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Interrogating the Interconnection between Sustainable Development and Knowledge-based Economy

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Abstract
The two expressions, sustainable development and knowledge- based economy are concepts that have all along been used and treated as if they are mutually exclusive. However, the truth is that the two concepts are intractable one from the other. Rather, they are, as a matter of fact, a sine qua non for each other. This is simply so because it takes intellectual capital or ''knowledge'' for any form of development, whether social or technological, not only to reproduce itself but also in or it to grow and expand into the future without any compromises to its form, quality or status. This paper sets out to interrogate this relationship between the two concepts, demonstrating how it is only when they feed into each other that real and meaningful development takes place. The interest in the paper arises out of the understanding that the sustainable development that is a product of the interplay between it and the knowledge economy is the answer to the contemporary problem of acute unemployment because, when correctly contextualized, the knowledge economy equips the individual not only to look for a job but also to apply their knowledge to earn a living through forging a niche in the economy through self-employment. At this point when there is widespread unemployment virtually the world over, but more especially in the developing countries

and Botswana is no exception, a topic that promises to significantly increase the opportunities for self-employment must attract the attention of all and sundry. And finally, BA ISAGO University has established a Research and Innovation Unit. The innovation section is the strongest indication that the University has taken a pioneering and bold stand to commercialize research outputs. It is in that space that the knowledge economy will find its utmost application.

Keywords: knowledge economy; sectoral linkages; ICT; sustainable development; self-employment; fourth industrial revolution technologies.

Word Count: 293

Knowledge Based Economy Versus Sustainable Development

The phrase ''knowledge - based economy'' has been trending and has become a significant part of our daily vocabulary since a decade or so ago. This is because the knowledge economy is viewed as a panacea for the economic meltdown that has engulfed the world. Seemingly, all of a sudden everybody wants to be a part of the knowledge economy, or to associate with it. For example, through several speeches, the President of Botswana has recently been pushing the economy of the country to be 'knowledge-based. Yet, there has never been any serious reflection, let alone interrogation, of what a knowledge economy is about, what its attributes are and how it is recognised let alone how it is characterised and measured. What this means is that we could be having in mind very different things when we talk about knowledge-based economy. Against that (mis)understanding, this paper de-bunks the concept of knowledge economy, mainly through nestling it on the sustainable development concept, given that whatever economy we end up with would ultimately need to be sustainable if it was to sustain people's lives without it getting compromised.

Historically, the concept of a knowledge-based economy can be traced back to the 1990s when Europe was still battling to catch up with the technological advancement of the United States (Ellena Sira et al: 2020). The knowledge based economy, because it is premised upon formal education, affects the competitiveness of the national

economy, something that subsequently links to its sustainability. On the other hand, sustainable development is a composite concept or phenomenon that brings together a number of variables, the three key ones being the environment, the economy and the social aspect. Eventually, a sustainable knowledge based economy results in improved living standards for its target population. But a critical catalyst for effectively bringing the two together is innovation, which ensures that the resulting development is accounted for more by intellectual capital or knowledge than by natural or physical resources as is the case with the economies of the developing countries which are mainly still operating within the first or second industrial revolution technologies.

Applying innovation involves using technologies, whether simple or sophisticated, new or old. These technologies can be developed or transferred from one economic sector (or even country) to another. This means that innovation is a form of technology transfer. However, fourth industrial revolution technologies have come to dominate the technology discourse around the knowledge economy in contemporary times. The expression "fourth industrial revolution" was coined by Klaus Schwab at the World Economic Forum in 2016 (Elena Sira, *op cit*). The fourth industrial revolution technologies have a number of sophisticated aspects but the dominant one is the internet of things (IoT), which is in fact more concerned with bringing together different aspects of knowledge or technologies in a single interconnected and systematic unit such as, for example, a robot that is capable of playing the function of a human being.

According to a dictionary exegesis, the internet of things describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet (Oxford English Dictionary). The dictionary goes on to observe that the goal of the internet of things is to have devices that self-report in real-time, improving efficiency and bringing important information to the surface more quickly than a single system.

In other words, the internet of things enables mankind to create systems and processes of knowledge where the outcome is

much greater than the outcomes of the first three industrial revolution technologies. The term was coined in 1999 to promote radio frequency identification technology which was itself central to tracking and locating targets through the use of radio waves which use sensors.

A brief history of the emergence and application of the various technologies sheds light on this regard. The first industrial revolution depended upon mechanisation, while the second was based on electricity. The third was based more upon computing and automation, that is where things happen automatically or on their own through some remote-controlled device which ensures that the operation is programmed to operate without human intervention except through the control device.

By contrast, the fourth industrial revolution technology was much more sophisticated than the three before it, bringing together various technologies in a single entity and thereby creating a system or even systems which are linked or connected to work together over the internet, hence the term 'internet of things'. In the internet of things arrangement, one technology collects information. The next technology sends that information out. The following one receives that information and then prompts yet another technology to act on the received information. Robotics is the commonest example where such combinations of linked technologies are applied. Wearable health monitoring and hydroponics, which uses autonomous farming equipment, are the other two. We briefly describe the functions of each of the two internet of things systems in the next two paragraphs.

