Seminar Proceedings

Prof. Calestous Juma Seminar Series

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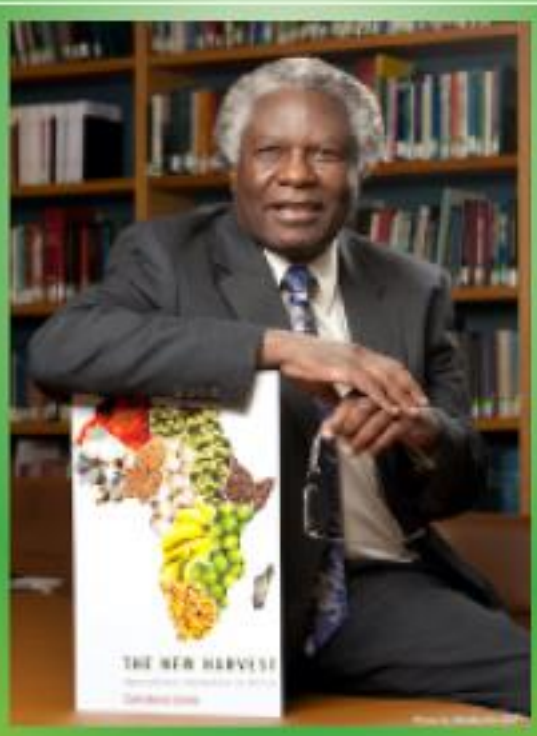

Re-Igniting Africa's Industrialization through Innovation

African Centre for Technology Studies
ACTS
Knowledge for Better Livelihoods

CJLF

Table of Contents

List of Acronyms

ACTS	African Centre for Technology Studies
AfDB	African Development Bank
AU	African Union
CJ	Calestous Juma
CJLF	Calestous Juma Legacy Foundation
DRC	The Democratic Republic of Congo
EPC	Engineering, Procurement and Construction (EPC
EPC	Engineering, Procurement, Construction
EPCM	Engineering, Procurement, Construction Management
EU	European Union
GDP	Gross Domestic Product
IAEA	International Atomic Energy
IAEA	International Atomic Energy Agency
ICT	Information and Communications Technology
IPCC	Intergovernmental Panel on Climate Change
IPCC	Intergovernmental Panel on Climate Change
IREK	Innovation and Renewable Electrification in Kenya
KIPO	Kenya Industrial Property Office
MIT	Massachusetts Institute of Technology
MNCs	Multinationals
MoU	Memorandum of Understanding
NIDCOM	Nigeria Diaspora Commission
R&D	Research and Development
SDG	Sustainable Development Goal
SEI	Stockholm Environmental Institute
SSA	Sub-Saharan Africa
UN	United Nations
US	United States

List of Figures

I. Executive Summary

The inaugural Prof. Calestous Juma Seminar Series knowledge and innovation for development was held on 12th - 13th August 2021 under the theme re-igniting Africa's industrialization through innovation. It was jointly organized by the African Centre for Technology Studies (ACTS) and the Calestous Juma Legacy Foundation (CJLF). The event provided the occasion for signing of a Memorandum of Understanding (MOU) between ACTS and CJLF. The first day featured an insightful keynote address by Prof. Banji Oyelaran-Oyeyinka of the African Development Bank (AfDB) which focused on five key themes relating to industrialization in Africa: the renewed debate on industrialization, the reason for the continent's poor industrialization record, consequences of relying on natural resources and the next steps for Africa. This was followed by an exciting discussion session specifically on inclusivity in the industry and health security interface, the role of diaspora in Africa's industrialization, prospects for the Africa's informal sector in the 4IR era, key policy agendas for Africa's future and green development prospects in Sub-Saharan Africa (SSA).

The second day focused on innovation and renewable electrification in developing countries with key insights on important opportunities for local economic development which discussed new paradigms for understanding green transformation and sustainable industrialization highlighting the opportunities and constraints for local capability building and the scope for local policy action. The discussions were based on a study on the IREK project "*Building Innovation Capabilities for Sustainable Industrialization: Renewable Electrification in Developing Economies*". It featured discussions on local capability building, local capabilities in renewable energy, innovative capabilities in solar PV firms in Kenya and Tanzania, the importance of local content issues in fostering sustainable industrialization and policies for appropriate pathways in energy and sustainable industrialization. It also featured discussant interventions from key experts.

Limited to dependence on natural resources, limited local manufacturing, increased concentration of industrial activity specialized in high value added activities and serving international markets, and high dependence on imports, reflecting uneven manufacturing and innovation capabilities emerged as the key challenges facing Africa's industrialization. Deriving from these discussions, several recommendations were put forth as outlined below:

- Africa must pursue an active industrial strategy and take agribusiness as the base; this is where it finds its competitive advantage while continuing to promote other industries and the services sector.
- There is need to use clustering and agglomeration as an industrial policy instrument. Special economic zones are models of industrial strategies integral instrument of industrial policy that stimulate clustering.
- Africa needs to build sectoral innovation and production systems for better health.
- African countries need to find ways to identify and share benefits in health and industry through mutual learning.
- There is need to enhance the contributions of the informal economy, ensuring that innovations emerging from the informal sector are recognized and captured by improving measurements, building non-traditional partnerships and involving formal and informal sector associations with other formal actors in the national innovation system.
- African government should enact policies that strengthens innovation and technological capabilities in informal enterprises as a bottom-up root to industrialization.
- African government and private players need to ensure co-benefits from access to clean energy projects recognize innovation in projects and encourage innovation in areas that currently lack innovation.
- It is imperative to develop strategies for enhancing local participation in global renewable value chains and have more local active involvement in related project lifecycles by reducing dependence on external actors

II. Opening Remarks

Prof. Tom Ogada, Executive Director, African Centre for Technology Studies (ACTS)

The executive director of the African Centre for Technology Studies (ACTS), Prof. Tom Ogada, set the stage of the seminar series by highlighting the critical role played by Prof. Calestous Juma in the application of science, technology and innovation for sustainable development, especially in developing countries; and analyzing how knowledge and innovation could be harnessed for development in the context of institutional change in socio economic systems and policies. He promoted this agenda through advanced science, technology, and innovation policies especially in biotechnology, provision of high-level science, technology and conservation of biological diversity. Notably, Prof. Juma founded the African Centre for Technology Studies (ACTS) in 1988, where his initial development ideas were nurtured to become a leading inter-governmental science, technology and innovation policy think-tank with the mandate to strengthen the capacity of African countries and institutions to harness science, technology and innovation for sustainable development.

ACTS has been instrumental in enlarging the range of policy choices for sustainable development in Africa through high quality research, outreach and policy including legislation and policy in environmental impact assessment standards in Eastern and Southern Africa. ACTS has policy footprints in agriculture, biotechnology, biosecurity and climate change in Africa; and was the first to organize an international conference to discuss options that could be adopted by African countries to mitigate the impact of climate change and also played a major role in the negotiations for the Convention on biodiversity. And due to its excellent work, ACTS was rated as a top environmental think-tank in Africa. In 2016, for example, ACTS was rated amongst the top three most influential think tanks in climate change globally and number one in Africa.

ACTS sixth strategic plan, 2019-2021, focuses on the core thematic areas seen as the most important t Prof. Juma, is expected to lay the foundation for his immortalization. ACTS has remained true to Prof. Juma's original vision and attention to science, technology and innovation, policy research and its application for sustainable development. Includes agriculture and food security, climate change and energy and the role of science, technology and innovation in addressing the challenges affecting these sectors. ACTS has remained true to its charter. In 2018, for example, the Governing Council established the College of Scholars, which is one of the organs provided for by the 1988 charter. The organization is working closely with the Calestous Juma Legacy Foundation (CJLF) to enhance synergy in building the foundation for CJs immortalization.

The seminar series will focus on Prof. Juma's previous work and will be held once every three months culminating in the ACTS-CJLF conference in 2022. Participants are encouraged to help shape the agenda of the CJ Seminar Series by proposing issues for discussions that you feel are not only relevant to the work of CJ but also captures the aspiration of Africa - as it as it is today and in the future.

III. Welcome Remarks

Prof. Alfred Oteng-Yeboah, Chairperson, ACTS Governing Council

Prof Oteng-Yeboah, the chairperson of the ACTS Governing Council informed participants that ACTS was founded from scratch through the initial Science, Technology and Innovation (STI) developmental ideas which Prof. Juma nurtured and published during his tenure as the executive director of ACTS and which later became the blueprint adopted by successive executive directors. Prof. Juma was an intellectual giant who made the youth of Africa proud in his very singular pursuit of knowledge and accomplishments to make the continent aware of and sought for better ways to derive benefits from these enormous genetic resources through exposure in the spheres of science, technology and innovation. The Governing Council is proud to be associated with the CJ Legacy Foundation to start this lecture series which falls within the governing Council's desire of immortalizing Prof. Calestous Juma. (**See Annex 1 for the full speech**)

IV. About The Calestous Juma Legacy Foundation

Angela Christiana, Executive Director, CJLF

The executive director of the Calestous Juma Legacy Foundation (CJLF), Angela Christiana, provided a brief background of the foundation founded in 2019 and whose mission is to advance economic transformation and sustainable development in Kenya and ultimately in Africa through the use of science and technological innovation. The foundation's primary goal is to help local communities develop and implement innovative solutions to health, educational, food security, environmental and employment challenges identified by local experts and community members. The organization's projects and initiatives will be grounded in and guided by the following principles reflecting Prof. Juma's vision, values and virtues:

1. A belief in experimentation and learning. Seed and build a belief in local learning and action, support learning by youth and women to collectively solve local problems with the goal of building inter-dependence and preventing over-dependence.
2. Leveraging local content and inputs. Using local knowledge, infrastructure, and other local resources, such as young people's energy.
3. Adding values to existing initiatives. Building on promising existing local community efforts rather than duplicating or crowding out local initiatives.
4. Clearly articulating vision and resource limitations. Managing expectations by clearly articulating and emphasizing humility and simplicity, building human capabilities to be interdependent and working toward the long term public good rather than individual monetary gain.
5. Building local capacity and momentum. Aiming to build local capacity to carry the work forward in a manner that is responsive to changes in context and continuous learning from the foundation's other projects and initiatives.
6. Maintaining the organization's initiative as non-governmental, not for profit and non-political.

Progress of CJLF

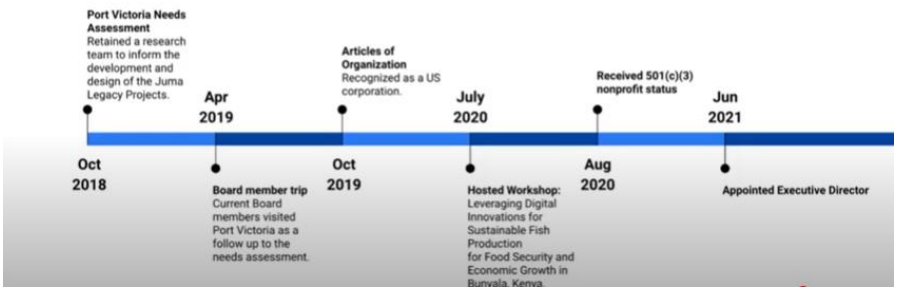

Fig. 1: CJLF Timelines

Questions and Discussions
The executive director and president of CJLF, Angela Christiana and Prof. Wesley Harris got an opportunity to respond to questions related to the foundation. The questions are listed below.

- Would the foundation, collaborate with Harvard University Kennedy School of Government?
- What is an immediate programmatic priorities for the CJ Foundation in the coming 12 months?
- What is the research focus of CJLF?
- What plans does the foundation have to enhance the expansion of technology and innovative knowledge in Africa?

CJLF will collaborate with Harvard University Kennedy School of Government. His legacy at the Kennedy School of Government is strong; he is remembered fondly mainly because he produced many students and the alumni association, specifically the Kenyan alumni group is very active and supportive of Calestous and his legacy. CJLF priorities are to respond to the needs of the community specifically in building the capacity of the local community in fish farming in Port Victoria on the shores of Lake Victoria. Meanwhile CJLF is exploring collaborative relationships and will continue participating and hosting similar seminars to enhance expansion of technology and innovation knowledge and Africa and work together with ACTS in producing some outputs from these sorts of conversations. Finally, CJLF will conduct research focusing on the relationship between healthcare, education and empowerment of the workforce men and women?

V. Prof. Juma's Biography

Prof. Calestous Juma was an internationally recognized authority and leader in the application of science, technology and innovation to sustainable development. His original work focused on analyzing the evolution of technological innovation and institutional change in socio-economic systems. He directed programs that advanced science, technology and innovation policy research, especially biotechnology. He provided high level science and technology advice and promoted the conservation of biological diversity. Prof. Juma was named one of the most influential 100 Africans in 2012, 2013, 2014 and 2016 by the *New African Magazine* in 2015. He was named by the Scientific American as one of the *World's 100 Most Influential People* in biotechnology. He co-chaired high level advisory panels for the United Nations (UN) and the African Union (AU) on science, technology and innovation. He served on the boards of numerous international organizations and universities, and he was a member of the board of the Pan-African University of the African Union.

He served on the judging panels of the Rolex Award for Enterprise, The Queen Elizabeth Prize for Engineering and the Africa Food Prize. He was the first permanent executive secretary of the UN Convention on Biological Diversity. In 1988, Prof. Juma founded the African Centre for Technology Studies (ACTS), Africa's first independent policy research institution designed to advance research on technology and development. In 1989, ACTS released a ground-breaking study on innovation and sovereignty that led to the adoption of the Industrial Property Act in Kenya, and the creation of the Kenya Industrial Property Office (KIPO). He was the author of many papers and several notable books*: The New Harvest, Agricultural Innovation in Africa,* (2015) and *Innovation and its Enemies: Why People Resist New Technologies* (2016). He also posthumously published the *Emergent Africa Evolution of Regional Economic Integration* with Francis McKinney. Calestous concentrated primarily on these main themes throughout his professional life: infrastructural improvement, practical education, science and technology investment and the overriding importance of encouraging innovation at all social levels from school-age to changes within the broader workforce.

He was Professor of Practice of International Development at the Harvard Kennedy School, and Faculty Chair of the Edward S. Mason fellows programme. He was also Faculty Chair of the Innovation for Economic Development Executive Programme and director of the Science Technology and Globalization Project. Prof. Juma directed the school's agricultural innovation in Africa and health innovation policy projects funded by the Bill and Melinda Gates Foundation. In 2014 and 2015, he served as the Dr Martin Luther King Jr. Visiting Professor at the Massachusetts

Institute of Technology (MIT). Calestous' death came after a long illness but still arrived unexpectedly in 2017. He had expressed with family, friends and colleagues his desire to start an institute of Port Victoria in honor of his parents, with the training curriculum focused on skills to promote employment of youth in Port Victoria. Not knowing that he would pass away shortly after he wrote out some of his ideas and from that we have defined the mission of the Calestous Juma Legacy Foundation. I'd like to share videos of Prof. Juma in his own words. This first video is responding to the challenge of feeding not just Africa but also the expanding world population.

Video 1: Is African able to feed itself?
Video 2*:* Resistance to Innovation

VI. CJLF Vision for Africa

Prof. Wesley Harris, Chair CJLF

The president of the CJLF, Prof. Wesley Harris was grateful to ACTS for its leadership and vison to begin this series and provide opportunity for action, not just discussion, but action towards innovation in the developing world and its entirety. CJLF is committed to the principles of respect for and a love for any positive vision for people. He observed that for innovation to happen and flourish, people, land, education, technology and environment must be at the centre. Those are the three ways of producing wealth. Education is also critical as it is the engine that moves the community forward; then comes this other piece called technology, science innovation and policy. Additionally, environment and culture are also paramount and must always be taken into account in development projects. And the dynamic nature of technology means that innovation will accelerate this change. For this reason, actors in the continent must always be aware of the need and the importance of physical resources.

VII. Signing of MoU between ACTS and CJLF

ACTS and CJLF signed a Memorandum of Understanding (MOU) detailing how the two parties will work together. Prof. Tom Ogada and Prof Wesley Harris signed the MoU on behalf of ACTS and CJLF respectively. Angela Christiana, the executive director of CJLF, described the signing of the MOU as very important and bittersweet day for the Foundation to sign an MOU with ACTS, an organization he founded and loved. She said CJLF was honored to partner with ACTS and look forward to joint efforts to immortalize the work of Calestous for the benefit his beloved hometown, country and continent. ACTS executive director, Prof. Tom Ogada, said the very delighted really to collaborate with CJLF with respect to signing the MOU and was ready to work closely with the foundation to leave a very strong foundation for the immortalization of the late Prof. Calestous Juma. Prof. Oteng, Chairman of the ACTS Governing Council described the moment as a watershed and something that 'we have been dreaming, thinking and looking forward to" and members of the council will be very proud. He promised that ACTS will work in tandem with CJLF to ensure their joint mission is achieved. The President of CJLF, Prof. Wesley Harris, said the foundation was honored to have ACTS as the first partner which provides to hit the ground running and create opportunities to grow and realize the vision of Prof. Juma. He noted that CJLF was open to like-minded people and organizations who want to improve the lives of people through industrialization and innovation.

VIII. Keynote speech: Re-igniting Africa' industrialization: The Role of Innovation

Prof. Banji Oyelaran-Oyeyinka, African Development Bank

The key note by Prof. Banji focused on five key issues relating to industrialization in Africa: why the renewed debate on industrialization, reasons for poor industrialization record of Africa countries, the relationship between abundance of natural resources the negative development outcome, how countries have in the past used natural resource basis to build strong economies and he next steps for Africa.

A. The Comeback of the debate on industrial policy

According to the speaker, the COVID-19 pandemic showed that countries with weak manufacturing capacity are vulnerable not to just to climatic shocks but health and food security risks. Secondly, the lessons of the last 50 years of Africa's post-independence shows that countries with poorly diversified technological production bases, technological production, especially on the export basket, have increased volatility and huge swings in their fundamental economic variables. This is especially true for resource dependent countries; they are the most heavily impacted by external shocks. And despite implementing trade liberation measures over the past decades, Africa countries do not realize the promise growth and development dividend. These countries continue to remain at the bottom rungs of the poverty ladder because we have failed to develop our technological base and to diversify the economy. One of the pillars of the African Development Bank (AfDB) is to industrialize Africa. This is an agenda that continues to be pursued; it never went under the radar in Africa. It's been a consistent debate at the African Development Bank and most of the Africa countries within the context of the African Union (AU).

B. Growth Trajectories of Countries

We all know that we were in the same boat with most of Asian countries in the 1950s. During this time, Africa processed huge amounts of minerals, including strategic minerals - cobalt, oxide, aluminum, graphite and manganese. The Democratic Republic of Congo (DRC) for example supply 70% of cobalt but this country remains poor. The majority of her people live in dire straits.

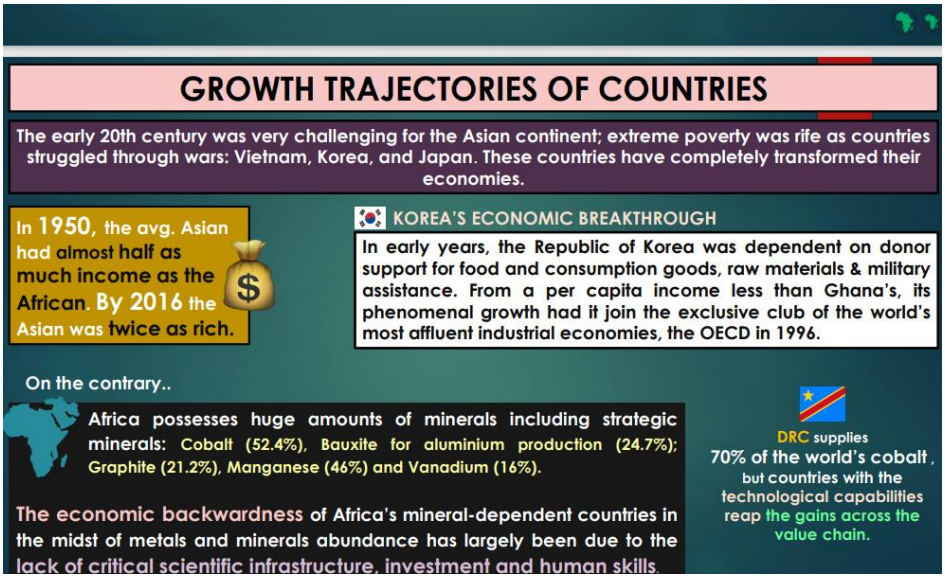

Fig. 2: Growth trajectories of countries

The reason why other countries have left Africa behind is that they have actually paid attention to industrialization. They maximized their competitive advantage by horizontal and vertical diversification. The reason why African countries stagnated can be attributed to the focus on exports and the legacy of colonialism and slavery trade in the

early 1950s meant that there were very few labour to actually build the industries. In addition. Poor governance systems and human behavior have exacerbated matters in the continent.

