15. High-stake conditions to catalyse local sustainable development through Fablabs in Africa

Thomas Hervé Mboa Nkoudou

INTRODUCTION

With the help of the Internet, information circulates instantaneously from one end of the world to the other, offering the possibility to exchange, share and contribute to the enrichment of knowledge. This Web 2.0 trend has paved the way for the exploitation of information for personal or community purposes, within citizen spaces for reflection, creation and innovation. In consequence, digital technologies are reconfiguring territories, facilitating debate in the public arena and imposing new forms of collaboration between the various actors in society. This contributes to providing citizens with knowledge through research and education, to providing answers adapted to the real needs of society, to offering services to marginalised/ disadvantaged and/or disempowered groups of people, to discovering new avenues of research by reformulating society's needs into research problems, and to proposing research results that are locally relevant. In other terms, digital technologies are strengthening the science-society mediation mechanisms. The maker movement through spaces like Fabrication Laboratory (Fablab) is part of this mediation.

Fablabs are collaborative spaces for the rapid prototyping of physical objects, where machine tools and computers are made available to users to carry out projects individually or collectively through digital design and manufacture (Bouvier-Patron, 2015, p. 177; Buclet, 2015, p. 45). Fablabs were created with the ambition to contribute to the democratisation of technological design and thus to allow each of us to become an inventor through the mastery of personal digital fabrication (Lallement, 2015). Often described in a virtuous way as agents of social change, vectors of the third and fourth industrial revolutions, with the promise of enormous and rapid economic benefits; Fablabs are therefore designed to facilitate access to technology, to enable any community to become more creative. Africa has not been left out of the charm of this fine discourse. Indeed, the first Fablab in Africa was created in Ghana in 2002 with financial support from MIT (Bosqué, 2016). With the first Fablab created at the MIT, then diffused in the rest of the world, it is interesting to raise the question of whether these spaces are really appropriate technologies for the African continent and especially for its development.

This chapter aims to answer this question and it is organised into three main sections. The first section presents the fundamentals that govern the maker movement. Based on decolonial studies, the next section proposes the risks associated with technocoloniality. The third section lays the foundations of the type of development to which appropriate technologies must contribute. The whole approach of this chapter is based on endogenous and authentic data, coming from research fields on Fablabs in Africa.

BACKGROUND

The maker movement is a community-based movement driven by a common understanding that democratising access to tools and technologies will revolutionise the distribution of material goods and disrupt existing socio-economic systems. The origins of the maker movement can be traced back to the beginning of humanity and can be summed up as the simple ability of human beings to make their own tools. So, this is not a new phenomenon, but the movement has gained momentum in recent decades with the rise of digital technologies (Bowen, 2017, p. 2; Irie et al., 2019; Mboa Nkoudou, 2017, p. 75).

Fundamentals of the Maker Movement

The maker movement is characterised by its ideological foundations, values, practices and tools.

Ideology

The maker movement is rooted in the hacker ethic, the free culture (in the sense of free software) and Do-it-Yourself.

The hacker ethic

According to Spadaro (2014, p. 52), the seven commandments of the hacker ethic are: 1) access to computers must be unlimited and total; 2) always give priority to the hands-on, and to personally check; 3) all information must be free; 4) distrust authority, promoting decentralisation; 5) hackers must be judged by their hacking; 6) it is possible to create art and beauty on a computer; 7) computers can change your life for the better. It is important to avoid assimilating hackers with computer hackers, which are instead referred to as crackers. The term hacker has a much broader connotation than just the computer dimension; a hacker would basically be an expert or enthusiast of any kind who develops a passionate relationship to work (Himanen, 2001; Lallement, 2015). The idea of hackers suggests a valuing of freedom of action, the importance of experimentation and verification, a distrust of all forms of authority, and a fundamental optimism about human capabilities.

Free software

According to the Free Software Foundation (FSF) and its founder Richard Stallman, free software refers to computer programs that give users the freedom to run, copy, distribute, study, modify and improve them. Note that free software does not mean free; software is free if it allows the four following essential freedoms:

- the freedom to run the program the way you want, for any purpose (freedom 0);
- the freedom to study how the program works, and to modify it to do your computing tasks as you wish (freedom 1);
- access to the source code is a necessary condition;
- the freedom to redistribute copies (freedom 2);
- the freedom to distribute copies of your modified versions to others (freedom 3).

The free culture ideology of the maker movement borrows from the four freedoms that characterise free software.

Do-It-Yourself
The maker movement puts a spotlight on the enthusiasm for self-manufacturing, tinkering, crafting and Do It Yourself (DIY). For Lallement (2015, p. 12), DIY refers to the idea that work is done without anyone imposing goals, deadlines or constraints. Anderson and Le Séac'h (2012, p. 27) attribute the following three characteristics to DIY: digital self-manufacturing, online collaboration and the use of common file formats.

