
Munich Personal RePEc Archive

Economics of Technology Innovation for Sustainable Growth – With reference to Sub-Saharan Africa (SSA)

Jackson, Emerson Abraham

University of Birmingham, U.K

3 March 2020

Online at https://mpra.ub.uni-muenchen.de/101787/
MPRA Paper No. 101787, posted 15 Jul 2020 09:33 UTC

ECONOMICS OF TECHNOLOGY INNOVATION FOR SUSTAINABLE GROWTH –WITH EFRENCE TO SUB-SAHARAN AFRICA (SSA)

INDUSTRY, INNOVATION & INFRASTRUCTURE - ENCYCLOPEDIA OF THE UN SUSTAINABLE DEVELOPMENT GOALS

Emerson Abraham Jackson

Affiliation: 1. Doctoral Scholar in Sustainable Livelihood Diversification, Centre of West African Studies, University of Birmingham. 2. Senior Research Economist, Model Building Analysis Section, Research Department, Bank of Sierra Leone.

Email: EAJ392@bham.ac.uk / emersonjackson69@gmail.com / ejackson@bsl.gov.sl

Disclaimer: *Views expressed in this chapter are those of the author and do not reflect any of the named institutions for which he is associated.*

SYNONYMNS

- Ingenious
- Ground breaking
- Imaginative

DEFINITION

The term innovation economy, also synonymous with economics of technology innovation is modelled on the background of economic theory, and places technology, innovation, entrepreneurship and knowledge at the centre of the model of economic growth (Luenendonk, 2016).

Based on the above definition, the foundation of economics of technology innovation is rooted on the principles of economic theory – in this regard, there is a need to spur up innovation in a bid to increase productivity, while at the same time fostering public-private partnership (PPP) as opposed to the over-reliance on price signals in ensuring higher returns on productivity is realised from human efforts. In this regard, innovation should be made as the forefront of wealth creation, which also attest to the need for society to embrace creation of new ideas through the utilisation of transformative technologies in a bid to addressing human insatiable needs (Jackson, In Press).

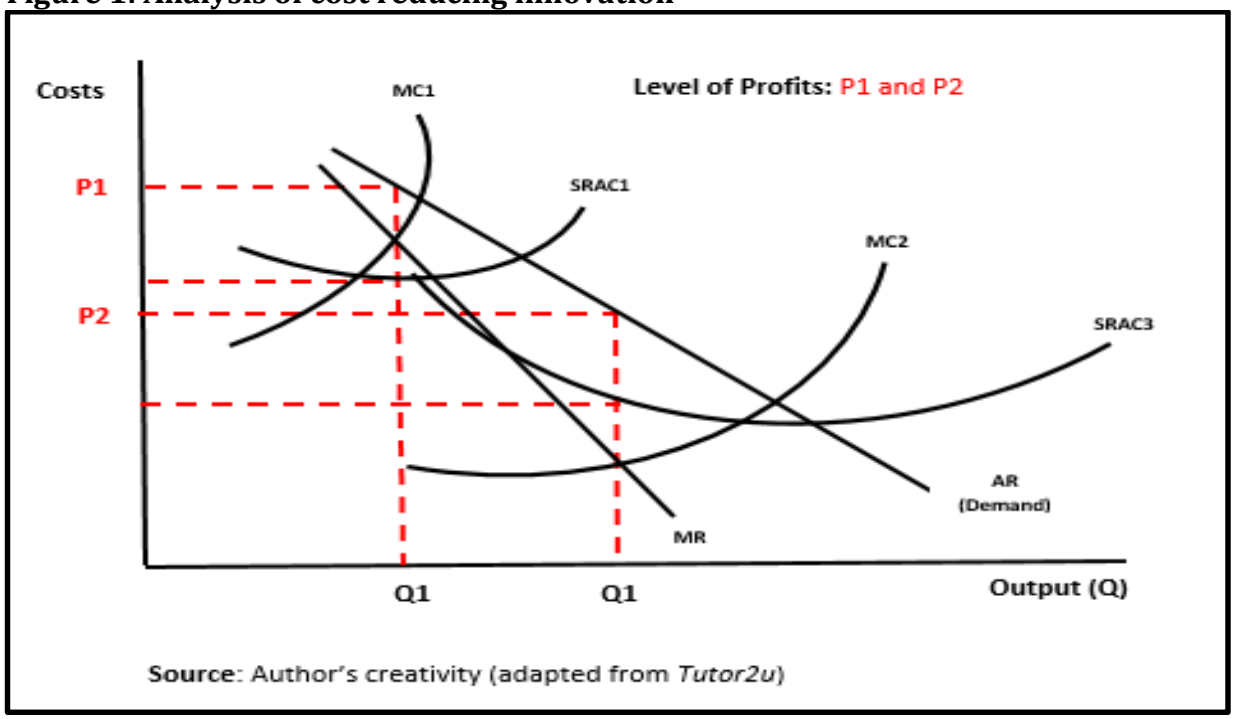
INTRODUCTION – THEORETICAL APPROACH ASSOCIATED WITH TECHNOLOGY INNOVATION

In view of the definition provided above, there is a need to shed light on innovation economics and the neoclassical school of thought; the basic tenet of the former (innovation economic) is modelled on the utilisation of human creativity and entrepreneurial ability to develop new products, business models or some form of productive ventures that impact positively on quality of life and also increase wealth capacity. In view of the latter (Neoclassical economics), it is highly focused on the predictability of price signals in a bid to allocate scarce resources efficiently (Luenendonk, 2016).

