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## Bridging the University-Industry Divide in Ghana: A Case Study of Umat and the Mining and Allied Industries

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### **Abstract**

*The state of university – industry divide in Ghana hinders the mutual expectations of both universities and industries. Using the University of Mines and Technology, Tarkwa, as a case, while drawing on broad literature on university-industry relations, this paper found a weak link between universities and industry in Ghana. All twelve (12) Memoranda of Understanding signed between UMaT and academic and non-academic institutions were found to be loose relationships rather than strategic partnerships. This limited opportunity for optimizing potential benefits of a strategic university – industry partnership which the university could leverage on to fulfill its research mandate whilst guaranteeing financial sustainability of the university, was found to be the main reason for low research uptake in Ghana.*

**Keywords:** University, industry, business, research, innovation, partnership, relationship

### **1. Introduction**

Universities the world over have long been powerful drivers of global innovation and economic development but must now be willing than ever before to break free from outmoded paradigms if they are to make meaningful progress in 21st Century Higher Education. The intensely competitive global economy has driven governments and other partners of higher education to demand more immediate, tangible returns on their investments in higher institutions. This reality challenges higher institutions of learning to be much more proactive and aggressive at consciously forging relationships with industry to not only make themselves relevant but also financially self-sustaining.

This paper takes a look at the need to bridge the university-industry divide within the context of universities in Ghana using the case of the University of Mines and Technology (UMaT). The discourse has become extremely relevant and should thus engage the attention of all actors interested in accelerating economic growth, job creation and poverty reduction using research and its fit within industry as the key driver. Ghana's new national strategy for promoting partnership between Government, Public Research Institutions, Academia and the Private Sector provides impetus for this discourse.

The Government of Ghana (GoG) through the Ministry of Environment, Science, Technology and Innovation (MESTI) collaborated with the African Centre for Technology Studies (ACTS) of the Science Granting Councils Initiative (SGCI) and other partners to establish the Ghana Innovation and Research Commercialisation Center (GIRC-Centre). The Centre has a quasi-independent status. Official commercialisation of research findings is expected to commence by September 1, 2019. To actualise this initiative, the Ministry of Environment, Science, Technology and Innovation in collaboration with the Council for Scientific and Industrial Research – Science Technology Policy Research Institute (CSIR-STEPRI) undertook a study of the Science and Technology Research Ecosystem of Ghana to identify innovation actors and scalable innovations in Ghana. The findings of the study are yet to be made public. However there are some lingering questions to be addressed which engaged the attention of this paper: what innovations exist in the research ecosystems of universities in Ghana? To what extent are universities in Ghana innovating to address the needs and problems of industry and society? And how will universities in Ghana take full advantage of the opportunity provided by the GIRC-Centre?

### **2. Method and Approach**

This paper draws from literature on university-industry relations and uses the real life experiences of the University of Mines and Technology (UMaT) to identify the gaps and also opportunities for fostering university-industry relations.

The following overarching questions guided the development of the paper:

- What relationships exist between universities and industry?
- What relationships between universities and industry promote mutual interests and benefits?
- Can the relationships be strengthened to promote the desired benefits and interests?

- What recommendations are required to transform existing and new relationships?

### 3. Definition of Concepts

The relationship between university and industry can be examined with emphasis on either the university or industry. The two divides create a demand and supply situation which makes their relationship mutually reinforcing. When approaching the relationship from a university – industry perspective, the emphasis is on the supply side – how university is creating knowledge - to address the needs of industry and making their (universities) role much more relevant to the needs of society. On the other hand, when approached from the industry – university dimension, the emphasis is on the demand side; examining how industry is making its needs available to universities and taking advantage of their (universities) capacity to generate new knowledge to address the challenges of industry.

This paper examined the university – industry divide, and thus placed emphasis on universities - the supply side- and how they could be much more proactive at leveraging on the needs of industry to innovate solutions and makes themselves much more relevant and also financially self-sustaining.