Practices and tools
Fablabs are also characterised by their tools and other emerging technologies. They are equipped with a variety of digital tools such as CNC machines, laser cutters, digital milling machines, 3D printers and so on. They are also equipped with non-digital tools such as welding stations, woodworking tools, sewing machines, Lego blocks, art kits and so on. Fablabs provide the public with a set of tools and encourage creative forms of (cultural and social) engagement in activities such as electronics, robotics, woodworking, sewing, laser cutting, computer programming or a combination of these activities. These activities are done with the aim to recycle, repair, design, create and prototype. Hacking, ideation and prototyping are among the most common practices in Fablabs (Geser et al., 2019, p. 61; Irie et al., 2019).

   Hacking refers to the act of adapting or diverting an object (a program, code …) from its original purpose so that it can meet our needs (Barniskis, 2014, p. 9). Hacking activities have the following four purposes: collaboration through shared access, problem solving, subversion and finally exploration (Bowen, 2017, p. 3). *Ideation* is an iterative means of projection that allows decision makers to express themselves creatively and generate new ideas. *Prototyping* is a four-step process of building, testing, feedback and revision. A prototype is developed for testing in iteration cycles. The diversity of maker communities and their networks is a huge advantage in the testing and feedback stages (Rieken et al., 2019, p. 106).

Values
Values central to the maker movement are openness, sharing, inclusivity. *Openness* – Fablabs offer those who use them access to expensive and powerful tools that would normally be difficult for individuals and especially the community to access (Geser et al., 2019, p. 62; Halbinger, 2018; Irie et al., 2019). *Sharing* – through the sharing of space, machines, blueprints, code, as well as instructions on how to use the machines within the community, machine shops are niches of altruistic values of open and reciprocal knowledge sharing. According to Irie et al. (2019), two important aspects of sharing in the maker movement are sharing ideas through collaboration and sharing knowledge through mentoring. *Inclusivity* – Fablabs are places that are open to all, regardless of social status or ability to engage; only the sharing of ideas and knowledge matters (Johns and Hall, 2020, p. 2).

An Overview of the Maker Movement in Africa

Nowadays, it is difficult to give the exact number of Fablabs in Africa. I attempted to exploit data from three web platforms that list collaborative workshops around the world, namely: a) the Fab Foundation's list of Fablabs; b) the list of Labs in the hackerspaces wiki; and c) the Makery journal's map of Labs. It appears that they would be estimated at nearly 200, distributed as follows: 45.6 per cent in Arabic-speaking Africa, 36.3 per cent in English-speaking Africa and finally 18.1 per cent in French-speaking Africa (Mboa Nkoudou, 2020) (Figure

15.1).To feed this text on Fablabs in Africa, I will draw on three main experiences that will give us an idea of the nature of the actors involved in the maker movement in Africa, the different fields that are addressed and the missions pursued.

Source: Africa Makerspace Network gathering (2019).

Figure 15.1   Makerspaces in Africa

An ethnographic study of Fablabs in French-speaking Africa

In my doctoral thesis, I was interested in the under-representation of francophone Africa in the distribution of Fablabs in Africa. To do so, in 2018 I conducted an ethnographic study among three Fablabs in francophone Africa:

- Ouagalab, a Fablab created in 2011 in Ouagadougou, the capital of Burkina Faso. It aims to be a gathering place for digital creation enthusiasts, in order to stimulate the spirit of creativity and knowledge sharing. This Fablab is the idea of two young Burkinabes.
- The Defko Ak Niep Lab in Dakar, Senegal, was created in 2014 by the Association Kër Thiossane. This Fablab gives access to digitally controlled machines to individuals, and links art with the inhabitants of Dakar, with the idea of developing the commons.
- Ongola Fablab was inaugurated in 2017 in Yaoundé within the francophone Digital Campus of the Agence universitaire de la Francophonie (AUF). This initiative is the result of a partnership between the Orange Foundation and the AUF in favour of digital education.

The Mboalab, a research-action experiment

The Mboalab is a personal initiative that I implemented after being aware of the potential of collaborative workshops for sustainable local development in Africa. I see it as a concrete utopia of a Fablab stripped of any shortcomings I noted in my research. Established in 2018 in Yaoundé, Cameroon, Mboaab is a social innovation lab whose aim is to catalyse sustainable local development and improve people's living conditions through open science. To achieve this, the main missions of Mboalab are as follows:

- provide community and continuing education for the population, as well as formal education for the younger generation;
- provide a meeting place for exchanges on problems related to the immediate environment of local communities;
- mediate between local communities and the academic world;
- propose solutions that meet the needs of communities, using local knowledge and open digital technologies;
- raise awareness of environmental issues.

The Africa Open Science and Hardware summit

Africa pen Science and Hardware (OSH) is a community of makers, hackers, practitioners and researchers in science and technology inclusive of government officials, private sector players and civil society across the African continent, the global South and the world. Africa OSH provides people interested in open science and hardware with an alternative to traditional intellectual property (IP) and closed systems as a means to achieve locally adaptable technologies that will foster economic growth in Africa. The goal is to create a conversation and set of actions on OSH among African actors, and between them and the international community, in order to adopt OSH principles and practices appropriate to our context.

The first Africa OSH summit took place in Kumasi, Ghana, in April 2018 and brought together 46 participants from across Africa, Europe and the USA. Topics discussed during the summit include STEM education in Africa, harmonising technical skills for educational research across the continent, Open Educational Resources, Open Science for impactful education and innovation in Africa.

