief Guest, the key note speech was read by the permanent Secretary in the office of the Minister of Education and Sports. The sub themes of the conference were:

i. **Sub theme one:** "Innovations in Ugandan Universities" presented by the Chairman Board of Directors, Kiira Motors – Prof. Tikodri Togboa
ii. **Sub theme two:** "Curriculum in Ugandan Universities", presented by the Vice Chancellor of Busitema University – Prof. Mary Okwakol
iii. **Sub theme three**: "Research and Publications" presented by Dr. Vincent Sembatya.

There was a fourth session in which a discussion on Research, innovation and publication was held. This session was moderated by Dr. Vincent Sembatya, Director of Quality Assurance at Makerere University.

The conference participants included representatives from both public and private universities, that is, Vice Chancellors, Deputy Vice Chancellors, Academic Registrars, and Quality Assurance Officers. The guest of honour was expected to be Hon. Janet Kataha Museveni, the Minister of Education and Sports. She was however, not able to attend and was represented by the Permanent Secretary in the Ministry of Education and Sports – Mr. Alex

Kakooza. Other invited guests included representatives from, National Council for Higher Education, Ministry of Education and Sports, and other national and international dignitaries.

Wilson Muyinda Mande

International University of East Africa Hosted the 8th Uvcf Conference

Emeka Akaezuwa

In his remarks, the hosting Vice Chancellor (IUEA), Dr. Emeka Akaezuwa welcomed all to the conference and thanked the conference organising committee and the general forum for the commitment shown towards organising the conference. He commented that Uganda's higher education standards were high and that's why universities should continue to work as a team to maintain the high standards. As such, positive competition would lead higher education in Uganda to greater heights. It would also enhance the production of a "whole graduates" who would compete favourably on the job market.

It would also be prudent for universities to aim their competitiveness at solving community problems thus contributing to societal development in those places where universities are located and beyond. Collaborations between and among universities would also be key in developing research based universities that solve community problems. Research findings would be a basis for ideas that inform and guide policy formulation. It would also be good if individual universities identified a unique niche upon which to base their competitiveness in their respective communities. Such niches could be agricultural, technology based, health related, to mention but a few. Otherwise, the whole point of being competitive as a university would be based on whether its graduates would be able to competitively solve societal problems

Welcome remarks by the UVCF Chairperson

The welcome remarks from the UVCF Chairperson were given by the Deputy Chairperson in absence of the Chair who was away on equally important duties. In his opening remarks, the Deputy Chairperson of the Uganda Vice Chancellors Forum – Prof. Patrick Manu thanked all for their attendance

and requested their undivided attention and open mindedness during the discussions. Participants were also informed that the Guest of Honour would not be able to attend the conference as she had to officiate at the world Teachers' day in Fort portal. However, there was communication that the chief guest would be represented by the Permanent Secretary in the Ministry of Education and Sports, Mr. Alex Kakooza.

The Key Note presentation was given by the Permanent Secretary in the Ministry of Education and Sports, Mr. Alex Kakooza. He represented the Minister for Education and Sports, Hon. Janet Kataha Museveni. The Permanent Secretary requested participants to take note of a few comments before he made a verbatim presentation of the minister's address. From his comments, participants noted that:

i. The Makerere visitation committee was yet to make its presentation to cabinet. Its findings and recommendations were likely to have far reaching impacts on education thus those in the business of providing education needed to know that education is more than a business. Universities therefore needed to take keen interest in improving the management of their institutions.

ii. Borrowing from the example of Finland's education system which is based on equity and equality, it would be good if those involved in education service provision in Uganda would supervise themselves and be keen on providing quality service to their students.

iii. Much as lecturers should also be trained on how to deliver quality education to their students, those involved in admitting students should also do a good job at admitting only those students with the requisite grades. In other words, the standards of education can potentially be compromised from so many angles.

iv. Considering the great potential of the UVCF, it would be important to make an even bigger effort for it to be visible. One of the ways of increasing its visibility would be through attending meetings at the ministry of education. There were even chances for the UVCF to access research funds if it were visible enough.

With the above comments, Mr. Alex Kakooza presented a verbatim address from the Hon. Minister of Education and Sports. He then declared the Conference officially opened.

Ugandan Universities And Their Competitiveness

Alex Kakooza

I am pleased and honoured to be here for the 8th Uganda Vice Chancellors' Forum conference on "Competitiveness of Universities in Uganda", and grateful to the conference organisers for the opportunity to speak to you this morning. I must say that as we gather here today, we do not only engage in intellectual debate, we also come here to discuss a topic of mutual concern regarding our universities in Uganda. Allow me to say that amidst rapid globalisation, Universities have the function and the duty to nurture globally competitive students equipped with the skills to cope with the challenges of a much more dynamic future. As we get ready to engage ourselves in today's conference theme, I am aware that there are numerous challenges facing our institutions today. I must also thank you for persevering and continuing to do your best in providing higher education to our nation's younger generation. As earlier on expressed by this Forum's Chairperson, some of the pressing issues include:

i. Agreeing on a conducive taxation regime for procurement of inputs into the functioning of the institutions including the formalities for regarding the institutions of higher learning as non-profit organizations for taxation purposes;
ii. The need for this Forum to acquire a permanent home where to base its activities;
iii. The suggestion of this Forum to hold Annual Meetings with the President of Uganda for purposes of briefing the President on the status of Universities and Higher Education in general and also to exchange ideas on future developments;
iv. The suggestion for this Forum to hold regular round table discussions with officials of the Ministry of Education and Sports for purposes of initiating the implementation

of Conference policy resolutions and also establish a working relationship with the Ministry officials;

v. Involvement of Vice Chancellors through this Forum in the discussions regarding avenues for sourcing Government funding especially for research and consequently be involved in the national budgetary process; and

vi. Involvement of this Forum in the National Planning process especially for issues concerning University and Higher Education.

While the above issues make it difficult to smoothly run our institutions, I believe that the team gathered here today is comprised of individuals with the ability to not only advise but also guide and formulate policy that can make our working environments better and also steer our universities in the right direction. I also believe that if we all work together as stakeholders we can achieve most of the above petitions and much more.

Therefore, as custodians, stakeholders, and stewards of higher education in our country, this is a great platform for us to discuss issues that impact the growth of our universities and our country at both national and international levels. The Conference theme today – "Competitiveness of Ugandan Universities"; - gives us a great opportunity to re-dedicate ourselves to assessing what our universities have to offer to the labour market and the surrounding community. The sub-themes - Research and Publications, Curricula, and Innovations give us a broader picture on the concepts embedded therein through which the competitiveness of our institutions will either be measured or enhanced for our universities to soar to international and global heights. I want to take this moment, when so much attention is being focused on universities here in Uganda and elsewhere, to share with you some views regarding universities in a changing and globalizing world. It is my hope that all the ideas expressed here today

will help us ponder the state of our individual universities, and encourage us to improve the status quo. We may also draw lessons to address the gaps that hinder our competitiveness both locally and globally.

Universities and Competitiveness

I believe a good university should be committed to excellence in all aspects of their activity - a value that cannot and must not be compromised. I also believe that our institutions gain from the unity of teaching with research; they gain from the breadth of a discipline; and they gain from being a set of interconnected ecosystems, where the unexpected may happen.

However, globally competitive Universities do something more than just educate a workforce and deliver research outcomes. They educate the leaders of tomorrow and that is a heavy responsibility, yet one we must accept with readiness. We should acknowledge that our ability to produce a workforce that can easily be absorbed on the local and global market is tested by our inputs. While I applaud you all in your individual and collective capacities for the great contribution made to our country's higher education, I must still mention that these successes are still compromised by a number of issues. Those are the very issues that compromise our universities' competitiveness.

Nonetheless, I believe the Uganda Vice Chancellors' Forum can ably discuss and find solutions to those impediments. You may agree with me that some of those issues arise from our very curricula, our modes of teaching which includes our research (for both students and staff), how we impart and maintain discipline in our students, capacity building for our teaching staff, funding of our university programmes, to mention but a few.

With that background, I wish to share a few thoughts about some of the above issues as I am sure they will be thoroughly discussed in due course of the conference.

Research and Innovation

As future demands for radical competence change, the versatile and high-standard research and teaching conducted at universities continues to grow in importance, but in a different way than before. Universities are expected to be active, creative, open minded and unbiased, and to take the role of true pioneers.

I also wish for us to note - as you may already know; that there is an intimate association between research and innovation. I believe that successful innovation is fuelled by the kinds of cutting-edge research that are the lifeblood of any great university. Through rigorous scholarship, and collaborations between universities and our communities – local and global, - new approaches to everyday problems can be identified. I believe that as long as our students come out of our universities as problem solvers, they will not be job seekers! If anything, the world will be yearning to receive them. I also believe that universities which produce problem solvers will definitely be rated highly. Allow me to site one example from one African country in collaboration with one of the highly rated universities worldwide.

