

# Challenges and Opportunities for Enabling Mutual Learning and Collaboration in Design and Innovation for Sustainable Development in Africa and Beyond

S. Nilsson <sup>1,✉</sup>, B. Shibwabo Kasamani <sup>2</sup>, J. Hede Mortensen <sup>1</sup>, D. Stevanovic <sup>3</sup>,  
M. Wanyang <sup>2</sup>, M. Norell Bergendahl <sup>1</sup> and P. Y. Papalambros <sup>4</sup>

<sup>1</sup>KTH Royal Institute of Technology, Sweden, <sup>2</sup>Strathmore University, Kenya,  
<sup>3</sup>Botho University, Botswana, <sup>4</sup>University of Michigan, United States of America

✉ suni@kth.se

## Abstract

Global collaboration and mutual learning in design are put forth as means to address the UN SDGs. This paper draws upon experiences in the Design Society's AFRICA-DESIGN initiative to build a network of design academics and practitioners based in Africa with a focus on design for sustainable development. We identify education and social sustainability as particular opportunities and challenges, highlighting the critical element of mutual learning in the collaboration process.

*Keywords: sustainability, collaborative design, innovation, mutual learning, Africa*

## 1. Introduction

Collaboration and mutual learning facilitate innovation and the exchange of best practices, ideas, and experiences in advancing a sustainable development agenda (Assane, 2010; Vangrieken et al., 2017; Robertson et al., 2014). Their practical implementation remains limited, predominantly due to organisational issues and power differentials, i.e., unequal power relations, in the partners (Isabekova, 2021). The African continent has the fastest projected population growth with a massive young people population (Ezeh et al., 2020; Kaba, 2020), strongly motivated towards design and sustainability, learning from each other and people around the world (Bartniczak and Raszkowski, 2019). Nevertheless, Africa has the lowest number of engineering professionals per capita globally (UNESCO 2021). Along with a traditional education model, it risks missing out on gains from new technologies and design practices. Academia and higher education have a critical role in developing education programs that enable learning in teams while addressing real-life challenges (Ibwe et al., 2018; Rosén et al., 2018). African nations can potentially leapfrog the developed world with disruptive innovations and avoid past resource-intensive practices (Bartniczak and Raszkowski, 2019). Design science and practice are vital contributors to innovation for sustainable development (Ambole, 2020; Mitropoulos et al., 2020).

There is relatively little reverse flow of ideas, approaches, and design practices from lower to higher-income countries and institutions. More effort to support such reverse flow is required for two primary reasons. Firstly, there is a danger of missing out on ideas and innovations from more than half of the world. Secondly, the opportunity for learning from people and countries that frequently lack established infrastructure and are freer to experiment and innovate is lost (Cirera and Maloney, 2017). Moreover, research and innovation are context-based, requiring deep knowledge of the targeted situation and the associated needs, challenges, and opportunities (Ambole, 2020).

While different countries may seek to create, expand or maintain innovations towards sustainable development goals (SDGs), they face the same issues, so the solutions are likely to be similar (Crisp, 2014). The notion of 'international development' is increasingly ill-fitting given that the world is now strongly interconnected, and the boundaries between developed and developing regions are blurring, indeed, concerning sustainable development (Horner, 2020). This situation advocates for a relational global development approach recognizing the necessity for a critical focus on the persistent tensions between universalization and geographic variation (Horner, 2020). It presents a particular set of challenges and opportunities (CEPAL 2018).

In 2019 AFRICA-DESIGN (AD) was initiated in the Design Society with an inventory of interest from design researchers, educators, and practitioners active in design for SDGs based in Africa and current and potential global partners. The AD network aims at increasing mutual learning with open experience sharing, collaboration, and joint support for sustainable development through design. The success of partnerships is strongly dependent on the adherence to the principle of mutuality in all aspects of practice, in turn, linked to working similarly. Robust strategies for mutual learning and collaboration are required to support design and innovation in fostering local, national, and multi-national fertilization of ideas and innovation (Vangrieken et al., 2017).

This paper aims to identify potential directions for how design research and practice can support sustainable development through mutual learning and collaboration with African peers. The paper draws from the experiences of workshops, course instruction, surveys, literature reviews, and other interactions within the AD network over the past three years to identify challenges and opportunities in seeking such mutual learning.

