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Chux Daniels: Science Policy Research Unit (SPRU), University of Sussex, UK,
c.u.daniels@sussex.ac.uk

Christiane Gebhardt: University of Edinburgh, Edinburgh Medical School, UK,
christiane.gebhardt@t-online.de

Global Innovation and Development Ecosystem in the COVID-19 Pandemic era

It is an accepted fact that Higher Education, Science and Research (HESR) Systems are essential to innovation, development and social progress. The emergence of COVID-19 pandemic in 2020 has required us to reflect on existing paradigms. Not only has the COVID-19 pandemic led to an assessment of our delineated futures; it also put a question mark on our dense network of global value chains and the interconnectedness of systems, sectors and societies at global level and governance approaches. Many of us saw the benefit, but also the flaws in the governance of intergovernmental cooperation on COVID-19 pandemic. We also experienced the deficiencies in efficient stakeholder networking and the persistence of old institutional structures that hindered entrepreneurial universities from playing effective roles in bridging disciplinary and departmental silos (Meissner, Erdil and Chataway, 2018) (Audretsch and Audretsch, 2014). While being off the grid had been a verdict for poverty and economic dependency, local autonomy and participatory governance and social innovation became legitimate concepts that open new avenues for development as next phase after globalization (Ali, 2005).

In addition, COVID-19 calls for us to reexamine the proximity factor as a precondition for creativity, innovation and development – underpinned by education, science and research systems. Furthermore, COVID-19 has called into question the narrative that has formed the foundations of our modern economic system: that global competition and high technology innovation are two sides of a coin. And that together, global competition and high technology innovation constitute the ideal route towards an advanced socio-economic prospect. This narrative needs to be reconsidered, alongside the many questions that COVID-19 has raised at the global level. How can we deploy innovation for the development of less globally integrated regions? What (new) roles for HESR, HESR ecosystems actors and stakeholders, and innovation policy in ensuring that innovation, including science and technology (S&T) policies, focus on transformation, that is, achieving the SDGs? Are there new answers from unexpected places?

The last decade has experienced a renewed interest in the role of the African continent in innovation and sustainability. Innovation, including S&T, policy is looking for fresh ideas and new pathways for smarter, more inclusive, environmentally and socially sustainable pathways

to transformation. In Africa, countries such as Ghana, Kenya, Senegal and South Africa, are now exploring the prospects of Transformative Innovation Policy (TIP) as a way of refocusing science, technology and innovation (STI) systems and policies to address economic, social and environmental challenges as articulated in the SDGs (Daniels, 2020; Daniels et al, 2020a; Akon-Yamga et al, 2021).

COVID-19, Digitalisation and Higher Education

The transition to digitalisation in education was already taking place in Africa's HEIs prior to COVID-19. However, the pandemic has revealed major gaps at systems, by showing that majority of Africa's HEIs were not adequately prepared for the digital future in research, teaching and learning. Some of the reasons for this include inadequate broadband and internet connectivity, data, and virtual research infrastructure¹. The few universities with good digital infrastructure and platforms have performed considerably better during the pandemic in their ability to either continue with their business of research, teaching and learning with minimal disruptions or restart operations with relatively less time lost. In this we group, we find the likes of The Virtual University of Senegal (UVS), Virtual University of Tunis (Tunisia), and Virtual University of Côte d'Ivoire (UVCI)². Digitalisation, especially high quality data, is therefore essential to the survival of universities and their ability to conduct research, teaching and learning that informs innovation and supports development objectives.

We have experienced the value of data and data analytics for integrated and rapid solution building and new services. With emphasis now placed on data and digital, at the African Union and across the continent, there is now a renewed focus on digitalization for transformation (AU, 2020). The importance of data, data analytics/science and digitalization broadly in Africa and globally have given rise to renewed tensions among global digital leaders with implications that geopolitics is taking a new course. Another implication of the shifts in digitalization and the resultant changes in cooperation at global levels, is reflected in the efforts by African Union and European Union for strengthening partnership in digitalization (Daniels et al, 2020b). Despite the keen interest in digitalization in Africa, progress in this area must be underpinned

¹ AAU (Association of African Universities) (2020). AAU Press Release on the Coronavirus (COVID-19) Pandemic, March 2020. <https://blog.aau.org/aau-press-release-on-the-coronavirus-pandemic-covid-19/>

