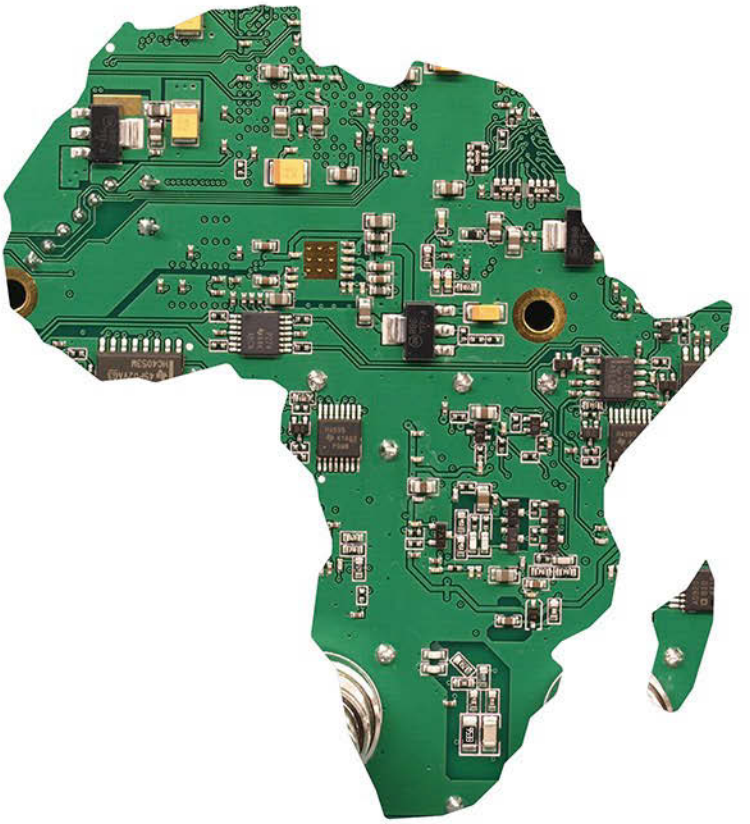
PERFORMING TECHNOCAPITALISM

Alev Coban

The Politics and Affects of Postcolonial Technology Entrepreneurship in Kenya



[transcript] Social and Cultural Geography

Alev Coban
Performing Technocapitalism

Social and Cultural Geography | Volume 21

Alev Coban (Dr.) is a feminist and digital geographer. She worked as a research assistant and lecturer at the Department of Human Geography at Goethe-Universität Frankfurt. She studied African Development Studies of Geography, Law in Africa and Human Geography in Bayreuth and Frankfurt and Design Thinking at the Hasso-Plattner-Institute in Potsdam. Her research interests include Feminist and Postcolonial Science and Technology Studies, Affect and Care Theories, Digital Work, Emancipatory Technologies, Makerspaces, East Africa and Ethnography.

Alev Coban

Performing Technocapitalism

The Politics and Affects of Postcolonial Technology Entrepreneurship in Kenya

[transcript]

The publication of this book was supported by the Open Access Publication Fund of Goethe University Frankfurt am Main, the Center Sustain of the Goethe Research Academy for Early Career Researchers (GRADE) and the Hans Böckler Foundation. Additionally, I am grateful for my PhD scholarship of the Hans Böckler Foundation. Siegelziffer D.30 (Goethe University Frankfurt)

Hans **Böckler**
Stiftung

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at https://dnb.dnb.de/

First published in 2024 by transcript Verlag, Bielefeld

Cover layout: Maria Arndt, Bielefeld
Cover illustration: "Platine" by Dave Jones / Flickr, modified, CC BY 2.0, https://creativecommons.org/licenses/by/2.0/deed.en. "African Continent" by Endstern / AdobeStock
Proofread: Sue Redgrave
Printed by: Majuskel Medienproduktion GmbH, Wetzlar
https://doi.org/10.14361/9783839467077
Print-ISBN: 978-3-8376-6707-3
PDF-ISBN: 978-3-8394-6707-7
ISSN of series: 2703-1640
eISSN of series: 2703-1659

Printed on permanent acid-free text paper.

Contents

Part II

Acknowledgements

Numerous people, knowledges, chocolate bars, dance distractions, sci-fi books, and landscapes supported me in writing this book. On the human side, I first and foremost thank you, the makers, entrepreneurs, journalists, researchers, hustlers, and friends in Nairobi, for sharing your knowledge and time with me, so that I could process your experiences, thoughts, and critiques along academic rules and squeeze them into this book. I especially appreciate the tremendous support of Gaki Gichia, Joe Mathai, Abu Okari, Brenda Livoi, Paul Birkelo, and Bitange Ndemo – *nawashukuru*. Institutionally, I thank both of my supervisors – Marc Boeckler and Seyram Avle – for giving me valuable feedback. Marc, thank you for your financial support and empathy in even the most demanding circumstances of life. Seyram, thank you for your constructive and motivating energy. In addition, I am grateful for the intellectual input of the (former) scholars at the Department of Human Geography in Frankfurt, particularly the AG Boeckler, Lucas Pohl, Stefan Ouma, and Julia Verne. I thank the Hans Böckler Foundation (especially Gudrun Löhrer) for granting me a scholarship in the first years of my PhD research.

Overall, this book is truly a result of female solidarity and synergy: my love and deep gratitude go to Christiane Tristl, the most wonderful symbiont, Klara-Aylin Wenten, my intellectual soulmate, Carlotta Giustozzi, my soothing spirit, Luisa Hoffmann, Mona Friedrich, Andrea Jiménez, Ivonne Felhauer, Christiane Kretschmer, Malve Jacobsen, Josefa Kny, Eleanor Marchant, Sigrid Rand, Lizzie Richardson, Gabriele Reichenbach, and Sue Redgrave (proofreader). Thank you for your precious feedback, your inspiring thoughts, and structuring advice; without you, my research stays, writing retreats, and office hours would have been dismal and the book would only be half as gratifying as it is now. I am very grateful for my fellow PhD survivors Mona, Josy, Christiane, Carlotta, Malve, Luisa, and Klara, for sharing self-doubts, deadline delays, and other rollercoaster emotions, so that we became aware that our

feelings are not individual, but affects structured by our varying precarities. Further, I would like to thank the academic and activist networks that have given me confidence in my (political) academic endeavor: Global Innovation Gathering, Zentrum Emanzipatorische Technikforschung, AK Feministische Geographien, and the Africa Tech Research Collective.

Last, but definitely not least, I thank my family and friends for always reminding me that life is not just academia, but about dance excesses, delicious greasy food, hiking in mountains, along cliffs and in forests, planting zucchinis, and laughing profusely. Jana, Stane, Moe, Ivi, Sonja, Johanna, Carli, Mona, Josy, Lü, Chrizzlon, Raoul, Stephanski, Felice, Lu, Klari, Malveroni, Elvira, Sarah, Chrystal, Alidi, Sabrina, Moira, Niki, Iris, Elena, Jolka, and Friedi – you are the best. My immeasurable thanks go to my family – Mama, Ivo, Oma, Heike, Sabine, Ruth (rest in peace), and Chris – you give me shelter whenever I need it. Meine Zuhauses sind dort wo ihr seid.

Technical Remarks

Anonymization

I have anonymized my research partners and their startups in order to preserve confidentiality. Thus, I have only indicated their job positions or used pseudonyms. The chosen pseudonyms reflect the person's identified gender. Due to the exemplary status of a few places, people, and startups in Nairobi's tech scene, I was not able to anonymize all researched actors. Thus, I have used the real names of public figures, famous tech companies, and innovative workplaces where important for the book's arguments.

Language

Gender

To avoid using masculine pronouns generically, I used the gender neutral *they* as a singular pronoun when making abstract statements. In the cases in which I referred to specific research partners, I used the pronouns with which they described themselves. I chose their pseudonyms accordingly. With regard to scholars, I only assumed their gender according to their given/chosen first names.

Kiswahili

I decided to translate words in Kiswahili in footnotes in order to keep the authenticity of the spoken words in quotes and to represent the common language of Nairobi's middle class, a fluent English infused with Kiswahili expressions. I am aware that my research partners would have used more *sheng*

(Kenyan urban slang composed of Swahili and English) if I had been Kenyan and not spoken the standard Kiswahili from Tanzania (*Kiswahili sanifu*).

Chapter 1
Introduction: The Postcolonial Making of Technology

The years 2007–2008 were a turning point in the historiography of Kenyan technology development. Despite accusations that the country's December 2007 presidential election was fraudulent, Mwai Kibaki was proclaimed the winner and, as a result, Kenya was struck by ethnicized post-election violence.[1] During the uproar, the government decided to ban all live broadcasts for three days. That meant that the only way for citizens to access news about the country's political situation was via the internet (Goldstein and Rotich 2008: 8). Bloggers became an important source of information and a digital civic campaign developed the software *Ushahidi*[2] that allowed everyone with access to the internet to map violent acts and make them transparent (Manske 2014: 14; Ushahidi 2020). While Ushahidi was spreading and the political struggles were dying down, Safaricom, one of the largest mobile network operators, introduced the mobile phone app *M-Pesa*.[3] M-Pesa allows its users to transfer money via SMS and thus transformed the banking sector that had previously precluded many citizens from having bank accounts (Marchant 2015: 8). Today, almost every transaction in Kenya is done via M-Pesa – be it

1 Profound analyses of the post-election violence in 2007–2008, including its causes such as the ethnicization of land conflicts and the consequent societal and political outcomes, are available in an anthology edited by Kanyinga and Okello (2010) and in a Special Issue of the *Journal of Eastern African Studies* edited by Anderson (2008).

2 *Ushahidi* means 'testimony' in Kiswahili.

3 M stands for 'mobile' and *pesa* is Kiswahili for 'money'. In 2022, M-Pesa had 52.4 million active users all over Africa (Statista 2023a) who had earned Safaricom over US$765 million by 2021 (Statista 2023b).

the payment of electricity bills, remittances, or the purchase of a coffee from a street vendor.

These two technologies 'made in Kenya' transformed the country's reputation as a place for technology development; it went from going unmentioned by international media to being one of the main references when talking about innovation 'from Africa'. Not only did international media recognize the cluster of technology developers in Nairobi, so did development agencies, venture capitalists, and international corporations such as Google, IBM, and Microsoft. They all invested heavily in Kenyan startups and technology development workplaces, known as tech hubs (Disrupt Africa 2021: 10; Microsoft 2019; Mwago 2021). These large investments indicate a technocapitalist economy that capitalizes intangibles such as creativity and knowledge to further technoscientific innovation and the development of new technologies (Birch 2017: 440; Suarez-Villa 2001: 4; Wajcman 2006: 14). Between 2015 and 2022, Kenya's startups raised a total of nearly US$1.3 billion, the second-highest amount of investment in Africa after Nigeria, and doubled their annual investment volume from 2021 to 2022 (Disrupt Africa 2022b: 14).[4]

With its fast-growing tech scene, Nairobi is an exemplar for many other places on the African continent: in 2011, a total of five technology hubs existed in four different African countries. Only eight years later, in 2019, there were at least 618 (Giuliani and Ajadi 2019). The term *tech hub* includes incubators, accelerators, university-based innovation hubs, makerspaces,[5] technology parks, and co-working spaces that offer a workplace, business advice, training, and networking to support early-stage entrepreneurial endeavors (ibid.; Friederici 2016: 18). It was in Nairobi that the first and largest technology hub in Sub-Saharan Africa, *iHub*, opened in 2010 and, as the location of the role model for

4 The data is taken from the annual financial reports of Disrupt Africa, a news portal on tech scenes in Africa, and includes only private sector investments, not (development) funding. In Chapter 6, I elaborate that technology developers and startups in Kenya do not benefit equally from the high investment in the country's tech scene. Tech analysts have identified a racial bias in investment: startups with white expat founders or CEOs receiving the most money in Nairobi (Disrupt Africa 2021: 20).

5 A makerspace is a collaborative workshop where members pay a monthly fee to gain access to the available machines – such as saws, 3D printers, and other digital fabrication tools – and further co-working facilities.

'African' innovation, it was soon nicknamed the *Silicon Savannah*.[6] The name stuck and international media coverage of technological success stories from Kenya has continued since then. Mark Zuckerberg's visit to Nairobi's tech scene in August 2016 to learn about technologies that use mobile money transfer made it clear that Nairobi's reputation as a place of technology development had reached global tech gurus.

Kenya's technology developers are surrounded by international journalists, investors, famous tech entrepreneurs, and promising narratives. They all praise digital technologies for breaking with hierarchical structures such as the uneven access to knowledge, the exclusive process of technology development, and the dependence on imports from so-called 'centers' of knowledge production. The current "globalization of Silicon Valley" (Mutua and Alliy 2012: 58) no longer attributes innovation to exclusive laboratories and individual geniuses. Knowledge sharing through co-working, do-it-yourself (DIY) instructions, and the tricks and tips of successful businesspeople promise to empower every person with the chance to change the world with a technological idea, anytime, anywhere (Barbrook and Schultz 1997; Bouncken and Reuschl 2018; Gillies 2011). Kenya's government is also certain that technology development offers new work possibilities and the ability to ultimately "catch up" with the economic development of other countries (MIED 2015: 6).

Against the backdrop of the globally omnipresent promises about improved working and living conditions through new technologies, this book examines what affective and socio-material practices are demanded to gain legitimacy in technology development, particularly of places and bodies that are marked as technologically 'catching-up' and therefore as peripheral to global technocapitalism. I am interested in the affects that drive technology developers' responsibilization to achieve individual, national, and global progress through technologies (Davies 2017; Irani 2019; Lindtner 2013; Sivek 2011). Focusing on technology development in Nairobi, my research considers how actors who have previously been ignored by much of academia *perform technocapitalism*. The majority of research on technology entrepreneurship focuses on Silicon Valley as an exemplar for tech innovation and thus perpetuates the Enlightenment understanding of modernity and progress (e.g., Cringely 1992; Saxenian 1996). Instead, I argue that, especially in contexts

6 Other 'emerging' – or newly discovered by the Global North – technology development locations have also been named after Silicon Valley: Shenzhen is called the *Silicon Valley for Hardware*, Cape Town *Silicon Cape*, and Bangalore *Silicon Plateau*.

that have been positioned at the periphery of technocapitalism, technology entrepreneurs have multiple and contrasting desires for progress.

To elaborate the technoscientific visions, affects, and practices in Kenya, I ask: *What positionalities does Kenya occupy in technocapitalism? How can Kenya be a place for technology entrepreneurship?* And, more specifically: *What affects and embodied practices of knowledge production occur in innovative workplaces in Nairobi? What global technoscientific norms affect makers*[7] *when developing technology?* Finally: *What kind of positionalities and norms of Kenyan science, technology, and innovation are too sticky*[8] *to be re-made and contested?*

I answer these questions by situating Nairobi's technology development sector within historical trajectories of colonial oppression, struggles for economic and epistemological independence, and the global paradigm of technoscientific progress. I claim that Kenya, its technology developers, the innovated technologies, and their users hold a *postcolonial positionality* within global technocapitalism. This means that political actors, investment flows, and development agendas examine and value Kenya's tech scene in terms of Western[9] epistemologies, whereas technology developers feel and handle the material disadvantages of the Global South[10] in their daily lives. I analyze Kenya's dis-

---

7 I use technology developers and makers (of technology) synonymously throughout the book. By both terms, I describe people who (entrepreneurially) create technology in places such as makerspaces.

8 As elaborated in Section 1.2, I refer to Sara Ahmed's concept of 'stickiness'. She sees emotions as sticking to some bodies and objects, while sliding over others (2004/2014: 8). As the stickiness of an emotion is shaped by histories of encounters (2004b: 120), emotions organize bodies and create boundaries along historically established power structures (2004a: 33).

9 I understand West as a discursively produced category that differentiates places and cultures based on Enlightenment thinking and a Eurocentric historiography of economic development (Hall 1992/2018: 92). Exoticizing novels, travel reports, academia, and governmental reports demarcated (and still do) an imagined West from other(ed) imagined places such as the East, the Orient, and so forth (Said 1978/1979). Due to colonization and the "globalization of western imperial power … many societies with different historical traditions [were fused] into a history which, … obliged them to follow the same general economic path" (Young 2001: 5). This means Western epistemologies and historiography became globally hegemonic and shape current postcolonial power asymmetries (Hall 1992/2018: 85).

10 I use the terms Global North and Global South to describe the global economic and political disparities which began to develop with the colonizations by European countries (McGregor and Hill 2009: 473ff.). As this book looks at the current distribution of wealth and power in technocapitalism, I do not limit the Global North to only former

cursive and material positionalities as reciprocally related to the country's situatedness in its past, present, and future. Thus, the country's positions – on the periphery of technocapitalism, yet at the center of African innovation – are relational and performative. Consequently, tech actors have the possibility to re-script their postcolonial positionality by narratively and materially negotiating hegemonic technoscientific norms, national development visions, daily working conditions, and the colonial imaginations of a workplace in Africa.

I furthermore turn attention to the effects of having such ambiguous positionalities and show how technology developers become emotionally invested in technology entrepreneurship and technoscientific progress. Kenyan tech developers enter into caring socio-material relationships to fulfill their ambitions while enduring (neoliberal and postcolonial) turbulences and ambivalence. Due to their postcolonial positionalities, merely promising technoscientific progress is not enough to gain international legitimacy. They have to affectively perform themselves as being worthy of inclusion in the technocapitalist world and, overall, as working in a place that keeps up with other places of knowledge production. As such, actors in Kenya's tech scene eradicate doubts by performing their work in a tangible and bodily perceivable way and making stories about Kenya's tech scene touchable, observable, and understandable for their, mainly white, international investors. As these affective and bodily efforts are necessary to gain investment, I define technocapitalism as an *economy of promises and performances* about technology yet to become.

Overall, I show that future visions depend on the context-specific situatedness of a place. I analyze how histories of colonialism, subsequent development experiments, and present modernist assumptions of economic progress, entrepreneurial selves, and digital technologies unfold within ambiguously desired futures. I argue that *postcolonial technology entrepreneurship* assembles intimate socio-material relations between developers, material, and machines that work hard to achieve seemingly contrary industrialized Kenyan futures.

(European) colonizers, but also include the current powerhouses of technology production, such as South Korea, Singapore, China, and Israel (Statista 2020: n.p.; World Population Review 2021: n.p.). I am aware that the dichotomy engendered by the terms is problematic as it homogenizes different economies and daily lives into two seemingly coherent contexts (McGregor and Hill 2009: 476). Therefore, in this book, I refer continuously to the fact that I am analyzing empirical data anchored in a specific local context, namely Nairobi's tech scene.

There are at least two desired futures: one is that of a decolonized country that has been emancipated from the supremacy of Western knowledge and technology by empowering local tech developers to care for the African[11] continent's needs; the second is that of a future nation that is integrated into the technocapitalist market by achieving global norms of tech development and a national Fourth Industrial Revolution.[12] The ambiguity of Kenya's future visions is paradigmatic for an ever-intensifying entanglement of heterogeneous practices and ambitions within capitalist markets (Berndt and Boeckler 2011; Collier et al. 2017). In this regard, I am especially interested in an ambivalence specific to technocapitalism: while the seductive promise of solving crises of capitalism through (capitalist) technoscience generates economic opportunities for marginalized states, at the same time technocapitalist practices reproduce the exact same global power asymmetries that need to be overcome to solve capitalist crises (Birch 2017: 433; Suarez-Villa 2001: 5). Against this backdrop, I depict technology development in Nairobi neither as an anti-capitalist craft revival such as in post-industrial contexts, nor as a copy of Silicon Valley's innovation culture. Instead, I emphasize what technocapitalism feels like – desiring exciting experiments with digital machinery, envisioning an industrialized and decolonized Kenyan future, and being stressfully self-employed in an exploitative global tech market.

1.1 Situating the Silicon Savannah: Postcolonial Positionalities in Technocapitalism

My research draws on concepts of positionality and affect inspired by feminist and postcolonial theories in geography, science and technology studies (STS), and sociology. Thus, the following pages lay out the theoretical frame for the book. I introduce theorizations on positionality, affect, and embodied work

11 I only refer to 'Africa' as a single location in order to highlight the demarcations that my research partners enact. Throughout this book, I seek to avoid the colonial homogenization of a whole continent into a single context. However, these homogenizations are important to mention as they represent the discursive frames in which my research partners (must) position themselves (see Zanoni et al. 2017: 348; Part I).

12 The Fourth Industrial Revolution describes a worldwide phenomenon of integrating interconnected and automated digital technologies into industrial production facilities (see Chapter 2).

that allow me to research the situatedness of Kenyan technology development and the work that is necessary to position Kenya within technocapitalism.

Positionalities, as carved out by feminist theorists, shape our possibilities to act – for example, the ability to envision futures, to be affected and to affect, or to access a research field (see Section 1.3). Generally, positionalities are defined along socially constructed categories such as gender or race and describe the situatedness of a person or group within a specific context (Rose 1997). Drawing on Eric Sheppard's concept of "geographic situatedness" (2002: 318), I claim that Kenya holds a postcolonial positionality within technocapitalism. By 'postcolonial', I mean the circumstance that although colonization has formally ended in most parts of the world, colonial trajectories, such as Eurocentrism, still produce global epistemological and material inequalities (do Mar Castro Varela and Dhawan 2015: 17). Postcolonial structures in technocapitalism include fiber optic cables that run along old colonial maritime trade routes, value chains that confine the extraction of raw materials to African countries while outsourcing their more profitable processing, investment flows originating primarily in the USA and Europe, and the extraction of local knowledge by multinational tech companies (Bejarano 2021; Kwet 2019; Smith 2022; Wan 2019). Throughout the book, I examine the discourses, affects, and materialities "sticky" (Ahmed 2004b: 120) with postcolonial power asymmetries that shape the work of developing technology. In the case of Kenya's tech scene, its dominant discourses and affects *other* Nairobi as a mere copy of Silicon Valley and thus, exoticize and demean the country as a deficient place that has to catch up through technoscience.

The importance of researching positionalities lies in the fact that Kenyan technology developers experience their geographic situatedness day by day. Not only they themselves, but also media stories constantly compare their technology development circumstances to technoscientific work in Silicon Valley, China, or Southeast Asian countries. Terminology such as *Silicon Savannah*, *to spur*, *leapfrog* or *catch up* indicate these discursive comparisons. Materially, Kenyan technology developers are confronted with resource scarcity and often lament that their work would be easier in a different place. As such, they feel and (rightfully) complain that their postcolonial positionalities within technocapitalism determine their visions, workplaces, technologies, labor, identities, and affects as well as, in general, Kenyan futures.

As positionalities are relational and thus performatively constructed, I emphasize the possibility of shifting positionalities. As such, I understand positionalities, technology, modernity, and progress as bodily and material

achievements and not as essentialized entities (Slater 2014: 153f.). In this respect, my research highlights the performative work of making and scripting Kenya's positionality as a place for technology development, and therefore scrutinizes the unquestioned permanency and stability of center-periphery relations (Chan 2013: xi).

The Situatedness of Technology Development

In order to grasp a place's "positionality within the global economy", Sheppard (2002: 308) draws on feminist theorizations of the relationality and performativity of positionalities and their inherent power asymmetries (Rose 1997: 317) but broadens them by adding a "geographic situatedness" (Sheppard 2002: 318). He states that although the power asymmetries that define a place's positionality are mostly path dependent, positionalities are topological and have multiple scales (ibid.: 324). This means that geographic categories have multiple positionalities just as feminist scholars conceptualize an individual's multiple and variable positionalities ranging "from the body to the world region" (ibid.: 322). Anna Tsing (2000: 330) also writes that geographic positionality is scale-dependent and therefore highly variable: she looks at how scales are made through "planet-wide interconnections" and, according to her, researching the politics of scale-making "requires locating and specifying globalist projects and dreams, with their contradictory as well as charismatic logics and their messy as well as effective encounters and translations".

Regarding technology development practices, researching the making of variable scales is a promising approach – especially when the focus is on tech scenes because they embody and materialize global discourses and the requirements of world markets within their daily work (Gibson 2016: 82). By analyzing the construction, representation, and negotiations of spatial categories through practices of technoscience, postcolonial STS questions how scales are made. This sub-discipline claims that "practices of science are always multi-sited" (Anderson 2009: 395) and, therefore, blur and contest dichotomies produced by colonialism (McNeil 2005):

> Attention to the 'complex border zone of hybridity and impurity'[13] should help us to understand how ideas about difference – racial (white/other or *évolué*/primitive), temporal (modern/traditional), class (élite/subaltern) – are enacted, and disturbed, in the performance of technoscience. A postcolonial perspective might show us how scientific and technological endeavours become sites for fabricating and linking local and global identities, as well as sites for disrupting and challenging the distinctions between global and local. (Anderson 2002: 644)

The different scales of technoscientific endeavors show that a place of technology development holds variable and multiple positionalities. In this context, Paul Dourish and Scott D. Mainwaring demand the recognition of "the historical specificities of sites of technology production and use" (2012: 139) in order to grasp the variegated positionalities of a place of technology production, its being more than just a center or periphery. They use the example of iPhones and state that although they are claimed to be designed in California, innovation happens most often during the manufacturing processes that are mainly outsourced to other places of technology production, usually China. Eleanor Marchant (2014) also relativizes the positionality of a center or periphery by comparing technology creation in Nairobi with that in Philadelphia. She analyzes how both center and periphery are contextual by showing that the tech scene in Philadelphia inhabits a peripheral status in the USA although it is located in the Global North (ibid.: 18), whereas Nairobi may be peripheral in the commodity flows of electronic parts (see Chapter 7), but is positioned in the center of international awareness (Marchant 2014: 18). Marchant's take on the "geography of technology creation" (ibid.: 5) shows that places of technology development are context-specific – and thus never generalizable.

Colonial Trajectories in Science and Technology

As Kenyan tech entrepreneurs perform global technocapitalism, they blur the distinctions between the putative centers and peripheries of technology development. The international excitement and wonder about technological in-

13 Kwame Anthony Appiah criticizes the terminology of purity when referring to 'culture'. He claims that discourses of pure and impure cultures legitimated and still legitimize discrimination, exploitation, and violence and that "contamination" would be a better term to describe the "endless process of imitation and revision" of lived cultures (2006: n.p.).

novation from Kenya imply that the existence of a tech sector in an African context must be something special. In this manner, the emergence of creative tech scenes all over the world, and the increasing concentration of technology production in China and Southeast Asian countries challenge the supremacy of the USA and Europe as the centers of knowledge production. Kenya, as the Silicon Savannah, is the role model for technology development in Africa and therefore, constitutes the continent's center of media attention and financial investment (Marchant 2014: 18). However, although Kenya represents the regional center of tech innovation, I argue that complicated commodity imports and Eurocentric discourses have maneuvered the country to the periphery of global technocapitalism.

Materially, the peripheral position of Kenya can be derived from the fact that the commodity flows of essential parts and machines to build technology omit Nairobi's tech developers (see Chapter 7). The centralization of affluent tech industry in only a few places, such as Silicon Valley or Shenzhen, motivates tech companies from all over the world to either move to these clusters – if they can afford to – or they have to remain in a place where access to local resources and success stories are limited (Takhteyev 2012: 9ff.; see Part I). Discursively, the scarcity of (academic) literature about makerspaces and technology development in the Global South illustrates Kenya's peripherality to technoscience. One of the reasons that historical accounts of the emergence of makerspaces, for example, omit places in Sub-Saharan Africa is that these contexts often do not have a long history of institutionalized technology development. Although practices around making and innovating in the Global South have "been going on both well before, and also at the same time, as the [maker] movement's rise in the West" (Braybrooke and Jordan 2017: 30), they have been neglected by the dominant Western narratives around innovations and their origins.[14] Therefore, the genealogies of hacker- and makerspaces focus on tech developers who form a counterculture DIY/repair movement against capitalist structures in post-Fordist environments (Maxigas 2012). This absence of literature around making and technological innovation in the Global South reflects the hegemonic story about the relation between the Global South and technology in general:

14 Although the majority of research on making and entrepreneurship is empirically located in places in the Global North, the community of scholars who provide detailed and contextualized accounts on makerspaces in other regions is growing (e.g., Avle and Lindtner 2016; Bardzell et al. 2012; Irani 2019; Philip et al. 2012).

> The story of the [Global South] and technology if it is told at all is one of transfer, resistance, incompetence, lack of maintenance, and enforced dependence on rich-world technology. Imperialism, colonialism, and dependence were the key concepts, and the *transfer* of technology from rich to poor, the main process. (Edgerton 2007: 92)

Historian David Edgerton (2007) writes that technology is embedded in exploiting and discriminating systems such as colonialism and imperialism. This is another reason why academic accounts of technology development in Sub-Saharan Africa are scarce: because "scholarly histories of technology and the digital are almost all intertwined with Western history, its theories, systems of knowledge production and its subsequent transfer, making it difficult to unravel or identify specific regional African histories and positions" (Bristow 2017: 282). This colonial trajectory within academia results in doubts about the legitimacy of research on technology development outside the Silicon Valley (Takhteyev 2012: 1). Anita Say Chan (2013: 8), for example, was asked why she would research digital culture in Peru, "a South American nation far less attended to for contemporary innovation than for its ancient Incan ruins and high Andean peaks".

Numerous places and people worldwide are not seen as active technological actors because of the Western historization and theorization of (technology) development as linear and teleological (see Chapter 2). For example, until now, people in African contexts have been depicted as passive recipients who lack technological and scientific expertise (Bristow 2017: 284). In this manner, the making of technologies in the Global South is mainly researched as *frugal innovation*, that is, innovation processes that use minimal resources, resulting in low-cost products (Radjou and Prabhu 2015). Terms such as *making* or *innovation* are used when describing practices in the Global North, whereas descriptions of making practices in the putative peripheries of technocapitalism refer to informalized hacks such as the Hindi term *jugaad*[15] (Butoliya 2018) or Kiswahili *jua kali*[16] (King 1996a). This discursive demarcation causes the othering of non-Western practices of technology development. The denial of technoscientific practices in the Global South follows a "logic of lack" (Dourish

15 The Hindi word *jugaad* describes a hack; "an innovative fix; an improvised solution born from ingenuity and cleverness" (Radjou et al. 2012:4).

16 *Jua kali* means 'hot sun' in Kiswahili and is used to describe the informalized sector in Kenya (King 1996a).

and Mainwaring 2012: 136). According to Dourish and Mainwaring, this logic evokes an "evolutionary relationship" (ibid.: 135) between the post-industrial West and other(ed) places, so that innovation and technology is believed to diffuse from a Western center to non-Western peripheries.

Within the Eurocentric teleology, technology represents the inevitable and de-politicizing driver of economic productivity and societal change (Graham et al. 2015: 345; Mavhunga 2017: 8f.). In this regard, development cooperation agencies, private companies, and governments ubiquitously use terms such as *leapfrogging* or *digital divide* to legitimize the investment in technologies as facilitators of development in the Global South.[17] They aim to close the digital divide – a "gap between people and places with regard to their access to … ICTs" (Graham 2011: 213) and other digital technologies – because the divide is claimed to hinder countries from participating fully in the global economy. In this context, technology is supposed to help countries leapfrog, that is, to skip a pre-defined development stage and thus catch up with prosperous economies. For example, the increase in mobile phone usage in many African countries is heralded as leapfrogging the usage of landlines as a communication device (Castells et al. 2007: 216).

Against this background, we see that global technocapitalism and its technoscience is interwoven with colonial trajectories of resource flows and restrictions, and hegemonic norms of scientific work such as the achievement of 'objectivity' through global standardization, and the teleological assumption that technological advance brings societal progress (Barnes 2005: 142; Wynne et al. 2007: 28).

17 The existence of digital divides is also seen in post-industrial contexts, such as the UK, USA, and Germany. Whether in the Global North or South, the numerous projects that aim to close digital divides all define the same populations as the most likely to be excluded from the digital: indigenous peoples, people living in rural areas, less educated and unemployed persons, individuals with low incomes, people with disabilities, women, youths, and children (WebJunction 2019; Good Things Foundation 2018; International Telecommunication Union 2019). In general, digital inclusion agendas have the goal of broadening internet access and fostering digital skills to (re-)integrate citizens into the labor market and improve national workforces (Digital Inclusion Survey n.d.; PricewaterhouseCoopers LLP 2009).

Emancipatory Struggles over Positionalities

Rather than understanding positionalities as fixed entities, this book shows that the performativity of discourses, affects, and materialities leaves room to re-make positionalities. Here, I am inspired by Mike Crang's concept of "scripting places" in which he claims that images, texts, and practices are able to create and "also rework the actual histories and geographies of places" (2004: 76). In this vein, I analyze the performative work of scripting Kenya's positionality as a place for technology development, and show the possibilities and constraints of technology developers, innovative technologies, and workplaces to articulate a self-determined positionality in postcolonial economies. Thus, I follow Sheppard's call for research into the existence of various positionalities to examine "struggles over meaning", but without restricting my research focus to how seemingly universal values and norms position places into "a common positionality in the space of discourse" (2002: 322). Theorizations of science and technology from African and Latin American contexts emphasize that the colonial history of technology gives reason to scrutinize the claimed universality of Western concepts of science, technology, and their making, and thus, to question the putative stability of technoscientific centers and peripheries (Mavhunga 2017; Medina et al. 2014; Rajão et al. 2014). In this manner, I highlight the visions and possibilities that (still) aim at epistemological, technological, and economic emancipation from Western hegemony by researching the everyday work of technology developers in Nairobi.

The situatedness of technology development is a pressing issue for actors who possess a postcolonial positionality in technocapitalism. In Kenya, the actors in the tech scene (have to) constantly negotiate their positionalities as their places, bodies, and machines are considered technologically deficient. Interestingly, it is mainly research partners in formerly colonized places who talk about their geographical situatedness in colonial pasts and contemporary capitalist technopolitics. Be it Brazil, Peru, India, Kenya, South Africa, Ghana, Jamaica, or China – all of the scholars who pursue research in those countries describe how technology developers, research institutions, and other workplaces of innovation struggle with their peripheral positionality in global economies, technoscientific discourses, and historiography (Avle et al. 2017; Chan 2013; Coban 2018; Irani 2019; Pollio 2020; Takhteyev 2012).

The discursive, material, and affective positioning of countries as places that lack technology and its accompanying (national) progress influences their possibilities and envisioned futures (Sheppard 2002: 307f.; Müller-Mahn 2020:

157). The material constraints that technology developers face at "the so-called peripheries of technological innovation" (Chan 2013: 8) complicate the local development of technology (see Chapter 7) and evoke desires in politicians, investors, and entrepreneurs to abolish peripheral positionalities and bolster national economies (see Chapter 2). As described above, the belief in modernity and progress through technologies is a global hegemony[18] and therefore spurs the aim to be included in global markets. In this manner, Mark Graham (2015: 880) describes how Kenyan tech entrepreneurs primarily problematize their disconnection from global tech markets which prevents them from fulfilling national development. He writes that in the "global margins – the people, places, and processes that have not been able to occupy central positions in transnational networks of production and value creation" (2019: 15), digital technologies are seen as promising tools to change their positionalities.

With my research, I show how technology development functions as a tool to change Kenya's positionality and *center* it within global power structures. This centering involves the Kenyan government's and tech developers' attempts to foster their inclusion within the world tech market, as well as the developers' fight against colonial attributes such as the discursively ascribed peripherality. I argue that Kenyan technology developers, machines, and stories unite to use their central (media) position within Africa's tech sectors to re-script their postcolonial positionality. They strive to change epistemological and material inequality through efforts at market integration *and* decolonial attempts to regain the power of writing one's own story.

The attempt to rework Kenya's postcolonial positionality by merging capitalist and decolonial endeavors with each other hints at the contradictory effects of, on the one hand, transcending boundaries and changing positionalities, but on the other, manifesting and reproducing dichotomies. The ambivalent pursuit of decolonial independence through capitalist technologies creates economic opportunities, but at the same time technology developers have to comply with technocapitalist valorizations that reproduce rather than overcome global power asymmetries. Yuri Takhteyev (2012: 11), for example, shows

18 I use the term *hegemony* to describe sets of ideas that have become the norm through a broad consensus in (civil) society. The majority does not question hegemonic norms; however, the suppression of alternative values and ideas can give rise to activist movements that challenge hegemony. For a detailed discussion of hegemony, see Gramsci (1975/1991-2002).

that developing software in a "wrong place", namely Rio de Janeiro, means pursuing global practices of high-tech work by disengaging with the local context. The valuation of global practices of innovation causes the parallel devaluation of those practices that have been practiced locally for a long time, such as *jugaad* and *jua kali* as explained above. In the case of India, Lilly Irani shows that the global project of "entrepreneurial citizenship" (2019: 22) draws distinctions between innovators and beneficiaries, innovative technology and *jugaad*, and thus, more generally "between those who can govern others and those who must be governed, cared for, and drawn into modernity" (ibid.: 13). Consequently, ascension from the peripheries of technocapitalism "hing[es] on the successful upgrading of individuals into entrepreneurial citizens and on the making of a new kind of professional identity" (Avle et al. 2017: 481).

My research on technology development in Kenya shows that technology and science are sites of hegemony and, at the same time, sites of multiple context-specific productions of globality (Anderson 2002: 651). I show that Kenya's positionalities are socio-material achievements of the technoscientific work that constantly negotiates path-dependencies of colonial histories and current global politics of technocapitalism. As such, postcolonial technology entrepreneurship is a highly ambivalent venture that has to be constantly negotiated affectively.

1.2 Affects at Work: Making Technologies, Stories, and Positionalities

I became aware of the affective and sensory attributes of technology development in Nairobi due to my ethnographic focus on everyday spaces of entrepreneurship (Steyaert and Katz 2004). I followed affects – my bodily sensations, the emotions of my research partners, and the affective language in stories – to be guided to issues "sticky" with strong emotions (Ahmed 2004b: 120). These emotions led me to the most relevant matters of entrepreneurial work in Kenya's tech scene: the (desired) enactment of societal progress and changing Kenya's status in global technocapitalism from postcolonial peripherality to a more central positionality. The embodied affects of making technologies and stories at makerspaces served as analytical tools to grasp how technology developers become invested in norms of entrepreneurial work, technoscientific progress, and social impact.

Based on a spatial, relational, and discursively structured understanding of affect/emotion,[19] I analyze how boundaries are affectively (re-)constructed along norms of technoscientific progress. I show that the affects, bodies, technologies, and narratives in Nairobi constantly negotiate the professionalism of technology, the norms of innovative work, the 'Africanness' of technology, and the 'right' collaborators to work with – whether white visitors, investors, co-workers, or machines. The manifold and ever-changing distinctions and connections between global norms and daily life, between friends and foes, between Africa and the West, and between tinkering and engineering highlight the affective work that is necessary to build technologies, stories, and positionalities. I claim that the technology development sector in Nairobi has brought Kenya to a historical (turning) point: intimate socio-material relations of technology developers, machines, and material re-scripting the country's positionality within postcolonial power asymmetries. As such, I show that structural inequity is negotiated affectively and socio-materially, and emphasize the practices that are demanded of places, bodies, and machines considered technologically deficient.

The Sticky Geography of Affects

Feminist scholars who deconstructed the belief in objective knowledge, claiming that it is always situated and partial, initiated the study of affects (Haraway, 1988). Methodologically, feminist theorists demand that the researcher's positionality in academic accounts should be transparent in order to be aware of "the substance and significance of matter, materiality and the body" (Pedwell and Whitehead 2012: 117) during the research process. However, some feminist scholars, such as geographers of emotions, have been criticized for personalizing research and focusing too narrowly on individuals' emotions (Cadman 2009: 458; Thien 2005: 452). In geography, a debate about emotion and affect has resulted in two disparate fields of research: geographies of emotion and non-representational geographies. The, mostly male, scholars of non-representational (NRT) geographies advocate for a broader theorization of affect, separated from individual and embodied emotions (see Pile 2010; Slaby 2018; Thien 2005). On the other hand, the, mostly feminist, geographers criticize this dichotomous understanding of affect and emotion in NRT "for reproducing an

19 Throughout this book, I will use 'affect' and 'emotion' synonymously due to the theoretical understanding of affect elaborated below.

objective/subjective dualism and downplaying the subjective" (Anderson 2017: 2). Further, they claim that NRT diminishes the insights of poststructuralist accounts on power and discursive representation (Schurr and Strüver 2016: 90f.).

The scholars I refer to in this book predominantly draw on Sara Ahmed's conceptualization of affect, claiming that affect and emotion signify the same thing. According to her, an "analytic distinction between affect and emotions risks cutting emotions off from the lived experiences of being and having a body" (2004a: 39) on the one hand, while, on the other, a distinction risks the assumption that emotions come from within individual bodies (Ahmed interviewed in Schmitz and Ahmed 2014: 97; Ahmed 2004b: 117). Therefore, research that follows Ahmed analyzes both – the emotional dimension of daily life as well as the discursive dimension, power-laden structures and representations that drive collective affect (Schurr and Strüver 2016: 94). To examine the body in the context of power structures, Margaret Wetherell (2012: 19) understands affects as discursively structured:

> An affective practice is a figuration where body possibilities and routines become recruited or entangled together with meaning-making and with other social and material figurations. It is an organic complex in which all the parts relationally constitute each other.

The emphasis on the 'figuration' of bodies, practices, discourse, and materiality underlines the relationality of affects and the inseparability of "language and representation from materiality and corporeality" (Militz 2017: 25). Affect's relationality means that an emotion is not only a bodily experience "inherent to a body or an object but is being activated in encounters with different bodies and objects" (ibid.: 22; Ahmed 2004/2014: 6).

However, within affective encounters, bodies and objects possess different capabilities to affect and to be affected. These capabilities are dependent on the bodies' and objects' "racialized, gendered and sexualized markedness" (Tolia-Kelly 2006: 215). This means the feeling that "a certain body (marked through signs of gender, sexuality, race, etc.) … [has] about another (differently marked) body is not simply a matter of individual impressions" (Laliberté and Schurr 2016: 74). Instead, the feeling is evoked by a "contact [that] is shaped by past histories of contact" (Ahmed 2004/2014: 7). In this respect, encounters between different entities not only produce connective relationality, but also have dividing and differentiating effects. For example, Ahmed asks "What do emotions

do?" (ibid.: 4) and analyzes how emotions shape "the surfaces or boundaries of bodies and worlds" (2004b: 117) and, as such, create insides and outsides.

One of Ahmed's most important concepts, to which I will refer throughout this book, is the 'stickiness' of emotions. She uses this term to explain *how* boundaries, such as stereotyping dichotomies, are drawn. As explained above, Ahmed (2004/2014: 4) sees emotions not as residing in bodies, but circulating between them. By analyzing the work that emotions do, she highlights that, in their movement, emotions stick to some bodies and objects, while sliding over others (ibid.: 8). She argues that every encounter comprises sideway movements that establish "'sticky' associations between signs, figures, and objects" (2004b: 120), for example, "dirt, the roach, the Black body", and backwards movements in which histories make associations sticky (2004a: 33). These sticky emotions bond figures to each other and create coherences (2004b: 119). As such, sticky emotions organize bodies and therefore create boundaries between collectives, for example, as people who are "hated or loved, as giving pain or pleasure" (2004a: 33). The analysis of the movement and stickiness of emotions aims to foreground "how we become invested in social norms" and eventually to answer why norms stay stable and social transformation is hard to achieve (Ahmed 2004/2014: 11f.).

The point that "affective relations organise bodies and objects across space and time" (Militz 2017: 21) directs geographical research to analyze the spatialization of affects. For instance, Elisabeth Militz looks at how "the circulation of national affects between different bodies and objects … engenders feelings of national belonging and alienation and connects some bodies and objects while disconnecting others" (ibid.: 22). And Sunčana Laketa (2018) conceptualizes the term 'sticky spaces' by analyzing how the affects of discursive and non-discursive practices in a school and on a main street in Mostar (re)produce ethnic difference. Kate Cairns (2013) explicitly combines economic circumstances with affects and labels her approach *emotional geographies of neoliberalism*. She researches the imagined futures of students at a rural school in the USA and combines the situatedness of that place with the affectivity of neoliberalism as the dominant discourse. As such, she is interested in how "young people encounter neoliberal notions of flexibility, mobility, and self-improvement from a specific location – one marked by whiteness, economic hardship, and classed narratives of 'rural decline' – which calls upon distinct forms of self-work", arguing that critiques of neoliberalism have to include affects to understand the "practice of self-making that is deeply felt" and "how risk and uncertainty are managed in place" (ibid.: 343).

In this book, I emphasize how the sticky affects of (post)colonial oppression and desires of emancipation organize the bodies and technologies at innovative workplaces in Nairobi. I argue that hegemonic discourses, material commodity flows, and (post)colonial affects position Kenya's tech scene and its actors as an *other,* as a periphery to global technocapitalism (see Ahmed 2004a: 33). For instance, the feelings of excitement, empowerment, wonder, and unexpectedness associated with technology development in Kenya depict its tech scene as a surprising phenomenon. These recurrent affects portray Kenya as a place that has to catch up in terms of technology, its national economy, and societal issues and thus draw boundaries between Kenya and other places of technology development (see Part I).

I claim that the postcolonial positionality of Kenya affectively limits the possibilities of developers and their technologies. Global technocapitalism demands that technology developers in Kenya have to first convince international supporters and investors of the value of their work in order to be able to affectively and socio-materially re-script their positionality. In this regard, I show that technology developers, narratives, and prototypes use international attention in order to shift boundaries and create identities: media attention centers Kenya's discursive positionality, investors' awareness changes material peripherality, and the building of a tech community creates a caring identity of Kenyan makers. The affects and embodied work of making technologies and telling stories about them show that positionalities are constant works in progress.

Affects and Work(place)

In Nairobi, a workplace such as a makerspace is where technology developers make prototypes and stories to enact and feel futures of independence and industrial revolution. Thus, it is where technology is developed to re-script Kenya's postcolonial positionality. Highlighting the normative affectivity at innovative workplaces, I argue that technocapitalism is an *economy of promises and performances*. Thus, Kenyan technology developers are required to strategically stage (over) optimistic technoscientific promises (Wynne et al. 2007: 24) and furthermore, bodily and affectively perform their audiences' expectations in order to gain legitimacy with actors both outside and inside the country. Only by promising and performing their envisioned futures along hegemonic norms of technoscience and exoticized imaginations of Africa are Kenyan tech

developers able to gain the crucial support needed to enact their work (see Part I).

Despite the affectivity of making technologies, the academic literature on makerspaces typically does not look at the everyday work and working bodies, but has an empirical focus on the political implications of entrepreneurial making in post-industrial contexts, for example, the reproduction of capitalist modes of production. However, Andrew Pickering (1995), for example, scrutinizes this political-economic stance of the majority of research on technology and labor. He analyzed David F. Noble's (1984) account of the introduction of the first numerically-controlled machine tools at the General Electric Aero Engine Group in Massachusetts in the early 1960s and showed that the industrial workplace remains a "key arena for Marxist studies of technology" (Pickering 1995: 158) because Computerized Numerical Control (CNC) machines serve as the "principle exemplification of the Marxist deskilling book"[20] (ibid.: 170). Pickering criticizes how Noble's Marxist-inspired account assumes a "stable set of actors: the dominators (capitalists/management) and the dominated (wage labor)" (ibid.: 171) who "can only waver between enduring limits" (ibid. 174). Likewise, geographers who coined the *Geographies of Making* distance themselves from labor geographies which "have often been dominated by the big stories, the epic struggles that occupy workers' minds, most often while their hands are occupied by manual tasks" (Carr and Gibson 2017: 4). Scholars who criticize the exclusive focus on the meta level of labor argue that huge constructs and promises about technology and labor:

20 Drawing on Karl Marx, Harry Braverman (1974) formulated the "deskilling thesis" claiming that various technological introductions to the industrial workplace continuously replace and deskill workers; for example, the assembly line replaced craftwork and the CNC machine replaced skilled machinists. According to Marx, machinery produces the capitalist relation that causes the "technical subordination of the workman to the uniform motion of the instruments of labour" (1867/2011: 463). Braverman's exegesis of Marx that focuses on the 'replacement argument' has often been criticized. Paul S. Adler (1990), for example, writes that "while agreeing with Braverman that Marx seems to have believed that capitalist development does embody a distinctive underlying skill trend, I argue that in Marx's theory this trend may not have been deskilling but quite the opposite—upgrading" (ibid.: 781). He refers to Marx's model of social change to show that deskilling is a short-term and local effect of power asymmetries in capitalism, but "nevertheless [represents] eddies in the broader current of a long-term skill-upgrading trend" (ibid.: 783).

> will not unfold in discourse alone; [they] will take place — or not — on the shop floor and be created and put to work by real people and their *living laboring capacity*, within real labor relations, using and creating real technology in all its *sociomateriality*. (Pfeiffer 2017: 120)

The research shift to the workers themselves and their affective labor dismantles the often linear and predictable Marxist narrations on science and technology development. Therefore, feminist and cultural geographies' perspectives, in particular, inspire this book to grasp the affective entanglement of making's local embeddedness and its global aspirations of technoscientific progress (e.g., Carr and Gibson 2017; Crang 1994; McDowell 2009).