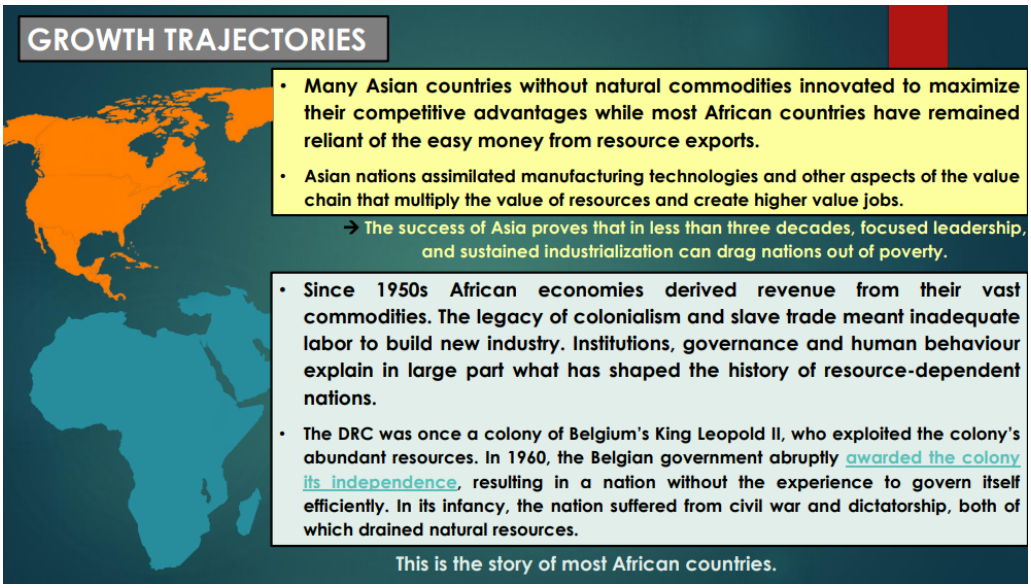

Fig. 3: Growth trajectories: The story of Africa

For instance, Africa accounts for 70% of the world's cocoa beans, of which 80% is already sold. However, the continent is only part of 1% of global chocolate market, which is the endpoint of cocoa beans.

C. Reversal of Fortune

According to Prof. Banji exports take jobs from Africa. This is illustrated by the fact in 2018, for example, the chocolate industry employed about 70,000 people in the European Union and the US. The global chocolate industry market was valued at USD 106.6 billion in 2019 and it's projected to USD 147 billion by 2025. Africa - which produces 21% of the commodity - has a share of only USD 6 billion. Therefore, this is the anomaly why countries in Africa remain poor: simply because they are not industrializing, we are not innovating and we are not adding value. This is well illustrated by figure **4** where the nominal rate price has been trending downwards since 1960 in terms of the real price, not the nominal price. F**igure 5** shows that although Asian countries were at the same point economically, these countries have left Africa behind. The reversal of fortune has manifested not just in this movement of income, but also in all manner of social, technological metrics. Compared with the other countries in Asia, the differences are really stuck.

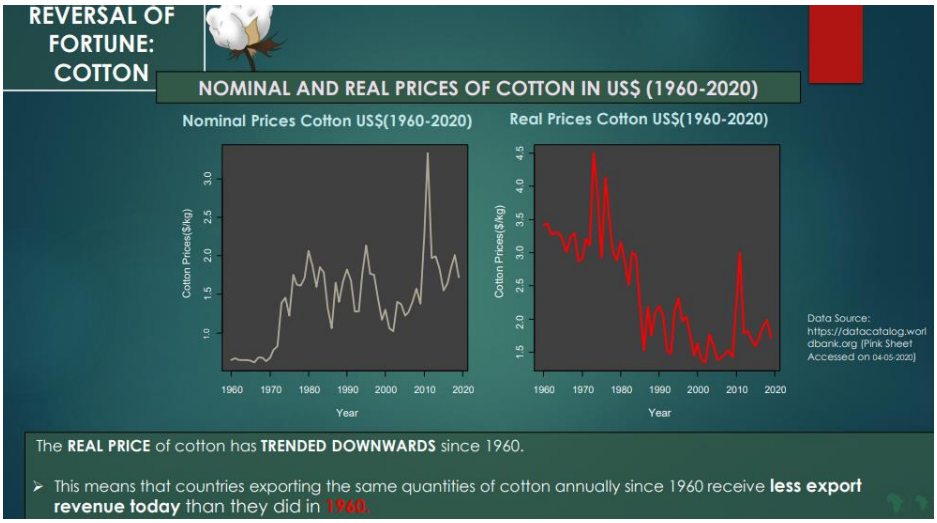

Fig. 4: Reversal of fortunes

By 2019, the income of Korea was six times that of Algeria and nine times that of Angola. These are countries with huge oil resources. All these countries had the same income level in 1980. Similarly, forty years ago, Nigeria's income was 40 times that of China. Sudan had 2.5 times China's income. In 2019, of course, China's income has skyrocketed and has become the second wealthiest country in the world. Another measure of industrial dynamism is export share of manufacturing. As illustrated in **figure 5**, Asia has gone up from the 1960s: the steepness of the graph at some point shows extremely fast rate of growth and the gap has widened. At some point, Africa was growing but then declined. And then began also the volatility.

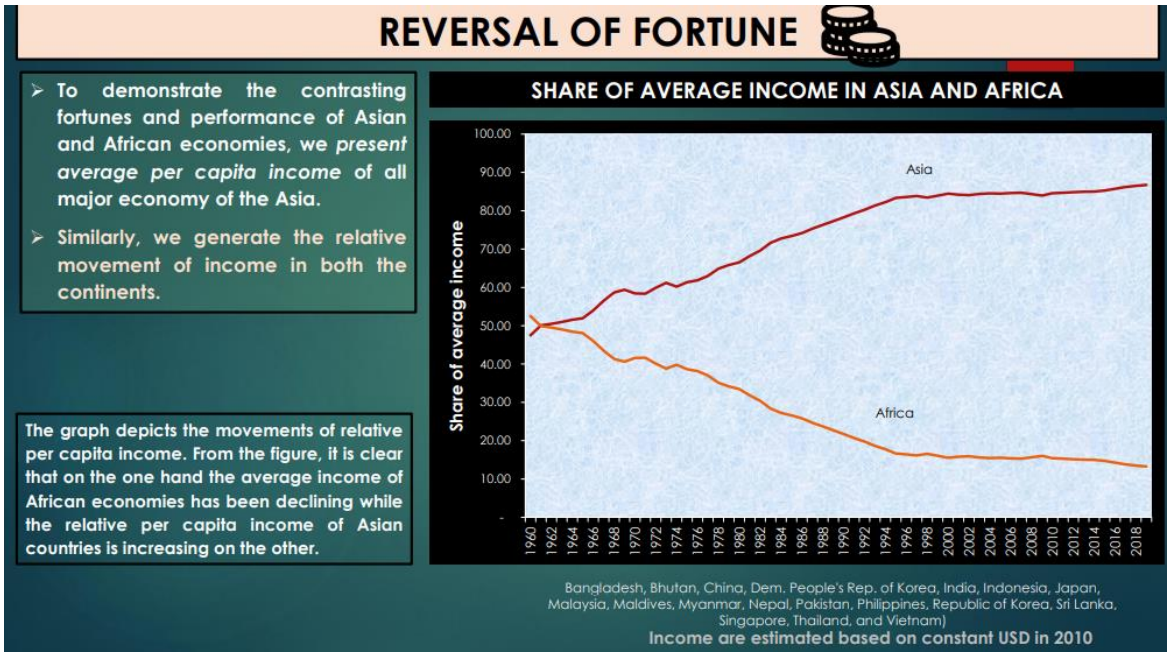

Fig. 5: Reversal of Fortunes, Africa Vs Asia

As shown in **figure 6**, minerals, energy and raw materials accounted for 80% of all African exports. Agriculture employs 65% to 80% of the workforce in the region.

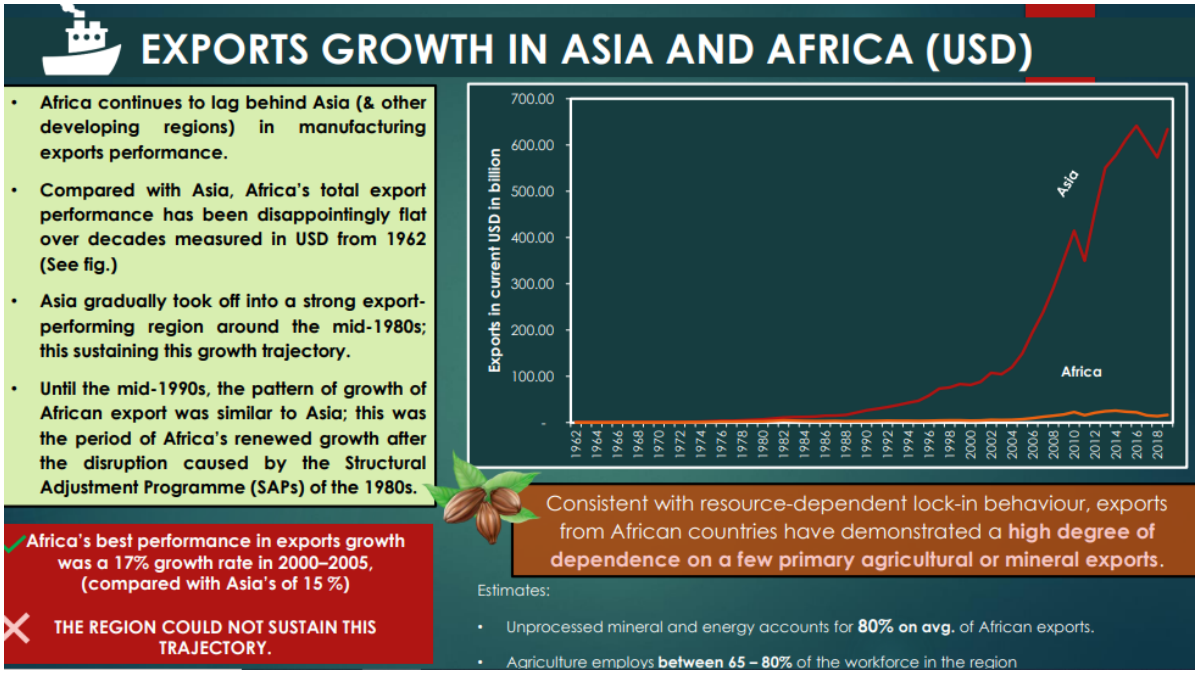

Fig. 6: Exports growth in Asia and Africa

A. Africa's Abundance of natural Resources: a curse or a blessing?

It's not the possession of a resource that makes it a curse, it is what we make of it; it is how we use it or what kind of institutions we develop around it. Africans have relied on the low-growth pathway of commodity extraction and export. Whereas there are many Asian countries like Malaysia and Vietnam that were also dependent on commodities like rubber in Malaysia; the game changed through horizontal diversification and developed sophisticated and complex products through horizontal diversification.

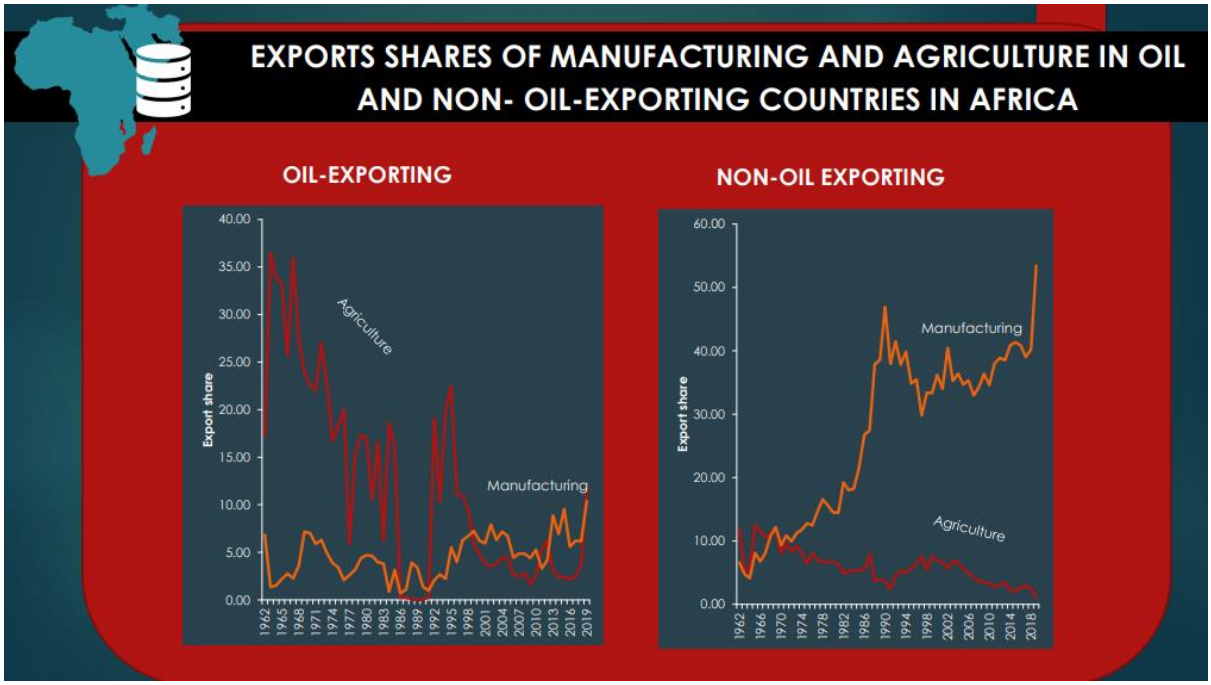

Fig 7: Fortunes of oil and non-exporting countries

As illustrated in **figure 7,** there is a clear difference between the oil-exporting and non-oil exporting countries. For oil-exporting countries, manufacturing had always been a priority for them and they don't get much out of it because of the greed that comes with easy money; and creating institutions that are opposed to manufacturing. In the non-oil exporting countries in Africa like Ethiopia you find very fast growth before COVID-19.

D. Implications of Natural Resource Dependence

When a country depends too much on natural resources, those countries tend not to focus on industrialization nor to be innovative. However, those countries that made good use of the natural wealth - converting such assets to good use by innovative processes - usually have a framework of sustainable equitable governance systems usually intolerant of corruption. Secondly, natural resource dependence undermines industrialization and innovation. Earlier industrial nations like the United States (US) were the biggest exporters of raw materials and minerals not because they had these resources but because of the technological base; they deployed resources and innovation to process minerals and continued to new discoveries of oil. Thus, it wasn't a curse with the earlier industrial nations. It became a curse 50 years down the road because most of our nation's inherited these resources without preparation: they don't have the human capacity, they don't have technological capability and they in turn develop perverse institutions - elite greed - and citizen's grievance. However, Africa does not need to industrialize the way it happened in Asia, Britain and Japan. The key principle is that countries must industrialize, in their own way given their comparative advantage using what nature has endowed them with. The implication is that is that it also jeopardizes technological learning and economic growth. Industrial manufacturing largely drives economic development; the key requirement is continuous technological learning, which underpins economic diversification and structural transformation. When a country is locked into resource attraction, it tends to decline in the traded sector. If you are not processing you are not learning; if you are not processing you are not innovating. Thus, all your labour shifts to non-traded sectors: Engineering, banking or tourism.

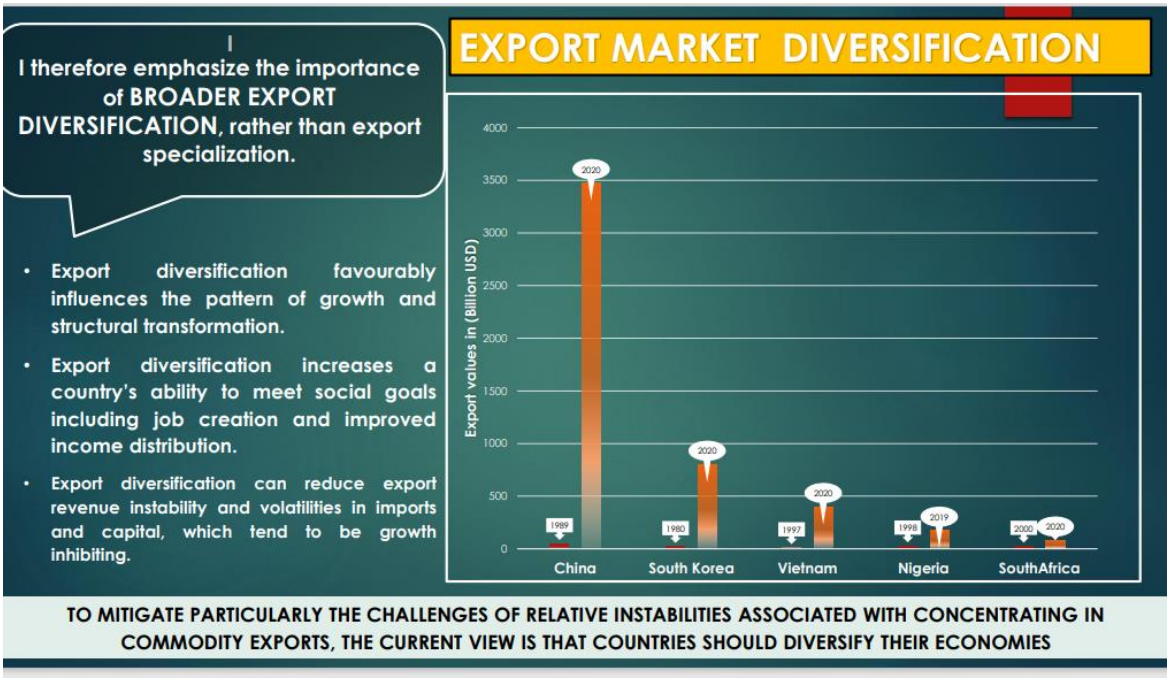

Fig. 8: Export Diversification

Figure 8 illustrates the advantage of export diversification. The story of China is very telling: in 1989-1990 the manufacturing export of China was around USD 100 billion but within 40 years, China's export is about $3 trillion, same with South Korea. What South Korea exports in a month is more than what Nigeria gets from oil annually. Vietnam is following in the same path. What Nigeria was exporting in 1998/1990 is still the same amount that it is doing in 2019, oil and gas. These countries are not diversifying their economies. That is why they are subject to volatility and all manner of dysfunctional institutions. In essence, what China is exporting in one year is close to the entire Gross Domestic Product (GDP) of Africa.

E. Future Industrial Policy Direction

The choice of policies and dedicated leadership that propel the use of industrial policy especially in post-World War especially in Asia is what helped them achieve sustained GDP growth. Neoliberal policies based on the principles of privatization, liberalization and stabilization – without a technological base have brought about a decline in industrial dynamism. Policies can be misapplied or misused or used in ways that are not competent. What distinguish the less successful performers is less of policy use than the neglect of the objectives for which it is meant.

So, what is needed?

First, Africa must pursue an active industrial strategy and take agribusiness as the base; this is where it finds its competitive advantage while continuing to promote other industries and the services sector, which has helped a lot of African countries. The African Development Bank (AfDB) is leading by a particular model called a Special Agro-Industrial Processing Zones. This is different from the usual special zones by deliberately locating them within rural communities. Thus, AfDB is using zonal and locational approach to lift zones of poverty into prosperity and in the process building new secondary cities. Economic History has shown that without diversification into industrial manufacturing, including modernizing agribusiness is the key. Therefore, Africa needs to modernize its agriculture in order to move away from the agrarian society. Without doing this the future will always be bleak for those countries that do not industrialize their economy, particularly agriculture.

Secondly, there is need to use clustering and agglomeration as an industrial policy instrument. From a development perspective as well as an investment policy perspective, special economic zones should be seen as models of industrial strategies and as an integral instrument of industrial policy that stimulate clustering. The success of Asia shows that

they have 75% of the over 4,000 special economic zones as of 2018 of which China has over 2500; Korea has 900 industrial parks of which 50% of them are agro-industrial farms.