Innovation economics is geared towards harnessing the good in human ingenuity to bring about dynamic efficiency that result in changed habit formation of consumer choices in the market, together with high quality / performance of goods and services consumed by economic agents. In as much as the worries or concern that innovation bring, given its characteristics of creatively destroying existing ideas or product existence in the market, it can still be seen as the way forward in accumulating wealth creation, while increasing welfare opportunities for those who are ready to embrace change in a fiercely competitive environment. Figure 1 below provide a simple illustration of how cost-reducing innovation and technological change can be utilised to bring about positive gains in producer and

consumer surplus (Riley, Online) which eventually result in lower prices, and the scope for an increase in real income of households or individuals.

Figure 1: Analysis of cost reducing innovation



The diagram (Figure 1) shows cost and revenue curves to explain the effect of driving down production costs from Short Run Average Cost (SRAC1) to SRAC2. The outcome of such situation is a reduction in prices of goods and services, which impact positively on consumers real earning power. Ideally, Figure 1 indicate that with improve rate of production, supposedly masterminded by new invention can result in the lowering of cost, with the ultimate outcome of improving quality. This then makes it possible for Price at P1 to move down to P2, thereby resulting in higher output from Q1 to Q2. As explored by Recica et al (2019) in their empirical study on innovation and the export performance of firms in transition economies, there is high opportunity for new product innovation to bring about significant impact on export performance, given the novelty of consumers taste towards new products in the market.

Various theoretically constructed growth models in economics have been linked to explaining the influence of technology and innovation in production processes – typical of this is the Solow Growth Model, which kicked off in the 20th century (Solow, 1956). The Solow model was used as a way of explaining the basics of physical input of production processes, namely labour and capital, and supported by some general technological input variable, without illustrating its source as critiqued by Sachs and McArthur (2002) and Broughel and Thierer (2019: 8). There is an assumption in the Solow model that, with the diminishing rate

of return to capital stock, countries with lower stock of capital will grow faster than those with higher stock of capital – a concept akin to Growth Accounting as commenced by Solow in 1956, already cited above. The use of technological change as utilised in the Solow model is also associated with the concept of Total Factor Productivity (TFP – practically linked with recent developments in Dynamic Stochastic General Equilibrium model [DSGE], see Jackson, 2018a). Such usage of the term TFP, which measure technological change is somewhat different from technological innovation – its usage in growth accounting is thought of as a residual component, which cannot be accounted for on the basis of differences in input measured (Broughel and Thierer, 2019: 9). As time progresses, such usage of the word TFP have transcended to incorporate measures like social infrastructure and government policies - through the effort of Paul Romer (1990), its usage has spanned into inputs like population size and Research and Development (R&D), which is modelled along the line of innovation. It is thought by economists that technological input is the essential element for long-term growth, of which innovation as a form of spillovers is needed to boost productivity. The notion of TFP, more so with innovations' impact is highly a laudable approach by economists (Verspagen, 2006; Schumpeter, 2008) and must be promoted by society despite its short-term ramification of creating destruct to enterprises / firms' operations.

In view of the contribution of Innovation to technological growth and development in the global economy, its outcome is mostly seen to be measured in terms of Gross Domestic Product (GDP), which is based on welfare assessment (Broughel and Thierer, 2019: 15-16). While it is good to utilise such measurement to address societal rate of growth, it also comes with a flaw, whereas on most occasion, activities are not fully captured into the accounting process, particularly in the case of household production, leisure activities and many more. The limit of GDP to capture productive activities other than so-called activities undertaken by firms or other forms of business ventures have made it possible for critiques to be raised about the effectiveness of methodology used to determine economic growth, particularly in this situation with the concept of innovation and technological progress.

RELEVANCE OF TECHNOLOGY INNOVATION AND ITS LINKAGES WITH THE SUSTAINABLE DEVELOPMENT GOALS (SDGs)

Innovation economists (Jackson, In Press; Jackson, 2020; Johnson, 2008; Antonelli, 2003) have made their points clear about the need for emphasis to be devoted in promoting knowledge-based economy in a bid to promoting sustainable growth in the world economy as opposed to the neoclassical assertion of capital accumulation. Technology innovation is the way forward for development in the world economy and more so the way businesses are done. There is an ever growing call for economies to invest on human capacity in a bid to ensure economies across the world are able to meet all 16 SDGs by the year 2030. Research evidence have shown that economies in the world, and more so in the SSA needs double-digit growth rate of about 16.6% per year between the time period of 2015-2030 to address

finance gap so as to create the way for ending poverty as outlined in SDG agendas 1, 2 and 3 – this is estimated to be an investment-to-GDP ratio / financing gap to GDP ratio of 87.5-65.6% per annum (Kedir et al, 2017).