From the Ouagalab to the Defkö Ak Niĕp Lab via the Ongola Fablab and the Mboalab, the spaces seem to be organised into four creative poles: modelling and 3D printing; experimentation, programming and electronics; crafts and sewing; and common space and reflection. Each hub is equipped with modern digital fabrication equipment including 3D modelling software, 3D printers and scanners, digital embroidery machines, laser cutting and so on. Given the various characteristics of the maker movement and Fablabs, there is no doubt that they fit very well into the category of appropriate technologies. Indeed, from Gandhi, Schumacher to the present day, appropriate technologies are generally defined as "technologies that are adaptable to local needs, acceptable to users and made using locally available materials with the aim to improve the lives and livelihoods of people in resource-constrained environments" (Assam Science Technology & Environment Council (ASTEC), n.d.). Beyond this common sense, it is important to remember that the idea of appropriate technology has been approached from different angles, the relevance of which varies according to the context. In the case of Fablabs, Pearce's approach of appropriate technology seems to be an interesting avenue to adopt. According to him, "appropriate technologies are defined as those that must be able to be easily and economically constructed from readily available materials by local craftspeople. Appropriate technologies must meet environmental, cultural, economic, and educational resource constraints of the localized community" (Pearce 2007, p. 655). However, the question remains: to what extent can Fablabs and their equipment really be considered as appropriate technologies for the development of Africa?

APPROPRIATE TECHNOLOGIES UNDER THE BURDEN OF TECHNOCOLONIALITY

The concept of coloniality was proposed in the early 1990s by the Peruvian sociologist Anibal Quijano to refer to the powerful political, economic and cultural logics that supported (and still support) colonisation. Coloniality is structural and persistent; it goes beyond colonialism (the political dimension of colonisation) which ended with independence and wars of liberation. Today, we continue to live in a heterogeneous set of colonialities known as the colonial matrix of powers whose main components are: control of the economy, authority, gender and sexuality, knowledge and subjectivity (Escobar, 2004; Maldonado-Torres, 2007; Mignolo and Walsh, 2018; Palmieri, 2018; Quijano, 2000). According to Mboa Nkoudou (2020), technocoloniality refers to the set of logics of coloniality induced by technology; the different modalities of technocoloniality are: technology transfer, techno-utopian discourse and neocapitalist practices (Figure 15.2).

Coloniality of Knowledge

The coloniality of knowledge is the imposition of Western global history on non-Western peoples; this results in the subalternisation of local historicities (Escobar, 2004, p. 217). Through the coloniality of knowledge, the crucial question of how Western modernity has spread by displacing other cultures, subordinating others and colonising the imaginary of colonised peoples is addressed. This coloniality is kept alive in books, in academic performance criteria, in cultural models, in common sense, in peoples' self-image, in self-aspiration and in many other aspects of our lives (Maldonado-Torres, 2007, p. 243). The coloniality of knowl-
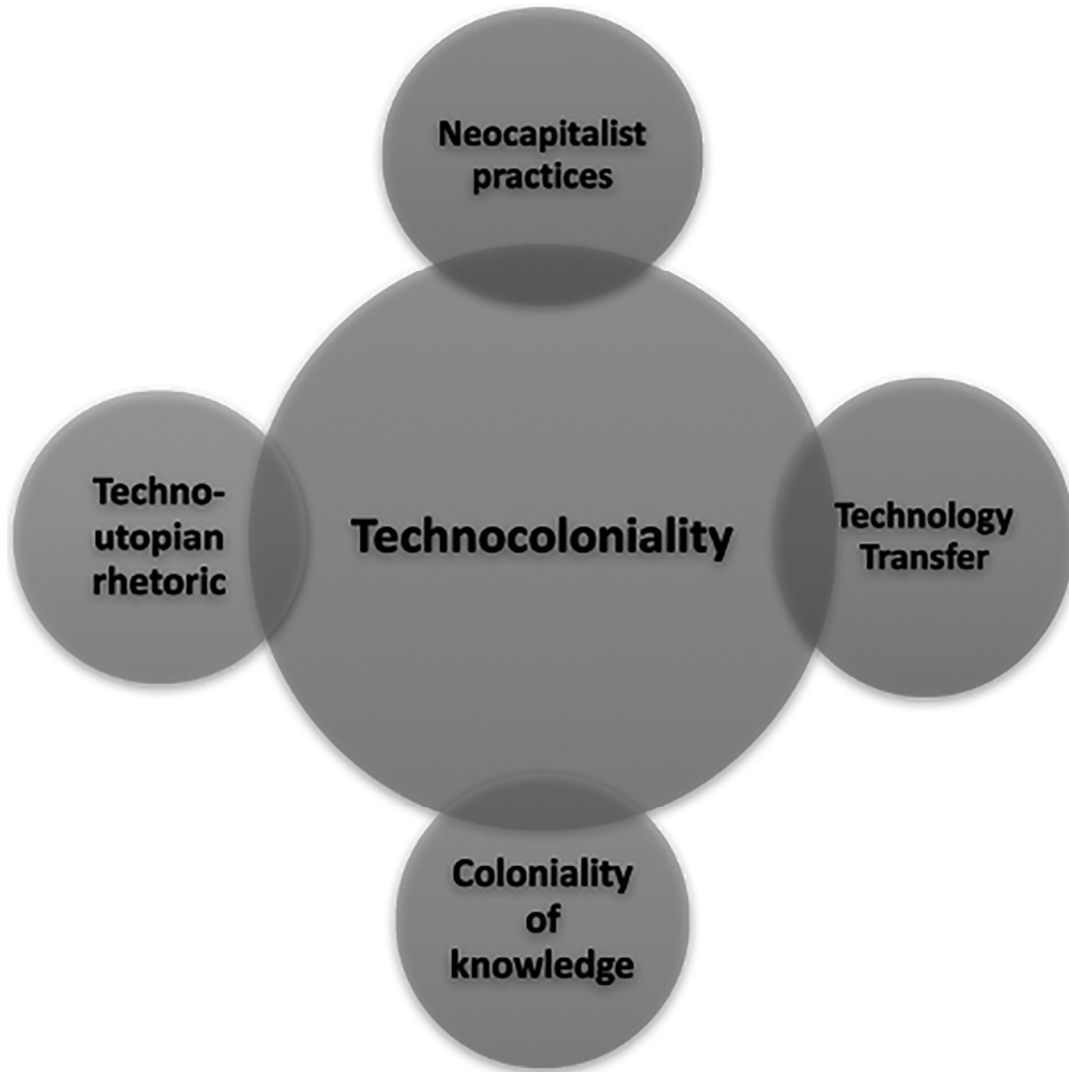
Figure 15.2   The four dimensions of technocoloniality

