Advancing a Clean Cookstove Culture in Sub-Saharan Africa: The Transformative Power of *Afrikan* Innovation

Marcel Maré
Department of Visual Communication - Multimedia,
Tshwane University of Technology,
Marem1969@Gmail.Com
Mugendi K. M'rithaa
Department Of Industrial Design
Cape Peninsula University of Technology,
Mugendim@Gmail.Com

ABSTRACT

A transition to an energy-efficient, clean and safe cookstove culture among the global energy-poor can reduce mortality, poverty and positively impact the protection of biodiversity and the climate, as identified in the United Nations' Sustainable Development Goals. Despite broad support, only a limited number of interventions have shown success, at scale, over the long term. The uncertain, complex and dynamic nature of sustainable development programmes is increasingly being recognised. Current design methods appear limited in addressing the inherent complexities of the sustainable integrated design of products, services and systems. Transdisciplinary design methods need to be considered, inculcating an African perspective. In this paper, the applicability of indigenised design approaches in achieving a significant shift to a safe and energy-efficient cookstove culture among energy-poor sub-Saharan households is investigated. The use of innovative transdisciplinary methods, specifically participatory methods embedded in local culture, could contribute significantly to shifting energy-poor sub-Saharan households to a clean and safe cookstove culture. The integration of Africa's resilient cultural practices could provide individual and collective alternatives to design research methods rooted in Western ontological and epistemological approaches, in transitioning to a sustainable future.

Keywords:Afrikan Design Innovation, Afrikology, Appropriate Technology, Clean Cookstoves, Design Thinking, Radical Incrementalism, Transformation Design, UN Sustainable Development Goals.

INTRODUCTION

Household air pollution (HAP), in large part due to the use of inefficient cookstoves, is the third most significant global cause of morbidity and mortality, primarily affecting women and children (WHO 2014). A transition to an energy-efficient, clean and safe cookstove culture among the global energy-poor can reduce mortality, poverty and positively impact the protection of biodiversity and the climate, as identified in the United Nations' Sustainable Development Goals (Yamey et al. 2014).

Despite broad support, only a limited number of interventions have shown success, at scale, over the long term (Hanna et al. 2012; Urmee & Gyamfi 2014). The challenge remains how to significantly increase clean and safe cookstove use within communities, reduce respiratory disease and mortality, protect biodiversity, climate protection (reduced greenhouse gas emissions) and poverty reduction, without on-going external development assistance. The uncertain, complex and dynamic nature of development programmes is increasingly being recognised (Alesina & Dollar 2000; Morrissey 2004; Stokke 2013). The use of development assistance as an extension of soft power traditionally by the West and recently China in sub-Saharan Africa is well established (Ayittey 2015; Nye 2012; Pamment 2015; Zhang et al. 2016). The intention is to portray a narrative of partnership, friendship, sympathy, appeal and influence, and assist the attainment underlying long-term strategic goals (i.e. markets for consumer products or securing natural resources) (Nye 2005; Pamment 2015).

Current design methods are limited when tackling the inherent complexities of the development sphere (Ceschin 2014; Qureshi et al. 2013). Any design-led efforts that address the use of inefficient cookstoves need to inculcate the explicit, implicit and tacit motivations of the various political, social and economic factors. This deeper understanding is often lacking due to the designers originating from a different cultural and socioeconomic backgrounds, leading to remote design solutions parachuted in with little effect (McClelland & Suri 2005; Ramirez 2010).

Transformation Design

Drawing on the field of *transformation design*, transdisciplinary design approaches are suggested in overcoming the abovementioned complexities and power dynamics (Ceschin 2014; Sangiorgi 2011; Vezzoli et al. 2014). *Transformation design* can be defined as a human-centred, transdisciplinary process to create sustainable changes in human behaviour and their systems and organisations to achieve social cohesion and equity (Burns et al. 2006; Jonas et al. 2015). A key component of *transformation design* practice is a concern with the power of decision making in the participatory design process, with the participant becoming co-creator (Sangiorgi 2011). Central to a transformation in cookstove use is the real empowerment of the cooks (i.e. the local women bearing the largest part of the burden). Transformative clean cooking initiatives could empower women, providing significant opportunities for social and economic empowerment.