² UNESCO (2020). The response of Higher Education to COVID-19 - Higher Education in Africa: challenges and solutions through ICT, online training, distance education and digital inclusion, <https://en.unesco.org/news/response-higher-education-covid-19-higher-education-africa-challenges-and-solutions-through-ict>

by strong research and innovation in universities and other Higher Education Institutions (HEIs) (AUDA-NEPAD, 2019), in addition to appropriate public policies (AUC, 2014, 2016). New technological enablers in universities and HEIs, renewable energy, biotechnology and artificial intelligence empower citizens and researchers all over the globe. Despite the fact that innovation takes place in many different places and institutions; the university remains a source of knowledge, capabilities and economic growth via innovation rather than an outmoded organizational model. Nonetheless, the university must be more actively embedded in a regional innovation ecosystem – or create one by itself – to become fully effective as a lever of a knowledge-based society. To live up to this important role, that is, strengthening universities to perform their functions in the relevant innovation ecosystems, significant personnel and financial resources are required. In addition to funding, there is need for deeper understanding of the political economy factors that influence and shape science and research funding and decision-making (Chataway et al, 2019). The process of integrating universities into innovation ecosystems has to be organized and managed. The latter point has been overlooked for too long. It calls for changes in multi-level governance (supra-, national-subnational), transformative governance (change) and the governance of innovation per se (participatory, citizen driven and institutionalized big sciences).

Many fundamental questions arise around this problem: How is decision making organized in transformative governance? Clearly, evidence-based Policy needs data. What are the adequate methods and indicators to measure progress and identify weak signals for change? The Covid crisis has reemphasized the point there is a new sense of urgency that underlines the importance of response time to act on disaster. The speed and direction of innovation and transformation depends, in part, on organizational readiness and we sense that the power of reflection, communication and necessary discourse might be an engine for putting smartness and sustainability to environmental, economic and societal benefit.

Higher Education, Science and Research Systems in Africa: Innovation Policy to the rescue?

Empirical research carried out by **Kahn** and **Oghenetega** shows that massive African brain drain to Europe and the United States might be a phenomenon of the past. The authors carried out a tracer study of African doctoral graduates of South Africa's leading universities to address the problem of brain drain with new data. Contrary to the expectation that the majority of graduates would depart from Africa they found that the majority returned home on completion

on completion of their doctoral studies in South Africa. The unexpected outcome of temporary migration was brain circulation and talent development in the region.

University-industry interaction researched by **Saad, Guermat, and Boutifour** indicate that innovation policies in Algeria failed to address the organizational problem of disciplinary silos in Higher Education Institutions. The authors analyze the types and extent of interactions that can exist between Algerian HEIs and industry and their impact on innovation. Their studies show incentives and blockages of constructive interaction in innovation.

In Africa, innovation can take a different turn, if the African ecosystem is capable of reinventing and of reflecting itself (Oloruntoba and Muchie, 2018). Africa profits from experimental designs all over the world and select from a multitude of programmatic policies to spur innovative growth and address societal, economic, demographic and environmental challenges, as articulated in the United Nations global Sustainable Development Goals (SDGs). The transformative innovation policy (TIP) is one such policy approach that involves experimental designs of innovation policies, programmes and projects with a focus on addressing the SDGs, thereby fostering the prospects for long-term transformative change (Schot and Steinmueller, 2018; Daniels et al, 2020a; Akon-Yamga et al, 2021).

The African innovation and digital agenda adopt participative science governance, real world laboratories, vocational makerspaces and stores, and ICT-driven hackathons more easily than in Europe. One reason for this easier rate of adoption is because the African continent can rely on a young population which are less reluctant to change, in comparison to citizens in European countries. This considerably high rate of adoption, fueled by Africa's youth population, also accounts for the fast growth in digital entrepreneurship in the continent, coupled with advances in technology commercialisation, and innovation policy for transformative change (Nesbitt-Ahmed et al 2020; Daniels et al, 2021).

The complex relationships between individual researchers and scholars, teachers and society will remain prominent on the research agenda of African scholars (Kahn, 2014; Muchie and Baskaran, 2013). The silo mentality is a condition or attitude marked by an absence of open and cross-disciplinary communication and a disinterest or unwillingness to learn from other disciplines and thought communities` (Meusburger, Heffernan and Suarsana, 2018). There is the need to embed scientific excellence in Africa. However, the process of embedding excellence must go beyond metrics and indicators that are based on individual performance in

terms of publications and citations; but rather focus on broader [science, research and innovation] systems strengthening that reward interdisciplinarity, co-creation and reflexivity in peer learning (Chataway and Daniels, 2020).