F. The Nexus of Innovation and Industrialization

Industrialization is the process through which nations transform from agrarian societies by growing specialization, increasing complexity and differentiation. This was a process enabled by technical alterations which by other means is called innovation. Without continuous innovation you cannot deepen industrialization. The textile industry that remains relevant to developing nations' economies today was transformed through mechanization. Africa should aim to foster manufacturing, deepen out innovation capacity and to pay attention to those critical challenges. Africa must formulate new industrial innovation policy that pay attention to the Sustainable Development Goal (SDG) number one: poverty and disease. Some countries in Europe and America have four times the vaccines; African countries don't even have 2% of their population vaccinated. This is a problem that we have neglected for 50 years by taking the easy path of exporting raw materials and neglected developing our industrial base.

G. Conclusion

When framing industrial policy, real world economic need to organize industrial policy within national context. Attaining global leadership for example in South Asians countries were framed within national contexts applying broad principles. Transitions do not occur automatically through 'natural course of things'. If Africa does not take industrial policy seriously which means governments must have a role. Many governments in Africa are weak but must be persuaded to have specific roles on industrialization. Countries that have progressed far ahead prioritize their own welfare and their policies will not favour the weaker countries. Africa needs to industrialize and innovate her way out of poverty, hunger and disease.

H. Questions and Discussions

The keynote speech elicited several questions some of which are outlined below:

- Is there an active effort to harness the free trade free trade policy for Africa, and open up the trade of the goods produced within the region from the Special Economic Industrials Zones?
- Is there an opportunity for negotiating commodities exchange or specialized production for countries to specialize in production and maximize on trade?
- Can we look at processing Tilapia in Port Victoria and sent to Dubai?
- Governance and poor leadership in Africa. What can be done?
- How to address education reform.

AfDB is already in 10 countries including Kenya and is close to finalizing negotiation of about six zones before the COVID-19 pandemic. The bank will push hard to have more zones and AfDB is negotiating the establishment of about nine zones in South Africa. And this will be tied closely with the continental free trade area. The *Arise* programme mentioned earlier has also established a big special zone in Mauritania, devoted to fish. The Islamic Development Bank is also keen to invest USD 15 million in special industrial zones in Nigeria. Finally, Africa should pay a lot of attention to values and vocational and technical education.

IX. Panel Discussion: Knowledge, Innovation and Industrialization

Moderator: Prof. John Mugabe, University of Pretoria

A. Inclusivity in the Industry/Health Security Interface

Prof. Maureen Mackintosh, Open University

Introduction

This presentation focused on pharmaceutical policies and industrialization through health industries in Africa and whose weaknesses have been brought to the fore by COVID-19. It provides interesting recommendations and opportunities on how to unlock innovations and create synergies in the health sector mainly by moving away from reactive approaches to industrial policy, building sectoral policies to promote continuous improvement in the health industry and tackling the conflict between innovation and incumbency and the need to build and support family business networks or conglomerates in Africa. And finally, why it is important to reframe policies to focus on local health security.

COVID-19 and medical supplies

Immediately during the COVID-19 crisis, African countries were at the back of the queue for supplies for medicines and vaccines as a result of existing high import dependence, low-to-relatively low-tech and limited local manufacturing capabilities and low purchasing power in the international markets. This has demonstrated the critical nature of local manufacturing for tackling medical emergencies and for generating health security. In the process, there's been enormous amounts of innovation that has especially been true where manufacturing is stronger - for example in Kenya and South Africa - sanitizer in Kenya developed using local resources, adaptation of delivery systems for medication, local swabs and testing kits and engineering innovation right across the continent. In a recent webinar - an African manufacturer commenting said some of those innovations were by people who weren't given the opportunity to innovate in a pre-COVID world. Currently, African governments are now much more focused on strengthening local health security; but how to make it happen in practice through local industrialization is the issue facing policymakers and industrialists. Effectively, the last few years before the COVID-19 hit, many African governments had included pharmaceuticals and other medical supplies but - particularly medicines - in revived industrialization policies.

Synergies in health security

Unlocking industrial health synergies for health security, means breaking out of existing habits and routines which Prof. Juma noted in his book. The pandemic has prompted the normally cautious governmental and private sector firms take some new risks and real organizational and cultural change, but can this be sustained? One possible example is the issue of oncology drugs. This is not a disruptive technology because these are chemical drugs and manufacturing them is relatively complex; it's an incremental technological change. Developing capabilities in new technologies needs medium term planning, patient capital, subsidies and consistent support for the scientific work in African sub-continent over time. It means shifting away from current conventional wisdom in ways which Prof. Juma was sharp in identifying the challenge.

Health policies

Innovative industrial policy is the institutional key to unlocking health industrial synergies. It means moving away from reactive and 'level playing field' approaches to industrial policy; building sectoral policies instead to promote continuous improvement in the health industry - medicines and medical supplies - and in particular, it means involving health system stakeholders and industrial policy in identifying upstream improvements. For example, opportunities to produce active pharmaceutical ingredients, locally produced excipients and better packaging - things that unlock the capability of the health industries, many of which locked by the COVID-19 crisis. This means government roles in industrial policy: solving an investors' 'problems', breaking deadlocks between suppliers and customers and bridging gaps. Finally, it involves local thinking on feasible and sustainable business models with opportunities for more work.

And family business networks or conglomerates, that dominate much of the East African private sector, are examples of this. These business models have huge strengths which can be developed further. Local health security builds on the recognized benefits of proximity e.g. shorter supply chains, inclusive geographical distribution patterns and recognizes the importance of positionality: building up local African agency within global health and the global economy.

So how to 'stay awake'?

Finally, it involves institutional representation of the search for synergies. This innovation needs institutional 'feet', it needs to be someone's job, responsibility and accountability.

- To build sectoral innovation and production systems for better health.
- Find ways to identify and share benefits in health and industry through mutual learning.
- Represent health needed health security requirements to industry
- Generate patient capital to make it happen.

B. Industrial Development in Times of COVID: Prospects for Africa's informal sector

Prof. Erika-Kraemer Mbula, University of Johannesburg

This presentation by Prof. Erika-Kraemer Mbula, focuses on three points: an overview of the informal economy especially highlighting its role in industrialization, a glimpse of challenges facing the informal actors amid the pandemic and the broader context of digital evolution. The speaker also gives an overview of the continental agendas guiding Africa's development and how this relates to industrialization and provides an overview of the linkages between African industrialization and the role of the informal sector - especially micro and small enterprises, their role in industrialization, related challenges and opportunities, why they are disconnected from high level manufacturing and what should be done to enhance their industrial capacity especially through digital technology.

Continental frameworks

There are various agendas guiding Africa's aspirations to develop and advance, some of them are the Africa Development Bank (AfDB), Africa Union (AU) Agenda 2063 and United Nations' Sustainable Development Goals (SDGs). They are interrelated and they share a desire for the continent to modernize through science, technology and innovation and as a driver for inclusive sustainable industrialization in a way that generates jobs, and improves the quality of life for African people. The case for industrialization rests on the idea that successful structural transformation will give rise to increased productivity and higher incomes and positive linkages between different productive sectors. This process of structural change is seen as a progressive shift to higher value added goods or services which requires investment and accumulation of capabilities and infrastructure. Industrialization in Africa has several challenges with regard to customization dynamics in the continent and several challenges related to it mainly driven by global imperatives, leading to an increased concentration of industrial activity specialized in high value added activities and serving international markets. This has increased the inequalities between those sophisticated producers and those less sophisticated.

Manufacturing and low skilled services

Meanwhile, African countries have experienced insufficient industrial growth and some even premature de-industrialization and linkages between manufacturing and low skilled services - particularly these large base of low skilled services - remain very weak. Majority of micro and small enterprises are operating informally, and to a large extent they are disconnected from high value manufacturing activities that tend to be the focus of attention in industrialization. Therefore, expanding and strengthening innovation and technological capabilities in informal enterprises can be a root for bottom-up industrialization.

Features of the informal sector

It affects all countries, but it's highly context specific in the way it manifests in different geographical spaces; some of the features of informality is that it's diverse, even though, often we refer to it as homogenous with a set of activities that comprises multiple activities related to manufacturing services, construction and waste collection. They are largely demand driven and satisfy a demand for low cost goods coming often from low income consumers. Though they generally are very much in tune with the local dynamics, it doesn't mean they're not affected by global dynamics. Imports of cheap products from other developing regions do affect opportunities for informal actors, but the way they operate is very much local. The informal is formal in the African context and it comprises about three quarters of non-agricultural employment contributing a third of the continent Gross Domestic Product (GDP) pre-pandemic. Probably these figures are higher now. It generates a huge percentage of new jobs in various countries. The majority of micro enterprises are informal settlements and mega slums, for instance in many African urban spaces.

There are two sides of informality and often we tend to see it in the light of one or the other. There's generally a skewed perception on either highlighting the negatives - the connection with poverty and low productivity, precariousness of work and lack of social protection; or the positives - the opportunities that it brings to employment and entrepreneurship collaboration skills, development and creativity. There is also literature highlighting the connection between informality and resilience, in the light of COVID-19 and the external shocks that we are likely to experience more in the future. Informal actors don’t operate by themselves, they are part of a system. They are involved in not only informal actors, but also actors of different degrees of formality and informality which exchange goods and services, knowledge and ideas. Thus, it's so important to take up this systemic view of informality rather than something that happens in the margins.

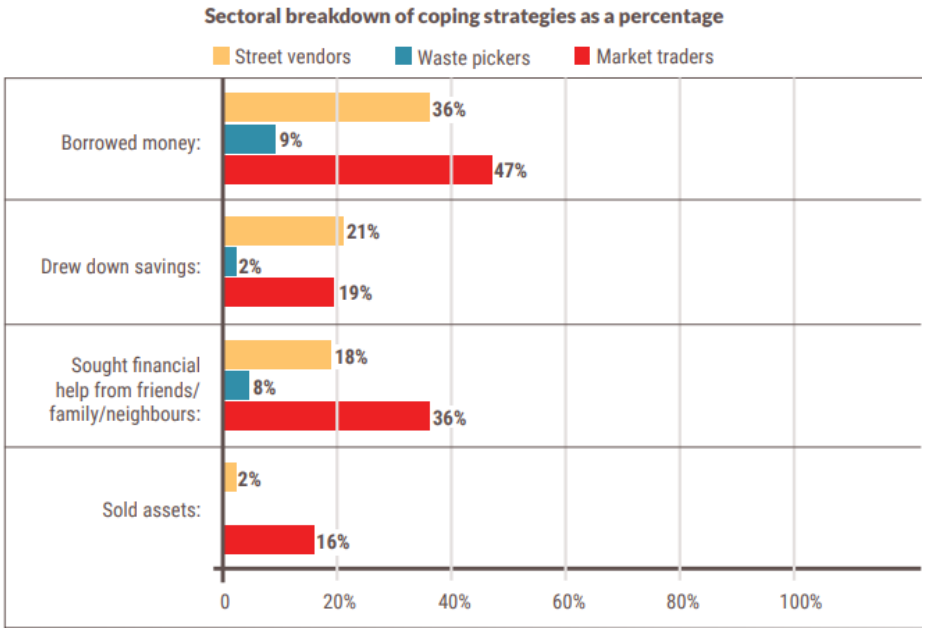

Fig. 8: Sectoral breakdown of coping strategies as a percentage

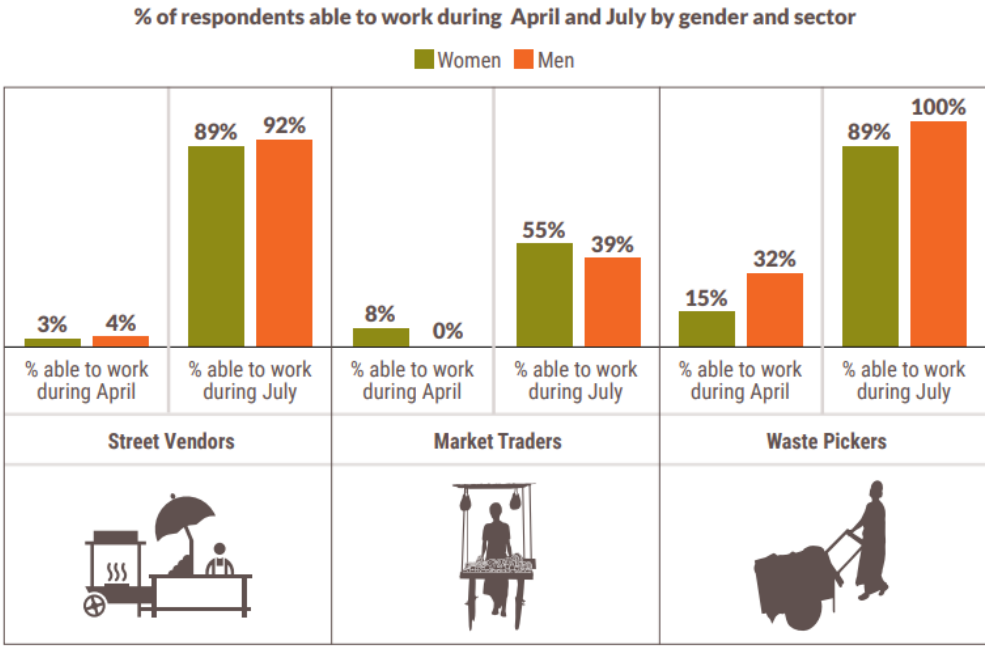

Fig. 9: Percentage of respondents able to work during April and July by gender and sector

Source: COVID-19 Crisis and the Informal Economy: Informal Workers in Durban, South Africa (2021)

The pandemic has had a very severe impact on the informal economy. Most countries went into a lockdown, closing down the spaces where most informal actors operate. Many of them responded with different coping strategies: borrowing money, utilizing their savings, seeking financial help, and so on. It also tells us a story about resilience - how quickly many of them managed to get back to work and this is the line on a survey that was conducted in South Africa. On the other hand, the informal sector have been innovative, which is a testament to their resilience and ability to respond to new realities. Many of the track and trace services in formal settlements were organized locally and informally. One of the strengths of the informal economy is the connection to the social networks. It will be important to draw on these advantages to ensure that the informal economy becomes an asset in the larger process of structural transformation.

Digital Technologies

For the past 15 years or so, African economies have been transformed by ICT. There has been a rapid adoption of mobile phones, internet capacity in the continent, although connectivity is still low. But digital technologies have been a source of dynamism, innovation and entrepreneurship. Many of the solutions that emerged through the pandemic have had to do with the use and adoption of digital technologies. Nevertheless, it's not all positive and there is need for caution with the implications of the adoption of these new business models based on digital platforms. Policymakers should address those negatives associated with adoption of digital technologies, address the basic needs of the informal actors and ensure social protection is offered to actors operating in the urban areas.

Finally, there is need to enhance the contributions of the informal economy, ensuring that innovations emerging from the informal sector are recognized and captured by improving measurements, enhancing and creating local innovation systems. Building non-traditional partnerships and involving formal and informal sector associations with other formal actors in the national innovation system. It is important to ensure new technologies should be adopted by and are accessible by informal entrepreneurs and micro enterprises - particularly digital technologies in disadvantaged areas - and ensuring that digital skills are taken up and widespread in disadvantaged communities to ensure that benefits of digitalization reach the disadvantaged communities.

C. ICT for Africa's industrial development and role of diaspora in Africa's industrialization

Dr. Shem Ochuodho, Global chairman of Kenya Diaspora Alliance; Senior Policy Advisor, Africa

In this presentation, Dr. Shem Ochuodho, Global chairman of Kenya Diaspora Alliance; Senior Policy Advisor in Africa provides an overview of the alliance and it role industrialization within the global frameworks on science technology and innovation and its link to manufacturing and industrialization. The presentation provides a glimpse of remittances from the diaspora, activities and what other roles they play in the continent's industrialization. It also delves into the role of Africans in the diaspora in digital innovation and other development projects initiated by members of the alliance.

Global and Continental Frameworks

Sustainable Development Goal (SDG) number 9, addresses issues on industry, innovation and infrastructure; and for this session sustainable industrialization and leveraging technology. Fortunately, the SDGs are aligned with the African Union's agenda 2063, and in particular, the aspiration number one that addresses the issue of inclusive growth. Goal number 2 in of particular interest, well educated citizens underpinned by STI. In that regard education and STI skills is the priority area. Equally, goal number 4, transformed economies, in particular STI driven manufacturing, industrialization and value addition. The diaspora is a major cog on the wheel of development and brings significant amount as we can in 2006 where diaspora remittances surpassed official development assistance and it's continued to grow.

Diaspora and remittances

The diaspora are either people who do businesses outside the country or own businesses out of the country. For the Kenyan case, there are about 4 million Diasporas outside the country remitting about $3 billion last year. The diaspora comprises of both the host and source country and governments as well as the corporate world work closely with the financial sector in Kenya: the telcos, the fintechs, real estate companies, and insurances. All of them have a major role to play in the four P's: public, private, and people's partnerships. Remittances from Africans in the diaspora stands at about USD 80 billion. So how do we do we tap into the African Caribbeans.

Fig. 10: About Kenya's Diaspora.

Diaspora projects and innovations

The diaspora COVID-19 Task Force has come up with one of the world's best remedy for COVID-19 in which those positive with the virus turn negative within 48 hours and more than 5000 positive cases have turned negative. In terms of technology and innovation, Kenya's prowess in mobile apps, block chain cryptocurrency, artificial intelligence and machine language and robotics are areas Africa need to pay attention to. Other areas like biotechnology, one of the major projects coming out of Kenyans in Boston, the university project where 500 acres of land in one of the rural areas of Kenya have been slated to create 100,000 jobs and also to produce a biotechnology vaccine developed by African diasporas - in this particular case based out of Boston. Also, Africa's first two smartphones, silk, was released three years ago in Kenya by diaspora returnees from the US; in Rwanda, Mara phones, producing mobile phones. Until Africa has sovereignty of technology, it's very difficult to talk of political independence. Economic and technological independence is even much more important.

D. Current Globalization Trends Impacting Policy Agendas for Africa's Future

Prof. Raphael Kaplinsky, University of Sussex, UK

This presentation by Prof. Raphael Kaplinsky of the University of Sussex was based on his book - *Sustainable Futures* - which posits that the global economy is now at a historical turning point. The presentation gives an overview of five major epochs, their characteristics, how they changed the world and their implications on developing economies; and highlights two key developments after the Second World War with implications for the policy agenda especially for developing countries. Finally, it provides insights into the global impact of COVID-19 and suggest ways of mitigating social-economic currently being experienced globally and policy implications for developing countries.

Historical epochs/waves

The first of these epochs was the water power and canals in the 18th century; then came steam technology and royal ways which was followed by heavy engineering, telegraphs and shipping - the communications infrastructure - which enabled national producers to meet global consumers. And the fourth one, which dominated the 20th century was mass production, beginning with Henry Ford's Model T 198, spurred on by the Second World War, the militarization of Germany and the UK in the 1930s and in the UK, and finally the welfare state. The period after the Second World War was called the golden age; a rate of economic growth which was historically unprecedented and was not confined just to the high income countries. It was a period of miraculous widespread growth; but towards the 1970s, mass production ran out of speed and two developments took place which have implications for the policy agenda in the future. The first is that the plutocracy - the rich - grabbed the reins of power in the late 1970s and early 1980s, beginning with Margaret Thatcher, Ronald Reagan and took over the means of protecting people's attitudes; it became social media in later years but it goes much deeper than that. They pushed through an agenda of a neo-liberal agenda of autarky. And what that agenda did was to promote the growth of short term financial sector, which inhibited the capacity of producers to engage in long term investments and long term innovation. The first thing about the collapse of the golden age was the rise of neoliberalism and their capacity to shape the great religion. Secondly, productivity growth fell during the 1970s, the rate of profit began to decline. The corporations reacted by de-globalization taking advantage of cheap labour in developing countries. This decimated the manufacturing sector in the rich countries and led to this overwhelming and substantial growth of the export market and industrialization in China, particularly.

The Impact of COVID-19

The outcome of the rich countries for the atrophy of mass production culminated in the Great Recession of 2008, which was as great as the Great Depression in 1925. The COVID-19 pandemic in recent years has exacerbated all these problems. But the critical thing is not seek to explain the economic crisis in terms of a COVID-19 induced crisis or COVID-19 caused crisis. The pandemic merely accentuated underlying weaknesses in the system. What that has done is that it led to three crises of unsustainability in rich countries. The crisis of economic sustainability, the linked crisis of political unsustainability but growth of populism, the age of rage, which is a good way of describing the decay of life and the erosion of liberal democracy and the unfolding economic crisis. The economic and socio-political and environment are all interlinked. The economic decay gives you political decay; political decay feeds back into

economic decay; the nature of the mass production gives in to an environmental crisis, the environmental crisis feeds back into the unsustainability of economic growth into internationally migration and that fuels again the rise of populist politics.