Afrikan Design

An *Afrikan* design approach, informed by Nabudere's concept of Afrikology, is proposed as a transdisciplinary approach during the design process of finding sufficient alignment in values between the different perspectives of stakeholders and beneficiaries. The convergence afforded by an *Afrikan* communitarian worldview provides a window of opportunity during a design process for a radical incrementalist process where the transformative change consists of a series of small changes over time, laying the groundwork for far-reaching large-scale changes, without maintaining the status quo.Nabudere (2012) suggests that in Afrikology, knowledge emerges holistically from a combinatory understanding of seemingly disparate fields (i.e. socio-economics,

philosophy, spirituality, governance, technology and science). Nabudere (2012) argues that it is impossible to detach a research problem from its larger context, suggesting a conscious process geared towards collective development, grounded in an African worldview.While Norman and Verganti (2014) believe that a typical human centred designprocess is better suited to an incremental innovation approach, Ma (2015) suggests that reframing the meaning-making process at the outset of a design process can accommodate the long-term goals associated with a radical transformative approach as found in the fields of social innovation and transformation design,

Ma (2015) asserts that the anthropogenic worldview in most design processes of designing to meet a short-term need through the lens of the desirability, viability and feasibility of a solution, without acknowledging that humans are part of a larger bio-physical, social, and economic infrastructure is the root of the problem. In this sense, a holistic African Design approach can accommodateradical incrementalist design process is guiding a long-term vision with incremental efforts to respond to, and influence human values and actions towards states of convergence within a variety of spheres.

Problem Statement

Design research appears to be deeply rooted in Western ontological and epistemological approaches, with designers attempting to bridge cultural differences by modifying existing design strategies, frameworks, methods and techniques to suit different cultural contexts with limited success (Truna et al. 2007; Winschiers-Theophilus & Bidwell 2013). In this regard, designers appear to approach local cultural differences as a collection of attributes associated with specific artefacts rather than an interactive engagement with local cultural practices (Winschiers-Theophilus et al. 2012).

The primary goal of achieving a measurable change in cookstove related practices appears to be subordinated to the design of increasingly efficient stoves. Abdelnour (2015) ascribes this phenomenon in clean cookstove initiatives to a form of *techno-saviourism,* where the technological object is elevated to the point where it can solve a myriad of complex and interrelated problems, yet neglecting to place the culinary practices of poor women at the centre.Sommer and Welzer (2014) suggest that sustained transformative change cannot be planned either politically or administratively at bureaucratic international conferences – a common feature of sustainability initiatives over the last four decades. Abdelnour (2015), Welzer & Leggewie (2009), Sommer &Welzer (2014) assert that sustained changes in practices do not occur due to the introduction of a superior technology or published scientific findings.

Research Question

The question arises whether an *Afrikan* design approach could significantly change cookstove-related practices, and help reduce the scourge household air pollution in sub-Saharan Africa.

Main Research Aim

The aim in this paper is to investigate the applicability of *Afrikan* design approaches in achieving

a significant shift to a clean and energy-efficient cookstove-related practices among energy-poor sub-Saharan households.

Design in an Afrikan Context

The practice of design in an African context needs to be grounded in perspectives of local history and culture (Asabere-Ameyaw et al. 2014). *Afrikan* design necessitates local participatory design processes and practices, taking cognisance of the danger of remaining in a neo-colonial paradigm (i.e. remotely designed cookstoves parachuted in as developmental assistance) (Asabere-Amayaw et al. 2014). Mafundikwa (2009) holds that the complexity of *Afrikan* creative expression and problem solving ability is underestimated due to the deceptively "simple" appearance of designed artefacts. The Western approach of linking cognitive abilities and narratives to traditional forms of literacy, lead to overly simplified narratives, thereby neglecting the complex cognitive practices developed in verbal and multilingual contexts (Bidwell et al. 2011).