There is money for experimental and translational activities that help initiate institutional change: national innovation, regional innovation and smart and sustainable development in Africa are addressed by different policies and various programs and institutions such as the African Union (AU), the African Union Development Agency (AUDA) (formerly, New Partnership for Africa's Development (NEPAD)), the African Development Bank (AfDB), the World Bank and the United Nations Educational, Scientific and Cultural Organization (UNESCO), or UNECA and the European Program of Regional Innovation Strategies for African regions (Guislain *et al.*, 2005) (Signé, Banda and van de Walle, 2017).

Resources and actions are necessary on various fronts, including higher education (HE) science and research systems to generate the knowledge, capabilities and skills; governments to coordinate efforts and partnerships at many levels, alongside formulating and implementing evidence-based policies (Ahmed, 2018). Consequently, efforts to address these challenges, must involve the entire innovation ecosystem and activate and transform players in academia, business, government and society in co-creating solutions and sharing effective practices that advance the frontiers of knowledge on collaboration for social and economic progress, inclusive development and transitions towards sustainability and regional circularity (Daniels *et al.*, 2017; (Gebhardt, 2020).

The contribution show that innovation studies need more research on governance of innovation and system thinking (Gebhardt, 2013). Systemic interdependences are about mutual dependence and influence in the relations between different simultaneous processes or between different institutions. The discrete processes or institutions are parametrically linked with each other as it were; that is, they can reciprocally change important basic conditions for each other (Mayntz, 2002).

In this line of thought, **Yongabo** and **Göktepe-Hultén** show the value of system building and stakeholder interactions and how policy frameworks contribute to the emergence of an agriculture innovation system – a highly relevant but long neglected topic in Rwanda and in Africa in general. Transformation challenges the role of governments to set up appropriate

frameworks and governance structures that enable multi-stakeholder interactions in co-creating knowledge and solutions with new actors and sectors. The study illustrates that strategic and organizational aspects such as evidence-based policymaking, institutional capacity building, and a local platform designed for transparent resource allocation and collaboration contributes to innovation ecosystems strengthening.

Various continental policies, strategies and frameworks of the Africa Union speak to the issue of local specificity in transformation: for instance, the Agenda 2063, *The Africa We Want* (AUC, 2015), the STI Strategy for Africa (STISA-2024) (AUC, 2014); and the Continental Education Strategy for Africa (CESA 16-25) (AUC, 2016). Another important discourse across the African continent is the need for sustainability driven transition – for instance, transition from economies based on the extraction of natural resources to knowledge-based economies that are both sustainable and inclusive (Daniels and Amadi-Echendu, 2021).

At the same time, digital technologies move in a globalized mode and change the academic and industrial landscape through a new division of knowledge production and use. These organizational and technological and streams challenge existing frameworks, institutional settings, and established innovation schemes. Consequently, innovation policies and policymaking are evolving and adopting greater levels of co-creation, experimental programme design, and a sharper focus on directionality (Daniels et al, 2020a). In addition, the funding of social innovation and changes to university funding to facilitate interdisciplinary and translational education and research are also evolving.

Apparently, this dynamic has not reached all universities and academic programs. In this regard, **Walwyn** and **Combrinck** analyze the deficiencies in current pedagogical approaches and curricula to science and technology policy studies in Southern African universities. They propagate a new unique approach of self-reflexive, epistemic and value-based education which may create a robust and strong community of new academics that can embrace innovation policies that ensures that innovation addresses broader societal concerns and spur entrepreneurial thinking at the same time.

Despite concern that universities live up to a new role in innovation seeking countries (Dabic, 2016; Gebhardt and Stanovnik, 2016) there is hope that in this new discourse curricula will be changed and the African university can become a prototype of a creative and entrepreneurial

milieu researchers had in mind for higher education in innovation systems (Funke *et al.*, 2009; Meusburger, Heffernan and Suarsana, 2018) (Etzkowitz *et al.*, 2000). **Walwyn** and **Combrinck** emphasize that capacity building cannot be restricted on conveying content but must include new pedagogical practices, and address values such as inclusion, self-reflection and responsibility for future innovation policy practitioners. Walwyn and Combrinck take the Covid crisis as a turning point to alter existing practice and reintroduce the concept of epistemic cultures (Knorr-Cetina, 1999).