The current global crisis

The world is experiencing a great crisis which is going to unfold in the future. In this regard, there is need to reorient the finance community away from speculation, away from gambling to supporting the economy, particularly the green economy. Secondly, it is important to unpick the political power of the rich, the plutocracy, who define what is considered to be normality and which tells us that tax cuts for the rich. Thirdly, there is need for a massive commitment to a green economy, which is absolutely critical. The fourth is the need to decentralize of power away from the national state to the regional municipal and local level and conversely, away from the nation state to global governance of their environment and doctrines and pricing. And the last one, in the interest of the rich countries is promoting green development in developing countries in the interests of the rich countries.

Implications for Developing Countries

It is imperative to create a de-globalization export oriented industrialization is not going to be a feasible development route following the Chinese model. Secondly, it is important to strengthen the informal sector because 70 to 80% of all people outside the agricultural sector in Africa are in informalised employment. Third, there is need to recognize mass production economy rolled in Africa will lead to labour displacement because it's labour saving and capital intensive. Green energy provides an opportunity to add value and make production more efficient and solve degradation of our environment. Also, there is need to reorient the informal sector and push them away from this fixation of producing things for the highest income consumers. Green energy and ICTS provide opportunities for improving life in the rural areas, and for improving agricultural productivity at the same time as giving us a regenerated environment are substantial.

As deglobalisation implodes, as the rich countries move inwards, there's increasing scope for south-south trade and south-south cooperation. There is substantial evidence that south-south trade is more inclusionary of poor people and informalised people and is more employment intensive and more just for consumers. Unfortunately, the same evidence shows that south-south trade is not very good with its present form for their environment. ICTs have this massive potential, but it must be rolled out in a systemic way. Finally, there is need for a type of capitalism which is not dominated by large corporations, large technology, large national systems of innovation and focused on the leading edge; a capitalism which builds on the bottom, works with a small scale sector, works with informal sector, works clusters of small and catalyzes this amazing potential which young Africa has to offer.

E. Green Development Prospects in Sub-Saharan Africa (SSA)

Prof. Rasmus Lema, Aalborg University, Denmark

In this presentation, Prof. Rasmus Lema delves into not only the critical role that green energy can play in industrial development but also highlights some of the challenges in adopting this kind of technology; and how it can mitigate against climate change by reducing greenhouse gas emissions. The presentation highlights the value chains that underpin these renewable energy technologies, the process of deploying them and how the government of China has enacted policies enabling the county to become a world leader in green energy and what lessons African countries can learn. Finally, he proposes new policies key of which is the need to change the circumstances around green infrastructure delivery - the process of infrastructure delivery in the green space.

Africa as an importer of technology

The big question at the heart of sustainable development is that there's no simple answer. The development agenda has become much more important than it was 20 years ago, and also that they we are a fundamentally changed world, which creates opportunities but also constraints. With technology available from industrialized countries, developing countries could and often to play only the role of a purchaser. An importer of technology produced elsewhere, reflecting uneven manufacturing and innovation capabilities. However, for many developing countries, this is affordable, it is not desirable; rather, they should strive to develop further technological capabilities, undertake manufacturing systems, systems integration and energy research and development.

Greening Now?

First, the global green transformation is on course and cannot be reversed, it's accelerating. The green transformation is also very costly, all aspects of the green transformation are costly. Although green energy systems helps mitigate against climate change by reducing CO^2 emissions, the cost will rise. And although renewable prices are falling, getting close to parity with fossil fuels, they are still expensive and comes with technical issues with respect to storage and system integration. In this light, should then countries in Sub-Saharan Africa embrace the green transformation, the greening of energy systems? Or should they adopt 'industrialized first and clean up later strategy? Sub-Saharan Africa does not have the moral obligation for cleaning up after the rich world. And also, these expensive green investments can leave space for other welfare enhancing investment...

Windows of opportunity

Sub-Saharan African countries can reap significant economic gains from greening and green growth; and they are reorienting their economies to develop competitiveness for the decarbonized world. In China, the government has been able to create and exploit 'green windows of opportunity' and marching towards leadership in many RE technologies available at the moment and some that are under development. Sub-Saharan will find it very difficult to emulate what the Chinese have done. But nevertheless there are some inspiration for other countries, mainly the degree with which China has taken seriously and used the green transformation as an opportunity for economic development. That takes a completely different form when we are taking about Sub-Saharan Africa.

The process of breeding can still provide valuable experience, industrial development gains, production and innovation capabilities and development of supply chains. The key, though, is to understand much better if and where these opportunities and experiences arise and can be gained. These gains can be reached, but they are certainly not automatic. Are there policies that can be used and strategies devised? One of the key insights from our project is that it is not useful to think about complete renewable technologies; what we need to think about are the value chains that underpin these renewable energy technologies and the process of deploying them; think about the production of these technologies and the deployment. There are some manufacturing elements - assembly of core technologies, and manufacture of peripherals - that goes into the core technologies and systems.

Most of the opportunities in green energy are in the deployment chain in the services elements, engineering procurement and construction elements of these technologies. And this raises a lot of questions about how one can

engage in some of these steps in the value chain and use those dynamics to move into other segments of the value chains. The key to do this is to find a niches in 'attainable functions' that are within reach, that can be acquired within a reasonable time frame and they should be used for leveraging and learning. Thus, it is important to have an in-depth analysis of the value chains that underpin these processes in the global energy change, not least the opportunities for substituting those functions in terms of imported inputs. The energy sector is going to be much more dynamic in the future and can have more opportunities for manufacturing and services in terms of activities and will have more openings for industrialization strategy; but this requires an understanding of how this space moves. And gaining a foothold at an early stage is very important because many of these opportunities are not there at the moment.

Going Forward – Need for Change

One key policy mission is the need to change the circumstances around green infrastructure delivery and look at the process of infrastructure delivery in the green space. Many policies are mainly focused on subsequent green energy delivery part. And that is important because it helps electrify communities, it creates other elements of industrialization. There are many important industrialization advantages from greening and decentralizing energy provision. But there is need to think about the process of infrastructure delivery because this is where most of the learning and supply chain development and job opportunities are required. This requires innovation in Research and Development (R&D) and technology which is important but it requires rethinking the deployment models of renewable energy that entails innovations and policy design, innovation system creation around these technologies, organized social models of delivery and service provision. In terms of directionality, it is important to build on domestic niches and indigenous innovation. The important of context specificity and building on what is appropriate in the context.

In the renewable energy space, distribution, and small scale deployment are used for rural electrification. That's huge market for these types of processes; there are still 1 billion people without access to electricity and reaching those people with renewable energy will be a key agenda going forward with market opportunities out there. However, it will be paramount to focus on local agendas and self-reliance because there are certain advantages and lower thresholds in building capabilities and experiences from outside that can compete and be more appropriate for the local contexts than those from outside. It is instrumental and imperative to distribute industrial gains arising from the green transformation, which is a global public good in the interest of the world and developing countries need to engage in this space.

F. Moderated Session

This session, moderated by Prof. John Mugabe, University of Pretoria, provided an opportunity for panelists to respond to questions from participants with regard to specific presentations on knowledge, innovation and industrialization.

Questions

- Has the pandemic ushered in a critical mass of new innovators to unlock some of the inertia in sustainable local production of medicines, or are we in Africa seeing entrepreneurship only from the same established actors who may revert back to the status quo post pandemic.
- Do we see different innovation ecosystems in this diversity and is there an opportunity to leapfrog these informal sectors?
- Any lessons learned from dynamic African informal transport sector that is now the dominant player in most African transport sector?
- Is Africa dealing with issue of capabilities and investment in green technology?
- Are we well positioned as Africa to contribute to effecting substantive agro-industrial change?

Prof. Maureen Mackintosh

In the last two years, there have been two striking things: one is South Africa based multinationals, Indian and Bangladeshi multinationals in pharmaceuticals moving into East Africa and elsewhere and also high income multinationals have been displaying new interest particularly associated with the money that's coming in for vaccines. The issue is for policymakers is to make sure that this brings true tech transfer to Africa. This involves business models - using joint ventures effectively for tech transfer not simply allowing them to be distribution mechanism for external investors. The Chinese were ruthless in making sure that joint ventures meant true build-up for new platforms; is not clear whether Africa policy-makers are achieving the same. New policies are needed to encourage new investors and potentially new local entrepreneurship. And for that to happen, there is need for much more innovative roles for procurement to build up an effective local industry with new investors.

Prof. Erica Kraemer-Mbula

There are interesting initiatives related to urban development and urban regeneration in the city of Cape Town that has attracted interest of the local government and venture capitalists and technopreneurs including the private sector. It attracted a lot of interest and media attention and was very successful. Then it starts struggling with financial sustainability then funds and interest move elsewhere. It is important to support these initiatives that are successful at a small scale are able to reach a systemic impact and to ensure financial sustainability.

Prof. Raphael Kaplinsky

There are three stakeholders in change: governments, the private sector and non-governmental organizations. Responding adequately to the systemic challenge we face, requires involvement all of these stakeholders in a systemic approach. And that means we have to construct alliances which are not easy because these alliances will require the gainers from change to compensate those who lose from change; for example in the US, 300,000 people are going to lose their jobs in the transition to electric vehicles, which don't require people to make. So we have to find a way of that compensation and they always do it. These three parties have different success criteria from the private sector, whose main success criteria is money; from the state the success criteria is about re-election while that of NGOs is about equity. The three stakeholders have different ways of measuring success and these coalitions will change over time.

Prof. Banji Oyelaran-Oyeyinka

The African Development Bank is keen on developing alliances especially in agribusiness. Special agrozone is built within the area of highest concentration of a particular commodity. For example, if their top three commodities are rice, cassava and cocoa, those will be the top. So we bring all the stakeholders together - big private companies, investors, small and medium enterprises. There is need to build those coalition's to ensure that everybody is on board and that is extremely important.

Part of the reasons for joining the processing hubs to farming communities is that the biggest issues are productivity and low yields in African agriculture and post-harvest losses. AfDB has brought all these groups together. In Sudan, where they used to grow cotton in extremely high temperature (45 degrees) we developed a heat resistant whet because Sudan was spending so much money to import the commodity. Last year, they cultivated 800,000 acres of wheat in that particular area. And the Sudanese government, in the next two or three years, will be fully sufficient in wheat. Same to Ethiopia which has 1.7 million ton deficit of wheat. Last year, they harvested a million tons against through a programme dubbed Technology for Africa's agricultural transformation. It's about bringing different stakeholders together, it's about vision, and it is about leadership, both at the country level and other players and the international community.

Questions and discussions

Participants posed questions to the panelists some of which are outlined below:

- In 2020 amidst COVID-19 Kenyans in the diaspora remitted more money compared to two sectors, tourism and industry. What does that tell us in terms of innovation and industrialization?
- In addition to electrification, which has received significant attention in Africa. Are there important opportunities in the heating market for technological and enterprise development in Africa, particularly in the agro industrial sector, for instance in the bio based co-generation?
- Have we looked in details the mix of formal and informal relationships - employment finance, access to technology - that characterize the important middle sized family farms?

Dr Shem Ochuodho

Remittances did actually exceed two times what Kenya has been earning annually from tourism – which is about $1.2 billion - remittances was three times that and even from agricultural exports the major foreign exchange for Kenya has been agricultural products: tea $1.2 billion, horticulture $1 billion and coffee about $400 million, a total of about $2.6 billion. Diaspora remittances was more. There other activities that Kenyans in the diaspora have been implementing. One good example, in is in Kisii County, where a team of Kenya Diaspora Alliance have set up a factory relying mainly on bananas by producing 10 different products from banana, including banana jam sanitizer, sopa wine, hair wigs and employing 100 people. The Kenya Diaspora Alliance aims to build a network working with about 10 different county governments. Kenya's administration has prioritised industrialization; the current administration's for Big Four agenda: food security, universal health coverage, affordable housing and industrialization. There's a major focus on industrialization as a means of tapping into the diaspora capital. The Alliance is working with accelerators, including a commercial banks that are interested in leveraging diaspora resources.

Diaspora resources go beyond just financial in terms of intellectual capital. The world's Academy of Sciences launched a report on scholarly global publications two years in Kigali Rwanda found that Africa's share was only 2%. The question being raised was where are Rwandese professors? Of that 2%, 7% came only from two countries - South Africa and Egypt. So where are the Nigerian doctors, the Kenyan engineers and other countries? Why are they not publishing? The question was then turned around: why are we just focusing on the 2%? Why don't we look at the 98%? We need to change the narrative of the 98%, whether it's German or Chinese or Japanese; how much of this is African? It's reported that there are more Nigerian doctors in Texas State in the US than they have in Nigeria; more Ghanaian doctors in Manhattan City than in Ghana. The average Kenyan born in the US is more educated than the average American; the average Kenyan born in the US has got a second degree. How can we tap into this African capital in the diaspora?

Prof. Rasmus Lema

The linkages between agro industry and the biomass sector. Industrialization strategy, is very much about inter linkages, where there are activities that are generating forward backward and horizontal linkages. And this is exactly one of the various production linkages the agro industrial sector. All of the waste products produced out of the agro sector can be used in the biomass technology to create electricity. Biomass technology is quite simple. However, most of the technology is sourced from India and China but in principle that technology is potentially worthy acquiring. Then main activity is really not about core technology of the biomass, it's about the entire construction of the plant. This ties in with a discussion about opportunities in engineering, procurement and construction, which is areas where capabilities can be gained and local competitiveness can be achieved. How do we counter delocalization trends in technology space? Countering those trends requires being aggressive and strategic about localization policies which are absolutely essential to make sure that it ties in with local needs but also making sure that all the elements that can be procured locally should be procured locally.

How should we be strategic about the localization policy? One very important element is about changing the bargaining power relationship between local users, typically the local governments and foreign producers. Some of the cases that we have been studying have been negotiated on an ad hoc basis, not least by the Chinese. So there's no systematic framework for evaluating different projects, and that really changes the bargaining power in favour of the producers. The question is really how much can we get away with in terms of local content which is controversial but nevertheless part of the grander and bigger scheme of things in terms of distributing the gains. But the question is really about how to design these local content policies for how long should they be in place; and which elements of the manufacturing and service process should we have in place.

Day II: Renewable Electrification and Industrialization in Developing Countries: New Pathways

X. Session I – Opening Remarks and Keynote Speech

Dr. Margrethe Holm Andersen, Senior Advisor, Aalborg University, Denmark

This session is based on Innovation and Renewable Electrification in Kenya (I REK) project and highlights of the study related to the project which will be published as a book. All presenters are contributors and a participants in the IREK project. Prof. Rasmus Lema from Aalborg University covers the introduction of the book followed by a panel discussion with three presentations and discussions. The first panel discussion focuses on how to build local capabilities for sustainable industrialization through renewable electrification which is the main topic of the whole book; the second panel discussion is concerned with policy issues and how to design policies that could help improve sustainable industrialization through renewable electrification.

IREK Project Video link

XI. Building Innovation Capabilities for Sustainable Industrialization: Renewable Electrification in Developing Economies

Prof. Rasmus Lema, Aalborg University, Denmark

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In this presentation, Prof. Ramus Lema highlights the key themes in the IREK book: Renewable electrification and sustainable industrialization. It provides and overview of renewable electrification and answers key questions relating to the subject matter: how does renewable electrification contribute to sustainable industrialization? To what extent, where and how does it occur? Under what circumstances does it happen? And how do we shape the renewable education pathways to maximize sustainable industrialization outcomes? The presentation also highlights the three key themes in the IREK book and briefly discusses the key findings and recommendations on renewable electrification deriving from the IREK study.

Renewable electrification and sustainable industrialization

Renewable electrification includes both the creation of access to electricity to formerly non electrified communities but it also includes transformation of existing energy systems with renewables. The first part is an on-going process across different countries in sub-Saharan Africa, while the second part is about transformation and breeding of existing energy systems. Sustainable industrialization has a double meaning; on one hand it is industrialization which is environmentally friendly, adhering to the planetary boundaries or helping to better humans. It is also a type of industrialization which can be sustained in the long run, not just capabilities that are only useful for short term but do-able in the long run. Sustainable industrialization activities contributes to restructuring of the economy in a way that we think about as industrialization and conventionally thought about within that term.

In respect to the above, innovation capabilities are key not only because you need certain levels of capabilities, production and innovation to participate in industrial activities but also because those innovation capabilities need to go in certain directions. In both of these cases, it's about the dynamic directionality of capability building. The main question is how does the former contribute to the latter? How does renewable electrification contribute to sustainable industrialization? To what extent, where and how does it occur? Under what circumstances does it happen? The key here is how do we shape the renewable education pathways to maximize sustainable industrialization outcomes? That is the key research question?

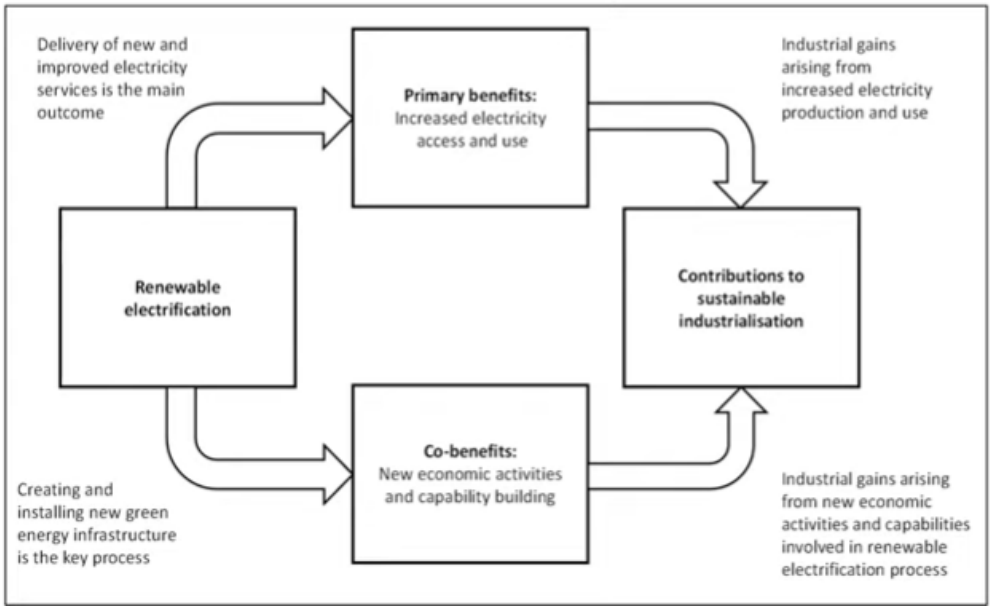


Fig.11: Economic co-benefits

Scope of the IREK project

The project collected evidence mainly from Kenya but also from other countries: Ethiopia, Uganda and Tanzania. This focused on renewable energy and have most material on solar and wind energy. This also included information on geothermal and hydro and other energy sources and the link between renewable electrification and sustainable industrialization in two ways: primary benefits and co-benefits. Primary benefits are when you electrify communities, formerly non-electrified communities. This means increased electricity access and use and that can produce industrial gains arising from increased electricity use; this comes with various downstream implications of that in terms of additional manufacturing activities and other productive activities, something which is particularly relevant in societies with ongoing electrification processes and not so relevant when you have fully electrified countries. Focusing on the process of renewable electrification creates new economic activities and capacity building which produces industrial gains. And as you learn from these activities, produce supply chains and create jobs.

Key themes

The first theme in the IREK book is project design, organization and linkages. Renewable energy is typically a project based activity and projects have different anatomies. How are local access involved? How much local content is provided? What's the nature of that content? What's the nature of linkages between local and foreign actors? And to what extent do they include elements of knowledge transfer and capacity building? The second theme is about the deployment model and the choice of technology. Renewable electrification involves different types of technology, some of the core technologies are solar and wind but also different modes of deployment. For instance, do we deploy it in a centralized or decentralized manner? How to characteristics matter for those associated opportunities and outcomes in terms of local industrial activity and capacity building in and around these projects? The third theme focuses on the role of policies and political access. There have multiple policy domains involved both local and global scale that are relevant to the processes. What policies are in place to foster sustainable industrialization gains arising from electrification? How do they affect the realization of these outcomes? What opportunities and obstacles are important for maximizing these outcomes?