Ambole (2016) suggests the necessity of comprehensive transdisciplinary frameworks when designing transformative systems in complex informal urban areas, with multiple actors and networks, spanning multiple modes of knowledge production. Ambole (2016) furthermore proposes co-creative and participatory design methods when attempting to meet the needs of poor communities in sub-Saharan Africa, with an ethnographic-based design approach succeeding where standard design practice has failed.

METHODOLOGY

To gauge the possible role of an Afrikan design approach in improved cookstove projects, Yin (1999) suggests a qualitative research approach with a literature-based cross-case study method when scanning selected projects, identify matching patterns, analyse general commonalities, uncover insights, and provide explanations.

A systematic bibliographic search on improved cooking stoves that had achieved some measure of success in cookstove dissemination within sub-Saharan Africa was screened down to five projects. This group was scanned for aspects of an Afrikan design approach. The main aspects were summarised, allowing conclusions to be drawn. As no successful large-scale implementation of a design-driven strategy was found in the sub-Saharan region, the three case studies were selected due to the (often unintentional) use of design methods in the programme implementations. The following were selected for review, namely:

the Jiko Stove Project,
the Basa Njengo Magogo Project and
the Tree is Life Trust Cookstove Project.

RESULTS

The literature-based cross-case study of improved cookstove dissemination programmes found that aspects of Afrikan design approaches were present in the selected cookstove projects as summarised below. A focus on the local needs and practices of the beneficiaries is paramount. Near all stove, projects applied participatory techniques embedded in the community with residents and artisans participating in the design process. The inclusion of participatory methods that incorporate the beneficiary as co-designer in a communitarian manner is particularly evident in the case of the Jiko Stove. The use of participatory methods in the Basa Njengo Magogo study was prevalent in the beginning, yet receded towards the end. Behavioural techniques were found in all the projects were used. Common in both the Jiko Stove Project and the Tree is Life Trust Project is the time spent of the development team and the community in coming to a common understanding of the problem, and jointly designing the solution. This success can largely be attributed to the dedication of the designers and the patient support of donors, in contrast to the Basa Njengo Magogo Project, where support was limited.

The Jiko Stove

The Jiko charcoal stove (Jiko meaning quick in Kiswahili), has become a ubiquitous part of Kenyan cookstove culture - its versatility in design lending itself to cooking and roasting meats and vegetables. The success of the ceramic Jiko Stove in Kenya is attributed, in part, placing the user as part of the broader community as the starting point in the dissemination strategies contextualised within the local community and the environmental pressures experienced (Hyman et al., 1987; Njenga et al., 2014). The Jiko stove success has led to the development of an indigenous relatively self-sufficient national production and dissemination infrastructure for higher efficiency charcoal stoves, with non-governmental organisations acting as technological and developmental intermediaries. This nascent industry developed despite Kenyan duties on the raw material imports used in the construction of the cookstoves (UNCTAD).

The Jiko phenomenon was the brainchild of the late Dr Maxwell Miringu Kinyanjui, a pioneer of a wide range of sustainability initiatives in Kenya, most notably the design and development of the charcoal-saving Kenya Ceramic Jiko, the promotion of commercial reforestation and efficient charcoal production in Kenya (Dunford, 2012). Kinyanjui's design approach approximates a circular design approach. This circular approach is best illustrated by the seed-to-ash philosophy central to Cookswell Stoves – the family-owned stove manufacturing company now run by his son Ted Kinyanjui (Dunford, 2012; Cookswell, 2017). The holistic strategy of the seed-to-ash cycle foresees a virtuous cycle where the planting and sustainable harvest of trees provides the feedstock for energy-saving biomass fuelled stoves, ovens and kilns. Central to the design process was a co-creative process with the final beneficiaries informed a communitarian ethos espoused by Kinyanjui.

The design of the Jiko was in response to the energy needs of Kenyan households, where traditional biomass still accounts for the majority of Kenya's cooking needs. The country's demand for

firewood exceeds its supply by an estimated 2 million tonnes per year, leading to deforestation, desertification, droughts and famine. Modern energy services are unaffordable for the majority of the population.