The shifts to these new paradigms are juxtaposed with former approaches that emphasized technological development paths and traditional academic teaching. Across the African continent, the development discourse is also shifting from STI and innovation policies for ‘catching up’ or ‘leapfrogging’ to innovation and innovation policies for transformative change, and transitions to more inclusive and sustainable development.

Nonetheless, **Twiringiyimana, Daniels, and Chataway** show that institutionalized big science, technology and innovation still play a central role in the national, regional and global social and economic development but changed to a paradigm of knowledge-driven innovation. The research underlines that innovativeness and creativity are never the result of individual action alone but needs a stimulating environment and interaction of university, industry and government within the innovation system. They discuss conceptual frameworks such as the Triple Helix (TH) and the National Systems of Innovation (NSI) that influence STI policies and regulatory frameworks for their applicability in the Sub-Saharan Africa context. The authors show that strengthening STI governance, in line with TH and NSI frameworks, requires clarity in responsibilities, improvements in accountabilities of actors involved in policymaking, structural reconfigurations and addressing management and capability gaps. These factors hinder effective interactions among research and innovation actors, thereby weakening the NSI’s ability to contribute to socioeconomic development and transformation.

With these new pathways of Big Sciences versus Citizen Driven Innovation Policymaking becomes a strategic importance and Governance an organizational challenge. What is the value of S&T for societal development, what science is needed in Africa and how can it be organized? Accordingly, (Manyuchi and Mugabe, 2018) argue that African S&T is narrowly defined, research and development (R&D) in local firms is not emphasized. And that important innovation aspects such as technology searching, procurement and technology diffusion. In

addition, institutional linkages and collaboration are few and weak, while engineering and entrepreneurship capabilities are not fully employed. They point to the problem of limited financial resources, low levels of technological readiness and innovation capacities and generally poor and neglected R&D infrastructure.

We believe that at the level of policy, a new thinking is required as a precondition for investments. This new thinking must transcend the practice of restricting policies on innovation to sectors. Rather, policies to foster innovation (including science and research in HEIs) must take a systems level approach, and focus on addressing directionality failures, the SDGs, transformation, and resilience of Africa. Achieving this objective demands a new approach to innovation policymaking, such as the TIP approach. Furthermore, innovation policies in Africa must begin to look beyond sectoral and national levels and explore how to formulate, implement and govern research and STI policies at regional levels in ways that help promote cross border collaboration and cooperation – as necessitated by the Africa Continental Free Trade Area (AfCFTA) agreement. Within the context of the regional integration agenda of the African Union as encapsulated under agenda 2063, there is an increasing need for regional policies on innovation and regional integration on the continent, the integration of local stakeholders in the governance of innovation and there is an urgent need for systematic collection of data and appropriate indicators to measure progress and execute evidence-based policy, especially in relation to STI policies.

If we adopt that renewed policy approach the systemic perspective on innovation underlines that Speed of Transformation and Policy Implementation relies on accomplishments in other fields such as Governance of Innovation, Development of the Innovation Ecosystem, Management Education and Capacity Building and on Technicalities. Organizational and technical solutions are relevant and have decisive impact on the success of the African policy agenda. Citizen Participation relies on the overall Quality of Education in a society and Communication on all levels appears to be a key success factor for reflecting the interconnectivity and interoperability of topics and stakeholders in a dynamic transformation process and for making the necessary adaptations and corrections.

A strong engine in the system is discernable through the linkages of Citizen Participation, Communication, Trust, local stakeholder governance, a new image and African brand, and the Speed of Transformation which will again spur citizen participation. This loop can be a strong

enabler of self-organized dynamics in the innovation system and a key point in African innovation policy.

Future research agenda for higher education, research, science and innovations systems in Africa that emerge from this special journal series include:

- The need for innovation studies to focus more research on the governance of innovation (and innovation policy) and system thinking.
- Reconsideration of global value chains. What does circular economy mean for African states?
- African innovations clusters and solution driven regional innovation. What does the quadruple helix in practice mean in Africa?
- Organizational and digital readiness check for high technology: what roles for Africa in space technologies and AI for development and transformation?
- Policy implementation of the new STI: cases and lessons learned. What are “best in class” governance models for the subnational level of innovation policy? And how may these best in class governance models be scaled up and better deployed to support Africa’s transformation agenda and development aspirations?
- In what ways can the possible impacts from UNECE driven SDG KPIs support the transitions to smart and sustainable cities in Africa?