Key Findings

Findings from the IREK study reveal that most projects on renewable electrification are foreign dominated and offer less strategic local involvement with little room for significant local participation in higher value and learning intensive activities. The main economical co-benefit - in most cases are jobs - directly involved but temporarily in the construction phase; and local learning by doing is limited in most projects. Secondly, projects with less capital intensity and complexity provides better economic co-benefits such as supply chain development and learning. In this case, the choice of technology matters in terms of deployment model and choice of technology, but the choice is also about organizational modes of how you will design the electrification process. In addition, limited attention is given to the economic arrangements for deployment, most of which is given connecting electricity to rural communities and getting on new projects to the grid. Meanwhile, there's unequal policy attention to different elements of the process, different technologies that influence both deployment levels and also importantly the industrial gains that can be reaped from this. Thus, deliberate policies are rarely formulated and implemented effectively. However policies for larger, local involvement and linkage creation, in particular local content, is becoming more pronounced but not being fully implemented and enforced. This is due to capacity deficiencies and external competition.

Session II – Building Local Capabilities for Sustainable Industrialization

XII. Why Project Design and Organization Matter for Local Capability Building?

Dr. Rebecca Hanlin, ACTS, Kenya

This presentation by Dr. Rebecca Hanlin focuses on where a firm is located in the project, at what stage of the project, the degree to which that matters and how the firm's activity within the project develops capabilities and leads to some level of value addition or upgrading. It presents some of the findings of the IREK study and how similar projects can build long term skills and local capabilities.

Focus of the IREK project

The IREK project set out to find evidence of different types of skills, different types of capabilities: whether those were new physical technologies; whether there was new knowledge being introduced into the firm; evidence of core competencies - the degree to which firms function as an EPC contractor, whether they're involved in the engineering, procurement and construction as a single piece of work or as a combined activity and also the ability to leverage new partnerships on the back of the work that they've been involved in. This is key to understanding the longevity of the capabilities that are built and their ability to use those to develop backward linkages into the economy. The study also looked at different types of upgrading that had occurred - increasing efficiencies in installation processes, changing the type of product they used or evidence of functional upgrading – moving to a whole different set of activities of chain upgrading were firms move into different areas of business.

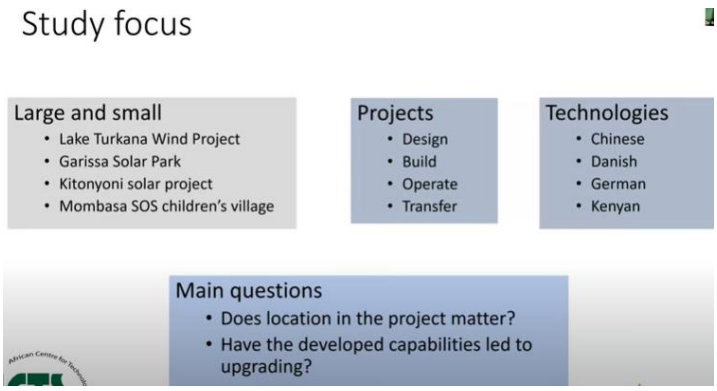


Fig. 12: Study focus for local capacity building

Major Findings

The study found that location in the project mattered a great deal, especially in large scale projects. Firms that were only involved in construction and build stage ended up building skills and capabilities that were routine. There were some exceptions where firms took the opportunity and upgraded - functional upgrading. What mattered most was who managed the project and how the project was managed. Specifically, findings show that there was a lot more work that needs to be done, a lot more research that needs to be conducted on the value of having an EPC style contract and not just EPC. There is also evidence to suggest that having more local involvement in who manages these projects is important for understanding and ensuring that long-term skills and capabilities are built. In addition, especially in small scale projects, a number of firms involved in this project used their experience to develop EPC capabilities, sometimes in the space of only about three years. But where it really matters is those that had the ability to manage the project and how it was managed. If done well, it determines to a great extent the degree to which local companies are involved and how they're involved in the project. The study also found out that where there was more local ownership and management of projects, there was more involvement of local firms. To encourage this in new and future project requires a set of skills that we don't have in abundance yet, particularly project management and the skills at the front end of projects at the design stage.

Take-away Points

There needs to be a critical base skills, created from investing in projects. And these projects can do more than just ensure access to clean energy. What's really needed is to ensure co-benefits from access to clean energy projects to ensure there's more recognition of innovation in projects, notably the need to encourage innovation in areas that currently lack innovation. Most firms, especially in large scale projects, were only doing business as usual; they weren't really innovating. They might be quite entrepreneurial in what they're doing, but they weren't necessarily innovating beyond bringing in new skills and buying new equipment. There is also need to recognize that innovation occurs through linkages and partnerships and these should be facilitated through effective project management. In addition, some projects were much more effectively managed than others which led to opportunities for firms to functionally upgrade and conduct other value added activities that weren't there in those projects that are less well project managed. As a result, this means there is need for much more attention placed on critical project management skills training. In many cases, particularly in the Kenyan context, companies were able to utilize skills in the form of human resource that was available in the country in the area of engineering because Kenya has quite a good base level of engineering graduates. There seems to be lack of set of project management skills, which is also something that comes with experience. Thus, having the ability for firms to do more project management and get more involved in the project management of these renewable energy projects is key.

XIII. Are Capabilities for Renewable Energy in Place? A Kenyan Firm Survey

Dr. Charles Nzila, Moi University

This presentation by Dr Charles Nzila focuses on the IREK project activities and the learning and development of capabilities. The presentation focuses on which capabilities are in place and where are the shortfalls? To what extent and do renewable energy technologies influence the development and deployment of these capabilities? And which developments should be pursued? It describes the analysis framework used to examine the capabilities in renewable energy projects in Kenya whose key planks include the types of technologies, dimensions of capabilities, key indicators and the corresponding metrics. It summarizes the levels of project capabilities, dependence on foreign actors with regard to financial design, planning servicing and supplemental capabilities.

Analysis of capabilities

Improved and sustained access to cleaner electricity is basically central to Sustainable Development Goals (SDG) number seven. The process of renewable electrification largely depends on finance and technology. However, availability of the requisite capabilities for deployment and use of the technologies is equally vital. Based on this, studying the capability pathways, shortfalls and directions and their respective outcomes with a view to linking the findings to capability permission and implications on the Kenyan energy sector is paramount. Capability refers to the competitive capacity to accomplish our mission based on the deployed strategies, competencies and resources. The key themes in this chapter are a multifaceted intervention, multi-sectoral analysis, enabling environment and models, capability accumulation and results based view vs task based view. The study analyzed the capabilities in renewable energy projects in Kenya using the framework which disaggregates the main technologies: dimensions of capabilities, key indicators and the corresponding metrics. Each of the capability dimension was analyzed based on the specified indicator by defining some specific metrics which can be used to show or bring out or tease out that specific indicator. This capability framework was operationalized by means of a survey. The survey looked at the deployment of the capabilities in five renewable energy technologies - small hydro, wind, solar, geothermal and biogas; and five steps in the value chain - project initiation, planning, implementation, monitoring and evaluation, follow up and closure. The sample frame was based on 102 firms from which we picked 94 firms for our sample size. The response rate from our survey was 76%.

Key Findings: Aggregate Analysis of Capabilities

Involvement of local actors in our renewable energy project value chain activities was evident, even though it was skewed pedagonally. Roughly 40% of all the firms are involved in all the project activities. The bar chart on the right (**figure 13**) illuminates, from an aggregate perspective, the types of capabilities and the levels of their manifestation. The orange part shows the firms which had high capabilities; they were not depending on foreign actors for the respective capability dimensions - financial design, planning servicing and supplemental capabilities. The purple part shows the level of the firm's dependence on external actors for the respectively stated capability categories, and the middle segment (blue) gives the moderate and dependence on foreign actors for the respective capability categories. The survey looked beyond capabilities and examined learning and development of the capabilities, benefits and outcomes and influencing factors. There is active involvement in most of the project lifecycle but it is quite clear there is a dependence on external agencies during project execution. Also, local sourcing of business and development services is evident and outsourcing of project finance and technology was noticed.

With respect to learning and development of capabilities, there are many accomplishments which has been added endogenously especially in the geothermal sector but minimal cooperation was seen across projects. Also, there was an obscure repository - little or minimal involvement of research institutions to document these lessons learned, which is an area of concern. If local actors don't pay close attention to the phenomenon of energy production from a process perspective, for instance, by being actively involved in the project value activities and attendant capabilities, then delivering industrialization based on energy as a product is likely to remain a vision.

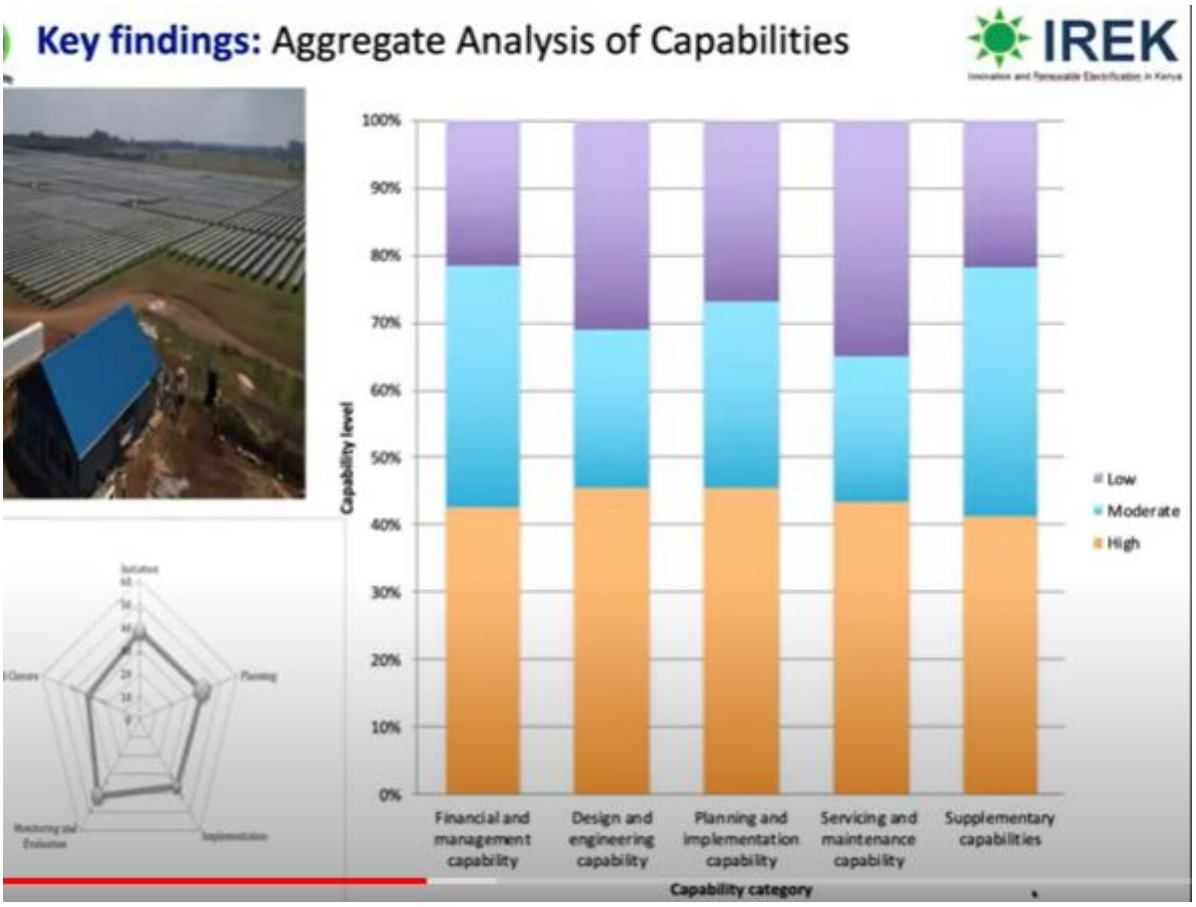


Fig. 13: Key findings on IREK Study

Key Take-away

First, in Kenya, the renewable energy landscape is dominated by high deployment of the related capabilities but there are areas which have bottlenecks, with low capabilities and as well as the weak deployment of this capability. There are some learning opportunities that have been announced to drive and grow their capabilities, but it is noticeable that the national guiding policies remain largely passive. Also, minimal diffusion of expertise - learning and development of the capabilities in most small scale renewable energy projects - continue to depend on external actors; and this calls for paradigm shift where we have more local active involvement in the entire project lifecycle, reduced dependence on external actors on the renewable energy value chain and targeted development of local capabilities. There is need for deliberate strategies for inserting local actors in global value chains, for example, through implementation of service contracts where local actors are playing in local projects.

XIV. Foundational Capabilities in the Off-Grid Solar PV Sector in Kenya and Tanzania

Joni Karjalainen, University of Turku, Finland Futures Research Centre

This presentation by Joni Karjalainen provides insights on why the renewable energy sector is quite a dynamic, for future expectations as well as technologies and the dynamics of innovation. Secondly, it highlights the role of foundational capabilities that seem to precede any subsequent developments with a low carbon technology or number of technologies.

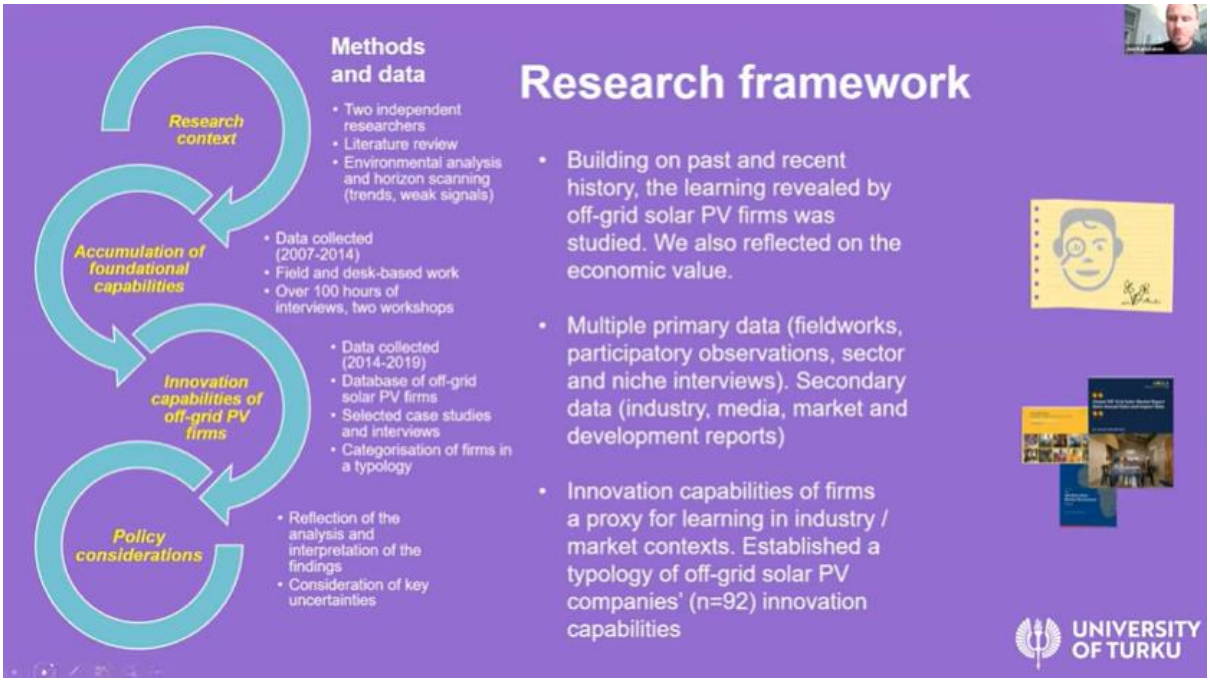


Fig. 14: Research framework on Foundational Capabilities in the Off-Grid Solar PV Sector in Kenya and Tanzania

Study background and context

The study aimed to draw on the innovation capabilities of firms, which were more or less treated as a proxy for learning in industry or market contexts. Solar power and solar energy are not new and can be traced to as early as late 1970s or the 1980s at the latest. However, during that period, the markets which we have today were far from existence, although there might have been early pioneers who already saw some of the potential of these technologies. In the subsequent decades in the 90s and early 2000s, there were quite a few domestic as well as internationally driven interventions to the adoption of solar PV which enabled the establishment of technical skills, knowledge, actor networks, different partners and actors learning with one another about the technology and coming into terms with many qualities and features. In the 2010s, there was considerable evolution of the pioneering markets with technology from the solar home systems markets and the growth in the adoption of solar lanterns. Other types of niches, more sophisticated technologies and finance innovations come into play, especially with the introduction of a pay as you go model. Why this is important is that we could observe the growth in finance and the 2010s (the yellow bars), we can see a growing number of finance being driven and targeted to the sector. And it seems that because of some of these foundational capabilities and some of the innovative dynamics, there is increasing international appeal to promote the ventures in this sector through finance both from development, social impact driven as well as venture capital.

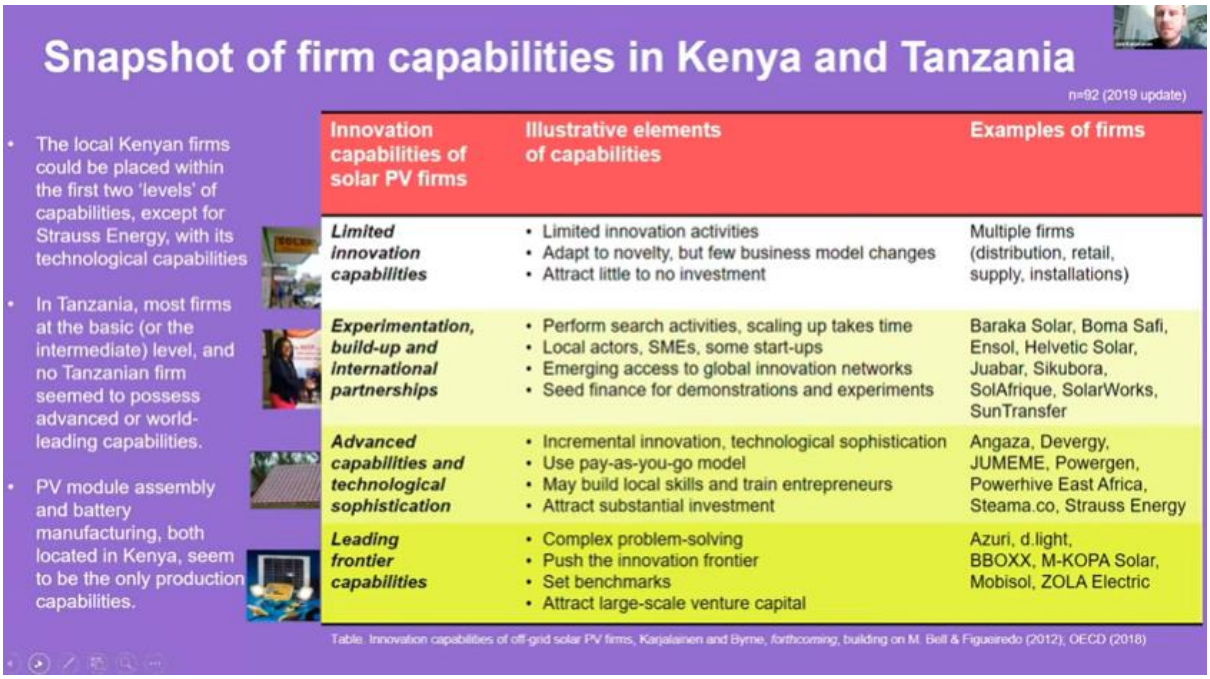


Fig. 15: Firm capabilities in Kenya and Tanzania

The study draws on the theory of innovation capabilities to think of the types of capabilities needed in the sector and specifically focused on the firm's that are active in this more market aligned context. In **figure 15, the** first row shows the types of capabilities, indicating quite limited amount of innovation activities. Then there are actors that seem to perform more experimental innovation efforts that have received and are able to attract some sorts of seed finance for different types of experiments. At the third level, there are firms which have been increasingly technologically sophisticated. And finally, there also seem to be firms which are really leading - thanks to their advanced almost frontier type of capabilities -performing complex problem solving activities. It is essentially these last types of firms also which seem to be able to attract the largest amounts of commercial venture capital. It should be noted all of these types of firms are needed in the market; they serve complementary roles and might serve different types of clienteles in different contexts but they all form part of the sector or the niche.