edge can manifest itself in three different ways: the coloniality of being, colonial difference and Eurocentrism. The coloniality of being refers to the ontological dimension of colonisation. It critically addresses the encounter between the coloniser and the colonised (Escobar, 2004, p. 218) and highlights the realities of dehumanisation and depersonalisation experienced by the colonised (Maldonado-Torres, 2007, p. 257). Colonial difference refers to the cultural dimension of the subalternisation process that takes place in the colonial matrix of powers, highlighting the persistent cultural differences that exist today within global power structures (Escobar, 2004, p. 218). Eurocentrism is the approach to knowledge based solely on the experience of Western history, dismissing any idea of the existence of non-Eurocentric epistemologies or currents of thought (Escobar, 2004, p. 218). Eurocentrism is thus an epistemic

hegemony that privileges Western knowledge and cosmology over non-Western knowledge and cosmologies.

The coloniality of knowledge is reflected in Fablabs through the fact that the majority of codes, designs and projects shared freely on the Internet come from the North and are generally written in English. Indeed, the ecology of knowledge on the Internet, as well as the trajectories of knowledge circulation on Fablabs, show that they are largely dominated by the North and disseminated in a unidirectional way. It would be an exception, even a miracle, to see knowledge produced in an African Fablab being widely adopted in the West.

Technology Transfer from North to South

Technology transfer is a process whereby knowledge capital acquired by one party is transferred to another party for application and exploitation (Khelfaoui, 2017). It has been clearly established that the idea of Fablab originated in the USA to meet the pedagogical needs of the prestigious MIT. Now that these Fablabs are so present in Africa, Shrum and Shenhav (1995, p. 628) warn Southern countries against adopting technologies from elsewhere: "imported scientific ideologies and technological artifacts from industralised countries are said to generate debilitating dependencies". In other words, the adoption of technology is never neutral: "When you are diffusing and transferring technologies, you are also diffusing different cultural practices, because the technologies are not value neutral or ideologically neutral" (Csikszentmihalyi et al., 2018, p. 5). Moreover, in the African context, makerspaces are socio-technical infrastructure loaded with meaning and history from the North.

One of the consequences of this technology transfer is this trend to the uniformity of Fablabs across the world, particularly in terms of structure, practices, tools and values. Shrum and Shenhav (1995) named this trend isomorphism, as the adoption of structurally similar forms in Africa to those in the West. Indeed, as far as Fablabs are concerned, there is a uniformity in terms of: 1) the name, with the suffix -Lab being systematically used; 2) the practices (programming, electronics, etc.); 3) tools (3D printer, arduino, etc.). This isomorphism is part of a logic of universalisation of Eurocentric science in the name of modernisation, without being relevant to the needs of African countries (Shrum and Shenhav, 1995, p. 631). In the same vein, Felwine Sarr (2016, p. 39) argues that this desire to take over so-called modern forms of social organisation and the attempt to espouse their philosophical concepts is initially a graft forced by the circumstances of the colonial encounter. Thus, the simple transfer of Fablabs from the West to Africa would present great risks of coloniality of knowledge; and could be the vehicle of a new form of subalternisation of knowledge, Eurocentrism and even epistemic alienation as suggested by Ndlovu-Gatsheni (2013, p. 22).