As emphasised by Broughel and Thierer (2019: 3), innovation through the mind creation of technology intervention is considered the fundamental driver of modern society's growth pathway. Despite critics' concerns about the destructive nature of technology on existing inventions, there is a need for the continued intervention of human crafted inquisitiveness in making it worthwhile for new creation to supersede old or existing thoughts – such approach have set the pace for sustained growth, and with an increased prospects for human opportunities in relation to decent work opportunities (linked with SDG8). While critics' views have been vigorously pursued in the demonic direction of demystifying technology's relevance on society through semantic attribute(s) connected with "*the cult of convenience*" (Morozov, 2015) and the supposed "*paradox of choice*" (Schwartz, 2004), it is but necessary for human innovative minds as supported by Broughel and Thierer, ibid) to continue in the direction of making it possible for economic agents to be spoilt with choice – this will eventually make it necessary to limit the inherent failure of market structures that seem to be highly prevalent in underdeveloped regions around Sub-Saharan Africa (SSA) and in some areas around Asia and Latin America (Jackson and Jabbie, 2019).

The drive towards ensuring innovation is set as the centerpiece for technological advancement in the world is very welcoming, particularly in ensuring the human ingenuity is utilised, much more in situations where entrepreneurs are making it possible to collaborate with communities to harness opportunities (Awan and Sroufe, 2019). Even though there is fear about the possibility of opportunities being lost in the process of introducing innovative technologies, on the whole, there is a high scope for people to be actively engaged in utilising skillset that will pave the way for new-found opportunities. Such situation has the capability of reducing inequality (linked with SDG10), particularly in situations where state actors (government) are prepared to work collaboratively with the private sector in sourcing out opportunities that will enable people to make use of their full potential.

Technological innovation is very relevant for economic development throughout the world – such approach can be utilised to ensure its impact is felt across all sectors, where inclusivity (and with the right level of policies to make sure gender inclusivity) is made an integral part of societal focus towards the achievement of the UN SDG target for 2030. As already stressed by Jackson and Jackson (forthcoming), there is a need to make sure Science, Technology, Engineering and Mathematics (STEM) education is made an integral part of core curriculum (in schools, colleges and universities) in a bid to create access for all in society, irrespective of gender or social background (TechWomen, 19th March, 2019; Jamme, 2015). Definitive policy measures about gender inclusivity will help bring the ingenuity from all gender groups to make sure skills are utilised, with incentives to explore creativity that support development in technologies to adequately sustain lives in busy cities (SDG11) and also, the

combatting of climate actions (SDG13) and all necessary things to do with life below water and on land (SDG14 and 15).

SUB-SAHARAN AFRICA (SSA) IN RELATION TO TECHNOLOGY INNOVATION

In comparison to the rest of the world, SSA is far behind in its pace with technological innovation and development (Vallejo et al, 2019; Gross, 2019). There are myriad of reasons that could be attributed to this and to name a few, high influence of political patronization, corruption and the lack of proper legislative system to ensure market system and governance of institutions are properly functional without interference (Jackson and Jabbie, 2019; Jackson, 2018; Jackson, 2016).

Governments across the SSA region must endeavour to pull resources and make research and development a priority for national agenda if they are to keep pace with the rest of the world (Jackson, 2016a; Jackson, 2017; Ogujiuba et al, 2011). With the astronomical cost of production factors in the developed economies, it is now time for economies in the SSA region to take advantage of their resource wealth capacity to induce scope for technology transfer that will ultimately impact on the developmental landscape of in region. As already mention, the situation in the SSA region is dire in terms of the need to foster innovation, and as expressed by Yao (2020), there is evidence to attest that global economic growth is on the downturn - with high uncertainty, there is a need to ensure innovation is set at the centre of developmental agenda so as to capacitate the necessary engines that will make the region more attractive to technology transfer. Such transfer of technology is based on the fact that cost of production in the developed economies is astronomically high compared to that in the SSA region.

Vallejo et al (2019: 1) explored the scope for innovation and intermediaries in the SSA, with the focus on ensuring wealth capacity is effectively harnessed – in this, they noted in particular, the intermediary role played by Science Granting Councils (SCGs) and Science Technology and Innovation (STI), which require systemic and institutional change in order to allow things to go forwards. Given the need to facilitate innovation as a way of supporting development agendas, the findings from their research called for collaboration, particularly through Public-Private Partnership (PPP) innovation in ensuring the region harness opportunities for advancing technology development. Given the pressing and rapidly-changing landscape in the market, environmental and socio-economic conditions, Vallejo et al (ibid) echoed the need for the establishment of development of scientific oriented centres to help harness opportunities availed through PPP schemes in a bid to building knowledge advancement in the region. It is thought that, the way forward in terms of building on the sustainability agenda as enshrined in the SDGs is for policy approach to move away from the linear mode to more explorative means of developing a systematic understanding, while also finding answers that addresses the challenges faced by local communities in support of development agendas.

In moving forward with the plans of achieving self-sustenance, the focus on the economics of technology innovation in the continent must firstly address a holistic approach of utilising human capacity in diversifying the agricultural sector. On that note, Pamuk and Van Rijn (2019) empirically investigated diversity and the impact of innovation platforms (IPs) on agricultural networks and technology adoption among 1200 households in nine SSA countries – this is based on the Integrated Agricultural Research for Development Approach (IAR4D). In this, the study proved that IPs utilised according to the IAR4D readiness principles are more efficient at promoting networks of households with different farmers within villages. The study conclude that IPs with more active members were more efficient at promoting agricultural technologies than those with variety of stakeholders. Similar study in the nature of agricultural technology innovation was explored by Ogundari and Bolarinwa (2019) and the outcome from a meta-regression analysis on 92 studies (published between 2001 and 2015 in the SSA region) manifested ambiguity in its impact on farm productivity and households' welfare. Even though there is evidence to attest some level of impact in terms of technology adoption in agriculture, the magnitude of such impact seem relatively small and hence, suggest a rather weak relationship.