## 2. Background

Design research and practice have a long history in sustainable development. Ceschin and Gaziulusoy (2016) show different design for sustainability (DfS) approaches addressing different system or innovation levels. DfS ranges from products to product-service systems and their influence on sustainable behaviors at the community spatio-social and techno-social levels to supporting a transition to new sustainable socio-technical systems where co-designing, co-creation, and collaborative innovation are vital approaches. Tackling complex societal 'grand' challenges and supporting a sustainable transition requires practices beyond traditional innovation and development processes. The involvement of a diverse range of stakeholders in the design process is necessary to explore relevant issues, interests, and value differences (Sanders et al., 2010) and long-term success (Rajski and Papalambros, 2020). Open and collaborative innovation practices have been studied for some time, but methodological and practical perspectives on sustainability challenges need further examination (Zolfagharian et al., 2019). Robust strategies for mutual learning and collaboration are required to support design and innovation, fostering local, national, and multi-national fertilization of ideas and innovation (Vangrieken et al., 2017). Partnership success is strongly dependent on adherence to the principle of mutuality in all aspects of practice, which is linked to working similarly. Mutual learning can be defined as the process of coming to a deeper understanding of principles through learning interculturality, and it is central to the development of lasting relationships (Martin and Wyness, 2013).

Achieving the SDGs is also demanding due to their systemic nature. Their linkages to each other and their complex geographical coupling require solutions that account for the influence from local institutions and contexts at many different locations (Coenen et al., 2015). Existing diffusion models for sustainable development and transition presuppose that innovations typically start in industrialized nations to reach emerging and developing economies slowly. There is, however, increasing evidence that activities and innovations are also originating in emerging economies through leapfrogging, e.g., where a developing country skips stages in industrialized nations' traditional technological development process, enabling them to implement new solutions faster (Binz et al., 2012). Such findings offer an essential source for learning and exchange and indicate alternative ways to address SDG challenges through innovation. In addition, there is an emerging stream of literature on the potential role of frugal and reverse innovations, e.g., when innovations developed for or in emerging markets also make inroads in developed markets (Pisoni et al., 2018; Zeschky et al., 2014). Africa's large informal sector produces frugal innovations using locally available and affordable resources (Ambole, 2020b). Frugal innovators

use modern technologies in new ways by merging digital technologies with traditional ones from indigenous knowledge (Hede Mortensen et al., 2021).

Consequently, we need to understand better how innovation, design theories, and practices apply in hitherto relatively new settings such as Africa. Design and engineering research in Africa is insufficient (Barlow et al. 2020), and there is limited awareness of African designers and engineers (Ambole, 2020). African design is rich in diversity and differs, for example, from Western design views and approaches (Yeo and Cao, 2021). One may question the underlying assumptions built into the research models for sustainable development and innovation and what and how design practices are shared. Teaching established design practices created, for example, in Europe and North America, entails the risk of overlooking the needs, challenges, and opportunities in very different places like Africa (Mittelmeier et al., 2018). Transfer of practices and research is situational and requires an intimate knowledge of the targeted environment.

Design practices and research in Africa must be pursued and developed in line with the relevant needs and opportunities of the surrounding environment, people, and a changeable, developing future (Ambole, 2020). For example, Africa has unique challenges and opportunities due to its dramatic acceleration of development in the last decades, especially in comparison to the ‘global north’ (Massen, 2020). Transdisciplinary research, opportunities for co-creation, and knowledge sharing could bring global relevance to African design (Chilisa, 2017). Several initiatives enable knowledge sharing and mutual learning, such as the WHO Global Learning Laboratory for Quality UHC (WHO 2018) and the Global Development Hub in Sweden (2021). Partners from Africa and industrialized countries build new competencies and identify novel solutions. They co-create local solutions and build knowledge on applying these in other contexts. AD aligns with such initiatives, designed to stimulate mutual learning and collaboration in design research, education, and practice for sustainable development.

In summary, we find that (i) sustainable innovation and design require collaboration among globally distributed stakeholders, not the least with the African continent, to ensure multiple perspectives and capacities; (ii) design-related studies are scarce in such a context, and therefore, there is a need for such studies to further our understanding of mutual learning and collaboration. Based on our experiences from developing AD, we identify areas of collaboration that emerge of mutual interest and areas where perspectives and needs differ. In addition, we suggest what may enable mutual learning and collaboration in design and innovation for sustainable development.