This transfer of technologies is well present in the history of the creation of the various Fablabs and Maker associations. For example, the idea of the Ouagalab was born following the InnovAfrica Forum, during which a Burkinabe participant met another participant from Fablab in France. It was on the basis of this meeting that he decided to create the Ouagalab in his country. In Cameroon, it was the Orange Foundation, a French organisation, that decided to create and fund the Ongola Fablab. Indeed, what impresses when you arrive at Ongola Fablab is the quality of the space and the facilities that are available. Indeed, Ongola Fablab has nothing to envy from Western Fablabs; and the similarity is really perfect with the foundation's Fablab model. For the African Open Science and Hardware Summit, it must be said that the idea came from the Global Open Science Hardware community. A US-based organisation

that supports OSH by convening meetings such as the Gathering for Open Science Hardware (GOSH), publications, activities. It was during GOSH 2017 in Santiago, Chile, that two Africans (including myself) who were attending decided to create a similar event in Africa.

The Techno-Utopian Discourse

The techno-utopian discourse is part of the rhetoric of modernity described in the colonial matrix of powers. According to Mignolo and Walsh (2018, p. 110), modernity refers to a coherent set of diverse discourses, originating in Western cosmology. In terms of technology, narratives of modernity consistently celebrate the idea of novelty and its associated concepts of revolution and innovation (Mignolo and Walsh, 2018, p. 140). Sismondo (2004, p. 139) says in this regard that "Technology was the symbol of Europe's modernity, and was something that Europeans could generously take to the rest of the world." The techno-utopian discourse usually takes the form of techno-solutionism, which refers to the view that technology can unilaterally solve difficult social problem (Lindtner et al., 2016, p. 1390).

This techno-utopian discourse is very present in the Fablab's communities. Söderberg (2013) illustrates this techno-utopian vision by explaining that, for some followers of the maker movement, the popular reappropriation of tools would pave the way for the democratisation of industrial production, with the abolition of consumer society in mind. Others hope to reduce labour costs and thus render obsolete the relocation of industrial production to developing countries. It is therefore an angelic discourse that places much more emphasis on the socio-economic benefits of Fablabs and the promise of an industrial revolution with huge economic spin-offs. In this regard, Susie and Mark (2016) say that: "The burgeoning maker culture or maker movement has been heralded as a lot of things, not least a postcapitalist, utopian revolution capable of breathing life back into stagnating First World economies, redistributing wealth opportunities and even rescuing the environment."

An example of techno-utopian discourse in Fablabs is the discourse that describes the vision of Ongola Fablab. It contains great promises of socio-professional integration, innovation and entrepreneurship. Thus, for the Orange Foundation, Ongola Fablab is intended to help disadvantaged young Cameroonians with their professional projects through enabling them to integrate digital practices and increase their employability, by developing their creativity and skills. For the Agence Universitaire de la Francophonie, co-founder of Ongola Fablab, their mission is now to design models of academic, associative and entrepreneurial third places, accelerating innovation, development and employability in a new francophone university space.

Neocapitalist Practices

In the past few years, advances in information and communication technologies have contributed to a tenfold increase in the production of collective knowledge, thus opening the way for very insidious but powerful practices of capitalism that exploit free information on the Internet to the detriment of the communities and individuals who produce it. This situation leads to cognitive capitalism visible through practices of commodification of individuals and their social activities (Moulier Boutang, 2007).

Another aspect of neocapitalist practice is that the economic model advocated during the diffusion of Fablabs in Africa is totally out of step with local realities. Indeed, this model put

forward the ideas of volunteerism and service to the community; the refusal of any search for financial profit in favour of the quest for the common good. However, these spaces consume energy, time and resources that require enormous financial means to ensure the survival of the space (Mboa Nkoudou, 2017). So, Fablabs are facing a real dilemma between the ideology originally conveyed by the maker movement, which advocates an open service to the community, without seeking money or any profit; and the financial needs related to the operation in the Fablab and the initial investment to open such a space. In Africa, their financial difficulties often force Fablabs to turn to international collaborations when possible or to adopt an entrepreneurial business model. However, both of these options can be seeds of neocapitalist practices. International collaborations can lead to financial dependencies that would force a local collaborative workshop to carefully follow the agenda of its funder. As for the entrepreneurial model, it is preferable that it be oriented towards the social and solidarity economy in order to remain within the primary mission of the maker movement, which is the search for the common good. Otherwise, the Fablab risks sinking into neocapitalist practices.

A DECOLONIAL APPROACH TO DEVELOPMENT

Jean Marc Ela (1990, p. 57) reminds us that it is essential to find the right position when you are addressing the issue of development in Africa. In order to define what development for and by Africa is, it is crucial, on the one hand, to avoid the reproduction of colonial processes and, on the other, consider the internal dynamics specific to Africa, that is, the specific historicity of indigenous societies.

The Development Myth: A Critique of the Dominant Model

It is estimated that the idea of "African development" was first used in the inaugural speech of US President Harry S. Truman (20 January 1949). In this speech, he mentioned the extension of technical assistance to all disadvantaged nations and introduced the concept of underdevelopment (Owono-Kouma, 2014, p. 19). The idea was to bring the least developed nations out of the underdevelopment stage to the development stage. This type of development requires the so-called underdeveloped countries to multiply their efforts to reach the level of the so-called developed (mostly Western) countries. Palmieri (2018) refers to the "myth of catching up" prescribed by the Centre (West) to the states of the periphery (South). This idea is still present nowadays and is the dominant paradigm of development advocated by the rhetoric of modernity; and the concept of sustainable development is not exempted.