Collaboration between Harvard and the Government of Botswana over a decade and a half ago made significant progress in AIDS prevention and treatment. One of its greatest successes focused on eliminating mother-child transmission of HIV/AIDS in a study population. It was an unforgettable lesson for the University President about the kind of difference a university could make - a lesson rendered powerfully real when the University President met a group of sampled mothers and their healthy, bright-eyed children. When asked about her hopes for her three-year-old daughter, one woman smiled and replied, “I want her to go to Harvard.” To this lady, Harvard was that university that produced problem solvers. Her response was based on her interaction with the project personnel/students from Harvard through the government - university collaboration.

Curricula Development

From the perspective of our inputs, and the final products we hope to send to the labour market, we should be able to examine ourselves. The content and mode of teaching in our institutions should produce an all-round employee/ problem solver at the end of the day. With reference to our curriculum development, we should ask ourselves whether our individual universities play a deliberate role in implanting and sustaining the entrepreneurial mindset in not only our varied communities but also for the global community. I will therefore ask our universities to make a deliberate effort to collectively and individually make an assessment of whether our curriculum is fit to make our universities competitive enough especially on the global market. I believe that together we can identify any existing gaps, for which we should be able to find solutions.

Capacity Building for Students and Staff

At this point I would like to pose a question whether our universities can be depicted as places that support and nurture the entrepreneurial spirit of its students and staff. You may agree that this requires deliberate effort to put in place the right incentives, the right university policies, the right space and resources to cultivate a competitive staff and student body. And even more than that, it requires an outward gaze to the global community for our universities to be placed on the same weighing scale with their competitors. With the great and rapid – and sometimes surprising – changes going on in the world, we cannot stress enough the importance of extensive high quality higher education for our country and for the entire world. This requires staff that is up to the expected standards. On this note, it is imperative that our staff take advantage of available scholarships through the Ministry of Education and Sports and also through scholarships from individual universities to upgrade to required standards.

Student Body

To educate globally competitive students, it is important that our institutions need to in addition to classwork, devise means of exposing students to the reality of an increasingly globalised world. I understand that our universities make an effort to send their students to communities and organisations in Uganda for internship. However, we could go a step further by sending our students abroad for structured and focused overseas internships that are long enough for them to acquire deeper understanding of and respect for foreign lifestyles and cultures. This may off course attract certain costs but I also believe that private and publicly-funded institutions could set for themselves specific exchange targets for their students to study outside Uganda for exchange programmes. This may for starters be arranged within the East African region. Again I must emphasize the cost implications but I believe where there is a positive will, there is always a way. Collaborating local and international institutions may be a starting point for the student exchange programmes.

Faculty / Research Funding

Apart from diversifying our student body, our institutions could make an effort to make investments in recruiting some of the best faculties from around the world. This is bound to bring international experience and international networks to our university systems. I will also say that a strong national commitment to high and sustained levels of public funding for university-based research would be crucial in enhancing the competitiveness of our universities. Needless to mention is the fact that University staff can improve their skill and teaching through research. It is therefore up to this forum to organize its members into a team that can tap into the available resources in a systematic manner.

On this note, I comment that the government through its line ministries is ready to work with this Forum to forge sustainable funding modalities for research through universities. I will also

mention that some of the efforts to fund research have already taken root and a few universities have already benefited from this in terms of infrastructure development (in terms of science labs).
I must therefore say that the competitiveness of our universities through appropriate curricula, research and innovation are vital ingredients to this country's future economic growth. However, we must also appreciate that we operate in a financially constrained environment. This brings us to the daunting question of how we can move forward. I believe this is an uphill task that cannot be accomplished by a single individual or single line ministry.

I also strongly believe that every entity, individual university and single stakeholder has a contribution to make. I would therefore like to lay down a challenge to the universities, the line ministries, stakeholders in higher education and more so the public and private sector today. That we come together, work together and plan a future together that makes the most of our universities' competitive advantage. This comes amidst our country's dire need to support our education system especially in financially difficult circumstances, for the benefit of us all.

Conclusion

As I conclude my remarks, I will say that competitive universities nurture the hopes of the world: in solving challenges that cut across borders; in unlocking and harnessing new knowledge; in building cultural and political understanding; and in modelling environments that promote dialogue and debate. This description captures an essential part of what our universities should be and why we need them. We may look at them as zones of openness, innovation and research focused on solving local, national and global problems. When we are certain that our universities have accomplished the above, I believe that is the when our universities will be worthy of being called competitive.

Innovation - An Enabler For Local Content Participation: Case Study Of The Automotive Industry

Sandy Stevens Tickdri-Togboa[1], Paul Isaac Musasizi[2], Richard Madanda[3], Fred Matovu[4], Enock Treasure Mwesigwa[5]

Abstract

The generation, exploitation and diffusion of knowledge are fundamental to economic growth, development and the wellbeing of a sovereign state. Globally, innovation for development is an imperative policy priority for many governments. Present–day businesses operate in a highly turbulent environment, where competitive advantage is sustained through product, process and business model innovation.

The Automotive Industry has a history of innovation and has been re-inventing itself since its birth in the 1860s. It has the highest combined expenditure on research and development globally which has led to rapid development of new technologies to satisfy the rapidly evolving customer requirements. Innovation in the automotive industry in industrializing countries has been driven by government local content policies. Local content policies usually target domestic industrial and technological development, value creation or addition, wealth increase, employment creation and the development of backward, forward and lateral linkages along the value chain.

This paper draws lessons from the global automotive industry, international, regional and national planning and development frameworks, as well as Uganda's automotive local content situation analysis to prescribe key innovation drivers including; streamlined governance, advisory, promotion and advocacy, relevant infrastructure, enterprise and human capital development, technology development, transfer and diffusion, financing, macro-economic incentives for market development, collaboration and integration and value chain performance assessment.

Keywords: ***Automotive, Innovation, Local Content.***

Introduction

Innovation

The Organisation for Economic Co-operation and Development, an intergovernmental economic platform with 36-member states was founded in 1961 to stimulate economic progress and world trade. It defined *innovation* as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organization or external relations. Innovation involves deliberate application of information, imagination and initiative in deriving greater or differentiated value from resources and includes all processes for generation of new ideas and subsequent translation into useful products.

The scholarly community advances three categories of innovation namely: product, process and business model innovation. Additionally, the use of new management practices and organization structures, the development and retention of skilled personnel, and new ways of securing financial resources and managing interface with government and other external agencies are also forms of innovation.

Product Innovation

This takes three different forms: 1) The development of a new product; 2) An improvement of the performance of an existing product; and 3) A new feature to an existing product, such as including a navigation system in a vehicle. Drivers of product innovation are typically technological advancements, changes in customer requirements, or out-dated product design. Product innovation is visible to the end-user and often results into greater demand for a product.

Process Innovation

This includes changes in the equipment and technology used in manufacturing; improvement in tooling and techniques; improvements in software used in product design, development, supply chain and delivery systems; as well as methods used for accounting and customer service. The need to optimise production costs is the foundation of process innovation. One of the most famous and ground-breaking examples of process innovation is the world's first moving assembly line by Henry Ford. This process innovation not only simplified vehicle assembly but also shortened the time necessary to produce a single vehicle from 12 hours to 90 minutes.

Business Model Innovation

Business model innovation focuses on changes in the way products get to the market. This includes penetration of new markets, new supply sources or distribution methods, and new industries. Business model innovation is radical, risky, and transformative. Online stores such as Jumia, Knocked-Down contract assembly and mobile money are examples of business model innovation.

The Innovation Cycle

Innovation is a continuous iterative process of product discovery, development and commercialization that enables companies to keep reinvesting in the next generation of technology. The innovation cycle in Figure1 is a repeatable process that results in the creation of a novel process, product, service, or business model that has value.

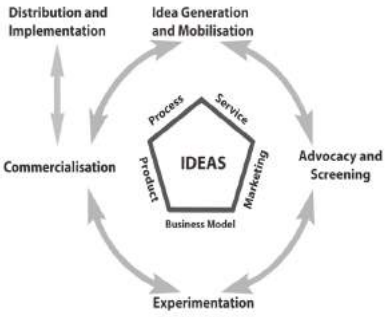


Figure1: The Innovation Cycle[1]

Idea generation and mobilization involves creating and capturing ideas, developing the value proposition and evaluating the opportunity and strategic fit.

Advocacy and screening help to evaluate an idea and measure its potential benefits and problems. Not all ideas are worth implementing.This also involves, facilitating and supporting the idea generators since they do not always have the skills to advocate for their ideas.

Experimentation involves testing the idea with a prototype or pilot to establish suitability of purpose and functionality.