In the following section, we describe what data was collected and analyzed. In the Findings section, we describe the three main areas identified in more detail, emphasizing similarities and differences in the survey participants' perspectives. Thereafter, we discuss our findings with the literature to highlight issues that emerge as critical to consider to enable mutual learning and collaboration in design and innovation for sustainable development. Finally, we offer some practical implications for design communities with an ambition to increase collaboration and mutual learning with African peers.

### 3. Data Collection and Analysis

The primary data source in this paper is material from three workshops and a survey. In 2019 the first AD workshop at the International Conference on Engineering Design (ICED) confirmed the need and desire to build the network (Greene 2019), and a website and LinkedIn group were set up. In 2020 several students were contracted to enable young generation voices particularly in Africa. Online workshops were held at the International Design Conference (Wanyang et al., 2020) and at ICED21. Recently and in line with the idea of mutual learning is the introduction of the AFRICA-DESIGN Barazas. *Baraza* is a Swahili word meaning ‘a public meeting place, get-together,’ and these workshops welcome members to suggest and organize an event in their own style supported by AD (Baraza 2021). Transdisciplinarity, mutual collaboration and learning opportunities were common themes in all AD workshops. Prior to ICED21 a survey was sent out to AD members and potential members, particularly university students, to solicit experiences and ideas on sustainable development and design (Stevanovic et al., 2021). The survey was created to gather insights about sustainable development and design and understand how different individuals behaved regarding sustainable behaviors, reasons for these behaviors, and the effects of COVID-19 locally and globally. The survey had 25 open-ended and Likert

scale questions and collected qualitative and quantitative data. The survey was initially sent out to approximately 49 individuals, posted on the AD LinkedIn group and forwarded to interested parties.

**Table 1. Areas of interest highlighted by workshop participants and survey respondents**

<i>Main areas of interest</i>	<i>Categories</i>	<i>Examples /Applicable to</i>
Education	Design education	Accessibility; sustainability issues; employability; creating impact; platforms; joint teaching opportunities; support the youth; conferences and workshops; reality-based projects
	Complex systems	Health care system; transportation; conservation; water; poverty; household equipment; renewable energy; waste management; disability equipment
Design Methods for Collaboration	Product service system methods and tools	Data integrity; affordability; multi-sector; codesign; system engineering; human centred approach; problem-based learning; challenge driven education; design thinking; frugal engineering
	Design practices	Degree of expert design practice enacted when designers are working with and without culturally concordant design challenges
Sustainable Behavior	Innovative society	self-sustainable; helping other societies; technology adoption and adaption; revised school system; creating awareness; circular economy
	Sustainability in Communities	Shift in mindset; recycling; recreation; pollution; inequality; poverty; limited knowledge on sustainability; over consumption
	Sustainability and COVID-19	Working remotely; travelling behaviors; technology usage; effects on collaboration; diversified revenue streams; inequality; exclusion; social interaction
	Practiced sustainable behaviors and reasoning	Purchasing behaviors; dietary choices; volunteering; waste management Global climate concerns; health; self-motivation;

From a total of 88 respondents, 40 from Africa, Europe and the Americas answered in full. Survey responses were used as a guide in conducting the ICED21 workshop. Survey data included single answers and responses based on age, region, and profession. The data were not sufficient for quantitative analysis but served as indicators to most and least prominent responses. Data analysis was performed using workshop material and survey reports as primary sources. Three of the authors started by labeling the workshop material (i.e., workshop report, concluding remarks from speakers and workshop breakout group reports) with a description and source and clustered it into themes based on topic (Guest and McLellan, 2003). In the next step, the open-ended answers in the survey report were analyzed similarly by identifying topics of interest and common and diverse perspectives on design and sustainable development among regions, age and profession. We identified in total 28 themes retaining the initial information. We reviewed the themes as a team and finalized their framing into descriptive text. The survey report was then analyzed again, extracting information not previously detected. These findings were used to augment the previous ones, finally classifying all findings into three main areas of interest, Education; Design Methods for Collaboration and, Sustainable Behaviors, see (Table 1). These areas are discussed further in Section 4, highlighting the diverse perspectives on design and sustainable development.