I target "such undertheorized areas as affect, intimacy, and perception" (Waldby et al. 2006: 3) in studies of science and technology to highlight the bodily and affective work of technology development. Thus, my ethnographic research responds to the call of 'workplace geographies' not to fall for grand narratives of labor transformation and its location-independent knowledge workers, but to closely examine the workplace, its identities, bodies, and emotions in order to show the entanglement of the intimate and the global in the workplace (Crang 1994; McDowell 2009). As for workplaces in the 'new economy', such as home offices, co-working spaces, and others that are determined by digital technologies, Melissa Gregg (2011: 5) advocates for research into the intimate relationships between white-collar employees and their work, writing that the focus on affects in the workplace highlights how easily intimate emotions and relationships become capitalized. In the case of entrepreneurial making of technologies, Sarah R. Davies (2017: 113f.) also emphasizes the commercialization of emotions. She notes that her research partners have never built things out of monetary interest, but always out of personal passion and enthusiasm. Although the emotions of work life, such as stress or the desire for a work-life balance, seem global, Carla Freeman (2014: 7) claims that emotions have distinctive meanings in different contexts. In this respect, geographies of making examine the interweaving of "macroeconomic forces" (Gibson 2016: 82) with local context specificities. They include the economic contexts of the sensory parts of (manufacturing) work in their analyses because "labor process[es] and [the] accompanying embodied skills, technologies, machines and materials [intersect] with the logics of cultural capitalism" (ibid.). In this regard, a workplace such as a makerspace consists of relationally constituting parts: designers, developers, technologies and

their prototypes, users, materials, legislations, context-specific histories, and discourses situate the work of making in unique ways (Philip et al. 2012: 8).

My research at innovative workplaces in Nairobi shows that technology developers become emotionally invested in technology entrepreneurship and technoscientific progress and that they (have to) enter caring relationships to fulfill their ambitions and withstand (neoliberal) turbulences and ambivalence. Further, I highlight the affects and discourses that normalize the, often precarious, norms of tech work (Cockayne 2016: 469): Kenyan technology developers are situated within the master narrative of technoscientific progress that stipulates a utopian belief in revolutionary societal change through technology. 'New work' methods such as 'design thinking' and rapid prototyping promise infinite creativity and make every technology developer want – and have – to work fast, flexibly, and self-responsibly. Specific to places with a history of colonialism, Kenyan technology developers are confronted with exoticizing norms. This means that the technologies made in Nairobi only gain legitimacy if they benefit marginalized communities, especially the rural poor (see Chapter 6).

The depiction of the explicit and implicit normativity of discourses, affects, and technologies (see Suchman 2009: 9; Weber 2007: 360, 364f.) offers insights into the daily negotiations between global norms of innovative work and context specific challenges to entrepreneurship, and between the tech developers' dependence on capital from the Global North and the wish for emancipation from it (see Parts I and II). Thus, the occurring affects and embodied practices at makerspaces illuminate the (re-)production and contestation of technology production's norms while bodies relate to digital machinery. Overall, I argue that the work of postcolonial technology entrepreneurs is charged with tensions between neoliberal aspirations, capitalist world markets, and the decolonial motivations that they have to handle and withstand on a daily basis at their workplaces.

1.3 Methods and Sites: An Ethnography of Tech Entrepreneurship

I paid (auto-)ethnographic attention to the workplaces of technology development in Nairobi in order to extend geographic scholarship on "digital economies at global margins" (Graham 2019) which has hitherto mostly considered the meta level, such as the role of information and communication technologies for development (Kleine and Unwin 2009; Verne 2014), connec-

tivity through underwater fiber optic cables (Graham and Mann 2013), effects of platform work on digital labor (Anwar and Graham 2021), infrastructural context specificity of smart urbanism (Guma 2022), and the overall potentials and dangers of digitization (Doevenspeck and Hollstegge 2019).[21]

Due to my research interest in the physical efforts and affects that tech developers (have to) invest in performing technocapitalism, I carried out three research visits between 2015 and 2017, working alongside technology developers, startup founders, journalists, and researchers for about six months in total. My workplaces were primarily located in the first makerspace in Kenya (Figure 1), Gearbox, and the most famous technology hub on the African continent (Figure 2), iHub. The repeated research stays gave me fruitful insights into the fast dynamics of Nairobi's tech scene. During each visit, I was researching amidst (mostly) different co-workers as the business models and prototypes of startups, premises of workplaces and individual job positions changed quickly. These changing settings gave me the opportunity to examine entrepreneurial work and its innovative workplaces from various angles. For example, I was able to accompany Kenya's first makerspace, through its first construction, to its operation and functioning, to its second construction because of its move to a bigger space as a way to further professionalize its aims. Thus, I gained insights into the making of hardware, that is, the affective relationships between makers and machines while realizing an innovative idea, and into the norms of what a globally comparable makerspace 'should' look like and how its employees 'should' work.

21 A small number of ethnographies of digital practices and technologies in African contexts exist. See Jack and Avle (2021), Pollio (2020), and Tristl (2023).

Figure 1: Work at a CNC machine in Kenya's first makerspace, 2016 (author's photo).

Figure 2: Co-working space in Nairobi's most famous tech hub, 2015 (photo courtesy of Abu Okari).

I use *work* as the methodological lens of my research to understand what kind of work makes and maintains Kenya's positionality as a place for technology entrepreneurship. *Participant observation* (Crang and Cook 2007) and *working participant observation* (McMorran 2011; 2012) were the key methods

used.[22] I used participant observation to look 'behind' the glossy reports and visitor tours and researched daily life practices, including the "boring things" (Star 2002: 108) and "the obvious" (Law 2006: 10). I worked in several co-working spaces, attended numerous events such as hackathons, competitions, and panel discussions, and participated in introductory trainings for every machine used in the production line of a printed circuit board (PCB) to observe the manifold tasks that technologists have to accomplish to transform an idea into reality.

As an intern at the makerspace, I used working participant observation, a method developed by Chris McMorran (2012: 490) who claims that "geography's engagement with participant observation–particularly around questions of embodiment, labour, and work–has indeed been limited". During the months of my internships, it was my priority to do whatever work came up – be it writing blog articles, carrying machines, or brainstorming about new projects to build. During these work activities, I used my white, cis-female and able-bodied form as a multi-sensory research instrument (Longhurst et al. 2008; Schurr and Strüver 2016: 88; Vannini 2015: 321). Thus, auto-ethnographic experiences of the smells, sounds, and socio-material intimacies at innovative workplaces, such as the constant noise of metalwork, smells of hazardous chemicals, or the overall distractions of other co-workers, relaxing couches, or coffee bars, and how they affect the work being done are included in my research analysis. The fact that I was exposed to similar working conditions as the tech developers allowed me to more easily understand and discuss sensitive topics such as stress, fear, passion, anger, and love while developing hardware and to expand them with my own sensory knowledge (Carr and Gibson 2017; Ehn 2011; Farias and Wilkie 2015). Furthermore, I observed and participated in the storytelling practices that a makerspace needs to carry out in order to position itself in the global sphere of technology development, for example, presenting tech projects to visitors, writing blog articles, and marketing

22 As the insights from my (working) participant observation represent the main body of data, references to my research diary and vignettes about the affective work of technology development characterize this book. I use the term *vignette* to describe longer paragraphs of ethnographic data that either merge several research diary entries into one story, assemble and relate different situations to each other, or simply narrate research situations in a more elaborate and affective way than my actual notes do. The topics of my vignettes represent moments or stories that were pivotal for my analyses and interpretations.

companies (see Chapters 4, 5, and 6). Such practices – the participation in numerous events during the week and the work on public relations – are part of the everyday life of tech entrepreneurs, although often neglected by scholars of entrepreneurship. Overall, my focus on everyday work illuminated the ways in which technology developers become emotionally invested in global norms of technology entrepreneurship.

Throughout all the research visits, I worked predominantly with the staff and members of the tech hub and makerspace and had little access to the people who managed the workspaces. Therefore, I also conducted interviews with stakeholders who were not part of my daily participatory research: political and juridical actors, famous hardware makers and entrepreneurs, and leading technology experts in the Kenyan tech scene. The topics of the interviews ranged from personal motivations, the specificities of developing hardware in Kenya – such as the national patenting system, the governmental visions about the national manufacturing sector and a Fourth Industrial Revolution, and overall questions on the role of the state, market, and other tech scenes, such as Silicon Valley, in Nairobi's tech development sector. The interviews allow insights into just how discursively structured and highly normative Kenyan tech entrepreneurship is.

As a white visiting researcher, I had epistemic privilege by being able to decide on categories and interpretations, the use of research data and the ability to withdraw myself from work with my research partners (Decoloniality Europe 2013; Staeheli and Lawson 1995: 332). Therefore, I implemented a continuous exchange about my research foci and insights with my research partners and organized at least one *focus group discussion* (Longhurst 2016) each visit in an attempt to scrutinize and deconstruct my privileges. In general, the focused discussions opened up my research methods and analytical frame to my research partners, with whom I worked closely over the three years, so that they could make adjustments or criticize the research endeavor. Additionally, the discussions constitute important empirical data and led to a more profound understanding of specific topics.

Relational Positionalities: A Caring Yet Exploitative Researcher

My ethnographic research approach emphasizes the ambiguity and processuality of the positionalities of researchers, research partners, technologies, companies, and nations (England 1994; Law 1994; Ouma 2012; Taylor 2011). Focusing on the feelings and bodies of everyday labor exposes, on the one

hand, how affects (re)produce social and geopolitical positionalities (Ahmed 2014/2004; Pedwell and Whitehead 2012: 120) and, on the other hand, how these can change through the construction of fragile and temporary relationships (Laliberté and Schurr 2016: 75; Thrift 2003: 108). Thus, my research interest lies in the relational and shifting character of positionalities – for example, Kenya's shift from the periphery of technocapitalism to the center of 'African' technology development, or the change in my positionality from an exploitative researcher to a caring person as elaborated in the following.

My first research stay in Nairobi's tech scene showed me that my whiteness, my initial lack of knowledge about tech development, and my profession of someone who asks many questions equated me with the predominantly white visitor groups who visit the tech scene on a daily basis. As those visitors usually do not have any prior knowledge of technology development, Kenyan techies perceive them as exploitative of their knowledge and work time (see Section 4.2). Thus, I had to prove that I was not an exploitative visitor by showing that I understood the ethos of innovative workplaces, namely sharing knowledge. "What do you make?" was the first question I was asked by every co-worker I got to know at the makerspace. Makers want to figure out what knowledge or skill they can learn from each other. Thus, I often elicited surprised faces when I answered that I was a social scientist without any technical background. However, to gain the legitimacy to work at a makerspace, it was essential that my presence somehow benefit the community. As such, I was often asked to perform short pitches about myself, so that the co-workers could inquire and evaluate how/whether my knowledge could be of any use for them. The explicitly articulated demand 'to give something back' to the Kenyan community of tech developers shows that knowledge sharing is of the utmost importance and a strategy to protect oneself from extractive visitors.[23]

23 The differing skillsets of an ethnographer and their research partners represent a common negotiation in participatory research. Often, ethnographers lack the expert knowledge of their research partners – whether scientific professionals or bearers of traditional knowledge. Thus, the ethnographer (even if inhabiting white privileges) is confronted with their irrelevance compared to local authorities, elites, and experts (Williams 2018: 200). In this regard, Caroline Faria and Sharlene Mollett (2016: 88) state that "our own privilege as scholars from the global north cannot be assumed" because "not all our participants … are among the oppressed" and they call for the acknowledgment of a variety of agencies to complicate and disrupt "our understanding of power in the field" (ibid.). Logan D.A. Williams (2018) calls the variety of agencies in global research relationships *superpositionality*. She uses this term to describe her multiple

I experienced how affects can shift positionalities when my positionality of being an exploitative visitor to Nairobi's tech scene changed to that of being a caring person to my research partners. Feminist scholars have already described positionalities as relational, performative, and multiple. Thus, positionalities are often hard to grasp because relationships are seldom a mere "relationship of difference" nor about people "being in the same position" (Rose 1997: 313). This is why Gillian Rose (ibid.: 313ff.) emphasizes the in-betweenness, processes of (dis-)connection, and the performative negotiations within (research) encounters. My choice of working participant observation and my efforts to satisfy the requirements of my research partners were driving factors in building caring relationships. By giving feedback on design drafts, on applications for hackathons, and on advertisement brochures, conducting an interview-based evaluation of a makerspace, supporting the makerspace's public relations team, etc., I could share knowledge and mutually endure workloads and stressful moments (e.g., Research Diary, November 9, 2015; June 20, 2016; March 23, 2017; April 20, 2017). In this vein, a research partner of mine compared me with Mark Zuckerberg to describe two visitors having a different impact. While the media attention that (famous) visitors trigger has a positive impact on the tech scene in Nairobi, the research partner made the point that she needs someone who 'scratches her back', meaning the support of a person who cares about her personal concerns and daily work (makerspace employee, Interview, April 24, 2017). Co-working, care, friendship, and often womanhood blurred the critique of white privileges and formed spaces of connection and in-betweenness.

Despite discussing how I was perceived – as an exploitative visitor or as a caring co-worker – the fact remains that I was a white visitor to Nairobi's tech scene. After a couple of months of participatory work, I returned to Germany to sit in my office and evaluate the gathered data. Race and its oppression and privileges are 'sticky' (Ahmed 2004/2014). That means affective work can nudge positionalities towards a desired direction, only to discover that some positionalities and affects stay stuck to certain bodies and places. Thus, positionalities are a constant work in progress, but shaped by bodily encounters that are

---

positionalities as she was "studying down" to people "with less privilege and power" in the Global South, "studying through" because she traced out "ideologies and discourses that shape policies and practice", "studying sideways" because she researched with knowledge producers that worked in a similar way than her own and also "studying up" to research high-tech elites (ibid.: 206).

embedded in "histories of contact between racialized, gendered, sexualized, and otherwise differentiated bodies" (Laliberté and Schurr 2016: 74). Technocapitalism is structured along historically manifested categories of race and colonial imaginations (see Section 4.4), so that sticky affects and positionalities of oppression cannot be transcended simply through friendship and care.

1.4 Book Overview

My analysis of the situatedness of technology development in Kenya has three objectives. First, to highlight the discourses, affects, materialities, and bodies that shape the power asymmetries of Kenya's positionality in technocapitalism. Second, to carve out the affective and socio-material practices in innovative workplaces that drive the entrepreneurialization of national progress, development agendas, and decolonial emancipation. Third, to ask what kind of positionalities and norms of Kenyan technology can and cannot be performatively (re-)made. The research focus on workplaces sheds light on the daily promises and performances that create, reproduce, and contest norms and visions of how to be innovative in an African context. In addition, the technology developers' emotional investment in the achievement of their desired futures becomes visible. Overall, this book demonstrates that making technologies in Kenya entails not only collaborative and loving work between co-workers, machines, and material, but also strenuous efforts of positioning within workplace hierarchies, technocapitalism, and colonial legacies.

The book has eleven chapters and two Parts, each of which begins with an argument-related literature review and theoretical reflections relevant to its chapters. Following this introductory Chapter 1, which lays out the theoretical and methodological frame for the whole book, Chapter 2 contextualizes the daily work of technology developers in Nairobi by analyzing Kenya's current manufacturing policies and the postcolonial histories of economic policies and entrepreneurship in Africa. I first present the historical persistence of the belief in economic progress through industrialization and technology, and second, the discursive staging of technology entrepreneurs as the main drivers of Kenya's national progress. The (historical) policy analysis explores how Kenya aims at industrialization as it tries to integrate into global economies and thus achieve societal transformation. I argue that although the utopian belief in industrialization, technology, and entrepreneurship persists, a shift has occurred in the current attempt to industrialize. The means of production are

supposed to be digital technologies, so that Kenya is aiming at a Fourth Industrial Revolution. Additionally, it is no longer the state which fosters industrialization nor the informal poor who have to undergo entrepreneurial training; rather it is well-educated technology developers who are responsibilized to realize the industrialization of Kenya. Carving out the neoliberal circumstances at stake, the chapter further points to the postcolonial specific in Kenya's ambition of technology development. Nairobi's tech entrepreneurs unite neoliberal logics with decolonial endeavors to create a pan-African identity of tech developers, transforming their societies for the better, and liberating the country from exploitative (post)colonial structures, such as the supremacy of Western technology and knowledge. As such, I define *postcolonial technology entrepreneurship* as neoliberal, but politically inflected work that performatively (re-)makes (peripheral) positionalities in technocapitalism.

Chapters 3, 4, 5, and 6 make up Part I of the book's ethnographic analyses. All examine the streamlined storytelling in and about Kenya's tech scene. Whereas Chapter 3 analyzes the content of published stories and the affects evoked by them, Chapters 4, 5, and 6 look at the socio-material practices of storytelling and highlight the economic necessities of tech development that shape how stories are told. In Chapter 3, I analyze the content, structure, and contexts of Nairobi's tech stories and depict them as totalizing narrations that are normative and affective. It becomes clear that each story is the same, no matter whether it is a journal article, a blog entry, or a marketing slogan. With each telling and leaving out of the same content, the story becomes singularized and powerfully materializes norms of technology development which affects the story's readers, storytellers, and protagonists. On the one hand, the story reproduces the "master narrative of technoscientific progress" (Davies and Horst 2016: 33) that understands technology as an apolitical and ahistorical tool of societal change and on the other, it reproduces colonial imaginations of a place in 'Africa' that exoticizes technology, its users, and developers. As such, the single story depicts technology development as a linear and teleological process of revolutionary, but smooth transformations while historical and political contextualization and the daily lives of tech developers are missing. I feed this discursive analysis with my research partners' feelings evoked by the materialized norms of how to work entrepreneurially and develop technology in postcolonial Kenya. Daily feelings include excitement, self-fulfillment, anxiety, pressure, and anger about the norms of working quickly, flexibly, and genially, about innovations that have to have social impact for national progress, and technology users who are supposed to be marginalized and impoverished

Kenyans. Overall, I argue that the norms and affects materialized and circulated by the streamlined tech story narrow the possibilities of technology developers and their technologies. The story 'narratively closes' (McNamara 2017: 272) Kenya's global positionality as an *other* of Western technology development and pushes its tech entrepreneurs into the inevitability of societal development through technoscience.

Chapters 4, 5, and 6 explore three storytelling practices to understand why the tech stories are told as analyzed in the previous chapter, and with what affective investments storytellers (have to) tell the streamlined story. I show that the daily practices of guiding visitors in Chapter 4, writing newsletters in Chapter 5, and branding technologies in Chapter 6 are ambiguous and emotionally strenuous as they are involved in the neoliberal making of technology. On the one hand, storytelling serves as a tool for empowerment by furthering a caring community of tech developers, refuting colonial stereotypes of African contexts, and re-scripting Kenya's positionality to a more elevated status in the global economy. On the other, it also has to attract (international) investors, and so storytellers strategically stage optimistic technoscientific promises and bodily perform the audiences' expectations. Therefore, I argue that techno-capitalism is an *economy of promises and performances*, which requires affective and bodily efforts by Kenyan technology developers. Storytellers have to endure discomforting feelings while being watched and objectified during visitor tours, the stressful but invisibilized work of constantly searching and 'caring' for the (suitable) content of newsletters, and the reluctant branding that resonates with the essentializing and discriminating imaginations of funders from the Global North. The daily negotiations between the storytellers' own visions and the (mostly external) expectations of technology development in Kenya emphasize that storytelling practices are affective and embodied negotiations over representations and positionalities. Overall, the analysis of storytelling practices illustrates that the decolonial attempt to become independent of centers of technology development, while at the same time seeking financial support from their actors, is paradigmatic for the entanglement of market logics and political endeavors in postcolonial technology entrepreneurship.

In Part II of the book, I delve into the work of actually building technology by focusing on the predominant affects felt by tech developers in makerspaces. Chapter 7 illustrates the hustle to handle the scarcity of resources to prototype technologies and the lack of state support and thus, explains why makerspaces in Nairobi are the only places that offer the possibility to rework Kenya's positionality through the 'professional' making of technology. In the

following chapters, I examine in depth the emotions of love and fear to show the preciousness of building technological products. In Chapter 8, I show that the love for digitalized machinery and aesthetic prototypes expresses the love for a liberation from postcolonial power asymmetries that hinder the country's inclusion in global technocapitalism. Chapter 9 focuses on the fear of failure that shows that technology developers are committed to the important tasks of achieving national progress and enacting technoscientific modernity while being confronted with context-specific challenges to prototyping. The fear of failure and the love for professional products highlight that making practices in postcolonial contexts are sticky with racialized national pasts, current global inequalities, and futuristic visions of an independent country. Furthermore, in both chapters I highlight that the transformation of an abstract idea into a marketable product needs socio-technical care and calculations. As such, the making of technologies in Nairobi shows the affective practices of bodies and machines in resource-constrained contexts where technology development is not a self-evident practice. Thus, I claim that the calculated and careful making of technological products in Kenya cannot be compared with the commonly researched post-industrial contexts where making represents a tinkering, anti-capitalist, or leisure time activity. Chapter 10 sheds light on those aspects of work that are incalculable and not cared for in Kenyan co-working places. I reveal the hierarchies within makerspaces and startups to offer insights into the makers' appropriation of prototyping methods to not only use technology development to rework Kenya's positionality within global technocapitalism, but also to position themselves within their workplace.

In Chapter 11, I conclude that technocapitalism is an economy of promises and performances in which tech scenes that represent a postcolonial *other* – a periphery in global tech markets – have to convince others of their work's worth by affectively and socio-materially re-scripting their positionality. As such, the situatedness of Kenya's tech scene amidst colonial histories and the global politics of technoscience determines tech development as convincing only when it reproduces hegemonic norms of technoscience and imaginations of an impoverished African context, pursues technoscientific perfection, and invites others to gaze at Kenyan tech development. I call the most prevalent affective practices to perform technocapitalism and gain investment, a *performance of poverty* and a *performance of professionalism*. The narrative and material reproduction of the belief in societal transformation through globally standardized technologies affectively limit the tech developers' possibilities for action and force them to comply with (Western) norms of technoscientific

progress and the (colonial) affects that other Kenyan technology development. In addition to the reproduction of oppressive structures, I show that the performativity of building technology and telling stories gives space for moments of decolonial agency and emancipation. In this regard, Kenyan techies care for technologies and the stories about them because they cater for the needs of their local communities, counter colonial imaginations of a passive and non-technological Africa, and decolonize Kenya from the epistemological and technological supremacy of the West.

Chapter 2
The Politics of Postcolonial Technology Entrepreneurship

Kenya is a popular example of *Africa Rising* with its fast-growing sector of technology entrepreneurs, startups, and co-working spaces. The imagery of Africa's so-called 'rising' represents an Afro-optimistic shift in media coverage of African politics and economies, celebrating the continuous growth in the continent's gross domestic product (GDP) (Khan n.d.). Many international and local actors praise the rapidly emerging middle classes, megacities and infrastructure projects, as well as the increased involvement of foreign investors, and diffusion of mobile phones in African countries (Beresford 2016: 1; Breckenridge 2021: 12; Fioramonti 2018: 739; Khan n.d.). Kenya's high-tech scene represents all of the celebrated features of Africa Rising: middle-class engineers who cluster in Nairobi attract investments from international companies and spur the digitalization of the country. In this regard, the Government of the Republic of Kenya (GRoK) considers the emergence of a technology development sector economically valuable and sees technology entrepreneurs and their innovative technologies as the main drivers of a Fourth Industrial Revolution[1] that should bring about national progress.

1 Klaus Schwab, the founder and executive chairperson of the World Economic Forum, was the first to define the Fourth Industrial Revolution. He explains it as processes whereby "[e]ngineers, designers, and architects are combining computational design, additive manufacturing, materials engineering, and synthetic biology to pioneer a symbiosis between microorganisms, our bodies, the products we consume, and even the buildings we inhabit" (Schwab 2016). In essence, the Fourth Industrial Revolution describes a worldwide phenomenon of integrating interconnected and automated digital technologies into manufacturing industries.

This chapter analyzes the visions of an economic upswing and an industrialized and emancipated Kenyan future to understand their impact on the work of Kenyan technology developers and to remind us that language and imaginations are never separable from materiality and affects (see Chapter 1). I argue that technology development in Kenya is a field in which modernist assumptions of economic progress, entrepreneurial selves, and digital technologies join with political aspirations to achieve decolonial emancipation from the global centers of technology and knowledge production. In this regard, I define *postcolonial technology entrepreneurship* as politically inflected neoliberal work which performatively (re-)makes Kenya's positionality in technocapitalism.

The chapter unfolds as follows: first, I demonstrate that the belief in economic development through industrialization and technology has been a persistent part of postcolonial African histories and is still present in Kenya's current manufacturing policies despite the longed-for economic development having often failed to materialize in the past. Based on this historical insight, I claim that the current aim to industrialize Kenya unites capitalist and decolonial thought, just as the country's post-independence industrial policies did; it follows a tech-deterministic teleology of development and the 'socialist' vision to emancipate itself intellectually and economically from colonizing countries. Second, the chapter explores the responsibilization of technology entrepreneurs to achieve the Fourth Industrial Revolution in Kenya and fulfill the Africa Rising promises. Although the belief in the need for entrepreneurship to survive in a capitalist state has propelled entrepreneurship trainings for Kenyan citizens since the 1970s, the Kenyan discourse on entrepreneurship has shifted. As a result, well-educated self-employed technology entrepreneurs who drive a digitally industrialized Kenyan future have replaced the state, male mineworkers, and informalized manufacturers as the principal agents of industrial modernity. By including ethnographic data, I show that current tech entrepreneurs ambivalently unite neoliberal logics of technological progress with decolonial endeavors to create a pan-African identity of tech developers, just as post-independence industrial policies did. I argue that, in Kenya, the *postcolonial technology entrepreneur* strives for Kenya's global repositioning by transforming their society for the better and scrutinizing exploitative (post)colonial structures. Overall, the analyses in this chapter highlight that industrialization, entrepreneurship, development, and other categories of (Eurocentric) modernity are not universal, but context-specific, as Kenyan technoscientific endeavors and futures are embedded

within histories of political African entrepreneurship, colonialism, and its discriminating remnants.

2.1 Kenyan Industrial Policies: Striving for Global Market Integration and Improved Living Standards

> The vision is "to be the leading industrialized nation in Africa with a robust, diversified and globally competitive manufacturing sector". (GRoK 2012: xii)

In Kenya, various policy initiatives such as the National Industrialization Policy 2012–2030, the Kenya Industrial Transformation Programme, and Kenya Vision 2030 have reinforced the interest in the industrialization of the country.[2] Furthermore, two institutions, the Kenya Industrial Training Institute (KITI) and the Kenya Industrial Research and Development Institute (KIRDI), focus on training and research exclusively benefitting industrial sectors. In addition to the manifold policies and initiatives, internationally-funded projects also target the country's industrialization, for example, the US$50 million 2019–2024 Kenya Industry and Entrepreneurship Project (KIEP) implemented by the Ministry of Industry, Trade and Cooperatives and the World Bank.[3]

The visions and missions in these policies mostly refer to the Government of Kenya's Vision 2030. Implemented in 2008, Vision 2030 serves as a blueprint for the country's development, aiming to "transform Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment" (Vision 2030 Delivery Secretariat n.d.).[4] Kenya is supposed to become "Africa's most competitive economy"

2 Other recent policies targeting Kenya's manufacturing sector are the Export Promotion Zones Act, 1990, the Buy Kenya Build Kenya initiative, the National Trade Policy, the National Export Development and Promotion Strategy, and the Special Economic Zones Act, 2015 (KAM 2018: 30). As these policies address specific sub-sectors of Kenya's industry, they are not included in this chapter's analysis.

3 The Kenya Association of Manufacturers (KAM), in their Manufacturing Priority Agenda 2018, criticized the variety of policies targeting Kenya's industrial development for "creat[ing] confusion instead of clarity in terms of what the focus should be in developing and supporting the manufacturing sector in Kenya", instead advocating for a single harmonized "National Manufacturing Policy" and the establishment of a single institution to coordinate the various mandates (2018: 41, 42).

4 Interestingly, Kenya's 1997–2001 Development Plan had already stated the aim of becoming a newly industrialized country by 2020 (Ikiara et al. 2004: 204).

with a "per capita income ranking among the five highest in Africa" (Kenya Industrial Research and Development Institute [KIRDI] 2006: 7).

Based on these development goals, all of the aforementioned policy initiatives agree that industrialization represents the only way to abolish the high levels of poverty and unemployment and to overcome Kenya's economic dependence on the export of primary (agricultural) commodities (KIRDI 2006: 13; GRoK 2018: 2). Consequently, the proponents of industrialization consider the overall decline of manufacturing sectors in Sub-Saharan Africa and the continuing dominance of low-tech and labor-intensive companies problematic (Taylor 2016: 18). In Kenya, the manufacturing sector's contribution to GDP fell from 9.3% in 2016 to 7.2% in 2021 (KAM 2023). This decline in Kenya's manufacturing and export sector is in stark contrast to the 72% share of the increase in GDP contributed by the service sector (such as mobile communications and financial intermediation) between 2006–2013 (Ramos 2017: 3). Although the growth of services based on technology, especially Information and Communication Technologies (ICTs), is acknowledged as a desirable development, Kenya's policies emphasize that a flourishing manufacturing sector is also necessary for a successful shift from an agro-based to a technology- and knowledge-based economy (KIRDI 2006: 57). Thus, in October 2022, the Kenya Association of Manufacturers (KAM) and the Ministry of Trade, Investment and Industry released the *Kenya Manufacturing 20by30* plan with the aim of increasing the manufacturing sector's contribution to the GDP from 7.2% to 20% by 2030 (KAM 2023; Mwangi 2023).

The government's conviction that only industrialization will make Kenya a middle-income country results from an analysis of the industrial strategies of five so-called 'newly industrialized countries', Hong Kong, Singapore, Taiwan, South Korea, and Thailand (GRoK 2012: 6). The bottom line of that analysis is a general claim stating that:

> the industrial sector can be seen as a key driver for increasing growth rates, generation of sufficient employment opportunities, and fostering Kenya's integration into the global economy. Further, research indicates that most of the rich nations have a thriving industrial sector whereas the poorest countries have agriculture, with very little value addition, as their dominant economic sector. (ibid.)

The government's aim of 'integrating Kenya into the global economy' deserves a closer examination. Being positioned on the periphery of the global tech econ-

omy, Kenya aims at industrialization in order to become an integrated player in this market and to improve the living standards of its citizens.

How exactly does the government want to achieve a national industrialization? The Director General of Kenya Vision 2030 told me in an interview that one of the problems of the manufacturing sector is that:

> after independence the policy on manufacturing focused on import substitution instead of export. Thus, manufacturing companies only target a very small market because they are manufacturing for the local market. They cannot enjoy economies of scale. So that is where we shot ourselves in the foot. We started on the wrong foot and we're still trying to recover from that. Now, in Vision 2030, we identified a need to focus on export. (Interview, April 2017)

Besides the fact that Kenya had already implemented export-orientated policy agendas before Vision 2030's start in 2008 (see below), the current aim of industrialization is supposed to be achieved by increasing local production and exports to regional and global markets (MIED 2015: 5). Kenya's industrialization policies and initiatives highlight that the country is "in a privileged position" (ibid.: 6) to manufacture exportable commodities:

> We are the fifth-largest economy in sub-Saharan Africa; we have a well-educated labour force; our financial services and information technology capabilities are amongst the most developed in the region; and our infrastructure is the most advanced among peers as well (with substantial further investment being planned). We have access to vast agricultural resources and are home to some of the most innovative entrepreneurs globally. (ibid.)

The emphasis on the human capital embodied by technology entrepreneurs is striking. Kenyan entrepreneurs are seen as a guarantor of success in the country's road to industrialization. This is not only claimed by Kenyan policy initiatives: international consultancy firms also advise governments of African countries to establish support structures that will facilitate entrepreneurs' success in the global market (see Section 2.2). As such, tech entrepreneurs are staged as the creators and makers of innovative exportable technologies. They are the agents who will improve the living standards of all Kenyans by positioning the country in the global economy as an industrialized place of high-tech development. The underlying belief in economic progress and society's development through industrialization and technology is presented in detail in the

following. The belief's histories and futures help us to understand that Kenyan policies and the practices of Kenyan tech entrepreneurs are embedded in powerful and persistent imaginaries of technoscientific progress (see Chapters 3, 4, and 5).

The Recurring Attempts at Industrialization in Sub-Saharan Africa's Postcolonial History

Ever since the formal colonization of African countries, if not longer, industrialization and entrepreneurship have been perceived as solutions to structural societal challenges such as poverty. Industrialization, it is claimed, will 'develop' a whole country by creating economic growth, and entrepreneurship will secure an individual's or community's livelihood. The belief that industrialization and technology spur (economic) development repeats itself constantly throughout history. Thus, the following historical synopsis lists various industrialization efforts on the African continent in general, and in Kenya specifically.

During the British colonization of Kenya, industrial development was only furthered if it served the needs of the colonial empire (Swainson 1976: 79). Consequently, industrial sectors in Kenya were kept "complimentary [sic] to rather than competitive with the accumulation process in the Centre economies" (Mkandawire 1988: 10). The colony was treated merely as a source of primary commodities, so that the manufacturing of products for the domestic and global market was repressed (ibid.: 9). Against the backdrop of this industrial suppression, it is no surprise that independence fighters demanded the "right to industrialise" (ibid.: 13). After Kenya gained its independence in 1963, the Ministry of Economic Planning and Development released the Sessional Paper No. 10 of 1965 that laid out a plan to industrialize the country following an *African Socialism* (Speich 2009: 450). This African socialism agenda stands for the state's planning era in postcolonial economic policymaking (Mkandawire 2014: 173). As such, African socialism "combined elements of a free market economy with strong government control and the nationalization of key sectors" (Speich 2009: 457). Consequently, capitalism and socialism were not employed as exclusionary approaches to economy, but as complementary to each other (ibid.: 451).[5] The agenda's socialism drew inspiration

5 Although Kenyan politicians merged capitalist and socialist economic approaches, the country had to position itself on one side in order to gain political and financial sup-

from African societies where social interactions were not structured by the institution of private property but rather were centered around the reciprocal responsibilities within a community (ibid.: 460). Therefore, the aim of industrialization through African socialism was to improve the living conditions of all Kenyans. The capitalist tweak was the conviction of Kenya's government that economic growth was essential for every future welfare program, such as the establishment of equal access to health and educational services (ibid.: 458).

The rapid industrialization after the independence of African states between 1960 and 1970 was challenged by their dependence on technological imports and the lack of foreign investments (Mkandawire 1988: 13ff.). In the case of Kenya, scholars argue that its government's focus on manufacturing products for a limited domestic market caused the manufacturing sector's growth to decline from around 8% in the first decade after independence to less than 5% in the 1980s and 1990s (Ikiara et al. 2004: 211f.). The overall decline of manufacturing throughout African countries caused (international) economists to pivot from heralding the industrialization and modernization of African states in the first half of the 20th century to "rail[ing] against 'protectionism' and 'inefficient' state-subsidized industries and instead, demand[ing] 'free markets' as a panacea for African economic ills" (Ferguson 1999: 238). As a result, the World Bank and the International Monetary Fund called for an end to national development planning in the 1980s (Mkandawire 2014: 178).[6] Together, they advocated for Structural Adjustment Programs (SAPs) that, they claimed, would turn African countries into export-led economies based on agricultural commodities and entrepreneurial efforts (Ferguson 1999: 239; Mkandawire 2014: 178). The pressure exerted on African economies to bend to the neoliberal policies of the SAPs shows the dominant role of international development organizations in Kenya's economic orientation (Ikiara et al. 2004: 210; Mkandawire 2014: 190). This influence became even clearer when "donors froze their quick disbursing aid to Kenya as a result of the slow pace in economic and political

port during the Cold War. Nevertheless, the West and the East did not differ in their 'assistances' to Kenya: both embodied the "unlimited trust in scientific and technical expertise" (Speich 2009: 465).

6 Not only were African governments engulfed in a planning paradigm, international donors and investors also demanded 'plans' in return for material and financial aid (Mkandawire 2014: 174).

reforms" in 1991 (Ikiara et al. 2004: 216) and the economic crises that followed made the country all the more dependent on international aid (ibid.: 210).

Historically, economic policies in postcolonial African countries shifted frequently. The realization that the SAPs and their focus on the export of primary goods were not achieving the desired economic improvements caused economists and World Bank consultants such as Jeffrey Sachs to change their opinion again: Sachs then suggested supporting economies that were fueled by "manufacturing and service exports rather than primary commodity exports" (1997: 22 cited in Ferguson 1999: 239). As such, the aim to industrialize African countries and achieve their utopias of modernity through technology are clearly recurring trends. Despite the fact that various industrial strategies have already failed in the past, the idea that "low-productivity and low-growth economies" can only be transformed "into dynamic and 'modern'" ones (Lall and Wangwea 1997: 70) through industrialization seems doomed to be repeated, each time animated by absolute statements and convincing figures.

Fulfilling Africa's Rising through a Fourth Industrial Revolution

The economic strategies of national planning and structural adjustment programs, and their agendas to substitute imports or facilitate exports, did not achieve the desired outcomes of economic growth and societal change (Mkandawire 2014: 186). In this regard, James Ferguson concludes his book on the Zambian de- and industrialization by writing that:

> [a] return to modernist teleology, a new grand narrative that would trace the hopeful signs of an Africa once more "emerging" out of the gloomy ashes of Africa's "development" disaster is neither plausible nor desirable. The modernization narrative was always a myth, an illusion, often even a lie. We should all learn to do without it. (1999: 248)

However, the rejection of modernization theory that Ferguson wished for did not happen. When writing his book in 1999, he could not have foreseen the current development of digital technologies in numerous African countries, the "increasing attractiveness of African markets to foreign investors; positive and sustained rates of GDP growth, as well as productivity growth; ambitious new infrastructure projects; and the growth of a middle class with considerable consumptive capacity and potential political weight" (Beresford 2016: 1). All of these circumstances are praised in the Africa Rising narrative that rein-

states modernist assumptions about development through (industrial) technology (Aderemi and Agaigbe 2018; Beresford 2016; Fioramonti 2018).

The 'Afro-optimistic' Africa Rising narrative was initiated by *The Economist* newspaper in 2011 when it published an issue with a cover showing a young boy running through a steppe holding a colorful kite in the shape of the African continent. The issue was titled "Africa rising". Following this, other magazines as well as global consultancies also began to write about this fundamental shift in African countries that welcomed investment and the development of (international) businesses (Fioramonti 2018: 739). On a linguistic level, the "connotations of modernity and economic progress" (Nothias 2014: 329) within the Africa Rising narrative are clear:

> '[R]ising' echoes the assessment of economic growth as made clear in the references to 'Africa's economic boom' (*Sunday Times*) and to the 'world's next economic powerhouse' (*TIME*). The 'lion's roar', then, also refers to the 'Asian tigers', a metaphor coined to label Asian countries often hailed as the success story of neoliberalism in the developing world. (ibid.)

As such, the Africa Rising narrative resembles the convictions of the long-criticized modernization theory that claims that the economic "take-off" (Rostow 1990: 36) of a country would only happen once it had replaced "traditional sociopolitical and economic institutions with more Western ones, [and] embrace[d] market economies and democratic rule – in short capitalism" (Aderemi and Agaigbe 2018: 591). In this manner, Kenyan ICT innovations play a major role in the Africa Rising narrative: broadband penetration is heralded as having a direct impact on the growth of GDP (Oloruntimehin cited in Delaney 2018), so that telecommunications (Radelet 2010), technological innovations such as M-Pesa (Aker and Mbiti 2010), and the internet in general are credited with having catapulted Kenya into modernity (Dieterich 2018).

However, the Afro-optimistic narrative and the hype about leapfrogging through mobile technologies (see Chapter 1) have already lost their shine. The narrative's promises have been criticized for remaining mostly unfulfilled because "the mobile revolution has hardly served as a stimulus for broader industrial development and appears to have had little impact on African innovation policy" (Juma 2017). Technology expert Calestous Juma argues that, instead of only creating users of technological services, policy focus should be set on supporting Kenyan producers and their "economic inclusion through local industrial development" (2019: 33). In his opinion:

> leapfrogging industrial development is not an option. … Leapfrogging particular technologies, such as landlines, may in some cases be an option. But industrialization itself, and the innovation and development it generates, cannot be skipped over. (Juma 2017)

The World Bank presents a more differentiated line of argument by emphasizing Kenya's innovative tech scene's potential for supporting industrial growth and competitiveness while, at the same time, noting that much "work remains to be done if the country is to ultimately live up to its moniker of Africa's 'Silicon Savannah'" (Ramos 2017: 4) and that Kenya's technology sector:

> remains largely disconnected from the rest of the economy. Firms in the major employment generating sectors, such as agriculture or industry, have not yet absorbed the benefits from Kenya's growing tech scene, and in turn, the tech firms are not creating solutions that respond to their specific needs. (ibid.)

KIRDI (2006: 20) had already noted in 2006 that 93% of the technologies utilized in Kenya's plants and the overall manufacturing sector were imported compared to only 7% from local sources.[7]

A major criticism of the claim about Africa's rising is that it is mainly based on quantitative criteria such as economic performance as indicated by the continent's GDP and fails to consider social and political structures (Nothias 2014: 335). The narrative is based on Africa's GDP growth of "5.6% between 2002 and 2008, making Africa the second fastest-growing continent in the world" (Taylor 2016: 9). Political economist Ian Taylor claims that "[t]here is little indication to propose that Africa's structural profile is rising or that the continent is going through even the birth-pangs of any structural transformation" (ibid.: 10). He analyzes the growing GDP figures and shows that their increase depicts the export of primary commodities and thus the exact same dynamics that have reproduced poverty since the colonization of African countries (ibid.: 21).[8] Furthermore, he deconstructs the claims about a growing middle class in Africa by showing that the African Development Bank arrived at "this figure

7 Of the imported technologies used in Kenya, 19% come from Germany, 17% from India, 14% from the UK, 8% from Japan, 7% from Italy, 6% from China, and 3% from the USA (KIRDI 2006: 20).

8 I draw on analyses from before the COVID-19 pandemic. During 2020, Africa's GDP fell to -1.8%. However, in 2021 the GDP growth rate rose to 4.8% and in 2022 it was 3.7%.

… by calculating the number of people estimated (using dubious statistics) to have a per capita consumption between $2 and $20" and, as "only 4% of Africans have an income in excess of $10 a day" (ibid.: 16), he refuses to speak of a broad middle class. Overall, the quantified narrative of Africa Rising disguises the issue of poor (informalized) working conditions, the unequal distribution of wealth, and other structural societal inequalities. In this regard, Africa Rising has been termed "a narrative about Africa for sale" (Obeng-Odoom 2015: 247) that is aimed purely at attracting foreign investment.

Digital Industrialization as the 'African' Way to Decolonial Modernity

Despite pointing out the shortcomings of a purely quantitative approach and refuting the possibility of societal betterment through economic progress, critical political economists concur with neoliberal advocates in seeing the solution to Africa's current challenges as, once again, lying in industrialization. They all problematize that African economies are based on primary agricultural production, large informal sectors, and stagnating manufacturing (Juma 2017; Kappel and Müller 2007: 6; Taylor 2016: 18). As such, technological change is still the "central strategy for Africa to address poverty, inequality and unemployment" (Taylor 2016: 20). In this vein, critical scholar Yves Ekoue Amaizo emphasizes the power of technological innovation by referring to "human history" which shows that:

> peoples with more effective technologies quite often dominate economically those with less effective technologies. It is on account of its relative deficiencies in technological knowledge that Africa came to be dominated by Europe from the fifteenth century onwards. (2012: 118)

Nevertheless, he criticizes the fact that research on African economies focuses on economic theories from Western research centers – whether neoliberal or socialist (ibid.: 121). According to him, these theories are usually produced far from the places that directly experience neoliberal capitalism and thus do not include the "unfortunate stochastic details of unemployment, corruption and poor infrastructure" (ibid.: 129). Therefore, Amaizo advocates for an "Africa-centred Pan Africanism" (ibid.: 137), which would invest primarily in

---

Between 2023 and 2027, growth is estimated to exceed 4%, compared to the European Union forecast of less than 2% (Statista 2022).

the research and development of technology to gain intellectual and economic autonomy from the "unbroken links that African nations maintain with their ex-metropolises … and an unreflective commitment to Western-engendered development programmes" (ibid.: 134). Amaizo's political objectives bear a similarity to those of Frantz Fanon and other decolonial thinkers.[9] In 1961, Fanon (1961/1966: 82) called for a new start for the independent African nations and advised that their focus on exporting primary goods should be abandoned in favor of technicians, engineers, and mechanics building independent infrastructures to fulfill decolonization.

While the faith in technology's ability to bring about progress is still prevalent in current development paradigms, there has been a noticeable shift regarding the imagined industrial modernity in Kenya. The modern state is not supposed to be based on the mechanization and electrification of (mass) production, but on a Fourth Industrial Revolution that uses digital technologies to ease manufacturing processes. Thus, the industrial future imagined does not follow the European teleology of industrial development as a blueprint. The former Permanent Secretary of the Kenyan Ministry of Information and Technology explained:

> Industrialization must not refer to pollution [like in Europe]. We could leapfrog by not going through coal; we are going through solar systems, we are going through geo-thermal systems. (Interview, April 2017)

The anticipation of the unprecedented Fourth Industrial Revolution reinforces the revolutionary capability of technology (Schiølin 2019: 3), so that the two goals of economic growth and independence from the West become one. Technology actors in Nairobi want to revolutionize their country, not by following the European path of economic development through an industrialization that pollutes the environment, but by finding a unique and sustainable 'African' way to use digital technologies. In this regard, technology that is "low-carbon, resource efficient, climate resilient and socially inclusive" (KIRDI and Kenya Vision 2030 2019: 20) is of great interest in current Kenyan economic policies. Kenya's Vision 2030, for example, is specifically aligned with the *Sustainable*

9 Whereas Fanon (1961/1966) aimed at a liberation from capitalism and its exploitation of labor, Amaizo (2012) calls for a political reorientation toward social welfare states. I discuss the possibility of decolonization within capitalism in more detail in the following chapters.

Development Goals to "promote inclusive and sustainable industrialization and foster innovation" (GRoK 2018: 4). In this manner, industrialization endeavors aim at securing "the future of the manufacturing sector in Kenya [through] green growth practices such [as] efficiency in energy use, industry symbiosis and recycling" (KAM 2018: 42). The basis of this green Fourth Industrial Revolution is proclaimed to be ICTs, which are able to link different economic sectors and digital, biological, and physical technologies with each other (GRoK 2018: 19). Therefore, the Government of Kenya encourages a "strong IT market" as a "critical component of competitiveness in a global market and … [an enabler of] industrial sectors" to allow "Kenyan industry to keep up with the rest of the world" (MIED 2015: 10).

All in all, the belief in economic and societal development through technology underlies Kenya's current manufacturing policies, and postcolonial African economic policies in general. The pursuit of industrialization unites two different ideologies: on the one hand, neoliberal thinkers assert that industrialization can fix the missing economic upswing celebrated in the Africa Rising narrative. On the other, decolonial scholars trust in industrialization to finally emancipate African countries from the West. In Kenya, the alliance of neoliberal and decolonial approaches started with the coalition of capitalist and socialist ideologies in the post-independence era. This ideological union demonstrates that modernization and dependency theories both assume that development happens through technology (Korf and Rothfuß 2016: 169) and that African places' trajectories often do not fit into the dualist theorizations of Western history.

2.2 Staging the Technology Entrepreneur

Kenya's striving for a Fourth Industrial Revolution is not only characterized by the government's support of industries through infrastructure projects such as the establishing of Special Economic Zones, Industrial Parks and Smart Cities, but also by its focus on Micro, Small, and Medium Enterprises (MSMEs) and their entrepreneurs (GRoK 2018: 3; KAM 2018: 41). In fact, current manufacturing policies highlight technology entrepreneurs as the main drivers of Kenya's national progress. As elaborated above, the Kenya Vision 2030 national development plan sees "the existing start up ecosystem in Kenya" (Ministry of Industry, Trade and Cooperatives [MITC] 2018: 8) as a crucial component in achieving the goal of economic development. Also, former US president

Barack Obama, who opened the Global Entrepreneurship Summit in Nairobi, praised Kenyan technology entrepreneurship as "the spark of prosperity" (Obama cited in Shapshak 2015):

> [Y]oung people … are harnessing technology to change the way Africa is doing business. … High-speed broadband and mobile connectivity are on the rise, unleashing the entrepreneurial spirit of even more Kenyans. (ibid.)

To support Kenyan tech entrepreneurs in developing digital technologies, the Kenyan government wants to lower the cost of doing business (GRoK 2018: 50). Nevertheless, technology developers often criticize the state support of entrepreneurs as insufficient (see Chapter 7). Therefore, makerspaces in Nairobi regard it as their job to support developers by providing access to equipment such as digital fabrication tools, offering trainings on how to use their machines, and, in general, lobbying for the use of digital technologies to build hardware. This commitment of hardware makers affects, in turn, the government. After a makerspace's Computerized Numerical Control (CNC) plasma cutter was shown to William Samoei Ruto, the then-Deputy President of Kenya, he tweeted: "We must prioritise technical and vocational training if we are to achieve industrialisation and development" (2017).