To clearly articulate the university - industry divide in Ghana, there is need to define, explain and contextualize common words and concepts associated with the theme of the paper to properly situate the content of this paper.

The University of Mines and Technology, Tarkwa, which was established by an Act of Parliament, 2004 (Act 677) provides the mandate of the university as, a) to provide education through teaching and active research and b) to provide service through extension and consultancy activities to foster relationships with outside persons and bodies. This is a shared mandate of universities (public and private) in Ghana and beyond. The two aims are interconnected because teaching and research are mutually supporting activities. As knowledge is imparted through teaching, new knowledge is generated and this requires research to validate such knowledge. Research on its own generates and creates new knowledge to support teaching and learning. Extension and consultancy services with industry equally require research because the foundation of extension services is the use of research findings to influence society and industry. Again, even though consultancies are geared towards raising income for universities, they also require research which leads to generation of new knowledge.

The words and concepts discussed in this paper are: “collaboration”, “partnership”, “co-operation”, “industry” and “business”. These words matter in this paper because they are variously used in the relationship discourse of organisations and institutions, and in this case, in the relationship between universities and industry.

We draw on definitions from the Cambridge English Dictionary. “Collaboration” is defined as the situation of two or more people working together to create or achieve the same thing; alternatively, it is working together with other people or organisations to create or achieve something. The same dictionary defines “partnership” as an agreement between organisations, people etc to work together; in the business world it is also when a company is owned by two or more people based on an agreement. “Co-operation” is defined as the act of working together with someone or doing what they ask of you; it is also the process of working with another company, organisation or country in order to achieve something.

From the definitions, we view “collaboration” and “co-operation” as rather loose concepts because in order to bridge the university - industry divide in Ghana, stronger relationships, rather than loose ones are required. Therefore, the “agreement” in the “partnership” definition promotes a compelling and also a clearer purpose in the relationship when they are seen as partnerships rather than collaborations or co-operation. We are therefore in support of universities and industries setting up partnership relationships that are concrete and geared towards producing tangible results in the long term, rather than loose collaborations and co-operations.

The Cambridge English Dictionary again defines “industry” as the people and activities involved in one type of business; alternatively it is companies and activities involved in the production of goods for sale, especially a factory. A “business” on the other hand is a particular company that buys and sells goods and services. Industry and business can thus be used relatedly because an entity has to be involved in the provision of particular type of goods and services to be doing business. We therefore use “industry” and “business” as related terms and also for the purpose of describing the sector that universities ought to be engaged with to create new knowledge.

In organisational development settings partnerships are hinged on principles of equality (power-sharing), mutuality, participation and commitment. According to the Science Innovation Board of the European Commission (AISBL), there are three types of partnerships: strategic, operational and transactional. In the context of university-industry relations, strategic partnerships are long-term flexible relationships of between five to ten years. Such partnerships allow for sustainable changes to take place, including enabling industry to do what it would otherwise not be able to do without a relationship with a university. Operational partnerships are approximately 1-3 year relationships such as research projects and could actually be the building blocks for strategic partnerships. Transactional partnerships are less interactive and less engaging and are starting points to future relationships.

### 4. Literature Review

Stimulation of technology transfer between universities and industry is critical for overall development. This entails strategic partnerships that merge the discovery-driven culture of universities with the innovation-driven culture of industry. When universities and industry work in tandem, they push the frontiers of knowledge and are thus able to promote innovation and economic growth. The Silicon Valley in the USA and Cambridge Science Park of the UK, are examples of products of strong and longstanding partnerships between universities and industry. These partnerships have given rise to new technologies at breakneck pace and transformed industries while modernizing the role of the university. Alan Begg, Senior Vice President, Group Technology Development, SKF Group says that “it is individuals who understand both worlds – academia and business – that are the driving force behind successful partnerships”. One of the latest

discoveries resulting from university – industry relations is the melanoma treatment ipilimumab, whose molecule was discovered by James Allison and successfully developed into a drug by Medarex which made Dr Allison win the 2018 Nobel Prize in Physiology or Medicine. Solutions to many of the complex social, environmental and economic challenges in areas of energy, environment, health and security require university-industry partnership.