## 4. Findings

### 4.1. Education

There is an impending, urgent need to reorganize education programs and courses in Africa and the world at large to incorporate sustainability. A focus group discussion during the ICED21 workshop on education and sustainability derived the realization that most of the time, sustainability revolves around relatively high-level concepts such as climate change, energy, resources and the green city — and the need for this notion to be challenged. This notion was argued to contribute to the slow uptake, application and discourse, and incorporation of sustainability in the academy. According to survey respondents, individuals, universities, and students are trying to address the lack of knowledge and education related to sustainability in their own communities and the evolving academic curricula. According to group discussions, non-designers initially apprehensive about using design thinking methods, when introduced to design process tools in their contexts, became comfortable and open to adopting design methods and tools to replace or complement traditional ones. Currently, sustainability and design thinking methods are introduced only at some higher learning institutions both in Africa and in most parts of the world. Great strides can be made if such thinking and methods are introduced at earlier stages of learning, invoking change and inspiring action. Examples from survey respondents were that teachers can support the sustainability movement by starting small and introducing sustainable thinking at earlier education stages, for example, STEM projects with reused materials in science camps, forming clubs to educate the public on tangible conservation benefits. According to a challenge-and-action group discussion at ICED19, it is critical to design sustainable education in a way that corresponds to the existing immediate environment and context, for example, the needs of a student, child, or parent, but also considering the entire society. This idea calls for a versatile curriculum and action-based training for teachers as well.

Within education, knowledge sharing can be created through joint teaching opportunities. For this to become a reality, joint teaching opportunities must be available and practical. Through a discussion at DESIGN 2020, joint teaching opportunities can entail two or more institutions with different contexts, learning together and from each other how best they can collaborate considering factors such as differences in financing, academic systems and time zones, and local conditions like attitudes and job opportunities. Despite all the challenges, such collaborations can chart the best way to get more individuals, including students, engaged in sustainability studies and practice. From the group discussion, joint grants for building collaborations and a larger platform/network as well as joint publications from such teams were suggested as possible ways of pursuing joint teaching opportunities.

Most teachers and students answering the survey agreed that COVID-19 had affected progress in sustainable development worldwide and created challenges for sustainable behavior in their own communities, independent of what region they were from. The majority of teachers also agreed that COVID-19 has facilitated collaboration around sustainable development and design. An example at hand is the AD workshops conducted online due to COVID-19 restrictions engaging participants from many more countries and industries than before. Another example was a semester-long online regular design course with students from Botho University in Botswana, Makerere University in Uganda, and University of Michigan in the USA (APD 2020.)

### 4.2. Design Methods for Collaboration

Collaboration and co-design can steer sustainable development. Integrating research teams with government or policymakers is necessary for designing complex systems contributing to the SDGs, as is a collaboration between local communities and researchers. This is a complex challenge in practice, as emphasized during break-out group discussions at ICED19.

Co-design teams can positively impact collaboration when common rules, roles, and methods are established, and mutual trust is built within the team. A place to store and share information and potential funding can lead to further discussions, broader research, and advanced innovative solutions. As spaces to share information, conferences and workshops are in demand to accelerate innovation, research, and

sustained engagement. For example, ICED21 workshop participants were asked to initiate a discussion on how to cultivate a global partnership in sustainability. The ensuing responses indicated barriers, such as participation costs and travel, need for action-based and practical value-added follow-up, and global emphasis on youth and students. Throughout all workshops, the need to make events affordable and accessible to all participants was dominant, while preserving continuity and promotion of peer-to-peer learning. As one result, the ICED21 workshop prioritized the engagement of a younger audience through a call for specific, personal, student innovative ideas and solutions within Africa, several of which were selected and presented at the workshop. An outcome from the workshop was the highlighting of Problem-and Challenge Based Learning in multi-disciplinary teams as an essential means to build international and regional networks and tackle sustainability challenges in local communities. Experiences from using such an approach were emphasised to facilitate knowledge generation on the challenges and create sustainable solutions to the challenges. The AFRICA-DESIGN Barazas aim to create and harness collaborations, networking, and sustained engagement. Co-designing design education is a critical action to create opportunities, behaviors, and incentives for social, environmental, and economic sustainability on a global and local level by and for all included.

### 4.3. Sustainable Behaviors

Social issues, circular economy, and environmental aspects were the three most frequent categories of interest in survey responses related to sustainable behaviors. Purchasing behaviors were the most common one in all regions, including buying in bulk, organic or eco-friendly products, and second-hand or fair-trade goods. In contrast to respondents from the other regions, African respondents dedicated time to volunteering and charity work, and made efforts to increase awareness about sustainable thinking in their communities. Proper waste management was of high importance to European respondents and dietary behaviors to the Americas. The African region was more interested in sustainable societal changes as opposed to interest in environmental sustainability behaviors in other regions.