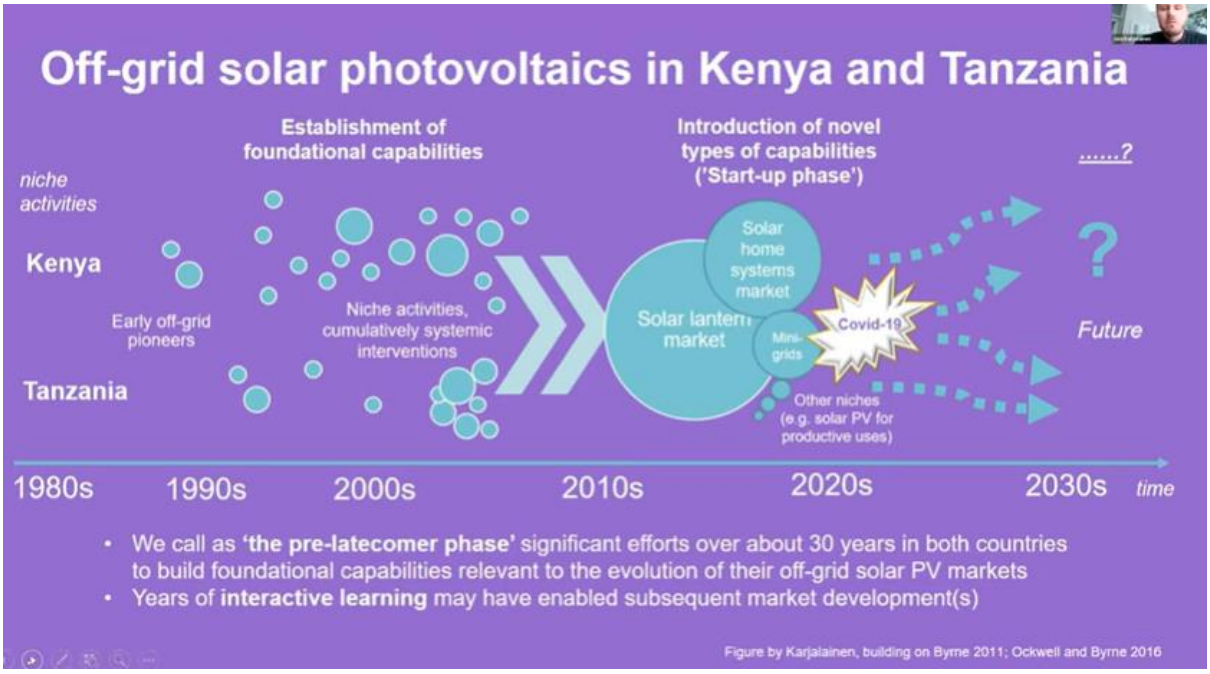


Fig. 16: Off-grid solar photovoltaics in Kenya and Tanzania

From the perspective of capabilities, it was noted that many of the local firms could be placed within the two first levels of capabilities, except for one Kenyan firm that seemed to have technological capabilities that were more advanced than some of the other firms.

So what next?

There has been an evolution of the markets by rapidly growing amounts of finance and a number of software startup firms. COVID-19 has had an effect on this sector as well and also other dynamics might have a role to play when thinking further into the future and the types of interactive learning that might be needed. Findings from the study show that development of foundational capabilities precede any subsequent developments; it is important to learn countries where such developments have not taken place. It is also important to encourage the types of efforts that help firms and the sector as a whole to advance and acquire more complex capabilities, and especially those that serve sustainable industrialization.

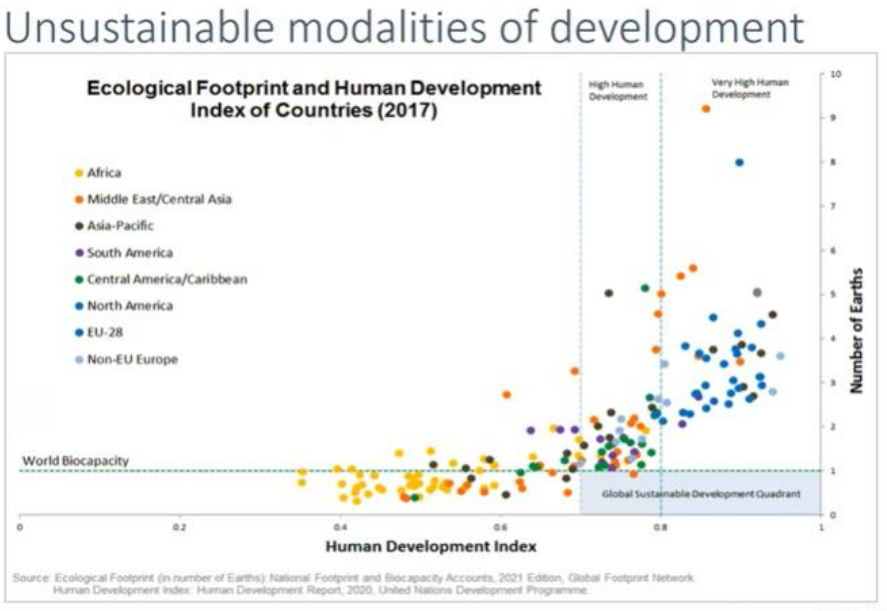
XV. Discussants' Interventions

Prof. Erika Kraemer-Mbula, University of Johannesburg

In this session, Prof. Erika Kraemer-Mbula, sheds light on key points on renewable electrification who offer insights on the opportunities and challenges relating to building local capabilities for sustainable Industrialization with respect to renewable electrification. She draws parallels between science, technology and innovation with enhanced well-being and life expectancy and the crucial role renewable energy can play in mitigating climate change.

Adopting renewable energy

Developing countries, particularly African countries, can easily leap frog to renewables - moving from the current system which is very much fossil fuel based. For instance, South Africa over 80% of electricity comes from coal. How can the country switch from fossil fuels directly to more renewable energies without passing through that intermediary state of building up a huge electricity infrastructure based on fossil fuels? COVID-19 may accelerate the focus on the move to renewables; however, financial constraints have limited the progress of adopting renewable energy. Several candidates on stage lack funding and support to continue developing to the stage that we need them to be. This challenge of leap frogging is particularly important for African intrinsic with its development pathway.



Source: UNEP

Fig. 17: Unsustainable modalities of development

Figure 17) shows that it has not been possible to marry the objective of improving people's well-being and environmental concerns. Countries that have managed to reach very high or high levels of optimal development have done so. And science, technology and innovation are the main drivers of this explosive development in many of these countries that have increased their life expectancy, education and well-being of the population; but also has brought many environmental negative impacts and or haven't managed to mitigate them. The key concern is focused on the bottom part of the sphere, which is that side where most African countries are sitting (yellow), which are still operating within the earth biocapacity but are very far from reaching these levels of human development that we desire. What kind of innovation and technological capabilities are needed for African countries to shift horizontally - into this graph - without having to go through the environmental degradation that others have done before us?

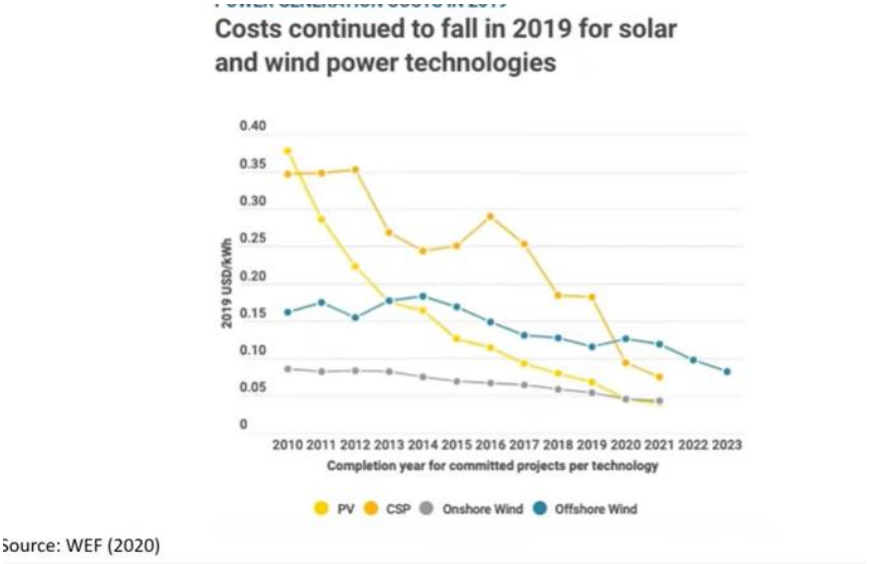


Fig. 19: Decline of costs of solar and wind technologies since 2019

Renewable energies have become increasingly competitive in recent years and more affordable. **Figure 19** shows the decline in some of the technology cost has been significant. For instance, between 2010 and 2019, the cost of large utility scale solar photovoltaic projects fell by 82%. The time seems to be right and many factors seem to be in place for us to take it very seriously. The importance of the complimentary capabilities, the sequence of capability - how to move up the capabilities escalator. Kenya is essentially a user or consumer of renewable energy technologies that are developed elsewhere.

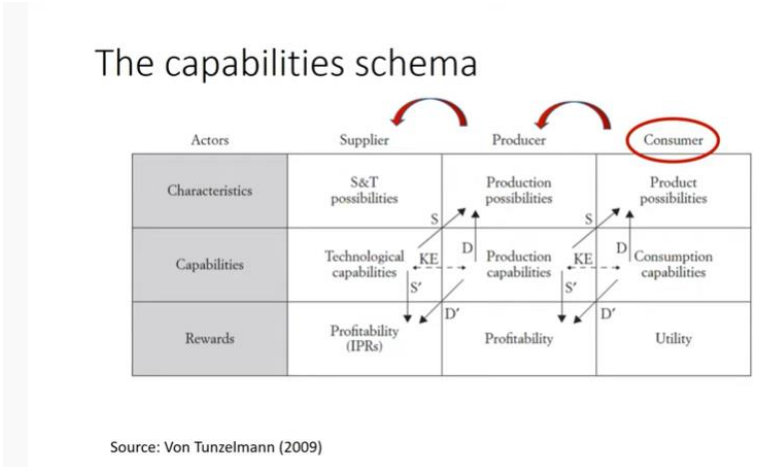


Fig. 20: Capabilities Schema

The capabilities of users of technology are not disconnected from the capabilities of producers or suppliers of this technology. The project that is discussed in this set of papers or the projects/cases that are captured will be located on the consumer - side right of this figure – explains how productive activities are part of the capabilities of the producers which are aligned or matching the capabilities of their consumers and their set of arrows that connect the production capabilities with product possibilities and similarly the technological capabilities of the suppliers of those that own the IP also have an impact on the performance of the possibilities for production and then manifest on the on product facilities for the consumers. The double arrows in the middle **(Figure. 20)** are connecting directly talking about knowledge exchanges that have consumers and producers and suppliers and that these are interconnected. It is important to be mindful of breaking away from this idea of passive users of technology and disconnected users of technology and the idea that building the capabilities of consumers or users of this technology, connects with a broader set of capabilities at the level of producers and suppliers. So it's a bigger picture of capabilities that we must have in mind.

With regard to policies linking this to issues around directionality and developmental states. A developmental state should be a key player in setting the direction of development in the context of energy transitions in Africa. At the level of renewable energy technologies, it is important to consider the connection and the alignment between those capabilities we find at the ground level or at the application level and then at the level of governance. Are they connected? How are they connected? These are questions to take into account. Looking beyond technological capabilities to a broader set of capabilities raises the need for looking at policy mixes and the growing complexities and pressing challenges of sustainability have pushed governments to rethink policy mixes and innovation, which is something that has gained popularity but difficult to implement.

Finally, is there a relationship between domestic capabilities to deploy and - perhaps even produce renewable energy technologies - and the capabilities of public sector to guide and align these efforts needed for innovation system that takes us to the direction that we want to move in.

XVI. Questions and Discussions

This session provided an opportunity for panelists and discussants to respond to questions and comments from participants on local capabilities for sustainable Industrialization with respect to renewable electrification. The key questions are outlined below:

- Innovation is a lung of socio-economic development without which no one can breathe in and out. However, it cannot be effective without practical policies and institutional enforcement. Therefore, how can we negotiate and suit them to the changing world in the context of Africa?
- Renewable, electrification is not the same as rural electrification. Is there a danger to confuse the two? What is your experience?
- Several agencies and institutions have been working on renewable energy in Kenya since early 1980s and as of course has been included in that research. How do we ensure that we are learning from and building on these foundational experiences?

Prof. Ramus Lema

Innovations are not being implemented because they require capabilities to implement. The issue is not just rolling out existing technological solutions because that will solve the climate change problem. Using existing technologies means going into a fixed direction process and not just using existing solutions. And that ties very closely with state capabilities. It is important to think about the end users: consumers of electricity, new electricity sources or electricity sources that are being reinvented. The issue is about user-producer interaction and government agencies, because they're professional users and upgrading the capabilities of those professional users are central. Thus, the power balance between the professional users, the sub-Saharan African governments and the perfect producers - the large multinationals around the world – shows that there's an unequal power balance in that relationship, which means that the outcomes are really not what they ought to be.

Dr. Charles Nzila

The difference between rural electrification and renewable electrification is that one is supply oriented and the other one is production oriented. Rural electrification is the supply of electricity to rural and marginalized groups, who are not mainly supplied by classical grid power. Renewable electrification on the other hand, is the production of that electricity using renewable resources. Our research in IREK is on production of electricity using renewable resources.

Dr. Rebecca Hanlin

Procurement policies are impacted by the degree to which you have local content rules in place. Research findings show that procurement was impacted by local content roles and not by who managed the project and how the project. Also, how the project was managed was also a key factor in determining which firms are involved in projects and how those firms were involved in projects. The more there is local management of the project - particularly in small scale projects – the more local management through local firms having the Engineering, Procurement and Construction (EPC) contracts and managing those EPC contracts. However, depending on who and how large scale projects were managed, that wasn't necessarily the case. Thus, procurement policies in and of themselves and the degree to which they interact with local content rules is not necessarily the single thing that needs to be looked at. There were a number of different questions around local capacity and the degree to which local capacity or local firms and local jobs were created and who is involved. Small projects had much more opportunity for local involvement than large scale projects, which leads to long-term sustainability of industrialization. So while small projects will increase inclusion, it is not necessarily going to boost sufficiently issues around durability of industrialization pathways.

Joni Karjalainen

Renewable energy epitomizes niche development, divergence, technological convergence and digitalization in a really modular form and one could make that claim or the argument that in some ways, they also represent the seeds of a shifting paradigms, shifting contexts and shifting times that speaks to this aspiration or a different kind of a future. At the same time, when we claim that the assumptions for the types of energy use or products and services or that developmental state may be shifting, it raises tricky questions on what kinds of capabilities are needed. What joint understanding would align the public and the private sector better so that they would not fight with each other?

Session III: Policies for local content, capacity building and sustainable industrialization in developing economies

XVII. The Importance of Local Content issues in Fostering Sustainable Industrialization

Dr. Ann Kingiri, ACTS Kenya

In this presentation, Dr Ann Kingiri focuses on the motivation for making policies that promote capabilities related to renewable electrification; what we understand by capabilities and local context requirements; the gaps and opportunities in the IREK study, particularly when looking at the historical evolution of Kenya's energy policy process and reflections on what needs to be done to enhance local content requirements and capability focusing on sustainable industrialization. It also discusses the necessary policies required to foster local capabilities.

Motivation for making policies on renewable electrification

There is an increased number of firms, especially those dealing with off-grid which is actually a motivation not just for policymakers but also for researchers focusing on innovation and development in this sector, which encourages stakeholders to actually look at renewable energy from an transdisciplinary perspective. The IREK research study analyzed the Kenya's energy policy process through the lens of local content requirements and also through the lens of capabilities. The study employed qualitative approach by administering a survey and also had some interaction with the key stakeholders to get their perspectives about that particular process.

Local Content Requirements and Capabilities

It is important to note that renewable technologies contributes to three main aspects: political, social and economic and how this can be translated through the process of enhancing technology transfer, creation of new industries and profusion of jobs for local people. This can help improve capabilities to local firms and or by the private sector. It also protects local firms while accumulating necessary capabilities to a level where they can actually compete with other companies locally or internationally. That is what is perceived to be local content requirements, which has now become an industrial policy tool that binds foreign investors and companies to support young, local industries or young local firms to build capacities they need to be able to compete. Local content focuses on the use of local expertise in development of both national and other capabilities at the firm or at the individual levels or focusing on enhancement of the economy. The IREK research study analyzed policy instruments focusing on energy and concluded that in the early years of the policy process, focusing on social and economic aspects but minimal considerations on local capabilities. After 2014 to date - now there is an Act of Parliament - the process provided for incorporation of capabilities in different forms: local capacity, taxes, licensing, rules/regulations and qualifications and experiences – what can be considered to be some policy milestones. However, capabilities are inadequate in both the solar and wind sectors, enough to steer sustainable industrialization. There is need to focus on the capabilities which are lacking: operations and maintenance, particularly in the wind sector.

Relevant policies

Participation in the policy process is critical particularly for researchers who can generate the needed evidence to inform decisions. The new Act of Parliament, which provisions for local content requirements is a window of opportunity for researchers and policymakers to enhance the needed capabilities for local firms and local manufacturers. Meanwhile, collaboration will remain critical in this sector and it should be promoted in the context of enforcement of local content requirements in addition to other forms of human related capabilities. In addition, different stakeholders have different ways of understanding this concept. And that is very key especially when it comes to creation of the needed awareness among all the stakeholders especially capacity building and information sharing. Evidence for influencing policy change is also critical and so is timing: when do we engage in the policy process? Finally, sustainable industrialization can only be realized if we can create a conducive policy environment that would support capabilities on one hand as well as collaboration on the other.

XVIII. Policies for Appropriate Pathways in Energy and Sustainable Industrialization

Faith Wandera, Moi University and Ministry of Energy, Kenya

This presentation by Faith Wandera focuses on the state of learning, innovation and capability development with focus on Sub-Saharan Africa, East Africa and Kenya. It outlines the gaps identified in the innovation system and technological challenges facing the sector in sub-Saharan Africa and delves into pertinent issues relating to renewable energy especially small wind sector in Kenya and implications for policy.

Technological Challenges

Questions have been raised as to whether renewable energy is really the solution in the 21st century; but the main argument has been focusing around the kind of the waste generated from renewable energy technologies. Also, renewable energy in off-grid areas owing to the lack of infrastructure for conventional energy sources. Sub-Saharan Africa mainly trades in unprocessed products attributed to low levels of technological learning and most R&D institutions are engaged in agriculture rather than manufacturing; supply of modern steel is inadequate and our physical infrastructure is weak. In East Africa, it's more or less similar; operational capabilities needed to compete internationally and simple technologies are still lacking. In Kenya, we find that mostly informal sector, small businesses focus on introducing new products rather than processes and they have a weak innovation culture. A survey conducted by IREK in 2016 indicated that the capacity building is done in the wrong places: people attend wrong courses and even after training they are not tested competencies gained on issues such as project implementation which could stimulate demand for renewable energy technologies after the training.

There's a lack of political will to support training and limited technical capacity with outsourcing of personnel for major contracts on almost everything, particularly for wind. There is also political interference and inadequate intellectual property rights at the local level to protect international patents. The survey also identified gaps in the small wind innovation system in Kenya. Using the technological innovation system approach, it was established that the technological innovation system for small winds is quite weak in Kenya. Having assessed all the seven functions of the technological innovation system, it was found that all of them rated less than two, on a scale of zero to six, where zero stands for non-existent and six as very strong. There is also limited availability of data for developing small winds systems and a lack of technical expertise to analyze the data. at the data collected in 2010 on wind energy between 20 meters and 40 meters has never been analyzed up to date and, therefore, it is not known whether this data is useful for developing small winds or not. Thirdly, there is no incorporation of wind in the 26 mini-grids that have been installed in the country. Two of these have wind, the others have solar PV. And yet the potential for hybridization has been established from studies that have been conducted in Kenya.

The study also found that policy documents have targets set for like wind and other renewable energies, but not for small wind. Lack of a dedicated budget for small wind is also a big setback in terms of developing small winds. The funds available has mostly been used for installing data loggers. There have been low levels of research and development and most of the products in the markets are imported. Also, the capabilities in developing countries are generally lower; they were established to be more or less at a basic level compared to the developed countries which were established at intermediate to advanced levels. In terms of what this means for small winds is the need to increase on capability development to enhance national capabilities particularly installation, operation and maintenance of small winds. It is also important to better use linkages with respect to a particular flow of knowledge and skills resulting from partnership with the developed countries. There are also weaknesses in the innovation system for small winds that need to be addressed to include consumer technological innovation system functions.