Meanwhile, both the state-run training and research institutions for industrial sectors – KITI and KIRDI – are mandated to train people in "technical skills with a strong component of entrepreneurship skills for self-employment" (Kenya Industrial Training Institute [KITI] n.d.) and to complement Kenya's tech hubs and startups by being "world class" public research institutions (GRoK 2018: 51). KIRDI's responsibilities include the support of entrepreneurs by providing technology for industrial development (KIRDI and Kenya Vision 2030 2019: xi), equipment for modern laboratories, and technological incubation for startups and MSMEs (ibid.: 4f.). Also, the Kenya Industry and Entrepreneurship Project (KIEP), which is implemented with the World Bank, "recognizes the centrality of technology and innovation to the development of industry" (Ramos 2017: 3). The project's general aim is to "strengthen the existing start up ecosystem in Kenya" (MITC 2018: 8) by supporting incubators, accelerators, and hubs and by offering "industrial technology bootcamps" and "entrepreneurship/business trainings" to small and medium enterprises (MITC and the World Bank Group n.d.: 4).

Just as the national agenda of industrialization has a long history, the governmental support of entrepreneurship can also be traced back: after indepen-

dence, the government encouraged Kenyans to become entrepreneurs through programs called variably "Africanisation", "Kenyanization" or "Indigenisation" of the manufacturing sector (Ikiara et al. 2004: 209). Entrepreneurship was not only supported for economic reasons in the first decade of independence; it was also seen as a tool to create a unified national vision of progress (Speich 2009: 459). The Kenyan government and international organizations started programs to train Kenyan citizens to become entrepreneurs in the 1970s and 1980s. With the support of the United Nations Development Programme and the International Labour Organization, entrepreneurship courses were implemented in all vocational and technical training facilities (Nafukho and Muiya 2010: 100f.)[10] in which, among other things, the students had to develop a business proposal starting from the moment of their graduation. Acknowledging that the main economic activity in Kenya was (and still is) driven by the 'informal' sector and its small businesses (Elkan 1988: 180),[11] entrepreneurship trainings aimed to "develop positive attitudes among students toward self-employment and self-reliance" (Nafukho and Muiya 2010: 101) and make them aware of the opportunities of working in the informal sector (ibid.: 97). The portrayal of work in the informal sector during entrepreneurship trainings is reminiscent of the various scholars who romanticize informal workers' entrepreneurial spirits (de Soto 1989; Esteva 1992; Lummis 1992; Rahnema and Bawtree 1997) and refute the precarity of informalized work (Ferguson 1999: 12; Nothias 2014: 331).

The belief that industrialization and technology is the best way to spur societal change is historically persistent and African governments continue to declare entrepreneurship to be the main mode of survival in a capitalist market (Chanda 2016: iii). However, I argue that a shift has taken place in the current attempt to industrialize: it is no longer the state which fosters industrialization nor the informal poor who have to undergo entrepreneurial

10 The entrepreneurship trainings took the "Western entrepreneur" as a blueprint; for example, the practices of accounting which is a Western ideal of entrepreneurial rationality and business development (Marris and Somerset 1971: 232). In the meantime, research on entrepreneurship in Africa disproved the negative character traits formerly attributed to entrepreneurs in Africa (Trenk 1991: 512); for example, that a company's success is hindered by the fact that it does not keep accounts (Elkan 1988: 183), that entrepreneurs are illiterate or survivalists (Fayomi et al. 2018: 664), or that they have a "relaxed attitude to labor management" (Elkan 1988: 176).

11 About ten million people were employed in the informalized sector in Kenya in 2012 (Fayomi et al. 2018: 664).

training, but well-educated technology developers who are responsibilized to accomplish Africa's rising by industrializing Kenya. Consequently, the policy focus has shifted away from tabooing or romanticizing the informal sector (Kiggundu 2002: 254) and only supporting the few large corporations in the country towards promoting the growing Kenyan middle class (Dana et al. 2018: 2). Thus, Kenyan entrepreneurs are presented in a new light; they are well-educated and mostly engineering students who cannot find work in the scarce industry jobs available. Therefore, they are being trained to become technology entrepreneurs who combine business thinking and innovative work methods with the efficiency of digital manufacturing tools (KIRDI and Kenya Vision 2030 2019: 17). As a result, technology entrepreneurship has become a more digitalized and technoscientific entrepreneurial activity than has previously been present in Kenya (see Part II). Overall, Kenya's envisioned industrial modernity is no longer a "masculine vision of modernity based on a hard, metallic, masculine industrialism" (Ferguson 1999: 25) with a (male) mineworker as the protagonist. Instead, it stages the technological entrepreneur as the main driver of social change through the innovation of technologies for a Fourth Industrial Revolution.[12]

In the following, I will include ethnographic material to further illuminate the neoliberal responsibilization of citizens aiming to spur industrial growth and societal transformation. In addition, I point to a postcolonial specific in Kenya's ambition of technology development. The country strives for a Fourth Industrial Revolution and its high-tech innovations not only because they promise economic progress, but also because local technology developers seek to disentangle the country from exploitative global structures. As such, I argue that the postcolonial technology entrepreneur merges the capitalist ways of production with the political motivation of decolonial emancipation in their desire to transform Kenyan society for the better, serve community needs through the social impact of technologies, and finally re-make Kenya's postcolonial positionality.

12 Joseph Schumpeter's 1934 definition of an entrepreneur is still cited regularly in the context of technology development in Sub-Saharan Africa as he "attributed the growth of the industrial world to entrepreneurs, the risk takers who introduce innovative products, services and new technology to the economy" (Nafukho and Muiya 2010: 98).

Neoliberal Entrepreneurs…

Research on African entrepreneurship from the 1970s and 1980s claims that successful entrepreneurs are (or have to be) socially excluded – either through being positioned outside a community or through personal feelings of not fitting into society. It is claimed that in socio-cultural contexts where the redistribution of income to family members and other groups is a social duty, those living outside such social arrangements (e.g., a family, village, religious community) have advantages when doing business (Granovetter 1990: 37ff.; Trenk 1991: 509, 512). Consequently, those who are able to remove themselves from the all-encompassing social reciprocity are said to be entrepreneurial because this facilitates their individual accumulation of capital (Elkan 1988: 173f.; Trenk 1991: 508ff.). Additionally, entrepreneurs in Africa were also analyzed as outsiders because, as well as being intelligent, well-traveled, risk-taking, and visionary, they reported feeling rejected. This feeling of rejection was evoked by the fact that in the early postcolonial period, non-Kenyans were given a wide variety of high-status jobs whereas Kenyans were restricted to subordinate job positions (Marris and Somerset 1971: 225). These entrepreneurs were frustrated by "the colonial civilization which dominated [their] childhood, and still informs society with its conception of success; and the administrative and political élite from whom [they are] excluded" (ibid.). Overall, Peter Marris and Anthony Somerset (ibid.: 226) identified "African entrepreneurs" as contradictory beings as they tried to tackle their frustration by following the same (Eurocentric) ideology of modernity that they suffer(ed) from.

Remarkably, these past descriptions of African entrepreneurial outsiders are still popular. Being a *misfit* is the most cited character trait of successful innovators. The tech developers in Kenya are said to be critical of society and described as misfits "who see and do things differently, who challenge the status quo and the power sources that prop it up" (Hersman 2013: 65). In this vein, the "futuristic and sometimes disruptive dream" (Maas et al. 2019: 8) of transforming society for the better is expected to be achieved through the development of new technologies. These transformative visions differentiate the entrepreneurial misfits from the "'necessity entrepreneurs' in the informal sector" (Junne 2018: 118).

Research on the (DIY) making of technologies shows that innovative work as "a proactive response to social and economic change" (Sivek 2011: 203) is a global phenomenon. According to Susan Currie Sivek, who analyzed the discourse created by the most influential magazine on making, *MAKE* Magazine:

> the contemporary maker is elevated to a societally significant problem solver, working on behalf of the nation and world, and within a community of makers, but still an individual who determines his or her own path. (ibid.: 201f.)

In the context of Kenya's entrepreneurial making of technologies, the technology developers/makers who are critical of their lived contexts want to "challenge the status quo" (Hersman 2013: 65) by developing products that alleviate poverty, improve inadequate infrastructures, and address other systemic challenges in Kenya (Madichie et al. 2019: 226; see Part II). Mwai Kibaki, a former Kenyan president, enumerated the character traits necessary for Kenyan entrepreneurs in order to achieve the far-reaching goals included in the Kenya Vision 2030: "sacrifice, hard work, self-discipline and determination" (GRoK 2007: i).

My research partners in Nairobi embody such descriptions of self-reliant and committed entrepreneurs as they task themselves with the duty of creating a technology development sector without any state support. The Kenyan government is argued to be incapable of supporting the tech sector because of its financial restrictions: "Government alone can't fund development" (Interview, former Permanent Secretary of the Ministry of Information and Technology, April 2017). In addition, tech developers claim that the Kenyan government has the 'wrong' approach to new technologies: "Most governments in Africa approach education technology by buying gadgets" instead of "actually produc[ing] better students who have better knowledge, better skills that can ultimately benefit the economies of the African countries" (Interview, hardware company founder, November 2015). Therefore, founders of companies and co-working spaces in Nairobi emphasize their self-reliance in an environment characterized by various challenges, including the lack of state support (see Chapter 6). Even the establishment of the tech scene is said to have happened 'organically' without government support:

> The most beautiful aspect is: it wasn't intentional. That wasn't a university saying, 'I'm going to build an innovation center'. This wasn't the government saying, 'Okay, I'm going to pour money into trying to promote entrepreneurial growth in my country'. No, it was literally five or six technologists sitting around the table asking "What could we do to help each other?" (Interview, hardware company founder, November 2015)

Among technology developers, the former Permanent Secretary of the Ministry of Information and Technology, Bitange Ndemo, is considered an exceptional politician in the Kenyan government. He supported the emerging tech scene by overseeing the arrival of the first undersea glass fiber cable from the United Arab Emirates to Kenya's coast in 2009 and planned to build a smart city outside of Nairobi, called Konza City (which was delayed when the government changed) (Interview, Bitange Ndemo, April 2017). As described above, the government has only recently seen the need to actively support tech entrepreneurs. Since 2019, it has increasingly implemented projects that create synergies between state institutions and the country's tech scene, for example, KIEP, the World Bank project, or the incubation programs for startups offered by the national research institute, KIRDI. However, the crucial investment in startups stems primarily from foreign private investors and international organizations.

Due to this ongoing lack of state support, neoliberal entrepreneurial selves continue to seek their own solutions to the challenges posed by Kenyan tech entrepreneurship, as well as to structural problems within Kenyan society.[13] In this manner, self-dependent entrepreneurs solve their infrastructural challenges by doing extensive research on their own, establishing international networks to gain access to other countries' markets, sharing knowledge with other tech companies, and eventually opening technology hubs and makerspaces that facilitate their businesses (see Chapter 7). Consequently, digital industrialization is driven by (mostly self-employed) entrepreneurs, rather than by the state or factory employees. As such, societal problems and visions are transferred to collective and individual subjects such as entrepreneurs or innovative workplaces (e.g., Lemke 2000: 38). According to Michel Foucault's theorization of neoliberal governmentality, it is not the state or a governor who forces people to act in a specific way, but "it is always a versatile equilibrium, with complementarity and conflicts between techniques which assure coercion and processes through which the self is constructed or modified by [themselves]" (1993: 204). Affects such as the feeling of self-fulfillment make tech entrepreneurs willingly accept their self-dependent and precarious beings (Cockayne 2016: 458). In feeling self-fulfilled when working in an entrepreneurial manner, Kenyan technology developers resemble a textbook

13 Governments and international organizations began to delegate the handling of poverty to citizens in the 1980s and 1990s when a neoliberal paradigm shift took place in African countries (Ochonu 2020).

version of neoliberal selves (Jones and Spicer 2005: 179f.). For them, work is "no longer … the imposition of constraint, order and routine"; they are workers in "search of meaning, responsibility and a sense of personal achievement in life" (Miller and Rose 2008: 194f.).

Kenyan technology entrepreneurs who develop "products that are really making a difference" (Interview, director of user experience at BRCK, November 2015) and aim at accessing the global digital economy (Hersman cited in Delaney 2018) become "entrepreneurial citizens" who are "celebrated in transnational cultures that orient toward Silicon Valley for models of social change" (Irani 2015: 801). The broadening of entrepreneurial goals from commerce to societal change is a global phenomenon (Steyaert and Katz 2004: 181). However, the specifics of social entrepreneurship in postcolonial contexts include the rendering of poverty as entrepreneurial and the individualization of constructing markets and nations (Irani 2019: 4; 14). As such, Irani (ibid.: 1) writes that tech entrepreneurs in the Global South subsume "their community ties, their capacity to labor, even their political hope … into the pursuit of entrepreneurial experiments in development, understood as economic growth and uplift of the poor". Thus, actors as diverse as entrepreneurial technology developers and private investors now enact modernization and development agendas (Ouma et al. 2019: 344f.; Rudnyckyj and Schwittay 2014: 4; see Chapter 6). Although "neoliberalism's individualist bias" can be criticized for moving "explanations for inequality away from structural factors" (McCarrick and Kleine 2019: 111), I show in the following that postcolonial tech entrepreneurs are indeed aware of structural inequality and that they interweave a decolonial agenda into the development of their technologies.

…with a Decolonial Agenda

Although the discourses on (social) entrepreneurship and making have a universal impetus, scholars who theorize entrepreneurial life and the making of technology in postcolonial and resource-constrained contexts highlight the legacies of colonialism and a differing precarity of workers (Avle et al. 2019; Freeman 2014; Irani 2019). According to them, entrepreneurial subjects use digital technologies to tackle challenges that their government neglects, to improve their precarious livelihoods, and to counter global exclusions (Avle et al. 2019: 2). Thus, "the labor of entrepreneurs in resource-constrained communities [is] particularly complex because they are performing this work both to meet survival needs and also to reach for something greater" (ibid.: 16).

Kenyan technology developers work in similar circumstances: the hegemonic assumption of societal progress through industrialization, technology, and entrepreneurship subjectifies them into entrepreneurs who foster a positive impact on society, as any other social entrepreneur worldwide would do. However, working in a context of postcolonial oppression, social entrepreneurs in Kenya always criticize their unjust position in global power structures. In their understanding, the social impact of an innovative technology is twofold; it should not only positively influence the daily lives of its targeted users, but also materialize the critique of structural inequality – such as the continuous dependence on former colonial powers or the lack of governmental support in building infrastructures. Therefore, I argue that postcolonial technology entrepreneurs are not only responsibilized individuals who act out what the state fails to do, but that they also fight against the disadvantages of living in a place peripheral to technocapitalism by (re-)positioning themselves and their countries within global power structures.

In general, the structural disadvantages of living in (post)colonialized countries were analyzed by the dependency school in Latin America in the 1960s (Blaut 1976; Frank 1967). Their center-periphery model criticizes the fact that former colonies function as peripheries and as such, as sales markets for technology made in the countries of colonial power, the so-called centers (e.g., Mavhunga 2017: 4). Dependency scholars acknowledge that a "country's position within the global capitalist economic structure impacts on its abilities to increase wealth" (Hope 2017: n.p.). In the 1970s, the research focus therefore shifted from the characteristics of successful companies and entrepreneurial individuals in African countries to analyzing external factors such as inadequate infrastructures, (international) competition, and the challenges of importing goods, legal insecurity, and corruption (Trenk 1991: 506). For example, Nigerian entrepreneurs producing lumber were long considered inefficient because they were only able to exploit 10%-20% of their sawmills' capacities. Focusing on the infrastructural constraints faced by Nigerian entrepreneurs revealed that "commercial skills are much more a product of circumstance than of innate qualities"; the sawmills in Nigeria were "bought because no smaller ones were available, yet in the full knowledge that the market was not large enough for full capacity utilization" (Elkan 1988: 179).

Researchers and activists deconstructed and disproved the assumption that a certain 'underdevelopment' stems from endogenous factors such as (cultural) character traits. Nevertheless, essentialized dichotomies, for example, modern and emerging countries or Silicon Valley and its blueprints, still define

the daily life of technology developers in Nairobi. As such, emancipation from the colonial continuity of the supremacy of Western knowledge and uneven economic conditions is a central aim of Kenya's tech scene. In this manner, the African *Maker Manifesto*, formulated by the organizers of the Maker Faire Africa, claims:

> 1. We will wait for no one. 2. We will make the things Africa needs. 3. We will see challenges as opportunities to invent, and invention as a means to proving African ingenuity. … 5. We will show the world how sexy African manufacturing can be. … 10. We will remake Africa with our own hands. (Maker Faire Africa 2012: n.p.)

The manifesto statements make it clear that the making of new technology stands for gaining independence from governmental and international support and emancipating the country from the stereotypical image of an impoverished passive Global South which acts only as a recipient of technologies from the Global North. A tech entrepreneur in Ghana emphasizes that technology production in Sub-Saharan Africa represents a denial of passivity:

> [I]t is about Africans taking ownership of the problems of Africa. It's about Africans creating the solutions that help solve and lift the multitudes of Africans who are in poverty out of that. … It's no longer about sitting down and having Westerners come in to the continent to do charity. (Gregory Rockson cited in Avle and Lindtner 2016: 2233)

In Part I, I elaborate in detail how the practices of building technology and telling stories about tech development are used to (try to) turn the dominant innovation discourse upside down and to position Kenya as a place for technology production. Here, I briefly introduce two self-ascriptions of entrepreneurs that deny passivity and dependence; local expertise, and the ability to care for local communities.

In regard to expertise, technology developers refer to the history and daily routine of making and innovating in Kenya to support their claim that they do not have to learn hacking and creative tinkering as in other innovative workplaces globally where industrialization resulted in people losing manual work skills. However, because the "artisanal production such as [the] production

of sufurias,[14] cassava flour, condiments, washing machines, you name it … [,] use traditional non-mechanized processes", they are "not considered when people talk about industrial revolution" (Gachigi interviewed by Omole 2019). Therefore, global discourses on manufacturing and technology production omit the informalized jua kali sector (see Chapter 1). As early as 1938 (/1971), Jomo Kenyatta, the first president of independent Kenya, in an attempt to fight the colonial denial of local expertise, wrote an ethnography of the Kikuyu with the explicit aim of evoking positive identification with Kenyan craft traditions. Nowadays, tech entrepreneurs highlight their skills and knowledge about what is best for one's own context (Cofie n.d.), for example, by branding technologies as 'Made in Africa, for Africa' (see Chapter 6). They use this brand to present on the one hand, their expertise and on the other, the technology that is developed for the local market. This branding recaptures the above-mentioned 'ownership of the problems of Africa' and thus, embodies the endeavor to detach the tech scene from global role models such as Silicon Valley (Cofie 2016).

Besides the emphasis on local expertise, tech developers demonstrate their active role in caring for local communities. The forerunners of the iHub, for example, emphasize how the "African maker ethos" that incorporates a "culture of doing" helped to build a tech community in Kenya (Interview, director of user experience at BRCK, November 2015). According to a user experience designer, "African" entrepreneurs are not just talking, but doing – thus, they are not only documenting the various challenges on the continent, but doing something about them (ibid.). Not even the challenge of entering a "forest without paths" (ibid.) to establish the first technology hub on the African continent could halt Nairobi's techies:

> We don't know much about quitting. And we certainly don't know much about not believing that our vision is not achievable. … If we would think like a Western engineer 'Och, that's too hard. If I don't have this, this and this, I can't solve that problem. Instead, with the African resourcefulness, it's kind of 'Okay, I have one of those and one of those and one of those. Now, how can I put them together to solve my problem?' We see this across the continent: in every village, you can find someone who is using one item which is not originally intended to solve that problem. And I think that kind of innovation is unique. Our culture in Kenya and across the continent of Africa has

14 Kiswahili for 'cooking pot'.

> a huge competitive advantage of resourceful innovation. Innovating from constraints. (Interview, co-founder of BRCK, November 2015)

Similar to the romanticizing narratives about the entrepreneurial spirit of informalized workers, Kenyan actors also praise the challenges of an 'African' context because they make people innovative: "God has been great with Africa because he has given us too many problems. And the moment you solve one, you will succeed" (Interview, former Permanent Secretary of the Ministry of Information and Technology, April 2017). Structural challenges are seen in a positive light, as business opportunities: "harsh and difficult conditions force out-of-the-box thinking" (Narla 2013: n.p.) and "only add fuel to Africa's innovative energy and creativity" (Jackson 2017: n.p.).

The tech community in Nairobi does not just praise the entrepreneurial spirit of precarious people in a neoliberal manner: it appropriates the exoticizing claim of creativity and innovativeness inherent to 'African culture' in order to form a pan-African identity of technology developers that differs from the global innovation scene. They claim that the Kenyan community of technology developers care for each other's well-being and for their broader context. A hardware company founder, for example, describes Nairobi's tech entrepreneurs as a "community of technologists and entrepreneurs that are collectively committed to seeing each other being successful and to seeing our country prosper from the success of these enterprises" (Interview, November 2015). Through sharing knowledge, investors, and publicity, tech developers care for their own work community and their social enterprises care for their context.

The emancipatory move to build a local tech community to free Kenya from exploiting postcolonial structures can be analyzed through the lens of critical making in design theory. Critical making asserts that a built thing empowers through:

> express[ing] the designer's ideological position (empowering oneself); caus[ing] critical reflection in others by raising awareness of or providing new choices to subvert existing structures (empowering others); and attempt[ing] to challenge the social construction of our made environment (empowering making communities). (Grimme et al. 2014: 434)

As the technology made in Nairobi should have a positive effect on various Kenyan contexts and help to overcome the oppressive structures still present,

Kenyan technology developers feel empowered to shift from a passive recipient of technology to "a maker subject position" (ibid.: 435). This is not only an individual feeling of empowerment, but is perceived as empowering the whole country through re-working Kenya's position in the global tech market (see Part II).

However, critical making is most often associated with anti-capitalist ideology (Grimme et al. 2014; Maxigas 2014) and therefore does not satisfactorily explain the driving affects of postcolonial technology entrepreneurship that aims at participating in the global tech market. Instead, historical accounts of entrepreneurs in Africa are more insightful because they emphasize the fact that African entrepreneurship has never been purely profit-driven, but also mandated to address non-profitable concerns. Precolonial entrepreneurship in Africa did not center on profit, but "existed in symbiosis with the demands, responsibilities, and ethics of the wider culture" (Ochonu 2020: n.p.). As such, its social impact was inherent to an entrepreneurial endeavor:

> Profitmaking was coextensive with social obligations. … [T]he idea that individual profitmaking could and should coexist with the provision of societal benefit and that entrepreneurial projects should catalyze society's economic potentials was an unwritten but well understood rule of business. (ibid.)

Against this background, the neoliberal understanding of an entrepreneur (stemming from Western theorizations) that "proclaim[s] the autonomies of … business and political spheres" (Ochonu 2020: n.p.) is unable to grasp entrepreneurial endeavors in African contexts that "are often still about much more than simply money and commodities, and impersonal encounters, and rather entangled into complex webs of interpersonal relationships" (Ouma 2016: n.p.).

I argue that postcolonial technology entrepreneurs in Kenya represent an entrepreneurial self that unites neoliberal logics of technoscientific modernity and decolonial endeavors to create a pan-African identity of technology development. The social impact of their technologies is a heuristic, not a simple business logic (see Chapter 6). As such, the aim of (re-)positioning Kenya in global economies through local technology development merges capitalist ways of production with the political motivation of decolonial emancipation. The fact that the merging of technocapitalist norms with emancipatory ideals is a highly ambivalent enterprise and must be constantly negotiated affectively is one of this book's main arguments (see Part I).

2.3 Conclusion: The Making of Technologies to Industrialize and Decolonize Kenya's Future

This chapter situated Kenyan technology entrepreneurship in histories of industrial policies and entrepreneurship in (post)colonial Africa to emphasize the context-specificity of technoscientific endeavors and futures. It showed that the belief in economic development through industrialization and technology is a recurring phenomenon in history. Although this development has often failed to materialize in the past, for example, during the colonial exploitation of natural resources and numerous subsequent economic paradigms that were (forcefully) implemented in African countries, the goal of industrialization is still popular. The analysis of Kenyan manufacturing policies and projects highlighted the current national aim of becoming an industrialized middle-income country by 2030. Further, it evaluated continuities and changes in industrial utopia, showing that the modernist assumptions regarding technology and progress that underlie the belief in economic growth through industrialization have not changed. Just as Kenya's post-independence industrial policies were characterized by the Eurocentric teleology of development and the parallel 'socialist' wish to emancipate intellectually and economically from colonizing countries, so the current aim to industrialize Kenya also unites capitalist and decolonial thought.

However, I demonstrated that two things have changed in the current industrialization endeavor compared to past ones: the means of production and the propulsive actors. The introduction of digital technologies as means of production in manufacturing industries has encouraged Kenya to aim, not at a Fordist industrialization, but at a Fourth Industrial Revolution. However, the state does not see itself as the driving force in achieving this digital industrialization. Instead, Kenyan policies and the global innovation discourse stages the 'African entrepreneur' in a new guise – well-educated, middle-class Kenyans who should foster the national economy by applying business and technical skills such as coding, digital manufacturing, and product design. Therefore, I argue that technology entrepreneurs are staged to be the makers of an industrialized and innovative Kenyan future that finally fulfills the Africa Rising promises.

Furthermore, this chapter established the characteristics of the *postcolonial technology entrepreneur* embodied by Kenyan tech developers. As responsibilized drivers of Kenya's industrialization, they are embedded in the global innovation paradigm that celebrates technology developers as "savior[s] of broken ed-

ucational systems and economies" (Ames et al. 2018: 16). To alleviate poverty, improve inadequate infrastructures, and address other structural inequalities, Kenyan tech developers delve into the neoliberal endeavor to build social impact technologies without any governmental support. However, postcolonial technology entrepreneurs also embody another characteristic that seems at first sight to contradict the neoliberal principle of sacrifice: they also follow decolonial aspirations. Through the local development of technologies, they fight for the acknowledgment of their expertise and against the stereotype of passive 'Africans' waiting to receive technological solutions from the West. Thus, they strive for an overall emancipation from the supremacy of Western technology and knowledge. Against this backdrop, I argued that the work of developing technology is actually the work of challenging Kenya's peripheral positionality by integrating the country into the global technocapitalism. What seems contradictory at first can be explained by the historical accounts of entrepreneurs in African communities, which highlight that business on the continent has always been politically inflected. I contend that the protagonist of Kenya's digital industrialization is a neoliberal tech entrepreneur with a decolonial agenda.

Overall, this chapter has shown that, due to the historical situatedness of Kenya's tech entrepreneurship, scholars should avoid using the same theoretical interpretations as they would when analyzing the development of technology in post-industrialized contexts. The existence of jua kali, the informalized manufacturing sector, shows that the skills of making things neither represent something new for Kenyan entrepreneurs nor are they equitable with manual skills that have to be re-appropriated from capitalist modes of industrial production. Further, the historical insight that industrial policies and entrepreneurship in Africa were always politically motivated constitutes a complex backdrop for the research outcome that neoliberalism does not stop at industrialization efforts. In this regard, I demonstrated that it is a postcolonial specific, which allows technology entrepreneurs in Kenya to understand their striving for technoscientific modernity as an emancipatory act of gaining independence from Western science and technology (imports). As such, Kenyan visions of the future relate to histories of entrepreneurship in Africa, colonial oppression, and the resulting hegemonic belief in societal development through economic progress.

Many scholars assess the development of technology in African countries as either emancipatory or capitalist. Some celebrate the agency of technology developers in Africa by "strategically deploying *things* (the mobile phone, computer, and internet) to effect their dreams" (Mavhunga 2017: 19) and some crit-

icize the 'Africanization' of technology and its aim of societal development for not thinking "*through* capitalism *beyond* capitalism" (Ouma 2020: n.p.). Unlike these binary assessments, this book aims to highlight the tensions that emerge between neoliberal aspirations, capitalist world markets, and decolonial motivations as well as technology entrepreneurs' handling of these in their daily life. In this regard, I follow a more conciliatory approach by accepting that nowadays, it is "difficult … to imagine ways of expressing care and concern without fostering markets" (Collier et al. 2017: n.p.). In consequence, I understand the entanglement of capitalist and decolonial logics, economy and politics as well as markets and ethics as one whose parts often cannot be separated from one another. The following chapters analyze the affective socio-technical practices of postcolonial technology entrepreneurs to shed light on emancipatory moments and their constraints in a technocapitalist world.

Part I

Storytelling: Affective Promises and Performances about Technology

Do! Make! Innovate! are common imperatives found in stories that encourage people to create innovative solutions. Such stories usually focus on the ease of innovating and the societal rewards that await heroic entrepreneurs if they dare to embark on the journey of technology development. However, what the stories do not include is that tech entrepreneurship is work that, like any other, is a strenuous process with its own challenges. There is nothing about how exhausting it is to attract money and find supporters to implement one's ideas.

The first part of the book's empirical analyses depicts the practices of storytelling that, at first sight, do not appear part of innovation processes, but are crucial for a technology project. Although current technocapitalism promotes science and technology as the ultimate drivers for economic growth and society's well-being, technology developers, governments, and other technology advocates have to tell positive stories about technological solutions to societal problems and global competition in order to convince doubters (Wynne et al. 2007: 24f.). As such, science communication is necessary to gain political support, investment from private companies or development agencies, and to establish a community around a common technological vision (e.g., Brown 2003; Davies and Horst 2016; Dickel and Schrape 2017; Felt and Fochler 2012). Public storytelling, especially in places that hold a peripheral status in Western dominated technocapitalism, represents the main possibility to make oneself heard and seen. Thus, I argue that telling stories about innovative technology development in Kenya is an as equally necessary daily life practice as the actual designing, prototyping, and coding of a technological idea.

Due to the need to publicly promote promising technological futures in order to fuel and finance scientific work, Wynne et al. (2007: 24) state that technology development is embedded in a global economy of technoscientific promises. In Chapter 3, I highlight these promises about societal progress

driven by technologies and argue that the 'master narrative of technoscientific progress' (Davies and Horst 2016: 33) causes technology developers to solely tell stories about social impact and heroic innovators. Chapters 4, 5, and 6 broaden Wynne et al.'s argument by claiming that storytelling about science and technology does not only involve the writing about (too) optimistic technological promises, but also the bodily and material performances of technological endeavors. Technology developers in Nairobi make stories about their country's tech scene touchable, observable, and understandable in order to convince doubters of their work. Consequently, I include bodies, materials, and affects in my analysis of storytelling practices to illustrate that technocapitalism represents an *economy of promises and performances* about technology yet to become.

Defining Ubiquitous Terms: Story and Narrative

Theoretical approaches to stories about technology, science, and innovation mostly have different understandings of the terms *story* and *narrative*, or use these highly contested terms interchangeably (Cameron 2012; Gabriel 2004: 3; Marchant 2018: 40). The science communication scholars to whom I refer use the term *story* to describe mediatized stories of technological visions and *narrative* to describe dominant beliefs and ideologies, such as the master narrative of technoscientific progress. Geographers, however, mainly use *story* to describe a personal account of intimate experiences that counter dominant narratives (Dutta 2016; Marshall 2014; Pratt 2009).[1]

In narratology, the narrowest definition of a story that is agreed on describes a story as having a plot that knits events together (Muir 1928 cited in Czarniawska 1999: 65) in contrast to an enumeration of events such as in a weather forecast or manual. Stories are characterized by the representation of events as certain and definite – the knitting-together of them produces plausibility (Gabriel 2004: 5; Prince in Biwu and Prince 2018: 15). As such, stories are neither fiction nor non-fiction (Ryan 2007: 26); rather, they combine the telling of a meaningful plot with the assertion of representing reality and therefore, "communicate facts as experience" (Gabriel 2004: 6).

1 Storytelling is also a prominent research methodology in geography to write thick and affective stories of research results (Christensen 2012; de Leeuw et al. 2017).

In the context of Nairobi's tech scene, communication scholar Eleanor Marchant (2018) analyzed stories told by Kenyan entrepreneurs. She defines stories as "*individual tales* people tell" and narratives as "the larger, more general, over-arching tales that shape and are shaped by our fundamental cultural and ideological views of the world" (ibid.: 40). For my analysis of the story told about Kenya's tech scene, I also make the differentiation between a story that conveys something specific and a narrative that functions as a broad frame for stories. However, the analyzed story is not a personal story told in informal situations, but a public singularized story about technology development in Nairobi (see Chapter 3).

In terms of *geographies of stories*, I am conceptually interested in Kenya's tech story as neither structural and universal, nor local and particular (Naylor 2008: 271). This geographic approach asks how stories (have to) conform to hegemonic discourses (Price 2010: 207), how small stories are able to create "larger and more general, though still situated, narrative knowledges" (Squire et al. 2013: 13), and how personal stories can be different from each other and at the same time resemble a similar story of structural inequality (Dutta 2016: 2). Thus, I argue that, although Kenya's public tech story is partial, it is at the same time universal because of its references to master narratives that possess a hegemonic status.

Research Lens: Analyzing the Performative Productivity of Kenya's Tech Story

The acknowledgement that storytelling is a daily practice in Kenya's tech scene leads to the awareness that stories are not simply 'lying around', but are "fabricated, circulated, and contradicted" (Czarniawska 2004: 48). Thus, the labor of storytelling – why stories are told, by whom, and under what circumstances – comes to the fore. Understanding storytelling as a productive practice, my research lens on stories and storytelling about tech development in Nairobi is twofold: first, I am interested in the narrative characteristics of stories to analyze the norms and affects that are created through them (see Chapter 3). Second, I highlight that stories are bodily achievements of making particular expectations, affects, and politics present or absent by examining three different storytelling practices – guiding visitors through innovative workplaces, writing media stories, and marketing locally developed technologies (see Chapters 4, 5, and 6). Overall, the following chapters ask about the stories' performa-

tive effects on their protagonists and storytellers, and the storytellers' abilities to change dominant narratives by negotiating between hegemonic norms and personal understandings of entrepreneurship, technology, and social impact.

The Performative Normativity and Affectivity of Stories

The theoretical foundation for the analysis of Kenya's tech stories is Michel Foucault's (1981; 1991) and Judith Butler's (1995) poststructural understanding of discourse and language that strongly influences the performative stance in narrative research. According to Butler (1990), performativity means that categories, norms, and identities are not innate, but enacted or "invented" (2010: 154) through the iteration of speech acts. This means that narratives and stories are productive practices that discipline and normalize things and people through the continuous reproduction of categories and norms (Bublitz 2003: 48, 55). Although continuously iterated discourses powerfully produce and oppress socio-material reality, Butler emphasizes the existing agency within discourses as they are also "open to resignification, redeployment [and] subversive citation from within" (1995: 135). Thus, the benefit of paying attention to storytelling is that stories can be grasped as ambivalent matter – not only as reproductions of oppressive structures, but also as tools to challenge seemingly irrevocable social norms created by hegemonic discourses (Gabriel 2004: 2; Sommer 2007: 68). In either case, stories are productive, as they "constitute realities, shaping the social rather than being determined by it" (Squire et al. 2013: 15).

Also, science communication scholars understand stories about technology as "productive types of communication" (Dickel and Schrape 2017: 54), meaning that stories performatively shape the form that a specific future technology, as well as its innovators, should take. This normativity of stories entails the production and circulation of affects that influence storytellers, protagonists, and audiences. Therefore, it is important not to see science stories as objective portrayals that only tell people about science and technology (Davies and Horst 2016: 228). They are also political, and so it is crucial to analyze the "explicit and implicit norms [that] form the basis of technoscientific discourses and practices" (Weber 2007: 364f.). Thus:

> [t]he challenge for science and communication scholarship is … to notice not just the visions and expectations – what is being promised? – but the norma-

> tivities implied by them. What societies are being imagined? Who is present within them, and who is excluded? (Davies and Horst 2016: 146)

This focus on the performative enactment or 'invention' of norms (Butler 2010: 154) offers insights into the affectivity of stories. Sociologists of expectations state that "the production of a particular narrative order … polices the future behaviour of a whole range of actors" (Brown et al. 2003: 4). For example, stories that perpetuate tech-determinism 'govern' scientists, storytellers, and audiences by distinguishing between visionaries and conservatives, by defining what constitutes societal problems, how these should be solved, and who is able to become an innovator and who not (Felt and Fochler 2012: 4; Irani 2019: 14). However, stories are not only a matter of explicit policing – they also respond to desire and positively connoted emotions such as happiness (Ahmed in Schmitz and Ahmed 2014: 103; McQuillan 2000: 16). Sara Ahmed calls encouraging accounts on how to become happy "subtle affective mechanisms" (Ahmed in Schmitz and Ahmed 2014: 103) because they pretend to advise voluntary actions but still direct, narrow, and homogenize possibilities (ibid.: 104). This means that the affectivity of stories – whether positively or negatively connoted – influences the scope of action. Cultural geographer Patricia L. Price therefore argues that stories are always productive:

> At the very least stories entertain. Beyond that, stories can perform pedagogical, emotional, and taxonomic work. They can instruct in the proper ways of behaving, provide a compelling order to events, serve as an articulated historical repository, elicit strong emotions, forge consensus, sway opinions, provide alternative understandings, and incite to action. (2010: 207)

In the workplace, the affectivity of stories produces communities and (work) identities; they generate commitment and meaning in organizations. Mary E. Boyce (1996: 7) states that as well as stories, other ritualized aspects of work such as events, branding, and insider jokes make up the ideology of an organization (ibid. referring to Dandridge et al. 1980: 77). According to Ames et al. (2015), the foundational story of a technological endeavor, in particular, possesses community-building effects. Such a story is often "ritualistically circulated within the community", producing religious-like "feelings of awe, transcendence, and connection to a greater purpose" (ibid.: 70). This greater purpose could be a shared vision of the future, as Detlef Müller-Mahn (2020: 57) points out. Hence, the re-telling of a visionary story eradicates doubts, builds

and stabilizes identities and relations, and furthers legitimation of decisions, for example in regard to the development of a certain technology (Brown et al. 2003: 4; Dickel and Schrape 2017: 54).

The affectivity and normativity of stories demonstrate that language and representation are never separable from materiality and corporeality (Militz 2017: 25). Thus, research that not only analyzes the narrative characteristics of a science story, but also its affects and materializations is inevitable (Cameron 2012: 581ff.; Czarniawska 2004: 48).

The Embodied Work of Storytelling

Researching the performativity of stories includes analysis of the stories' effects, such as the (re)production and contestation of (collective) identities, places, and futures. However, it is insightful to also examine the embodied practices that bring stories and their effects into being (Czarniawska 2004; Lippert 2014). What work is necessary to produce stories? What "stabilizing work" (Czarniawska 2004: 43) makes particular stories coherent and thus, constitute norms? By researching the practices of storytelling, we can understand the structural context of a story's content, a requirement for investigating the relationship between narratives, power, and agency (Squire et al. 2013: 9; Tamboukou 2013). Asking questions such as why stories are told in a certain manner, why storytellers draw on hegemonic master narratives, or why they silence specific things and circumstances (Steyaert 2007) illuminate how norms are "constructed, perpetuated or subverted" through stories (Gymnich 2002: 62).

Science communication scholars Sarah R. Davies and Maja Horst (2016: 214) take the emotional and bodily parts of storytelling into account, writing that science communication "is a jungle, full of colour and smells and different kinds of beasts and strange things lurking in the shadows". Put simply, they claim that stories are affective achievements. In the same vein, John Law (1994: 155) claims that the socio-material practices of storytelling are strenuous:

> [Storytellers] don't just select between the myriad bits and pieces that happen to be lying around and shake them up together in a bag to form a picture. Neither do they invent such bits and pieces, de novo. Instead, the components of a picture are built up. With difficulty. Often painfully. On the basis of what is already being performed out there.

Researching the work of storytelling therefore reveals the material, embodied, and emotional performances of stories. For this research endeavor, I use Linda McDowell's understanding of work in the service sector in which she describes the bodily and emotional relationships at work. According to her, emotions such as:

> [d]isgust, contempt, shame, humiliation, anger, empathy, surprise, pleasure, enjoyment and excitement may singly or in some combination be part of the provision of a service that includes selling the body in different ways and these emotions may be felt by either or both workers and consumers. (2009: 225)

Workplaces in the manufacturing sector are often depicted as unsocial places of physical labor (e.g., McDowell 2009). In this manner, organization scholars emphasize that quantified information dominates workplaces of knowledge production without leaving much space for narrating (emotional) stories (Gabriel 2004: 70). However, this observation does not correspond to the current entrepreneurialization of manufacturing. I argue that the storytelling practices in the tech sector are similar to those in the service sector in which embodiment and "how bodies connect (or do not)" are the principal themes of work (McDowell 2009: 225). Hackathons, pitching competitions, and co-working spaces in general are places where tech developers bodily perform themselves, their visions, and technologies as revolutionary and heroic. Whether on a stage, at the workbench, or through social media, technology developers constantly present themselves to the public, thereby staying in contact with potential investors and customers. Thus, self-marketing performances, and the social interaction with users, potential investors, and like-minded techies characterize the work of making new technologies.

The Agency of Stories to Script Positionalities

By looking at the labor of producing stories and the stories' effects on their protagonists and storytellers, we see that discourses produce hegemonic norms. However, the iterations of storytelling also create space for a subject's agency to contest these (Bublitz 2003: 60). Feminist scholars in particular, such as Donna Haraway (1991) and J.K. Gibson-Graham (2002), engage with the performative possibility of countering hegemonic narratives by presenting alternative stories. They deconstruct oppressive and discriminating accounts

of economy, gender, and technology and write multiple and often contradictory stories of society in their scholarly practice.[2] As such, scholars who are interested in performativity acknowledge that stories not only represent a certain status quo of people, places, and things, but also affect and materialize them (Cameron 2012: 581, 586). This means that the narrative work of storytelling – if critically applied – can have emancipatory effects of (re)creating meaning (Boyce 1996: 21).[3] As storytelling's performativity affects and creates collectivities, stories are able to counter hegemony and to "build an oppositional politics among marginalized groups" (Cameron 2012: 580). Gibson-Graham (2002: 36) terms this emancipatory potential of stories "resubjectification", meaning the creation and maintenance of alternative – in their case, non-capitalist – institutions, practices, and discourses wherein subjects are enabled to inhabit these alternative spaces.

Butler broadened her focus on language and her "cultural constructivist position" (2010: 153) that she argued for in *Gender Trouble* by acknowledging the performativity of socio-materiality:

> It is not only the explicit speech act that exercises performative power. … [I]t is not simply that a subject performs a speech act; rather, a set of relations and practices are constantly renewed, and agency traverses human and nonhuman domains. (1990: 150)

Humans and materialities have not only performative agency, but also affects. Sunčana Laketa (2018: 182) analyzes "how emotions and affect congeal in space through repetitive practices and [that] … they are involved in the constitution of boundaries between bodies and objects". She combines Butler's theory on

2 Haraway goes one step further than writing stories of multiplicity; she uses fiction to materialize new realities. For example, her writings on cyborgs who transgress boundaries by being "in partial connection with others, in communication with all of our parts" counters the hegemonic "dualisms of mind and body, animal and machine, idealism and materialism in the social practices" (1991: 154). According to her, emancipatory potential lies exactly in the storytelling about "very fruitful couplings" (150).

3 Mary E. Boyce emphasizes the two-sidedness of storytelling (in organizations); stories and storytelling can "be socially controlling or participatory and emancipatory" (1996: 21). Thus, they can be used to either "describe and sustain the current power structure, or to nurture … liberation and to develop new meaning of work and personhood by individuals and groups" (11).

performativity with Ahmed's theorizations on affects to stress that the deconstruction of boundaries is possible due to variations in affective repetitions (ibid.: 192f.). In regard to 'place', Mike Crang (2004: 76) uses the concept of "scripting places" to claim that images, texts, and practices are able to create places and "also rework the actual histories and geographies of places".

Based on the depicted understanding of performativity, I empirically show that the storytelling about Kenya's tech scene signifies an attempt to re-script the country's positionality in technocapitalism. Narrative promises and embodied performances about Kenyan startups and technologies create international awareness of technology development in Nairobi. As such, public relations employees, visitor guides, and technology developers tell stories to eradicate doubts about Nairobi being a place for tech development.[4] Hence, the writing of newsletters, the guiding of visitors, and the marketing of technologies function to gather supporters of technological ideas – be they communities of local tech developers, the Kenyan government, or (the mainly international) investors.

Overview: The Storytelling Chapters

In Chapter 3, I analyze the singularized founding story of Kenya's tech scene by drawing on various sources that all recount revolutionary but smooth transformations, heroism, and amazement at technological innovation made in Kenya. Thus, the chapter shows which narrative characteristics tell a partial story in a generalized way, and which normative and affective effects the totalizing narration has. I highlight the partiality of the story about Kenyan tech development by dissecting the story's content and structure. My analysis determines the presences of overarching narratives, for example, the belief in technologies as drivers of national progress, and the absences of complicating daily life and contexts. However, the research into absences and presences does not aim to discover if the story is 'true' or not, but rather to expose what is silenced while claiming to represent reality (Gabriel 2004: 6). In addition to the narrative content analysis, I draw on contextualizing empirical data from interviews, conversations, and my own experiences to examine how Nairobi's tech story is

4 In the case of South Africa's tech scene, Andrea Pollio claims that primarily "numbers, figures, lists" (2020: 2717) and "texts, reports, maps, stories and marketing gimmicks" (2727) ontologically produce the Silicon Cape's existence.

productive of affects and norms which influence the agency of the story's protagonists, namely technology developers, tech users, an 'African' environment, and technology itself. In this vein, Kenyan tech developers 'should' work fast, flexibly, and ingeniously and their technological ideas 'should' ease the problems of marginalized (rural) communities. Overall, Chapter 3 argues that the singularization of the story of technology development in Kenya totalizes the tech-deterministic belief in societal transformation through technology and, therefore, makes technology developers and their innovations affectively comply with global norms of technoscientific progress and postcolonial development paradigms that *other* Kenyan technology development.

The normative conviction that technology advances (societal) development also comes up throughout Chapters 4, 5, and 6. However, the focus of these chapters lies on the actual practices of storytelling. I ask what work produces norms, imaginations, and identities, and what effects storytellers desire from – and eventually enact with – their stories. Using the examples of three different storytelling practices – guiding visitors through workplaces, writing media stories, and marketing technologies –, the chapters show that storytellers aim to re-script Kenya's discursive and material peripheral positionality. However, as the stories' promises and performances are embedded in colonial (capitalist) trajectories, they have ambiguous ambitions. On the one hand, stories about technologies, startups, and Kenyan co-working spaces function as discursive resources to counter the stereotype of Africa as a passive and non-technological place. As such, they represent the tech developers' decolonial desire to abolish postcolonial asymmetries by scrutinizing colonial imaginations of Kenya, and by building a caring local community of technologists. On the other hand, the stories told are supposed to center Kenya in the global technology economy and attract investors who predominantly come from the Global North. In this regard, the guiding of visitors is done not only to share knowledge with the local community, but also because affluent visitors embody potential investment. The writing of media stories serves not only as a way to empower Kenyans to become technology developers, but also as a tool to gain legitimacy and accountability for investors. And the marketing of technologies as 'Made in Africa, for Africa' expresses care for contextual challenges and, at the same time, reproduces the investors' essentializing imaginations of a single 'Africa'.

Chapter 4 offers ethnographic insights into the practice of guiding visitors around co-working spaces and shows that the tours function mainly as touristic events for interested people from the Global North. Thus, they turn the technology developers, innovative workplaces, and technologies visited into watch-

able objects. The clash between idealistic aims and discomforting feelings is paradigmatic for all of the storytelling practices; in the case of visitor tours, feelings of anger and irritation while being watched clash with the ideal of sharing knowledge with others.

In Chapter 5, I show that the making of media stories needs affective and collaborative socio-technical care. Storytellers and technical infrastructures – for example, electricity – have to work together in order to distribute stories to a global audience. However, the absence of infrastructures and the lack of 'adequate' stories that fit into the technoscientific and exoticizing norms of how technological innovation in Kenya 'should be' complicate this work. Thus, writing media stories represents invisible care work for media content and a continuous negotiation between narrative norms and the realities of daily life.

Chapter 6 analyzes the marketing practice of branding technology from Nairobi as 'Made in Africa, for Africa'. I explicitly depict the tension between the technology developers' financial needs and their emancipatory visions. Technology developers have to market their projects according to the expectations of the predominantly Global North impact investors. Thus, they use hegemonic essentialized understandings of ethnicity and origin to make their technological ideas convincing although such marketing might reinforce oppressive structures. I claim that this marketing *performs poverty*, and thus constitutes Kenya as a homogenous African place of technology for the rural poor. The chapter empirically shows that tech developers not only reproduce the essentializing imaginations of funders, but also negotiate the obligation to perform stories about societal progress through technology. However, the tech developers' dependence on investment restricts this performative ability to re-script stories and positionalities. They usually have to surrender themselves to the postcolonial power asymmetries in investor-developer relations and, ultimately, follow the investors' choice of which ideas are worth financing and which are not.