Under 35-year-olds were more driven to make changes due to increased awareness, self-motivation, and concerns about global climate. At the same time, over 36-year-olds were motivated by social concerns and the influence of family or friends. Age did not factor greatly but under 35-year-olds showed more consciousness of waste management, including reusing or recycling, volunteering, and dietary behaviors, such as leading a vegan or vegetarian lifestyle. Concentrating on sustainability surfaced various concerns depending on the region. Over-consumption of water, energy, food and, clothing, and waste management were main concerns of respondents from Europe and the Americas. On the other hand, social concerns, inequality, poverty, economic growth, limited knowledge on sustainability, pollution and lack of proper waste management were the main concerns of African respondents.

The DESIGN 2020 workshop discussions suggested that a shift in mindset must occur regarding the social aspect of sustainability to encourage behavioral changes towards more mindful ways of using resources, and manufacturing for a circular economy and restorative business models. It was pointed out that while governments, NGOs, the private sector, and schools are prominent stakeholders in tackling inequality, poverty, and economic growth, individuals make decisions every day. Making conscious sustainability decisions requires community engagement and awareness. Several sustainability projects were mentioned as driven by the youth (18–35-year-olds) globally. Project financing was an essential requirement expressed by survey respondents along with implementation of action-based practical solutions.

The COVID-19 pandemic induced an increase in technological development, faster spread of Information Communication Technology (ICT), and some African and European respondents expressed a surge in ICT usage. While start-ups that were aiming to tackle SDGs increased, those with limited access to resources like ICT believed they were left behind. African respondents stated that behaviors affected by the pandemic diversified revenue streams and incomes, working from home, increased technology use, greater shared knowledge, and more accessible collaboration opportunities both locally and globally. European respondents, on the other side noted the pandemic to facilitate easier collaborations globally but less on a local level. In addition, it increased local awareness and more time

for oneself. American respondents mentioned increased healthy behaviors and technology use. On a community and global level, the pandemic showed a push for sustainable materials, illuminating environmental issues, and sustainable behavior changes, such as more extensive interest in greener cities and less consumption of energy and water by European respondents, imposed lockdowns contributing to climate preservation by the African respondents, increased electricity usage by American respondents. More limits on resources for actors interested in sustainability and halting some community development were also mentioned. African and American respondents stated that there had been reduced or no emphasis on sustainability during the pandemic. Finally, many survey respondents perceive that the pandemic created challenges for sustainable behaviors in their community, such as increased inequality and exclusion. Some believe that COVID-19 has negatively affected progress in sustainable development worldwide, such as in global collaboration and shared systems.

## 5. Discussion

From the above findings, we assert that collaboration and co-design in design education and research related to sustainable behavior offer two particular opportunities for the design community to make contributions.

Collaboration in design education includes collaboration among teachers, collaborative problem solving, learning by studying real problems in communities and co-designing their solutions, and collaboration in digital technology-based learning. The latter provides a flexible, affordable, and increasingly effective opportunity for mutual learning and collaboration, which enhances knowledge sharing and serves as a catalyst for innovation. Also, more recent pedagogical concepts such as Challenge-Driven Education using design methods and co-designing as cornerstones support learning experience, innovation, and sustainability and can be harnessed and extended (Rosén et al., 2018; Ibwe et al., 2018). As Ambole (2020b) articulates, design is a practice in creative thinking and a collaboration tool that can facilitate the participation of marginalized communities.

However, we must carefully select the SDGs to include in education, as our findings show that the views on what goals are important differ significantly among regions. Social sustainability is prominent from the African perspective. However, Africans are alienated from the sustainability discourse as the environmental aspect dominates the discussions. Our findings and the literature show how Africans focus more on social sustainability while Europeans and Americans focus more on environmental sustainability.