References

- Ahmed, F. (2018) 'Preparedness and Economic Integration in Africa - A Case with Reference to APRM', *African and Asian studies*, 17(3), pp. 205-254.
- Akon-Yamga, G., Daniels, C.U., Quaye, W., Ting, M.B and Asante, A (2021). Transformative Innovation Policy Approach to E-Waste Management in Ghana: Perspectives of actors on transformative change, *Science and Public Policy*, <https://doi.org/10.1093/scipol/scab005>
- AU (African Union), 2020. The Digital Transformation Strategy for Africa (2020-2030), <https://au.int/en/documents/20200518/digital-transformation-strategy-africa-2020-2030>
- African Union Commission (AUC) (2014). Science, Technology and Innovation Strategy for Africa 2024. Addis Ababa, AUC.
- AUC (2015). Agenda 2063, The Africa We Want, Popular Version, AUC
- AUC (2016). Continental Education Strategy for Africa (CESA) CESA 2016-2025. Addis Ababa, AUC.
- AUDA-NEPAD (African Union Development Agency), (2019). *African Innovation Outlook III*. Johannesburg, South Africa: AUDA-NEPAD

- Audretsch, D. B. and Audretsch, D. B. (2014) 'From the entrepreneurial university to the university for the entrepreneurial society', *The Journal of technology transfer*, 39(3), pp. 313-321.
- Chataway, J., Dobson, C., Daniels, C., Byrne, R., Hanlin, R. and Tigabu, A. (2019). Science Granting Councils in Sub-Saharan Africa: Trends and tensions, *Science and Public Policy Journal*, scz007, <https://doi.org/10.1093/scipol/scz007>
- Chataway, J. and Daniels, C. (2020). The Republic of Science meets the Republics of Somewhere: Embedding scientific excellence in sub-Saharan Africa, 39-58. <http://doi.org/10.5281/zenodo.3607326>. In Kraemer-Mbula, E., Tijssen, R., Wallace M. L. and McLean, R (eds) *Transforming Research Excellence: New Ideas from the Global South*. Cape Town: African Minds
- Dabic, M. (2016) *Entrepreneurial Universities in Innovation-Seeking Countries Challenges and Opportunities*. 1st ed. 2016.. edn. New York: New York : Palgrave Macmillan US : Imprint: Palgrave Macmillan.
- Daniels, C. (2020). Transformative Innovation Policy Africa, technical report for the IDRC, Canada: <https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/59142/IDL-59142.pdf>
- Daniels C., Amadi-Echendu J. (2021) Entrepreneurship, Innovation, and Technology Commercialisation for Transformative Change in Africa: Perspectives, Policies and Practices. In: Daniels C., Dosso M., Amadi-Echendu J. (eds) *Entrepreneurship, Technology Commercialisation, and Innovation Policy in Africa*. Springer, Cham., https://doi.org/10.1007/978-3-030-58240-1_1
- Daniels, C., Dosso, M., and Amadi-Echendu J. (eds.) (2021). *Entrepreneurship, Technology Commercialisation, and Innovation Policy in Africa*, Springer Nature, Cham., <https://doi.org/10.1007/978-3-030-58240-1>
- Daniels, C., J. Schot, J. Chataway, M. Ramirez, E. Steinmueller and L. Kanger (2020a), Transformative Innovation Policy: Insights from Colombia, Finland, Norway, South Africa, and Sweden, In *Innovation policy at the intersection Global debates and local experiences*, Cele MBG, TM Luescher and AW Fadiji (eds.), HSRC
- Daniels C., Erforth, B., Floyd, R. and Teevan C. (2020b). Strengthening the Digital Partnership between Africa and Europe by ETTG, DIE, ECDPM and ACET, available at: <https://ettg.eu/2020/10/26/strengthening-the-digital-partnership-between-africa-and-europe/>
- Daniels, C., Ustyuzhantseva, O. and Yao, W. (2017). Innovation for inclusive development, public policy support and triple helix: perspectives from BRICS, *African Journal of Science, Technology, Innovation and Development*, 9, 5, 513-527
- Etzkowitz, H. (2003) 'Research groups as *quasi-firms*TM: the invention of the entrepreneurial university', *Research policy*, 32(1), pp. 109-121.
- Etzkowitz, H. (2008) *The triple helix : university-industry-government innovation in action*. New York: New York : Routledge.
- Etzkowitz, H. (2013) 'Anatomy of the entrepreneurial university', *Social science information (1967)*, 52(3), pp. 486-511.
- Etzkowitz, H., Webster, A., Gebhardt, C. and Terra, B. R. C. (2000) 'The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm', *Research policy*, 29(2), pp. 313-330.
- Funke, J., Meusburger, P., Wunder, E. and SpringerLink (2009) *Milieus of creativity an interdisciplinary approach to spatiality of creativity*. Dordrecht: Dordrecht : Springer.
- Gebhardt, C. (2013) 'The making of plasma medicine. Strategy driven clusters and the emerging roles of cluster management and government supervision', *The Journal of technology transfer*, 38(4), pp. 401-414.