Saka-Helmhout et al (2020) explored further in terms of addressing the relevance of technology innovation as a way of helping economies in the SSA region to address the UN SGDs by the year 2030 – in their study, they unearthed the shortcomings of resource bottlenecks and institutional weaknesses by exploring the relationship among firms' resources and both formal and informal pathway into being innovative in their approach. The qualitative methodology utilised noted that informal institutions complement formal institutions in the presence or absence of high level of firm resources in a bid to support firm innovation. In this regard, the study is a very good pursued venture to addressing myriad of approaches firms can utilise to become innovative in a context that best fit their existing institutional situations.

The way ahead in the future for the global economy is through technology innovation, which critics are very worried in terms of their destruct to business continuity and the prospects for excessive profits by well-established institutions (Peck, 2005). In more recent time, the continent of Africa has made some strides in addressing a stronger call for economic progress – this for instance include effort of the African Union's (AU) launch of the African Continental Free Trade Area (AfCFTA) in a bid to create a single market, capable of generating a combined GDP of more than $34 trillion, while also benefiting over 1billion people (Liu, 2019). On a parallel move, the South African government also announced a launch of its new Affiliate Centre of the World Economic Forum's for the Fourth Industrial Revolution (C4IR) – it is hoped that the creation of such centre will pave the way for dialogue and cooperation relating to challenges and opportunities that advanced technologies brings - seemingly thought to be impacting on the physical, digital and biological occurrences on the earth's planet (Liu, 2019).

Equally, innovation requires sustained intervention in nurturing human creative minds, which can be achieved through opportunities created in engaging with formal and informal

education (Jackson, Jackson and Jackson, 2020). Support earmarked by the World Economic Forum, with the launch of its African Growth Platform (AGP) is a move in the direction of creating opportunity for startup enterprises, which therefore will make it possible for them to compete globally – notably, a projection of 13% entrepreneurial activities higher than the global average.

Amidst such advances, there is the chance that move towards advanced technologies will disrupt industrial growth prospects in the African continent as a whole – highlight of such technologies include and not only limited to the itemised list (Liu, 2019): *Internet of Thing (IoT) and Ubiquitous Linked Sensors, Satellite Enablement, Distributed ledger technology, Biotechnology, Advanced Robotics, 3D Printing and additive manufacturing, Human Enhancement Technologies, Artificial Intelligence (AI) computing and Advanced Materials and nano-materials*. In addition to the aforementioned emergence of innovative technologies, there are also structural issues to Africa's sustained pace of growth and these include poor agricultural sector productivity, high youth unemployment and the projected 2.4 billion population explosion by the year 2050 (UN, 2019). Despite these challenges, a well-planned approach to the opportunities created from 4IR is likely to bring semblance of hope to the continent and currently, the installation of more than 400 tech hubs in cities like Lagos, Nairobi and Cape Town have made their mark as internationally recognised technology centres, hosting series of startups, space-makers, innovation hubs, maker spaces, technology parks and co-working spaces that earmarked to support advances in innovation technology (Liu, 2019).

Notable amongst many of the successes witnessed in technology innovation in the SSA region is the emergence of mobile lending app, which so far seem to have raised up to $170million in a round of funding achieved by an African focus startup – Branch International as the fundraiser will make it possible for the utilization of VISA access on mobile phones and at ATMs (using virtual credentials without the use of bank accounts) in the African market (Kazeem, 2019). An interplay in the innovation ecosystem involving capacities like proper regulatory policy measures, access to financial support, infrastructure, education attainment and human creativity will make it possible for the SSA in particular to keep pace with the rest of its counterpart in the Northern region of the African continent. This will also make it possible for many of the SDGs to be realised, with the ultimate goal of ensuring sustained growth and development is achieved as the road to embracing innovative technology in the SSA region and the continent as a whole.

There is high scope that through investment in human potential incorporating transformative technologies (Saffa and Jabbie, 2020), which also embraces gender equality to facilitate women's contribution to economic growth (Jackson and Jackson, forthcoming), the human ingenuity will be explored so as to create the enabling opportunity for their sustained access to decent living conditions. Despite the risks that innovation is purportedly seem to bring, it is also seen as a new form of ventured opportunity, with the continued effort of entrepreneurs / firms to explore new forms of innovative technological project. There is always scope for new-found opportunities for people to seek decent living and also placing

themselves in higher income bands. Innovation as seen more lately is being pursued in all walks of life, for example as witnessed in the field of finance / baking, product development and the enabling technologies to support the automated transactions. As championed by innovation economists (Allen et al, 2020), there is a need for (block-chain) technology innovation to be made the centre piece of institutional focus, with research evidence indicating high level of progress in ~~the~~ areas connected with Internet of Thing (IoT) and Artificial Intelligence (AI) – this is also making it safe and cost effective for the world's growing population to address decent living conditions in highly populated (Smart) cities around the world (OECD, 2018 and 2019).