Currently there is an ongoing project on capacity building in the country under the Sustainable Energy for all Initiative, a project is funded by EU. It started in 2020 and it's supposed to end in 2024. Capacity at national level and counties is being conducted through this project, mainly because of the provision in the Energy Act that devolves the functions from national level to county level. IREK is trying to enable the counties to be able to deliver on planning for energy services in the country. It is not project based but we want to enable the counties to think about their energy needs, plan for them, implement the projects monitor and also report to the national level.

XIX. Policies for Value Capture: Chinese Renewable Energy Investment in Africa

Ulrich Elmer Hansen, UNEP DTU Partnership

Tis presentation by Ulrich Elmer Hansen is based on the IREK project and focuses on the role, specifically of policies, that aims to capture value that relates to sustainable industrialization. It discusses the role of Chinese investments in renewable energy in Africa - large scale renewable energy – the dynamics around Chinese investments in renewable energy and their implications for sustainable development in Africa.

This case study research tries to provide a first exploratory attempt to create new knowledge in this area. There's certainly need for more research in this field as we've also been pointing at in our research. The three projects point to the evidence of bounded benefits - a term used in research related to the role of China in Africa, one of which is Jo creation. There was also linkages created to local service providers, local sourcing of minor components to the project activities and training of local staff involved in the project activities. A lot of this has to do with the fact that projects involving Chinese actors are brought in from the outside as a kind of full turnkey package, which involves technology suppliers from China, EPC contractors, investors and to some extent also labour, not necessarily imported but available locally. This apparent purchase parachuting creates a kind of local economic enclave. There are several implications at the project level and have been looking at how exactly this plays out in the specific projects.

What is interesting is the role political system can play in influencing the creation of these local benefits. There is a an important aspect relating to this issue of local content requirements that we've just heard from the previous presentation; and which can play a very important role in terms of stimulating or enforcing foreign technology suppliers to localize parts of the component production activities. That can certainly be the case but a lot of this will depend on the design of the local content requirement. There are numerous examples of where this has not worked in other sectors -oil and gas - and around the world; in renewable energy, we have done some research in South Africa - a review of what we know about this area in general. In this regard, there's a lot about policy design not only in terms of avoiding loopholes that are easy to navigate around for technology suppliers but also in simply in terms of the levels and requirements.

There's also the issue of destiny: is this actually being monitored and enforced effectively by relevant government agencies? A lot will depend on the modalities of such requirements. There seems to be a kind of preference for Chinese projects for directly negotiated projects and contracts which would be different from other types of policy environments like feeding chairs systems or auction schemes which would be more competitive and not involving direct government negotiation. But when it comes to project related contracts, there can be several elements included in order to enhance knowledge transfer or local learning and training of staff. This was certainly shown in the case of Adama in Ethiopia where there was deliberate thoughts about university involvement and localizing at least some degree of knowledge development. It can also go in the other direction. For example, exemptions of customs duties, which basically encourage import of hardware components from the outside, could in a way undermine these kinds of localization efforts. The conclusion here is that these co benefits are not necessarily automatically delivered. It probably requires, deliberate, policies and regulation to realize.

XX. Discussants' Interventions

This section provides insights from Youba Sokona and Paul Mobole on opportunities and challenges relating to renewable energy especially for developing countries. They discuss the importance of energy in industrial development particularly the role that can be played by renewable energy and why there is increasing attention on this type of energy. They discuss key actors critical for renewable electrification and industrialization of policy options across different levels and the challenges that affect sustainable industrialization through deployment of renewable energy.

Youba Sokona, Intergovernmental Panel on Climate Change (IPCC)

The increasing focus on renewable energy is because the game has completely changed particularly solar energy and PV. The prices have dramatically dropped, the technology is much more mature with various possibilities and applications of the solar mainly because of the scalability. At the global level, there is a move towards electrification of the society starting with the transport sector. In that context, solar will speed-up electrification not only in rural areas but also urban and peri-urban. Renewable electrification brings us to question the energy system: The current centralized energy system -the grid system- is no longer an option. If the current energy system is designed based on the renewables, particularly those that have been indicated in this seminar, then the dynamics will change. There is need to question the energy solutions, and to redesign rethink them by looking at not only the innovation in the technological aspect but also institutional innovation aspect. That means new kinds of solutions need to be put in place as part of capacity development and mobilization.

There are three main components that need attention. The first component are the stakeholder and that need to interact permanently. There is also need to identify the increasing capacity, identify the gaps then make a distinction between the three key clusters of actors that are critical for renewable electrification and industrialization of policy options across different levels - local, national level and international. The knowledge cluster has been at the centre of this seminar in different presentations. Then you have the practice cluster. One of the question is: can we learn from the experience that has been gained from geothermal? The whole experience of the jiko stoves in Kenya have a huge implication in the African context. One needs to learn from experiences in order to better inform what is needed and as a local content in the innovation that is needed. It's very important to have those different elements and then determine the objectives of industrialization: What kind of economic industrialization? What type of industrialization? What key sector?

It is important to think about the industrialization process: whether to focus on small scale agro-industry development, or focus on manufacturing of cars or other goods. Then think about how you approach those different issues especially the energy aspect. It is also important to have in depth discussion on the renewables and particularly solar and wind that has been indicated at different levels; and then to look at the electrification system to be sure that different projects will inform policies at national level; currently, there seems to be is disconnection between projects and policies. Projects are not relevant in informing policies at different levels.

Paul Mbole

Climate & Energy Expert

Part of the challenges that affect how we can inform sustainable industrialization through deployment of renewable energy is the black-box approach. The fact that consumers are often seen as passive users and the potential of them informing the 'how', the 'what' and the 'when' means that they are only there to receive, accept and respond to a package. This is a key area of the conversation that we need to focus on if we are to deploy renewable energy sustainably and promote enterprises within a structure that can inform sustainable industrialization. If you involve users at the tail end of the process then it will come with many challenges.

Secondly, a lot of financing mechanisms are deterministic and tailored for big ticket investments. They have this 'big-bang' approach where you bring big technology, dominated by big players who have the capacity and wherewithal to deploy and deliver on such complex initiatives. And even by having financing for bigger players with a propensity for the 'big-bang' approach limits involvement and potential for inclusivity and sustainability. Thirdly, the possibility of securing greater involvement of local actors and stakeholders are very dependent on the size of the project; the bigger the project means that involvement of local users becomes limited. And that goes against the bigger story because the energy access challenge is a decentralized small-scale challenge – village by village, community by community. Although integration is key, the final user is someone living in a specific location, in a place where they are struggling to access the energy they need to meet their obligations and needs. Thus, we need to start thinking of enabling possibilities and opportunities for small scale projects to actually find traction and leverage that to find sustainable industrialization agenda.

There is need to re-think about the whole value chain, sustainable energy value chains – development of technology, the provision application and utilization – should also become part of the matrix. Is there other ways we can deepen the use of this power so that we can leverage the asset and promote the core benefits that comes through sustainable industrialization? How do you integrate productive use into any deployment in mini-grid so that the deployment has an anchor client who goes beyond providing energy but even supporting energy use in productive activities which may leverage local materials? Capacity development should be thought of not only in deployment of the technology or the design and management of the asset but going beyond that to even the productive use capabilities.

With regard to policy, the government of Kenya has made great strides to mainstream issues on renewable energy and deliver on that agenda through the plans it has and the action agenda it has committed to. But there is an opportunity to deepen and leverage on local capacity requirements provisions not only to secure the development of that capability now but also approach it from a progressive capability escalator. Let us start with small projects that do small developments but as they move forward you can see incremental development of capabilities and sophistication as people gain confidence in developing small and learn to do bigger projects. This is something we need to think about and see how we can take it forward. In conclusion, at the core of inclusion and involvement is the need to come up with sustainable business models; how do we become more creative in formulating business models that are more flexible and that allow participation and involvement of more actors.

Questions and Discussions

In this session, the panelists respond to questions from participants regarding policies for local content, capacity building and sustainable industrialization in developing economies. The questions are as outlined below:

- What are the insights that we can gain from other sectors, case studies and other countries in relation to policy processes in this area?
- Kenya has had quite a lot of geothermal product projects for a long time: what can we learn from that?
- What is the role of academia and government in ensuring more research in this area takes to fill the gaps in knowledge in this area?
- What are the linkages within the policy environment or to what degree are linkages within the policy environment important?

Dr. Ann Kingiri

There are lessons to be learned from other countries in terms of capabilities and local content requirements especially South Africa, which is more advanced in local content requirements and operationalization of policies that have to do with local content requirements. There are also quite a number of other cases we can draw from outside Africa with regard to sectoral much has been done especially in Kenya.

Faith Wandera

A lot that has been written about China and India and how they have leapfrogged from very low levels of wind penetration to high levels over generation from wind projects. However, there's a little interaction between wind, geothermal, biomass and solar and there could be mechanisms that can be developed to enhance interaction between the sectors within the broader energy sector. The African Union and Minister of Energy has also been working closely on biomass technologies.

Prof. Rasmus Lema

There seems to be no sufficient discussions on 'vision' and how industrialization coming out of electrification and linkage to industrialization. Centralized energy systems are no longer an option. This ties in with the point about small scale industrial development. The important task is how to create capabilities that support both of those processes. And again, the black box approach does not work. There is need to find out how local solutions, local technology can be developed, which is not black-boxed.

XXI. Closing Remarks

Prof. Tom Migun Ogada, Executive Director, ACTS

ACTS executive director thanked the speakers and participants for supporting the seminar series. He was impressed by the quality of presentations and the reactions from the participants. He noted the difference between rural electrification and renewable and electrification and its link it to the provision of energy for use in the productive sector particularly industrialization. He emphasized the need for more investment in renewable -particularly in Africa- in the use of existing technologies as a way of scaling up industrialization and realizing sustainable development. The concept of reverse engineering, for those who are familiar with the technology, that were taken by China, Japan and India are sold to that concept. He promised to share information products coming out of this seminar series to influence policy decisions.

Angela Christiana, Executive Director, CJLF

The executive director of CJLF all of the panelists and participants for taking time sharing expertise on industrialization and renewable energy. The themes and key take-away from the IREK project are very aligned with some of the work that Prof. Calestous Juma did throughout his career and whose main focus was improving the lives of communities by building local capability through local actors, stakeholders and their synergy with innovation and industrialization.

XXII. Annex I: Profile of Presenters

Prof. Alfred Oteng-Yeboah

Governing Council Chair, African Centre for Technology Studies (ACTS)

Prof. Oteng-Yeboah was the Deputy Director-General of the Council for Scientific and Industrial Research (CSIR-Ghana) and has served as board/council member of a number of Ghanaian public institutions, including the Environmental Protection Agency (EPA), the Government of Ghana Scholarship Review Committee, the University of Ghana College of Health Sciences and the Centre for Scientific Research into Plant Medicine, the Ghana National Commission for UNESCO.

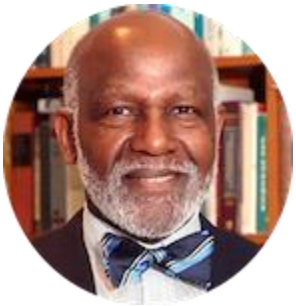
Prof. Tom Ogada

Executive Director, African Centre for Technology Studies (ACTS)

Prof. Tom Ogada is the Executive Director, ACTS. Prof. Ogada has enormous experience from senior management levels in research, university, public and private sector including Associate Professor of Energy and Environmental Engineering at Moi University, Managing Director of the Kenya Industrial Research and Development Institute (KIRDI), Chairman of the Kenyan National Commission for Science, Technology, and Innovation (NACOSTI) among others. Prof Ogada has expertise in intellectual property (IP) policy and strategy, commercialization of research results and technology transfer, among others.

Prof. Wesley L. Harris

President, Calestous Juma Legacy Foundation (CJLF)



Wesley Harris is Charles Stark Draper Professor of Aeronautics and Astronautics at MIT. He previously served as the associate provost (2008–2013) and head of the Department of Aeronautics and Astronautics (2003–2008). Before coming to MIT, Prof. Harris was a NASA associate administrator, responsible for all programs, facilities, and personnel in aeronautics (1993–1995); vice president and chief administrative officer of the University of Tennessee Space Institute (1990–1993); and dean of the School of Engineering and professor of mechanical engineering at the University of Connecticut, Storrs (1985–1990). In academia Prof. Harris worked with industry and governments to design and build joint industry–government–university research and development programs, centers, and institutes and transferred technology effectively. Prof. Harris is amember of the National Academy of Engineering.

Angela P. Christiana

Interim Executive Director, Calestous Juma Legacy Foundation (CJLF)

Angela P. Christiana is the inaugural Executive Director for the Calestous Juma Legacy Foundation and has served on the Advisory Council of the Foundation since 2019. She is also a leader in Moms Demand Action for Gun Sense in America, an organization at the forefront of gun violence prevention advocacy in the United States. Angela was formerly the Director of Operations at African Food and Peace Foundation (AFPF), a U.S. based nonprofit providing funding and strategic resources to innovative rural development projects in Uganda. It was during her time at AFPF when she came to know Calestous Juma through his generous mentorship of the AFPF team. She is currently working towards her Executive Certificate in Nonprofit Leadership at the Harvard Kennedy School.

Prof. Norman Clark

Emeritus Professor at the Open University and the University of Strathclyde

Prof. Norman Clark is an expert in innovation systems and development and Emeritus Professor at The Open University and the University of Strathclyde, UK. His research interests include science and technology development in Africa and South Asia, a field in which he has acted also as an adviser to relevant agencies including the World Bank, UNCTAD, UNDP, DFID, NEPAD and the CGIAR. He continues to serve on the Governing Council of the African Centre for Technology Studies (ACTS), Nairobi, Kenya.

Prof. Banji Oyelaran-Oyeyinka

Senior Special Advisor on Industrialization, African Development Bank

Prof. Banji Oyelaran-Oyeyinka is the Senior Special Adviser on Industrialization to the President of the African Development Bank. He is a fellow of the Nigerian Academy of Engineering and Professorial Fellow, United Nations University. His research interests are in Science Technology, and Innovation (STI) Policy and Systems in Late Development; Innovation Systems in Industry Small and Medium Enterprises; industrial clusters in Developing Countries and latecomer Industrialization and Economic Development.

John Ouma Mugabe

Professor of Science and Innovation Policy at the Graduate School of Technology Management (GSTM), University of Pretoria
Board of Directors, Calestous Juma Legacy Foundation (CJLF)

John Ouma Mugabe is Professor of Science and Innovation Policy at the Graduate School of Technology Management (GSTM), University of Pretoria and Director of the Foundation for Innovation and Technology-Africa (FIT-Africa) Pretoria, South Africa. He is an Associate Faculty at the Science Policy Research Unit (SPRU), University of Sussex. He was one of Calestous' first research assistants at ACTS 1989-1990 and succeeded him as the Executive Director of ACTS in 1995. Prof. Mugabe is a Fellow of the World Academy of Art and Science, Fellow of the African Academy of Sciences, anda Fellow of the Academy for Engineering and Technology for the Developing World. He holds a PhD in political economy of technology policy from the University of Amsterdam, The Netherlands, and has published widely on science, technology, innovation and environmental policy in Africa. Prof. Mugabe grew up in Port Victoria, Kenya.

Prof. Maureen Mackintosh

Professor of Economics, The Open University

Prof. Maureen Mackintosh is a past Director of the Open University's inter-faculty Centre for Innovation, Knowledge and Development (IKD). She is member of INNOGEN, an institute that produces high quality research and supports the delivery of innovation that is profitable, safe and societally useful.

Erika Kraemer-Mbula

Professor of Economics at the University of Johannesburg

Prof. Erika Kraemer-Mbula is a Professor of Economics at the University of Johannesburg, South Africa. Erika's work focuses on alternative development paths for African economies. She specializes in the analysis of innovation systems in connection to equitable development and inclusive development, and has done pioneering work on innovation in the African informal sector. Erika is currently the Chairholder of the DST/NRF/Newton Fund Trilateral Chair in Transformative Innovation, the Fourth Industrial Revolution and Sustainable Development, based at the College of Business and Economics (University of Johannesburg) and in partnership with ACTS and SPRU.

Prof. Raphael Kaplinsky

Honorary Professor at the Science Policy Research Unit

Prof. Raphael Kaplinsky is Honorary Professor at the Science Policy Research Unit, and is also an Emeritus Professor at the Institute of Development Studies and at the Open University. His primary research interests are in Globalization, Global Value Chains, Inclusive Growth and Inclusive Innovation,the Terms of Trade and the Impact of the Rising Powers (particularly China) on Sub Saharan Africa, publishing extensively in all of these fields. Over the past four decades he has worked with policy makers, the private sector, trades unions and civil society groups.

Prof. Rasmus Lema

Associate Professor in Innovation and Development at the Department of Business and Management, Aalborg University

Prof. Rasmus Lema is an Associate Professor in Innovation and Development at the Department of Business and Management, Aalborg University. He has been an active member of the Globelics network as part of the secretariat.He has been teaching MSc in Innovation, Knowledge and Economic Dynamics(MIKE) and MSc in Operations and Innovation Management – Global Management (OIM/GM at Aalborg University; MSc in Innovation Management at Sino-Danish Center for Education and Research.

Dr. Margrethe Holm Andersen

Senior Advisor, Aalborg University

Dr. Margrethe Holm Andersen is a senior advisor at Aalborg University with more than 25 years of experience from research, consultancy, planning and implementation of development cooperation working on a broad range of issues including capacity development, agriculture, climate change and environmental management, community development, gender issues, civil society and fragile states. Current research interests include capacity buildingin renewable energy, inclusive innovation, health systems strengthening and research capacity building.

Dr. Charles Nzila

Senior Lecturer, Moi University

Dr. Charles Nzila is a senior lecturer, school of engineering at Moi University, Kenya. He is a renewable energy and sustainable technologies expert and with an emphasis on the promotion of sustainable energy, cleaner productionand life cycle engineering in Africa. He has a strong background in applied research and sustainable development and is the founder of the Renewable and Sustainable Technologies (RenST) research group, and the Renewable Energy Database System for East Africa (REDSEA). In the most recent years hisresearch and consultancy interests have included: renewable energy andenhancing energy accessibility in Kenya, clean technology, sustainable development and life cycle analysis.

Dr. Rebecca Hanlin

Director, Social Business Solutions East Africa Limited

Dr. Rebecca Hanlin is a science, technology, and innovation policy expert withan emphasis on promoting innovation and business developmentopportunities for small and medium sized businesses in Africa. She has a keeninterest in inclusive innovation and development with focus on renewable energy, health systems and social innovation. She has been a lead researcherand consultant at ACTS and has been leading ACTS' work on rural electrification, AfricaLics Innovation and Development specialist and also works on a project focused on the challenges facing African science granting councils in building science systems. She has published widely on innovation and development issues.

Joni Karjalainen

PhD Researcher, Finland Futures Research Centre

Joni Karjalainen is a researcher at University of Turku, Finland Futures Research centre. He is a renewable energy expert focusing on the long-term transformation of energy systems. His research interests include the dynamics that affect the adoption of renewable energy technologies and the emergence of solar energy business in East and West Africa, innovation ecosystems, leverage points, solar photovoltaics, science-communication, andurban governance.

Dr. Ann Kingiri

Director of Science Technology, Innovation, Knowledge and Society (STIKS) Programme, ACTS

Dr. Ann Kingiri is the Director of Science Technology, Innovation, Knowledge and Society (STIKS) Programme at ACTS. She has an interdisciplinary training background (biological sciences, environmental science, innovation, and development policy) and vast experience in networking and advocacy in multicultural settings involving diverse development and policy actors in the public and private sector. Areas of expertise include policy analysis, climate change, sustainable development and research capacity building.

Faith Wandera

Senior Deputy Director of Renewable Energy at Ministry of Energy, Kenya

Faith Wandera is a senior deputy director of renewable energy at the ministryof energy, Kenya. She is a renewable energy policy expert with emphasis on bioenergy development. She has had experience with a wide range of renewable energy technologies, including solar PV, solar thermal, small hydro, wind and biogas through training and participation in different local and international fora.