I conclude the empirical analyses on storytelling by stating that postcolonial power asymmetries pervade the technocapitalist *economy of promises and performances*. As such, the guiding of visitors, the writing of media stories, and the marketing of technology are emotionally strenuous work practices that affectively and socio-materially negotiate representations and positionalities. Storytelling's performativity has the ambivalent effect of both reproducing colonial imaginations and creating communities that aim for decolonial technology development. I claim that this ambiguity signifies the entanglement of market logics with political endeavors within the current paradigm of post-

colonial technology entrepreneurship in Kenya. Thus, Nairobi's tech scene is a place of daily resistances that represent moments of agency and emancipation within the neoliberal making of technology.

Chapter 3
The Normativity of Kenya's Tech Story

"I come from the land of M-Pesa", was how a Kenyan technology expert introduced herself to a German audience (September 2015),[1] referring to the reduction of Kenya's tech scene to the mobile phone application M-Pesa (see Chapter 1). According to her, it was M-Pesa's success story and the subsequent emergence of iHub, the first technology hub on the African continent, that had resulted in Nairobi becoming the role model for an 'African' place of technology development. Since 2015, Kenya has ranked among the four largest tech scenes on the continent, but its success stories are better known internationally than those of the three other leading countries – Nigeria, South Africa, and Egypt (Disrupt Africa 2021; Giuliani and Ajadi 2019: n.p.). Therefore, how Kenyan technology developers share their experiences, attract investors, and legitimate their technological endeavors in the media serves as a role model for other tech scenes on the African continent (Pollio 2020: 2724f.). Against the background of Kenya's pole media position, this chapter explores the specificity of media coverage of Kenyan technology development and reveals that only a single story about the tech scene exists. Regardless of the format, storyteller, or audience, the founding story of Nairobi's tech scene always starts with the success of M-Pesa and Ushahidi in 2007–2008 – as I did in this book. The story is narrated in the same way and with the same content, no matter by or for whom it is told, or through which form of media it is published.

As discursive singularity produces hegemony, I analyze the narrative characteristics of the singularized story and their normative effects. Whereas Chapter 2 claimed that economic and industrial policies discursively stage Kenyan technology entrepreneurs as the protagonists of national progress,

1 Panel discussion on 'Digital Human Rights and Development Agencies' at Stiftung für neue Verantwortung in Berlin.

this chapter shows that it is not only state actors that responsibilize technology entrepreneurs to bring about change, but also the mediatized stories about and from Nairobi's tech scene. By analyzing its founding story, I highlight two things: first, I show that the story becomes universalized through the use of narrative characteristics from the "master narrative of technoscientific progress" (Davies and Horst 2016: 33) and the prevailing colonial imaginations of a place on the African continent.[2] Second, I demonstrate that the continuous reproduction of the master narrative's belief in societal progress driven by technologies and the exoticization of technology, their users, and developers, materializes norms. In this regard, I argue that the presences and absences of people, things, and circumstances in the story constitute "sediments of norms and practices" (Czarniawska 2004: 48) and drive affects within Kenya's tech scene.

To illustrate this argument, I first retell the singularized founding story of Kenya's tech scene by drawing on various sources that all recount revolutionary but smooth transformations, heroism, and amazement at technological innovation made in Kenya. Second, I analyze these narrative characteristics to show that the presence of linearity, heroism, and unexpectedness, and the absence of challenges and daily life circumstances manifest a tech-deterministic and exoticized image of technology developers who are single-handedly solving the struggles of an impoverished 'Africa'. As such, the master narrative of technoscientific progress and the colonial imaginations serve as hegemonic ideologies that narratively establish plausibility and legitimacy for technological endeavors in Nairobi. Third, this chapter emphasizes the normativity of the story, that is, the performative production of norms that affect how Kenyan technology developers and their technologies act, feel, and work. Finally, it claims that the narrative singularization of Nairobi's tech story portrays an ahistorical, apolitical, and exoticized image of Kenyan technology development and thus, totalizes the belief in societal development through technology and science. The technology developers' emotional investment in their work offers an insight into how the story affectively narrows the developers' possibilities of

2 Whereas this chapter analyses the narrative characteristics of the existing story about Nairobi's tech scene, Chapters 4 and 5 focus on the actors of science communication. I show that storytellers can be technology developers themselves, PR staff of innovative workplaces, or (international) journalists, and that Kenyan storytellers often deliberately construct their narratives to match the technoscientific and colonial imaginations of their audiences (who are mainly funders from outside Africa).

action and makes them comply with precarious working conditions, as well as (Western) norms of technoscientific progress and (colonial) affects that *other* Kenyan technology development.

3.1 The Single Story about Kenyan Technology Development

The people who tell stories about technology development in Nairobi are diverse, as are the intended audiences, and the stories' formats. Perhaps a makerspace's newsletter tells the story of a member's innovative idea in order to gain legitimacy in the eyes of investors (see Chapter 5), international journalists report on their visits to innovative workplaces in Nairobi, rewriting what they heard from the visitor guides (see Chapter 4) or a Kenyan newspaper such as the *Daily Nation* applauds Barack Obama's appreciation for Kenyan technology entrepreneurship (Ondeng 2015). Famous storytellers such as Mark Zuckerberg or Barack Obama, Kenyan tech influencers such as Juliana Rotich or Erik Hersman, and even the more 'invisible' staff of innovative tech hubs and startups in Nairobi have one thing in common: their public stories about technology development in Kenya are similar to each other. In fact, they are so similar to each other that the story about the Kenyan tech scene remains the same, even though it is told by many actors through different media outlets – in blogs, on websites, by the guides who lead the daily visitor groups through workplaces, in newspapers, and in the few academic accounts of Kenyan technology development (e.g., Friederici 2016; Gathege and Moraa 2013; Graham 2019; Kusimba 2018; Marchant 2015; Ndemo and Weiß 2017; Poggiali 2016).

During my research visits, I did not once encounter a story about the emergence of Nairobi's tech scene that differed from the accounts I had read and heard about from abroad. Although the repetition of the same few success stories of the same technology entrepreneurs is a common phenomenon in science communication, Andrea Pollio (2020: 2720f.), who researched the startup sector in Cape Town, encountered differing founding stories during his fieldwork. Furthermore, the genealogy of technology development in Ghana is explained by the worldwide internet penetration in the early 1990s and thus, does not refer to a single successful innovation (such as M-Pesa in Kenya) as a historical starting point (Foster et al. 2004). Against this background of diverse historical accounts of the emergence of tech scenes, my surprise about the uni-

formity of Kenya's tech story became the starting point of my research interest in the singularization of a story.

In the following, I reproduce the founding story of Nairobi's tech scene, including the importance of technology development to the country's economy and the rapid pace of the Silicon Savannah's development, in order to analyze its narrative characteristics thereafter. I use different sources –authors, voices, and observations – to reproduce the story, although I could have also cited only a single source, as they all tell the same story.

"The Rise of Silicon Savannah and Africa's Tech Movement"[3]

It was the end of 2007 when a couple of technology developers met in Nairobi to build a software program with which everyone who had access to the internet could map the election process in Kenya. Immediately following the election, which was subject to numerous claims of manipulation, massive violent protests took place, and this software, Ushahidi (Kiswahili for testimony), was used to map and comment on the post-election violence (Marchant 2015: 8; Manske 2014: 14; Ushahidi 2020). This previously unforeseen ability to make humanitarian emergencies transparent through a digital tool caused the open-source software to gain a lot of international recognition. By 2018, 22,000 various actors in 154 different countries used Ushahidi; for example, the project *Document Hate* used the software during the US election in 2016 and humanitarian volunteers used it to map the aftermath of the earthquake in Haiti in 2012 (BBC 2016; Cessou 2018). While Ushahidi started to receive international praise in 2008, the mobile operator Safaricom, supported by the Vodafone Group, introduced M-Pesa in Kenya (Manske 2014: 10). M-Pesa is a mobile banking platform that allows people to send money to others via their mobile phone. This application revolutionized the banking sector because, for the first time, people without access to a bank account were included in formalized money transfers (Marchant 2015: 8). By the end of 2019, M-Pesa had 23.6 million active users (Otieno 2019) who had made Safaricom 62.9 billion Kenyan shillings which constituted 28% of the mobile operator's total revenue in 2018 (Alushula 2019).

Following these successful Kenyan innovations, venture capitalist firms, accelerators, international corporations such as Google and Microsoft, and development agencies began to invest heavily in Nairobi as a place of technological knowledge production (Disrupt Africa 2021: 10; Microsoft 2019; PSCU 2021). Various donors, such as the philanthropic investor Pierre Omidyar's

Omidyar Network and the Dutch development agency HIVOS, funded the first permanent Kenyan co-working space where technicians, investors, tech companies, developers, and researchers could meet to co-work, talk, and network (Macharia and Mutuku 2014; Sanderson 2015: 6). This space, iHub, opened its doors in 2010. From then on, Nairobi's tech scene grew organically from an Ushahidi office and the iHub co-working space to a variety of creative workplaces in the same building (de Bastion 2013: 7). According to Erik Hersman, one of the founders of iHub and other successful tech companies in Nairobi, iHub feels like "a high-tech community space one could find anywhere in the world, but with a Kenyan flavor" (2013: 62). Nowadays, Kenya is known as the *Silicon Savannah* and acts as a role model for Africa by "fuel[ing] an ecosystem of innovation and technology that allows people to develop enterprises that creatively solve problems around them using technology, while shaping the way African innovation is viewed by the world" (iHub 2017: n.p.).

The social impact of a technological innovation is the main priority for Nairobi's tech entrepreneurs. The internet modem BRCK, for example, caters for internet connection during power cuts and various mobile phone apps address agricultural and health problems, especially in rural areas (Köckritz 2017). Kenyan tech entrepreneurs defy their challenging environment in which "more Africans have access to cell phone service than piped water" (Parke 2016: n.p.) and help their country leapfrog particular stages – landlines for example – and lift citizens out of poverty (Mutua and Alliy 2012: 3ff.; *The Economist* 2016). Bitange Ndemo, Kenya's former Permanent Secretary of the Ministry of Information and Technology, praised the challenges faced by many in African contexts because, he said, they offer entrepreneurial possibilities: "God has been great with Africa because he has given us too many problems. And the moment you solve one, you will succeed" (Interview, April 2017). Also, Ban Ki-Moon, the former Secretary-General of the United Nations, has no doubt that local innovative ideas will revolutionize Kenya to achieve national progress. During his visit to iHub, he predicted that innovations made in Nairobi would lead to 50 percent more national productivity than in the past and compared them to the development of steam power which revolutionized Europe (United Nations 2014).

3 Title of 2015 Hruby and Bright article.

The persistent story of the emergence of Kenya's technology development sector is told to apply for funding, to gain legitimacy, to share experiences, and to build identities, and the variety of actors and media formats that tell the story and its singularization leverage the narration's productive power. To shed light on the performative productivity of the single story, I analyze the story's narrative characteristics, and its entanglement in the master narrative of techno-scientific progress and colonial imaginations of 'an Africa'. Further, I depict its affective creation of norms regarding Kenyan technology developers, their innovations, and their users.

3.2 Heroism and its Missing Parts: The Universalization of a Partial Story

Technology developers in Nairobi are ambivalent about the constant media coverage of their work. On the one hand, the once-fascinating newness of innovative technology in Kenya legitimated the media hype but on the other, the coverage had arduous effects on their daily work. A former iHub employee stated that she understood why the emergence of the startup scene in Nairobi is fascinating:

> It was something new, a new culture that we hadn't experienced before. iHub was the first space having a very relaxed, very different feel than the other *kawaida*[4] offices. People are used to rigid structures of being at work at 8am and wearing a suit. Instead, iHub is a place where people listen to music with their iPhones as they work and where they are allowed to wear whatever they want. (Interview, March 2017)

However, one tech company founder criticized the local, regional, and international media's reporting of the story of Kenya's technology development, saying: "There are some cool Africans doing some really cool stuff and it's really normal considering the progression of the country and its various industries" (Interview, April 2017). According to her, media "sensationalize everything" (ibid.) instead of covering a story about new technologies in Kenya as an ordinary circumstance. While tech developers are annoyed by the sensationalization of their work (see Section 3.4), research has demonstrated that

4 Kiswahili for 'usual'.

sensationalizing and inflating technological promises is a major characteristic in science communication. Storytellers inflate the motivation and effects of technological endeavors because they have to convince as many actors as possible with their story (Brown et al. 2003: 3; Chapter 5).

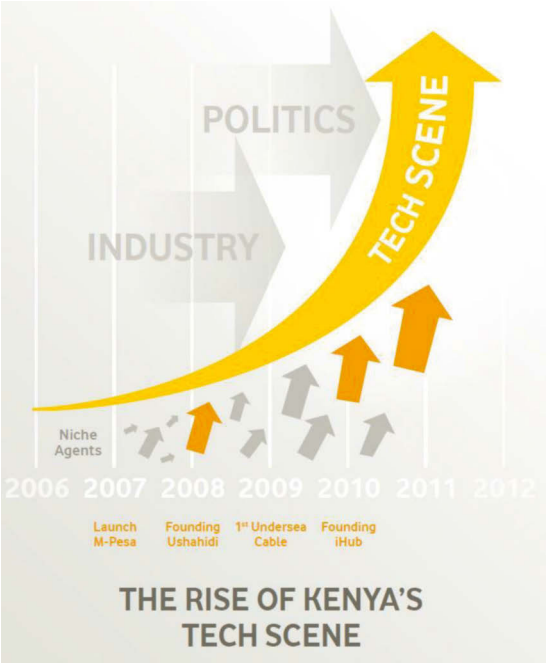
My analysis of the sensationalized story of technological innovation in the Silicon Savannah divides the narrative characteristics into presences and absences, both of which shape the story's content. The three present characteristics – linearity, heroism, and unexpectedness – and the three absent characteristics – daily life, its sometimes unmanageable challenges, and complex contextualization – are the themes that occur most frequently in the media stories and in the interviews I conducted. I conclude the story's content analysis by arguing that the narrative characteristics reproduce tech-deterministic beliefs of development based on the praise of neoliberal entrepreneurship and colonial imaginations and thus, present technology development in Nairobi as smooth labor that easily brings about societal transformation.

Presences: Linearity, Heroism, and Unexpectedness

Linearity

One striking aspect when listening to or reading the story of Nairobi's tech scene is the temporal linearity of the events that led to its establishment. Ushahidi and M-Pesa are framed as the first Kenyan innovations and, following their success, the glass fiber cable that linked the United Arab Emirates and the East African coast further boosted digital labor (Graham et al. 2015). The subsequent opening of iHub initiated the institutionalization of Nairobi's technology development scene. In this vein, Figure 3 is a perfect example of how every historical incident – for example, the introduction of M-Pesa to Kenyan mobile phone customers, the founding of Ushahidi, and infrastructural novelties such as the first undersea cable leading to East Africa – are presented as a stringent order of events that naturally led to iHub's foundation.

Figure 3: The Rise of Kenya's Tech Scene (Source: Manske 2014: 20).



The story's linearity and coherence is remarkable. Told in retrospect, whether in the form of a written story or the diagram in Figure 3, the development of Nairobi's tech scene seems to have happened as a smooth process. For example, the steady increase of startups settling close to or in the same building as iHub is referred to as "organic growth" of the tech scene (Interview, co-founder of BRCK, November 2015). Any setbacks, barriers, or other challenges that may have occurred during the early years of the technology development sector are absent from the story. Indeed, if challenges are mentioned, it is only to show how they were overcome through science and technology; for example, the reporting of violence after the 2007 election through Ushahidi, and M-Pesa as the solution to lack of access to traditional banking. Thus, the events that occurred in the tech scene are knitted together in a temporally and causally linear way to create coherence and plausibility regarding the developments in Kenya.

Heroism

The uplifting story of becoming the Silicon Savannah revolves around the "heroic plot, in which science contributes to shaping societal futures, to realizing societal values and to solving societal problems" (Felt and Fochler 2012: 6). Consequently, the story always stars a heroic technology entrepreneur and a charismatic technology which solves context-specific problems. The main heroes of the Kenyan tech story are a handful of committed individuals who founded the putative base for Nairobi's technology community: Ushahidi, iHub, and BRCK. Media accounts call Erik Hersman, the co-founder of, amongst others, iHub and BRCK, the "founding father of Kenya's tech scene" (Rybak 2019: n.p.) who "harnesses Africa's boundless spirit of innovation" (TED n.d.). And Juliana Rotich, co-founder of Ushahidi (amongst others), has been called "the face of a successful African continent" (Claus Stäcker cited in Pelz 2019: n.p.) while former German Chancellor Merkel described her as an "inspiration for countless people in Africa" (Pelz 2019: n.p.). Hersman and Rotich are both publicly depicted as pioneers who started a movement of innovative people that develop technology to solve the context-specific problems of 'Africa'. Only a few other Kenyan technology entrepreneurs are also portrayed as emancipated individual knowledge workers who are heroes and saviors within a challenging African environment. Stories about Kenya's tech scene describe them as enduring Prometheans when working for higher aims than just their own survival (see Sørensen 2008: 88).

The heroic tech developers share the spotlight with additional protagonists; namely 'charismatic' technologies that either have already conquered the Kenyan market or promise to do so. According to Morgan G. Ames (2015: 110), technologies that do not lose their auspicious promises and visions are "charismatic objects". In her research, Ames shows that charismatic power sticks to a technology "even when an object's actions do not match its promises" (ibid.). She uses the *One Laptop per Child* project in which laptops, called XOs, were to be sold to families in Latin American countries for US$100 each (at the time, the average laptop retailed for US$1000) as an example. Although the features of the XO laptop never existed or worked, for example, the initial promises of a laptop that was manually chargeable (ibid.), easily repairable, and cheap (ibid.: 112), journalists and the tech community continued to discuss and praise these features. Thus, Ames concludes that the XO laptop "embodied and performed its charisma, and the discussion around the machine amplified and perpetuated these promises" (ibid.: 110).

In the case of Kenya, technologies' charisma is made up of economic success and promises to be societally transformative: a technology or its company has to possess these attributes to be charismatic enough for media coverage. However, such examples are still rare in Nairobi, so that startups and technologies, once presented as successful by the media, seldom lose their reputation as a success model. Thus, Kenya's tech story repeatedly refers to a few chosen technologies and their companies. It "always mentions the same brands – iHub and M-Pesa, iHub and M-Pesa, iHub and M-Pesa", according to a public relations manager (Interview, March 2017). Additionally, the fact that M-Pesa is the product of a multi-national cooperation does not weaken the praise of the app as a "homegrown" Kenyan innovation (Nitsche 2019 in *Deutsche Welle*). The charisma of technologies also sticks to its inventors; for example, the founder of a once successful app is still celebrated although the company does not exist anymore (Research Diary, April 5, 2017).

Overall, the few protagonists of Nairobi's tech story not only possess a manifested success status through the repetition of their names, but also achieved this status because they became a part of the "master narrative of technoscientific progress" (Davies and Horst 2016: 33). This specific narrative brings together tech-deterministic beliefs that understand "science and technology [as an] unconditional good" for solving societal problems and, as such, form "the basis for economic prosperity and cultural enlightenment" (ibid.). Therefore, the narrative plot around heroic tech entrepreneurs and charismatic technologies that solve long-standing societal challenges in Kenya reproduces the beliefs within the master narrative of technoscientific progress.

Unexpectedness

As well as the hegemonic belief in progress through science and technology, Nairobi's tech story includes narrative characteristics that are context-specific. In particular, international media always depict technology development in Kenya as a stark contrast between a seemingly modern and a supposedly backward daily life. On the one hand, the story tells of shiny workplaces and entrepreneurial technology developers who work in a country where cashless payment is normal, where mobile phone networks function trouble-free even in the countryside, and where enormous amounts of capital flow within the real estate sector. On the other hand, it depicts a country in which the political elite is corrupt, where tribalism separates society, where people suffer from poverty, and where infrastructural deficiencies cause unbearable traffic

jams (e.g., Cessou 2018 in *Le Monde diplomatique*; Schubert 2018 in *Frankfurter Allgemeine Zeitung*; Köckritz 2017 in *DIE ZEIT*). This narrated contrast supports Barbara Czarniawska's (2004: 9) analysis that "[n]arrative thrives on the contrast between the ordinary, what is 'normal', usual, and expected, and the 'abnormal', unusual, and unexpected". In the case of Nairobi's tech story, the occurrence of technology development seems an unexpected activity in Kenya, in stark contrast to the 'normal' media coverage on Africa that focuses on disasters (see Nothias 2014).

While I was responsible for the social media accounts of a Kenyan makerspace during my working participant observation, it became clear to me why someone might be surprised to hear of technology development in an African country. During that time, I constantly looked for hashtags to broaden the audience for social media photos of the makerspace. One day, I came across the hashtag *#africanengineering* on Instagram and found that its associated pictures only showed 'improvised' fixes such as a cooling box made from a plastic box, a fan and a ventilation pipe, tools that had been repaired with duct tape or a car that had been given a loading area in the front by fixing a wooden plate on the hood (Research Diary, April 20, 2017).[5]

Eleanor Marchant (2018: 91) observes that "nothing sells a story of 'pivoting' from failure to success" better than a story about technological innovation. Aware of this, the tech scene in Cape Town consciously decided to 'improve' the storytelling about their work by using Nairobi as a role model and started to feature especially marginalized people who have been unexpectedly successful in their entrepreneurial endeavors (Pollio 2020: 2725). However, this can backfire; such 'success' stories mainly result in astonished journalists asking how a postcolonial country is able to transform into a "modern economic force" – as Kavita Philip (2016: 288) found out in the case of India's IT sector. According to her, "[p]opular global analytics … tend to deploy a model of linear transition from backward to entrepreneurial nation, narrating a development from colonial to emerging economy" (ibid.: 277) while leaving complexities aside.

5 A follow-up on the hashtag revealed that the first photo showing a digital technology was posted at the end of 2017. It was an advertisement for a dating app targeting "African working professionals". In September 2018, the first post about an innovative hardware technology celebrated a Nigerian robotics engineer who had gained support from Apple. Other hashtags used on this post included #blackengineers, #blackexcellence, and #blackmindsmatter (see Chapter 11).

In the story of Kenya's technology development sector, the teleological understanding of development is expressed through the constantly cited increasing mobile phone and internet penetration in East Africa and the heralded 'leapfrogging' of landlines (Mutua and Alliy 2012: 3ff.). Furthermore, exclamations such as "Tech changes Africa!" (Interview, public relations manager, March 2017), Kenya's entitlement to be known as the Silicon Savannah (Hruby and Bright 2015), and the comparison of Kenyan innovations with the effects of steam power in Europe (United Nations 2014) entangle Kenya's technology development sector in Western historiography. As such, the narrative characteristic of unexpectedness and wonder positions Kenya within an understanding of progress that is teleologically oriented towards the economic development of industrialized countries and, therefore, causes the alignment of development agendas along European (and East Asian) role models (see Chapter 2).

Overall, the single story transforms putative facts about daily life in Kenya into perceivable emotions, such as wonder, in order to engage and affect the story's audience. In this regard, the tech scene's context is depicted as a contrast between two spheres – the modern and the backward. This simplification and homogenization of Kenyan daily lives is an example of how storytelling is involved in "global coloniality" (Ndlovu-Gatsheni 2014: 182) which predominantly describes African contexts through absences, lacks, and "nothingness" (Mbembe 2001: 10). The still existing colonial power asymmetries also determine how stories about science and technology in Kenya are told: "[P]ositive futures [can only be envisioned] as an antithesis to the perceived present deficiencies and backwardness" (Müller-Mahn 2020: 157).

Absences: Daily (Work) Life and its Complexities

Causal and temporal linearity, heroic protagonists, and affective unexpectedness are the most visible narrative characteristics of Kenya's tech story. However, to analyze the normativity of stories it is also important to consider what is missing from the story in order to understand in what way streamlining occurs.

As mentioned above, the challenges of entrepreneurs or organizations are only told in retrospect if they were managed well. In this vein, a Kenyan technology journalist told me that most media coverage "take[s] away the flesh of the story" because, even when they do acknowledge the existence of challenges, they fail to state that the downside of entrepreneurial work is probably more

prevalent than its upside (Interview, April 2017).[6] The rare and superficial references to challenges cause the narrative deletion of the technology developers' feelings. In this regard, Avle et al. (2017: 476) claim that the "bodily and viscerally-felt dimension of technology production" is absent from technologies' success stories. They refer to the daily life of a Ghanaian entrepreneur to illustrate the kind of work not mentioned in media stories:

> [He] described how doing everyday things like visiting prospective clients was a physically laborious process, one that required doing things like queuing, walking under a hot sun, sitting long hours in traffic etc. on top of contending with bureaucratic issues and business culture that made negotiations protracted. (ibid.)

Personal experiences that characterize entrepreneurship and knowledge production, such as stress, routine work, and timeframes that are "notoriously behind schedule" (Felt and Fochler 2012: 8), are neither told nor problematized publicly. Instead, labor and its conditions are relegated to the background of Nairobi's tech story while creativity and knowledge are celebrated as abundant resources that flow naturally. Making "capital dance" (Sørensen 2008: 91) is presented as happening automatically without having to put much effort into the work of technology development.

It is not only the difficult and strenuous daily working conditions that are absent from Nairobi's tech story, but also the existence of companies that "just want to make money" without necessarily "changing Africa" with their product (Interview, public relations manager, March 2017). Two technology experts expounded:

> Joseph: The startups that get hyped in the news, they are very few. The guys who are actually doing the proper work on the ground, you know, doing a lot of profits with viable businesses, you will hardly ever hear about them. … They are quietly doing their thing and making lots of money. You don't hear the stories of successful tech companies that are able to build their five-story office building with their own money.
> Glory: They don't have that sexy ring to their business and they don't consider

6 Chapter 5 depicts the differences between Kenyan tech development that strives to be perfect and challenge-free and Silicon Valley's maker ethos that celebrates the benefits of failures, such as failing prototypes, failing business ideas, and failing companies in general.

> themselves as startups but as *watu wa biashara*.[7] Those guys are actually the ones who make the major changes in the ecosystem although you never hear about them. (Interview, March 2017)

It is not entirely the journalists' fault that they cover neither discomforting working conditions nor businesses without a charismatic promise of social impact. According to John Law (1994: 156), everyday life simply does not fit into streamlined and heroic stories because most of the stories' audiences only take/have the time for a quick overview of the issues that are relevant for them. He illustrates the deletion of everyday life with the following question: Do stories "talk of heroes and villains: of Little Red Riding Hood and the Big Bad Wolf … [o]r … heroes [who] are effaced in due process, in duties and legalities?" (ibid.: 150).

In Nairobi's tech scene, where stories are produced and performed to gain legitimacy and build identities (see Chapters 4, 5, and 6), both emotional daily life and the broader contexts of entrepreneurial work are stripped away from the singularized story. In this respect, a tech expert criticized the fact that neither the political nor the historical context of why a technology became successful are covered. He explained that Ushahidi only became successful because of the specific circumstances in Kenya at the time of its release. In his opinion, the only reason the software gained so much attention during and after the post-election violence in 2007–2008 was because Kenyan radio and TV were not broadcasting as usual. According to him, Ushahidi "came up in a vacuum" that provided the opportunity for its success (Interview, April 2017). As such, the fact that "success is contextual" (ibid.) is missing from the tech scene's story.

In summary, my analysis of the presences and absences in the founding story of Kenya's tech scene results in the insight that the story manifests an understanding of technology development as a teleological process of societal development. The narrative characteristics of linear and heroic transformation reproduce the tech-deterministic convictions of the master narrative of technoscientific progress. Technology is assumed to be an apolitical and ahistorical tool that inevitably improves human life (Cherlet 2014: 775; Dickel and Schrape 2017: 53). I argue that the tech story positions Kenya in postcolonial development narratives due to its combination of technology's portrayal as modern and progressive and the narration of the unexpectedness of Kenyan technology development. In this manner, heroic technology developers and charis-

7 Kiswahili for 'business people'.

matic technologies are depicted as 'saving Africa'. Overall, the story's analysis has shown that Western technoscientific norms and colonial imaginations serve as universal ideologies to narratively establish plausibility and legitimacy for technological endeavors in Nairobi.

3.3 Precarity and Exoticization: The Narrative Production of Norms and Affects

Developing the argument of a story's impact further, this section examines how the totalizing narration regarding Kenya's tech scene affects its audiences and materializes norms. In general, stories about technological endeavors have to emotionalize their audiences in order to stimulate actions by investors, governments, and engineers who should be interpellated to work for national goals. To achieve such an affective call to action, Sarah R. Davies and Maja Horst (2016: 142) claim that technological promises have to be carefully constructed:

> On the one hand, they have to be concrete and convincing enough that they can be used as a reason for making particular actions and decisions in the present (such as allocating special funding). On the other hand, they have to be somewhat vague or fragile so that we understand that these technological opportunities will not arrive without investment or dedicated resources.

The following analysis shows that the continuous reproduction and circulation of Kenya's tech story increases its "affective value" (Ahmed 2004b: 120) while creating powerful affective "attachments to normative (and often precarious) working conditions" (Cockayne 2016: 458). However, the affective story not only encourages tech developers to accept or even celebrate their precarity, it also evokes pressure, anxiety, and anger about having to act according to global norms and Western imaginations of what constitutes being a Kenyan tech entrepreneur. Based on ethnographic data, I shed light on the performative productivity of Kenya's tech story and expose the specific norms and affects that shape how Kenyan technology developers and their technologies act, feel, and work.

Heroism and Linearity as Drivers of Responsibilization

The overarching single story celebrates Kenyan technology entrepreneurs as heroes who work within a challenging African environment by using their creativity to combat long-standing problems and, as such, support national progress – be that in economic or societal terms. The effects of this narrated heroism and the above-described teleology of development are manifold and ambivalent for Kenyan tech entrepreneurs. Positively connoted feelings such as excitement and passion mix with uncomfortable emotions such as anxiety and the feeling of pressure. This ambivalence in affects appears characteristic for working environments in which 'success' and self-fulfillment are primary goals (see Ahmed 2010; Armano and Murgia 2013).

In almost every one of my conversations with tech entrepreneurs, I heard statements such as "My projects were my life" (Interview, former tech hub employee, March 2017), "Work has to be uncomfortable to gain progress" (Interview, mechanical lead at makerspace, April 2017) and "He is always performing; going to bed at 3am and waking up early" (Research Diary, April 28, 2017). These statements teem with sacrifice and show that work is the highest priority in the entrepreneurs' lives – often without any criticism of their strenuous working conditions. In this manner, most startups cherish their flexible work and creative workplaces that are visited by celebrities such as Mark Zuckerberg and Ban-Ki Moon. In addition to the heroic celebration of tech entrepreneurship, the linear story of Nairobi's tech scene and the widely circulated manuals of how to be a tech entrepreneur, mockingly titled by my interview partner as, for example, "'Five Things to Do to Get Investment', [or] 'Two Things You Have to Do if You Want to Start a Co-Working Place'" (Interview, technology journalist, April 2017), convey an image of tech entrepreneurship as easy. These, invariably positive, accounts prevent (challenging) experiences from being told publicly. A tech expert explained:

> A lot of people fall for the hype, the whole glamour thing, you know, the press thing. You get coverage, you speak about your thing, you go to conferences, but your business is suffering and you won't admit it openly. Because you have to keep up appearances and say, "We are killing it!" and "We are working 20 hours a day which is a fantastic thing! We only sleep for four hours a day. That's us!" (Interview, April 2017)

The media absence of stresses and strains involved normalizes knowledge workers' precarity. This normalization is not only a Kenyan issue, but a global phenomenon that has been widely discussed in academia (Anwar and Graham 2021; Brophy 2006; Cockayne 2016; de Peuter 2011; Lorey 2006). Interpreting this specific storytelling and normalization using Ahmed's analysis of the "subtle affective mechanisms" of happiness (Ahmed in Schmitz and Ahmed 2014: 103), we see that the positive heroic narrations of Kenya's tech story encourage its readers and protagonists to follow a promising path of self-fulfillment. According to Ahmed, affirmative sentences such as "I just want you to be happy, so do this, do that" (ibid.) do not explicitly prohibit any action, but subtly influence people to feel that a certain path is the best (and happiest) way to follow.

In the case of Kenya's tech scene, the subtle affective encouragements to work entrepreneurially have various effects: "People make decisions without having full information. I see people saying spontaneously: 'Let's come over and do a startup'" (Interview, tech journalist, April 2017). This means that the hyped stories on science, technology, and innovation cause a business mentality of "lets do anything and see what sticks" instead of "lets have a plan" (Interview, former tech hub employee, March 2017). Technologists who have been in the tech scene for a while problematize this way of working. They criticize startups that try their luck with every interesting business idea they have and constantly attend competitions hoping to win prize money. Focusing on winning money means that:

> you do not have time to actually build a working product. There is nothing wrong with selling your story, but at the end of the day it's less about the story, it's about what product you have produced; if it works and if it is scalable and viable. (Interview, freelancer, March 2017)

The narrated excitement, smoothness, and linearity of knowledge work not only leads to uninformed business decisions, but also incorrect assumptions about the timescales involved in the making of a technology. These include the assumption that the development of a new technology is a fast process. Non-engineers often approach makerspaces to ask for support in materializing their idea. Usually, they tell the makers about their wishes and imagination with the expectation that they will deliver a final product within two days. These expectations annoy the makerspace members because they are supposed to be "geniuses" who are able to defy the reiterative process of building tech-

nologies (Interview, mechanical lead at makerspace, April 2017). The underlying "Myth of the Lonely Only Entrepreneur" (Schoonhoven and Romanelli 2001: 385) imagines technology development as moments of genius ideas which entrepreneurs can implement and build smoothly without any substantial challenges. Although the "larger than life image" feels flattering (Interview, freelancer, March 2017), it becomes problematic when it results in unrealistic expectations within business relations. Overall, the narrative characteristics of linearity and smoothness in the story of Kenya's tech scene and the absence of daily (challenging) working conditions put pressure on technology developers to work quickly and flexibly in order to meet the normative imagination of brilliant and inventive entrepreneurs.

Another factor that puts pressure on tech developers is that the single story celebrates their technologies as transformative. As Kenyan tech developers gain the opportunity to think about their technological ideas, they also feel "the societal obligation to deliver" the solutions promised by tech stories (Brown et al. 2003: 5). In this regard, the recurring references to structural crises and poverty in Kenya prompt the necessity of revolutionary technology. In particular, the depiction of Ushahidi tells of great social impact and successful scaling: the software is now used in over 120 countries and by about 20 million people (Interview, co-founder of Ushahidi, April 2017). This ubiquitous success story makes numerous actors like those that invest in Kenya impatient for the next technological success (Interview, tech expert, November 2015; Marchant 2018: 140). Therefore, most technology developers in Nairobi feel under pressure as they are expected to innovate "biiiiiiig things, although normally you make baby steps" when developing a new technology (Interview, former Permanent Secretary of the Ministry of Information and Technology, April 2017). As there has been no new candidate to generate a media frenzy since M-Pesa, Ushahidi, and BRCK, the former Permanent Secretary of the Ministry of Information and Technology hopes that "another success like M-Pesa" will come soon (ibid.), so that tech entrepreneurs are (temporarily) relieved of the pressure to deliver success stories.

To sum up, the single story produces powerful norms and ambivalent affects. The linearity of technological work and the absence of labor conditions within the story create an image of a smooth entrepreneurial work life in which technologists are fast-working geniuses who embrace the flexibility of creative work. Additionally, the heroic portrayal of a few technology developers who are celebrated as 'saving Africa' with their technology set the norm for technology to come: it should foster national progress. Therefore, the normative story re-

sults in the responsibilization of technology developers to change their contexts into better worlds and thus, to work for higher aims than just running a normal business. Further, this responsibilization and normativity evoke ambivalent emotions. Kenyan tech developers feel excited and self-fulfilled, yet at the same time, they feel anxious and pressured to live up to the imagined tech worker.

Wonder and Unexpectedness as Drivers of Exoticization

As analyzed above, the story about technology development in Kenya revolves around a stark contrast. The tech scene and digital technologies in general are contrasted with 'Afro-pessimistic' accounts of political, infrastructural, and societal challenges. The results of this narration are wonder at the unexpectedness of finding "a good thing" such as the existence of high-tech developers in Kenya (Interview, tech journalist, April 2017). The narrative characteristic of unexpectedness, mainly used by international media, results in absurdities as recounted by a laughing iHub employee:

> Even now during the relocation of iHub, people come and say 'Oh my god, that's iHub! This place is so amazing!' And I am like: 'Those people are looking at bags of cement…' (Interview, March 2017)

The employee wondered why international visitors are amazed by a construction site and criticized, like many other people working in the tech sector, the "narrative that Western media has of tech in Kenya" (ibid.). As depicted in the story recounted in Section 3.2, Kenya's tech story includes the comparison of the number of smartphones with the number of leopards or toothbrushes in Africa to show that digital devices are important and numerous on the African continent. A Kenyan tech journalist furiously attacked these comparisons:

> Why do you need to compare mobile phones with toothbrushes or toilets for you to create content?! It's the whole thing of portrayal, projection, and how people speak about Africa and Africans. (Interview, April 2017)

The narrated astonishment at Kenya's technology development sector and the resulting framing of "new postcolonial technopolitics" into "familiar colonial frames" (Philip 2016: 277) have made technology developers feel that they are

not taken "seriously as a viable business but seen as an NGO that is changing Africa with new technologies" (Interview, iHub employee, March 2017).

Contrasting Afro-pessimism with technology development and the silencing of daily life create an *exoticization* of Kenyan technology developers, the technologies and their users. In this regard, the usage of the buzz phrase 'Silicon Savannah' to describe Kenya without any further context of the actual work being done is commonly criticized:

> Calling us Silicon Savannah is ridiculous, I think. Silicon Valley is called Silicon Valley because they used to make silicon chips there.... And until now, we have never made silicon chips here.... And I think by calling us Silicon Savannah, you ignore some of the important appreciable differences of a local, contextual thing. We are not just a Silicon Valley 2.0! (Interview, intellectual property law expert, April 2017)

The attempt to contextualize Nairobi's tech scene has exoticizing effects. Labelling Kenya's technology scene as the Silicon Savannah and expressing wonder about knowledge production in an African country produce "a reductive and fantasized vision – caught between colonial imagination and neoliberalism – of what Africa is, and what it means to be African" (Nothias 2014: 335). This means that the neoliberal responsibilization of tech entrepreneurs to solve long-standing societal problems merges with the colonial trajectories that exoticize technology made in Kenya (see Chapter 4). The affective narrations of unexpectedness and the recurring contextualization of technology development with infrastructural disasters or nature images demonstrate that affectivity is linked to historicity (see Ahmed 2004b: 120). Thus, the historical path dependencies of colonialism stick to the narrative characteristics of Kenya's tech story.

I argue that the colonially-stained story positions Kenya as a global *other* of technology development by assuming that it has different needs and motivations from the 'usual places' of technoscientific knowledge production. This exoticizing *othering* affects technology developers materially and bodily. They feel[8] that they have to build technology that exclusively caters for the needs of customers who are marginalized – and in the context of Kenya's tech scene, this

8 The obligation to build impact technologies is not only a feeling: Chapter 6 shows that tech entrepreneurs are also *materially* limited in developing such technologies due to the amount of funding available.

customer group consists mainly of rural farmers and people in need of health care. Hence, the revolutionary language around technoscience and the colonial imaginations about a place on the African continent set the norm for innovating 'technology for good' – and therefore narrow the possibilities of what technology to build. Technology is only valued as innovative and successful if it has a social impact that has already been agreed on by development agendas. Consequently, it is not only the international media that exoticizes Kenya's tech context; having seen that they achieve more funding and support when reproducing the colonial imaginations of Western actors means that local storytellers copy the international ones (see Chapter 6).

3.4 Conclusion: A Narrative Closure of Kenyan Technology Development

Although the media hype around the so-called Silicon Savannah mobilizes investment, governmental support, and committed engineers to develop a local tech community, many tech developers articulate a feeling of deep insecurity about whether they are working in a hyped bubble. "The fear of illusion" (Interview, tech journalist, April 2017) is evoked by the singularized Kenyan tech story because, according to a tech hub employee, "[i]t's dangerous when you are not able to distinguish what's fluff and what's real. … The story can be fine, the story can be fantastic, but when you clear the story, what can you actually see?" (Interview, March 2017). As Kenya's tech story does not include any details of entrepreneurial challenges, it evokes the desire for research insights, such as a "database on startups to have a full picture of what is happening on the ground" (ibid.). A Kenyan tech researcher observed that the only insight that the largest Kenyan tech hub publishes is the number of their members and startups:

> Fine, we have a number of members, but so what? What does this number do? The questions that should be asked are about the activities of members and startups. What are they doing at the tech hub? Where are the companies after their time at the hub? Are they making money? You can't just say we have a thousand companies who have passed through our tech hub. So what? There are more who passed through Java [a popular coffee shop chain]. (Interview, March 2017)

Many entrepreneurs criticize the tech scene's focus on storytelling because they feel that the hyped story makes their daily work more difficult as, often, they are not able to meet the expectations of the story's audience as well as their own responsibilities (see also Marchant 2018: 140).

To recap, this chapter has analyzed how a partial story is narrated in a totalizing way and the normative and affective effects that the singularized story about Nairobi's tech scene has on the people working there. Thus, the story is only a partial representation of the people, workplaces, and technologies, yet it still 'matters' (Cameron 2012: 586) as it produces affects and norms of how to work entrepreneurially and develop technology in postcolonial Kenya. Concretely, this means that the narrative characteristics of linearity and heroism and the absence of the daily life of tech workers depict a (false) image of a smooth entrepreneurial work life. Additionally, the depiction of heroic technology developers and charismatic technologies that 'save Africa' reproduce the tech-deterministic convictions of the master narrative of technoscientific progress, namely that technoscience always leads to economic progress and positive societal change. Unexpectedness was also revealed as another narrative characteristic of the single story. The narrated surprise about technological work in a country that is more known for depressing Afro-pessimist narrations of natural catastrophes, poverty, and political corruption signifies the 'global coloniality' that is inherent in media stories about technology. Overall, the analyzed story uses Western teleology and colonial imaginations as hegemonic ideologies to establish plausibility and legitimacy for technological endeavors in Nairobi.

Furthermore, I have argued that the singularization of Kenya's tech story makes technology developers and their innovations affectively comply with the norms of technoscientific progress and teleological societal development. The chapter emphasized that technology developers in Kenya are supposed to work quickly and flexibly, like mythologized and globally heralded innovative geniuses, and their innovations have to foster Kenya's progress by solving long-standing societal problems. Moreover, as societal problems are defined by development agendas, the prospective users of new technologies should be marginalized communities, especially the rural poor. The heroic and charismatic depiction of tech entrepreneurs and their innovations evoke feelings of excitement and self-fulfillment among often precariously situated tech developers. It also creates pressure to act according to global norms while at the same time evoking anger about imaginations that do not treat Kenyan developers as equals to other technology developers globally.

Altogether, the analysis of the mediatized story has brought to the fore that narrative totalization is achieved by stories that refer to master narratives possessing a hegemonic position. Technoscientific progress and the teleology of societal development responsibilize technology developers to solve structural problems and exoticize technology made in Kenya. As such, the streamlined story materializes norms and circulates affects that narrow the possibilities of technology developers and their technologies. The story 'narratively closes' (McNamara 2017: 272) Kenya's global positionality into an *other* of technocapitalism and pushes its tech entrepreneurs into the inevitability of societal development through technoscience.[9]

9 Ouma et al. (2019: 351) criticize the modernist assumptions of current discourses on technology because their teleological understanding of a country's development is a reason for the capitalist continuation of power asymmetries and the assumption of technology being apolitical. See Section 4.4 for more criticism of tech-deterministic development agendas.

Chapter 4
Tangible Tech Stories – The Embodied Performances of Visitor Tours

> Just landed in Nairobi! I'm here to meet with entrepreneurs and developers, and to learn about mobile money – where Kenya is the world leader.

So posted Mark Zuckerberg on his Facebook page when he arrived in Nairobi to pay a day visit to its tech workplaces and startups (Macharia 2016: n.p.). Zuckerberg's short trip to Kenya's tech scene in August 2016 made it clear that Nairobi's reputation as a place of tech innovation had reached the top level of global tech gurus. Famous technology entrepreneurs were not the only people to visit Nairobi; politicians, donor agency representatives, international investors "interested in … an 'untapped' consumer base … [in] African markets" (Marchant 2014: 18), tourists who had booked a "Get to Know Kenyan Startups" tour on Airbnb, and students from Kenya and other parts of the world who wanted to get a first-hand impression of the latest Kenyan technologies also flocked in. The number of visits to workplaces such as the iHub and Gearbox was tremendous; my research diary documents people visiting these places on every single day of my research stays. This influx of visitors confirms that Nairobi is a center of global attention and role model for technology development on the African continent. It also means that hosting visitors and guiding them through the workplaces is part of the everyday life of Kenyan technology developers.

The tech scene in Nairobi is clustered in a few buildings and city districts, so that a visitor tour usually consists of walking through the whole building, being shown various workplaces and startups while listening to the story of their beginnings, goals, and achievements. The visitor guides are company or co-working space employees and sometimes members of the workplaces are asked to pitch their current projects to the visitors. The visitors usually do not

come alone, but in groups of three to ten, although occasionally singletons or large groups of 15–20 people also tour. As depicted above, the visitors' backgrounds and interests are manifold, but they all have two things in common: they usually come well equipped with cameras or smartphones and have little prior knowledge about Nairobi's tech scene.

Hosting visitors is a regular act for innovative co-working spaces all over the world. Their managers and members foster a global ethos of tech communities that support each other by sharing knowledge. For this reason, the doors of Nairobi's creative workplaces are left open, so that everyone is able to wander around, enter (almost) every room, and approach people and fabrication tools in order to chat and experiment with them.[1] For one user-experience (UX) designer I interviewed, the possibility for anyone to enter the workplaces of technology developers signifies the "culture of openness" celebrated in tech communities all over the world (Interview, November 2015). He stated that leaving the doors open is a non-hierarchical way of sharing knowledge and that it makes up the "DNA of Nairobi's tech community" (ibid.). When I asked him if the researchers and journalists who frequently come in and ask questions annoy him, he assured me that the benefit of learning from each other's mistakes and experiences offset the unpaid and time-intensive work of sharing knowledge with visitors.

Like this UX designer, many emphasize that the iHub, in particular, revolves around visions of "collaboration, openness, community, creativity, and diversity" (Friederici 2019: 194). Kenyan tech developers appreciate the "central values of openness and collaboration" in the technology sector, as they are not typical values of other organizations in the country (Interview, serial founder, April 2017). In this respect, a former iHub member remembered the tech hub as "fantastic and collaborative" because he could walk around the co-working space and ask for help when faced with a problem he could not solve himself: "there was a lot of synergy and comradery" (Interview, April 2017). An electrical engineer also emphasized that the existence of a hardware innovation community was encouraging: "There is a perception of hardware being hard. But the more you are in the community, the less hard it is" (Interview, May 2016).

The conviction that knowledge is a freely available and collectively shared good is a central part of the global maker ethos. In Kenya's tech scene, this

1 Knowledge is not only shared in analogue forms; a large amount is also shared digitally via platforms such as GitHub, where makers and coders share their projects transparently on a global level.

global ethos gets a 'local' touch: one designer claimed that in Nairobi, "technology has started to restore Ubuntu, [so that] these days people are concerned about working together; every morning you are on Twitter and saying hello to the community" (Nyamweya interviewed in Bristow 2017: 287). Referring to the philosophy of *Ubuntu*, the designer pointed to a difference between Kenya and tech scenes outside of Sub-Saharan Africa. Ubuntu stands for "I am because you are" (Stassen interviewed in Kohtala et al. 2020: 139) and understands life as ontologically relational (Escobar 2015: 341). As such, the designer argued that the Kenyan tech developers' care for each other is contrary to the society of capitalist modernity (ibid.). Along this line, a startup founder explained that developers are aware of working and living in a network and therefore prioritize the community's well-being:

> That's probably different from Europe or the US where people are a little bit more competitive and want to keep things to themselves – they don't want to share, so they don't share investors. I feel like, people here see it more like a win for Nairobi or Kenya to get someone to invest. So, we know a lot of other startups that recommend investors or pass them around our way. There is a lot of openness and collaboration, which is quite nice. (Interview, April 2017)

This quote makes it clear that entrepreneurial success is understood as a collective endeavor. Tech entrepreneurs share their investors because they care about other startups, innovative workplaces, and developers, and do not draw a line between their own and another's business. In this vein, a hardware company founder described Nairobi's tech developers as a "community of technologists and entrepreneurs that are collectively committed to seeing each other being successful and to seeing [the] country prosper from the success of these enterprises" (Interview, November 2015).[2]

Against the background of this context-specific ideology of sharing, co-working spaces serve as support structures in which entrepreneurs care for their broader community. Thus, the guiding of visitors through technology development workplaces is an important tool to convince investors of the value of technological ideas, startups, and co-working spaces. Once convinced, the investors function as a shared asset:

2 As well as the care for the community's entrepreneurial success through sharing knowledge, investors, and publicity, Section 6.4 shows that Kenyan tech developers also care about their broader environment by establishing almost exclusively social enterprises.