In view of the importance of innovation to support technological development in economies across the world, there is a need for businesses and also governments across the SSA region to focus investment in Research and Development (R&D) in areas that will capacitate the pace for economies to harness the opportunity to become economically competitive (Ahlstrom, 2010; Asongu and Nwachukwu, 2017). On this note and specific to SSA economies, it is very important that the old fashion means to rent seeking is buried, with emphasis carved in ensuring value for public service investment is made a critical part for institutional growth in the region. In this vein, governments should endeavour to support creativity through investment in institutions, for example schools, colleges and universities, but with the ultimate goal of ensuring conditions are placed for accountability to be made the centerpiece of demonstrating reward for the initiation of creative development efforts. Given the weak infrastructural base of many of the economies found in SSA, Latin America and some parts of the Asian continent, it is very important that an approach to ISI is made an integral part of governments' agenda in view of supporting nation building (Jackson, forthcoming1). The purpose of this is to make sure talents are explored through investments in education and also, with the need to promote both vocational and academic forms of education that engages with human ingenious potential. Hence, there is a need to ensure sustainability is made the critical focus, where engagement with Public-Private Partnership (PPP) innovation scheme is made an essential element of infusing efficiency to deter unproductive rent-seeking opportunities availed from public purses – this will help shape future direction of equitable pace of economic growth in the world economy (Lember et al, 2019).

The economics of innovation technology will continue to take centre stage in world development, particularly in the SSA where its emergence needs to be researched keenly as a way of understanding both its positive and negative impact on lives and the development of operations pertaining to financial market activities. Several of such type of studies seem to be an ongoing venture in the continent - to cite as an example, Mlambo and Msosa (2020) recently pursued the effect of financial technology on money demand, with the case of selected African economies. Their study was done on some covert understanding of demand for digital payments being carried out in many markets in the SSA region, through the use of mobile-communication technologies. The study, which was done using panel data analysis and a GMM panel technique showed that variables that captured financial technology seem

to have negative effect with money demand (MD), and this is inclusive of Mobile Subscription and Automated Teller Machines (ATMs). On the basis of such outcome, it was recommended that central banks continue to monitor and predict the overall consequences of financial innovations. This is with regard to the stability of re-examining the appropriateness of monetary policy measures to assess both positive and negative impact of financial technologies on money demand.

GOVERNMENT INTERVENTION / POLICY IMPLICATIONS

There are plethora of evidences (both theoretical and empirical) to attest the significance of technology innovation in fostering long-term or sustained growth in the global economy (Broughel and Thierer, 2019; Kane and Peretto, 2020; Tingting and Hu, 2020; Zhu et al, 2020). While the applaud is raised towards long-term prospect, there is also glimpse of discontent or discomfort the approach brings to businesses and firms, particularly in terms of their adjustment to change, more so in the short-run period. It is clearly evident that such adjustments can also result in unwanted costs, which in many cases can result in the destruction or closure of firm or business operation – in many rare cases, end up in merger-acquisition. Mirrored in the direction of creative destruction, innovation is certainly the way forward for businesses' prospect to sustain their existence in the foreseeable future (Jackson, In Press). News about closures and disruption of businesses will continue to dominate the press or media outlets – notably common nowadays is that of the emergence of Uber services, which now threaten conventional mode of taxi operation, Whatsapp and Email technology is already making traditional postal services an outdated culture in rural communities and in high populated towns and cities.

With all the above cited examples about the acclamation of technology innovation's benefit to society and possible demise of businesses, it is worthwhile that intervention measures are formulated in a bid to making the process very much sustaining for smaller businesses that are very much incapable to stand the time of meeting huge costs to survival in business. On a similar note to the work of Acemoglu and Robinson (2012), many nations around the world would be inclined to use some form of protectionist measure(s) in a ensuring the survival of businesses in time of fierce competition stemming from the emergence of innovative technologies.

There is a need for public service intervention to be made an integral part of society's effort to increase wealth capacity through technology innovation as dictated through policies that support equality in human creativity (Jackson, forthcoming). In that vein, the yardstick approach of Substitution Industrialization (ISI), which was a common thing for the Asia Tiger countries could be seen as a short-fix measure for under-developed economies found in the SSA region (Jackson, forthcoming1). Effective policy (for example, Public-Private Partnership innovation) that minimizes the abuse of rent-seeking must be adopted if government for example, is to intervene on the basis of protecting vulnerable businesses at the expense of emergent innovations. Such approach to PPP involvement will make it

worthwhile for roller institutions that have become too highly dependent on public funds to pull their weight, with the focus of being accountable to tax payers. Without such stringent approach, businesses in the continent will ever seek to continue their easy approach of being too over-reliant on public taxation as a bailout for their continued existence in business as opposed to being creative.