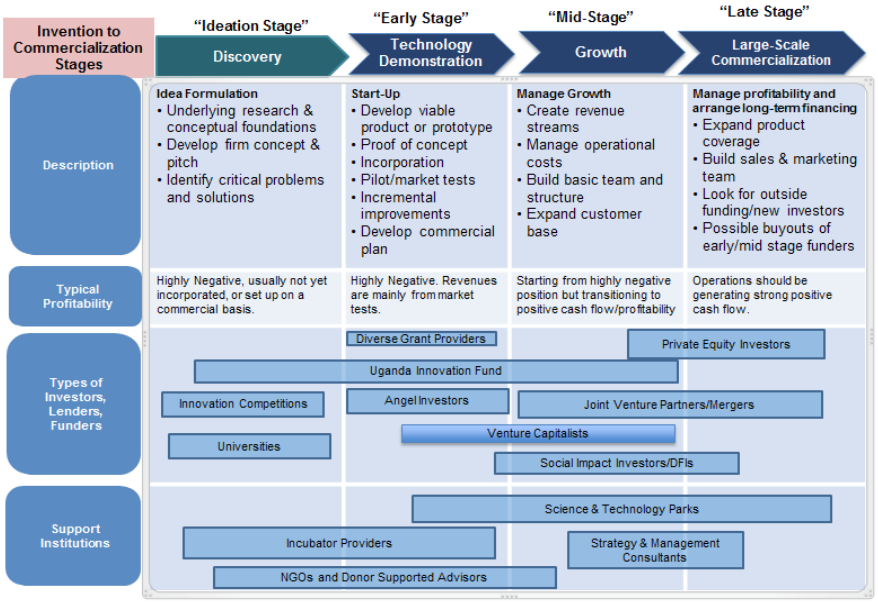
Commercialisation aims to create market value for an idea by focusing on its potential impact. This involves developing a

1 AlissaMariello, "The Five Stages of Successful Innovation." Sloan Management Review and Brian Neese, "Cultivating a Robust Organization: 5 Stages of the Innovation Process", Rivier University Online

marketing plan, communicating and packaging the solution so that is appealing to the audience, explaining how and when the idea can be used, using data or prototypes from experiments to demonstrate benefits.

Diffusion involves acceptance of an innovative idea by implementing it in a population. Diffusion is always aided by knowledge brokers.

The innovation ecosystem describes the nature of participants and resources necessary for innovation. Fig.2 illustrates the different types of possible investors, support institutions, profitability margins from discovery of an idea to large scale commercialisation in the Uganda eco-system. The existing support institutions include; universities, incubators such as Uganda Industrial Research Institute, science and technology parks. Financial sources include; the government/innovation fund and presidential pledges, angel investors, innovation competitions, universities, private equity investors and social impact investors/direct foreign investment.



It is imperative to note that the innovation and technology commercialization lifecycle involves several risks which call for sustainable funding interventions to realize viable business from ideas. Scholars have defined two (2) regions of high risk requiring financial intervention namely; the Valley of Death and the Darwinian Sea illustrated in Figure 3.

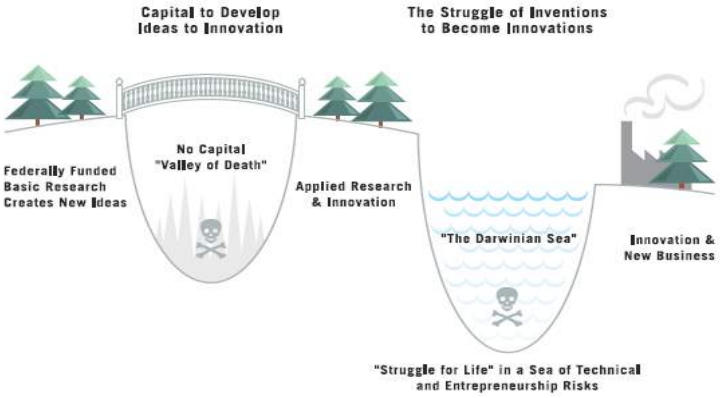


Fig. 3: Valley of Death and Darwinian Sea

Local Content

The Uganda Local content Bill (2017) defines Local content as the quantum or percentage of locally produced materials, personnel, financing, goods and services utilized by a person, body or entity in any operation, undertaking or activity carried in Uganda and which can be measured in monetary terms.

Local content policies, strategies and requirements are generally a set of policy instruments put in place by national governments to ensure that a certain share of factors of production (such as Labour, supplies, technology and knowledge) required at each stage of the value chain is sourced from the domestic economy [1]. It is important to note that development of local content policies and strategies should take into account World

Trade Organization and multilateral agreements including the General Agreement on Tariffs and Trade (GATT), Trade Related Investment Measures (TRIMs) Agreement on Subsidies and Countervailing Measures (ASCM) and the Government Procurement Agreements (GPA).

Automotive local content promotion strategies vary significantly between countries, depending on the current status of their economic, political and social development. None the less they follow a similar model; the most direct and widely used model has been through industry protection; imposing quantitative controls over vehicle imports while at the same time offering firms opportunities to establish local factories, thus attracting Foreign Direct Investment(FDI), subject to the condition that they go beyond assembly of imported knocked down kits and incorporate specified levels of "local content" in the form of domestically produced components, either produced in-house or purchased from domestic suppliers.

Linkages with International, Regional and National Planning and Development Frameworks

There is a number of national, regional and international planning and development frameworks prescribing relevant targets regarding domestic technology development, research, innovation and value addition aimed at developing native industries and local content.

1.1 Sustainable Development Goals: 2030 Agenda

The Sustainable Development Goals are a collection of 17 global goals set by the United Nations Development Programme to rally members of the UN towards common causes. They prescribe the need for industrialization and value addition for the least developed countries. ***Goal 9*** of the SDGs targets to support domestic technology development, research and innovation in developing countries; including ensuring policy environment for inter alia, industrial diversification and value addition to commodities. Facilitate sustainable and resilient infrastructure in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island nations. ***Goal 17*** targets the promotion of development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms.

1.2 African Union Agenda 2063

The Africa Union Agenda 2063 recognizes value addition as one of the enablers for achieving the development goals of the Africa Union and its member states. Formulation of a commodities strategy, enabling African countries add value, extract higher rents from their commodities, integrate into the Global Value Chains (GVC), and promote vertical and horizontal diversification anchored in value addition and local content development was earmarked as one of the 12 priority flagship programmes/ projects for the first ten year implementation plan of the African

Union Agenda 2063 framework document adopted in 2015.

1.3 **STISA-2024**

The African Union Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024) places Science, Technology and Innovation (STI) at the epicentre of Africa's socio-economic development and growth and tasks member states to create an overall enabling environment for STI by having evidence-based policies and programs that encourage STI development.

The STISA-2024 advocates for social transformation and economic competitiveness, through human capital development, innovation, value addition, industrialization and entrepreneurship. Priority Area 6 of the STISA-2024:- Wealth creation, aims at accelerating Africa's transition to an innovation-led, knowledge-based economy, empowering human resources with the necessary skills placing emphasis on innovation and appropriate adaption of technology and existing research to locally process the continent abundant natural resources.STISA-2024 points out that the above will be achieved by:

(1) Improving STI readiness in terms of infrastructure, professional, technical competence and entrepreneurial capacity; and

(2) Implementing specific policies and programs in STI that address societal needs in a holistic and sustainable way.

1.4 East Africa Community (EAC) Vision 2050

Leaders of the five partner states of the EAC explicitly recognized the importance of STI in the EAC treaty. The partner states integrated STI considerations into a range of policy frameworks and adopted a protocol on STI. The partner states also launched a number of regional STI initiatives including establishing the East African Science and Technology Commission (EASTECO)

whose remit is to promote regional integration in the development, management and application of STI in the Community.

EAC Vision 2050 asserts that STI, whether embodied in human skills, capital goods, practices and organizations, is one of the key drivers of economic growth and sustainable development. It is further affirmed that during the period of Vision 2050 the region will commit itself to: Disseminate and exchange information and results of activities in industrial research, technological development and demonstration programs; Facilitate access to their technological and research facilities by researchers and other experts; Encourage private sector participation in activities relating to intra-regional research and transfer of technology; Establish and support research infrastructure, facilities and institutions; Establish regional mechanisms for developing human capacity for industrial and technological advancement; Establish a Research and Technology Development Fund (RTDF); and Establish a Regional Research and Innovation Capacity Building Program.

1.5 Uganda Vision 2040 and National Development Plan II

Vision 2040 underscores the need for Uganda to re-orient herself to make Science, Technology, Engineering and Innovation the main driver of economic growth and the key pillar of competitiveness. It points out that to harness opportunities in Science, Technology, Engineering and Innovation, Government will support innovation financing by introducing special grants, loans and guarantees for start-ups and new firms as well as subsidies, tax incentives to stimulate research and development in the public and private sectors.

The National Development Plan II whose theme is "*Strengthening Uganda's Competitiveness for Sustainable Wealth Creation, Employment and Inclusive Growth*" emphasizes the development,

promotion, application and integration of Science, Technology, Engineering and Innovation into the national development process.

1.6 National Resistance Movement Manifesto (2016-2021)

The theme of the NRM Manifesto 2016-2021 is, "Taking Uganda to Modernity through Job Creation and Inclusive Development". The manifesto pledges support to technological innovation by increasing the innovation fund to help anyone with scientific ideas that need to be developed into viable business.

1.7 The Strategic Guidelines and Directives for the Term 2016 – 2021

While expounding the strategic guidelines and directives for the term 2016 – 2021, H.E. Yoweri Kaguta Museveni, the President of the Republic of Uganda at the inaugural cabinet meeting, directed that, *"In order to avoid doubt, our priorities among priorities remain: Defence and Security; electricity generation and distribution; tarmacking all the major roads already identified; Japanese equipment for feeder roads; the Standard Gauge Railways; NAADS; the Industrial Parks; the Innovation Fund; the Youth Fund; the Women Fund; as well as on-going programmes in Health and Education sectors."* In his specific guidance to the STI sector in a letter dated 24th March 2017, H.E. the President guided that the Ministry of Science, Technology and Innovation (MoSTI)to concentrate on supporting innovations that have been started but have not received enough funding and attention to enable them get off the ground.