Incremental improvements to the stove design continued after its launch in 1982 in a co-creative manner, increasing the usability, affordability and efficiency of the stove (Dunford, 2012). After prototyping a variety of different designs of efficient cooking stoves, Kinyanjui oversaw the production, marketing and of the cookstove. As part of the design process, Kinyanjui started a small manufacturing business, hiring and training artisans in the manufacture of the stoves, with the goal of creating sustainable communities of practice with skills required to build the cookstoves considered as necessary as the dissemination of the artefact itself. The artisans were assisted in establishing their stove manufacturing businesses. The stove designs were not patented, with the copying of the stove design encouraged, to aid a speedy dissemination process (Dunford, 2012). This cooperation with manufacturers enabled the establishment of viable marketing and distribution networks and ensured consistency in the initial build-quality of the stoves. This cookstove infrastructure provided the base for local women's groups and individuals being trained, thus leaving institutional knowledge and a thriving stove market as a legacy (Chavangi, 1995; Karekezi, 2002). The consistency in the stove's quality and appropriateness to local cooking needs at an affordable price built confidence among customers and employment opportunities in the stove production sphere.

As part of the dissemination strategy in Kenya, households with relatively higher living standards were targeted initially. This might appear counter-intuitive, yet as producers and local marketers grew their business and achieved economies of scale, the prices started to drop, achieving market penetration among all the other urban segments. By the year 2002, the Jiko charcoal stove initiative had achieved a penetration rate of approximately 50%, while the firewood-based version languished at around 5% penetration. This poor performance has been attributed to the communal lack of incentive to save fuelwood except where it was already scarce. The Jiko design has become the template for numerous stove projects around the world. However, most other attempts have met with failure (Karekezi, 2002; Bazilian et al., 2012). In addition to the initial prototype of the "Kenya Ceramic Jiko" stove, the product range has widened to include ovens and griddles — the charcoal oven reputed to be 70% more cost-efficient than its gas or electricity counterparts (Dunford, 2012).

Basa Njengo Magogo

One of the most notable programmes to promote clean and safe cookstove behaviour in South Africa was the *Basa Njengo Magogo* alternative fire lighting method for coal-fired self-constructedstoves. While not explicitly a design intervention, the programme used participatory research methods. Developed and piloted by the *NOVA Institute* in 1999, the behaviour change intervention entails inverting the way fires are lit as shown in **Error! Reference source not found.** below.

Figure 1: Basa Jenje Magogo Demonstration (Nova Institute 2017)

The name *Basa Njengo Magogo* originates from Mrs. Nebelungu Mashinini, an elderly grandmother from the eMbalenhle community, who participated in the design process and means "to start a fire like grandmother". Household air pollution from coal-fired stoves is reduced by applying the suggested top-down ignition method. While laboratory tests confirm a reduction of smoke emissions by 80% a large scale dissemination has not yet been demonstrated (Nuwarinda 2007).

Tree is Life Trust Cookstove Project

The *Tree is Life Trust* of the Laikipia and Nyandarua Districts in Kenya, is a training and capacity building project assisting local households in the sustainable use of their natural resources. Most of the households depend on firewood and charcoal for cooking and heating, leading to deforestation and a reduction in biodiversity (Kiendi 2016).

Figure 2: Stove, heater & chicken brooding box, Laikipia District, Kenya (Obiria 2016)

The project provided local entrepreneurial farmers in Laikipia County with the nudge to design and build an efficient ceramic cookstove and space heater, with the added benefit of a chick brooding box as demonstrated in Figure 2. The popularity of the design has been attributed to its simple indigenous design and ease of construction with local materials. The accruing benefits are listed as the fuelwood saved, increased survival rates of hatchlings and a measurable increase in household income notwithstanding a warmer, healthier household in this colder mountainous region (Kiendi 2016; Obiria 2016).

CONCLUSION

Afrikan design approaches, specifically participatory methods informedbyacommunitarian philosophy, can contribute significantly to shifting the cookstove-related practices of energy-poor sub-Saharan households to a cleaner and safer cookstove culture. The integration of Africa's resilient cultural practices could furthermore provide individual and collective insights for a meaningful redistribution of power to specifically energy-poor women and children. An *Afrikan* Design approach can provide a resilient complex interconnected and at times adversarial dynamic process across disciplines in achieving transformative change.