In pursuance of the emphasis towards driving technology innovation as part of the UN SDG agenda for sustainable development, efforts must be made (particularly by the state) to institute policies that support the ecosystem of entrepreneurial innovation. The importance of open system policies (or business accelerator as it is called), was recently pursued empirically (through us of qualitative and quantitative approaches) by Pustovrh et al (2020) and Striebing et al (2020). In a bid to address (gender) equality in the pursuit of innovation, Striebing et al (2020) in their qualitative study specifically touched on the not-so-much said thing about the difficulties women faced in being made an integral part of research that focuses attention on innovation – this seem to be a common phenomenon across the globe, even in the most developed economies around Europe and the United States of America. In their summary, it was particularly noted about the need for intervention to make sure gender equality is made an integral part of organisational system. Such approach if adopted will also make it worthwhile for women's input to be made an integral part of the assessment of growth and development statistics that bothers around decent work and economic activities computed in GDP term (SDG8).

Equally, public culture about the embracement of (technology) innovation should be made a process of national pride – in this vein, the ethical focus behind the venture of engaging in activities that explore the human ingenuity should be well supported by law-makers, and more so in ensuring patents on new inventions are registered to the benefit of creators. The benefit of innovation can only be realised as a long-term gain to society, hence activities that seek to distract the good intention of new invention must be very well supported through public (financial and moral) support. Such focus will make it possible for society to develop the understanding pertaining to the long-term economic gains that innovation brings to society as a whole.

CONCLUSION

As already addressed through discourses involving economic theory involving Solow model and TFP, the way forward for society in the modern society is to make sure institutions are very well supported to embrace technological innovation. Innovation is a dynamic process and hence, there is a need for society (particularly policy makers) to embrace ventures that utilizes human creativity in support of the long-term sustainability of economic progress. Despite the fear of firms and Small-and-medium Enterprises (SMEs) regarding the destruct of innovation on business continuity, it is still worthwhile for efforts to be made in ensuring the human entrepreneurial talent is utilized to make way for businesses to stand the time of dynamism that innovation (bring) bring to the world. As already emphasised by contributors

(Jackson, In Press; Broughel and Thierer, 2019; Awan and Scroufe, 2019; Verspagen, 2006), there are myriad of gains ascribed to the effort made in being innovative – such example include prospect for the creation of new ideas / inventors and its resulting impact on high return to growth and development for the benefit of present and future generations.

The scope for society to become integrated into the global discourse of innovation requires sacrifices, which normally necessitate the support of policy makers or governments to make sure support is regularly provided to those that are in need in exploration of their human ingenuity. As emphasised by Broughel and Thierer (2019), there is a moral obligation on the part of society to nurture and embrace (technological) innovation, particularly in present day society in a bid to ensuring the benefits are reaped by the future and unknown generations. Despite the unsurmountable costs and risks-taking ascribed in fostering innovation, it is a necessary evil, which means that the gains from creativity should be made a national pride as in the case with inventions like the talked about efforts of Albert Einstein and many more. Globally, effort must be made to ensure innovation's contribution towards GDP computation is revised, with the focus of acknowledging human ingenuity at all levels

CROSS-REFERENCING

- Sustainable Cities and Communities (SDG11)
- Decent Work and Economic Growth (SDG8)
- Quality Education (SDG4)
- Good Health and Well-being (SDG3)

REFERENCS

Acemoglu, D., and Robinson, J.A. (2012). Why Nations Fail? The Origins of Power, Prosperity, and Poverty. London: Profile Books Limited.

Ahlstrom, D. (2010). Innovation and Growth: How Business Contributes to Society. Academy of Management Perspectives, Vol. 24(3): pp. 11-24. https://doi.org/10.5465/AMP.2010.52842948.

Allen, D.W.E., Berg, C., Markey-Towler, B., Novak, M., and Potts, J. (2020). Blockchain and the evolution of institutional technologies: Implications for innovation policy. Research Policy, Vol. 49(1): 103865. https://doi.org/10.1016/j.respol.2019.103865.

Antonelli, C. (2003). The Economics of Innovation, New Technologies, and Structural Change. London: Routledge.

Asongu, S.A., and Nwachukwu, J.C. (2017). PhD by publication as an argument for innovation and technology transfer: With emphasis on Africa. Higher Education Quarterly, 72(2): pp. 1-14. https://doi.org/10.1111/hequ.12141.

Awan, U., and Scroufe, R. (2019). Inter-organisational collaboration for improvement in manufacturing firms': The mediating role of social performance. International Journal of Innovation Management, No. 2050049. https://doi.org/10.1142/S1363919620500498.

Broughel, J. and Thierer, A. (2019). Technological Innovation and Economic Growth: A Brief Report on the Evidence. Mercatus Research, Mercatus Centre at George Mason University, Arlington, VA.

Gross, A.K. (2019). Sub-Saharan Africa and the 4th Industrial Revolution Technological Leapfrogging as a Strategy to enhance Economic Growth? Master's thesis in Economic Development and Growth, Lund University, School of Economics and Management. Available at: http://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=8986790&fileOId=8986795. (Accessed: 10th March, 2020).

Jackson, E.A. (forthcoming). Importance of the Public Service in achieving the UN SDGs. In Walter L. Filho, et al. (ed.). Decent Work and Economic Growth: Enclyclopepdia of Sustainable Development Goal, Springer Nature Publisher.

Jackson, E.A. (In Press). Fostering sustainable innovation through creative destruction theory, In: Leal Filho W., Azul A., Brandli L., Özuyar P., Ozuyar, P.G. (ed.) Industry, Innovation and Infrastructure. Encyclopedia of the UN Sustainable Development Goals. Springer, Cham.