History, and particularly the legacy of colonization, together with the importance of context and local conditions in design, our findings also point to challenges that need careful consideration to ensure mutual learning and collaboration. The key challenge is related to the power balance. Collaborating and co-designing in design education requires attention to assume that only the industrialized nations have the ability to teach and innovate (Robertson et al., 2014; Pisoni et al., 2018). We suggest a need to re-think the co-design concept developed in the industrialized world with a focus on end-user involvement. Our challenges' global and systemic nature highlights that it is not self-evident who is the 'end-user.' (Binz et al., 2012; Horner, 2020; Coenen et al., 2015). A solution developed in one region may influence and be coupled to end-users in other areas (Zeschky et al., 2014). Hence, we must evolve the concept of co-designing itself to facilitate mutual learning and collaboration. The Baraza mentioned earlier is such an effort — even the naming of concepts is vital for inclusivity.

Our findings point to the potential for collaboration in research studies focusing on design and sustainable behaviors. We suggest that such collaboration can build knowledge on the link between individual behavior change and systems change. This aligns with the recent interest in system engineering to address not only complex technical systems but also socio-technical systems (Ceschin and Gaziulusoy, 2016). For example: What product-service system designs promote social sustainability? What is the impact of regional and age differences on such design decisions?

COVID-19 has influenced social behavior changes, and it is crucial to capitalize on the gains made. However, COVID-19 has shown that people have divergent views and experiences on how the pandemic has affected collaboration, especially for sustainability. It shows that we are not connected globally to even understanding what sustainability issues and efforts exist. COVID-19 may have provided a fresh page to start from on tackling these problems

## 6. Conclusion

With Africa's population projected to reach 1.5 billion by 2030 and then 2 billion by 2050, it is critical to engage and collaborate with Africa for global sustainable development. We believe that design researchers have an essential role to play. As shown in this paper, the opportunities for mutual learning and collaboration are many and will continue to grow. We bring light to the opportunities related to education, where traditional course designs and modes need to be challenged for mutual learning and collaboration to take place in practice. With the support of new digital technologies and the adoption of design-driven, innovative and collaborative modes such as challenge-driven education, teaching sustainability that can be of impact has a chance to become more effective. Further, we identify the many possibilities for collaboration in design research where building knowledge on the diverse needs and perspectives and the consequences from the systemic nature of the SDGs emerge as critical targets. We need design research to focus on locally developed context-sensitive devices to support sustainability in everyday life and to address complex social and economic issues, for instance, through systems-level modelling of design decisions. There is also a need for studies exploring non-mutual-learning situations across different age groups, countries, teams, cultures, and territorial characteristics. Additionally, innovative spaces for global knowledge and exchange of ideas, such as the Baraza's and the AD network to also support the networking among African peers. Design communities have a substantial agenda going forward that relates to constructive and critical engagement to formulate context-aware mechanisms of mutual learning and collaboration in design and innovation for sustainable development.

## Acknowledgement

This work has been partially supported by the Donald C Graham Endowed Chair at the University of Michigan and GDH Global Development Hub, KTH Royal Institute of Technology.

## References

- Ambole, A. (2020), "Rethinking Design Making and Design Thinking in Africa", *Design and Culture*, Vol. 12 No. 3, pp. 331-350. <https://doi.org/10.1080/17547075.2020.1788257>
- Ambole, A. (2020b), "Embedding Design in Transdisciplinary Research: Perspectives from Urban Africa", *Design Issues*, Vol. 36 No. 2, pp. 28-40. [https://doi.org/10.1162/desi\\_a\\_00588](https://doi.org/10.1162/desi_a_00588)
- APD (2020) Analytical Product Design', University of Michigan, <https://sites.google.com/prod/umich.edu/adp>. Accessed 2021-11-12.
- Assane, M., I. (2010), "South-South Mutual Learning: A priority for national capacity development in Africa", *Development Outreach*, Vol. 12 No. 2, pp. 13-15. <https://openknowledge.worldbank.org/handle/10986/6078>
- Barlow, T.W., Greene, M.T., and P.Y. Papalambros (2020). "Review of Design Research for Sustainable Development in Africa: A Design Science Perspective", *Proceedings of the Design Society: DESIGN Conference*, 1, 1863-1872. <https://dx.doi.org/10.1017/dsd.2020.154>.
- Baraza, (2021), Design Society AFRICA-DESIGN, <https://africadesign.designsociety.org/25/AFRICA-DESIGN+BARAZA>. Accessed 2021-11-15.
- Bartniczak, B. and Raszkowski, A. (2019), "Sustainable Development in African Countries: An Indicator-Based Approach and Recommendations for the Future", *Sustainability*, Vol. 11 No. 1., pp. 1-23. <https://dx.doi.org/10.3390/su11010022>
- Binz, C., Truffer, B., Li, L., Shi, Y., and Lu, Y. (2012), "Conceptualizing leapfrogging with spatially coupled innovation systems: The case of onsite wastewater treatment in China", *Technological Forecasting and Social Change*, Vol. 79 No. 1, pp. 155-171. <https://dx.doi.org/10.1016/j.techfore.2011.08.016>
- CEPAL (2018), Emerging challenges and shifting paradigms: New perspectives on international cooperation for development. Economic Commission for Latin America and the Caribbean, <https://www.cepal.org/en/publications/44002-emerging-challenges-and-shifting-paradigms-new-perspectives-international>. Accessed 2021-11-15.
- Ceschin, F., and Gaziulusoy, I. (2016), "Evolution of design for sustainability: From product design to design for system innovations and transitions", *Design Studies*, Vol. 47, pp. 118-163. <https://doi.org/10.1016/j.destud.2016.09.002>
- Cirera, X. and Maloney, W.F. (2017), "The innovation paradox: Developing-country capabilities and the unrealized promise of technological catch-up". World Bank Publications.