The concept of sustainable development promoted by the United Nations is defined in the Brundtland Report (ONU, 1987) as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". However, since its introduction in 1987, this vision of sustainable development has been subject to numerous criticisms, the most virulent of which have described it as imperialistic (Arnaud et al., 2011, p. 12). Indeed, the Sustainable Development Goals (SDGs) can be criticised for their universalist claim. The fact remains that they are global objectives to be adopted by all the countries of the world. Therefore, we can ask ourselves whether the reference point for achieving these goals is set in relation to the realities of the Cameroonian, Chadian or Central African contexts; or the realities of the USA, Canada or France. It is clear that the choice of

one or other of these contexts as a reference point will be operationally translated into "development aid" from the richest to the poorest countries; or into the progress that underdeveloped countries should undertake to reach the level (of industrialisation, education, well-being) of developed countries. Seen through this prism, the global nature of the SDGs contributes to reinforcing the hegemony of the centre over the peripheries, to borrow from Wallerstein's (2004) concept of the world system.

Indeed, for some, the persistence of this dominant model of development is tightly related to the colonial domination keeping African states in a situation of structural dependence on the centre of international capitalism (Engueleguele, 2009, p. 233). In this regard, Felwine Sarr (2016, p. 13) says that the dominant model of development is an expression of the Western enterprise of extending its episteme in the world; we need an alternative to this development. That is why I propose sustainable local development as an alternative.

Local Sustainable Development

Sustainable local development is a decolonised approach to development that requires a double epistemological and socio-political constraint. The epistemological constraint calls for the fight against cognitive injustices and the liberation of African alternative thinking. While the socio-political constraint involves taking into account local realities related to the informal economy, commons and inclusion.

The quest for cognitive justice

Cognitive justice is an epistemological, ethical and political ideal proposed by Shiv Visvanathan (2009), which aims at the emergence of socially relevant knowledge and advocates for the equality of knowledge according to contexts and situations. The concept of cognitive injustice refers to a situation, phenomenon, policy or attitude that prevents an individual from deploying the full potential of his or her capacity to think for local sustainable development (Piron et al., 2016). In their work on digital technologies and knowledge democratisation in Africa, Piron et al. (2016) identified the following nine cognitive injustices:

- almost non-existent research infrastructure and policies;
- paywall to scientific publications;
- limited digital literacy and access to the web;
- local knowledge are often excluded and disregarded;
- the almost hermetic separation between science and society;
- the Western research system is closed to African scientists;
- the language of science is colonial, with English as the *lingua franca*;
- the pedagogy of humiliation that still prevails;
- the deep epistemic alienation in universities.

Combating these cognitive injustices requires a permanent quest for cognitive justice that operates through two main missions. First, by valuing the knowledge of the South, whether scientific or not; second, by putting science and scientists at the service of local populations and sustainable local development. Fablabs contribute strongly to the fight against cognitive injustice by democratising access to digital equipment, promoting collaborative work, and facilitating the bringing together of science and society. Indeed, the artefacts produced in such

spaces usually have applications in the areas of education, art, agriculture, health, environment and electronics.

For example, in the agro-pastoral field, the Ouagalab has developed the AgriAlert project. AgriAlert is a package consisting of a box and a platform, designed to alert government authorities to possible disasters in farmers' fields. The box has drawings that represent most of the problems faced by farmers, such as locusts, army worms, bush fires and so on. When a farmer (illiterate or not) encounters one of these threats, he turns the cursor to the drawing that corresponds to the threat he is encountering; an alert is immediately sent to the Ministry, which can effectively intervene in the fields under attack. All these alerts are recorded on a platform to produce statistics that will make it possible to establish the periodicity of these attacks and to prevent them.

In the field of education, one of the flagship educational products that Ouagalab has developed is the "Jerry". It is a computer whose shell is a jerry can (plastic can) within which are computer parts that have been recycled from computers that are no longer in use, and combined to make a new computer. This type of project contributes to bringing science and society closer together; combating cognitive injustices such as limited access to infrastructure, illiteracy and lack of digital literacy.

Inclusion

One point on which I agree with the dominant development paradigm (the SDGs) is the desire to leave no one behind. Indeed, the different Fablabs considered in this text clearly display the desire to be inclusive as much as possible; this by allowing a healthy integration of the different members of the community without distinction. This inclusive dynamic is based on certain core values that the promoters of the different collaborative workshops cherish: equality, sharing and solidarity. Aside the gender, the equality of members also extends to age; this is demonstrated when adults and young people participate in the same programmes, sit at the same tables and do activities together and so on. At the Defko Ak Niep Lab, for example, it is a pleasure that the members of the collaborative workshops work together with different, but complementary profiles (computer scientists, electronic engineers, craftsmen, etc.) and that these people are allowed to do things together. According to their members, Fablabs seem to be real islands of solidarity in which all members, without exception, feel like family. Beyond solidarity, sharing also plays an important role in the daily life of Fablab members.