Jackson, E.A. (2020). Innovative educational technologies for early-year curriculum delivery: A theoretical roadmap for economies in Sub-Saharan Africa (SSA). Economic Insights – Trends and Challenges.

Jackson, E.A. (2018). Hermeneutics of Ceteris Paribus in the African Context. Economic Insights – Trends and Challenges, Vol. 9(71): pp. 9-16.

Jackson, E.A. (2018a). Book Review of Introduction to Dynamic Macroeconomic General Equilibrium Models. (2nd Ed) Wilmington, DE: Vernon Press, 2015. 282pp ISBN: 978-1-62273-030-8 (Hardcover) written by Josh L. Torres. Journal of Applied Thought, Vol. 6(1): pp. 282-287. Available at: https://www.econstor.eu/handle/10419/190826.

Jackson, E.A. (2017). Challenges and optimism for sustainable research capacity in Sierra Leone. Management of Sustainable Development, Vol. 9(1): pp. 43-46.

Jackson, E.A. (2016). Phronesis and Hermeneutics: The Construct of Social/Economic Phenomenon and their Interpretation for a Sustainable Society. Economic Insights – Trends and Challenges, Vol. 8(2): pp. 1-8.

Jackson, E.A. (2016a). Competitiveness in Higher Education Practices in Sierra Leone: A model of Sustainable Growth. Economic Insights – Trends and Challenges, Vol. 4(4): pp. 15-25.

Jackson, E.A. and Jackson. J. (forthcoming). Global Perspectives on Gender Sensitivity and Economic Benefits. In Walters L, Filho et al (eds.). Gender Equality: Encyclopedia of Sustainable Development Goal, Springer Nature Publisher.

Jackson, E.A. and Jabbie, M. (forthcoming1). Import Substitution Industrialization [ISI]: An approach to global economic sustainability. In Walter Leal Filho, Anabela Marisa Azul, Luciana Brandli, Pinar Gökcin Özuyar, Tony Wall (ed.). Industry, Innovation and Infrastructure: Enclyclopepdia of Sustainable Development Goal, Springer Nature Publisher.

Jackson E.A., Jackson E.E.S., Jackson H.F. (2020) Nurturing Career Development for Human Resource Sustainable Development. In: Leal Filho W., Azul A., Brandli L., Özuyar P., Wall T. (eds) Decent Work and Economic Growth. Encyclopedia of the UN Sustainable Development Goals. Springer, Cham. https://doi.org/10.1007/978-3-319-71058-7_2-1.

Jackson, E.A. and Jabbie, M. (2019). Understanding Market Failure in the Developing Country .Context (Online First). In, Walter L. Filho (eds), Decent Work and Economic Growth: Encyclopedia of Sustainable Development Goals, Springer Nature Publisher. https://doi.org/10.1007/978-3-319-71058-7_44-1.

Jamme, M.E. (2015). What STEM can do for Africa. https://www.weforum.org/agenda/2015/01/what-stem-can-do-for-africa/. (Accessed: 11th March, 2020).

Johnson, B. (2008). Cities, sstems of innovation and economic development. Innovation, Organisation and Management, Vol. 10(2/3): pp. 146-155. https://doi.org/10.5172/impp.453.10.2-3.146.

Kane, R.F., and Peretto, P.F. (2020). More apples vs. better apples: Distribution and innovation-driven growth. Journal of Economic Theory, Vol. 185(104964). https://doi.org/j.jet.2019.104964.

Kazeem, Y. (2019). A $170 million funding round is the latest big-ticket fintech deal in Africa. QUARTZ AFRICA. Available at: https://qz.com/africa/1589587/africa-fintech-branch-raises-170-million-in-series-c-round/. (Accessed: 10th March, 2020).

Kedir, A., Elhiraika, A., Zivanemoyo, C., and Sandjong, D. (2017). Growth and development finance required for achieving sustainable development goals (SDGs) in Africa. African Development Review 29(S1): pp. 15-26. https://doi.org/10.1111/1467-8268.12230.

Lember, V., Petersen, O.H., Scherrer, W. and Agren, R. (2019). Understanding the relationship between infrastructure Public-Private Partnership (PPP) and Innovation. Annals of Public and Cooperative Economics, Vol. 90(2): pp. 371-391. https://doi.org/10.1111/apce.12232.

Liu, A. (2019). Africa's future is innovation rather than industrialization. World Economic Forum. Available at: https://www.weforum.org/agenda/2019/09/africa-innovation-rather-than-industrialization/. (Accessed: 9th March, 2020).

Luenendonk, M. (2016). Innovation Economics. CLEVERISM. Available at: https://www.cleverism.com/innovation-economics-definition/. (Accessed: 7th March, 2020).

Mlambo, C., and Msosa, K. (2020). The Effect of Financial Technology on Money Demand: Evidence from Selected African States. European Research Studies Journal, Vol. 23(1): pp. 143-150.

Morozov, E. (2015). The Taming of Tech Criticism. Baffler, March 2015.

OECD. (2019). Fostering Science and Innovation in the Digital Age. Available at: https://www.oecd.org/going-digital/fostering-science-and-innovation.pdf. (Accessed: 10th February, 2020).