1.8 The Omaswa Committee Report, 2014

The Omaswa Task Force, 2014, noting the immense successes of the Presidential Initiative for Science and Technology Innovations at Makerere University (provided through the allocation of the

Uganda shillings 25 billion over the five year period 2010-2015), as instanced by the Kiira EV Car Innovation, recommended that the Initiative be developed into a National Science and Technology Research Fund to be awarded competitively through the Uganda National Council of Science and Technology (UNCST) under a Ministry of Higher Education, Science, Technology and Industry/Industrialisation. More specifically, His Excellency the President accepted this recommendation on 9th September 2014 in Kyambogo University when he flagged off 200 students from Ugandan Universities who went to Israel for the one-year Agricultural Skills Apprenticeship Programme (Agro studies). Still more concretely, in December 2015, while on his Presidential Campaign trail in Mbale, Eastern Uganda, His Excellency the President announced the Uganda Shillings 500 billion Innovation Fund, now being operationalized under the subsequently established Ministry of Science, Technology and Innovations (MOSTI).

1.9 The Rwendeire Committee Report, 2016

The Rwendeire Committee Report, 2016, strongly recommended the operationalisation and scaling-up of the Research and Innovation Fund from the initial pledge of UGX 500 Billion. The Report noted and commended the interventions by Government such as the millennium Science Initiative as well as the Presidential Initiative for Science and Technology Innovation.

Impact Of Innovation On A Sovereign State

The generation, exploitation and diffusion of knowledge are fundamental to economic growth, development and the wellbeing of a sovereign state. Globally, the issue of innovation for development is an imperative policy priority for many governments. Government can play an important role in shaping a country's innovation profile through creating enabling infrastructure for innovation, improving the business environment, establishing well-balanced Intellectual Property

Rights management systems, investing in human resources (skills development), enhancing the Research and Development (R&D) infrastructure to attract private investment, and encouraging the establishment of industrial clusters in serviced parks.

Investment in R&D by Government and the Private Sector is a critical factor that differentiates a country's innovation performance and subsequent sustainable growth. NDP II targets a Gross Domestic Expenditure on R&D (GERD) as a percentage of Gross Domestic Product of 1% and a Technology Achievement Index (TAI) of 0.21 placing Uganda in the dynamic adopters group by 2020. The Science, Technology and Innovation Statistical Abstract, 2016 highlights that GERD dropped from 0.5% in 2010 to 0.23% in 2014 while the TAI dropped from 0.15 in 2010 to 0.14 in 2014 indicating a decline in the capacity to participate in innovations and technology diffusion.

Innovation facilitates entrepreneurship and economic specialization through increased Intellectual Property ownership. Proper innovation management enhances academia–industry cross fertilization enhancing the relevance of research projects with both scientific and commercial purpose. Proper management of innovation leads to ease of access to university inventions, providing a platform for industry-academia collaboration for strategic innovation. Intellectual Property Rights protection is a key enabler for commercialization of innovations toward generating profit and growth.

Innovation enhances attraction of FDI, which usually brings into a country new technologies and new products contributing to the gradual upgrading of a country's innovation capacity. Innovation is often born out of the blending of indigenous knowledge with the technological and organizational inputs from foreign firms. The blending is critical to upgrading the country's innovation capacity.

Innovation enhances the quality of human capital, especially

in science and technology, critical for innovation and a host nation's competitiveness.

Innovation is a key input for stimulating a competitive market structure by incentivizing companies to innovate new and better products, process and business models to attract consumers and retain market share.

Lessons from the Global Automotive Industry

The automotive industry is one of the biggest industrial sectors in the world. If one includes the economic activities up and downstream of actual manufacturing, the sector's value added stands at around 5-10 percent of global trade [2], valued at over 1 trillion USD[2] with the largest vehicle producers and markets being China, USA, Japan and Europe. Worldwide there are over 1.2 Million registered passenger and commercial vehicles[3].

Innovation and local content development strategies are not entirely new concepts in the automotive industry. This section presents lessons taken from case studies of countries with established automotive manufacturing with specific emphasis on local content participation governance, relevant infrastructure, enterprise and human capital development, technology development, transfer and diffusion, financing, collaboration and integration, promotion and advocacy, value chain performance assessment and macro-economic incentives for market development.

1.1 Governance, Advocacy and Promotion

An overarching legal and institutional framework with proper governance structures and mandate such as government ministries, agencies, departments and councils, is a key driver of an innovation environment. The department of industry in South Africa, the ministry of international trade and industries

2 The Global Trade by Category of Goods
3 OICA, World Vehicles in Use , 2015

in Malaysia, the ministry of commerce in India, the Automotive Council in UK, the national auto parts industry in Mexico and American automotive policy council (AAPC) are good examples of bodies with mandate to foster local content and innovation development in the automotive sector in the respective countries.

Policy instruments aimed at promoting research and development activities, technology transfer, market development, human capital development are key in bolstering innovation and local content development for example the make in India policy, the Inovar-auto policy and the innovation legislation and national initiative for innovation in Brazil and Japan's small and medium enterprise basic law which aims to promote business innovation and new business start-ups.

One of the innovation stages identified in the innovation cycle requires advocacy for innovation and local content. Associations such as the national association of automobile manufacturers of South Africa (NAAMSA), Japan's alliance of automobile manufacturers and motor industrial federation (JMIF), the automotive industrial partnership (AIP),automotive investment organization (AIO) and the Automotive Council in the UK, automotive component manufacturers association of India (ACMA) and Malaysian Automotive component parts manufacturers (MACPMA), perform an advisory and advocacy role in the motor vehicle manufacturing industry. Advocacy groups are normally composed of representatives from the triple helix i.e. government, private sector and universities.

1.2 **Relevant Infrastracture**

The big three automakers in the US i.e. Ford, General motors and FCA fund or operate more than 200 assembly plants, manufacturing facilities, research labs, distribution centres, and other facilities. China's and Japan's auto industries are grouped into distinct industrial clusters which are located near the key regional industrial centres such as Shanghai, Beijing,

Changchun, Hubei, Chongqing and Guangzhou. Clustering enables centralized access to key resource inputs. China operates a Technology and Research Centre as a central government-level enterprise covering about 5.4 km^2 dedicated to research in the auto industry. Malaysia has over 500 developed industrial parks which have been instrumental in Malaysia's home-grown parts and components manufacturers who constitute over 80% within the domestic eco-system. India has set up seven national automotive testing and R&D infrastructure project (NATRiP) centers, focusing on providing low-cost manufacturing and product development solutions. South Africa has Automotive Industry Development Centers (AIDCs) established by the provincial government with commitment to research, localization and investment. Ethiopia has an industrial parks development corporation mandated to develop, administer, and prepare detailed national industrial parks. Mexico has auto Engineering and design centers specializing in research, design, development of automotive components and specialized vehicle testing. They are both private and government funded e.g. General Motors regional engineering center and the industrial engineering and development center.Brazil has established technology hubs with more than 900 companies. The Brazilian innovation legislation mandates every Public Research Institute (PRI) to build its own Technological Innovation Department (TID).

In summary, key infrastructure with the required equipment and tools such as R&D centers, Innovation hubs, Incubation centers, Industrial Parks and Industrial clusters are very instrumental in innovation and local content development.It is important to note that this entire infrastructure should be accompanied by well-developed social infrastructure such as key road networks, electricity, internet fibre links, housing and recreation facilities.

1.3 Technology Development, Transfer and Diffusion

Technology development and innovation are synonymous, Innovation results into new technologies. Technology diffusion is the process by which technologies/innovations are adapted by

a population. Technology transfer is the process of disseminating technology from the places of its origin. It occurs along various axes: among universities, from universities to businesses, from large businesses to smaller ones, from governments to businesses, across borders, formally and informally, and openly or surreptitiously. The different channels of technology transfer include licensing, support contracts, joint ventures, franchising, strategic alliance, turnkey agreements, equipment acquisition, management contracts, foreign company acquisition, direct foreign investment, buy back contracts and original equipment manufacturing leases.

In industrialised countries, technology development, transfer and diffusion processes involve research, development, production and distribution of technology. There is clear evidence of technology development in the US for example the rigorous R&D in Automated, Connected and Electric vehicle technologies. US auto parts companies invested an average of over USD 1,150 per vehicle sold in developing new vehicle technologies. China has an international technology transfer center (CITTC), a Government platform that bridges overseas universities, research centers, science parks, competitive clusters, public organizations and SMEs with the Chinese market. China's Government mandates that foreign investors in specific industries form joint ventures with domestic Chinese companies to promote technology transfer. The UK has a strong automotive local content base with several design and technical design centers of several foreign companies. As such, the UK has maintained a high level of automotive local content, 44% by 2017 in terms of value of parts sourced from tier-1 suppliers [3]. The Japan Science and Technology Agency (JST) facilitate technology transfer of leading-edge research output from universities and public research institutions to the industrial sector. Japan also has well established Technology Licensing Organizations (TLOs) which play an important role in the development and transfer of technologies. Brazil established Technology Transfer Offices (TTOs) as agents for technology protection and licensing. TLOs

and TTOs ensure that there is proper management of intellectual property rights which encourages innovation.