> We rent space from this makerspace. It's been a nice story of both companies growing and trying to help each other out. When we have visitors and investors coming around, we also tell them about the great space we are in and how it needs additional help and funding to create a better ecosystem. (Interview, startup founder, April 2017)

In the following, I claim that guiding visitors is a highly affective and embodied storytelling practice; tech developers guide visitors because of their care for the tech community as well as their fear of not surviving in tech entrepreneurship. As such, they aim to rework Kenya's positionality as a place of technology development by strengthening the local community of technology developers and by attracting investors to support technology innovation. Therefore, visitor guides (have to) convince, particularly financially affluent, visitors of the worth of the technological ideas, startups, and workplaces that they see. This usually works through making Nairobi's media tech story (see Chapter 3) comprehensible to the incoming visitors by letting them wander through open doors in order to experience the places where entrepreneurs work, touch machines, and hear about tech projects. Due to the need to secure money from visiting investors, the guiding tech developers perform their work as a touristic event in which Kenya's tech story is staged according to the visitors' (often discriminatory) imaginations and technoscientific beliefs. In this regard, technology developers, workplaces, and technologies are turned into watchable touristic objects. In this chapter, I first argue that the daily visitor tours 'script' the workplaces, bodies, and technologies along the narrative characteristics of the single story analyzed in Chapter 3. This means that the guided tours performatively materialize and embody the technoscientific and exoticizing norms of how to tell stories about technology development in Kenya. Second, I shed light on the affects and effects of leaving the workplace doors open and reveal the extent to which tech developers feel disturbed when treated as touristic objects.

4.1 Visitor Tours as Touristic Events

The story of Nairobi's tech scene is told by media outlets (see Chapter 3), but is also enacted by members of co-working spaces while giving tours to visitors. The following vignette merges several research diary excerpts from 2015 to 2016 and shows how visitors are guided through the Magua Bishop Building, the location of iHub, Gearbox, and many other tech startups at that time.

Attention should be paid to the affective performance of technoscientific storytelling norms and discriminating imaginations of Kenya.

A Guided Tour through Nairobi's Tech Spaces

Four design students and two professors from a British university follow Peter to the fourth floor of the Magua Bishop Building. He starts his introduction in front of iHub's door, mentioning the post-election violence in Kenya in 2007–2008 and how Ushahidi was developed in a Java Coffee shop until Ushahidi became popular and founded iHub. After these preliminary words, the visitor group enters iHub's co-working space, greeted by murmurs, the smell of coffee, and John, the space manager. They see that the co-working space is full of tables, green chairs, a sofa corner, and last, but not least, a tabletop soccer game, a seeming fixture in any co-working space around the world. Slowly, the six visitors wander around between the tables of people who are hunched over their laptops – coding, writing, or watching YouTube videos.

After a couple of minutes, Peter leads the group downstairs to the third floor where Microsoft and some mobile app startups have offices. Moving on to the second floor, that has more attractions for these visitors, the group laughs about a poster on the wall saying "In case of fire, please leave the building before posting it to social media". As well as the tech hub's research and consultancy department that Peter describes briefly, the first makerspace in Kenya, Gearbox, and the BRCK office are here. In front of BRCK's door, Peter explains how the BRCK team developed a mobile modem because Ushahidi had problems with stable power access 'back then'. Thus, they built a robust modem with its own battery. As he starts to talk about BRCK's latest project, he runs into the office to ask if the group can look at the products. He returns and gives the group a sign to enter. "Wow! This place is spacious and looks 100 percent like a creative workplace in the US!" exclaims one of the visiting students. The group gathers around Peter, who shows them a BRCK. Behind them is a wall bearing the slogan, "You can do hard things". Peter explains that the BRCK has been shipped to Rwanda, South Africa, and the USA amongst others and that it is already available almost everywhere in Kenya.

The next stop is Gearbox – the reason the design students and professors travelled from Britain to Nairobi. Peter shows the visitor group the computer space with numerous makers working on their digital models, the PCB production machines, the laser cutter, and 3D printers. The visitors are amazed and constantly marvel at the fact that a makerspace in Kenya is better

equipped than theirs at a British university. Using their cameras and smartphones, they take many photos. Peter asks a makerspace member to show the visitors around and explain the machines. After the introduction to various machines, including a CNC machine, welding machine, and wood saws, Peter guides the group out of the workplace again and downstairs.

Without stopping, Peter says "That's the first floor" and leads the group down to the ground floor without mentioning the various other (non-tech) businesses and offices in the building. At the User-Experience (UX) lab, an employee stands up and presents the lab and design thinking basics, even though he knows that the visitors are product design students and probably already know the basics of UX. After this short visit, the visitors encounter another nuance of a visitor tour at workplaces: Peter asks a woman to say something about their charity organization, but she just answers 'deadline' without looking up from her laptop and points to her seated neighbor. He rolls his eyes, sighs, and starts to talk.

The final stop is Pete's – the famous coffee and burrito café in the building, which is said to be the place where the real innovations happen. While drinking refreshing juice and coffee, the visitors exchange their newly gained impressions. (Research Diary, November 2015; June 2016; July 2016)

The vignette shows that visitor guides perform a tangible and thus, perceivable tech story by allowing guests to walk around workplaces of technology development, to watch people and machines at work, to hear people talk about their ideas, and to eat/drink where every Kenyan tech developer supposedly eats, thinks, and networks.[3] Delving into the tastes, smells, and sounds of the tech developers' daily lives lets the visitors experience what the work of technology development is (supposedly) like in Kenya.

In particular, visitors from the USA, UK, and Germany exclaim in amazement and wonder during their visits to Nairobi's tech scene. They compare the interior design of the workplaces to the look of creative co-working spaces in their home countries, express astonishment at the fact that the workplaces are better equipped than their own, and marvel at the sheer existence of a tech scene in Kenya. The continuous utterance of wonder about Kenya's technology

3 The rumor that all innovations actually happen at Pete's persists, even though the casual staff and members of co-working spaces only rarely eat lunch there, because Pete's is more expensive than the restaurants serving local food nearby.

development sector and its unexpected comparability to the places of high-tech work in the Global North cause many Kenyan technology developers to assume that colonial stereotypes frame the visits of (white) visitors. According to an iHub employee, "white visitors" are fascinated by merely "see[ing] young African techies working on their computers building a great app" (Interview, March 2017). Often, my research partners expressed the feeling that the majority of their visitors had "no real interest" because the (exotic) event character of visiting a place that does not exist in Western histories of technology was more important to them than hearing a detailed story (Interview, former tech hub employee, March 2017). Thus, the employees who show visitors around assume that "white visitors" are merely looking for confirmation of the story that they have already read from afar:

> It's so easy to give out the same story of what iHub is, because that's what most white people are looking for when they come. You don't need to delve further into what projects you do. I remember talking about projects that we did yeeeeeeaaaaaars ago. They were like 'Wow! That's so cool, man!' No one will ask what YOU do. They don't really care; they don't want to know about us – they just want to know that some cool projects have been done in Africa. … They want a tour, the same thing that is on the BBC, but this time it's told by someone who works there. … They won't ask any hard questions. So, for me, that's less time away from my work and I take five minutes to take them up and down. Fine. (ibid.)

The interviewee was angry and sad that the visitors she guided around did not ask questions about her, her work, motivation, and education. She perceived the visitors' amazement about a depersonalized story of "cool projects in Africa" as offensive and based on discriminatory imaginations of 'an Africa'. The lack of interest in stories that deviate from media reports is reminiscent of tourist events in which contexts in countries of the Global South are specifically staged for "the interests of the metropolitan center", that is Western travelers (d'Hauteserre 2004: 238). In this light, tourism studies scholars claim that Western tourists perceive African contexts as the imagined "myth of Africa" that "hinges on time-honored stereotypes of Africa as an exotic, receptive, timeless space, a *tabula rasa* waiting to be filled by the imperialist imagination" (van Eeden 2004: 21).

4.2 Scripted Stories Script Nairobi's Tech Places

The more visitor tours I watched, participated in, and gave during the three years of my empirical research, the stranger it seemed to me that the story of Nairobi's tech scene stayed the same during these tours. Why did every guide tell the same story? In the quote above, the tech developer explains that giving tours is an unsatisfying task. The negative emotions evoked by the interaction with (white) visitors made her conduct the tours as quickly as possible. Performing the tour swiftly and scripting its content are strategies to survive the unpleasant duty of giving tours, as other former tech hub employees told me:

> All newbies had to do tours. So, if you just joined, you had to give a tour. Not just 'a' tour: you had to do tours for a couple of weeks until the next person joined. So, you were told what you should say and what the tech hub is and then you repeat that to all the visitors coming. So, you are going over and over and over and over and over again. (Interview, March 2017)

> The reason why people at the tech hub will show and tell you the same rehearsed version of its story is because it's a survival thing. You do it over and over again. So, you don't want to do it again. So, when people come and ask you to do a visitor tour, you just do it as a formality and the quickest way possible. You go for the default story. (Interview, April 2017)

The repeated story becomes a script – 'a default story' – that annoys and bores the visitor guides, but was a condition of keeping their jobs.[4] The guide who gave the visitor tour I referred to most in the vignette replied to my compliment of giving the perfect visitor tour, that there was no choice in doing them: "you have to give tours" (Research Diary, June 30, 2016).

The scripting of the tours causes the stabilization of Nairobi's tech story.[5] As such, the vignette shows strikingly that visitor tours materially and bodily perform the singularized media story analyzed in Chapter 3. During the tours,

4 Interviews by visiting researchers and journalists also seemed to proceed in a scripted way. A management studies researcher told me that her interviewees had asked her if she could get the audio recordings of a researcher who had been there the week before instead of interviewing them again (Research Diary, November 23, 2015).

5 Not least because journalists and researchers who write about Nairobi's technology sector also acquire their knowledge through guided tours, spreading their content through media and academia to a broader audience.

the absences and presences of the story's content are enacted by stopping only at certain places in the Magua Bishop Building while leaving others out. As such, visitor guides enact the technoscientific norms of mentioning only successful companies, products, and workplaces, and concealing personal and alternative stories (see Chapter 3). They reproduce the linear establishment of Nairobi's tech scene, which is a main characteristic of the mediatized story, by starting at the top of the building where iHub's co-working space was located. From there, the guide leads the visitors through the workplaces, along the same linear story about events and successful companies that led to the emergence of Nairobi's tech scene. Additionally, the story's characteristics of focusing on success stories and hard numbers while eliminating daily life challenges are also part of the visitor tours:

> You stick to your script and say 'Yeah, it's all good!' I talk about this project, this project, and this project that help people. Don't forget to throw out big numbers: 'Hey, we have 16,000 members! We have done 20M+ in funding!' (Interview, former tech hub employee, March 2017)

As illustrated in the previous chapter, the presence of success, numbers, and linearity leaves little space for alternative stories. In the case of visitor tours, we learn from the vignette that no tour guide mentions the other companies in the building, be it an exchange bureau, a print shop or fashion shop. This underlines the storytelling norm of only staging 'revolutionary' startups and ideas fitting into the master narrative of technoscientific progress. Individual stories are also not told – or at least not in a holistic way, inclusive of doubts, fears, and setbacks. I realized the absence of people and individual emotions in the visitor tours I conducted, too, when I guided a new employee through a makerspace: I only told her about the functionalities of the rooms and different workplaces – be it the quietness of the computer lab compared to the machine space, the possibility of renting the huge rooms as offices for startups, the industrial aesthetic of the machine space's ceiling, or the functionality of a prepaid gas meter invented by a startup (Research Diary, April 7, 2017).

Nairobi's tech story and the tech scene itself performatively produce each other. As such, the scripted tour story 'scripts' (see Crang 2004) the workplaces, technology developers, and their technologies along the norms of the technoscientific master narrative and the visitors' exoticizing imaginations of work in an African country.

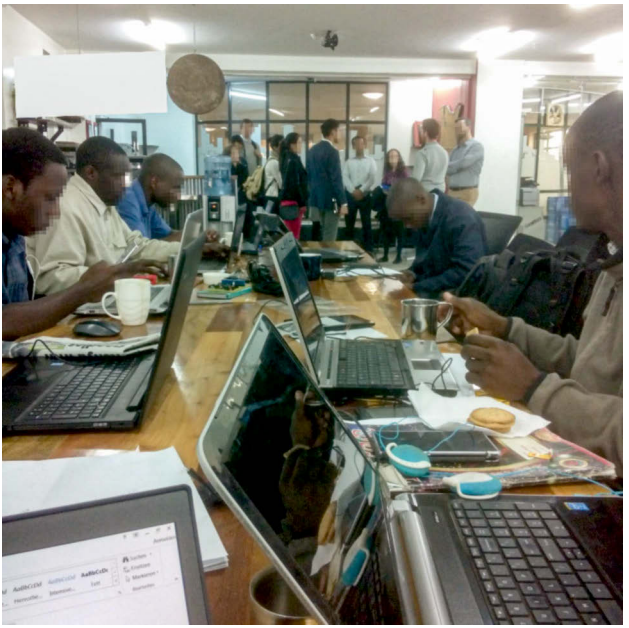
4.3 Feelings of Objectification

Visitor tours not only streamline and stabilize the story of Kenyan technology development, they also have an impact on the workers in the visited co-working spaces. The visitor tours are accompanied by feelings of fear of not being able to survive as a tech entrepreneur, of caring for one's own community, and of anger about serving as an illustrative object of Nairobi's tech scene.

A research diary entry of only one day shows numerous visitors and that only a few of them interacted with the tech developers. On this average day, the makerspace was visited four times: one tech hub founder came in with a visitor – both holding takeaway coffee cups in their hands; a bit later, one group came in and stood close to the entrance looking at the workplace; in the afternoon, another large group talked to one of the makerspace managers; when they left, four people stayed behind and took photos of the workplace; and, after that, a Kenyan journalist came in and asked for information as she wanted to write an article about the challenges of manufacturing and how the tech scene could support manufacturers (Research Diary, July 3, 2016).

The spatial arrangement of visitors and workers distinctively indicates their non-interaction. A smartphone snapshot of mine shows that visitors usually stay close to the workplace entrance, listening to their tour guide and watching the workers from afar (Figure 4).

Figure 4: Smartphone camera snapshot of a visitor group at a makerspace, 2016 (author's photo).



However, the distance between visitors and developers is bypassed by the visitors' action of taking photos of everything and everyone:

> At some point, [a serial founder] and a group of 15 people in suits, who I would categorize as white, came in. They didn't enter very far, but were just standing in the entrance space, looking at us. Two women split from the group and went around the makerspace taking photos with their phones. I felt intimidated as they went close to the computers that show people's projects and took photos of the screens and people without asking. They moved like lurking cats. Brian, who sat across from me, leaned over the table and asked me in a whisper: "Do they come because they don't believe that something like this can happen in Africa?" (Research Diary, June 23, 2016)

> Before lunch, we had several visitors. Two guys were standing behind me, but they didn't walk around the makerspace. They just stood there. … Again, their smartphones were capturing everything. They shot quickly in every di-

> rection, probably hoping that one of the photos would be nice. (Research Diary, June 27, 2016)

Those two research diary excerpts illustrate that visitors see taking pictures as a crucial part of their guided tours. In my case, witnessing how visitors invaded the privacy of co-workers, and the sensation of being observed while I worked led to feeling intimidated and uncomfortable. In Brian's case, the white visitors evoked questions about why they came to the makerspace. Brian could feel the spatial distance between him and the visitors at the entrance as it was far enough that he was unable to hear the purpose of their visit. Additionally, Brian's questioning of and irritation about visits from white people signified his sensation of a bodily boundary between the visitors' bodies and his own (see Schmitz and Ahmed 2014).

This perceived *otherness* was also the topic of a conversation with two former tech hub employees, who compared their work situation to being an animal in a zoo:

> Joseph: For me, the most annoying part about the tours is that they just walk in and a whole team comes filming: 'Who are you?! Why are you filming me?'
> Glory: That even happened at one of the Kids Hacker Camps. … We had to stop random people from taking pictures of children in the middle of our class. What's wrong with you? 'Oh, I just wanted to take a picture, I think you guys are doing something very cool.' They just see Kenyan children in a tech space and think it's something cool.
> Joseph: Like in a zoo.
> (Interview, former tech hub employees, March 2017)

Taking photos without first asking permission makes the developers feel objectified – as Joseph said, like animals in a zoo; the photos serve as illustrations of a touristic event in which the developers have no agency. Thus, it is important to consider the gaze during the tours: who is allowed to look and who is looked at? The lack of (verbal) interaction between working people and the predominantly white visitors, as well as the taking of photos, consolidate the so-called *colonial gaze*, which has exoticized people in (former) colonies by portraying them as different since colonial times (Melber 2001).

Besides the feelings of intimidation, technology developers are regularly confronted with uncertainty and unpredictability, as they never know who will be visiting or why they are visiting. The nonexistent interaction between visi-

tors and tech developers prevents any inquiry about the visitors' motives. In addition, the staff of the co-working spaces never know who is coming: "I thought that I remembered this guy and then I realized that Ban Ki-Moon was standing next to me" (Research Diary, June 29, 2016). As such, technology developers who work at co-working spaces to meet investors and donors have to be constantly prepared for requests to present their project to visitors:

> Marcus told me that he had heard from someone that visitors were coming that day; maybe from the World Bank. So, he was in a hurry because he wanted to be ready to show his 3D scanner to them in case they were interested in his work. I asked a makerspace employee if he knew that people from the World Bank were coming that day, but he answered: 'That's interesting. I didn't know'. (Research Diary, June 29, 2016)

The high hopes of investment, achieved by giving visitors one of the famous and fast elevator pitches, are interwoven with emotions such as uncertainty as to when and what visitors will arrive and anger toward visitors who simply watch, do not interact, and photograph people, screens, and work life without asking.

Of course, the incoming visitors cannot be generalized into a single gawker who does not respect the workers' privacy and their need to concentrate. A former tour guide, for example, sensed that sometimes his visitors "wanted to ask more questions, but they didn't because they are clever and noticed that I was busy" (Interview, April 2017). This reminded me of my embarrassment on my first day at the tech hub because my presence forced people to talk to me although they did not have time for a conversation (Research Diary, November 3, 2015). It should also be noted that some visitors on a business trip explicitly apologize for taking random photos and having no time for interaction; their schedules are tight as they have to visit as many companies or NGOs as possible and the photos are necessary to prove their activities (Research Diary, June 28, 2016; March 30, 2017).

However, I am not concerned with judging individual visitors to Nairobi's tech scene as either interested and self-reflective or as unsympathetic and discriminating. Rather, I am highlighting the postcolonial power asymmetries that manifest in directions of travel, looking, and knowledge exploitation.

4.4 Conclusion: The Affective Ambiguities of Performing Stories

The empirical insights from visitor tours of co-working spaces show that they serve their function, which is to convince doubters that technology development exists in Kenya. However, looking at the different feelings evoked in both the visitors themselves and the visited tech workers, we come to understand that visitor tours have ambiguous effects and affects: from the workers' side, the visitor guides doubt that employees and members of the co-working spaces gain any benefits from the visitors: "What are WE getting out of this? Do you want to fund something? Do you want to work with us? Please, don't just say bye" (Interview, March 2017). They long for visitors who ask "targeted questions" (ibid.), showing that they are interested and not sightseers who "just walk in like 'I'm just passing by [because] I am in Nairobi'" (Interview, public relations manager, March 2017). The tech workers are annoyed by having to tell the same story several times a day, irritated when being watched, angry when being photographed without permission, and stressed by the constant need to be prepared to pitch their work. The visitors, however, usually enjoy the sensual experience of Kenya's tech scene by watching, touching, and photographing workers, technologies, and machines:

> For every single [design] student, the five days of visiting Nairobi felt awesome. The twenty-something year olds exclaimed that they would tell their grandchildren about the trip and that they hadn't expected it to be so nice here. I asked them what they had expected and one student answered 'fewer materials to work with and not such nice and like-minded people'. (Research Diary, July 3, 2016)

This research diary excerpt shows that visitors socialized in countries of the Global North go home inspired and with slightly changed imaginations about technology development in an African country, whereas the Kenyan developers return to work as usual after hosting them. Thus, visitor tours often do not leave anything behind except the hope for investment and the loss of working time. The outcome for tech developers hosting visitors is more of irritation and intimidation than inspiration, knowledge gain, or a tangible (financial) outcome.

The differing feelings point to the performative ambiguity of storytelling practices. On the one hand, the narrative work of technology developers, the open doors of co-working spaces, and the visitors' affective states of wonder

and astonishment carry emancipatory potential to re-script Kenya's positionality by refuting colonial stereotypes of a supposedly atechnological place. On the other hand, the one-sidedness of visitor tours objectifies tech developers, their workplaces, and technologies and reduces them to mere touristic performances in which the visitors have more agency than the storytellers.

The reason for this ambiguity is the ambivalent striving for decolonial independence through capitalist technologies: the tours are supposed to promote knowledge exchange and encourage local technology developers to collaborate, but at the same time, they are fundamental to gaining investment for the tech scene. Thus, stories about technological projects are turned into services for potential investors and must therefore meet the expectations of the primarily international – and white – audience. This means that Kenya's racist colonial past and current global injustices cause feelings of, for example, wonder or amazement, to "stick" (Ahmed 2004b: 120) to the bodies and technologies of innovative workplaces in Nairobi, organizing them along historically constructed power structures. The opposing affects of enthusiasm and anger highlight the emotional and embodied negotiation between the technology developers' attempt to re-script Kenya's positionality in technocapitalism on their own terms and the need to attract investors by performing stories according to the expectations of others.

Examining context-specific affects such as anger, intimidation, and passion at technology development workplaces highlights the precariousness of developing technology and creating desired futures. Tech developers protect these precious endeavors and their mental health with daily forms of resistances (see Scott 1989). They utilize various strategies to cope with the steady stream of visitors that disrupts their concentration by making them feel uncomfortable being watched while working, makes it too noisy to understand the words of a co-worker, and means that someone has to interrupt their work in order to guide them around or pitch a project (Research Diary, June 22, 2016; March 24, 2017). One such strategy is the telling of the scripted 'default story' of Nairobi's tech scene to keep the tours as short and formal as possible. Tech developers also take protective measures such as wearing highly visible headphones to appear busy and unresponsive, or placing whiteboards between the door and work desks so that they are not visible to visitors entering. By sighing loudly, rolling their eyes, and conspicuously turning on timers, technology developers show their displeasure with constant disruptions (Research Diary, e.g., November 11, 2015).

Chapter 5
Writing Media Stories – The Socio-Technical Care Work of Storytelling

The previous chapter showed that guiding visitors as a form of storytelling is an embodied achievement. In this respect, this chapter focuses on the tedious work of making stories for newsletters, blogs, and social media. Usually, this work is invisible to media consumers, who only see the output in the form of a finished story. Thus, I depict the 'invisible' circumstance of fragility in the production of media stories and claim that the making of stories is a fragile assemblage that needs socio-material effort to be maintained (see Coban and Wenten 2021). In Nairobi's tech scene, the fragility originates from the lack of content that fits into technoscientific norms, and from the often missing reliable technical infrastructures that are necessary to perform public relations (PR). As such, I argue that the norms of what technoscientific stories from Kenya should be about and how those stories should be distributed globally make the writing of media stories a tedious endeavor, constantly in need of socio-technical care.

These claims are based on insights from my working participant observation when I supported a makerspace's PR staff during two different time periods. I encountered various PR practices, such as the production of newsletters, writing of blog entries, and 'feeding' of social media channels. The public communication work I participated in was marked by very different circumstances: during one of my research stays, the makerspace had only opened its doors a couple of months earlier and, thus, had set its PR focus on writing newsletters that covered the work and possibilities at the venue. Two monthly newsletters were written; one for international funders and one for the makerspace's paying members. A year later, the makerspace moved to a huge building in order to: a) enlarge the makerspace itself, and b) establish a hardware hub in Nairobi

by offering offices to hardware startups. Hence, during that whole research stay, the makerspace was a construction site, yet the public communication strategy had broadened to also feed the website's blog and various social media channels on Facebook, Twitter, and Instagram.

In the following, I show that the writing of media stories includes the affective and socio-material handling of the lack of 'suitable' content and technical infrastructures. The consequences are that storytelling is a fragile endeavor that requires collaborative socio-technical care and that the reproduction of the technoscientific master narrative's norms seems easier in the face of missing innovation stories.

5.1 Writing Stories along Technoscientific Narrative Norms

An ongoing component of the makerspace's monthly newsletter was a short introduction of a makerspace member and their innovative project. The public relations employees perceived the writing of those short pieces as tiresome. Usually, the process starts with the employee's introduction to a member that the management finds interesting. As such, in 2016 when I was entrusted with writing newsletter stories, I was introduced to a makerspace member called John, who was working on a locally manufactured version of a ram pump, used to pump water from the river to farmers' hilly fields. After the brief introduction, we agreed on an interview date and met two days later. During the interview, I stuck to the questions which had been collectively compiled by the staff of the makerspace beforehand and recorded the conversation. After the interview, I sat down and listened to the recording in order to write down the interesting parts of his story. I decided, rather instinctively, that his background, the challenges he had faced as an engineer, his project idea, and the benefits he gained from working at the makerspace would be of interest to both of the target groups of the newsletters – funders and members. Thus, I wrote a story about John – three-quarters of a Word page was the requirement made by one of the makerspace's heads – and sent it to the staff (Research Diary, June 27, 2016). They edited the story and, to my surprise, shortened it to one-third of a Word page. The edited story was sent to John himself, asking his permission to publish it in the newsletter. Since he made several comments, we needed to edit the story again before finally publishing it in the newsletter under the heading "Getting to know the makerspace's members".

In the final newsletter, the story was entitled "John Owino – An Environmental Technologist Who Farms Hibiscus"; it was illustrated with a picture of him in front of a computer screen showing a digital model of his ram pump:

> "It is all about water, water, water, living as a farmer". Being a farmer himself, John (43) observed the need to gain better access to river water and its distribution to the farmers' fields. Thus, he sought to develop a hydraulic ram pump which runs on the kinetic energy of the river water to pump water to different farms and homesteads in his area. In the spirit of solving local community problems, John wants to build a locally manufactured version of the ram pump which is adapted to the specific needs of the local environment like the filtering of contaminated water and dropping water levels due to the seasonality of the rivers. … Before being a member at Gearbox, he explains, he only had access to welding machines, which produced inaccurate work, and to material like PVC, which cracks easily due to the pressure inside a ram pump. (Gearbox newsletter, June 17, 2016)

This particular process of writing newsletter stories and the quoted result above fit the technoscientific narrative norms of how to fabricate and tell a technology story. Most importantly, a story should briefly and excitingly cover a heroic entrepreneur and a charismatic technology that has a positive social impact in their local context (see Chapter 3). As exemplified by John's story, the idea of a locally manufactured ram pump constitutes an entrepreneur's success story. The reader is able to anticipate how the pump will solve farmers' water problems in hilly areas. Thus, the social impact of John's technological solution becomes clear. Additionally, the storyline emphasizes the success of the makerspace model, namely to empower people to build their ideas through access to high-quality machines. As such, John's challenges with machines that did not work well were only told in order to show that those challenges were solved by the makerspace.

The fact that the content of the makerspace's blog entries has not changed since my research stays in 2016 and 2017 indicates that the same norms of storytelling still exist. The stories still cover Kenya's need to experience a Fourth Industrial Revolution and, thus, the need for policies to support building its own national innovation system and numerous makerspaces that foster innovation and industrialization. In this manner, stories talk about trainings and academies for university students and the informalized sector (jua kali) taking place at the makerspace. The same number of stories feature machines,

projects, and ideas that promise to have social impact, such as speed governors to prevent vehicles from exceeding the national speed limits, or vein locators and fetal heart monitors for clinical use. Visits by international and local politicians and representatives of international companies such as Tesla are also well documented[1] (Gearbox 2021).

5.2 The Lack of Innovation Stories

Stories about science and technology favor neither the members' daily lives and their setbacks, nor the tedious work of storytelling itself. As it turned out, writing stories for the next newsletter – which was due two weeks after the publication of John's story – was more difficult than expected. The PR employee and I tried to find another member to write about, but as the makerspace was in its setup phase at that time, paying members were scarce and none of the other few existing members wanted to talk to us. I did not understand why until somebody explained this phenomenon to me: the majority of members who work at the makerspace are secretive because the enforcement of intellectual property rights in Kenya's tech scene is low for various reasons (see Chapter 9). Therefore, most of the members do not even interact with staff or other makers in order to hide/protect their ideas and prototypes, fearing a loss of their intellectual property (Research Diary, July 13, 2016). This fact seemed to conflict with everything I thought and had read about open co-working spaces, where knowledge is shared with others to create new technology.

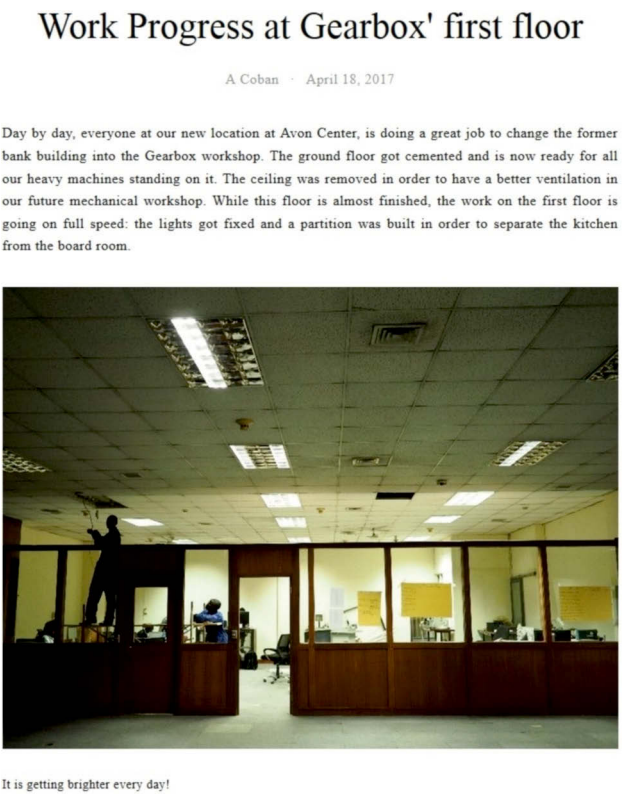
Leaving my astonishment aside, I looked for other stories to write about and found – obviously – the other users of the makerspace who were willing to talk to me. They were mostly interns and, as such, still students enrolled at universities. However, they did not seem to be the right material for newsletter stories, as one of the heads of the makerspace confirmed. According to him, young people strive to build high-tech printed circuit board (PCB) solutions and not innovations that are marketable to the majority of Kenya, which he

1 As mentioned in Chapter 4, visitors to Nairobi's tech scene bring (international) awareness of the local technology development. Thus, it is a high priority for PR staff to write instantly about well-known or high-ranking visitors. For example, numerous members and employees of the makerspace got to know about it through the media coverage of Obama's and Zuckerberg's visits (Interviews, makerspace member, June 2016; mechanical engineer, April 2017). As such, writing about famous visitors advertises technological ideas, startups, and workplaces.

called the "bottom of the pyramid market". In his opinion, the students' behavior is a problem because they are not ready to think and prototype in business terms (Research Diary, June 20, 2016). Adding his strong opinion to the other constraints of finding the right story to tell, I felt frustrated because I could not identify a suitable subject to write about. The lack of content made my colleague feel the same: "My brain is drained", he told me. The newsletter was to be published the next day and we were still looking for the "big stories that have to be told to the funders" (Research Diary, June 28, 2016).

During my research stay in 2017, the PR requirements were even more ambitious than the previous year, although the makerspace was a construction site with even fewer maker stories to tell. Every second day, new posts and tweets had to be written for the Facebook and Twitter pages, the blog needed stories twice a week, and a newsletter had to be sent out every two weeks (Research Diary, March 30, 2017). These deadlines put the PR staff under such pressure that they began documenting almost everything regarding the makerspace's construction process in order to create any content at all. Interviews were conducted with the makerspace's staff to highlight what everyone liked about the place; the list included anything from furniture, staff, the laser cutter, and the table shaped like the African continent to the soldering station, which, funnily enough, was mentioned by the non-engineering secretary (Research Diary, March 23, 2017). The days were peppered with random walks through the building to photograph people building partitions, sandpapering tables, designing co-working tables, and repairing ceiling lights to use to post progress updates (Research Diary, March 31, 2017; April 26, 2017; April 27, 2017) (Figure 5).

Figure 5: Screenshot of a blog entry on the makerspace's construction progress (Research Diary, April 18, 2017).



Work Progress at Gearbox' first floor

A Coban · April 18, 2017

Day by day, everyone at our new location at Avon Center, is doing a great job to change the former bank building into the Gearbox workshop. The ground floor got cemented and is now ready for all our heavy machines standing on it. The ceiling was removed in order to have a better ventilation in our future mechanical workshop. While this floor is almost finished, the work on the first floor is going on full speed: the lights got fixed and a partition was built in order to separate the kitchen from the board room.

It is getting brighter every day!

Eventually, the progress updates became repetitive because making a new makerspace is a process that takes time and does not regularly deliver exciting news. Thus, an external PR consultant criticized the progress updates as being boring and childishly written. He and the management demanded stories about successful makers, who had already built technology with social impact, even if they were only slightly connected to the makerspace (Research Diary, April 20, 2017). Sticking to the norms about technology from Kenya was the most appreciated strategy to "please some funders" (Research Diary, July 13, 2016). Another attempt to remedy the lack of content was to write about the machines available at the makerspace, because those stories also functioned

as advertisements for the tools and devices it offered (Research Diary, June 29, 2016).

This tedious procedure of writing stories shows that the norms of what technoscientific stories from Kenya should be about define the existence of 'suitable' content and that this normative storytelling is negotiated affectively. Following Ingmar Lippert (2014: 42), who analyzes what happens if data and facts are missing in the creation of accountability, I asked 'what happens when there is no suitable content to write about?' The empirical data shows that bodily stress is one result, that is, the PR staff handle the lack of content affectively. Exhaustion from thinking about possible new topics for newsletters was a dominant emotion in light of the lack of suitable makers to interview, because they were either secretive or did not fit into the master narrative of technoscience (Research Diary, June 28, 2016). Feelings of boredom met those of anxiety when the construction of the workplace became the only coverable topic, with no exciting innovation to be seen.

However, following the norms of technoscientific narrations is a necessity to 'stabilize' (Czarniawska 2004: 43) the celebratory story about Kenyan technology development that furthers acknowledgment, investment, and the re-scripting of Kenya's positionality in global technocapitalism. As such, the writing of media stories is a tedious negotiation between the required maintenance of particular content and daily life deviations. Further, I claim that the putative lack of content signifies what narrative content is important in a story about innovation and how those stories differ from daily life contexts: processual aspects of scientific daily work life such as fear and boredom are absent from media stories. Thus, certain success stories are continually repeated and context specificities, such as the fear of losing intellectual property or the pressure to develop technology for the poor, are not included (see Chapters 6 and 9). Consequently, the outcomes of the negotiations between narrative norms and daily life reproduce the single story about technology development in Nairobi (see Chapter 3).

5.3 The Absence of Technical Infrastructures

In addition to the continuous search for content, other challenges of writing stories include the technical requirements, such as electricity, internet, and other connective devices that are necessary to conduct public relations work. Technical infrastructures are usually taken for granted as long as they are

working smoothly (Star 1999: 380); however, power cuts, slow internet, and missing devices make them tangible as complicating factors of (digital) PR work. It is precisely these complications that show that the making of stories is a socio-technical effort in which humans and non-humans mutually care for distributing stories globally.

In this vein, I draw on Maria Puig de la Bellacasa's (2012: 198) socio-material understanding of care as being "concomitant to life" and thus a "vital necessity". According to her, care practices signify who or what is vulnerable and precarious (ibid.). Until now, only a few scholars have studied care in technology work. Regardless of what they study empirically – be it IT security (Kocksch et al. 2018), water infrastructure maintenance (Buser and Boyer 2021), scientific data production (Pinel et al. 2020), or agile technology development (Coban and Wenten 2021) – they all draw on Puig de la Bellacasa's understanding of care. Thus, they claim that care practices are not only found in (feminized) reproductive work, but are also present between humans and non-humans in the sense of "taking care" of sociotechnical assemblages (Puig de la Bellacasa 2011: 93).

The socio-material interdependency in the process of writing stories was most evident when the makerspace moved to a new building located in the industrial area in Nairobi, an area which suffers heavily from daily power cuts. As far as the work of writing and publishing media stories goes, no electricity means no internet and, thus, no chance to upload the written stories. However, even with electricity, the wi-fi at the makerspace was still too weak to work smoothly, as this research diary excerpt illustrates:

> It's super annoying. Neither of us have an account to access the website's blog. Thus, we tried to publish our blog post via the secretary's account. To do that, the relevant pictures had to be on her computer so we were asking around for a flash drive to transfer the pictures to her computer. But then, the pictures couldn't be uploaded because they were too big. Also annoying… After I converted the pictures into smaller files in Paint, we met again at the secretary's computer to upload them. The four pictures for the blog post took half a day to finally be uploaded. The slowness of the internet is really cumbersome and makes every step tedious! (Research Diary, April 11, 2017)

Research diary entries bemoaning the slowness of the internet and the resulting constraints on fulfilling the PR tasks were a daily feature during the con-

struction of the new makerspace. Be it four pictures to illustrate the blog post or posting a Tweet or a single Instagram photo – uploading and publishing each of these took at least half a day (Research Diary, March 31, 2017). It was not only the slow internet that hampered the PR work, but also the misplaced cable that connects the makerspace's camera to a computer, the missing administrator password to install software on the makerspace's computers, and the nonexistent work smartphone on which to install Instagram: all of these complicated the accomplishment of the various outstanding PR tasks (Research Diary, April 11; 18, 2017).

After we had finally managed to upload the four pictures for the blogpost mentioned above, the secretary was very careful with every subsequent step of the publishing process, such as pasting the text, headline, author, etc. into the content management system of the makerspace's website (Research Diary, April 11, 2017) illustrating that, once storytellers achieve the creation of content, they handle the story with tremendous care lest it be lost in disrupted infrastructures.

5.4 Conclusion: The Careful Making of Media Stories

The dependence on technical infrastructures reveals that the PR staff are not the only actors who are responsible for making PR work. Technical devices also support the staff in bridging the absence of infrastructures. As such, socio-material 'hacks' such as using the software 'Gramblr' on a private laptop to upload photos to Instagram, using Paint to minimize photo files, or using the secretary's computer to upload the PR work were in constant demand.

According to Alev Coban and Klara-Aylin Wenten (2021: 60), the emotional (and bodily) exhaustion of technology workers points to the things they care about and the things that care for them. The above depicted ethnographic insights into the creation of newsletters, blogs, and social media posts about science, technology, and innovation show that storytelling is laborious and emotionally strenuous work. It requires storytellers who care about writing stories according to technoscientific norms even when it is almost impossible to find such stories. In addition, storytelling requires technical devices that support the global distribution of stories. Overall, the lack of innovation stories and the absence of technical infrastructures make the creation of stories a time-consuming and exhaustive task; a fragile endeavor that is in need of affective and collaborative socio-technical care.

Chapter 6
Marketing Poverty – The Conservatism of Social Impact Technologies

"Once you have an idea, you need money": a makerspace employee explained the importance of co-working spaces, pitching events, and media coverage to establish relations between possible investors and technology developers (Interview, November 2015). Telling stories about a technological idea, whether to visitors at a co-working space, at pitches, or on websites and blogs, functions as marketing for startups. As shown in Chapters 4 and 5, the practices of hosting visitors and writing media stories allude to the financial needs that shape storytelling in Nairobi's tech scene: newsletters are written to provide accountability for investors and the hosting of visitors is infused with the hope of their investment. As well as these subtle economic motivations of storytelling, this chapter sheds light on a particular form of storytelling that is a well-known economic practice, namely marketing. As the majority of Kenyan startups are in their early business stages and rely on external support, most of the marketing strategies are not directed at users, but at possible investors and the local community of technology developers (Interview, serial founder, April 2017).

In this chapter, I argue that the promises made in the marketing of technologies are a result of the performative negotiations between (international) investors and tech developers. These negotiations include the tech developers' considerations of whether to strategically utilize the (post)colonial stereotypes expected by Western investors or not. I show that the marketing of technologies from Kenya has ambiguous effects. On the one hand, it constitutes the technologies as social impact-driven, their users as rural and resource-constrained people, and Kenyan contexts as a singularized impoverished Africa. On the other hand, brands such as 'Made in Africa, for Africa' specifically contest the colonial stereotypes of lagging African contexts that depend on

technology from the Global North by creating visibility for technology production in Kenya. Thus, colonial (capitalist) continuities that define how to market technological ideas are intertwined with decolonial endeavors to re-script the putatively peripheral positionality of Kenya.

To analyze the marketing of technological ideas, I draw on STS scholars Elena Simakova (2013) and Steve Woolgar (2004) and their conceptualizations of marketing as performative and constitutive. Both argue that marketing practices constitute relations and identities, such as the identity of inventors, technologies, and their users (Simakova 2013: 31; Woolgar 2004: 454). According to them, marketing stories often serve two goals as they can be told to a public audience as well as to actors inside a community or organization. First, marketing resonates with the expectations of the targeted public audiences and second, it creates meaning and accountability within organizations of technology development (Simakova 2013: 35; Woolgar 2004: 452). As such, Simakova's and Woolgar's approaches to marketing agree with sociologists of expectation who state that storytelling about science and technology builds "protected spaces" within a community and additionally speaks to a public audience to "attract attention from (financial) sponsors" (Brown et al. 2003: 4). Just as storytelling represents continuous socio-material work (see Chapter 5), marketing is also a continuous achievement (Simakova 2013: 34). Therefore, Woolgar (2004: 453) states that any analysis of marketing should always include the circumstances that build and sustain a product identity.

Using this performative stance of marketing, I analyze the content of marketing stories and how they are produced. Therefore, the following pages illustrate the seeming paradox of the critique and simultaneous reproduction of (post)colonial stereotypes in marketing strategies such as those for the 'Made in Africa, for Africa' brand. I claim that marketing practices performatively produce realities; they reproduce existing oppressive structures and at the same time, form (politicized) and empowered communities.

This argument is presented as follows: first, I show that the geographically situated marketing 'Made in Africa, for Africa' functions to narratively intervene in hegemonic imaginations about 'a' passive Africa and furthermore, to build a collective identity of tech developers who care for their local context through social impact technologies. Second, I analyze the oppressive effects of the 'Made in Africa, for Africa' marketing by showing that startups market their technologies with content and images that (re)produce colonial imaginations of a homogenous Africa in need of help. I explain that the marketing's focus on exoticizing representations stems from the preponderance of funders com-

ing from the Global North who prioritize technological projects that foster social impact. By showing the negotiations of Kenyan technology developers between their own visions and the investors' expectations, I argue that postcolonial power asymmetries manifest in the developer-investor relations. These perpetuate the historical entanglement of technology (and entrepreneurship) with development agendas and ultimately define what and who is 'worthy of' funding. I emphasize that the need to gain investment spurs essentialized and conservative narrations of ethnicity and origin in the marketing stories. I call this marketing of technologies a *performance of poverty* because it configures users and contexts as poor and rural, and technologies as positively affecting them. Third and finally, I assess the marketing practices of technologies made in Kenya as paradigmatic for the entanglement of capitalist logics of investment with decolonial endeavors to re-script positionalities. I offer insight into the emancipatory potentials of technology by showing the narrative work of tech developers that counters colonial hegemony and tech-deterministic expectations of social impact.

6.1 'Made in Africa, for Africa': An Empowering Brand

> Do we have our own inherent culture that informs us how we go about building stuff or are we just dancing to the tune of whoever wants to listen?! (Interview, technology expert, November 2015)

Tech experts from the African continent frequently discuss the question of whether a specific 'African' way of building technology exists (Africa Capital Digest 2015; Cofie 2019; Jackson 2017). In the media accounts that discuss the specificities of Kenyan technology development, the emphasis is on local expertise that does not need knowledge 'from outside'. Further, technological innovations are proudly marketed as a continental achievement – 'Made in Africa, for Africa'. As such, the marketing of technology developed in Nairobi – be it through branding, pitching, or writing – aims to re-script Kenya's peripheral positionality within the global tech economy. Thus, marketing is used to tell stories about the agency of Kenyans to develop technology. This narrative work intervenes in hegemonic imaginations about a singular passive Africa and builds a collective identity of tech developers who care for their local context through technologies.

Social Impact Technologies as Community Care

Be it a car, a makerspace, or water barrels – all are branded as being invented and produced in African countries for 'African' contexts. The slogan 'Made in Africa, for Africa' has several variations, but what they all have in common is that the advertisement represents more than a brand for technologies developed in Nairobi. It is the claim of having the expertise regarding what is best for one's own context, and what to make and build for it.

For example, the first car designed and manufactured in Kenya is marketed as 'Designed for Africa. Built in Africa.' (Mobius Motors 2019: n.p.). The makerspace I worked with claimed on their website to "build better products for Africa, in Africa" (Research Diary, August 30, 2016) and 'The Roll Out the Barrel Trust' prominently uses the hashtag #madeinAfricaforAfrica to promote their mobile water barrels on Twitter (The Rotary Water Barrel Project 2016). The hardware company, BRCK, is also an example of the geographically situated 'Made in Africa, for Africa' marketing. Advertising their BRCK internet modem as 'born in Africa and made for Africa' shows the conviction of the developers: "you can't effectively engineer for the realities of Africa if you don't experience the realities of Africa" (Walton 2014: n.p.). According to the CEO of BRCK:

> only … if you get dirt under your fingernails, get thorns in your legs, get sunburn on your face, and really deal with the harsh realities of Africa, will you understand Africa. (Interview, CEO of BRCK, November 2015)

For BRCK's employees, their internet modem is "a solution that is born out of Africa under the specific situation here" (Reg Orton cited in Manske 2014: 7). These statements and the advertisement of technologies being 'made in Africa, for Africa' show that having local knowledge is a must for tech developers in Kenya – because only the contextualized design of technologies is able to tackle context-specific challenges.[1]

1 Geographers Megan K. Blake and Susan Hanson argue that innovation is inescapably contextual. According to them, 'place' is essential for the process of innovation and its resulting form: "Popular advice to the would-be entrepreneur is to identify a need and fill it. The unspoken part of this aphorism is that most needs are defined spatially; properly revised, the adage should be, 'Find a need *somewhere* and fill it *there*.'" (2005: 689). Therefore, they claim that innovation should always be analyzed as the capitalization of knowledge about a specific place and its local customers (ibid.: 691).

Knowledge of daily life challenges – the "harsh realities of Africa" as expressed by BRCK's CEO – means a competitive advantage, as local problems are "unimaginable to an entrepreneur living in Silicon Valley" (Knott-Craig 2015: n.p.). Thus, Alan Knott-Craig, a serial technology entrepreneur in South Africa, states that "the only way to beat the Valley in a race is to ensure the Valley is not competing" (ibid.). Another tech entrepreneur (Karake 2018a: n.p.) advises that, instead of imitating the "casino style investing practices" of Silicon Valley where startups build something without having an exact business model, the business model for every startup in African contexts should be the solution to a basic need. According to these technologists, a startup that builds a social-impact technology which "satisf[ies] both the mass-market poor communities and growing middle classes will make a lot of money" (Knott-Craig 2015: n.p.). In the context of Ghana, Seyram Avle (2020: 4) claims that although entrepreneurial makers are inspired by Silicon Valley's and Shenzhen's knowledge production, they do not cling to any one innovation model, but use both as "tools" to make a regional "Afro techno-future".

Thinking in business terms to capitalize local knowledge (Blake and Hanson 2005: 691) is one reason why almost every startup in Nairobi develops a technology with a positive social impact. Another is the tech developers' desire to support marginalized communities; for example, M-Farm builds "solutions that empower farmers to work and communicate in new and innovative ways" (M-Farm 2020: n.p.) while Eneza Education uses "mobile technology to improve access to education" (Marchant 2014: 12). A founder of several Kenyan tech companies stresses the importance of combining the "technology narrative" with the "development narrative" (Interview, April 2017). According to her, only technologies are able to achieve "social impact at scale" and "social impact being transformational … [and] substantive" (ibid.). In this manner, the Kenyan research partners of Eleanor Marchant (2014: 11) also see the scaling up of a 'local' appliance to the whole continent as the social impact of a technology:

> Nairobi's role as a technology 'gateway' to Africa has pushed its programmers and entrepreneurs, while very proud of their city and the people in it, to focus on broader problems creating tools to address the needs of Africans more widely, with Nairobi more of a testing ground than the penultimate end user for the developers. (ibid.: 18)

The overarching aim of developing technological solutions for a specific Kenyan or broader 'African' community – depending on the definition of 'local'

– represents not only a marketing and commodification strategy, but also an 'Afro-centric indigenous human computer interaction paradigm' (Winschiers-Theophilus and Bidwell 2013). Heike Winschiers-Theophilus and Nicola J. Bidwell describe this paradigm as technology development that is embedded in "African communalism" (ibid.: 246), a "collective ethic … [that] recognizes that survival derives from group harmony and [that] all actions are within a collective context" (Mkabela 2005: 185 cited in Winschiers-Theophilus and Bidwell 2013: 246). Thus, the social impact of a technology represents a way of expressing care for a community. In this regard, the capitalization of local knowledge not only spurs economies, but also improves local life as geographers Megan K. Blake and Susan Hanson found (ibid.: 690). They write that the effects of social impact innovation in marginalized areas in the United States include "meeting legitimate needs in the community (for example, for care of seniors) …, developing skills, and generating social cohesion (for example, via providing a community social space)" (ibid.: 697).