The different cultures of industry and universities ought to be unlocked in order to find the right fit. A multi-stakeholder group of experts in technology who met in Tianjin, China, at the World Economic Forum's Annual Meeting (2018) of the New Champions identified the following as common challenges and opportunities confronting both industry and universities. Industries' expectations which ought to be met by universities included market-aligned courses, developed skilled manpower, solutions for their (industry) concerns and strong partnership. Universities or academia on the other hand, had expectations of industry and these included funding and infrastructure, equal partnership, placement of students and feasible goals to match with industry. These mutual expectations require a two-dimensional flow of ideas between universities and industry to find lasting solutions to their respective needs.

Collaboration between universities and industries is therefore a mutually beneficial relationship. Whereas universities desire to create new knowledge, industry partners are challenged to research into problems confronting their businesses for which they are unable to find solutions to. The need for university - industry collaboration is no longer an option but the surest way for industries to survive by remaining in a competitive environment. It is also the way for universities to remain relevant by being responsive in their research and extension services to society. A model framework for effective collaboration between universities and industries as proposed by Ivascu et al (2015); a) the existence in the university of a well-defined structure that effectively supports research projects; b) the involvement of young researchers in identifying the characteristics of the economics of the environment; c) developing new partnerships and supporting existing projects to launch new opportunities; d) establish a dissemination strategy to share research findings and to use elements of marketing to attract new partners.

#### 4.1. Investing In Research and Development (R&D)

Globally, investments in R&D are increasing, and according to the UNESCO Centre for Statistics it has reached 1.7 trillion United States Dollars with only 10 countries accounting for (80%) of this figure. According to the Association of African Universities (AAU), Africa is home to about (15%) of the world's population, but accounts for just (2%) of world research output, (1.3%) of world research spending and holds a tiny (0.2%) of patents worldwide. This situation is partly due to over dependence on government subvention by African Universities which unfortunately, has been dwindling over the years.

Placing Science, Technology and Innovation (STI) at the center of a country's socio-economic development agenda, is critical to a sound economy. However Ghana, until a recent allocation of (1%) Gross Domestic Product (GDP) for Research and Development, spent only about 0.4% of GDP on R&D. Universities in Ghana appear not to have prioritised R&D, let alone develop conscious linkages with industry for research uptake. Government support to public universities and authorities of public universities have also focused heavily on developing physical infrastructure (buildings, equipment and facilities), human capacity (education and training of researchers, engineers and technicians), as well as in ongoing payment of salaries, benefits and travel expenses of research staff, to the detriment of promoting innovation and research.

A positive development in recent times, however, is the establishment of offices and centres for R&D collaborations and technology transfer centres in most Public Universities in Ghana. Examples include the University Of Ghana Office Of Research, Innovation and Development (ORID), the KNUST Office of Grants and Research (OGR), the University Of Cape Coast Directorate Of Research, Innovation and Consultancy (DRIC) and the UMaT Office of Research, Innovation and Consultancy (ORIC).

The GIRC-Centre is aimed at providing impetus to existing structures by translating ideas, technologies, innovations and proposed solutions to specific issues into marketable products and capital gain for the public.

## 5. Results and Discussion

According to the Ghana Statistical Service (GSS) Living Standards Survey (GLSS) Round 7, 6.8 million Ghanaians, representing (23.4%) of the population live on less than USD 1 a day and are thus the poorest segment of the population. This inequality and poverty gap in Ghana has been described as a technology gap. The implication is that the link between research and industry has been weak thus far, and hence failed to explore the use of Ghana's resources to create wealth for its people.