Hydroponics is a soil - less plant growing system where through indoor farming, a large volume of tomatoes, or any other crop, can be grown in a greenhouse or temperature - controlled environment. In this system of modern agriculture, one sensor will release a certain amount of water once a given level of dryness in the atmosphere is sensed. A different sensor will pick any deficiency of a certain mineral in the artificial soil and then release a certain amount of that mineral into the artificial soil. Yet a different sensor will control the temperature of the atmosphere inside the greenhouse where the tomato plant is growing, to make sure that the plant does not wilt from heat or from insufficient moisture. Farmers can more precisely time the harvesting system using this internet of things technology

than they could with traditional rain fed arable farming, and they can plan the amount of food they want.

Wearable biosensors, a product or combination of the disciplines of medicine and medical engineering, have recently become commonplace in collecting health data and initiating the basic treatment of an ailment in the body to a certain health condition for people who wear such biosensors. The data that is collected through the wearable biosensor makes the diagnosis of the health problem easier and even more accurate as it is collected continuously, something that minimizes the error. Again, this is a case where several activities are initiated one after another through the interconnection of sensors that trigger the actions.

These two examples of the internet of things have several outcomes that are of immense benefit to human life. First, humans become more efficient in that they are eventually able to take control of environments that are otherwise out of the range of any single or even normal technology or the internet. In other words, there is intellectual capital development. Second, both unquestionably raise quality of life because both food and health are essential for human survival. Third, both of the two can have substantial industries that are simple for individuals working in them to govern.

Research and Development: Purchasing Information from Research Providers

Research and innovation are critical for further improvements of the systems of the internet of things discussed above. As clearly stated, such systems lead directly to economic growth. What this means is that on a national scale, further economic expansion will result from the application of knowledge. Given this realisation, the developed world and at least one emerging economy that is at the level of the upper middle income have since been expanding their investment in research by making direct financial payments to purchase research and innovation outputs from the providers.

Two countries can be cited in this regard, the United Kingdom and South Africa. In 1986, the United Kingdom started what they termed the Research Assessment Exercise, which was an exercise carried out every five years to assess the quality of research in the British higher education institutions. Research funding would then be

allocated to the institutions based upon a formula that ranked the quality of the research in the institutions. The exercise was replaced in 2014 by the Research Excellence Framework, which emphasised the impact of research.

As an emerging high - middle income economy, South Africa also seeks to draw a direct link between knowledge and the growth of its economy. Its model of encouraging knowledge and innovation outputs entails paying the researchers for their research outputs as well as paying for their efforts to produce knowledge manpower. Supervisors are paid for every master's and doctoral students that they graduate.

The developing countries generally are not in a position to directly link knowledge or research with the growth or expansion of their economies. For that reason, they are not in a position to invest in the direct payment of their knowledge providers.

Challenges of Applying Knowledge Based Economy in the Developing Countries

Several reasons account for the failure of many African countries to make economic breakthroughs, when, to the contrary, the BRICS nations (Brazil, Russia, India, China and South Africa) are making huge strides in economic development. South Korea, although not among the BRICS countries, has attained an even higher level of economic development, from a level that was comparable with that of a number many African countries. Each one of the BRICS countries may have followed a path different from others but a common thread that runs through all of them is the success they have attained in the sphere of innovation. By all accounts, innovation is what has catapulted them into the status of the higher middle - income countries (Sing, 2016).

Yet, several obstacles hamper innovation in much of Africa. The low uptake of technologies in this continent is a major piece of evidence that innovation levels are low. There are a few others as well. The technology institutions are few and in the majority of cases they are not aligned to complement each other. There are no forward and backward linkages between these technology institutions, just as there are no inter-sectoral linkages within the broader economy.

A direct consequence of the economic sectors that function in silos is lack of economic diversification, which leads to an innovation chasm. An innovation chasm simply means that the outputs of knowledge, including those that are research based, are not able to reach the market. Hence, although ICT skills are fast growing across the world, including in Botswana and much of the rest of Africa, ICT graduates are not as successful in exploiting their ICT knowledge as their counterparts who operate in the diversified economies of the developed world.

As was mentioned previously, the internet of things and other technologies from the fourth industrial revolution depend heavily on reliable power sources for the internet. The fact that electricity-dependent activities are still disrupted by power outages shows that some regions of Africa may need to stabilise their power supply before attempting to successfully utilise fourth industrial revolution technologies.

Conclusion

The aim of this paper was to give a theoretical point to the definition of a knowledge-based economy which ultimately will lead to sustainable development for any economy. From literature, economic expansion results from the application of knowledge: what is evident is that research and innovation are critical for improvements of all systems of internet of things as this may lead to economic growth. Nations need to invest in the growth or production of knowledge for economic growth. Direct payment of their knowledge providers is one option nations could make to encourage innovation. In such a scenario research funding would be allocated to the institutions based upon a formula that ranked the quality of the research in a particular institution vis-a-vis that of other institutions.

Achievement of sustainable development through a knowledge economy has certain basic requisites. These include a well-developed ICT system, sufficient and dependable electricity supply, the presence of complementary technology institutions and a diversified national economy with strong intersectoral linkages. A technology system in which all these requisites are in place very much facilitates innovation whereby the products and outputs of knowledge easily reach the

market, to ensure commercialisation which in turn leads to economic growth and national development.

Yet, national development has to be sustainable in order for it to improve the quality of life. And intellectual capital or knowledge, rather than natural resources, needs to be the driver of the economy through the provision of the technologies that embrace the internet of things.

BA ISAGO University is positioning itself for producing manpower that is prepared to operate within this technological and socio-economic context.

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