FURTHER RESEARCH

It is anticipated that a prospective pilot design project in Sibabalwe, an informal settlement on the outskirts of Cape Town in South Africa, could act as a case study in how to apply Afrikan design research methods to shift energy-poor sub-Saharan households to a clean and safe cookstove culture. On a broader scale, it is hoped that the study will contribute to fundamentally transforming the underlying socio-cultural dynamics around efforts to achieve the global Sustainable Development Goals.

REFERENCES

Abdelnour, S. (2015). The Cookstove–Rape Prevention Myth and the Limits of Techno-saviorism. In *Sustainable Access to Energy in the Global South* (pp. 205-215). Springer, Cham, Switzerland.

Alesina, A., & Dollar, D. (2000). Who Gives Foreign Aid to Whom and Why? *Journal of Economic Growth*, *5*(1), 33–63.

Ambole, L. A. (2016). Understanding co-production through sanitation intervention case studies in South Africa, (March), 1–209.

Asabere-Amayaw, A., Anamuah-Mensah, J., Sefa Dei, G., & Kolawale, R. (2014). *Indigenist African Development and Related Issues: Towards a Transdisciplinary Perspective*. *Sense Publishers*. Rotterdam: Springer.

Ayittey, G. (2015). Post-MDGs and Africa's development conundrum. *Journal of International Development*, *27*(3), 345–361.

Bazilian, M., Nussbaumer, P., Eibs-Singer, C., Brew-Hammond, A., Modi, V., Sovacool, B., … Aqrawi, P. K. (2012). Improving Access to Modern Energy Services: Insights from Case Studies. *Electricity Journal*, *25*(1), 93–114.

Bidwell, N. J., Winschiers-Theophilus, H., Koch Kapuire, G., & Rehm, M. (2011). Pushing personhood into place: Situating media in rural knowledge in Africa. *International Journal of Human Computer Studies*, *69*(10), 618–631.

Burns, C., Cottam, H., Vanstone, C., & Winhall, J. (2006). Transformation design. *RED Paper*, *2*.

Ceschin, F. (2014). *Sustainable Product-Service Systems - Between Strategic Design and Transition Studies*. Heidelberg: Springer.

Gadgil, A., Sosler, A., & Stein, D. (2013). Stove Solutions: Improving Health, Safety, and the Environment in Darfur with Fuel-Efficient Cookstoves. *The Solutions Journal*, *4*(1), 54–64.

Hanna, R., Duflo, E., & Greenstone, M. (2012). Up in Smoke : The Influence of Household

Behavior on the Long-Run Impact of Improved Cooking Stoves Faculty Research Working Paper Series Massachusetts Institute of Technology Department of Economics Working Paper Series. *HKS Faculty Research Working Paper Series*, *12–10*(1), 73.

Jonas, W., Zerwas, S., & von Anshelm, K. (2015). *Transformation design: Perspectives on a new design attitude*. *Transformation Design: Perspectives on a New Design Attitude*. Birkh{ä}user.

Karekezi, S. (2002). Poverty and energy in Africa— A brief review. *Energy Policy*, *30*(11), 915– 919.

Kelley, T., & Littman, J. (2000). *The art of innovation: lessons in creativity from {IDEO}, {America}'s leading design firm*. Random House Digital, Inc.

Kiendi, D. M. (2016). Tree is Life Project. Nyahururu, Kenya: Country Lessons Learnt Workshops, Nyahuru Catholic Diocese.

Ma, J. (2015). When human-centered design meets social innovation: the idea of meaning making revisited. In *International Conference on Cross-Cultural Design* (pp. 349-360). Springer, Cham, Switzerland.

Mafundikwa, S. (2009). Sia, Le Rêve du Python (Sia: The Dream of the Python), Dani Kouyaté (2001). *Design and Culture*, *1*(2), 226–228.

McClelland, I., & Suri, J. F. (2005). Involving people in design. *Evaluation of Human Work*, 281–333.