- Chilisa, B. (2017), "Decolonising transdisciplinary research approaches: an African perspective for enhancing knowledge integration in sustainability science", *Sustainability Science*, Vol.12 No. 5, pp. 813-827.
- Coenen, L., Hansen, T., and Rekers, J. V. (2015), "Innovation policy for grand challenges. an economic geography perspective", *Geography Compass*, Vol. 9 No. 9, pp. 483-496. <https://doi.org/10.1111/gec3.12231>
- Crisp, N. (2014), "Mutual learning and reverse innovation—where next?" *Globalization and Health*, Vol. 10 No. 1, pp. 1-4. <https://doi.org/10.1186/1744-8603-10-14>
- Ezeh A. Kissling F. and Singer P. (2020), "Why sub-Saharan Africa might exceed its projected population size by 2100", *The Lancet*, Vol. 396 No. 10258, pp. 1131 – 1133. [https://doi.org/10.1016/S0140-6736\(20\)31522-1](https://doi.org/10.1016/S0140-6736(20)31522-1)
- Global Development Hub (2021), Royal Institute of Technology, Stockholm. <http://www.kth.se/gdh>. Accessed 2021-11-15.
- Guest, G., and McLellan, E. (2003), "Distinguishing the trees from the forest: Applying cluster analysis to thematic qualitative data", *Field Methods*, Vol. 15 No. 2, pp. 186-201. <https://doi.org/10.1177/1525822X03015002005>
- Hede Mortensen J., Nilsson, S., Samuelsson, M. (2021), "Exploring the role of technology in social business models", *Continuous Innovation Network: 22nd International CINet Conference, Gothenburg, 13-15 September*.
- Horner R. (2020), "Towards a new paradigm of global development? Beyond the limits of international development", *Progress in Human Geography*, Vol. 44 No. 3, pp. 415-436. <https://dx.doi.org/10.1177/0309132519836158>
- Green, M. (2019), ICED 2019 Workshop on Design for Global Sustainable Development, Summary Report, <https://africadesign.designsociety.org/5/Report+on+ICED19+Workshop+on+Design+for+Global+Sustainable+Development>. Accessed 2021-10-31.
- Isabekova G. (2021), "Mutual learning on the local level: The Swiss Red Cross and the Village Health Committees in the Kyrgyz Republic", *Global Social Policy*, Vol. 21 No. 1, pp. 117-137. <https://dx.doi.org/10.1177/1468018120950032>
- Ibwe, K. S., Kalinga, E. A., Mvungi, N. H., Tenhunen, H., and Taajamaa, V. (2018), "The impact of industry participation on challenge based learning", *International Journal of Engineering, Science and Innovative Technology*, Vol. 34 No. 1, pp. 187-200.
- Kaba, A. (2020), "Explaining Africa's Rapid Population Growth, 1950 to 2020: Trends, Factors, Implications, and Recommendations", *Sociology Mind*, Vol. 10, pp. 226-268. <https://dx.doi.org/10.4236/sm.2020.104015>.
- Maassen, P. (2020), "Developing equal, mutually beneficial partnerships with African universities. Recommendations for a new European collaboration strategy", The Guild Insight Paper No. 1. Retrieved from The Guild of European Research Intensive Universities: <https://www.the-guild.eu/publications/insight-paper-one>
- Martin, F and Wyness, L. (2013), "Global Partnerships as Sites for Mutual Learning", *Policy and Practice: A Development Education Review*, Vol. 16, pp. 13-40.
- Mitropoulos, S.-A., Sicko, A., Frilingos, S., Aroh, N. and Papalambros, P. Y. (2020) "Funding design and innovation for sustainable development in africa: a review of sources" *Proceedings of the Design Society: DESIGN Conference. Cambridge University Press*, pp. 2079–2088. <https://dx.doi.org/10.1017/dsd.2020.73>.
- Mittelmeier, J., Long, D., Cin, F.M., Reedy, K., Gunter, A., Raghuram, P. and Rienties, B. (2018), "Learning design in diverse institutional and cultural contexts: Suggestions from a participatory workshop with higher education professionals in Africa", *Open Learning: The Journal of Open, Distance and e-Learning*, Vol. 33 No. 3, pp.250-266. <https://doi.org/10.1080/02680513.2018.1486185>
- Pisoni, A., Michelini, L., and Martignoni, G. (2018), "Frugal approach to innovation: State of the art and future perspectives", *Journal of Cleaner Production*, Vol. 17 No. 1, pp. 107–126. <https://dx.doi.org/10.1016/J.JCLEPRO.2017.09.248>
- Rajski, P. V., and Papalambros, P. Y. (2021), "Integrated Natural Resource and Conservation Development Project: A Review of Success Factors from a Systems Perspective", *Proceedings of the Design Society*, 1, 1867-1876.
- Robertson, T., Tuck W. L., Durick, J and Koreshoff, T. (2014), "Mutual learning as a resource for research design", *Proceedings of the 13th Participatory Design Conference: Association for Computing Machinery*, New York, NY, USA. DOI:<https://doi.org/10.1145/2662155.2662181>
- Rosén, A., Högfeldt, A. K., Lantz, A., Gumaelius, L., Wyss, R., Bergendahl, M. N., ... and Lujara, S. K. (2018), "Connecting North and South through Challenge Driven Education", *Proceedings of the 14th International CDIO Conference*, Kanazawa Institute of Technology.
- Sanders, E. B. N., Brandt, E., and Binder, T. (2010), "A framework for organizing the tools and techniques of participatory design", *Proceedings of the 11th biennial participatory design conference*, pp. 195-198).
- Stevanovic, D., Hede Mortensen, J., Wanyang, M., Rajski, P., and Nilsson, S. (2021), Report on the Results of the ICED21 AFRICA-DESIGN Pre-Workshop Survey on Sustainability, <https://africadesign.designsociety.org> Accessed 2021.10.31.