According to the Ghana National Accreditation Board (NAB) there are 10 Public Universities, 8 Public Technical Universities and 2 Public Polytechnics responsible for providing public Higher Education in Ghana. The main objective for the establishment of public universities in Ghana since 1948 has been to provide teaching, research and entrepreneurship training in Science and Technology for skilled manpower for the development of Ghana and Africa. After seventy one (71) years of institutionalising Higher Education in Ghana, this paper is offering a critical review of the relationship between public universities in Ghana and industry. This relationship is however urgent and critical now than ever before. Industry now needs universities to help them become much more efficient through cutting edge research and innovations, whilst universities on the other hand need financial support from industry to conduct its research and be financially sustainable in the wake of declining public funding of universities. Unfortunately the relationship between universities and industry has been weak in Ghana over the years due either to mistrust or lack of the will to explore mutual opportunities between the two entities.

The study shows that university-industry relationships must promote forward and backward linkages. The forward linkages entail that Universities, through their relationship with industry, identify the research needs and priorities of industry and respond to those needs through research and innovations. The backward linkage implies that industry feeds universities with data and technology that helps to both train students for industry and also promote cutting edge research for the benefit of industry.

Public Universities in Ghana have generally been dependent on the state for support for the running of their programmes. For any country to develop especially with rapid industrial growth there is the need for governments to pay attention to higher education. This is because it is the surest way to build a competent human resource base for accelerated development of the nation and also to improve on the welfare of citizens. This implies that higher education, therefore, requires that university graduates are given hands-on skills that would help them meet the demands of industry. This will help them become entrepreneurs to create jobs for the teaming unemployed youth in the country.

There is growing global competition in the development of factors that would bring about new models for economic growth. To achieve growth targets, a country must move from the exportation of its natural resources to intensifying innovation and developing technological products for export. Universities and industries are the two partners that can come together and connect to bring about entrepreneurship and development.

With the Government pushing hard for industrialisation of the economy with flagship programmes such as the One District, One Factory (1D1F) and Youth Entrepreneurship and Business Development, innovation is one of the surest means to increasing the foundation for economic development and entrepreneurship. It is therefore important for Public Universities to create, harness and leverage technology-based intellectual capital by linking up with industry.

## 6. University of Mines and Technology (UMaT)

UMaT is a specialised institution of higher learning which takes theory and practical training of its students very seriously. The University's programmes are designed to achieve a careful balance between theory and practical training both in the laboratories and on the field. This balance is to give students the essential hands-on skills and experiences to prepare them adequately for the world of work, to perform their jobs professionally and to solve societal problems. As a way of proving to be innovative, the University has instituted an Innovation and Career Fair where students are given the opportunity to pitch their ideas at the fair. The Fair is aimed at bringing together engineers, researchers, students, consultants, business executives, service providers and all those interested in innovation in Mining, Petroleum and related disciplines. During the fair, industry players express interest in the ideas that are showcased and follow ups are made for idea owners to collaborate with industry players on how to advance their ideas. The University's Innovation and Career Fair has spurred in students and staff the culture of innovative projects since its inception in 2015.

### 6.1. UMaT – Industry Relations

Platforms such as the Innovation and Career Fair ought to have increased strategic partnership between the University and industry by further developing the innovations from early stages to the level of industry uptake. The relationship between the University and external entities was assessed to ascertain the extent to which UMaT prioritised relationship with industry.

It was realised that the University had formalised many loosed relationships with industry and like-minded academic institutions. The formalised relationships included signed Memoranda of Understanding (MoU) spelling out mutual responsibilities of the parties involved, whilst the loose relationships were based on goodwill and longstanding relationship between the University and external entities (academic institutions and industry). The Office of International Programmes (OIP) established under the Vice Chancellor's Office had its core function as collaborating with Faculties and Departments of the University to establish staff and student academic exchange programmes with international institutions to promote teaching, research and cultural integration. It was not so obvious which office or unit of the University managed industry relationships but there were twelve academic and non-academic MoUs currently managed by the Office of International Programmes (OIP).