Morrissey, O. (2004). Conditionality and aid effectiveness re-evaluated. *World Economy*, *27*(2), 153–171.

Nabudere, D. W. (2012). *Afrikology and Transdisciplinarity*. *A Restorative Epistemology*. Pretoria, South Africa: African Books Collective.

Njenga, M., Karanja, N., Munster, C., Iiyama, M., & Neufeldt, H. (2014). Charcoal production and strategies to enhance its sustainability in Kenya. *Development in Practice*, *2*(2013), 359–371.

Norman, D.A., Verganti, R. (2014). Incremental and radical innovation: design research vs technology and meaning change. *Design Issues*, *30*(1), 78–96.

Nova Institute. (2017). *Basa Magogo Demonstration*. Retrieved from https://www.youtube.com/watch?v=VQnnZE8-nI4

Nuwarinda, H. (2007). Air pollution study of a Highveld township during a Basa njengo Magogo rollout. *Environmental Management*, (November).

Nye, J. S. (2005). *Soft power: the means to sucess in world politics*. New York: Public Affairs.

Nye, J. S. (2012). China and soft power. *South African Journal of International Affairs*, *19*(2), 151–155.

Obiria, B. M. (2016). *Efficient cookstoves save trees - and chickens - in Kenya*. *Thomson Reuters Foundation*. Retrieved from http://news.trust.org/item/20160826063250-du8uh/

Pamment, J. (2015). Media Influence, Ontological Transformation, and Social Change: Conceptual Overlaps Between Development Communication and Public Diplomacy. *Communication Theory*, *25*(2), 188–207.

Qureshi, A. J., Gericke, K., & Blessing, L. (2013). Design Process Commonalities in Trans-Disciplinary Design. In *ICED13: 19th International Conference on Engineering Design* (pp. 1–10). Seoul, Korea: University of Luxembourg & Newcastle University.

Ramirez, M. (2010). Making Poverty History : Alerting Industrial Design Students to the

Millennium Development Goals. In *Making Poverty History : Alerting Industrial Design Students to the Millennium Development Goals* (pp. 1–6).

Sangiorgi, D. (2011). Transformative services and transformation design. *International Journal of Design*, *5*(2), 29–40.

Sommer, B., & Welzer, H. (2014). *Transformationsdesign: Wege in eine zukunftsfähige Moderne; Transformationen; 1*. oekom verlag, Munich, Germany.

Stokke, O. (2013). *Aid and Political Conditionality*. *Routledge Research EADI Studies in Development*.

Truna, Bidwell, N. J., & Radoll, P. (2007). Redisplacement by design. *Interactions*, *14*(2), 12–14.

Urmee, T., & Gyamfi, S. (2014). A review of improved Cookstove technologies and programs. *Renewable and Sustainable Energy Reviews*, *33*, 625–635.

Vezzoli, C., Kohtala, C., & Srinivasan, A. (2014). *Product-Service System Design for Sustainability*.

Welzer, H., and Leggewie, C. (2009). *Klima, Zukunft und die Chancen der Demokratie*. Fischer Verlag. Frankfurt am Main, Germany.

WHO. (2014). *Burden of disease from Household Air Pollution for 2012* (Vol. 35). New York.

Winschiers-Theophilus, H., & Bidwell, N. J. (2013). Toward an Afro-Centric Indigenous HCI Paradigm. *International Journal of Human-Computer Interaction*, *29*(4), 37–41.

Winschiers-Theophilus, H., Bidwell, N. J., & Blake, E. (2012). Community Consensus: Design Beyond Participation. *Design Issues*, *28*(3), 89–100.

Yamey, G., Shretta, R., & Newton Binka, F. (2014). The 2030 sustainable development goal for health. *BMJ: British Medical Journal*, *349*(7973), g5189–g5189.

Yin, R. K. (1999). Enhancing the quality of case studies in health services research. *Health Services Research*, *34*(5), 1209.

Zhang, X., Wasserman, H., & Mano, W. (2016). *China's Media and Soft Power in Africa*. London: Palgrave Macmillan.