- Gebhardt, C. (2020) 'The Impact of Participatory Governance on Regional Development Pathways: Citizen-driven Smart, Green and Inclusive Urbanism in the Brainport Metropolitan Region', *Triple helix (Heidelberg)*, 2019(1), pp. 69-110.
- Gebhardt, C. and Stanovnik, P. (2016) 'European Innovation Policy Concepts and the Governance of Innovation: Slovenia and the Struggle for Organizational Readiness at the National Level', *Industry & higher education*, 30(1), pp. 53-66.
- Guislain, P., Ampah, M. A., Besançon, L., Niang, C. and Sérot, A. (2005) *Connecting Sub-Saharan Africa : A World Bank Group Strategy for Information and Communication Technology Sector Development*. Washington, DC: World Bank.
- Kahn, M. (2014) 'The rise of the BRICS and resource nationalism: challenge and opportunity for Africa's innovation systems', *African Journal of Science, Technology, Innovation and Development: Innovation Research and Economic Development in Africa*, 6(5), pp. 369-381.
- Knorr-Cetina, K. (1999) *Epistemic cultures : how the sciences make knowledge*. Cambridge, Mass. ; London: Cambridge, Mass. ; London : Harvard University Press.
- Manyuchi, A. E. and Mugabe, J. O. (2018) 'The production and use of indicators in science, technology and innovation policy-making in Africa', *Journal of Science and Technology Policy Management*, 9(1), pp. 21-41.
- Mayntz, R. (2002) 'University councils: an institutional innovation in german universities: Patterns of internal decision-making in universities', *European journal of education*, 37(1), pp. 21-28.
- Meissner, D., Erdil, E. and Chataway, J. (2018) *Innovation and the Entrepreneurial University*. 1st ed. 2018.. edn. Cham: Cham : Springer International Publishing : Imprint: Springer.
- Meusburger, P., Gregory, D., Suarsana, L. and Klaus Tschira, S. (2015) *Geographies of knowledge and power*. Dordrecht: Dordrecht : Springer.
- Meusburger, P., Heffernan, M. and Suarsana, L. (2018) *Geographies of the University*. 1st ed. 2018.. edn. Cham: Cham : Springer International Publishing : Imprint: Springer.
- Muchie, M. and Baskaran, A. (2013) *Creating Systems of Innovation in Africa: Country Case Studies*. Cape Town: Cape Town: African Books Collective.
- Nesbitt-Ahmed, Scharwatt & Daniels (2020). Supporting the Growth of the Tech Start-Up Ecosystem in Uganda - A Policy Outlook, GSMA, <https://www.gsma.com/mobilefordevelopment/resources/supporting-the-growth-of-the-tech-start-up-ecosystem-in-uganda-a-policy-outlook/>
- Oloruntopa, S. O. and Muchie, M. (2018) *Innovation, Regional Integration, and Development in Africa: Rethinking Theories, Institutions, and Policies*. Cham: Cham: Springer International Publishing AG.
- Ottevanger, W. (2007) *Developing science, mathematics, and ICT education in Sub-Saharan Africa patterns and promising practices*. Washington, D.C.: Washington, D.C. : World Bank, Africa Region, Human Development Dept.
- Schot J and Steinmueller WE (2018) Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, 47, 9, 1554–1567
- Signé, L., Banda, H. E. J. and van de Walle, N. (2017) *Innovating development strategies in Africa: The role of international, national, and regional actors*.