In industrializing countries, technology transfer processes normally follow a reverse technology life cycle starting with distribution, to production, development and research. This involves reverse engineering. Brazil, India, Malaysia, Taiwan and many ASEAN Countries have followed this path of technology transfer. Malaysia has achieved technology transfer through technology partnerships including agreements on rebadging vehicles of renowned automakers. Proton, one of Malaysia's main automotive companies, was originally a manufacturer of rebadged Mitsubishi Motors (MMC) products in the 1980s and 1990s.

In the least developed and developing countries, technology transfer is across borders from industrialized countries. Technology development is mainly through reverse engineering.

In summary, technology development, transfer and diffusion depends on the level of development of a given nation. The very successful model for nations that need to catch up with the industrialized nations is the reverse technology development cycle.

1.4 **Enterprise and Human Capital Development**

Innovation and knowledge creation is hinged on a well-developed and trained human resource. Human capital is the productive capacity of the people in an enterprise or nation. Government, University Research Centers and Industry are very important drivers of human capital development. The US has developed an advanced human resource because of the strong collaboration through the industry university collaborative research center program (IUCRC) which provides funding opportunity for universities to perform industry specific research. The community college system in the US has been instrumental in developing the human resource and practical skills for the auto-industry. Malaysia offers incentives for industrial linkages,

research and development and training efforts.

Coordinated training programs at all levels are a precursor to a quality human resource. A formal education system alone is not sufficient. In South Africa, an institutionalized National Artisan Development System handles artisan development. Japan has a vocational ability development program that includes fixed term on the job training, practical human development system; young worker's challenge program and the dual system for job seekers needing to acquire practical vocational skills. As such japan has managed to maintain a high quality human resource in the auto industry. The UK's automotive Industrial Partnership (AIP) ensures that the automotive industry has top class skills and talent. Foreign Direct Investment by multinational companies should not only be directed at establishing infrastructure but at developing relevant human resource potential for innovation. Brazil, Mexico and Argentina auto industries have developed rapidly because of the stringent requirements by their respective Governments regarding training of the local human resource by the multinational companies which have established there.

Micro, small and medium enterprises (MSME) are powerhouses of innovation, and in most cases they are always borne out of these innovation activities. China has seen rapid growth in its auto parts industry and other industries in general because of government involvement in developing enterprises. The China National Development and Reform Commission (NDRC) facilitates the creation of conditions for dynamic development of MSMEs by conducting research into the problems of MSMEs, information gathering and creating a comprehensive system of services for them. The China Centre for Business Cooperation & Coordination (CCBCC) was founded as a special agency for business development support to small businesses as well as providing economic and technological cooperation between domestic and foreign business organizations. Mexico's federal government supports and promotes the development of

MSMEs and a strong entrepreneurial ecosystem via the National Entrepreneurship Institute (INADEM). Brazil has a number of accelerators that provide help to entrepreneurs e.g. Acceleratech, and incubators such as Gemindora that organize boot camps to nature new businesses.

1.5 **Financing**

Financing of innovations and domestic enterprise growth has been best demonstrated by the initiatives of global leaders, US and China. Both governments have played a very significant role in maintaining their automotive industries. In 2009, the Obama Administration bailed out General Motors, GMAC (ally) and Chrysler with over USD 80.7 Billion[4]. In addition to government direct funding, they have several other financing options including debt financing through commercial banks, direct external funding through shareholders using registered capital, supply chain financing; where the banks focus on sustainability of the whole supply-chain, the authenticity of the business and the credibility of the trading partner. Angel investments,venture capital investments are also another source of financing where investments are made by a company, which manages money on behalf of investors. Venture capitalists get convertible preferred stock in the company. The Brazilian association of private equity and venture capital, ABVCAP, is a good example of how successful this form of capital can be. ABVCAP expanded its funding base from USD 20.3 billion in 2011 to USD 48.9 billion in 2015. However, availability of funding sources alone is not sufficient. A well developed and stable financial system is key to ensuring that innovators access affordable financing. Self-financing in the case of big organizations for R&D is very important driver of innovation in the auto industry. It should also be emphasized that FDI is an essential funding package for developing countries, taking many forms such as investing in machinery, training, establishing processes and cash.

4 "Key Facts" U.S. Department of Treasury

1.6 Macro-Economic Incentives for Market Development

The automotive industry presents very clear examples where macro-economic incentives and protection policies encourage domestication and innovation. U.S federal government has over1,853 state business incentives programs which include tax credits (489), grants (407), loans (381), and tax exemptions (254) among others. Malaysia's government offers attractive incentives to automobile and component manufacturers to ensure success of the national vehicle projects such as the Industry Linkages Programme which provides duty exemption to an Original Equipment Manufacturer (OEM) that uses local components.

Brazil, Mexico, South Africa, India and many other countries that have quickly developed their auto-industries restrict importation of vehicles manufactured outside their markets and prescribe local content requirements on those manufactured within.

In addition, regional agreements normally have the effect of expanding access to wider markets. Mexico has a mature auto industry thanks to the North American Free Trade Area (NAFTA) agreements which gives Mexico access to the American and Canadian markets. The ASEAN agreement has had the same effect on the auto-parts sectors in Indonesia, Thailand, Singapore, Malaysia, Vietnam and Philippines.

It is however, important to note that incentives and protectionist policies sometimes encourage inefficient production and the burden is shifted to government making such programs expensive.

Collaboration and Integration

Collaborations among key actors in the value chain of auto development are important to reduce on duplication and enhance economies of scale. Commercial production is viable at prescribed volumes, for example, it should target at least

5,000 units per model/part per year in the auto industry. The Automotive Supply Chain Competitiveness Initiative ASCCI in South Africa is a collaborative effort between NAAMSA, NAACAM, DTI and NUMSA with the specific task of setting a strategic direction for the auto supply chain development in the South African auto industry. It is now common that one parts manufacturer, produces the same part for different auto-manufactures.

Value Chain Performance Assessment

Data collection aimed at processing key statistical indicators such as the innovation index, local content percentage, product quality are instrumental in measuring and as such improving or correcting any government efforts aimed at mainstreaming innovation and local content efforts. The Automotive Council and Society of Motor Manufacturers & Traders (SMMT) Industry in the UK are responsible for assessing the automotive domestic content contribution percentage in the UK and are subject to the Department for Business, Energy and Industrial Strategy. This council, through periodical assessment and recommendations, has seen vehicles manufactured in the UK increase local content from 36% in 2011 to 44% in 2017.

Automotive Local Content Particiation in Uganda

The size of the vehicle market in the East African Community (EAC) grew from 158,000 in 2011 to 257,000 in 2015 and is projected to reach over 500,000 by 2027 [4]. Despite the growing demand for vehicles in Uganda and the EAC, vehicles are predominantly imported as Fully Built Units without domestic value addition. The Uganda vehicle import value grew from US$ 190 Million in 2005 to US$ 550 Million in 2015 [5] at a Compound Annual Growth Rate of 11.8% representing approximately 10% of the National Gross Import

Value. The consumerism perspective in the vehicle market not only undermines the prospects of domestic value addition, but also contributes to the undesired growing trade deficit. Without strategic interventions for harnessing such opportunities to drive industrialization, unemployment and under employment challenges can only escalate.

Cognizant of the need to develop the domestic auto-industry, government of the republic of Uganda allocated 100 acres of land and seed funding as capitalisation for setting up and kick-starting the operations of the Kiira Vehicle Plant.

In order to successfully establish a sustainable Uganda Automotive industry, there shall be need for deliberate efforts to promote innovation and local content participation in line with existing policy and regulatory frameworks to;

(1) To stimulate the domestic manufacture of auto parts and components;

(2) Automotive Market Development with attention to affordable end-user finance and strategic purchase programs;

(3) Enterprise and Human Capacity Development to enable participation in the domestic Automotive Industry; and

(4) Automotive Technology Development and Transfer across different institutions including; Universities, Research and Technology Incubation centers and enterprises.

Uganda is well positioned for participation in automotive innovation and local content development. The automotive industry in the EAC region has already attracted interest from the leading multinational OEMs from Japan (such as Toyota, Mitsubishi, Suzuki, and Mazda), Europe (such as VW, Mercedes Benz, and IVECO), USA (such as GM and Ford), Korea (Such as Hyundai and KIA) and China (such as FOTON and Chery). It is important to note that each of these typical plants assemble

vehicles with as much as 8,000 to 12,000 different components and more than 30,000 individual parts. Vehicle assembly/ manufacture accounts for just up to up to 15% of the automotive sector opportunity space while and suppliers of the automotive parts and allied services constitute 85%.

Uganda has an abundant human resource; in 2010, the Ministry of Gender, Labour and Social development estimated that the Ugandan economy needed to absorb about 392,000 new entrants into the labour market. The labour force growth rate was estimated at 4.7 per annum in 2009/10, a momentum which was higher than the population growth rate.