OECD (2018), "Artificial intelligence and machine learning in science", in OECD Science, Technology and Innovation Outlook 2018: Adapting to Technological and Societal Disruption, OECD Publishing, Paris, https://doi.org/10.1787/sti in outlook-2018-10-en.

Ogujiuba, K., Nwogwugwu, U., and Kike, E., (2011). IMPORT SUBSTITUTION INDUSTRIALIZATION AS LEARNING PROCESS: SUB SAHARAN AFRICAN EXPERIENCE AS DISTORTION OF THE "GOOD". Business and Management Review, Vol. 1(6): pp. 08 – 21.

Ogundari, K., and Bolarinwa, O.D. (2019). Does Adoption of Agricultural Innovations Impact Farm Production and Household Welfare in Sub-Saharan Africa? A Meta-Analysis. Agricultural and Resource Economics Review, Vol. 48(1): pp. 142-169. https://doi.org/10.1017/age.2018.10.

Pamuk, H., and Rijn Van, F. (2019). The Impact of Innovation Platform Diversity in Agricultural Network Formation and Technology Adoption: Evidence from Sub-Saharan Africa. The Journal of Development Studies, Vol. 55(6): pp. 1240-1252. https://doi.org/10.1080/00220388.2018.1453606.

Peck, J. (2005). Struggling with the creative class. International Journal of Urban and Regional Research, Vol. 29, pp. 740-770.

Recica, F., Hashi I., Jackson, I., and Krasniqi, B.A. 2019). Innovation and the export performance of firms in transition economies: the relevance of the business environment and the stage of transition. International Journal of Entrepreneurship and Small Business, Vol. 38(4): pp. 476-506.

Pustovrh, A., Rangus, K., and Drnovsek, M. (2020). The role of open innovation in developing an entrepreneurial support ecosystem. Technological Forecasting and Social Change, Vol. 152 – 119892. https://doi.org/10.1016/j.techfore.2019.119892.

Riley, G. (Online). Innovation and Intervention in Markets. Available at: https://www.tutor2u.net/economics/reference/innovation-and-invention-in-markets. (Accessed: 8th March, 2020).

Romer, P. (1990). Endogenous Technological Change. Journal of Political Economy, Vol. 98(5): 71-102.

Saffa M., Jabbie M. (2020) Developing Transformational Competencies for Sustainable Development. In: Leal Filho W., Azul A., Brandli L., Özuyar P., Wall T. (eds) Quality Education. Encyclopedia of the UN Sustainable Development Goals. Springer, Cham. https://doi.org/10.1007%2F978-3-319-69902-8_116-1.

Saka-Helmhout, A., Chappin, M., and Vermuelen, P. (2020). Multiple Paths to Firm Innovation in Sub-Saharan Africa: How informal institutions matter. Organisation Studies (First Online). https://doi.org/10.1177/0170840619882971.

Schumpeter, J. (2008). Capitalism, Socialism and Democracy (ed.). New York: Harper Perennial.

Schwartz, B. (2004). The Paradox of Choice: Why More Is Less? New York: Ecco.

Solow, R.M. (1956). A Contribution to the Theory of Economic Growth. Quarterly Journal of Economics, Vol. 70(1): 65-94.

Striebing, C., Schmidt, E.K., Palmen, R., Holzinger, F., and Nagy, B. (2020). Women Underrepresentation in R&I: A Sector Program Assessment of the Contribution of Gender Equality Policy in Research and Innovation. Evaluation and Program Planning, Vol. 79 - (101749). https://doi.org/10.1016/j.evalprogplan.2019.101749.

TechWomen. (19th March, 2019). SIERRA LEONE DAY 2: SHOWING STUDENTS A FUTURE IN STEM. https://www.techwomen.org/uncategorized/sierra-leone-day-2-showing-students-a-future-in-stem. (Accessed: 10th March, 2020).

Tingting, Z., and Hu, D. (2020). Credit, social mentality and technical innovation efficiency. Management and Economics Journal, Vol. 3(3): pp. 211-230.

UN. (2019). Growing at a slower pace, world population is expected to reach 9.7 billion in 2050 and could peak at nearly 11 billion around 2100. Available at: https://www.un.org/development/desa/en/news/population/world-population-prospects-2019.html. (Accessed: 11th March, 2020).

Vallejo, B., Oyelaran-Oyeyinka., Ozor, N., and Bolo, M. (2019). Open Innovation and Innovation Intermediaries in Sub-Saharan Africa. Sustainability, 11(2019): pp. 1-18. https://doi.org/10.3390/su11020392.

Verspagen, B. (2006). "Innovation and Economic Growth", in Jan Fagerberg and David C. Mowery, The Oxford Handbook of Innovation (ed.). Oxford: Oxford University Press.

Yao, J. (2020). The Decline of National Innovation and Its Implications. Proceeding of the 2019 International Conference on Education Science and Economic Development (ICESED 2019). https://doi.org/10.2991/icesed-19-2020-2.

Zhu, X., Asimakopoulos, S., and Kim, J. (2020). Financial development and innovation-led growth: Is too much finance better? Journal of International Money and Finance, Vol. 100(102083). https://doi.org/10.1016/j.jimonfin.2019.102083.