Technologies as Discursive Intervention

The storytelling about technologies 'Made in Africa, for Africa' presents the agency of Kenyans to develop technology that caters for the needs of 'local' communities. Thus, this narrative work intervenes in hegemonic imaginations about a singularized passive Africa and empowers Kenyan technology developers. In this manner, one of my interviewees stated that the 'Made in Africa, for Africa' slogan creates a collective identity based on the uniqueness of one's context (Interview, technology journalist, April 2017). Julia Manske (2014: 14) also found that the international awareness of Kenya's tech scene positively affects the self-image of Kenyans: "M-Pesa's success became an identity-forming narrative", so that young people in particular feel empowered to make Kenyan innovations possible. A former head at a tech hub told me that through all the people who are producing "stuff" in Nairobi:

> The image is starting to change and people are starting to realize that we also have a place in this changing tech scene, here in Nairobi and globally and in the region. (Interview, November 2015)

Various other technology experts in Nairobi emphasize that the international visibility of M-Pesa, Ushahidi, and BRCK have changed the narrative about Kenya: "Before M-Pesa and Ushahidi, the technology narrative did not look

at us. But now it does" (Interview, co-founder of Ushahidi, April 2017). In this vein, the former Permanent Secretary of the Ministry of Information and Technology sees Nairobi's branding as the Silicon Savannah as a sign of worldwide acknowledgment of and respect for Kenyan innovations (Interview, April 2017).

Technologies with social impact are not 'revolutionary' purely because they solve a local problem, but also because their marketing creates international awareness around technology production in Nairobi and thus, contests the clichés of the superiority and universality of knowledge and technology coming from the Global North. The fight against stereotypes of putative dichotomies, for example, center and periphery of technology development, modern and emerging economies, Silicon Valley and its imitators, still defines the daily lives of tech developers in Nairobi even though many researchers and activists have deconstructed and disproved these dichotomies since the emergence of the dependency school in the 1960s. Therefore, tech developers use the marketing of their technologies to intervene narratively[2] in dominant innovation discourses that represent a passive Global South which only acts as a recipient of technologies from the Global North. A researcher and education technology expert explained to me that it is important to interfere in the accepted narrative about technology in Kenya – especially in academic discourses – because it is driven by people who are not a daily part of the innovation scene. She said, "the fact that … we were able to access that research by participating in the conference helped us to correct the narrative … [of] what's being told out there" (Interview, November 2015).

6.2 'Made in Africa, for Africa': Marketing's Performance of Poverty

The existence of technology development in Kenya refutes the common stereotypes of the African continent as a non-technological place. However, the marketing slogan 'Made in Africa, for Africa' and the social impact focus of tech investors result in imaginations and images that homogenize Africa into a single rural place that lacks infrastructures.

If we look at the BRCK advertisement in detail (see quotation below), we are presented with a technical device that is robust like a brick, works (among other

2 Tegan Bristow (2017: 299) explains that "narrative, particularly in Kenya but largely on the continent, is a more comfortable, interactive and traditional way through which to produce and engage cultural critique".

functionalities) like an internet modem, and is made especially for "harsh environments" (Mushakavanhu 2017: n.p.). According to its developers, the motivation to develop such a device was the fight against poor internet connections which shapes daily life (Shapshak 2017). Therefore, BRCK developed a modem with its own battery, so that it would continue to work unaffected by (the frequent) power cuts. Additionally, it is built to be water and dust repellent. BRCK advertised its modem on the company's website as follows:

> Made to work where others won't: most routers and modems are built for New York and London, whereas most people connected to the internet today live in places like Nairobi or New Delhi. The BRCK was designed to work in harsher environments, where the infrastructure isn't robust. The rugged design of the BRCK allows for drops, dust and weather resistance, and dirty voltage charging. (BRCK 2016)

By comparing the infrastructures in "places like Nairobi or New Delhi" to cities in the US and UK, the company defines infrastructures in the Global South as unstable and endangered by a challenging environment. If we combine this marketing of a technology built for a "harsh environment" characterized by hot sun, dust, tropical rain, and disrupted connectivity with the branding 'Made in Africa, for Africa', an exoticized and generalized image of 'Africa' emerges (see Said 1978/1979). Thus, BRCK's marketing represents a whole continent as harsh and wild, and the continent's obstacles as the needs of rural societies.

Komaza, a Kenyan startup, is another example of a technology developed in Nairobi being marketed by using "humanitarian communication" (Chouliaraki 2010: 108). This means that the marketing resembles the global media coverage about African contexts that predominantly portray women and children who live in rural environments where resources are scarce (see Nduka-Agwu and Bendix 2008). Komaza developed a technological solution to environmental degradation, and in 2020 it was one of the top five most invested-in startups in Africa (Disrupt Africa 2021: 9).[3] Komaza created the concept of 'microforestry', meaning that "tens of thousands of small-holder farms" each grow trees for commercial purposes (Komaza n.d.). Via Komaza's platform, the wood is sold as fencing poles. The startup explains that their impact is twofold: first, they support the reforestation of degraded ecosystems and, second, they help farmers to earn income from their land (ibid.).

3 Komaza attracted investment totaling US$ 28 million in 2020 (Disrupt Africa 2021: 9).

Looking at Komaza's website, the first image shows a woman wearing a colorful headwrap surrounded by trees (Research Diary, July 25, 2021). The website welcomes its visitors to "Africa's new face of forestry" (Komaza n.d.) and claims that Komaza is "revolutionizing African forestry" (ibid.), indicating the startup's aim to scale their technology to the whole continent. I argue that the perpetual references to 'Africa', the target customers of farmers who live in degraded environments, and Komaza's social impact of alleviating poverty, homogenize all African contexts into one rural place where potential customers are in need of technological solutions to their, often structural, problems, such as poverty.

Homogenizing and essentializing identities and places is a major effect of the branding 'Made in Africa, for Africa'. According to geographer Andy Pike (2009: 637), branding that refers to a country of origin always represents "geographically inflected characteristics (e.g., efficiency, quality, reputation, tradition) connected to and resonant of a specific type of space or particular place":

> The Sony brand and its branding, for example, are inescapably entangled in spatial associations and connotations of ingenuity, high-technology modernism and innovation situated in the geo-economic context of the company's specific role in the particular history of Japan's late industrialization, rapid economic growth and contested economic leadership in east Asia in the postwar period (Haig, 2004). (ibid.)

Referring to the origin of technologies developed in Kenya as 'from Africa' evokes images of essentialized geographic characteristics such as rurality. Nairobi's branding as the 'Silicon Savannah' is another example of semiotic references to environmental conditions in Africa. The fact that Nairobi is an urban metropolis and not a savannah shows that *nature* is an exoticizing narrative characteristic in marketing stories about African contexts (see Chapter 3). In this regard, communication scholar Touissant Nothias (2014: 328) pointedly remarks that Afro-optimistic media reports combine neoliberal "signifiers of modernity, economic attractiveness and progress" with narrations of "sun, savannah and wilderness – [that] are an integral part of a colonial portrayal of Africa". In addition to depictions of 'natural' environments as rural, the potential customers in Africa are also homogenized as rural farmers who lack access to various infrastructures.

To sum up, the marketing of contextualized technologies as 'Made in Africa, for Africa' stages Kenya as an active technological producer on the one

hand, while performing and (re)producing colonial imaginations about a rural and poor Africa that is in need of solutions, on the other. This reproduction of discriminatory stereotypes stands in contrast to the tech developers' political endeavor to change essentialized imaginations about Africa through storytelling. To understand why tech developers market their technologies in such a way, I show that their marketing is directed mainly at investors in the Global North rather than local customers. As such, the following pages depict the investor landscape in Nairobi, investors' motivations, and the postcolonial power asymmetries inherent in investor-developer relations.

Investors' Expectations of Social Impact

The answer to the question of why the critics themselves use the dismissed tropes of 'an Africa where resources are scarce' is not found in "the harsh realities of Africa" (see above), but rather amidst the harsh realities of business life, namely the acquisition of money. As well as the high taxes on imported goods and the resulting difficult access to resources and machines necessary to prototype in Kenya (see Chapter 7), one of the toughest aspects for developers of new (hardware) technology is gaining the funding to work on their technological ideas.[4] Until now, the priority for local investors in Kenya has been the property market. In this context, a startup founder explained why it is difficult to find local funding:

> It's difficult to get angel investors because the property market returns fifteen percent and it's quite a low risk. So, no one is ever going to invest in higher risk and lower return. (Interview, April 2017)

As a result, most of the funds for Kenyan tech startups come from internationally-owned firms and organizations that specialize in investing in technological innovations (Njugunah 2016: n.p.). Thus, the tech scene in Nairobi is characterized by high numbers of international investors, such as private companies, venture capitalist firms, business angels, philanthropic foundations, and development agencies (Hain and Jurowetzki 2018).

4 Tech entrepreneurs often bemoan the missing support from the Kenyan government (see Chapter 7). For an elaboration on how policymaking processes during President Mwai Kibaki's administration fostered (ICT) innovation in Kenya, see Ndemo (2015).

Interestingly, the manifold actors who invest in technology development in Kenya are united in prioritizing technological projects that foster social impact. I gained this insight through analyzing investor statements, hackathons, interviews with tech developers, and scientific data from other scholars. The key moment in researching the intention of investors in Kenya was a pitch competition in Nairobi in 2015. During the competition, I sat in the audience while my Kenyan research partner, who is a mechanical engineer, sat on the jury. Other than her, everyone else on the jury was German, representing three companies, the embassy, and three foundations. Looking at the jury, the asymmetry in terms of who grants funds seemed clear. Along with an entertaining support program with salsa dance shows, food, and drinks, five projects were pitched. The prizes (German language courses and monetary prizes of between five hundred and two thousand euros, which were only allowed to be used for the particular award-winning ideas) were not revealed until the winners were announced at the award show; thus, entrants had no idea what they might win. Through my research partner, I had access to the evaluation forms and the guidelines for the jury. Looking over the jury's scoring sheet and seeing their guidelines for judging, it seemed notable to me that, out of a total of twenty points that could be given to rate each project, ten were assigned to the criteria "Originality of the innovation and demonstrated creativeness" and "Impact of the innovation". The other 50% of the scores were divided between "Practicality/viability of [the project's] application", "Market opportunity", and "Applicability", and seemed to be secondary criteria. This means, according to the guidelines, questions about the uniqueness of an idea and the possibility of a "fundamental change in processes on the well-being of the community" were considered more significant than questions of competitive advantage, the clear identification of target consumers, and the sustainability of the project (Research Diary, November 5, 2015). Therefore, the key moment of that pitch competition was the insight that the social impact of a technology is more important in the decision of whether or not to fund an idea than mere for-profit business logic.

The fact that (charitable) donors, such as foundations or development agencies, presuppose a social impact of a new technology is obvious. They have to legitimate their financial support in business spheres with doing something 'good'. Thus, their investment in startups and innovative workplaces follow postcolonial trajectories of "conventional development regimes" (Schwittay and Braund 2017: n.p.). The following quote from a foundation that funds a Kenyan makerspace, exemplifies the donors' developmental intentions:

> We are confident that [the makerspace] will transform the environment for invention in East Africa. It will provide a much-needed space for inventors to talk, build, test, and ultimately take their ideas to market. We anticipate that inventions born at [the makerspace] will make people's lives better and bolster local economies for generations to come. (The Lemelson Foundation 2014: n.p.)

The above quote signals the foundation's assumption of social impact through technologies. Another example of donor-driven investment in African tech scenes is UNICEF's Innovation Fund. It invests in technologies that promise to support education, health, and water and sanitation access. UNICEF states that they only fund startups that fit into its:

> global aim of ensuring that every child can survive, thrive and live and learn in a safe, inclusive space, and that innovation is applied to the most pressing problems faced by some of the most vulnerable children and young people. (UNICEF n.d.: n.p.)

Humanitarians' turn to "an optimistic faith in the possibilities of technology with a commitment to the expansion of markets" (Scott-Smith 2016: 2230) emerged around 2009 when the most accredited network of humanitarian organizations, the Active Learning Network for Accountability and Performance (ALNAP), exhibited the first humanitarian innovations (ibid.: 2229). According to Anke Schwittay and Paul Braund (2017: n.p.), development agencies try to follow "Silicon Valley's techno-utopian and libertarian values", but, in reality, fund what they have been used to funding during the last decades of development aid. Their research analyzed the crowdsourcing platform 'Amplify' that was run by the British Department for International Development. Through this platform, innovation challenges were held online "with topics ranging from women's safety in urban areas to improved refugee education to youth empowerment in East Africa and enhanced opportunities for people with disabilities" (ibid.). Similar to the pitches at the Kenyan competition described above, participants who submitted their innovative idea to Amplify had to answer questions about its intended beneficiaries, uniqueness, and overall social impact (ibid.).[5]

5 The development organizations' turn to business sectors has precarious effects. In the 'usual' grant awards of projects and NGOs, there is no investment in sustainable business models. For example, UNICEF requires applying startups to work on open source

However, the tech investment landscape in Kenya is not determined only by charitable organizations; private companies also play a big part. Almost all big technology companies, such as Microsoft, IBM, Google, and Intel, have established regional offices in Kenya (Marchant 2015: 8). Interestingly, the private investors also focus on technology that promises to have a social impact. For example, Benjamin A.J. Pearson and Seyram Avle (2016: 1) describe the rhetoric of Google and Facebook as "aid language" when discussing the companies' investment in the Global South. These companies draw "from human rights-based and international development narratives that emphasize global imbalances and position the global south as recipients of the north's largesse and expertise". Microsoft, as another example, explains its investment in African countries with the company's overall "mission to empower every person and organisation on the planet to achieve more" (Microsoft 2019: n.p.). Its most prestigious investment in Africa are two engineering centers in Nairobi and Lagos, called *Africa Development Centres* (ADCs). In Microsoft's statements about these, the humanitarian visions of corporate social responsibility (CSR) strategies fuse with the company's explicit intention to broaden their product market. Microsoft executive vice president Phil Spencer said:

> The ADC will be unlike any other existing investment on the continent. It will help us better listen to our customers, develop locally and scale for global impact. Beyond that, it's an opportunity to engage further with partners, academia, governments and developers – driving impact in sectors important to the continent, such as FinTech, AgriTech and OffGrid energy. (ibid.)

The global trend of corporate social responsibility is only a partial answer to the phenomenon of profit-oriented tech companies that focus on social entrepreneurship in Kenya, claims Marchant (2015: 11). She studied the assimilation of visions from private companies and development agencies when legitimatizing investments in technological ideas from Kenya. Marchant argues that besides CSR strategies, "the current pervasiveness of interest in technological innovation among development practitioners makes it difficult for the technological innovation sector to disassociate itself from such development

---

technologies (UNICEF Innovation Fund 2021: n.p.). The organization does not mention the fact that open source technologies rarely result in profits (ibid.) and thus, a company that is independent of grants.

objectives" (ibid.: 10). Thus, according to her, multinational companies have to refer to social impact in the Kenyan innovation context because the country has been dominated by development agencies and NGOs for decades (see below).

Private sector investment in Kenya also includes the usual investors in high-risk technology projects, namely venture capitalists (VCs), accelerator-linked investors, and business angels. Again, these actors are mainly non-Kenyan. This means that tech entrepreneurs rarely gain local early-stage funding because Kenya "lacks the thriving local angel community apparent in Nigeria" (Disrupt Africa 2021: 20). Instead, the most active investor in Africa is *Kepple Africa Ventures*, a Japanese VC firm (Disrupt Africa 2022b: 37). The Kepple Group initiated the Kepple Africa Ventures program to connect startups from Japan and Africa (Kepple Africa Ventures 2020: n.p.) in order to 'create new industries' (Kepple 2018: n.p.). Although most of the VCs, accelerators, and angels do not describe themselves as philanthrocapitalists, the sectors and startups that they invest in, nevertheless, speak of prioritizing social entrepreneurship. As such, the energy and agri-tech sectors raised the most funds in Kenya, whereas fintech received much less than in other countries in Africa (Disrupt Africa 2022b: 36).[6]

Postcolonial Genealogy of Technologies for Social Impact

Astonishment is often expressed about the fact that private investors and charitable organizations follow the same aims in Kenya's tech scene. Tom Scott-Smith (2016) illustrates how Californian ideology from the Silicon Valley merges with humanitarian approaches conducted in the Global South. He states that 'humanitarian innovation':

> has the same emphasis on liberation, freeing people from suffering and aid from top-down control. It places the same value on entrepreneurship, seeking to liberate the productive citizens of refugee camps from the dependency of aid. But most crucially it celebrates novelty. In the world of humanitarian innovation, effective aid comes through new markets and new technologies. … Simultaneously, however, the innovation movement seeks technol-

6 According to DisruptAfrica's funding report, in 2020, "the energy sector [gained] US$41 million (21.4 per cent of Kenya's total), and agri-tech US$35.7 million (18.7 per cent of the total). The remaining funds were split between the logistics space (US$27.3 million, 14.3 per cent), e-commerce (US$23.7 million, 12.4 per cent), and fintech (US$16.2 million, 8.5 per cent)" (Disrupt Africa 2021: 19).

> ogy with an emancipatory force: technology as a more efficient and effective way to realise human rights and basic needs; … technology as an opportunity for social and political transformation. (ibid.: 2233)

Although Scott-Smith emphasizes the extraordinariness of different funders who follow the same goal of social impact, the entanglement of technology (and entrepreneurship) with development agendas is not a new phenomenon. On the contrary, the Enlightenment belief that technology and knowledge production are the drivers of societal progress has been enacted in Kenya since the first colonial conquests. Generalized, we can say that from the 18th century until the 1970s, colonial powers saw technologies as something that had to be transferred to other countries – first, in order to 'civilize' the inhabitants and later, to serve the humanitarian goal of ending poverty in former colonies (Cherlet 2014: 777ff.). Around the 1970s, a shift happened in development discourses when a group of scholars criticized the UN for its narrow focus on achieving economic growth by producing and transferring science and technology. Instead, 'capacity building' was claimed to be a better approach because it would empower people to build their 'own' economies (ibid.: 782; Scott-Smith 2016: 2234). However, the concept of capacity building did not flatten the hierarchies between donors and beneficiary countries because it is still based on learning something that is already known by people in the West (Cherlet 2014: 789 referring to Wilson 2007). Throughout history, technology has served and continues to serve different aims in (post)colonial development agendas: "for civilizing the 'inferior races,' as the engine of economic development, for poverty alleviation, and for empowerment" (Cherlet 2014: 789). As such, technology still serves as a tech-deterministic umbrella for the manifold expectations of development in Kenya (see Brown et al. 2003: 4).

Entrepreneurship was only considered as a development tool some decades later than technology, namely, after the Second World War when colonizers allowed colonies to aim for economic growth. Since then, the global shift to neoliberalism resulted in numerous target groups in Kenya being trained as entrepreneurs, to be empowered risk-takers who are able to help themselves within capitalism (see Chapter 2). In light of Silicon Valley's rise and the praise of tech entrepreneurship, actors such as philanthropic venture capitalists argue that businesses are able to fulfill basic needs without the state (Irani 2019: 8f.). They see the state as "inefficient, old-fashioned and a source of dependence. The private sector, in contrast, is seen as progressive and creative" (Scott-Smith 2016: 2237). This means that private companies and

investors became 'ethical actors' that aim to solve societal challenges, such as poverty, through their investment and business advice (Dolan and Rajak 2016: 5). The inclusion of 'Bottom of the Pyramid' markets (Prahalad 2006) and fostering 'social entrepreneurship' (Dees 1998) are two examples of the business approaches in development agendas.

It would be insightful to explore the genealogy of technological social impact (in the Global South) in depth, but the brief historical overview provided here has already demonstrated that technology and entrepreneurship have long been colonial tools for alleged development. Thus, the entanglement of technology and entrepreneurship with social impact aims is nothing new for formerly colonized countries. What *is* a relatively new phenomenon is the range of international private companies and entrepreneurs who promote technology to improve lives in countries of the Global South. Despite the new actors in development agendas, support and investment in technology development in African countries is still shaped by postcolonial power asymmetries. The private sector's influence is still "paternalistic" because the funders believe that "business, market and financial knowledge … are somewhat universally applicable to [sic] no matter what context or problem, be it HIV or water supply" (Tristl 2020: 56). Due to the dominant presence of investors from the Global North, the following section shows that Kenyan startups (have to) adapt their technological ideas and marketing to their funders' expectations of a valuable idea, although they often have different understandings of impact, technology, and business models.

6.3 Negotiating Investment's Postcolonial Power Asymmetries

Between 2015 and 2022, Kenya's startups raised a total of nearly US$ 1.3 billion from the private sector (the second-highest amount of investment in Africa after Nigeria), as well as doubling their annual investment volume from 2021 to 2022 (Disrupt Africa 2022a: 15). Although Kenya has fewer startups than Nigeria, Egypt, and South Africa, the 2020 investment in Kenyan startups made up 27.3% of the total funding in Africa and was thus the highest investment sum ever achieved by tech companies of a single African country (ibid. 2021: 18). Compared to the region, Kenya receives a large amount of investment; yet it is highly contested as the money mainly goes to a few high-paid startups (ibid. 2022a: 27).

Therefore, marketing is a valuable practice. Its storytelling makes a technology and its envisioned impact charismatic and convincing enough to gain the interest of investors. As such, marketing always hovers between the ambitions of tech developers and those of their potential investors. To negotiate the latter, technology developers in Nairobi research the purposes that investors are willing to give money to. Thus, they get involved in pitching events and other situations where they encounter potential funders, for example, at visitor tours, hackathons, or bilateral investment negotiations. In this respect, an interviewee recalled a conversation with a friend about his experience of trying to gain money from investors:

> A friend of mine was raising funds … and I could hear him making a lot of skype calls with potential investors. He flew out to meet them face to face and did the whole pitching thing. So, I asked him about his experience and he told me 'You see, eventually you have to package your story in the way the investors see things. So, when you start out, you usually package [your idea] the way you see things. … So, over and over again, based on feedback and networking, you reach a point when you can actually show [your idea] the way these guys can understand. And then, they give you the money. … [Their view] is not totally different [from my view]. But you have to tweak it … to show it to these guys'. (Interview, technology journalist, April 2017)

The fact that this tech entrepreneur had to fly out to meet his potential investors points to the predominance of international funders in Kenya. Furthermore, the depicted process of convincing investors of a technological idea shows that knowledge of the investors' expectations and mindsets is crucial. According to another interviewee, it is important that investors "understand what you are saying" when talking about a solution to help people; for example, in the Kibera 'slums' (the largest informalized settlement in Nairobi) because "the investor wants to understand where his money is going" (Interview, mechanical engineer, April 2017). As such, marketing a technological idea means 'making the investors understand' and 'packaging' the story according to their worldviews. In this vein, Garud et al. (2014: 1483) emphasize the importance of enabling investors to "interpret a story from their own vantage points" in order to gain legitimacy and attract investment.

When asking Kenyan startups how they approach the mainly European and US investors, all of them stated that they have to tell stories that fit into the investors' unanimous goal to finance technologies that promise to transform

Kenya. Referring to the funders' investment motivations, an interviewee recounted his experiences:

> The kind of foundations which fund hardware development, they see very clearly what they want done. They have clear conditions like 'this is what we are looking at, if you fulfill this, we are going to give you funding'. Of course, for any development agency, social impact is key. They wouldn't just fund a technology thing. (Interview, mechanical engineer, November 2015)

As already depicted above, the expectations of funders as well as private investors focus mainly on the social impact of new technologies. This persistence resembles "strings" that are attached to investment, according to a leading Kenyan tech expert:

> A lot of the money we've seen, either in development projects, private companies' investment, VC, angel investing has been very Americentric. When it comes with Americentric values, it comes with an Americentric thinking. … American money just wants to know how you are going to change the world. … So, it's all about whatever centric values this money is being attached to. There is no money that doesn't have strings attached. (Interview, November 2015)

The strings, such as the expectation that the technology will "change the world", played out by investors determine (the marketing of) technological ideas from Kenya. During pitches and guided tours, in newsletters, and other reports, technology developers have to present their social impact in the form of numbers and stories. In this respect, a makerspace employee stated that once a startup has gained money, it has to constantly report to the funders: "They want to know, they want to be sure, they want you to write a lot of literature about your projects and all that. So they are quite conditional" (Interview, November 2015).

To understand exactly how technology developers have to present their social impact, I analyzed the internal 'Monitoring and Evaluation Framework' of the makerspace where I conducted my research. Looking at what the Nairobian makerspace measures makes it clear that figures showing a quantitative societal output are important in "facilitating the timely and accurate reporting of Gearbox's status to our backers, and holding Gearbox to account for its projected output" (Gearbox 2016: 5). Measurable results such as, amongst others,

the "number of new prototypes developed" (ibid.: 6), "number of inventors actively involved in the community" (ibid.), "number of inventors trained in global standards of design, fabrication, business, and manufacturing" (ibid.), and "number and reach of knowledge sharing tools and platforms created" (ibid.: 8) are gathered to serve as an evaluation of and accountability for the workplace's actions. Numbers also seem important to the tech hub iHub, as it enumerates the numbers of people who work(ed) with or are interested in the tech hub in their 'About Us' section of its website:

> 100+ startups can trace their roots to the iHub. 1000+ individuals have at some point worked with us. Our mailing lists and events reach 10000+ people regionally, and our social media outreach has exceeded 200k followers globally. (iHub 2017)

The affinity with "big numbers" (Interview, public relations manager, March 2017) was also demonstrated by visitor guides when they described what content their tours should include (see Chapter 4).

However, numbers are only one part of the process of gaining legitimacy. For the makerspace's evaluation, its statistician compiled the space's quantitative impact figures into Excel spreadsheets as well as creating a spreadsheet called 'Qualitative Stories' so that the published newsletter stories (see Chapter 5) also became a part of the evaluation (Research Diary, June 28, 2016). The equal importance of quantitative and qualitative data for evaluation fits with Zenia Kish and Madeleine Fairbairn's (2018) analysis that impact investors "measure seeming intangibles such as social impact" by telling stories about the "compassionate dedication to pulling people out of poverty" (ibid.: 578).[7]

The tech scenes in Kenya and South Africa are aware of the fact that well-narrated stories are key "[f]or an [tech] ecosystem to thrive" (Pollio 2020: 2723; 2725). Although my research partners dedicated much time to storytelling practices, they perceived the expectation of stories about social-impact technologies as unfair.[8] In this manner, a startup founder criticized investors

7 Kish and Fairbairn (2018) studied impact investors who invest in farming projects in Ghana.

8 See Marlen de la Chaux and Angela Okune (2017) for a broader assessment of contradictory views between technology entrepreneurs, innovation hub staff, and investors about the availability of capital, the constitution of business skills, and viable technology markets.

in Kenya as "impact investors" who treat Kenyan startups as possible success stories in technological impact, but not as potentially self-reliant small businesses:

> They want nice stories and photographs. Because of that it's not good enough to have a sustainable business that employs people, and you make some money and you are not reliant on grants. That's my definition of impact, but for an impact investor, they want you to save the world and reduce carbon emissions and increase access to energy. So, the bar is actually higher for companies to get investment here than it is in Silicon Valley. (Interview, April 2017)[9]

Technology developers in Nairobi do not feel that they are taken seriously by international investors because a developer is not 'allowed' (financed) to build technology without an externally defined social impact. The "genuine … care about having an 'impact'" that many Kenyan entrepreneurs have cannot be seen because they are not able to define impact by themselves (Marchant 2018: 92). In that vein, Kish and Fairbairn (2018: 584) generalize that "impact investor ethics center the value systems of the investors themselves, with little (if any) discernible input from broader communities involved or impacted by their work".

The investors' conditionality and so-called strings of a pre-defined impact were highly problematized by almost all the technology developers I talked to. However, only a few of them were able to openly criticize the prevalent tech-deterministic expectations. The founder of a hardware company explained their strategy to "push back":

> Yeah, our business is helping access energy. It's potentially helping to reduce a lot of emissions, potentially helping people with health problems, but we never sort of lead with the impact. We look more at treating our customers like customers first. Rather than cases that we need to help. … We do a push back when someone says "I want you to measure how long someone saved

9 Schwittay (2014: 37) draws on Jamie Cross (2013) to argue that there is also an asymmetry in technological endeavors with social impact with regard to their origin: most "technological solutions to the Global South's problems" are still developed in the Global North because "indigenous … creators cannot capitalize on the same networks of support and publicity as their Northern counterparts".

> walking for fuel and impact on xyz". Sometimes, we say, "Rather than measuring impact, let's talk about what you, funder, cook with at home. Do you cook with a cooking stove and charcoal? Do you have a solar stove?" "No." (Interview, April 2017)

As well as confronting investors with their unequal requirements, another pushback would be to "limit the number of funders that can come and visit someone's home [as] a lot of funders say 'I want to visit a customer'" (ibid.).

Despite criticism and pushbacks, technology developers are still dependent on obtaining funds to pursue their work. Thus, being in the midst of funders' expectations, entrepreneurs have to constantly negotiate their way between their own understandings of impact, technology, and business models, and the obligation to perform stories about societal progress through technology in order to be financed. This means the 'harsh reality of business life' is that the myth that "every good idea can find funding" is not true for African contexts (Junne 2018: 122). Therefore, I argue that the negotiations of technological ideas in the process of finding funds emphasize the postcolonial power asymmetries in investor-developer relations.

Further, the constant negotiation between the startup's own goals and investor expectations shows that marketing is an affective achievement in which technology developers have to adapt to investors' definitions of a valuable technological idea in order to obtain funding. As such, the predominantly Global North investors define who and what is worthy of funding in Kenya, and thus determine the visual representations and narrated stories in marketing. In this vein, the aforementioned startup that tries its best to 'push back' against investors' discriminating imaginations of technology made in Kenya had to conclude:

> We try our best to push back as much as possible. But we also have to be realistic sometimes – that if there is no other funding and there is a certain narrative required, we do grit our teeth. (Interview, April 2017)

Another interviewee agreed, stating that there is nothing else for it but to use "different languages" (Interview, tech expert, November 2015), meaning to market one's technological idea according to what the potential funders would like to hear – even if that means promising to change the world in a tech-deterministic way. Moreover, the funders' expectations are not only tech-deterministic, but draw on hegemonic humanitarian and colonial imaginaries

(see Chapter 3). Thus, an interlocutor admitted that handling the worldviews of funders:

> calls for patience sometimes, because you are going to deal with a lot of Eurocentric perspectives, you are going to deal with people who are still navigating the idea of Africa, the poor Africa, the lacking Africa, this Africa not rising for all. (Interview, tech expert, November 2015)

The fact that an investment is more likely when the terminology is familiar to the investors who are, however, unfamiliar with Kenyan contexts, prompts technology developers to use discursive resources of "ethnicity" (Zanoni et al. 2017) and "geographically inflected characteristics" (Pike 2009) to make their technological idea 'charismatic' and thus, convincing (Ames 2015). In this regard, marketing stories 'from Africa, for Africa' and other publicly distributed stories about technology made in Kenya homogenize and essentialize identities and places. Performing ethnicity and geographic stereotypes means the "self-exoticization" (Zanoni et al. 2017: 342) of African contexts and people and thus, the reproduction of colonial imaginations about a rural and poor place. As such, ethnicity and putative cultural characteristics are not used as:

> an innate or true 'essence' of a social group but rather [as] a discursive resource in individual creatives' identity work, that is, their presentation of who they are, wish to be, used to be, fear to be, are thought to be, and so on. (ibid.: 335)

Sometimes however, the adaptation to the investors' mindsets and expectations is not enough to convince; *race* seems to be a category that is decisive in Kenya's investment landscape. Journalists, as well as a report on tech funding in Africa, identify a racial bias in investment decisions: in 2020, the biggest investments went to startups with white expat founders or CEOs (Disrupt Africa 2021: 20). The reasons why this racial bias especially exists in Kenya are yet to be researched. Overall, the (limited) negotiations between investors and developers make clear that these relationships are not only financial, but are also permeated by postcolonial power asymmetries.

The Conservatism of Performing Poverty

The limited possibilities of resistance to investors' expectations causes technology developers to market themselves, their technological ideas, and their potential users as how 'they are thought to be' (Zanoni et al. 2017: 335). I draw on theoretical approaches to socio-material performativity of marketing (Simakova 2013; Woolgar 2004) to argue that the negotiations between investors and tech developers lead to the reiterative configuration of technological innovations, their users, and their contexts according to the investors' exoticizing and discriminating expectations of tech from Kenya. In this vein, Woolgar states that marketing practices include not only the "careful packaging" of ideas "in light of the performed expectations of their imagined audience" (2004: 452), but also the constitution of "social relations and identities" (ibid.: 454). As such, marketing tools such as media images are not neutral objects, but powerful processes in circulation (Rosati 2007: 1000).

I claim that the essentialized narrations of ethnicity and origin within marketing stories about technology 'Made in Africa, for Africa' and the investment flows in primarily social entrepreneurship conservatively *perform poverty*. Technology developers align with both national and international development agendas because they then have a higher chance of gaining funding. As such, colonial imaginations and decades of development agendas constitute technologies with a positive social impact as the norm. The investment focus on impact technologies presupposes that only social problems exist, without considering other possibilities, such as investing in technology for industrial processes. Thus, marketing not only performs technologies in a certain way, but also their respective contexts. Nairobi's marketing stories constitute a homogenized rural and impoverished 'African' context, and essentialize users as in need of technology developers and technological solutions. As such, the *performance of poverty* makes marketing stories economic by reproducing investors' expectations of 'African' technology solving long-endured problems of customers living in rural Kenya.

The marketing of promissory technologies that solve poverty has two effects: first, the depoliticization of structural problems; and, second, the creation of conservative futures and technology. With regard to the first point, the belief in universal technological solutions depoliticizes inequalities such as poverty because it "cancel[s] out politics" (Arora and Romijn 2011: 482). Evgeny Mozorov (2013: n.p.), one of the most vocal critics of Silicon Valley, claims that tech scenes are pervaded by the "ideology of solutionism", which he describes

as "an intellectual pathology that recognizes problems as problems based on just one criterion: whether they are 'solvable' with a nice and clean technological solution". Besides social impact technologies, entrepreneurship in general is also heralded as a "catch-all solution, and … startup culture [a]s the best way to solve any problem" (Marwick 2013: n.p.). As such, treating technology and entrepreneurship as universal tools to solve structural problems obscures the context-specific power asymmetries.[10] This means that the references to "the same set of utopian stories" about disruptive technologies (Ames 2015: 116), turn technology into an apolitical and ahistorical tool that obscures the political aspects of technology production. In the case of Nairobi's tech scene, the performance of poverty neither scrutinizes nor tackles the postcolonial power asymmetries that cause the resource scarcity in rural areas of Kenya, or the colonial trajectories of investment in Kenyan tech.

This depoliticization of structural inequalities leads to the creation of conservative futures and technology. Be it historical facts of a region, imagined stereotypes connected to Kenya, or the essentialized understanding of ethnicity and origin, according to Ames (2015: 118), new technologies convince an audience as soon as "they echo existing stereotypes, confirm the value of existing power relations, and reinforce existing ideologies". Thus, through branding a technology by reinforcing the imaginations and circumstances to which investors are accustomed, the technology becomes convincingly "charismatic" (ibid.) for them, even though the marketing might reinforce discriminating and oppressive structures. Therefore, Ames claims that technologies are "ideologically conservative: even as they promise revolution, they repeat the charisma of past technologies and ultimately reinforce the status quo" (ibid.: 115).[11] Through the performance of poverty, the hegemonic expectations and Western definitions of how technology, innovative work, and 'better' futures should look in African contexts are reinforced. Depoliticized

10 Further, various scholars accuse international investors of using poverty as a business opportunity rather than aiming to solve structural inequality through technological fixes (see Arora and Romijn 2011; Elyachar 2012; Fressoli et al. 2014; Schwittay 2011).

11 The conservatism of new technology would be no surprise to Bruno Latour (2009: 361) who claims that *design* stands opposite to revolution and modernization. In his opinion, (re)designing is a meticulous practice of transforming something according to requested requirements – for example, becoming more sustainable, commercial, or user-friendly (ibid.: 359ff.). Due to the elaborateness and relativity of design – as it always draws on something existing – Latour understands design as the antidote to radical new beginnings.

expectations of future technologies therefore have no revolutionary potential, but rather conservatively reproduce the performance of poverty to which the Global North is accustomed.[12]

6.4 Conclusion: Emancipatory Moments within the Capitalization of Poverty

The depicted two-sidedness of marketing stories illustrates the crux of assessing technocapitalist technology development. Kenyan technology developers and international scholars alike concern themselves with the question of whether the current innovation paradigm represents a decolonial chance for countries in the Global South or if it is a further enclosure of emancipatory potential in capitalism.

The proponents of tech development's emancipatory potential argue that the (participatory) making of technology represents an anti-capitalist move, which empowers people "as active participants in the decision-making process of technological change" (Fressoli et al. 2014: 59; Grimme et al. 2014; Kera 2012; Maxigas 2014; Smith et al. 2013). This applies in particular to makers in the Global South who were (or still are) excluded from economies of technology development. However, Fressoli et al. (2014) differentiate between emancipatory Latin American movements of tech development and the Indian neoliberal concept of the 'Bottom of the Pyramid', claiming that ideological differences exist between movements, startups, and organizations that develop technology for social impact. While the Indian concept "aim[s] to empower people as entrepreneurs and consumers of technology" (ibid.: 59), Fressoli et al. are convinced that technology development can have emancipatory effects. In this manner, Scott-Smith (2016: 2232) claims that humanitarian organizations who turned to business logics and innovation still resist "neoliberalism's inexorable spread". He argues that these organizations only selectively embrace the private sector, continuing to enact a different approach from companies and the state (ibid.: 2234). However, he worries that "autonomous humanitarianism is increasingly under threat" due to the tech-deterministic belief in technologies and capitalist markets as the only solutions to societal problems (ibid.).

12 Due to the still existing colonial imaginations of Africa, Detlef Müller-Mahn states that imaginations of the future of Africa "can only envision positive futures as an antithesis to the perceived present deficiencies and backwardness" (2020: 157).

Unlike these mainly optimistic assessments, criticism of the revolutionary promises of technology development is widespread. For example, Saurabh Arora and Henny Romijn (2011: 482f.) subsume both approaches – targeting poor people, the so-called bottom of the pyramid, as potential customers, and co-creating innovations with marginalized communities – under the shift toward neoliberalism that lets corporate interests and development agendas converge. Lilly Irani (2019: 2) contrasts the entrepreneurial work of tech development with the "slow, threatening work of building social movements". She criticizes social entrepreneurship for making political endeavors compliant with market values (ibid.). The claim that social impact technology is not revolutionary but reformist – if at all – can also be found in Stefan Ouma's (2020: n.p.) analysis of the concept 'Africapitalism'. Africapitalists aim at making capitalism inclusive by serving a specific community while making a profit (ibid.). As empirically depicted above, the Africapitalist tech developers' desire for social impact fits into the current paradigm of philanthrocapitalism. At the same time, however, they wish for a continent that is independent of Western dominance, for example, through the contextualized design of technology made in Kenya. Ouma argues that 'Africapitalism' is a de-politicized version of Pan-Africanism and, as such, fails to think "*through* capitalism *beyond* capitalism" (ibid.). Further, he criticizes the fact that "Africapitalists have no problem with the foreignness of capitalism" (ibid.) and claims that they therefore do not act in decolonial terms.

For a long time, it seemed to me that I had to choose a position – either techno-optimism or a critical perspective on capitalism – in order to analyze technology entrepreneurship as a development tool. However, my empirical analyses show that (the marketing of) technology developed in Nairobi is neither exclusively oppressive nor emancipatory, but both. Technology development in Kenya does not represent a revolutionary overcoming of capitalism and its inherent structural problems. Therefore, I would agree with Ouma (ibid.) that the Africanization of technology development does not fulfill decolonization as long as it remains embedded in capitalist structures. Nevertheless, researching the marketing practices of Kenyan technology developers reveals that they struggle emotionally with accepting international investment and the strings attached to it. The emotional ambivalence in storytelling practices becomes evident through the rapid change between and/or simultaneity of contrary feelings. For example, a common mix of feelings is anger about postcolonial legacies in the relationships with white visitors and the simultaneous praise of global knowledge exchange and flexible working

conditions. This ambivalence of tech development points to the existence of emancipatory endeavors and feelings, although they are of a momentary and negotiable kind.

With reference to Demirović et al. (2019: 8), I understand emancipation as diverse practices, struggles, activities, and movements. According to them, the term 'emancipation' is indeterminate and open, leaving it to those who seek emancipation to determine what it should consist of. Understanding emancipation as practices that are situated and context-specific, I see Nairobi's tech scene as a place of daily resistances that represent moments of agency and emancipation within the neoliberal making of technology. Colonial (capitalist) continuities that define how to market technological ideas are intertwined with decolonial endeavors to re-script the putatively peripheral positionality of Kenya. This means that the 'Made in Africa, for Africa' marketing reproduces (post)colonial stereotypes through the performance of poverty for international audiences and, at the same time, positions Kenya as a place that builds high-tech solutions for global markets. In this context, Zanoni et al. (2017) show that the commercialization of an exoticized ethnic identity creates legitimacy for creative workers to speak publicly and, thus, ultimately "re-signify the discourses constituting them in non-subordinate terms" (ibid.: 348). Thus, technology developers appropriate the discriminating narratives and expectations of international investors, visitors, and observers to enact their decolonial goal of making their work visible and discursively fight against the (assumed) superiority of knowledge and technology coming from the Global North.[13] With this claim, I resist smoothing the analysis of marketing practices

13 I do not want to omit the fact that some startups changed their marketing stories over the course of my research. Startups that employed exoticizing images and terminology to market their technology in 2017 represented themselves in a different way three years later. Their websites are in unimpressive muted colors and there are no pictures of rural contexts or impoverished users that should be empowered. I can only speculate about the reasons and point out two possibilities: the changed representations could signify a shift in business models, investors, and collaborators, or it could be that the startups have matured enough that they have sufficient customers to sustain themselves so they no longer have to compete for early stage investment from funders. For example, a startup that sold prepaid gas meters to the 'bottom of the pyramid' now operates only in partnership with (transnational) gas distributors. Another startup stuck to its business model of connecting farmers to markets. Instead of presenting their social impact on rural farmers who live 'unconnected' to regional and global markets, the startup now offers a functional website that simply provides their customers with a member login and a trading platform.

by repeating the common criticism of the "imposition of a Western modernity on the Third World" (Arora and Romijn 2011: 497) and of a "neoliberal market dominance" (Schwittay and Braund 2017: n.p.). Instead, manifold resistances, collaborations, and indifferences toward power asymmetries come into focus (Arora and Romijn 2011: 498).

Other scholars also emphasize the seemingly paradoxical interplay of critique and reproduction of oppressive structures in the realms of social entrepreneurship and the making of technology. Stefanie Mauksch, for example, states that social entrepreneurship is a morally complex phenomenon. According to her, it "is neither … [an] ethically neutral technique of improvement …, nor just another phenomenon of expanding neoliberal ideals" (2017: 149). She states that social entrepreneurship resembles both "a fundamentally human process of hope-seeking and a phenomenon of capitalist manipulation" (ibid.). In the few studies of technology entrepreneurship in African contexts, scholars also observe the two-sidedness of aiming at a different positionality in the global sphere of technology production. Seyram Avle and Silvia Lindtner (2016) found that the people they worked with in Accra (and Shenzhen):

> challenged the notion that the west was the supposed center of contemporary design and innovation, while they also productively leveraged the discourse on innovation at the periphery for their entrepreneurial practice. (ibid.: 2234)

For instance, Kenyan managers of outsourcing firms strategically use descriptions of a periphery that is either digitally unconnected or that is finally connected and no different from the rest of the world (Graham 2015). Mark Graham describes these "strategic spatial essentialisms" (ibid.: 880) about Kenya's connectivity as drivers of money flows because they affect the imaginations about an economically marginal country (ibid.). In this manner, Andrea Pollio (2020) emphasizes that in the case of Cape Town's tech scene, manifold rationalities agglomerate, presenting lucrative markets in Africa while searching for solutions to structural inequality (ibid.: 2718).

Overall, my analysis of the marketing stories of technology developed in Kenya broadens our view on the tension between agency and oppression. I show that the performative work of storytelling is emotionally strenuous because it negotiates (post)colonial representations and positionalities. It is precisely this performativity of marketing that leaves space for emancipatory moments that contest hegemonic assumptions about a supposedly technological

periphery – for example, making local expertise visible or creating images different from an impoverished rural environment.

Furthermore, my analysis above shows that the creation of new technologies and their marketing stories address not only public audiences, but also tech community 'insiders' (see Simakova 2013: 35). As such, the re-scripting of the country's positionality also speaks to Kenyan tech developers as 'insiders' by building a collective identity that strengthens not only their solidarity with each other, but also their 'care for Africa'. As argued above, the majority of social enterprises in Kenya can be seen as attempts to care for their contexts. Due to that, Tegan Bristow (2017: 286) writes that, for Kenyans,

> the use of mobiles as new communications tool [sic] was initially not strongly linked to a globalized media imperialism, but was rather – due to developments like Ushahidi and MPesa – more synonymous with innovation that assisted in solving problems via community access.

Thus, understanding social impact as a heuristic approach to serving a community well widens our perspective, allowing us to see the capitalization of poverty as a tool to build communities and economic networks which are not based on Western understandings of investment and social impact and which are, as such, an emancipatory moment of self-determination in the global power structures of technocapitalism. The fact that the care for local communities is expressed through marketable technologies resonates with Collier et al.'s description of current capitalism; it has become "difficult … to imagine ways of expressing care and concern without fostering markets" (2017: n.p.). They describe social impact technologies as "caring commodities" (ibid.) that, on the one hand, depoliticize structural inequality and therefore prohibit societal change and, on the other hand, are invented to "save lives, restore communities, improve health, even save the world" (ibid.). Consequently, they understand a caring commodity as a "remedial" approach to social change (Schwittay 2014: 41 referring to Latour 2008). I would express it thus: technologies 'made in Africa, for Africa' signify that capitalist logics and decolonial ambitions, economy and politics, work and care are entangled and cannot be separated (see also Chapter 2). The situations in which 'social impact' means more than a nod to funders' expectations give momentary outlooks into the emancipatory potentials of technology.

Part I
Conclusion: Technocapitalism – An Affective Economy of Promises and Performances

The Part I chapters show that the innovation imperatives *Do! Make! Innovate!* could be extended by adding *Tell!* I analyzed daily practices at innovative workplaces that, while at first glance did not seem to be a part of an innovation process, are, in fact, essential to it, namely public relation practices. Hence, I showed why "stories matter" (Cameron 2012: 586) by delving into the storytelling practices of guiding visitors through technology development workplaces, writing stories for newsletters and social media, and the marketing of technology made in Kenya. Stories matter because they serve as a tool to acquire funding, gain accountability, and present one's work to the global tech community, and, as such, their telling is an equally important daily life practice as innovating itself. Stories matter because, by working at an innovative workplace in Nairobi, one has to produce stories that show, contrary to widespread assumptions, that places situated 'outside' of Silicon Valley also have success stories to tell and role models to exhibit. Further, stories matter because they performatively materialize beliefs in societal progress through technoscience, reproduce colonial expectations of a place in Africa, and affectively build empowering and caring collectivities.

I argue that technocapitalism is an affective *economy of promises and performances* about technologies and positionalities yet to become. It valorizes anticipating promises about technological futures, so that Kenya's tech actors need to tell promissory stories in order to build alliances with as many (influential and affluent) stakeholders as possible. As shown in the previous chapters, merely promising technoscientific progress is not enough for Kenyan technology developers to gain global accountability and convince investors. The doubts about the adequacy of technology from a postcolonial context seem almost in-

superable. Places, bodies, and machines that hold a peripheral status in Western dominated technocapitalism additionally have to perform their work in a tangible and bodily perceivable way according to the audiences' expectations.

These differing requirements hint at a racial bias in investment: tech developers and startups in Kenya do not benefit equally from the high investment in the country's tech scene. Instead, startups with white expat founders or CEOs receive the most money in Nairobi (Disrupt Africa 2021: 20). In this vein, race was a continuous topic in the conversations with my research partners: for example, when they used whiteness to explain why certain sentences, motives, and actions of a person were perceived as awkward or when scrutinizing manifold white privileges. In that context, I was even asked if I would become a fake CEO (I did not), so that a startup could use my whiteness to gain international investors (Research Diary, April 24, 2017).