- UNESCO (2021) Engineering for sustainable development: delivering on the Sustainable Development Goals UNESCO [61267], International Centre for Engineering Education, Paris, France.
- Vangrieken, K., Meredith, C., Packer, T., and Kyndt, E. (2017), "Teacher communities as a context for professional development: A systematic review", *Teaching and Teacher Education*, Vol. 61, pp. 47–59. <https://dx.doi.org/10.1016/j.tate.2016.10.001>
- Wanyang, M., Stevanovic, D., and Rajski, P. (2020), AFRICA-DESIGN 2020 Online Workshop Report - Design for Global Sustainable Development, <https://africadesign.designsociety.org> Accessed 2021-10-31.
- WHO (2018) Global Learning Laboratory for quality UHC: 2017 annual report. World Health Organization, Geneva, Switzerland.
- Yeo, A. and Cao, F. (2021), "A Creative Research Process for a Modern African Graphic Design Identity; The Case of Ivory Coast", *Art and Design Review*, Vol. 9 No. 2, pp.210-231. <https://doi.org/10.4236/adr.2021.92017>
- Zeschky, M. B, Winterhalter, S. and Gassmann, O. (2014), "From cost to frugal and reverse innovation: Mapping the field and implications for global competitiveness", *Research-Technology Management*, Vol 57 No 4, pp. 20–27. <https://dx.doi.org/10.5437/08956308X5704235>
- Zolfagharian, M., Walrave, B., Raven, R., and Romme, A. G. L. (2019), "Studying transitions: Past, present, and future", *Research Policy*, Vol. 48 No. 9, pp. 103788. <https://doi.org/10.1016/j.respol.2019.04.012>