A review of the MoUs revealed that there were indeed twelve (12) active and ongoing relationships between UMaT and external entities. These comprised of six (6) academic exchange MoUs and another six (6) with industry. The academic exchange MoUs were entered into with the Memorial University of Newfoundland and Labrador, Canada (MUN), for five years, signed in September, 2018; University of Portsmouth Higher Education Corporation, for 2 years, signed in January, 2019; Herriot Watt University, Edinburg, Scotland; Montana Tech of the University of Montana, US, for five years signed since March 2010; University of Ibadan, Ibadan, Nigeria, signed since June 2011 and the Egypt-Japan University of Science and Technology, Egypt, signed in September 2018. As a technology and engineering university, the academic MoUs commonly established mutual relationships in the fields of strengthening scholarly academic links and co-operation and promoting scientific and technology development through research.

The university – industry related MoUs were entered into with six (6) industry-related institutions and these were with Genser Energy Ghana Limited, Accra, November 2018, signed for three (3) years, focused on Genser providing technical, training and teaching assistance to UMaT, whilst UMaT was to support Genser with its research related projects it intended to undertake.

The MoU with Metso Minerals Ghana, signed in October 2013 initially for 5 years and renewed for another 5 years was aimed at establishing academic and industrial co-operation linkage and collaboration for mutual benefit. It also intended to promote collaborative research through Metso's facilitation of linkages with international organisations and for Metso's assistance to organize the Biennial International Mining and Mineral Conference and Metso Mining Schools.

The MoU with Development Gold International (CIC), London, signed in October 2018 until 2023, is aimed at shortlisting using the Impact Facility Mine Selection and Basic Environment Social Governance (ESG) criteria to select 10 gold mines within the 5-year plan. This required conducting feasibility studies on potential mine sites for CIC and UMaT recommending graduates for employment at CIC.

The MoU with Japan Motors Trading Company was initially signed in January 2014 and renewed in September 2018 for another two years until 2020. The aim of the relationship as stipulated in the MoU was to encourage multidisciplinary industrial training and promotion of scholarship towards the training of human resource development of both parties. It also provided for practical training for UMaT students at Japan Motors, joint evaluation of graduate interns and student performance at Japan Motors Trading Company.

The MoU with the Ghana National Association of Small Scale Miners (GNASSM) was initially signed in September 2013 and renewed in 2017 for another 5 years. The aim of the relationship was to promote sustainable mining in Ghana. Whereas GNASSM expected UMaT to support it with research in innovative mining, processing technologies as well as environmental care and marketing, train its members in surveying, geology, mining, mineral processing, environmental management and reclamation, UMaT expected consultancy services from GNASSM as well as opportunities for student field visits and attachment and internships. GNASSM was also expected to provide financial support to establish a Mining Chair at UMaT.

The MoU with the Ghana Institute of Surveyors (GHIS) was initially signed in 2011 and renewed 2019 for five years. The aim of the MoU was to establish scholarly academic and professional linkages and cooperative relations between GHIS and UMaT. The relationship would mutually promote scientific and technological development of Ghana as well as the West African sub-region. There would be exchange of UMaT staff and resource persons of GHIS to enhance scientific scholarly professional and cooperation in teaching and research.

## 7. Challenges of University – Industry Relations

The twelve (12) UMaT MoUs reviewed of its relationship with academic and non-academic institutions revealed that none focused on advancing the University's innovations; none equally focused on research with the sole purpose of investigating an industrial challenge. The University did not have any potential of significantly benefiting from any of the relationships. The MoUs represented loose relationships and therefore had not binding outputs for both parties. This further reduced the University's chances of obtaining the desired benefits from the relationships.