However, it cannot be denied that there is gender-based prejudices that exist within Fablabs. Fortunately, Fablabs can also act as environments where prejudices are broken and women are empowered. One of the phenomena that can be observed, for example, is the refusal of women to be reduced to domestic tasks. Indeed, while it is true that some women legitimise and accept prejudice against them, it must be acknowledged that some women have rebelled in contact with the maker culture and are doing everything they can to change the situation, at least while they are in the Fablab. In addition, in order to crusade against prejudice, Fablab management teams are taking strong measures to ensure the full development of women and to foster a sense of equality. One of these measures is to entrust women with so-called "male tasks" or tasks traditionally reserved for men.

Empowerment

Inclusion is the basis for empowerment, which would allow citizens to be creative in solving problems that they feel are relevant or related to their immediate environment (Bilandzic

and Foth, 2013; Brady et al., 2014; Keulartz and van den Belt, 2016). Empowerment is facilitated by collaborative work, which allows us to overcome hierarchical, time and space constraints that sometimes act as a brake on the achievement of objectives. Collaborative work would therefore be the set of capacities for understanding, reflection, decision and action of a restricted work group resulting from the interaction between its members and implemented to face a given present or future situation (Boutillier and Fournier, 2009; Gangloff-Ziegler, 2009). In Fablab, the different dimensions of collaborative work are mutual aid in peer training, teamwork, coworking, peer production and mentoring.

Teamwork
This variant of collaborative work focuses on the relationships that individuals have with each other when they pool their skills to accomplish a task. Teamwork is then defined as work done jointly by several people resulting in a common work. It implies that people interact to achieve the set objective, each according to their skills and the role they play in the group dynamic (Boutillier and Fournier, 2009). In Fablabs, young people are empowered when they arrive. Materials and documentation are made available to them; they are then organised into groups according to projects.

Mentoring
In addition to the very technical learning, the members of Fablabs also benefit from very good mentoring in the area of social entrepreneurship. They admit that they have learned not to rush into setting up their projects, but to develop them step by step while taking into account the many parameters that can influence their successful execution. In fact, this is because many of these Fablabs also consider themselves to be incubators that accompany young people, projects and startups from the idea to their maturation. This mentoring process always begins with a phase of listening to the project that the new member has (when he has one); this listening is carried out by the managers of the Fablab. Those who do not have a project receive support in finding one. Following the listening phase comes the guidance and advice phase, during which the project leaders are assigned a mentor. Thus, as members gain experience, they also participate as mentors in the training of new members.

Peer production
Peer production is the result of social practices on the Internet; it refers to the production of knowledge through the contributions of several people connected. The central principle of peer production is mutual cooperation instead of the quest for efficiency, profit and competitiveness. Peer production is very much present in wikis, the production of open educational resources and open source software and is part of the logic of the commons. Within the Africa OSH community, for example, new online partnerships between participants started and initiatives were launched, such as: the pan-African preprint repository AfricarXiv.org, designing learning kits for primary school kids, concepts for STEM/STEAM practical training for all educational levels and new members for the global MakerNet Alliance.

Peer training
The group dynamics of Fablabs encourage members to train each other through mutual aid and information sharing. Whether it is the sharing of knowledge, information, equipment or space, or the duty to help each other that emerges among the members, these practices contribute

favourably to peer learning/teaching. During their daily activities, members of the collaborative fabrication workshops can acquire knowledge related to 3D printing, electronics and programming on Arduino boards. This mutual support goes beyond the hierarchical position one occupies within the Fablab; even the leaders of the space often have recourse to the views and advice of other members.

Coworking

The idea of coworking is to share physical workspaces where everyone has their own business; and when needed, it is possible to draw on the skills, experience and even the network of other workers.

This type of empowerment could lead to the transformation of African consumers by encouraging them to replace foreign products usually imported into Africa with local alternatives (Irie et al., 2019). This process is made possible by the capabilities that Amartya Sen (1993, p. 270) describes as the capacity of a person to perform valuable acts or, better, the different combinations of things a person is capable of doing or being. Fablabs are real tools that can empower individuals who use them and thereby enable them to contribute directly to sustainable local development.

Decoloniality: an imperative for a decolonised appropriation

According to Mignolo and Walsh (2018, p. 145),

> Decoloniality emerges out of the need to delink from the narratives and promises of modernity – not to resist, but to re-exist. In this sense, decoloniality is both an analytic of modernity/coloniality (its constitution, transformation) and a set of creative processes leading to decolonial narratives legitimizing decolonial ways of doing and living.

Decoloniality allows us to position ourselves distinctly in relation to Western rationality, which places itself as the only framework and only possibility for existence, analysis and thought. It is only through this epistemological rupture that we can observe a decolonised appropriation.

Appropriation is defined as the set of particular uses that an individual or a group can make a good, an instrument, an object; this makes it possible to highlight the social uses, and the complex cultural meanings in everyday life (Breton and Proulx, 2002). Based on this, I posit that decolonised appropriation refers to the capacity of Africans to refute what does not correspond to the realities of their context; to, if possible, adapt, divert and recreate foreign artefacts so that they can meet the needs of their local context. In the case of Fablabs, decolonised appropriation would manifest itself in the detournement of the original vision of the Fablab idea and frugal innovation.