As storytelling is embedded in the neoliberal (and racist) making of technology, I have argued that it is an ambiguous practice. Narrative work is, on the one hand, a tool for empowerment. As such, communities of tech developers create international attention in order to scrutinize the colonial stereotypes still lingering in imaginations of African contexts and to overall re-script Kenya's positionality. In this vein, the guiding of visitors is used to make technology development tangible and shareable, the writing of media stories serves to empower Kenyans to become technology developers, and the technologies 'Made in Africa, for Africa' care for local communities by solving their context-specific challenges. Nevertheless, tech developers also have to tell stories to gain investment for their technological ideas and startups. In this regard, visitor tours transform media stories and imaginations about Kenyan tech into touristic performances through which affluent visitors should be convinced to invest. Media stories repeat the same innovation story to hide daily life deviations from global technoscientific norms, and the 'Made in Africa, for Africa' marketing reproduces the investors' essentializing and exoticizing imaginations of African contexts by performing poverty.

In depicting the effects and affects of storytelling practices prevalent in Nairobi's tech scene, I show that storytelling is emotionally strenuous work. The guiding of visitors, writing of media stories, and marketing of technologies are all shaped by postcolonial (capitalist) power asymmetries and, as such, these practices are affective negotiations over representations and positionalities. These negotiations include the possibilities to shift the "meanings, presentation, effects, and affects of race" (Faria and Mollett 2016: 81), but also the stabilization of race "through mundane, naturalized, and everyday language

and performance" (ibid.). The Part I chapters show that these negotiations take place in the invisible background of public relations work and involve weighing up the tech developers' own visions and daily life circumstances against hegemonic norms of technoscientific progress and global coloniality. These norms set the high expectations for stories from Nairobi's tech scene: they should be quick to read, easy to understand, and center on a hero who innovated a technology that has social impact by solving a context-specific problem of the poor. In general, the performative work of storytelling creates and contests norms of how to be innovative and what – and what not – to build, while at the same time stressfully searching and caring for 'suitable' story content, feeling objectified by (white) visitors, and being frustrated by the realization that the tech developers' business goals are considered to be less important than those of the funders.

Overall, these chapters have shown the difficulty of storytelling amidst racial capitalism (Robinson 1983/2021). Thus, there is no easy answer to the question of whether the storytelling practices in Nairobi's tech scene resemble decolonial endeavors or capitalist market logics. Will technology development in Kenya lead to epistemological and economical independence from the Global North and a change of the country's peripheral positionality? Alternatively, are the storytelling practices simply tools to market Kenya's tech development sector and integrate it into global technocapitalism? I claim that the current paradigm of technology entrepreneurship in Kenya is a perfect illustration of the entanglement of market logics with political endeavors in which emancipatory moments often succumb to capitalist requirements.

However, I have also encountered storytelling strategies in Nairobi that deliberately do not fulfill technoscientific storytelling norms or exoticizing narrations. One of these narrative strategies is to write stories for people living and working in the same context as the story is set in. In this vein, one technology journalist interviewed said that he had decided to "just tell stories to each other" (Interview, April 2017) by not writing "for the international audience, but someone who lives in Nairobi" (ibid.). He explained his target audience further:

> They could be of any nationality, but they understand what is happening here. So, it's more of a localized thing. So, they understand what's happening here. If I'm doing that, there is no way, there is no freaking way, I'd sit down and [use the] phrase 'There are more mobile phones in Africa than toilets'. (ibid.)

To challenge the discriminating stereotypes in stories about Kenya's tech scene, this interviewee tries to circumvent the alleged need to use colonial stereotypes so that people are able to imagine Nairobi's tech scene. His decolonial endeavor wants to "build Kenyans' own confidence" (ibid.) without constantly referring to Western imaginations to tell stories. As such, the narrative work to build communities around technological visions seems to be the antithesis of the colonial project of establishing dichotomies. In the case of Nairobi, storytelling establishes a community that takes "locality, specificity, and plurality not as a problem to be compiled away but as a consideration to be celebrated and retained" (Dourish and Mainwaring 2012: 137). Telling stories that are embedded in daily life and not in imaginations is also what the scholars Marlen de la Chaux and Angela Okune (2017: 286) advise Kenyan technology developers to do: they (the Kenyan technology developers) should more explicitly articulate "the specificities and visions associated with technology entrepreneurship [in Kenya, so that] nonlocal actors [are able] to root their expectations and perspectives in local realities rather than in unexamined hopes and expectations".

Some of the internationally well-known actors in Nairobi's tech scene are already resisting the expected story. Serial founder Juliana Rotich, for example, told me that she was eager to explain to the female representatives of the *Women20 Summit 2017*, who included amongst others, the German Chancellor Angela Merkel, Christine Lagarde of the International Monetary Fund, and Anne Finucane of the Bank of America:

> that there are now second and third generation services built on top of M-Pesa. … The point is, it's 2017 and we've seen a lot of progress and now the narrative needs to incorporate these second generation and third generation services. That's why I talk about them, I don't talk necessarily too much about BRCK and Ushahidi. Instead, I try to push the new generation of young entrepreneurs. That's a tougher story for the media to eat up. (Interview, April 2017)

Rotich uses her success and visibility to support Kenya's tech community by speaking about less visible startups. This example shows that power asymmetries do not only exist between well-travelled investors from the Global North and local technology developers, but also between the storytellers of Nairobi's tech scene. Only specific voices, such as those of successful and well-known companies and individuals with social and financial security, are able to do narrative work that fights against discriminating clichés. The majority

of storytellers who are responsible for performing Kenya's tech scene must tell a scripted story which follows the technoscientific and colonial norms, as they lack the agency to contest them, while waiting and hoping for shared knowledge and investment.

Instead of putting the onus on Kenyan technology developers to resist and fight hegemony, actors in the Global North, too, should work to change post-colonial power asymmetries. As such, development practitioners should scrutinize their taken-for-granted assumptions about development interventions and think about the fruitfulness of including "indigenous and collective ways of knowing and living" in innovation processes (Schwittay 2014: 43), while, in regard to private investments, Zenia Kish and Madeleine Fairbairn (2018: 584) demand that "new discursive spaces of dissensus and political levers for contestation must be opened up to hold the … investors accountable to the populations impacted by their work".

Part II

Making: The Careful and Calculative Manufacturing of Professional Products

"Hardware is tough", technology developers often complain (Interview, May 2016). They bemoan the fact that building hardware is "very resource hungry" compared to software development because it needs more material and machines to iteratively prototype a product idea (ibid.). In addition, there is less funding available for hardware projects than for software development. These circumstances apply to the development of hardware globally, but Kenya's positionality as a peripheral place for technology development complicates the making of hardware there even more. The lack of state support, difficult access to global commodity flows, and scarcity of investors who dare to invest in hardware made in an African country result in time- and money-consuming processes of technology development.

This second part of the book's empirical analyses shows how Kenyan makers invest care and calculative work in the making of technology in order to survive in the competitive world of technocapitalism. I analyze the bodies and affects present when makers and machines collaboratively design, make, and assemble technology and show that the feelings of empowerment, liberation, love, amazement, and fear arise out of the fact that Kenyan tech entrepreneurs deal with colonial trajectories and neoliberal responsibilization affectively and socio-materially.

With this research focus, I broaden and challenge current studies on making. First, I show that making hardware in Nairobi cannot be compared with the more commonly researched post-industrial contexts where making mainly happens as anti-capitalist practice, leisure time activity, or craftwork such as carpentry, sewing, and pottery. Instead, I argue that feelings of empowerment in contexts that have not undergone an industrialization along European and North American models are evoked by the possibility of building professional-looking and marketable technology and not by an anti-capitalist appropriation

of manual labor. As such, making in Kenya implies the development of professional technology with the help of digital fabrication tools in order to become independent of Western technology imports and finally shift Kenya's positionality in technocapitalism.

Second, I challenge those STS and making studies that draw dichotomies between engineering and making by describing one as rational and abstract and the other as emotional and creative. Instead, I show that making practices of technology development inhabit both affects and abstract calculations. Thus, emotions and rationalized work processes are interdependent, so that the making of new technology in Kenya consists of care *and* calculations to make professional technologies in a resource-constrained context. I am inspired by Kate Cairns' (2013) and Daniel G. Cockayne's (2016) approaches to understanding the affectivity of neoliberalism and I claim that only the investment of care *and* calculative practices makes it possible for Kenyan technology developers to generate technology that they consider professional. By looking at the practices of knowledge production such as the joys of creation or the struggles of everyday work, I shed light on those aspects that are missing in the stories about Nairobi's tech scene and overall in studies on science and technology (see Chapter 3; Myers 2008; Puig de la Bellacasa 2011; Waldby et al. 2006: 4f.). As such, the following chapters highlight the affective making practices that are demanded of places, bodies, and machines in resource-scarce contexts (see Chapter 1; Coban and Wenten 2021).

(Re-)Making Positionalities by Performing Professionalism

The majority of academic and popular accounts on makerspaces and making emphasize empowerment through manual labor that is inclusive and often anti-capitalist. Thus, makerspaces are described as places that foster education (Blikstein 2013; Benton et al. 2013; Halverson and Sheridan 2014; Martin 2015; Vossoughi and Bevan 2014) and the inclusion of grassroots groups in technological development (Kera 2012; Smith et al. 2013). The participation of diverse people in experimenting with scientific knowledge and technologies is seen as a democratization of science development (Kera 2012; Lindtner et al. 2014: 442; Ratto 2011). In this context, the widely praised increase in "user control over technologies" shows the appreciation of the political power of maker- and hackerspaces to raise awareness about existing developer-technology-user relations (Maxigas 2014: 11). Thus, research foci are often

set on makers who want to maintain "control over the final product, directly criticizing preexisting commercial structures" (Grimme et al. 2014: 434). In this vein, makers are often quoted as saying that making represents their self-expression instead of "an attempt to develop (let alone bring to market) a serious product" (ibid.: 439). These so-called *critical making* approaches direct attention towards empowerment through manual labor that is self-determined, at best critical of capitalism, and aimed at small-scale manufacturing rather than standardized mass production (Boeva 2018: 6; Zoran and Buechley 2013: 5).[1] All in all, making is generally depicted as a:

> semantic and ontological shift from manufacturing and craft towards … an attempt to reframe debate about 'economy' (Massey and Rustin, 2014), to capture the need to move onwards from the modern capitalist paradigm of profit-driven, high-throughput production of physical things, towards other ways to furnish humans with material comforts. (Carr and Gibson 2016: 299)

Touching upon the entrepreneurial engineering practices of makers in Nairobi, I make the point that the academic understanding of making as a practice of relearning manual labor and unlearning the consumption of mass-produced products is a legacy of research done primarily in post-industrial contexts such as Europe or the USA. Embedded in these contexts, making reconnects the dichotomy of "'mind' and 'body' in the sites and processes of production" (Carr and Gibson 2016: 300) which was fortified during industrial revolutions:

> Since machines could replicate the work of the hands, the manual dexterity and expertise required to construct objects lost value. Meanwhile, the work of the mind – the ability to envision and plan for the construction of objects, to design – was elevated. (Zoran and Buechley 2013: 6)

1 Besides critical making and DIY research, some scholars also research the commercialization and institutionalization of making practices; see, for example, the contributions in the special issue 'Makerspaces and Institutions' in the *Journal of Peer Production* (2018). In this vein, academia breaks away from the binary notion of making as *either* anti-capitalist *or* capitalist practice and turns increasingly to the variety of practices that making includes. In this manner, Sabine Hielscher (2017: 66) summarizes makerspaces as places of "diverse sets of socio-technical configuration of digital fabrication", meaning that makerspaces include various visions and practices – from leisure time activities, to political motivations, and entrepreneurial endeavors.

This "mind-body dualism indicated in the superiority of drawing over construction established forms of labor division" (Boeva 2018: 73), so that reappropriating the process of building things by hand – from design to production – is claimed to grant agency to makers (ibid.: 6).

In contrast to a context where goods have lost value and society has lost the need for craftwork and manufacturing, makerspaces in Kenya are situated in a national context which did not undergo an industrialization based on mass production. Therefore, manual making does not have to be reinvented in Kenya (Kenyatta 1938/1971: 41ff.) where *jua kali*[2] – entrepreneurs, artisans, and other workers who drive the informalized economy – have existed for decades (King 1996a: 24ff.) and constitute about 80–90% of the Kenyan hardware manufacturing sector (makerspace employee, November 6, 2015). Although the jua kali sector has been affected by global trends of formalizing economies (King 1996b), it consists mainly of manufacturing microenterprises that 'informally' employ apprentices to repair or make almost everything. Drawing on these characteristics, my research partners describe jua kali as inefficient and of a low skill level because the sector is devised to "create as many jobs as possible" (Research Diary, November 6; 25, 2015).

Makerspaces in Nairobi are established to cater for the needs of predominantly university-educated engineers who have professional ambitions of inventing a technology to earn money. Therefore, Kenyan makerspaces function as workplaces of (institutionalized) entrepreneurship where prototypes come to life and engineers are trained to persist in the capitalist market. In the following, I illustrate that makerspaces aim to enhance their makers' daily work of building hardware and to enable them to make *professional* technology to integrate Kenya in global economies and therein position it globally as a place of technology development.

Empowered by Professional Technologies

In Kenya, where the manufacturing sector is driven by the informalized sector and where high taxes do not allow beginning entrepreneurs to import components to prototype high tech, makerspaces are perceived as empowering because they offer machinery not available elsewhere and the possibility to make a 'professional' product from scratch. In this regard, a makerspace member, at

2 Kiswahili for 'hot sun'.

that time still an engineering student at one of Nairobi's universities, told me why he thought that a makerspace "is one of the best places on earth":

> In Kenya, what normally happens is that we have repairs, which is the main work offered out there. So, for an engineer, you study, you understand a lot of concepts, but the only work that you get is to maintain what others have designed. … I would like to work in places which deal with more interesting and challenging things, like coming up with solutions, again empowering others to come up with solutions, which is exactly what is being offered at [the makerspace]. (Interview, July 2016)

This makerspace member feels "empowered" by prototyping with digitalized machinery because, as an engineering student, he hopes for a job other than repairing and maintaining imported goods. His devaluation of the maintenance and repair of machinery resonates with the opinions of many other research partners:

> I don't like doing the maintenance of machines because I don't feel like I'm growing. But [the makerspace] gives me the platform to grow because we have projects that make you think, explore, and adventure in your career. … Tomorrow there is a project about a car. The next day there is a project about a pump. So, you are always constantly upgrading yourself – reading and studying. You find that only at [a makerspace]. (Interview, makerspace employee, April 2017)

Both quotes show that the emergence of makerspaces that materialize global aesthetics, discourses, and role models of technology development imply a different type of entrepreneurial activity than that present in the current manufacturing sectors: technology entrepreneurship "relies heavily on science innovations and therefore a strong technology skill and knowledge base" (de la Chaux and Okune 2017: 270). As such, makerspaces are places of advanced qualifications and knowledge production which stand in contrast to maintenance work. The appraisal of innovative high-tech work in Kenyan makerspaces and the overall devaluation of manual labor is openly expressed by makers who embrace digital fabrication tools and their "professional" output:

> Many others who make PCBs [Printed Circuit Boards] are astonished when they see a PCB made from here: 'How on earth did you make that casing?'

> or 'How on earth did you do this PCB? It looks so quality'. Then they show theirs made with an electric iron and their own chemicals. They etched it at home and they drilled it with a hand-drill. It looks so imperfect. And they see mine, I drilled it with the CNC machine, I etched it with the wonderful etching station, I tinned it, I placed a solder mask, I soldered it, I tested it, I've done everything: it looks so professional. (Interview, makerspace member, July 2016)

The overwhelmingly positive emotions towards machines that produce aesthetic and functional prototypes are discussed in Chapter 8. The point I want to make here is that the term 'professional' directs us to the engineers' aim of making products. Kenyan makerspaces and their members focus on product ideas that are scalable and suitable for mass production instead of the re-appropriation of manual labor or craftwork to act against capitalist economies.

Performing a professional image is crucial for Kenyan makerspaces. Shortly before Nairobi's first makerspace was about to open its doors in 2015, one of its managers told me that they distanced themselves from the description of being a 'makerspace' "because it tends to have a connotation that is more amateur-ish or DIY or tinkering or hacking and not professional engineers" (Interview, November 2015), referring to his carpenter friends in New York who distance themselves from being makers because this self-description would devalue their work. Talking to the same manager some months later, I asked him why the term 'makerspace' had suddenly become very prominent on the organization's website. He explained that the term was a new one in Kenya and he saw the chance to endow the concept of a 'maker' with a "positive connotation" through the space's professional approach (Research Diary, August 4, 2016).

This 'positive' connotation about the making of professional products was present in all my conversations with makerspace members. The makers were enthusiastic about making things that "qualify for the market" (Interview, makerspace member, July 2016), while also being aware that having a "wonderful idea" does not automatically mean that it can be easily introduced to the market at a later stage (Research Diary, July 28, 2016). In their opinion, only access to a makerspace leads to the transformation of an idea into "something that is able to convince people" (Interview, makerspace member, July 2016). Thus, the 'professional' work executed by a makerspace's machines is an important stepping-stone to making a "meaningful circuit" (ibid.) that solves a problem and can be sold.

The makers' goal to build economically scalable products is also represented by the makerspace itself. An internal document about the makerspace's objectives and milestones states that it aims to be "a world-class prototyping facility and training center" (Gearbox 2016: 6) with "cutting edge knowledge of design and fabrication techniques" (ibid.: 1). By offering these resources to the makerspace's members, they will be exposed to global quality standards of manufacturing and competitiveness in order to "help … [them] bring new inventions and products to market quickly and efficiently" (ibid). The makerspace's highest aim is summarized in their first objective, namely "[t]o help inventors and entrepreneurs bring innovative, locally relevant products that serve the needs of the poor to market at world-class quality standards" (ibid.: 6). In order to achieve these ambitious goals, one of the makerspace's managers recounted how the team in charge travelled internationally to look at various makerspace models and the machines they offered to get inspiration for the composition of Kenya's first makerspace. In regard to the machines for making printed circuit boards, he explained:

> In fact, the PCB line that we've put up is unique. I didn't find any makerspace anywhere that had this PCB production. And part of the reason is, if you live in the United States, you find most electrical engineers that have 20 or 30 years of experience, but have never made a PCB by hand themselves. There is no reason that you ever would because you draw or design with your computer and send it off to a company in China who produces a copy for ten dollars and ships it to you three days later. In Kenya that's not so easy. Shipping is a lot more expensive, can be prohibitive in fact for many people, but especially if you are just experimenting. Being able to create PCBs was the number one demanded service of anything in our service. … The PCB is your standard building block of all electronic devices. If you don't have that you don't have anything. (Interview, November 2015)

He explained the makerspace's vision further: "Ideally, you go from start to finish without ever having to leave the room. You should have every tool that you need to create just about anything within that facility". In reply to the observation that this sounded like the old Ford factories, he stated, "that's the goal" (ibid.).

Overall, the professionalism of a technology is determined by various factors: for Kenyan technology developers, the means of production, the technology's intention, its aesthetics, and its marketability are signifiers of

professionalism (see Chapter 8). As such, a locally manufactured technology should be made with automated and digital fabrication tools, its intention should be innovative and societally impactful, it should look polished and fulfil global quality standards, and it should be marketable and scalable to the whole African continent.

The Particularities of Postcolonial Making

Contrary to many studies on making in post-industrial contexts, I argue that Kenyan making represents a *performance of professionalism*. This means that tech developers perceive only professional technologies, as defined above, as liberating of precarious circumstances.

Grimme et al. (2014) explain the Kenyan makers' feelings of empowerment evoked by building electronic devices and hardware as feelings that occur in places of "limited finances, geographic isolation, [and] barriers of entry created by a need for formalized education" (ibid.: 438). In such places, they claim, the access to tools and knowledge empower makers to "explore their world by making" (ibid.). In this vein, a research partner of mine declared that he felt powerful because he is able to make abstract things into physical objects. However, he also observed that this agency of makers should be handled with care: engineers "have to be responsible how they make a thing appear in the world. It should not be something which just appears, but something which is going to be meaningful and useful" (Interview, electrical engineer, November 2015).

This seriousness with which Kenyan makers face the development of technology points to the meaningfulness of their intentions. Toombs et al. (2014: n.p.) explain the significance of making thus:

> [mechanical] tools connect human understanding to the material world through the possibility of change; they extend or augment, sometimes radically, human capabilities; they require us to change our physical behaviors, skills of imagination, and judgment to learn how to use them well; and, if all of this happens, they empower us to envision and pursue new futures.

It is precisely the intention of makers to pursue 'new Kenyan futures' that makes technology development such a meaningful and serious endeavor. In Nairobi, technology development is a political endeavor of re-making Kenya's positionality as an active participant in technocapitalism. As such, Kenyan makers feel empowered by locally developed technology that is aesthetic,

innovative, and profitable because it presents Kenya as independent of the epistemological and material supremacy of Western technology. The work of 'professional' technology development and its marketable products promise independence from tech imports and the refutation of stereotypes that depict African contexts as exoticized places of improvised low-tech handicrafts.

The particularity of the aspired futures in Kenya signifies that making is a context-specific phenomenon, situated in "circuits of people, objects, capital, and skill, … [while taking] on a particular character within a local landscape of production forms" (Ames et al. 2018: 16). Because various circuits and temporalities situate making practices, technology cannot be judged in a binary way, for example, either as a neutral tool for development or as the root of inequalities (Schurr and Verne 2017). Instead, I follow Ames et al. (2018) in their understanding of making's visions, effects, and politics as multiple and ambivalent. According to them, making practices are not:

> purely mechanisms of empowerment (as commonly envisioned), but also mechanisms for positioning oneself in relationship to serious (and seriously disempowering) constraints, including those associated with neoliberal modes of governance as practiced across a growing range of global contexts. … [The scholars] neither wish to romanticize modes and cultures of technology production driven by necessity nor do … [they] argue that … [their] sites are simply yet another form of innovation. Rather, … [their] goal has been to demonstrate how making across … [their] sites functioned as a mode of intervening in and positioning oneself in relation to existing social, economic and political structures. (ibid.: 17)

In the case of Kenya, the practices of making technologies are entangled in global discourses and local context specificities. The professionalism that technologies should enact responds to global technology standards that make technology from Kenya convincing for (international) investors (see Chapter 6). In Nairobi, the feelings of empowerment do not come from the endeavor to appropriate the capitalist means of production as in post-industrial maker movements. Instead, histories of colonialism and subsequent development experiments shape the future vision of a Fourth Industrial Revolution that leads to national progress (Birkelo 2017; Gachigi 2017). Postcolonial technology entrepreneurs and Kenyan makerspaces aim to gain independence from Western technology imports that prescribe what a former colony supposedly needs and desires (see Chapter 2). Therefore, the local making of professional

technology represents neither the appropriation of manual labor nor a simple copy of Silicon Valley's innovation culture, but – as well as the work of storytelling – the attempt to make Kenya a place of technology development.

The following chapters illustrate the emotions that are dominant in an environment where the transformation of an abstract idea into a tangible and professional product is not a self-evident practice. Amongst others, I examine the fear of failure and the love of machines and prototypes to show that the performance of professionalism in Kenya needs caring socio-technical relations between makers and machines. Overall, the affects prevalent in Nairobi's tech scene illustrate that technology developers vacillate between humble desires for a work life with automated machines and glorious visions of Kenya's future driven by a Fourth Industrial Revolution.

Overview: The Making Chapters

Chapter 7 gives insight into the hustle of the actual technology development in Kenya by illuminating the context-specific challenges of an ambiguously situated place in technocapitalism. I depict the daily challenges that hardware entrepreneurs face when trying to make new technologies. In particular, the lack of capital and resources, worsened by missing state support and investors, difficult access to global commodity flows, and colonial legacies, characterize the difficulties inherent in the development of hardware in Nairobi.

In Chapters 8 and 9, I analyze what 'professionalism' means for Kenyan tech developers and show that the making of professional technology is a precious endeavor. In this vein, I examine the feelings of love and fear in makerspaces in depth, and show that the value of building technological products stems from the envisioned future of changing Kenya's positionality through local high-tech development. Chapter 8 reveals that loving affects are perceivable during the artistic making of technology in which the order and preciseness of technologies are seen as beautiful. Love and trust characterize the human-machine care relationships that collaboratively contribute to the possibility to make professional products locally.

However, love, amazement, and collaboration are not the only components of making marketable technologies. Chapters 9 and 10 depict the emotions of fear and resistance in order to analyze "where creativity and innovation rub against precarity and marginalization" (Ames et al. 2018: 2). In Chapter 9, I show that the fear of failure is a maker's constant companion. They fear that

their prototype will be unprofessional due to 'human error', but also because of the lack of adequate high-tech material. And they fear the theft of their idea. To counter the fear of failure, makers invest a lot of time into *calculative making*, the thorough planning of transforming a digital model into a tangible prototype. Consequently, Kenyan makers focus on an efficient design process not only to pursue control (see Alexander 2009: 1012) and prevent theft, but also to deal with the scarcity of prototyping resources.

Having highlighted the care and calculation invested during technology development, Chapter 10 illustrates those aspects of work that are incalculable and not cared for. I reveal the hierarchies within makerspaces and startups to show that they make technology development a laborious process: managers' decisions make projects unpredictable and their missing appreciation of intangible design work invisibilizes makers' work efforts. Insights into makers' appropriation of prototyping methods to challenge the hierarchies at their workplace show that they not only use technology development to rework Kenya's positionality within global technocapitalism, but also to position themselves within their workplace.

Finally, I conclude this empirical Part II on making by arguing that postcolonial technology entrepreneurs are responsibilized to care – not only about their own income, but also about enacting national visions (see also Chapter 2). As such, Kenyan makers have to invest affects and establish socio-material relations to handle the neoliberal entrepreneurialization of (technology) development.

Chapter 7
Hustle – The Making of Technologies in Kenya

Technology entrepreneurs all over the world face challenges during the production of their technological ideas. In Kenya, the already difficult hardware development is worsened by a lack of state support, difficult access to global commodity flows, a scarcity of investors, and overall colonial legacies. These context-specific challenges form the peripheral positionalities of Kenyan tech entrepreneurs and make technology development a time- and money-consuming process, not allowing for failure-intense prototyping. As a result of the unequal economy of global technocapitalism, Kenyan technology entrepreneurs are almost entirely dependent on international ties to investors, supporters, or family to escape their financial and material resource constraints (see Chapter 6).

The following vignette and further empirical examples below illustrate the Kenyan tech entrepreneurs' hustle to handle the challenges of developing an innovative product in a material periphery of technology production. The vignette tells the anonymized[1] story of an entrepreneur's attempt to develop new technology in Kenya and is based on an interview (May 2016) and several private conversations.

Making Hardware in Kenya – The Story of John and BrightVest

Hello, my name is John and I am from Nairobi, Kenya. I run a wearables startup called BrightVest that tries to reduce motorcycle accidents with wearable technology. BrightVest is a vest for motorcycle riders and their passengers that transmits the motorbike's light systems to their backs. The vest contains

1 I have anonymized the name of my research partner as well as the name of the company.

bright LED lights that turn red when braking and amber to indicate right turns, left turns or hazards. Thus, the motorbike's indication is made more visible to other motorists and road users. BrightVest is wirelessly connected to the motorbike and can be worn over your favorite riding jacket while being water and dust proof.

Let me tell you the story of why hardware is called HARDware. The journey of developing hardware technology is tough, that's why. It entails a lot of bootstrapping: it takes a lot of resources, time, and research. I did not know that when starting five years ago. What I did know was how to fix and disassemble things. When something broke down at home, I helped my father fixing it. When the bulbs did not work, I fixed them. When my dad's radio did not get signals, I disassembled it. I helped my father in repairing his car, handing him the tools he needed. I grew up doing this and did not have much time to play outside as a child. Most of the time I was making; and probably spoiling everything in the house as I started playing with electricity when I was really young.

As you can see, I have no formal education in engineering. I'm one of those guys who have learnt through participating in hackathons and attending events run by Intel and Microsoft. I gained all of my engineering skills from working at co-working spaces like iHub. And that's also how I met my co-founder: we both participated in a German hackathon; a two-day boot camp in which we realized 'Oh, we both have good skills in making hardware'. That was a surprise because he was the first maker I'd met in a co-working space. I realized that he was a maker because he knew about Arduinos although they were not yet in the Kenyan market. Other makers I've met were not really into engineering and robotics, more into the recycling of e-waste through designing fashion, art, and furniture. In that hackathon, we won six months of incubation at a business accelerator and ended up starting BrightVest together.

From that moment on, it took us two years from the idea to the actual product. When we started BrightVest we wanted to sell fancy clothes with lights on them but after joining the business accelerator, we found out that there was no business model around that. Asking people, "Would you buy a shirt with lights?", they were like "Oh no! Why would I wear a shirt with lights?! So I can get robbed at night? People could see me everywhere!" We had funny conversations that forced us back to the drawing board. That was when we

stumbled over reports from the World Health Organization, saying that if we increased the visibility of motorcycle riders, we could reduce the chances of accidents by 70%. As the tech scene in Nairobi puts emphasis on building products that solve problems in Kenya and other developing countries, we came up with the business model around BrightVest as a vest for motorcyclists.

We started building the vest and had a complete prototype in only two weeks. The first one had cables running from the vest to the motorbike. That was easy. But after some days we had problems with short circuiting and cables coming loose from motorbikes at high speeds. So we had to sit down and think: 'Now we need a wireless technology'. Getting the components for a wireless device was quite a challenge. The components available in Kenya were all power hungry. So this other issue came up: we first had to find low power consumption devices. All of this was challenging because the only components available on the market were the usual ones that we had already used. Trying to get the required parts from China to Kenya was extremely expensive because there is a huge tax on imported goods. My co-founder didn't have a job and I had to quit my job to work on BrightVest, so we were limited on capital and boot-strapping with family and friends. That was quite demanding.

In addition, a small company can't order small quantities of five hundred components of each part needed. To place an order you need to order almost 4000 components at a time. If you somehow manage to find a company in China that will sell you a small number of electrical components, it takes about three weeks to get them. During those weeks, the only thing you can do is to wait. By the time you wait, it's almost a whole month. This means that your process is delayed. You have six months in an incubator to work on your project and have demos to present but you cannot deliver anything because essential components for the prototype are missing. So we got the few parts that were available here and hacked around those, like using lights from bulbs instead of the right LEDs.

If we had had a maker community around us back then, maybe we would have finished a marketable product faster. But we didn't have access to tools or manufacturing plants and thus, we had to find alternatives. That is why we decided to do crowdfunding. With that money, we managed to fly out to the Netherlands to meet with engineers and build the complete thing from scratch. Finally, we managed to build our product after two years full of chal-

> lenges. I can tell you, the two things that most helped us to reach our goal were thorough research and exchanging experiences with other Kenyan hardware companies. We spent a lot of time doing research, reading books, and talking to other companies that had been on the same journey but with different devices, just to see how they got started.
>
> Luckily, we have now reached the point where we can make the vests manually and have already produced almost fifty vests. We have even shipped some to Malawi and Uganda. In Kenya, we still have a market of over 600,000 motorcycle riders. Thus, we need to automate the process of making our vests which is why we are now looking to go to China for mass production.

Meeting John again a few weeks after our interview, he told me about his countless contacts all over the world. That evening he had a skype meeting with an entrepreneur in Germany, the day after he would talk to someone from the Massachusetts Institute of Technology, and the Dutch engineers had become close friends and technical advisers. When I told him that he seemed to be the best networker that I knew and that his connections would possibly help him to find funding to scale his enterprise, he sighed and told me despondently that he had sacrificed everything – his family, his friends – over the last few years. He had not seen or talked to his sister in over a year although she had recently given birth to her first-born and lived not far from him. He sighed several times more and emphasized how hard it was to be a hardware entrepreneur in Kenya. John listed all the funding proposals he had written and explained that most of the replies came in the negative; no-one wants to finance a hardware project. During this conversation, John told me that he had made up his mind with a heavy heart and decided to stop working on BrightVest and anything else with hardware unless he received investment (Research Diary, June 24, 2016).

7.1 The Scarcity of Prototyping Resources

John's experiences of developing hardware are not unique, but resonate with the whole hardware tech scene in Nairobi. The following additional ethnographic insights show that technology developers perceive themselves as disconnected from global economies. They blame colonial path dependencies for Kenya's peripheral status in commodity flows and compare themselves to their role model, Silicon Valley, where procurement is described as "easy"

because "you can simply order components from online distributors … and parts arrive quickly, with familiar shipping options" (Mellis 2011: 54).[2] I argue that Nairobi's makers feel that they exist in a place that is antithetical to Silicon Valley as they are confronted with restricted and complicated access to resources that makes technology development more time-intense and costly than it would be in countries holding central economic positions in technocapitalism.

For Kenya's technology developers, access to machines and components to prototype and manufacture electronic devices is limited. High taxes on imported resources, such as basic soldering wire, 3–5mm screws for electric circuits, or CNC (Computerized Numerical Control) machines render imported goods too expensive to buy (Mungai 2015: n.p.). Complaints about high taxes and the overall problematization of Kenya's government and its missing support of the manufacturing sector are made and heard daily. Technology entrepreneurs complain that making in Kenya is challenging because national laws and policy frameworks restrict cheap prototyping. A researcher at the Centre for Intellectual Property and Information Technology Law (CIPIT) at Strathmore University confirmed that most makers in Nairobi are concerned about the tax laws in Kenya that make it too expensive for them to import resources such as machines, components, and other parts necessary to execute their work (Interview, April 2017). The high taxes defined in the customs regulations and the high costs of production in Kenya in general, makers claim, prohibit the local development of technology:

> Our hardware is designed here, but it is produced in California. Even producing it there and bringing it over to Kenya is still cheaper than having it produced in Kenya. The manufacturing license here, just a license, a piece of paper, costs ten thousand dollars. (Interview, hardware company employee, November 2015)

2 The description of the USA or other industrialized countries as challenge-free places of technology entrepreneurship is a homogenization. Making, and technology development in general, is predominantly done by high-income status groups. In this vein, Avle et al. (2019) describe how makers in low-income areas in Detroit experience challenging access to funding and material resources due to categories of class and race. In addition, gender inequality and its resulting restrictions are also present in tech hubs and makerspaces worldwide (Jiménez 2019; Eckhardt et al. 2021).

The hardware company employee went on to elaborate that everyday political affairs have implications for his company, for example, on the product's pricing. Therefore, he concluded, hardware companies "do not operate in a vacuum", but within a legal environment that enforces the "rule of law" (ibid.). According to him, the Kenyan government tries its best to cope with the demands of technological innovation and the pace of technology development was a challenge for governments worldwide (ibid.). Nevertheless, specifically in Kenya:

> The institutions of the day were set up by the colonial masters – the policies, customs, and law. And if you look at the laws that exist, a lot of them need to be updated to the realities of today. When the law was put together, they didn't anticipate that we were going to build this kind of hardware here. So there is a gap between what we are doing and the rigidity of the legislative environment. (ibid.)

This is a good example of how hardware entrepreneurs problematize the lack of state support. The Kenyan government is said to complicate manufacturing because of its prohibitive tax laws, outdated business legislation unsuitable for technological development, and overall "bureaucracy and corruption" (Gearbox 2016: 2).[3] Despite the existence of various government departments, initiatives, policy papers, and agendas that aim to support the manufacturing sector in Kenya (see Chapter 2), difficulties in acquiring components and machines to prototype still exist; resulting in a scarcity of prototyping facilities and industrial factories to manufacture locally.

Engineers who tried to import resources in the 2000s had even more problems:

> I tried to do online importing when there were only a few online shops. I had to go to a bank but no bank would accept my international money order. So I

3 Corruption as a challenge for entrepreneurs was mentioned on various other occasions; for example, at a panel discussion on tech entrepreneurship in November 2015. Corruption was mentioned in the first five minutes of this discussion, and from then on, the topic was present throughout the evening. Amongst others, stories about the absurdity of licensing processes were told: entrepreneurs have to go to six different offices to license a business; each visit entailing extra 'payments'. One of the panelists felt that if face-to-face interactions were reduced through digital systems, corruption would decrease tremendously.

> had to find an international check and send it by post not knowing how long it would take. (Interview, mechanical engineer, November 2015)

An electrical engineer and expert in Nairobi's hardware innovation scene observed that the hardware scene improved around 2012:

> Before, it was so hard to get stuff. There were two stores in the city where you could buy components. Later on, one company went online and you could order from a limited selection online. What I realize when I look back is that this particular company really influenced how people were approaching making. If they had Arduinos, people would rush in and start working on Arduino. Then Raspberry Pi. I don't think they are aware of it, but they really affected how people interacted with electronics. Because when it's available, then you build something with it. (Interview, May 2016)

Although internet penetration and thus access to international knowledge and sellers has increased dramatically, the cost of machines and components are still restrictive. A daily practice at makerspaces is the online search for new projects and the latest components for making. One day, a makerspace member showed me the website of a new Russian startup who had built the "smallest computer". He complained that he could not order one because the initial cost of 45 dollars would increase to 100 dollars due to the Kenyan taxes. Further, he doubted that it would actually be delivered to Nairobi successfully (Research Diary, June 23, 2016).

'Waiting' characterizes the acquisition of material – both locally and internationally. The local purchase of prototyping material is determined by the supply of well-known local shops (see quote above) or an exhaustive search for the required parts. If fortunate, technology developers will find their specific components somewhere in Nairobi after having called numerous sellers around the city. To find suppliers in Nairobi is difficult because:

> Often, they are family-owned companies. They have a stable, reliable customer base and they don't need to advertise. Therefore, they don't have websites, catalogues, or pricelists and are extremely difficult to find. You have to ask around and ask who does what. (Interview, mechanical engineer, April 2017)

The search for locally available parts causes daily absences from the makerspace because people have to go to 'Tao' (Nairobian slang for "Town") to buy essential

components. At this point, it should be said that a purchase in the Central Business District or Industrial Area, where most of the sellers are located, means losing at least half a working day due to Nairobi's notorious traffic jams.

Sitting in a traffic jam for two hours is one way to wait for a component; another is to wait six to eight weeks for components, machines, or whole prototypes ordered from abroad. If specific components are not available in Kenya, they are usually imported from countries such as China or the USA. These imports include long waiting times which make prototyping a tiring process as a hardware company founder explained:

> I got someone to take me to town to go to where the electronic components were sold. I hoped to find microprocessors, surface melt technology, you know SMT components, and instead I found those big capacitors and resistors and things that aren't very useful to do embedded electronics. And, you know, that was all that existed. And so we did the best we could with the parts that were available. From that we learned and said, 'Okay, what we really need is one of these and one of these'. And so we were able to import stuff. Sometimes it would come in one week, sometimes it would come in eight weeks. It was really challenging in those early days. (Interview, November 2015)

A common strategy to make prototyping cheaper and quicker is to send a digital model of the prototype to specific companies in the USA or China, have it built there and then shipped back to Nairobi. Nevertheless, according to my research partners, the international outsourcing of prototyping makes technology development in Kenya even more time- and money-consuming than it is for engineers in the USA or UK:

> Prototyping is expensive, even doing it in China. Because prototyping involves putting an idea out there to test it, so you are paying someone every time you are testing. So every time the prototype goes out, you are spending money because you have to pay freight. And you, you have to sit back and wait until it comes back. And be surprised about 'Does it work or does it not?' It takes ten times more money and time than for a person prototyping in the US or UK. (Interview, mechanical engineer, November 2015)

The international purchase of components and prototypes is not only challenging for individual makers, but also for Kenyan startups. They face barriers to acquiring resources because they are often not eligible for discounts or deals with

global hardware suppliers. In the example of BrightVest, it became clear that startups who experiment with hardware and therefore need only a small number of components, do not qualify for orders from manufacturers in China. The hardware company BRCK also had experience of being "a small Kenyan company":

> It is very difficult for us to get the attention of electronic part suppliers. Therefore, one of the issues we had from the beginning was our modem. A company called Novatel makes our modem. They are used to dealing with billions of units, so a deal with a small Kenyan company for one thousand units is not exciting to them. That meant that they changed their modem and did not tell us. And then we had issues. So we had considerable component constraints – even getting those 25,000 units. Only our partnership with Intel Education and their strength and power, allows us to get access to manufacturing and component suppliers as they are now paying attention to us. (Interview, co-founder of BRCK, November 2015)

The example of BRCK's partnership with Intel, a multinational tech company, shows that Kenyan technology developers are greatly dependent on international ties in order to access other countries' markets and escape resource constraints. The vignette at the beginning revealed that John and his co-founder were only able to build their final prototype in the Netherlands. Makers who have an international background often use their personal travels to the USA or Europe to purchase material: "I brought pumps from San Francisco last time I was there, just because I saw them in a hardware store and it was 70 dollars. That exact same model here in Nairobi costs almost 700 dollars" (Interview, makerspace employee, November 2015). The co-founders of BRCK also brought various components with them when they moved to Kenya: "We literally brought our piles of stuff into a room, dumped it on the table, and put together the first working BRCK from those components" (Interview, co-founder of BRCK, November 2015).

7.2 The Scarcity of Financial Resources

The fact that international relations ease technology development through, for example, giving access to global electronics markets, is a privilege not granted to many. In the case of BrightVest, the startup was unable to secure funding

to scale the production of their vests, and John was forced to give up his hardware innovation after two years of work. The difficulty of finding investors is a challenge bemoaned by many (Black) technology entrepreneurs (see Chapter 6). One reason for the lack of investment in hardware technology is that the investors in Nairobi focus on software innovation. This means that money-bringing competitions such as hackathons suit software and coding projects better than those tinkering with electronic components.

A hackathon's limited period of 24 to 48 hours also excludes the making of hardware, as an electrical engineer explained: "The timelines are very unrealistic to come up with an MVP [Minimal Viable Product] for hardware. Additionally, the hackathon organizers do not provide the hardware components needed to experiment and research" (Interview, November 2015). Despite the engineer's critique, he and his team had managed to win six months of incubation at a hackathon, as John and his co-founder did (see Vignette). Nevertheless, he soon realized that this six-month period is far too short for developing hardware. The reiterative process of prototyping hardware takes more time than coding software due to the long waiting times for components and machines. Based on these experiences, the interviewee was convinced that some investors are not willing to support hardware ideas:

> [The international companies that are involved in Nairobi's tech scene] just come here for a beer and marketing to show that they are in Africa. If they were committed to building stuff and going to market, they would figure out an ecosystem to help Kenyan innovators. It can't work within a short period of six months. No, it can't work. And even if it is a competition – what is the spirit of a competition? Just to have an MVP at the end? You shouldn't have a process where you eliminate guys, you have to at least help us along the process. … Hardware projects are time-consuming and very painstaking, so the companies should consider how they can actually support the participants. (ibid.)

As well as accusing technology investors in Kenya of not being serious about their work, a hardware company founder had a different explanation for the scarce investment in hardware innovation in Kenya:

> Hardware scares people. And the ones you find that are willing to invest in hardware are genuinely scared of Africa. So to find people who aren't scared of hardware and aren't scared of Africa is a bit of a challenge. (Interview, November 2015)

A global stigma also seems to cling to hardware innovation; it is too difficult to understand and assess for non-engineers. As such, it is difficult enough for a hardware company in the USA or Europe to find investors, but working in an African country that has the additional stigma of being a homogeneous frightening context for investment makes the search for hardware investors even more challenging (see Chapter 6). As depicted, the scarcity of investment causes many startups to fail at scaling up their enterprise or even at testing their prototypes.

7.3 Conclusion: The Challenges of Postcolonial Technology Entrepreneurship

The illustrated hassle of accessing prototyping resources due to the lack of support from the state and investors shows that "the context of East Africa makes a hardware project very resource hungry – the manufacturing course, patent issues, and getting a VC fund" (Interview, hardware innovation expert, May 2016). Without having access to abundant capital and resources, the already difficult development of hardware is exacerbated for technology entrepreneurs in Nairobi. A Kenyan makerspace summarized a similar status analysis of the hardware innovation scene:

> There is a vibrant culture of designers, engineers, and entrepreneurs creating products designed to improve people's lives, … [but it] is highly constrained by a lack of skills training, access to quality tools and materials, and an insular culture in the face of regional and international competition. The best local organizations and talent are forced to design and develop abroad, increasing costs and time to market and spurring brain drain. (Gearbox 2016: 7)

The makerspace's analysis of entrepreneurial challenges in Kenya draws on experiences of local hardware startups and further explains how a makerspace can help to solve the challenges faced by companies, makers, and other people who aim to develop new technology. In an interview, a co-founder of BRCK admitted laughingly that they had built the makerspace Gearbox for them-

selves: BRCK and Sanergy,[4] two of the founding companies of Gearbox, shared their experiences of prototyping problems and subsequently decided to launch a makerspace that supported companies like them (Interview, November 2015). By offering digital fabrication tools to develop prototypes more cheaply, the establishment of makerspaces should serve to alleviate the challenges inherent in the peripheral positionality of Kenyan startups in technocapitalism. Chapters 8 and 9 illuminate the perceived preciousness of the local making of high-tech that conforms to global standards, as it promises to re-make Kenya's positionality.

4 Sanergy is based in Nairobi and builds sanitation solutions for informalized settlements.

Chapter 8
Love – The Careful Making of Technologies

As explained in the introduction to Part II, academic accounts of making mainly focus on craftwork and manual labor. In the following, I show that scholars distinguish between making as a manual and affective practice, and developing technology as an abstract and rational action, by continuously referring to crafting or DIY (do-it-yourself) projects when speaking of making. My empirical insights into the presence of the emotion of love during the making of technology show, in contrast, that engineering practices also entail strong affects. Against this backdrop, I transfer the academic insights on crafting's socio-materiality to the socio-technical collaborations of makers, technical components, digital fabrication tools, and prototypes involved in carefully turning an abstract idea into a tangible technology.

Craft, bricolage, and DIY practices are mainly analyzed by using research methods such as auto-ethnography, observation, and interviews (e.g., Bardzell et al. 2012; Davies 2018; Peppler et al. 2016; Price and Hawkins 2018). Researching the actual work done by crafters and makers, the sensory attributes – or "hand tasks that emphasize touch and feel" (Gibson 2016: 62) – come to the fore and highlight the interaction between makers and their material which is often described as a dialogue. Bardzell et al. (2012: 13), for example, describe how their research partner Jill "allows her materials to 'help' her and become collaborators in the production process" because she herself "does not have a 'preconceived idea' … of what lies ahead". In this regard, craft seems to rely on spontaneous ad-hoc decisions and imperfection (Boeva 2018: 6) whereby the material resources shape the outcome.

As this spontaneity causes the product to be unpredictable, "the quality of the result is continually at risk during the process of making" (Pye 1968/2010: 342). Thus, makers invest "judgment, dexterity and care" in their work with the material (ibid.). Due to the "[h]aptic, tactile skills embodied and embedded in

workers' bodies" (Gibson 2016: 82 referring to Sennett 2008), researchers of making observe deeply affectual collaborations between the makers and their materials. The emotional appreciation of the makers' material is exemplified by one of Bardzell et al.'s (2012: 13) interviewees, a famous potter in Taiwan. This potter is so amazed by his craft resource, clay, that "he hopes that his public will also come to appreciate clay – not his work, but *clay itself* – as a beautiful material". The socio-materiality of making practices is summarized as follows:

> [M]aking something entails a different type of mediation with your surroundings, potentially a more sensorial awareness of things (Borgmann 1984), or even a sense of craftsmanship (Sennett 2009) and its values of satisfaction of doing good work, the pursuit of community, and the respect for material reality. (Nascimento 2014: 1)

Although the majority of the literature on making ignores the practices of technology development by focusing on crafting and tinkering, other scholars explicitly differentiate between making as manual and emotional, and technology development as abstract and rational. In this regard, Richard Sennett (2008: 84) argues that since the Enlightenment, "the craftsman [has become] an emblem of human individuality" and that, contrary to mechanical perfection, craftwork is positively valued due to its "variations, flaws, and irregularities". The continuous differentiation between two sets of making practices is also expressed in research agendas that include technology development. Leah Buechley and Hannah Perner-Wilson (2012: 1), for example, conducted a survey with several makers to "compare the experience of making electronics with the experiences of carving, sewing, and painting". They highlight that their interviewees who build electronic devices are emotionally involved during the making of technology, but also emphasize a difference between them and their other interviewees who paint, carve, and sew:

> It is noteworthy then that electronics makers never brought up relaxation or aesthetics in their reflections. Though these makers expressed similar sentiments of enjoyment and engagement, … no maker mentioned aesthetic aspects of their projects in their reflections. (ibid.: 6)

Beauty and aesthetics seem to be the motivation of the other crafts while "electronics builders were much more likely to mention ideas, concepts, or theories than other craftspeople" (ibid.). Therefore, Buechley and Perner-Wilson make

the point that electronics makers mainly focus on the functionality of their devices and not on the aesthetics of their designs. To explain this different approach to making, they argue that abstract thinking and systematic planning "is built into the standard tools and techniques of electronics" (ibid.: 17). According to them, the tools and techniques of making electronic devices do not allow for a material conversation and open-ended outcome as in other crafts:

> The electronics maker works with a set of discrete components – like resistors, capacitors, sensors, and amplifiers – with precisely specified properties. Several of our survey respondents identified these discrete components as essential qualities of the medium and crucial materials. "We are talking about creating circuits/electronic devices from components pre-made. We do not have to worry about making these components themselves" [E1]. "The essential properties of the medium are the basic components" [E7]. (ibid.: 7)

Buechley and Perner-Wilson (ibid.: 8) conclude that "making electronics is characterized by an emphasis on abstraction and discreteness" because it focuses on abstract ideas, specified components, and the functionality of its product. Two other scholars, Sherry Turkle and Seymour Papert (1990: 136), call this affinity to abstraction a "planner's approach". In their study of students who use computers at school or during their first programming course, they describe the students as planners who prefer to work in a "rule-driven system" and solve programming problems by "dissect[ing] it into separate parts and design[ing] a set of modular solutions that will fit the parts into an intended whole" (ibid.). They differentiate the planners from the small number of people, predominantly female, who are "bricoleurs":

> For planners, a program is an instrument for premeditated control; bricoleurs have goals, but set out to realize them in the spirit of a collaborative venture with the machine. For planners, getting a program to work is like "saying one's piece"; for bricoleurs it is more like a conversation than a monologue. (ibid.)