Uganda has huge potential to tap into utilization of natural resources such as steel from iron ore deposits, plastics from oil and gas, lithium ion batteries from graphite, lithium and cobalt deposits, vehicle upholstery and interior padding from cotton and leather, glass from silica and sand among others.

Governance

The government of Uganda is currently processing a local content bill (2017), which proposes a National Local Content Committee among other things. The government recently passed into law a ban on importation of vehicles manufactured more than 15 years. These are steps in the right direction. The Automotive Value Chain in Uganda is loosely coordinated under the activities of Ministry of Works and Transport. The government of Uganda is committed to establishing local automotive assembly and manufacturing capabilities through Kiira Motors Corporation (KMC) which is spearheading innovation and local content initiatives through the Ministry of Science, Technology and Innovation. KMC has built three vehicle concepts with the Kayoola Solar Bus having over 60 % local content.

The EAC is also proposing establishment of the Automotive Industry Council of East Africa (AICEA) and respective national

councils and national automotive industry coordination Offices (NAICO), to streamline efforts of governance of the automotive value chain[5].

7.2 Policy Advisory, Promotion and Advocacy

Uganda's automotive industry is still in its infant stages, no sector specific associations and automotive policy councils have been established. However, associations, such as the associated motor dealers, Uganda manufacturers' association (UMA), have been actively and persistently engaging the government and policy makers to put in place mechanisms that shall promote local manufacturing. Some of UMA's registered successes include; the BUBU policy, textile policy and sugar policy. Government

7.3 Relevant Infrastructure

The Government of Uganda through the Uganda Investment Authority (UIA) plans to establish a minimum of twenty-two (22) Industrial and Business Parks (IBP's) throughout the Country to support local Manufacturing through value addition to the raw materials within the country. KMC is setting up a plant in the Jinja Industrial Park. It should be emphasized that to reap benefits of clustering, such a park should be designated as an automotive industrial park. Other parks should also be prioritized to strategic industrial sectors. There should clear plans to develop access roads, extension of standard gauge rail, internet fiber links and other social infrastructure to such parks.

Enterprise and Human Capital Development

The global automotive industry requires a number of technical skills and core competencies including; product design and development, assembly and manufacturing, material joining methods, production planning and scheduling, product and process quality, advanced product quality planning, testing inspection and validation, logistics and packaging, industrial

5 Draft Terms of Reference for the Establishment of the Automotive Industry Council of East Africa (AICEA)

machine maintenance, inventory management, lean production, material flow and handling, painting, supply chain management among others.

Uganda has a total of 47 Universities, 11 public and 36 private.

Only Kyambogo University offers a Bachelor's degree in Automotive and Power Engineering. There are also over 102 technical and vocational education training institutions. Nakawa Training and Vocational Institute, is one of the vocational training institutes that provides automotive specific vocational training skills. The current scope of vocational training remains limited to traditional courses like carpentry, civil work masons, electrical foremen, specialized welding, forging, casting, machining and surface finishing. There should be coordinated efforts to address specific automotive value chain skill needs. The Government has developed the Business, Technical and Vocational Education and Training (BTVET) Strategic Plan 2011 – 2020 titled - Skilling Uganda, aimed at developing a human resource with employable skills and competencies relevant in the labour market.

Other similar efforts in line with streamlining the employability of the human resource include; the Uganda National Entrepreneurship Development Institute, Competitiveness and Enterprise Development Project, UIA's Entrepreneurship Training programme and the Uganda Skills Development Project (USDP) managed jointly by Ministry of Finance, Planning and Economic Development and Private Sector Foundation Uganda.

Technology Development, Transfer and Diffusion

Uganda's automotive technology development and transfer initiatives are realized through reverse engineering, licensing from multinational companies and in some rare instances of collaborative R&D with Universities such as Makerere University, Research Institutes such as Uganda Industrial Research Institute (UIRI) and Uganda National Council for Science and Technology (UNCST). There is evidence of

technology development by innovators such as KMC, the MV Mulimi and Katwe metal workers such as MUSABODY. It is important to note that the Uganda Registration Services Bureau grants innovators and inventors exclusive intellectual property rights if their innovations are registered.

Some Automotive value chain actors such as Uganda Batteries Limited, the local market leader in auxiliary battery production acquired technology through a partnership agreement with Chloride (UK) Ltd.

Financing

The Innovation fund is one of Government's funding instruments aimed at encouraging creativity and supporting innovations in Uganda. Innovators in the Uganda have also previously accessed funding through the presidential initiative for science and technology. KMC has been a beneficiary of this initiative.

Uganda is one of the countries that attract the most FDI in EAC. Uganda's FDI is estimated to have increased by 18.5% during the 2017. The minimum capital investment required for a foreign investor to be eligible to invest in the country in any sector, apart from those that may compromise the country's security, is $100,000 over three years as stipulated by Uganda Investment Authority. In the Automotive value chain, there are a number of FDIs including; Toyota Uganda Ltd, TATA Uganda Ltd, Kenya Uganda Ltd, Motorcare Uganda Ltd, and Mobikey Uganda.

Others sources of funding include; Matching Grant Facility (MGF), soft loans, venture capital, competitions, commercial loans among others. Commercial loans from banks attract high interest rates (about 31-35%) and demand high levels of collateral, predominantly immovable, which most MSMEs do not have. Government should provide more meet-half way grants/funds to fast track domestic automotive component manufacturing.

Collaboration and Integration

Through collaborations with Uganda's Government, Parts suppliers and Makerere University, KMC designed and built three concept vehicles and is position to start commercial production in 2019. More collaboration between private innovators and research centers should be promoted to increase levels of local content development.

Value Chain Performance Assessment

The certificate of origin issued by URA and differentiates products manufactured in the EAC region from those out of the region. This is used to determine the percentage of local content in the product depending on the origin of inputs used in entire manufacturing process and can be extended to the automotive value chain.

The Uganda National Bureau of Standards (UNBS) is the statutory body responsible for Standardization, Quality Assurance, promoting local industries and protecting consumers. UNBS has so far drafted the DUS 1928 the Bus body design and construction standard for buses. It is expected that UNBS will put more effort into developing similar standard for Uganda's automotive value chain.

Macro Economic Incentives for Market Development

The Government of Uganda has provisions for a wide range of tax incentives to businesses to attract greater levels of FDI into the country. All investors with a license from the Uganda Investment Authority are entitled to tax exemptions and refunds on; Imports of necessary equipment, motor vehicles; and VAT incurred on the purchase of building materials for industrial/ commercial buildings. Gazetted vehicle assemblers in Uganda are entitled to import duty remission according to the EAC Customs Union External Tariffs.

The EAC rules of origin also offer tariff relief where the minimum value added by a producer in a partner state is 30%

of the ex-works price of the given product. To encourage local content development and resource utilization, URA should push for a local content requirement of at least 30% at the start.

Uganda's fiscal incentive package for both domestic and foreign investors provide generous capital recovery terms, particularly for medium and long-term investors whose projects entail significant plant and machinery costs and involve significant training. For example, 50% of capital allowances for plants and machinery are deductible from a company's income on a one-time basis for an investor setting up in Kampala, and 75 % for the rest of Uganda.

There are also Energy Rebate incentives (introduced by Electricity Regulatory Authority - ERA) for manufacturers to build industries in remote areas with no existing electricity infrastructure. There are also policies such as Buy Uganda, Build Uganda which encourages domestic production.

Assessing the Potential of Existing Companies

Uganda has 4,725factories[6]engaged in different manufacturing sectors including; food processing, beverages, chemical products, paints, soap and foam, construction materials, plastic and plastic composites, metal fabrication, textiles, clothing and foot wear, paper and printing, wood processing, electronics, pharmaceuticals, etc.

The UMA directory of 2018 highlights over 100 manufacturers with potential for direct or indirect participation in the nascent automotive industry including; metal fabrication and engineering services, plastics and plastic composites manufacturing, fiberglass products, oil and lubrications blending, paints, rubber products and electronics. Key stakeholder engagements are on-going to put in place the modalities for developing these companies as domestic manufacturers and suppliers of auto parts. The key players include; Luweero Industries, Fabrications Systems,

6 State of the Nation Speech by H.E. The President of Uganda, delivered on 9th September, 2018

Victoria Engineering, GM Tumpeco Giant Uganda focusing on metal fabrication works; Gentex Enterprises, Blowplast, Nice house of plastics focusing on plastics; Henkel, Axcl Lubricants CCLE Rubber Company Ltd focusing on manufacture of fiberglass, lubricants and tyres respectively, Cable Corporation, Electrical Controls & Switchgear Ltd, Gayaza Electronics Ltd focusing on manufacture of electrical components. Based on this established manufacturing potential, Kiira Motors Corporation has developed a roadmap (Figure 4) for automotive local content participation with emphasis on local parts manufacturing. This shall require strategic collaborations along the value chain and product, process and business model innovation to adapt to the automotive industry requirements.