Detournement refers to the fact that a device is used in a role that has nothing to do with the uses intended by the designer (Akrich et al., 2006). In this respect, the Defko Ak Niep Lab has chosen to detach itself from the Fablab approach as defined by MIT, in order to put art and digital technology at the service of the common good and the development of the SICAP Liberté II district of Dakar. One of his achievements is the rehabilitation of an abandoned plot of land in the SICAP Liberté II neighbourhood, and its conversion into a garden dedicated to permaculture. This magnificent result is the fruit of a long period of mediation (carried out by the Fablab) between the local population, the administrative authorities and the religious authorities; followed by a collaboration between the Department of Plant Biology at Cheickh Anta Diop University and the Defko Ak Niep Lab, through which the local women worked

with academics to develop permaculture. Detournement therefore help to combat the isomorphism caused by the transfer of technologies and consequently reduce the effects of the coloniality of knowledge.

Frugal innovation or *juggad* (in Hindi) can be defined as a solution developed in the context of limited resources, to produce affordable and accessible goods for communities that do not have the possibility of obtaining commercialised equivalents (Mokter, 2021). A good illustration of frugal innovation is the Shaker incubator built by the Mboalab. Most biology labs in Cameroon and elsewhere in resource-constrained contexts are under-equipped due to the high cost of lab equipment and it is essential for many protocols including open enzyme manufacturing to provide optimal conditions for cell growth, where some type of agitation or shaking is necessary to incorporate oxygen and evenly distribute nutrients throughout the culture media. That's often done by placing a separate shaker inside an incubator, but incubator shakers combine those functions for a more convenient and efficient setup. The incubator shaker can be used for growth of just about any kind of cell including bacterial cultures, tissue cultures and yeast.

The informal sector

Sustainable local development in African countries requires taking into account the informal sector, which is a set of heterogeneous activities that take place outside the legal framework without being illegal. They produce goods and services and create jobs and income. These activities develop in the same branches as those of the formal sector (processing, service, trade, etc.), with a low level of organisation, a weak division between labour and capital, and labour relations that are often an extension of traditional life, which includes kinship, social and personal relations (Cessou, 2015; Yacouba Barma, 2017). In Africa, the collaboration between Fablab and the informal sector is very present and can be considered as sharing of functions, also known as outsourcing. Outsourcing is a mode of collaboration between two or more organisations that consists of entrusting certain functions to another organisation. For example, when the Ouagalab in Burkina Faso cannot find certain skills among its members, they do not hesitate to collaborate with actors from the informal sector such as welders, carpenters and so on. This form of collaboration is very well illustrated in Senegal where the Defko Ak Niep Lab works closely with a blacksmith in the Dakar market. This practice is the same in Burkina Faso, Cameroon and elsewhere. This collaboration is not only one-way, it can also be in the direction of the informal sector that benefits from the support of Fablab. Indeed, informal sector actors can also use the equipment of the collaborative workshop for a fee.

A governance model based on commons

One possible interpretation of underdevelopment in Africa can be associated with poor resource management. This perception results from the failure to take into account African cultural practices in international models of good governance. From the perspective of sustainable local development, the theory of the commons offers a very good framework for integrating African cultural practices into resource management. The scientific literature is convergent on the fact that one speaks of the commons when the following four conditions are met: 1) the existence of a resource shared by 2) a community that uses, protects and maintains it according to 3) rules (rights and obligations) that govern the use of the resource by the community 4) and a governance structure that ensures the sustainability of the resource and the community that governs it (AZAM, 2013; Bollier and Helfrich, 2014; Coriat, 2015; Hess,

2008; Ostrom, 1990, 2009). It appears that in Fablabs several tangible resources (computers, 3D printers, laser cutters ... including the Fablab itself) and intangible resources (Internet, software, code, etc.) abound. The actors who share these resources display the characteristics of communities of practice (around electronics, design ...), epistemic communities (around the Open ideology), online communities (with the worldwide network of Fablabs for example). These collaborative spaces are governed by rules (access rules, ...) and are managed by a governing body (fabmanager, funders, etc.). On the basis of this evidence, I am able to say that the Fablabs are knowledge commons; thus, they serve the common good.

CONCLUSION

At the end of this chapter, I am able to define appropriate technologies from a decolonial perspective as technologies that are not part of the logic of technocoloniality, but whose societal purpose is to contribute to sustainable local development. As an illustration, I am particularly happy to present the Mboalab as the result of a decolonised appropriate technology. The Mboalab is a concrete utopia that has evolved from the failures and successes of the Fablabs studied in my thesis; this makes the Mboalab one of the most appreciated community biology laboratories in Africa and by the makers community. Among the aspects that make it unique is the intense collaboration between the Mboalab and the informal sector, which contributes to the fabrication of objects such as laboratory benches, room dividers, tables and chairs, laboratory equipment (incubator, desiccator, etc.). These different artefacts are always made in a co-creative dynamic with the participation of Mboalab members in all phases of the process. Another aspect that makes Mboalab proud is the presence of women in important and strategic positions of governance.

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