Dr. Padmasai Lakshmi Bhamidipati

Postdoctoral researcher, DTU-UNEP

Dr. Padmasai Lakshmi Bhamidipati is postdoctoral researcher in sustainable energy at DTU-UNEP. She works at the intersection of research, policy and implementation in the areas of renewable energy, environmental governance, livelihoods, and sustainable development. Her research focuses on sustainability transitions and low-carbon energy innovation in developing countries to provide an improved understanding of the interface between thestate, markets and donors as they develop and diffuse solar PV technology (off-grid and grid) in East Africa.

Dr. Yuoba Sokona

Vice-Chair of the Intergovernmental Panel on Climate Change (IPCC)

Dr. Yuoba Sokona was elected Vice-Chair of the Intergovernmental Panel on Climate Change (IPCC) in October 2015. Prior to this, Youba Sokona was Co-Chair of IPCC Working Group III on the mitigation of climate change forthe Fifth Assessment Report after serving as a Lead Author since 1990. Dr. Sokona is currently the Special Advisor for Sustainable Development at the South Centre. He has over 35 years of experience addressing energy, environment and sustainable development in Africa and served as a coordinator of the African Climate Policy Centre (ACPC) and as Executive Secretary of the Sahara and the Sahel Observatory (OSS). He is a Member of the Board for the Institute of Development Studies, UK, Honorary Professorat the University College London (UCL), and as a Special Advisor to the African Energy Leaders Group. Overall, he has deep technical knowledge, extensive policy experience and an unreserved personal commitment to African led development.

Paul Mbole

Associate partner, Baca Development Partners LLP

Paul Mbole is an associate partner at Baca Development Partners LLP. He is an experienced sustainability, climate and energy expert with a demonstratedhistory of working in project/program cycle management and finance, enabling multi-stakeholder processes and policy dialogues, brokering public private partnership engagements, enabling technology adoption and innovation. He has relevant professional development training in Sustainable Energy Systems, Disaster Risk Reduction and Climate Resilience, Policy and Legislative Drafting and Institutional and Organizational Development.

XXIII. Annex 2: Seminar Programme

PROF. CALESTOUS JUMA LECTURE SERIES ON KNOWLEDGE AND INNOVATION FOR DEVELOPMENTKICK OFF SEMINAR: RE-IGNITING AFRICA INDUSTRIALIZATION THROUGH INNOVATION

12th – 13th August 2021

Virtual Event

DAY 1: 12th AUGUST 2021: OFFICIAL LAUNCH AND SETTING THE SCENE PRESENTATIONS			
Time	**Activity**	**Institution**	**Responsible person**
Session I – Opening and Official Launch – Moderator, Prof. Tom Ogada, ACTS			
13:00 - 13:10	Welcome Remarks	ACTS	Prof. Alfred Oteng-Yeboah, Chair, ACTS Governing Council
13:10 - 13:20	A brief overview about CJ Seminar series	Executive Director, ACTS	Prof. Tom Ogada
13:20 - 13:50	CJ Vision for Africa	President Calestous Juma Legacy Foundation (CJLF) Executive Director, Calestous Juma Legacy Foundation (CJLF)	Prof. Wesley Harris Angela Christiana
13:50 - 14:25	CJ biographical memoir & official Launch of the CJ Seminar series	The Open University, UK	Prof. Norman Clark
14:25 - 14:55	Keynote speech: Re-igniting Africa industrialization: the role of innovation	African Development Bank (AfDB)	Prof. Banji Oyelaran-Oyeyinka
14:55 - 15.05	**Health Break**		**ALL**
Session II: Knowledge, Innovation, and Industrialization: lessons for Africa – Panel discussion: Moderator Prof. John Mugabe, University of Pretoria, South Africa			
15:05 - 16:50	Inclusivity in the industry and health security interface	Open University	Prof. Maureen Mackintosh
	ICT for Africa's industrial development and role of diaspora in Africa's industrialization	Global chairman of Kenya Diaspora Alliance; Senior Policy Advisor, Africa	Hon Dr. Shem Ochuodho
	Industrial development in times of COVID: Prospects for the Africa's informal sector in the 4IR era	University of Johannesburg	Prof. Erika Kraemer-Mbula
	How are current globalization trends impacting Africa and what are the policy agendas for Africa's future?	University of Sussex, UK	Prof. Raphael Kaplinsky
	Green development prospects in Sub Saharan Africa (SSA)	Aalborg University, Denmark	Prof. Rasmus Lema
16:50 - 17:30	Moderated discussion		All

DAY 2: 13th AUGUST 2021: RENEWABLE ELECTRIFICATION AND INDUSTRIALIZATION IN DEVELOPING COUNTRIES: NEW PATHWAYS

Innovation and renewable electrification in developing countries provide important opportunities for local economic development, but new pathways are required for turning these opportunities into successful reality. This webinar will present a new framework for understanding how green transformation and sustainable industrialization can be combined, highlighting the opportunities and constraints for local capability building and the scope for local policy action.

IREK project website: https://www.irekproject.net/

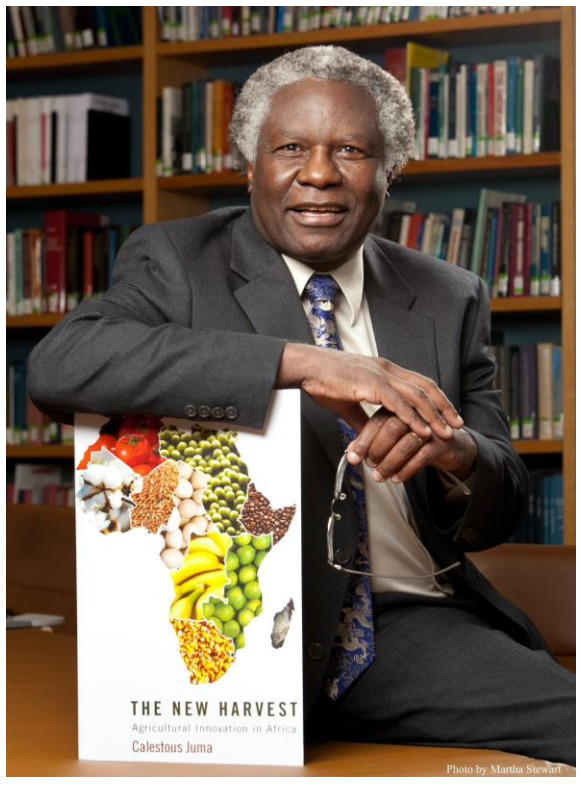
Researchers and collaborating partners from a collaborative research project on Innovation and Renewable Electrification in Kenya (IREK) will discuss key questions such as: What capabilities are developed through on-going renewable

electrification projects in developing economies? What policies may help support industrialization through renewable electrification? And finally, what role do international linkages (South-South and North-South) play and what role should they play in the greening of energy systems in developing economies?

Time	Activity	Institution	Responsible person
Session I – Opening and Keynote speech. Moderator, Dr. Margrethe Holm Andersen			
13:30 - 13:40	Welcome Remarks	Aalborg University, Denmark	Dr. Margrethe Holm Andersen, Senior Advisor
13:40 - 13.50	IREK Video	Moi University, Kenya	Dr. Charles Nzila
13:50 - 14.10	Introduction to the IREK book: "Building Innovation Capabilities for Sustainable Industrialization: Renewable Electrification in Developing Economies".	Aalborg University, Denmark	Prof. Rasmus Lema
Session II – Building local capabilities for sustainable industrialization			
14:10 - 14.20	Why project design and organization matter for local capability building?	ACTS, Kenya	Dr. Rebecca Hanlin
14:20 - 14:30	Local capabilities in renewable energy - evidence from a survey in Kenya	Moi University, Kenya	Dr. Charles Nzila
14:30 - 14:40	Innovative capabilities in solar PV firms in Kenya and Tanzania	University of Turku, Finland Futures Research Centre	Joni Karjalainen
14:40 - 15:00	Discussants' interventions	University of Johannesburg	Prof. Erika Kraemer-Mbula
15:00 - 15:15	A&Q and discussion		All
15:15 - 15:30	**Health Break**		**All**
Session III: Policies for local content, capacity building and sustainable industrialization in developing economies			
15:30 - 15:40	The importance of local content issues in fostering sustainable industrialization	ACTS, Kenya	Dr. Ann Kingiri
15:40 - 15:50	Policies for appropriate pathways in energy and sustainable industrialization	Moi University and Ministry of Energy, Kenya	Faith Wandera, Senior Deputy Director
15:50 - 16:00	Policies for value capture	DTU-UNEP	Padmasai Lakshmi Bhamidipati, Post-doc
16:00 - 16:20	Discussants' interventions	Intergovernmental Panel on Climate Change (IPCC) Baca Development Partners, Kenya	Youba Sokona, Vice-Chair Paul Mbole, Climate & Energy Expert
16:20 - 16:40	Q&A and discussion		All
16:40 - 16:45	Wrap-up	Aalborg University	Dr. Margrethe Holm Andersen, Senior Advisor

XXIV. Annex 3: Day 1 Flier

Launch of Prof. Calestous Juma Lecture Series on Inclusive Knowledge and Innovation



Date: 12th August 2021

Time: 13:00PM – 17:30PM EAT

About ACTS

ACTS is an Intergovernmental organization founded in 1988 by Prof. Calestous Juma to pursue policy orientedresearch towards strengthening the capacity of Africancountries and institutions to harness science, technology and innovation for sustainable development.

Learn more

About CJLF

The Calestous Juma Legacy Foundation (CJLF) is a U.S. basednon-profit foundation, founded in 2019 to foster policies, programs and projects to develop and utilize technologicalinnovation in education, public health, and in advancing the application of science and technology in economic transformation and sustainable development, particularly in Kenya, Africa, and developing countries. The initial focus of the Foundation's work will be on Calestous Juma's hometown of Port Victoria, Bunyala District, Kenya, on theshores of Lake Victoria.

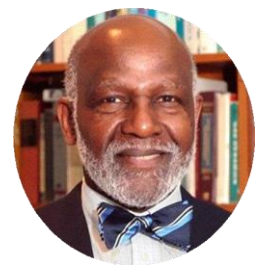
Learn more

Join Calestous Juma Legacy Foundation (CJLF) and African Centre for Technology Studies (ACTS) for the re-igniting Africa industrialization through inclusive knowledge and innovation, lecture series - 01

Day 1: Speakers

Prof. Alfred Oteng-Yeboah
Chair, ACTS Governing Council
Welcome remarks

Prof. Tom Ogada
Executive Director, ACTS
Topic: Overview about CJ Seminar series



Prof. Wesley L. Harris
President, CJLF
Topic: CJ vision for Africa

Angela Christiana
Executive Director, CJLF
Topic: CJ vision for Africa

Prof. Norman Clark
ACTS, Governing Council
Topic: CJ biographical memoir and official Launch of the CJ seminar series

Prof. John Mugabe
University of Pretoria
Moderator

Prof. Banji Oyelaran-Oyeyinka
Africa Development Bank
Keynote speech: Re-igniting Africa industrialization: the role of innovation

Prof. Maureen Mackintosh
Open University, UK
Topic: Inclusivity in the industry and health security interface

Hon Dr. Shem Ochuodho
Kenya Diaspora Alliance
Topic: ICT for Africa's industrial development/role of diaspora in the industrialization of Africa

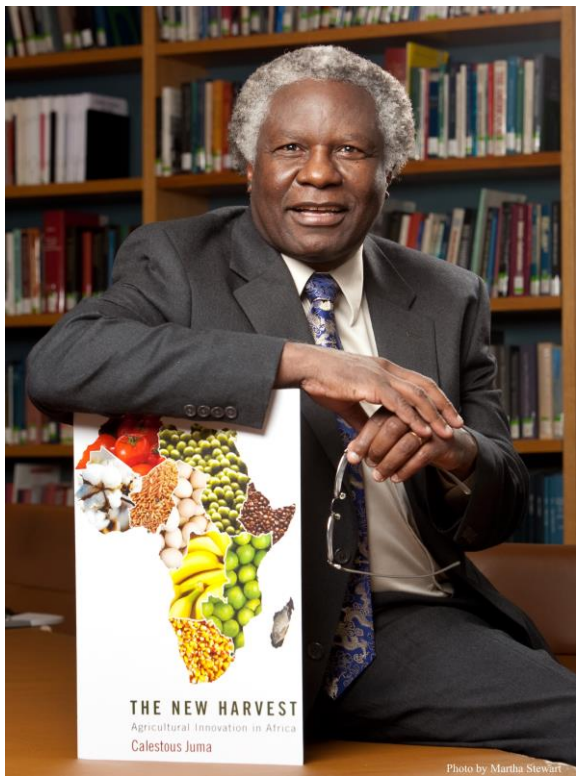
Prof. Erika Kraemer-Mbula
University of Johannesburg
Topic: Industrial development in times of COVID: Prospects for the informal sector

Prof. Raphael Kaplinsky
University of Sussex, UK
Topic: How are current globalization trends impacting Africa and what are the policy agendas for Africa's future?

Prof. Rasmus Lema
Aalborg University
Topic: Green development prospects in Sub Saharan Africa (SSA)

XXV. Annex 4: Day 2 Flier

Launch of Prof. Calestous Juma Lecture Series on Inclusive Knowledge and Innovation



Date: 13th August 2021

Time: 13:30PM – 16:45 PM EAT

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Learn more

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Day 2: Speakers

Dr. Margrethe Holm Andersen
Aalborg University, Denmark

Dr. Charles Nzila
Moi University, Kenya

Prof. Rasmus Lema
Aalborg University, Denmark

Dr. Rebacca Hanlin
ACTS, Kenya

Joni Karjalainen
University of Turku,
Finland Futures Research centre

Prof. Martin Bell
University of Sussex, UK

Prof. Erika Kraemer-Mbula
University of Johannesburg

Dr. Ann Kingiri
ACTS, Kenya

Faith Wandera
Ministry of Energy Kenya

Padmasai Lakshmi Bhamidipati
DTU-UNEP

Youba Sokona
IPCC

Paul Mbole
Baca Development Partners, Kenya

XXVI. Annex 5: Speech by ACTS Executive Director, Prof Tom Mign Ogada

The chair of ACTS Governing Council, Prof. Alfred Oteng-Yeboah and members of the Council present today; members of the College of Scholars of ACTS and members of the Calestous Juma Legacy Foundation (CJLF) leadership under Angela Christiana and Prof. Wesley Harris; our keynote speaker today; Prof. Banji Oyelaran Oyeyinka, former classmate of Prof. Calestous Juma (CJ); distinguished panelists for today: Prof. John Mugabe, Prof. Maureen Macintosh, Dr. Shem Ochuodho, Prof. Erica Kraemer Mbula, Prof. Rasmus Lema, Prof. Raphael Kaplinsky and members of the press present. . First, before I give a brief overview of the CJ seminar series, the organizing committee requested that we have a minute of silence in honor of the late Prof. Calestous Juma as a way of celebrating his achievements.

We are here today to launch, Professor Calestous Juma Seminar Series on knowledge and innovation for development, organized by the African Centre for Technology Studies (ACTS) in collaboration with Calestous Juma Legacy Foundation (CJLF). Until his untimely death in December 2017, Prof. Juma was an internationally recognized authority in the application of science, technology and innovation for sustainable development, especially in developing countries; and focused on analyzing how knowledge and innovation could be harnessed for development in the context of institutional change in socio economic systems and policies. He promoted this agenda through advanced science, technology, and innovation policies especially in biotechnology, provision of high-level science, technology and conservation of biological diversity. He founded the African Centre for Technology Studies (ACTS) in 1988, where his initial development ideas were nurtured to become a leading inter-governmental science, technology and innovation policy think-tank with the mandate to strengthen the capacity of African countries and institutions to harness science, technology and innovation for sustainable development. I'm delighted to mention that today ACTS is active and we have projects in over 25 African countries.

In pursuit of this mission, ACTS has been instrumental in enlarging the range of policy choices for sustainable development in Africa through high quality research, outreach and policy including legislation and policy in environmental impact assessment standards in Eastern and Southern Africa. . ACTS has policy footprints in agriculture, biotechnology, biosecurity and climate change in Africa; and was the first to organize an international conference to discuss options that could be adopted by African countries to mitigate the impact of climate change and also played a major role in the negotiations for the Convention on biodiversity. And due to its excellent work, ACTS was rated as a top environmental think-tank in Africa. In 2016, for example, ACTS was rated amongst the top three most influential think tanks in climate change globally and number one in Africa.

Currently, ACTS is implementing its sixth strategic plan, which is dedicated to Prof. Calestous Juma. The strategic plan runs from 2019 to 2021. It is hoped - through it - to lay the foundation for the immortalization of Prof. Calestous Juma. As a result, allow me to mention the following three points. First, ACTS has remained true to Prof. Juma's original vision and attention to science, technology and innovation, policy research and its application for sustainable development. The current strategic plan, therefore, focuses on the core thematic areas that were always seen as the most important by Prof. Juma.

These includes agriculture and food security, climate change and energy and the role of science, technology and innovation in addressing the challenges affecting these sectors.

Secondly, we have remained true to the charter that established ACTS. In 2018, for example, the Governing Council established the College of Scholars, which is one of the organs provided for by the 1988 charter. The Governing Council appointed Prof. Shem Wandiga as its first dean. I'm delighted to mention that the College of Scholars was recently launched in June 2021 as guided by the strategic plan. And finally, we have strived to work very closely with the Calestous Juma Legacy Foundation (CJLF) to enhance synergy in our efforts to build the foundation for CJs immortalization. I'm glad, ladies and gentlemen, that today will not only witness the signing of an MOU between ACTS and CJLF but that you're also participating in the first collaborative event organized by the two organizations to keep CJs dream alive by creating a platform that will elicit discussions around knowledge and innovation for development.

In conclusion, allow me to say that the launch of this seminar today is not a one-off event. We aim to keep the discussions focused; and, therefore, the topics for the seminar series will always be centered on Prof. Juma's previous work. Thus, this seminar series will be held once every three months and will culminate to ACTS-CJLF conference in 2022. We believe that you all cherish the work of CJ and call upon you, before you leave this this seminar today, to help shape the agenda of the CJ Seminar Series by proposing issues for discussions that you feel are not only relevant to the work of CJ but also captures the aspiration of Africa - as it as it is today and in the future. And with that, I would like to thank all of you for participation in today's seminar and therefore take this honor and humble opportunity to invite ACTS Council Chair, Prof. Alfred Oteng-Yeboah to formally welcome you on behalf of all of us.

Thank you!

XXVII. Annex 6: Speech by ACTS Governing Council Chairperson, Prof. Alfred Oteng-Yeboah

I'm pleased to be part of this initiative and to provide a welcome statement to all the participants in this very important seminar series which I believe is going to begin the process of immortalizing Prof. Calestous Juma. I want to start with a quote from a very famous Scottish poet named Thomas Cambell (1777-1844) who stated: *'To live in hearts we leave behind is not to die'*. I'm using this quote to preface my statement of welcome to all of you distinguished scholars and associates of Prof. Calestous Juma who lived and worked with us from sunrise period of 9th June 1952 to his sunset period of 15 December 2017. I speak on behalf of the Governing Council of the African Centre for Technology Studies (ACTS) based in Nairobi in my capacity as the chairman. For us, there is no way you can talk about ACTS without a passing reference to Prof. Calestous Juma.

The process of establishing ACTS has already been elaborated by the executive director. But I'd like to say that ACTS was founded from scratch through the initial STI developmental ideas which Prof. Juma started nurturing. These ideas, which he published during his tenure as the executive director of ACTS later became the blueprint which have been followed by successive executive directors including Prof. John Mugabe, Prof. Judy Wakhungu, Prof. Tom Ogada and others. Calestous has been many things to many people; but for us in ACTS, we saw him and continue to see him as an intellectual giant who made the youth of Africa proud in his very singular pursuit of knowledge and accomplishments to make the continent aware of and sought for better ways to derive benefits from these enormous genetic resources. He saw this happening through exposure in the spheres of science, technology and innovation. Much of the mandate of ACTS has been provided and the successes have been also indicated by the executive director, Prof. Tom Ogada.

But let me say that the Governing Council is proud to be associated with the CJ Legacy Foundation to start this lecture series. This falls in line with the governing Council's desire, mooted in its deliberations in reference to the idea of immortalising Prof. Calestous Juma. I also reiterate that to us at ACTS, Calestous lives in our hearts. And therefore, to quote Thomas Campbell, he is so with us. With these brief remarks, I want to welcome all the participants to this very important lecture series. And I believe all of us will gain a lot.