Figure4: Roadmap for Domestic Auto Parts Manufacturing in Uganda

Conclusions and Recommendations

This section builds upon the lessons from the case studies of the automotive industry to prescribe key recommendations to mainstream innovations across the different sectors including agriculture, health, ICT, military and the manufacturing industry.

Governance, Promotion and Advocacy*:* Countries that have improved their innovation performance over the past decades (Finland, Germany, Korea, Singapore, United States, etc.) have all implemented sound public policies in shaping greater national innovation capacity. Uganda needs a legal and institutional framework that streamlines the governance of the STI sector. This framework should cover aspects of coordination of the different stakeholders, funding and government investments in innovation, intellectual property rights ownership, protection and necessary innovation infrastructure requirements.

The creation of the Ministry of Science, Technology and Innovation (MoSTI) to further strengthen Uganda's National System of innovations is a good step in the rigth direction. The Ministry should be fully operationalised and streamlined with all the different required actors.Government should prescribe clear laws and regulations regarding the STI sector. This will go a long way to deliver the desired science, technology and innovation dividends. There is need to explore strengthening linkages between MoSTI and higher education instituions by bringing higher education research instittuions under MoSTI.

Financing*:* Government should set up a legal framework and operationalize the research and innovation fund. The innovation fund shall increase the impact of more focused and relevant applied research; improve innovation system linkages and the overall quality of research and education. The NDP II prescribes a Gross Domestic Expenditure on Research and Development as a percentage of Gross Domestic Product of 1% and a Technology Achievement Index (TAI) of 0.21.

Government investment will attract other sources of funding

including; foreign direct investment, private equity, FDI angel investors and venture capitalists. Funding the STI sector shall go a long way in enhancing the quality of the human capital, especially in science and technology, critical for innovation and Uganda's competitiveness

Relevant Infrastructure*:* It is important that the key actors in the Uganda innovation ecosystem work toward the establishment of relevant infrastructure to support the innovation process including well stocked incubation centers and hubs. These centers serve the purpose of nurturing innovative ideas and developing enterprises the human resource.

Technology Development, Transfer and Diffusion: Innovative capacity should be built mindful of the dynamics of technology development, transfer and diffusion. In industrializing countries, such as Brazil, Mexico, India and even China, technology transfer process has followed a reverse technology life cycle/ reverse engineering starting with distribution acquisition of mature technologies from industrialized countries, to production, development and research. Technology Licensing offices (TLOs) and Technology Transfer Offices (TTOs) are very important actors in the technology transfer cycle. They help Innovators to protect their innovations and industrialists acquire new technologies.

Enterprise and Human Capital Development*:* Coordinated training programs at all levels are key to a quality human resource. Higher education degrees should incorporate practical and industry-tailored training programs. Formal education alone is not sufficient. Vocational ability development program that includes fixed term on the job training, practical human development system; young innovation challenge programs, national STI competitions such as the Makerere schools robotics challenges, innovators boot camps and accelerator programs such as those pioneered by DFCU bank stimulate ambition among innovators and should be encouraged and promoted. UIRI and UNCST shared use incubator programs are a step

in the right direction toward development of enterprises and vocational skills.

MSMEs are the driving force of innovation, economic growth, job creation, regional and national development and social cohesion. There is need to harmonize Uganda's policies and legislation on MSMEs so as to ensure sound framework for their establishment, growth, funding and development.

Macro-Economic Incentives for Market Development*:* It is important to stimulate a competitive market structure by incentivizing companies to innovate new and better products, process and business models to attract consumers and retain market share. Industries should be incentivized to enhance academia–industry cross fertilization enhancing the relevance of research projects with both scientific and commercial purpose. These outcomes are poised to enhance the ability to place students in industry.

Collaboration and Integration:

It is important to develop backward, forward and lateral linkages and collaborations along the innovation value chain. This eliminates duplication of efforts. Industry or incubation hubs clustering based on value added per sector is a pre-requisite to consolidating efforts of innovation. For the case of the auto-industry which requires different tiers of suppliers, there should be clear collaboration of extractive industries which supply iron-ore, to processing industries such as steel processing, forging and stamping industries, and delivery to the assembly line. This cannot take place without a body mandated to do so.

***Value Chain Performance Assessment*:**

Innovation should be measured recognized and awarded across the value chain of innovation. The ministry responsible for science technology and innovations should closely regularly monitor, evaluate and streamline key innovations indicators such as the Gross Domestic Expenditure on R&D and Technology Achievement Index against those prescribed by regional and

international frameworks.

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Curriculum For Fostering The Mix Of Arts, Humanities And Science

Professor Mary J.N. Okwakol

Introduction

The science emphasis in curriculum development has manifested in the STEM (Science, Technology, Engineering and Mathematics) movement which has resulted into substantial efforts and resources invested in it. This has mostly been influenced by the belief that STEM drives development. In recent years, however, the world has been gripped with a debate that STEM alone is insufficient in producing the all-round graduate demanded by the 21st century labour market. This has given rise to the STEAM movement which supports integration of the Arts (hence the "A") in STEM. The proponents of STEAM argue that arts integration can have such positive impact on teaching and learning as to result in well-rounded graduates. It is their belief that inclusion of arts in a STEM curriculum may enhance student confidence, motivation and creativity.

In this paper, I examine the importance of curricula that foster the mix of the arts, humanities and science in moulding all-round, fit-to-task graduates. I explore some strategies that have (or could have) been applied to implement such integration and look at some contemporary challenges to the integration. Finally, I have suggested possible strategies to overcome such challenges, especially in the context of higher education institutions in developing countries.

Delineating the Discipline Boundaries

Attempting to delineate the distinction between different disciplines tends to be an uncertain, if not unnecessary, effort. It is commonly understood that knowledge can be broken into several disciplines, all falling under broad categories of fields of study. However, there is little agreement on the actual

categorisation of the various forms of study. Broadly, we may consider knowledge to fall under one of these categories: Natural sciences, Applied Sciences, Formal Sciences, Social Sciences, Humanities and Arts. The natural sciences (Biology, Chemistry, Physics etc) which are the foundation of all the sciences are concerned with the description, prediction, and understanding of natural phenomena, based on empirical evidence from observation and experimentation. The applied sciences (Engineering, Medicine, Computer science etc) use principles derived from natural science and techniques developed in formal science (Mathematics, Statistics etc) to develop solutions for human survival and endeavour. The term science loosely refers to any of these three categories. On the other hand, distinguishing social sciences, humanities and arts is more blurred with different authors categorising disciplines differently – e.g. anthropology as part of arts, humanities or social sciences. The Merriam-Webster dictionary distinguishes humanities as "the branches of learning (such as philosophy, arts, or languages) that investigate human constructs and concerns as opposed to natural processes (as in physics or chemistry) and social relations (as in anthropology or economics) (Merriam Webster, 2018). The arts are in this sense considered part of humanities. Rather than get mired in this endless battle to distinguish the different fields, it will suffice for purposes of this paper to refer to two broad categorisations – the Sciences (natural, applied and formal) and Arts and Humanities (to include social sciences as well).

The Importance of mixing arts, humanities and science

While science and engineering can tell us the "what and "how" of the world, the humanities and social sciences provide insights into answering the "why", and with skills necessary to communicate it all to others.

Mishra, et al., (as cited in Henriksen, 2014) have argued that the multifaceted issues and complex problems served by scientific

thinkers today require 21st century professionals who go beyond disciplinary content and are also creative thinkers who can work between disciplines. It has further been argued that teaching and learning that connects the arts and sciences is essential, because historical evidence demonstrates that these connections are already innate for the most effective and innovative STEM practitioners.

Very rarely, if at all, do life's problems confront humanity from a single discipline perspective. Global societal problems like climate change or a looming large-scale epidemic may seem scientific in nature, but a closer look shows that they are all multi-faceted and need an interdisciplinary approach to their resolution. Much as the scientific facts are important to properly define the problem, the mere fact that it is a people-based solution being sought necessitates the need to fully understand the social exigencies and dynamics involved to adequately address such problems. The compartmentalisation of knowledge into different disciplines is an age-old tradition probably stemming from the desire to perfect through specialisation. The effectiveness of graduates of such highly specialised curricula in the resolution of societal problems has always come into question thus calling for a more integrated or interdisciplinary approach to curriculum at all levels of education.

Science and technology today are advancing at record breaking paces and continue to define our progress and influence works. As much as science curricula run the risk of being deficient without humanistic foundation, so too must liberal arts obtain firm grounding in and understanding of science and technology. That includes familiarity and comfort with all aspects of technology; past, present as well as the possibilities in future. Society today faces many challenges, among them poverty, hunger, inequality, climate change, and crime. Scientists and engineers should study arts and humanities to better understand what it all means to society and humanity. Artists should also learn science and

computing not just to gain skills but also to better participate in the dialogue on emerging issues.

The knowledge of science is necessary for understanding issues such as global warming and species extinction, the ways in which humans alter the natural course of evolution, of the ways in which technology and digital media shape our access to information and to each other, of how technology informs our decisions and influences public policy. However, there is need for more scientists to better communicate the importance of science and implications of its findings to the public. For instance, while an issue as complex as global climate change needs scientist to identify the root causes, it also needs experts from the humanities and social sciences to evaluate its impacts on human populations and societies, and journalists to communicate this information.