Academics and industry players in Ghana admit that over the years, universities have not consciously approached industry to identify their needs and tailor their researchers to respond to same. Industry on the other hand has also not identified the capacity of universities in Ghana to offer solutions to their innovative dreams. This is an underlying reason for the university-industry divide in Ghana.

Strong university – industry relations entail leadership on both sides that define their interest clearly and the two must coincide in order to provide the drive needed to promote strong partnerships.

According to a May 2010 study of European university – industry relationships, it was found that most European academics were not engaged in collaborations with industry; only few did to a high degree. This implies that the challenges of university - industry relations are not peculiar to Ghana. However, universities in Ghana are increasingly challenged by reducing public finances, including freezes on Academic and Residential Facility User Fees, and therefore would require creative ways to remain relevant and self-sustaining. Strong partnerships with industry provide universities opportunities that would not only enhance their core mandate, but also rake-in some resources to support university programmes and activities.

## 8. Recommendations

This paper is establishing that what would make seamless and mutually beneficial relationships between universities and industry are long-term strategic partnerships that transcend decades; shared research vision between universities and industry; establishing deep professional ties, trust and shared benefits that help to bridge the gap between industry and academia.

### 8.1. Strategic Partnership between Universities and Industries

Building strategic partnership between universities and industry is a precondition for bridging the university – industry divide in Ghana. Without long lasting partnership, the different cultural contexts of the two cannot be broken to ensure joint reflections towards common solutions. Strategic partnerships are long-term flexible relationships of between five to ten years. Such partnerships would allow for sustainable changes to take place, including enabling industry to do what it would otherwise not be able to do without a relationship with a university.

### 8.2. Partnering Industry to Set Up Research and Innovation Centres

The good practices of industrial parks such as the Silicon Valley in the USA and Cambridge Science Park of the UK could be used to guide university – industry partnership in Ghana. This would help facilitate the setting up of research and innovation centres across the country, particularly within universities. These centres would be used to promote innovation and business competitiveness in the country. It is a fact that a lot of research findings are currently gathering dust on the shelves of universities in Ghana, but these could be taken up, developed and nurtured at research incubation centres for successful industry uptake.

### 8.3. Legal and Policy Framework for GIRC-Centre

The idea of a GIRC-Centre to promote university – industry partnership for enhanced research in Ghana, is a great idea but would require a legal and policy framework to make the initiative much more sustainable and stand the test of time, albeit under the supervision of the Ministry of Environment, Science, Technology and Innovation (MESTI). This is against the backdrop of changes in name of MESTI associated with different governments, implying that a change in name of the Ministry could result in a change in mandate or focus of that Ministry. Such changes could affect the annual allocation of the proposed 1% GDP by government to the centre.

### 8.3. Governance of the GIRC-Centre

In order that governance of the GIRC-Centre is proactive and effective, the centre's management could be outsourced to the private sector (including civil society) to the extent of making the centre financially self-sustaining in addition to the proposed funding arrangements in the current design. This would make it possible to attract private sector funding support based on responsive university research to address industry needs.

### 8.4. Aligning the GIRC-Centre with National Development Framework

The GIRC-Centre could operate in alignment with Ghana's national development framework to ensure that all researches are geared towards identified national development challenges. It would help link Strategic Technology Centres (STCs) with flagship initiatives such as the One District, One Factory (1D1F). This will not only enhance relevance of the STCs as providers of demand-driven services, but also challenge them to be functional institutions.

## 9. Conclusions

University – industry partnerships will positively impact the quality of teaching and learning in universities; it would develop new funding streams to make universities self-financing; it will enable universities rethink and refine the role of research in universities and reposition them as research universities rather than teaching universities. The benefits of strategic partnership between universities and industry include substantial streams of external funding. It also portends enhanced opportunities for university staff and students in respect of providing groundbreaking research, vital inputs to keep teaching and learning on the cutting edge and the impact of research that delivers solutions to pressing social needs.

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