For most part, the public perceives scientists as out of touch with common people, due in part to scientists' failure to communicate the excitement of modern science to the public. This is one reason why scientists need arts and humanities to better communicate the wonders of science to the rest of the world. Mathematicians and scientists, for instance, have been very successful in making discoveries, writing journal articles or winning large grants, but they are losing the war of hearts and minds of the public. They therefore need to communicate by giving public lectures, writing articles in the media and promoting interdisciplinary studies that combine arts, humanities and science.

Taylor (2017) summarises the importance of transforming from STEM education to STEAM education by clarifying that the latter:

– is not in opposition to STEM education; it enriches and expands the scope of STEM education;

– is a curriculum philosophy that empowers science teachers to engage in school-based curriculum development;

– involves teachers in developing a humanistic vision of

21st century education and their role as professionals;

– provides a creative design space for teachers in different learning areas to collaborate in developing integrated curricula;

– can be designed and implemented on a modest scale by an individual innovative teacher;

– can draw inspiration from project-based learning programs; and

– engages students in transformative learning, which promotes five interconnected ways of knowing: cultural self-knowing, relational knowing, critical knowing, visionary and ethical knowing, and knowing in action.

The above summary clearly encapsulates the key attributes and importance of integrating arts (and humanities therefore) in the teaching and learning of science. It is the kind of learning that makes an individual whole and increases his/her capabilities in solving societal problems, both present and future, predictable or not. Yet, STEAM is not a smooth conceptualisation; it comes with some challenges and concerns.

Challenges and criticisms of STEAM and interdisciplinarity

By its very nature, interdisciplinarity calls for teamwork and collaboration not only in curriculum development but in programme delivery and assessment as well. Integrating arts and humanities in science calls for formation of teams from across the disciplines who, notwithstanding their specialisations, have a basic understanding of the other(s) discipline(s). Our current teachers and lecturers are products of narrowly-focussed discipline-centred learning that it may pose problems finding those knowledgeable (or at least interested) in the other discipline(s). In addition, teamwork and collaboration require more time per individual team member to develop a mutually acceptable product. Infusing the arts and humanities in sciences also runs the risk of perception; that its products are shallower

than the highly specialised ones. (It is still a common college practice to hold in higher esteem the so-called 3-1-1 students – an allusion to early specialisation in their programmes). Even the lecturers on such programmes might be considered less competent. Kanakia (2007) articulates this fear aptly by quoting Donald Barr as saying "professors who focus on interdisciplinary studies isolate themselves from the core of their field"… In contrast, interdisciplinary studies focus on the fringes of a field, which lowers an academic's reputation in the eyes of his [or her] peers and hurts his [or her] chances for tenure". Further, any a professor will question the rationale of leaving their well charted discipline comfort-zones for a vague, time-consuming novelty. Another issue likely to confront institutions going the interdisciplinary way is the lack of a unique or single pedagogy for integrative interdisciplinary learning (Klein, as cited in Lyall et. al., 2015). This means that different teams must agree on own methodologies which in their opinion best deliver the desired learning outcomes, on a case by case basis. Getting convergence among the team members on such methodology may inhibit the development of the method. Even if they did, the laboriousness of doing this differently every time the situation warrants may lead to team member fatigue.

Lastly, but not least, it should be noted that interdisciplinarity is unlikely to succeed if we stick on our current knowledge-based assessment systems as these tend to glorify the discipline as the source of authentic content and therefore knowledge. Introduction of radical reforms towards authentic performance-based assessment is needed; but at what cost? Radical reforms to educational systems almost always evoke a lot of stake-holder resistance and are known to carry a usually high price-tag.

I shall shortly suggest how we think these challenges and concerns could be overcome but, first, I look at how interdisciplinarity is (or could be) implemented.

Contemporary approaches to interdisciplinarity

Lyall et al (2015) have authored a comprehensive report on "Interdisciplinary provision in higher education - Current and future challenges". After an extensive review of the literature, Lyall et. al. (2015) synthesised a set of pedagogical techniques that had been discussed in the literature within the context of effective practice in interdisciplinary learning and teaching. Quoting DeZure (2010) and Klein (2010), the authors, however, recognised that interdisciplinary teaching and learning requires a host of powerful pedagogies, and that there is no unique or single pedagogy for integrative interdisciplinary learning. Lyall et. al. (2015) extracted three major strategic themes under which several pedagogical techniques in use could be grouped; namely co-teaching, interactive methods and programme-level strategies. Table 1 summarises this.

Table 1: Synthesis of interdisciplinary teaching strategies and pedagogical techniques - From Lyall et. al. (2015).

Strategy	**Pedagogical techniques**
Co-teaching	Advanced planning and negotiation with co-teacher
	Co-advising with industry representatives
	Taking turns in teaching
	Creating learning community
	Co-creation of syllabus and case studies

Interactive methods	Project-based learning (PBL)
	Case study methods
	Role-playing
	Simulations
	Virtual methods
	Peer-assessment and review
	Peer-assisted learning (PAL)
	Small-group teaching
Programme-level strategies	Interdisciplinary electives
	Core courses covering material from different perspectives
	Research conducted for the initial stages of graduate school

In a nutshell, interdisciplinary teaching and learning calls for a shift from the traditional one lecturer-led course to team teaching and from content-centered delivery to learner-centered interactive methodologies. At programme level, learners need to have choices in the selection of electives that best suit their purpose alongside core courses that approach the content from multiple discipline perspectives. Graduate research can also be deliberately steered to interdisciplinary themes. According to Barker (2015), The Welcome Trust funds crucial science research, but they are also involved in promoting science and art collaborations by specifically funding arts and science collaboration projects.

Way Forward

Higher Education Institutions (HEIs), especially in the developing world, will need to adjust their policies and practices to embrace

interdisciplinarity and ensure deliberate infusion of the arts and humanities in science if they are to address the ever-growing concern about graduates who are ill-prepared for the reality of work life. Deliberate efforts are needed aimed at creating well-facilitated interdisciplinary teams composed of (at the start) science staff with a keen interest in the arts and humanities and vice-versa. For a start, core courses such as Philosophy of Science, Education for Sustainable Development, Professional Ethics etc, that already have an infusion of arts and humanities into science, need to be launched using an interdisciplinary approach.

In addition, HEIs have to employ time-tested change management techniques like identification of champions from the early adapters to reduce on negative perceptions and minimise resistance to change. Allowing sufficient time allocations and other incentives for early adapters to cope with the demands of interdisciplinarity would be helpful for soft-landing the efforts.

Lastly HEIs need to collaborate and work towards development of contextually applicable pedagogies and assessment approaches that embrace interdisciplinarity, especially the infusion of the arts and humanities into science (STEAM).

Conclusion

I have highlighted the importance of curricula that foster the mix of the arts, humanities and science in moulding all-round, fit-to-task graduates who are well equipped for the workplace of the 21st century. The need for team teaching and the use of learner-centred interactive methodologies have been mentioned as requirements for effective interdisciplinary teaching and learning. Challenges, especially of perception and attitude, will exist to the infusion of the arts into science but these could be overcome by use of known change management techniques. HEIs need to collaborate and work together in the development of pedagogies and assessment approaches that suit the novel interdisciplinarity. Whatever the case, the efforts in embracing

interdisciplinarity are well worth it and the only sure way of ensuring that HEIs churn out graduates who are relevant to the changed and changing job market of the 21st century.

"It is Apple's DNA that technology married with liberal arts, married with the humanities that yields us the result that makes our hearts sing" Steve Jobs

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Resolutions of the 8th UVCF conference

held on 5th October 2018 at the International University of East Africa

Theme: Competitiveness of universities in Uganda

Resolutions for government

Government to be requested to:

1) set up a research and innovation directorate in Ministry of Science and Technology to support innovators and researchers
2) formulate a research agenda for national development of the country
3) set up a mechanism of rewarding researchers and innovators
4) fund all researchers in both public and private universities
5) (especially technical staff) be invited to UVCF conferences
6) develop a policy for traditional medicines
7) require all universities to report on their progress in research
8) support universities to produce more PhD holders
9) Improve the governance and management of universities

Resolutions for universities

Universities to the following:

1) engage in problem solving undertakings

2) produce an all-round graduate by incorporating practical skills acquisition in their curriculum

3) make Ugandan graduates competitive in the global economy

4) adopt the STEAM (Science, Technology, Engineering, Arts and Mathematics) approach instead of the STEM (Science, Technology, Engineering and Mathematics) in curriculum development

5) ensure quality education

6) train lecturers in pedagogical skills

7) promote research and innovations

8) reward their best innovators and researchers

9) partner with traditional and community experts in researches

10) partner with industries, businesses and civil societies in research and related programmes

11) UVCF lists university journals so that they are recognised and widely known

12) institute a board of ethics for research

13) collaborate in researching and publishing journals

The Minister of Education and sports
Hon. Janet Kataha Museveni

Permanent Secretary Ministry of Education and Sports

Mr. Alex Kakooza

Vice Chancellor Inter-University East Africa (**IUEA**)
Prof. Emeka Akaezuma