The attributes of bricoleur programming students and makers who sew, paint, and carve emphasized by Turkle and Papert are similar to the craft qualities noted above; all the researched groups seem to be engaged in a dialogue with their material – be it code, wood, fabric, or canvas. The admiration for one's material and its beauty and aesthetics are a motivational source that implies

the sensory stimuli gained from craftwork. Additionally, working in a dialogue brings an openness to the outcome of the making process. This means that making consists of spontaneous and probably imperfect acts. Unlike these artistic approaches to making, makers of electronics, often with a background in engineering, are categorized as 'abstract thinkers' and 'planners' whose main goal is the defined outcome of a functional device. The modularized components of a printed circuit board (PCB) do not seem to allow a dialogue with the material and thus, no possibility for the expression of beauty. Engineering is declared as antithetical to crafting, as abstract and functional versus creative and aesthetic, driven by rationality instead of being a highly embodied practice, and resting on the power of machinery while craft celebrates manual work.

To complicate this binary understanding of technology development and craftwork, I argue in the following that engineering practices also entail feelings such as love and admiration. I exemplify the 'dialogue' between maker and material by depicting the socio-technical relationships that care for making PCBs professionally. The affectual and intimate practices of care invested in the daily work done at Kenyan makerspaces highlight first that aesthetics has the same value as functionality when making products because prototypes are only perceived as professional when they are beautiful and functional at the same time. Second, intimate feelings of love and empowerment are present in human-machine relationships that collaboratively materialize an idea into a product for the capitalist market. Overall, the emotion of love makes us understand that beauty as well as the functionality of a prototype are signifiers of professionalism and that the work of building professional products is a precious one.

8.1 The Art of Making Technology

When making a printed circuit board, the achievement of a specific arrangement of the components is crucial: "Electronics are a precise media. It cannot work unless the elements are in exact order" (interviewee cited in Buechley and Perner-Wilson 2012: 7). Thus, it seems that a technology developer has to stick to the rules and standards inscribed in the specific components, tools, and machines to achieve a functional PCB. However, I disagree with the scholars cited in the previous section who sideline creativity and affects during coding and building electronics and claim that the aim of technological functionality leaves no room for aesthetics. In this vein, the vignette below illuminates how working with electronics makers in Nairobi taught me that the very ordered arrangement of PCB components can, indeed, represent beauty and aesthetic pleasure.

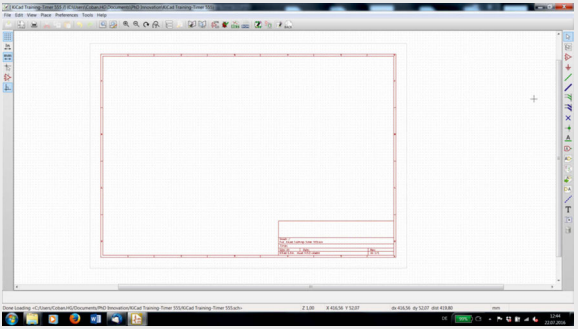
Getting Trained in KiCad and to See Beauty in Order

Today, I arrived early at the makerspace to participate in a training offered there for the first time. It was about printed circuit board *computer-aided design* (CAD) using the software KiCad 4.0.2. Martin, an electrical engineering student working at the makerspace, offers this training and I registered for it to try to better understand what every electronics maker does at their computer day after day. We were a group of about 10 participants trying to squeeze into the 'computer lab' that consists of four tables and six computers arranged in one corner of the makerspace. Martin gave a 16-page handout to everyone. I flipped through the pages and did not understand a word: "EDA", "555 timer IC based circuit", "schematic file", "external resistor network", "Gerber file", … I was the only person without an engineering background at the training, thus, I tried to absorb every single word Martin said.

He started with an enthusiastic introduction to KiCad: KiCad is a software for EDA (Electronic Design Automation) "which helps to bridge the gap between one's idea and the actual prototype". He emphasized that if we have "a problem in our head that we want to solve, then we have to develop a concept as a solution and KiCad helps us to materialize this exact idea". Everyone in the computer lab listened attentively to Martin's words while sitting in front of computer and laptop screens. After his introduction about the importance and advantages of EDAs in general, and KiCad as open source software in par-

ticular (Figure 6), he gave us the task of composing a "schematic file" for a "555 timer".

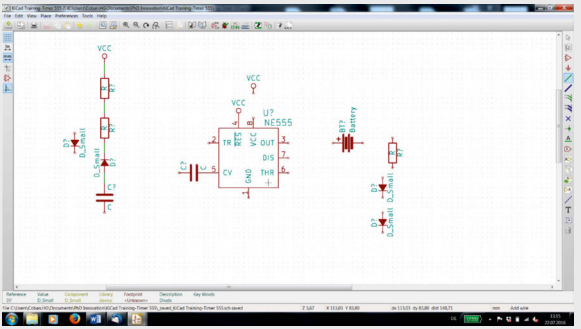
Figure 6: Screenshot of a first blank page of a schematic file in KiCad 4.0.2. (Research Diary, July 22, 2016).



Martin added, "Put the components on the page. But not in an order. And don't connect them to anything yet". I did not know where to start: GND, THR, OUT, VCC, C, D_Small? I was confused. What did the abbreviations mean? I needed a reference point and looked at the figure of the "555 timer" in our handout. I tried to find out which abbreviations stand for what in order to look them up in the component library of the software. From time to time, I asked Martin, "What will each component do? Why are these specific components important for the electric circuit? How do they relate to each other?" Without this knowledge, I could not imagine how to place the components in the best way: for example, if a certain arrangement makes more sense than others do. I started to connect my components to each other, as it felt like the only possibility for me to gain a sense of order and comprehension.

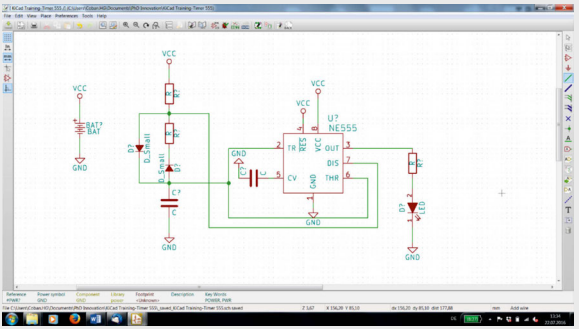
And I failed, dramatically.

Figure 7: Screenshot of my failure (Research Diary, July 22, 2016).



I only recognized my failure because, once connected to the main square in the middle of the schematic file, I could not move my components anymore (Figure 7). Martin reminded me that he told us not to connect the components: "There has to be a wire between every component, one cannot connect them right away". He explained that the wires are called 'traces' and they represent very thin conducting strips made out of copper, which will connect two components on the tangible PCB substrate. I was angry with myself that I did not follow Martin's instructions from the beginning, but instead followed my impatient impulse to connect the components in order to arrange everything 'neatly' according to my gut instinct. I had to delete everything and add every single component to the page again. Some time and several confusions and mistakes later, I was the proud owner of a schematic file! (Figure 8) Everyone in the group looked at their finished schematic files and Martin enthusiastically exclaimed, "Look! A PCB is artwork – it is in order and beautifully organized like an image!"

Figure 8: Screenshot of my finished schematic file of a 555 timer (Research Diary, July 22, 2016).



This extract from my research diary gives insights into the first step of assembling a printed circuit board, namely the creation of a digital file that is then used by other digitally automated machines to fabricate the tangible PCB. When I reread my diary notes after the research stay, I was astonished that during the training I had so quickly connected the components to each other although the trainer had explicitly said not to do so. I obviously wanted to order and connect everything in my schematic file, as the extent of my knowledge was that the electrical circuit would function only through the connection of the components. I longed to achieve a functional electronic device, the "555 timer".[1] In this regard, Lucy Suchman (2009: 10) claims in her work on human-machine interfaces that the specific materialities of a medium spark affective effects. This means that the software KiCad and its intrinsic aim of designing a circuit board evoked my wish for connectivity and order. I was prompted to think in an abstract way, trying to connect the modular components to "fit the parts into an intended whole" (Turkle and Papert 1990: 136).

Nevertheless, I failed to achieve the desired outcome of a schematic 555 timer at first because it was impossible for me to imagine the final PCB while

1 The '555 timer' is an integrated circuit (IC) that is able to produce applications with a time control, for example, delay timers, alarms, LED flashers. The IC got its name from its three internally connected 5 kilo-ohm resistors (Electronics Tutorials 2021: n.p.).

lacking the knowledge about the abstract configurations of this technical device.[2] Yet, the specific requirements of the components were my only anchor in a wild sea of terms and concepts that I did not understand. As such, I used the opportunity to search online for the components' specifications without really understanding the physical laws of why specific components have to be connected to each other in order to create a functional PCB. With the help of the standardized specificities, I was finally able to achieve a functional schematic 555 timer. This intricate process of building a digital PCB illustrates how my lack of technical knowledge and skills resulted in me sticking rigidly to the abstract specifications of KiCad's materiality. As such, it did not occur to me to leave the specified functionalities and prescriptions of the PCB aside.

My lack of expertise is also a reason for why I did not initially recognize the beauty of my schematic file, and Martin had to explain it to me. Contrary to the literature's assumption that functionality is more important than aesthetics for makers of electronics, Martin's enthusiasm about the schematic files as artwork clearly shows that order and the specific arrangement of PCB components are perceived as beautiful. Yet, only a few researchers claim the prevalence of embodied affects usually ascribed to craftwork in scientific technology production. Natasha Myers (2008: 169) is one, and explains that:

> scientists' movements, gestures, and affects as they work with their objects … [blur] the boundaries between automated machinic productions and the skilled work of scientists, and between the intellectual and physical labor of research.

Thus, she tears down the dichotomy between manual craftwork and abstract engineering. Drawing on her case study of the relationships between protein crystallographers and their three-dimensional protein models, Myers (ibid.) argues that "modeling practices challenge narrow conceptions of 'thinking' as a cerebral activity, and make visible the craftwork, creativity, and embodiment of scientific reasoning". Similar to my empirical observations in Nairobi which show the perception of a digital PCB model as beautiful art, Myers states that "a crystallographic protein model is an artisanal object" (ibid.: 188). In this man-

2 Sebastian Dahm (2017) who autoethnographically learned how to code describes the same kind of failure; he failed to code a pentagon because he followed his instincts without knowing the abstract specifics of coding.

ner, Jonathan Bean and Daniela Rosner (2012: 88) argue that "design is a form of craft":

> The design of a mobile phone or a building is anything but disembodied, impersonal, or generic. Design requires working with one's hands in the "soil" of computing infrastructures, just as crafters handle wood or clay. (ibid: 87f.)

Due to the affective entanglements between a crystallographer, designer, or electronics maker and their work, the resulting digital model resembles "a craft product of labor and love" (Myers 2008: 188). As an example, Myers refers to her research partner's anecdote about publishing a 'birth announcement' when a digital model is finished:

> I don't know, some other people say that they want birth announcements when the structure [is coming out] … because it is kind of like being in labor. … And often a building process will take nine months. … [Y]ou're all of a sudden, 'Oh! Look at where that conserved patch is. … [S]o it's sort of this unveiling. And then you finally give birth to your molecule. And what I've started doing is putting our structures on refrigerator magnets and so then for Christmas you can share with your family and friends. Everyone sends out their pictures of their kids and you send out pictures of your kids. (ibid.)

Returning to Nairobi's technology developers: their motivation for making electronics may not be primarily to express themselves artfully, as in pottery for example, but to build a marketable product. However, the practices of making hardware are saturated with amazement regarding models, designs, and materialized PCBs. Both aesthetics and functionality of a technical device are strived for, as an electrical engineer who developed a PCB which is able to signal the necessary renewal of chemical solutions by measuring the solutions' acidities explained (Figure 9):

> Designing the PCB is a nice part of assembling the components on the PCB. For example, all connectors for the sensors [which will be immersed into the liquid chemicals to measure their concentrations as seen in the photo] are in a row at one end of the PCB. The two tiny blue things that look like pearls are resistors. The largest component is the micro controller. That is the most important thing because as the name says, 'it controls everything'. (Research Diary, June 28, 2016)

Figure 9: Testing a PCB, 2016 (author's photo).

In this quote, and in the vignette above, the assemblage of the components on a PCB constitutes the beauty of it. The specific arrangement of sensors, resistors, and the micro controller on the tangible board, as well as the order of components in a digital PCB model engenders amazement. As such, loving affects characterize the engineering process of transforming an abstract idea into a visible and tangible prototype. Makers are proud of their products and satisfied by an outcome that is accurate and functional.

The blending of aesthetics and functionality made me interested in what exactly 'beauty' stands for in technology development. Thus, I was attentive to further feelings of pleasure and wonder as in this conversation with Martin some days after the KiCad training:

> Martin showed me the schematic file of his work. I asked him how he decides which component is connected to which component – if it is a trial and error process or a design decision or something else. He answered that all the connections that he builds are based on research; he uses Google to search for the specific datasheets of every component in order to read about their values. However, he went on to say that he knew from the beginning that he wanted to have the connections for the sensors on one side, the LCD [Liquid Crystal Display] above, and the button below. Enthusiastically, he exclaimed: "People want to see professionalism; they want aesthetics to make

> their board look wonderful. Yes, they want it to be made even to that level!" (Research Diary, July 25, 2016)

This conversation highlighted that the aesthetics and functionality of a PCB cannot be seen separately because a specific arrangement of components make the board work in the intended way and additionally presents a 'wonderful look'. Martin stated that the beauty of a board signified 'professionalism'. As such, aesthetics has the same value as functionality because technology only represents professionalism if it is beautiful and functional at the same time.

Based on the depicted empirical insights, I claim that both qualities – aesthetics and functionality – are entangled and not dichotomous as claimed by those scholars who distinguish between the creative artwork of craft and the rational approaches of engineering. Technology developers in Kenyan makerspaces assemble and order technical components in a standardized way and find pleasure in building both an aesthetic *and* functional prototype – because both attributes signify a professional technology. The fact that I was not immediately able to see the connection between beauty and order indicates that the aesthetics and functionality of a technical assemblage, and thus, the professionalism of a technology is only visible to the trained eye. Kenyan makers passionately learn and apply globally standardized technical skills and knowledge in order to produce technology according to global norms. Thus, the art of making technology consists of achieving a desired professionalism that is able to compete in global technocapitalism.

8.2 Caring Human-Machine Relations

The vignette concerning the KiCad training demonstrates that the ordered assemblage of a PCB is beautiful to a knowledgeable contemplator and that precisely this aesthetics of order is a crucial element of the professionalism of a technology. In addition to these insights, the vignette also hints at another facet of loving feelings, namely the intimacy and care between makers and the tools that they work with. I show in the following that the human-machine relations in Kenyan makerspaces are built upon love and trust for machines which accurately transform an abstract idea into a tangible device and upon the machines' fast and precise work for makers who suffer from limited manual capabilities. The perceivable love signifies the preciousness of professional

technologies as they enact the envisioned future of being included in techno-capitalism.

During the introduction to the KiCad training, Martin's chorus of praise about the software's benefits took up a lot of time. Therein, he expressed his gratitude towards the software that, he said, assists a maker in materializing the idea in their head. This admiration of technological support to "bridge the gap between one's idea and the actual prototype" (Research Diary, July 22, 2016) is also mentioned by Turkle and Papert (1990: 131) who seemingly joined the optimism about the rise of computers in the early 1990s:

> At the heart of the new possibilities for the appropriation of formal systems is the computational object, on the border between an abstract idea and a concrete physical object. In the simplest case, a computational object such as an icon moving on a computer screen can be defined by the most formal of rules and is thus a mathematical construct, but at the same time it is visible, almost tangible, and allows a sense of direct manipulation that only the encultured mathematician can feel in traditional formal systems. The computer has a theoretical vocation: it can make the abstract concrete; it can bring formality down-to-earth.

The computational object, in our case the software KiCad, helps to make an abstract idea and the formalities of electronics concrete through their materialization into a digital PCB model. Thus, the gratitude towards KiCad is understandable – it takes over the task of materializing one's idea by ordering and assembling PCB components; even in a beautiful way.

Suchman (2009) has also analyzed such emotional relationships between engineers and software. She claims that within the mutual relation between computer-aided design (CAD) images and their users, the CAD interface constitutes "a particular configuration, a specifically enacted site of extended, heterogeneously constituted human/nonhuman capacities for thought and action" (ibid.: 10). Further, she draws on Laura Marks, a film theorist, who writes about a "'three-dimensional intimacy' among persons, images and their materiality, and the worlds to which the images connect" (2007: 279). Where Suchman uses the three-dimensional intimacy frame to illustrate especially human interaction with CAD imaginary, I show that intimacy can also be found in every other human-machine interaction in a makerspace (see Ehn 2011: 57). This intimacy is characterized by a mutual care for making professional technologies. Relating to Maria Puig de la Bellacasa's (2011:

93) understanding of socio-material care, I argue that the human-machine care for building prototypes signifies the importance of making professional technologies (see Puig de la Bellacasa 2012: 198 and Chapter 4). Love and care are invested to realize the political endeavor of making products for the local market in order to dispense with imported technology.

In this regard, the following empirical insights show that love, as component of an intimate relationship, is not only felt towards KiCad, but also towards other tools of the PCB production line which help to make an abstract idea of a PCB visible and beautiful. The vignette focuses on the most intense feeling when a model of a PCB becomes concrete and tangible: excitement.

Entering the Darkroom of Excitement

Every single day, the engineer Joy has a new project to build and every evening, she researches the following day's project: a 3D printed belt that holds several cables together, a laser-cut glass, or a PCB that controls LEDs. She was very keen to introduce me to the work process at the makerspace and so one day she took me to the darkroom for the first time and said, "This must be very exciting for you, now". Indeed, I had never entered that room before and had wondered what was in it. As we entered the small gloomy room, I saw a scanner in front of us. This machine comes next in the PCB-line after modelling and testing the PCB file on a computer. We closed the door and Joy placed a transparent folio with her PCB model printed on it and a photovoltaic PCB substrate onto the scanner. The substrate lies on the scanning glass, on top of it the printed folio. Joy put a plastic layer on them and turned a vacuum pump on. The plastic fixes the arrangement so that nothing is able to move. We put down the lid and turned the scanning light on for one and a half minutes. I read and translated the button labels on the scanner – "*Kopie oben*"[3] and "*Kopie unten*"[4]; Joy was thrilled because she hadn't realized before that the scanner was able to do a double-sided PCB.

At the makerspace, Presensitized Copper Clad Boards are used to make PCBs. These boards have a thin photosensitive coating that reacts to UV light. Thus, "the artwork" as Martin called it, namely the digital PCB model that gets printed on a transparent paper, acts like a mask to the UV light of the scanner. This means that the scanner produces a kind of photo negative of what the traces between the components will be on the PCB. After we left the darkroom, Joy guided me to the 'SplashCenter', an etching station that consists of two containers filled with chemicals. These are the developing chemicals and

Joy told me that they are extremely corrossive, and we would get a serious skin rash if we made contact with them. I remembered the graphic description of another electrical engineer telling me that "the chemicals will eat the exposed copper away, leaving only the intended copper traces on the substrate". Joy put on plastic gloves and dunked her PCB plate into the developer chemical. I had to leave for 10 minutes to fulfill another task. When I returned, Joy had already finished. I was surprised how quickly she got a tangible PCB (Research Diary, July 13, 2016).

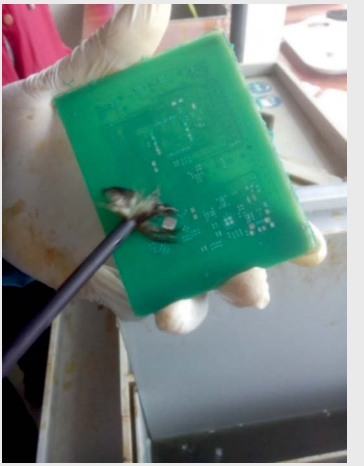
Fortunately, I was able to observe the etching process several more times, as the sound and smell of the etching station were daily companions while working at the makerspace:

> Tsch, tsch, tsch, tsch. In the corner next to the darkroom, three guys are 'painting' liquid on a plastic screen. (Research Diary, June 28, 2016)

> In the corner in front of the darkroom, two makerspace employees are wearing gas masks and doing something with big bottles of liquids. It smells sweet. (Research Diary, June 30, 2016)

> I went to a guy who was developing his PCB. He wore plastic gloves and put the board into the brown liquid for some seconds, took it out, and used a brush to remove the plastic on his circuit. It looked fascinating. The traces slowly became visible. I felt as if I was watching a magician conjuring up a PCB. (Research Diary, July 8, 2016)

Figure 10: Etching a PCB, 2016 (author's photo).



The above empirical snapshots show that making a PCB is part of the daily work of Kenyan makers and that transforming one's idea into something tangible is accompanied by feelings of excitement about how the digital model that took a long time to design will come out in reality. After designing the PCB, it took Joy only half a day until she held it in her hands, ready for the components to be mounted on it. This fast implementation of an idea into something tangible evokes love for the machines that materialize the PCBs:

> I can easily come here [to the makerspace] and within a very short span of time, I move from my manufacturing file – my PCB file – all the way to a board that I can touch, mount my components, and use. So one of the machines I really love is the [etching station called] SplashCenter which gives me the board that I want: a professional version of a printed circuit board. (Interview, makerspace member, July 2016)

3 German for 'copy above'.

4 German for 'copy below'.

As analyzed above, this quote illustrates the positive emotions felt towards professionalism, but also that the machines which support the materialization of an idea are loved and appreciated because they enable makers to make beautiful and functional prototypes. In this vein, makers often emphasize the specific characteristics and loveable benefits of a machine that assists them to work more precisely and faster than they could do manually. A common comparison is made between automated machines and the "normal way" of manufacturing a PCB:

> The CNC machine is able to drill the holes that I want. … There are other versions of drills, like there is one called the Dremel that is a hand-drill. You use your hand. Some standard bits come with [the drill], you plug them in and then you use your hand and drill. Now imagine if your board has a thousand holes, you sit down and drill a thousand holes of different sizes. It limits you. We use other forms at home, like etching your PCB with the normal, traditional way of using an electric iron to iron out your board. … For someone like me who wants to … come up with quite complex boards that can be applied to solve a lot of problems, I prefer machines that are able to do those things in the fastest way possible and to expand my scope of doing things. Not like a Dremel which limits me to a hundred holes. … The makerspace has a collection of very important tools, like that Computer Controlled Drilling, so that I just need to export my drill files from the KiCad software … and send the coordinates to the machine. And I just sit back and wait as my machine drills all the holes in the right sizes on the board. Even if there are a million holes, it will drill it for me in the shortest time possible and with a precision that you cannot achieve with a hand-drill. And my etching station is able to achieve very fine tracks, very thin tracks that I'm not able to achieve at home. So you find that these are special machines which can really assist me and empower me to come up with my prototype in the shortest time possible. (Interview, makerspace member, July 2016)

Complaints about the 'normal' "tedious and very manual" processes that "do not give professional results" (ibid.) join the praise of the accessible machines in makerspaces. These machines assist the makers through the speed and precision of their work, thus, releasing them from the usual manual constraints such as working with a hand-drill or an electric iron. The makerspace member quoted above sees the expansion of his scope of doing as empowering. In other words, mechanical tools are felt to empower the human maker, who is subject to limited capabilities, to build things quickly and precisely. Sennett (2008: 85)

calls such tools "robot tools" and describes them as "ourselves enlarged" by being stronger, working faster, and never tiring. In this regard, the quote above indicates that the emotion of love results from the liberation from hard manual work and from the machines' strength, speed, and stamina. These mechanical qualities are loveable because they help the maker to keep up with the pace of the current innovation paradigm and build technical devices that are acknowledged to be professional.

In addition, the loving machine-human relationships are characterized by care and trust. The feeling of trust is expressed in the maker's statement above, that while working with the CNC machine, he is able to "sit back and wait" as the machine drills all the holes. This ability to relax while watching the machine shows the trust in the machine's capabilities. In this context, Andrew Pickering (1995: 158) explains that a tool such as a milling machine is "a prototypical device for capturing nonhuman agency [as] one can accomplish things with a lathe that naked human agency could never accomplish". Nevertheless, he concedes that these machines need human volition to be operated. Thus, he describes human-machine relations as a "dance of agency" whereby human and material agency are reciprocally 'tuned' with alternating roles of activity and passivity (ibid.: 21). The example of the maker's trustful interaction with the CNC machine illustrates Pickering's argument more clearly: the maker first worked as an "active, intentional being" who instructed the machine and then took on a "passive role, monitoring the performance of the machine" (ibid.). Therefore, the quote above demonstrates that the relationship between technology developers and a CNC machine is not only based on gratitude for the mechanical support, but also on trust in collaboratively taking care of prototypes.

8.3 Conclusion: The Socio-Technical Care for Professionalism

The loving and intimate human-machine relations at Kenyan makerspaces carefully transform an attentively and precisely designed idea into a tangible device. Although every interaction between a maker and the various machines in the PCB line is unique, they all strive to make professional products that are both beautiful and functional. This professionalism should achieve inclusion into global technocapitalism and, with that, societal progress in Kenya. Overall, the feelings of gratitude, trust, and love that characterize the agential dance between makers and machines signify that technology development is by no means a purely abstract and rational practice of making.

Chapter 9
Fear – The Calculative Making of Technologies

The desire to make professional technologies evokes affects that are perceived as positive and empowering; however, it also evokes fear. In Nairobi, the fear of failure is a common companion during the making of prototypes even though failures are expected in rapid prototyping. Machines such as 3D printers, CNC machines, and laser cutters should materialize ideas quickly (Culpepper interviewed by Nichols 2015), so that technology developers are able to speedily test their prototypes and reiteratively integrate the gathered feedback into the subsequent development process. In this vein, hardware entrepreneurs who work on projects at the pre-commercialization state praise makerspaces because they deal with the financial and logistical challenges of assembling the digital fabrication tools necessary for rapidly prototyping high-tech devices. A makerspace manager explained:

> The biggest contribution that [the makerspace] makes when it comes to spreading innovation and entrepreneurship is reducing the cost of failure. It would not be possible for most of the people in Nairobi to purchase any machine in this room. For less of a fraction of the price of one of those machines, you can access all of them. So that frees you up to spend your money on materials to try stuff out, experiment, fail, iterate, and then try something new. (Interview, November 2015)

The arguments for doing rapid prototyping come from different angles. From a business perspective, rapid prototyping is said to reduce the time and financial risks of developing technology: "[T]ime savings can help organizations gain competitive advantage by bringing new products to market quickly, ahead of competitors. … [And] by enabling detailed physical analysis at an early stage in the development program, rapid prototyping can reduce the risk of costly er-

rors" (Linton 2017: n.p.). This business approach that fosters an efficient engineering process is entangled in the global maker ethos where making is seen as a process of tinkering, characterized by embodied experiences that leave space for imperfection and thus, failure. Sensual affects such as touching and feeling a prototype are welcomed in order to get a sense of how the design could be changed to improve usage, functionality, and aesthetics. Therefore, the successful making of technology is not only based on theoretical knowledge; practical knowledge and prior experience with the unpredictabilities of physical laws is equally necessary for technology development:

> You know, with electronics even if you model it out and it says it will work one way, the physical world introduces random factors that we can't understand. Electrons that are moving around on the circuit board are unpredictable. There is some level of predictability, but it is like your circuit is working on the paper but in the real world it doesn't work. And that's a difficult thing for students to understand until they experience it. We now see more students that come to us with a legitimate understanding of 'I think it's going to work that way but until I try it, I'm not going to know for sure and if it doesn't work than these are the things that I'll try to correct it'. (Interview, hardware company founder, November 2015)

This unpredictability of models highlighted by a hardware company founder has also been analyzed by Richard Sennett (2008: 101), who claims that "a model is a proposal rather than a command. Its excellence can stimulate us, not to imitate, but to innovate". Thus, models implemented in the 'real' world are unpredictable. To handle this unpredictability, various design thinking mantras revolve around fast prototyping in order to test ideas and 'fail early and often':

> Getting it wrong is just another component of success! True success comes when you learn from your failures and improve your ideas. As long as you validate, iterate and improve, success isn't just in the bag, it's inevitable. (Branham 2017: n.p.)

As such, proponents of rapid prototyping herald the failure-intense and iterative process as being the inevitable way of achieving success when making products:

> There is actually a basis for a link between failure and innovation success in the whole "survival of the fittest" thesis. It is not always the strongest of the

> species that survives – it is the one most adaptable to change. … The most successful companies today will be those that are able to embrace failure in all of its forms: They must fail fast, fail early and fail often. Only then will they succeed. (Basulto 2012: n.p.)

These stereotypical design mantras and the imagination of a makerspace where everyone is tinkering with cheap materials and fast prototyping machines had been in my head when I first entered a Kenyan makerspace. Thus, I was surprised at what I actually encountered: most people were sitting in front of their computers, first planning an idea and then calculating and drawing it digitally.

> It's eight months since my last visit to Nairobi. I look into the makerspace: wooden furniture, green plants, and silver-white machines. I am impressed by how stylish and nice everything looks now, but what astonishes me is that people are sitting at their computers working. Is it because they first work on their designs and then delve into rapid prototyping? (Research Diary, June 20, 2016)

Instead of confirming my imagination of makers who embrace failure, the technology developers tried literally everything to circumvent it. The director of the Centre for Intellectual Property and Information Technology Law (CIPIT) in Nairobi made the same observation of failure-averse makers. He had worked as a patent attorney for several years in Silicon Valley before he took up his position in Nairobi and explained the difference between the two tech innovation scenes:

> In Silicon Valley, if you don't fail a few times, people don't take you seriously. Until you've done several startup plans, people don't bother with you. They think you are not serious. I think it should be mandatory for people to understand that failure is not a bad thing at all – it's a way of learning how to do better next time. One of my biggest complaints about Kenya and one of the major differences between Kenya and Silicon Valley is that people here are really afraid of failure. If you fail, people think you are a loser or you are a failure. They equate failure with people being a failure. (Interview, April 2017)

During my research, it became clear that, in Kenya, a failed prototype does not mean valuable feedback for the development process, but a failed materializa-

tion of a business idea. In a world of *professional making* where "ideas carry the day" (Interview, UX designer, November 2015), the design of an idea has to be perfect because its prototype functions as 'material evidence' to convince investors and the tech community (Dickel 2019: 47ff.). Therefore, Kenyan technology developers aim to make a "polished" prototype rather than one held together with duct tape, and to own a patent to attract investment and qualify for the market (Interview, makerspace manager, November 2015).

Although the first makerspace in Kenya changed the hardware development sector in Nairobi by creating the possibility of making professional technology, this newly established possibility is fragile. Access to resources is still limited due to their scarce availability and the scant financial means of developers; Kenya still lacks factories for mass manufacturing, and startup funding is fiercely contested. Due to the fact that Kenya is a context where the making of technology is more costly and time-consuming than in places of abundance (see Chapter 7), technology developers in Nairobi do not embrace failure as in the Silicon Valley mantras; rather, they fear the 'back and forth' of rapid prototyping processes because the continuous reiteration of a prototype is extremely resource-intensive.

This chapter depicts the emotion of fear lingering in Nairobi's tech scene. Technology developers fear the failure of their innovative ideas – be it the fear of fabricating an unprofessional prototype due to the lack of resources and human incapability, or the fear of losing an idea through intellectual property theft. The analysis of the empirical data illustrates the specific practices resulting from the fear of failure, namely *calculative making*. I argue that calculative making is the situated form of making in Kenya and thus, a different kind of making than that promulgated in the global maker ethos. Technology developers in Nairobi cannot live up to the rapid prototyping and design thinking mantras that originate from places of abundance as they lack access to the material and components necessary to build high-tech products. Thus, they cannot afford to fail in the same way as someone in Silicon Valley fails. Although rapid prototyping should allow for imperfection and tinkering, Kenyan makers have to perform perfection and professionalism in order to take part in technocapitalism.

9.1 Fear of Unprofessionalism: Calculating Scarcity

Realizing that most of the work at a Kenyan makerspace is done sitting in front of a computer confounded my imagination of a makerspace as a place of failures. Kenyan makerspaces are not workplaces of messy and failure-intense prototyping where cheap heterogeneous material is assembled to build clumsy prototypes. Rather, drawing, testing, and simulating digital models makes up the majority of the work. An electrical engineer explained to me why it is crucial to "test, improve, and polish the design" (Interview, July 2016) before its implementation:

> It's a lot of simulations, it's a lot of thinking that goes into the laying out of the [printed circuit board] tracks, coming up with the right concept, testing it on breadboard[1] before you … [actually construct a] PCB. So the design can take a week or even more and you still not have started on fabrication. The design stage is what normally takes the greatest amount of time because you have to get everything right. Otherwise, you will be wasting your time going through the PCB [production] line, making something that does not work or does not meet the required need. (ibid.)

When striving for perfection, the fabrication of an idea makes prototyping difficult and thus experienced with charged emotions. Sennett (2008: 97) defines the "desire to do something well … [as] a personal litmus test; inadequate personal performance hurts in a different way than inequalities of inherited social position or the externals of wealth: it is about you". A prototype's inadequacies are not simple deficiencies of material; they represent a failure of the self because one was not able to translate the perfection of the design into 'reality'. Therefore, not achieving a polished prototype "corrodes one's sense of self" (ibid.). The resulting fear of failure causes the attempt to eradicate all the human errors that become visible when translating an idea into something tangible (Interview, mechanical engineer, April 2017). Thus, creating a perfect digital file of a preliminary idea – be it a PCB, a water pump, or a piece of furniture – is obligatory before fabricating and materializing the prototype.

However, such careful and time-consuming design work is nothing special. Although rapid prototyping is hyped as a magical tool, there is no button

1 A breadboard is a rectangular plastic board with prefabricated holes and power rails. As such, PCB components can be mounted onto the board without soldering them (Science Buddies 2021: n.p.).

that has to be pushed so that "out pops whatever you want. In reality, that process might take weeks of design … work, and that's not rapid, that's regular engineering" (Culpepper interviewed by Nichols 2015: n.p.). Also, Yana Boeva (2018: 75f.) explains that testing a digital model "through a multiplicity of design renderings that allow for testing without their actual physical fabrication" is a common process. Such digital test runs of a model can be interpreted as a rational engineering process, but:

> [t]here is also a value content. … A structural engineer will perform simulation calculations even for a simple bearing, for which [they] could define the characteristics using [their] know-how alone. Acting in this way gives greater value to [their] action and design work. (Mer 2003: 87)

In Kenya, this greater valuation of work through digital design is observable in the love for computer software that professionalizes the fabrication process of technology (see Chapter 8).

Kenyan technology developers not only draw perfect digital models to achieve a fast and smooth fabrication of professional prototypes, but also to concretely plan what components are necessary to materialize such prototypes, bearing in mind their lack of access to abundant resources. The following vignette is based on research diary entries in March and April 2017 when the makerspace I worked at was a construction site and its making activities concentrated on designing the co-working spaces' furniture. It shows that digital models such as CAD drawings are used primarily as calculative tools to plan the acquisition and costs of a design's implementation.

The Calculative Making of a Co-Working Space Table

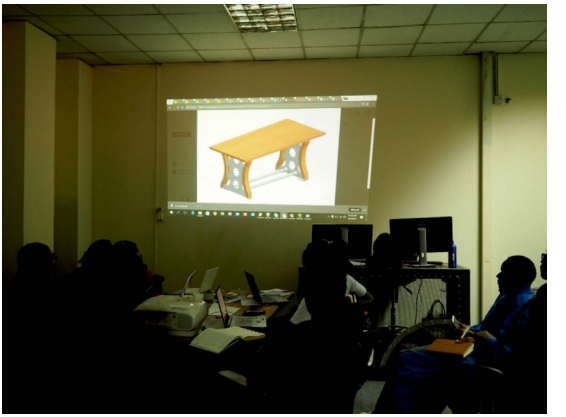
A daily design meeting at the prospective makerspace looks like this: the staff gather around two large tables at the computer lab, dragging their office chairs behind them. It is dim because not enough lights have been installed yet; only the light of the projector illuminates the room. Two staff members show pictures taken from the internet that inspired them in their task to design furniture for the makerspace. A reception desk, tables for the computer lab, and a coffee table made from a car engine are projected onto the wall. The assembled employees like the ideas, but the higher-ranking staff repeatedly ask about the material proposed to build the furniture. Njeri and Anne ask about the estimated costs, Jethron asks if the material is suitable, as wood

cannot easily be shaped into a round, and Fred reminds everyone that the makerspace should produce something professional and not something that "looks beautiful but does not work functionally". After everyone gives their opinion on the suggested designs, the two presenters are sent off to work on the feedback received.

Two days later, one of the managers demands updates about the progress made during the last week. Some people show him the four pictures that we looked at during the design meeting. He is angry: "I have no interest in looking at pictures. It's a waste of time. I want to see drawings. I want to see measurements to assess how the furniture sizes fit together and how it can be placed in the co-working space. I need to know the sizes". He demands a plan of the space to better imagine where everything could be placed in the future. According to him, only with a plan, can the space be measured. He constantly repeats the sentence "I need to know the sizes".

The next day, a makerspace employee presents the CAD drawing of her suggested co-working table design. It has a wooden top, 'legs' made from metal sheets with wooden edging and structural support/footrests from recycled water pipes, so that it has an "industrial look". Njeri asks again about the estimated costs of the material for one table. Fred asks how many metal sheets are required and suggests using recycled wood from the partitions removed downstairs in order to reduce the expenses. He says, "Guys, that's why I ask you to do the measurements. So we can do research about the potential costs. Please, let's have the figures by the end of the day".

Figure 11: Design meeting, 2017 (author's photo).



The recurring questions about the proposed material and furniture measurements during design meetings illustrate that decisions on the material to be used are necessary in order to calculate the potential costs of manufacturing. Surprisingly, design objectives such as fostering collaboration or creating a trendy aesthetic are not the focus of the scrutiny. Instead, CAD drawings are demanded in order to make measurements tangible and assessable. The lack of financial resources to buy materials and the overall limited access to them, make Nairobian technology developers use their material carefully. There is no room for wasteful behavior during prototyping. Therefore, the *calculative making* of technology – or furniture as in the vignette above – includes the choice of local (recycled) material and their exact measures to predict costs. Thus, the daily life of making consists of efficient calculations based on digital models such as CAD drawings and the compilation of lists about where to get the required parts to make a design tangible. A makerspace member stated:

> The challenges lie in the deep details of component selection. Basically, the design consists of selecting components, coming up with a list of those, and getting them. (Interview, July 2016)

The design and manufacturing of a prototype – and, thus, the *possibility* to actually make professional technologies – include the obligatory production of lists documenting the necessary materials and where to get them. The scarcity of electronic components and other prototyping material in Kenya makes it es-

sential for makers to write meticulous lists of the parts required when designing a model and these lists are the basis for the laborious research of where to get the needed material. Thus, the written hardware project documentation at makerspaces is not only done to share open source knowledge about the necessary components and their connections to each other, but also to include a list of where to get them, so that other people in Kenya are able to replicate the projects (Research Diary, July 8, 2016).

In a tech place with scarce resources, the procurement of material is of such importance that it is included in the daily morning routine of the makerspace's mechanical lead:

> In the morning, I have to plan the day. I look at the tasks left over from the day before and why they have not been done. Then I plan the milestones that I need to achieve during the day. I have to plan what the 13 employees under me do. After putting up the schedule of who is doing what for the day, I need to know the material. How will it get to the workshop? Will the process go smoothly? There has to be material, so there has to be a plan. Then we have a meeting. I brief everybody on what he or she should do. After that, I start to follow up on the material and how to get it to the people. (Interview, April 2017)

Usually, the logistics of getting material to build prototypes takes a lot of time as elaborated above. Makers have to call every shop and supplier in town to ask about the availability and costs of each of the necessary parts. If they are available, the journey to Nairobi's central business district starts, usually including long hours of traffic jams. If the material is not available in Nairobi, research has to be done on if an alternative material can be used or from where to expensively import the necessary components. The vignette about the startup BrightVest in Chapter 7 shows the consequence of material being unavailable; the two makers had no access to low-power consumption components to build a wireless device, so they had to rethink their design and "go back to the drawing board" (Interview, co-founder, May 2016). Thus, their process of developing a hardware device was highly time- and money-consuming when thinking about how to get their necessary prototyping material.

Overall, Kenyan tech entrepreneurs stay as long as possible within the infinite realms of computing – drawing models, compiling Excel sheets, and making calculations – to circumvent the costs of experimenting and the danger of failing. These ubiquitous practices of calculative making observed at Kenyan

makerspaces are a necessity to compensate for the lack of resources specific to making technology in Nairobi.

9.2 Fear of Theft: Calculating Competition

The scarcity of resources and investment in hardware startups make the Kenyan innovation sector highly competitive although its tech entrepreneurs are committed to maintaining a reciprocal community of tech development (see Chapter 4). As elaborated above, an unprofessional looking prototype or the stalling of an idea due to a lack of resources are perceived as a maker's personal failure. As well as the fear of producing 'unprofessional' technology, tech entrepreneurs additionally fear the loss of their idea (and potential profit) through intellectual property (IP) theft. In the following, I show that makers are responsibilized to take care of their ideas without relying on external support such as the juridical protection of patents. Working in a highly competitive tech sector, makers are advised to protect their ideas by hiding their prototypes from others and by thoroughly planning the implementation of any prototypes.

One day, I stumbled upon a tweet saying: "There are two ways of protecting your intellectual property: Legally or shutting up. [followed by two laughing emojis]" (Birgen 2017: n.p.), meaning either you have to patent your idea or hide it in order to protect it from intellectual property theft. Although the emojis included in the tweet suggested irony, the statement reflects the various occasions on which I encountered the fear of losing a product idea. For example, tech entrepreneurs claim that hackathons and competitions – "an IP lawyer's nightmare" (Interview, director of CIPIT, April 2017) – are THE places to steal others' ideas. During a conversation between two makerspace members, one initially explained an innovation competition to the other as a place where people pitch their ideas. One second later, he refined his explanation by adding that it is also an event where people come and steal the unpatented ideas of the presenters. I expressed my puzzlement about his statement and he further explained that big companies usually sit on the jury or in the audience, listening to the ideas in order to steal them instead of investing in the people pitching. He was convinced that he needed to pitch his idea at some point to gain investment, but wanted to develop his technological idea further in order to patent it before doing so (Research Diary, March 31, 2017). Participation in competitions and hackathons is often unavoidable for young entrepreneurs

looking for seed funding. However, the decision to participate is usually considered carefully as the depicted conversation shows.

At a hackathon, I also observed a strategy of participating in a competition while protecting one's idea without a patent. A young engineering student pitched his idea of a novel generator. After his pitch, the jury asked him where the prototype of his generator was and admonished him, saying "you have to build it and show it to us non-believers". He defended himself and said that he had built the generator once at his friend's workshop, but after he saw that it worked, he destroyed it out of fear that someone could steal his idea. The whole audience laughed. However, the amusement quickly faded away as the competitor's seriousness prompted thoughtfulness about the fact that the fear of losing an idea can be so enormous that it drives a tech developer to destroy their prototype (Research Diary, November 5, 2015). I experienced the same thing at makerspaces where openness and the exchange of knowledge should be facilitated, yet members working on a business idea are often secretive (see Chapter 5). The makerspace staff regularly complained about members who ask for advice on using a machine to make something in particular, but refuse to tell the staff about the context and intention of the specific part. This sometimes results in the staff not being able to help those members because they are missing crucial information about the manufacturing process.

Besides the refusal to participate in competitions without having a patent, or in general refusing to talk with others and even destroying and hiding one's work, a legal expert sees a more profound problem in Nairobi's tech scene, namely the belief in a patent system as a panacea:

> People do actually look at the patent system as this panacea of 'Oh, I protect my invention and then I have a successful business'. And that's just blatantly not true. A patent is a tool that sometimes helps your business and sometimes not. The most valuable thing to a company is your drive to make your company succeed no matter what happens. There will always be people copying you; if nobody is copying then what you have done is not worth doing. (Interview, director of CIPIT, April 2017)

The legal expert argued that, most of the time, patents in the tech space are not useful and a waste of money. In the case of software development, for exam-

ple, the minimum wait-time of eighteen months[2] to get a patent is too long for a software not to run the risk of becoming obsolete, as startups often change their code during iterations. Although IP theft risks have to be determined on a case-by-case basis, the legal expert recommended the "first mover advantage": "have a good product that is well advertised, well branded, and updated frequently, functional, easy to use, all those basic business things. That's much more important in IT than patents" (ibid.). He went on to explain that assessing risks while working on your idea is neither a technological decision, nor a legal one, but a business decision. The director of CIPIT clearly advocated not clinging to patents when it comes to the fast-moving tech development sector. He is not alone in his opinion; the debates in legal studies also swing between the promotion of public regulation and the withdrawal of excessive regulation of new technologies. Although public regulation could be required to constrain "private mechanisms of self-help" (Pagallo cited in Fernández-Barrera et al. 2009: 27), "regulating a new technology at the outset would merely stifle technological progress and eventually prevent the emergence of new and more efficient business solutions" (ibid.: 28). Thus, a founder of a hardware company in Nairobi also favored striving for competitive advantage instead of a complex patent system because:

> even if you have a patent, it doesn't protect you. It doesn't stop someone doing what you are doing. If they do, you have something that says 'I own…' or 'I have first rights to…', but you still have to find whoever is copying you, you have to take him to court, all of that is time and money that most companies don't have. So patenting is mostly to calm investors. (Interview, April 2017)

This startup founder explained why tech entrepreneurs see patenting as a panacea and a must for becoming successful; entrepreneurs have to please investors to gain highly contested investment and the first question that investors ask is if they have already protected their idea. These requirements give entrepreneurs the impression that patenting is necessary for business. However, according to the CIPIT's director, that is not the case: patenting is just "a tool" (Interview, April 2017).

---

2 Eighteen months for the examination of a patent is the global average. According to the director of CIPIT, the Kenyan patent office is one of the busiest on the continent as it handles a large number of patent applications, particularly compared to South Africa, Nigeria, and Ethiopia.

Working in an emerging hardware innovation sector without the security of legal regulations drives the fear of losing one's ideas:

> Everybody tries to protect their idea. Because you don't want someone to take the idea and run away. Because it's YOUR idea and we are all hungry for ideas, for solutions, for money. You know, to make money at the end of the story. So protection is a concern. (Interview, makerspace employee, April 2017)

This interviewee claimed that fear of IP theft is justified because a good idea for a marketable product has the potential to bring in money. But if a patent is not a suitable guarantor for protecting one's idea, what can calm a maker's mind while caring for their idea? Legal and business experts in Kenya do not recommend relying on legal regulations, but advise makers to self-responsibly care for their ideas in a powerful field of capitalist competition. In this vein, a hardware hackathon competitor confidently answered a question posed by a German investor on the jury: "How will you implement your idea without having a patent?", "Competition will always be there. But I try to grasp the market and I will try hard" (Research Diary, November 5, 2015). This quote and the above cited opinions of tech lawyers and other experts show that the prevailing perception of technology entrepreneurship in Kenya is that every entrepreneur has to delve into an unpredictable market, trying to survive and succeed with the help of business decisions.

The makerspace's mechanical lead and a professor of entrepreneurship at the University of Nairobi agreed that planning is the answer to making this survival easier. The mechanical lead condemned the belief that "you come and have a look at something and then you know everything and can build it" (Research Diary, July 13, 2016). In this regard, the professor emphasized that he knew that "IP is nonsense" as he teaches entrepreneurship (Interview, April 2017). According to him, "[n]obody can steal all of these ideas. Even if you're told to. My mind has to be aligned with what you are doing for me to steal that idea" (ibid.). Both technology experts advised entrepreneurs to concentrate on the research and planning phase before building the prototype of a promising product:

> Few people take the time to steal an idea. Because it's not easy. It's not like waking up and having your tea on the table. It's the process that makes the tea arrive at the table. You have to sit down and research to develop a prod-

> uct. It's not easy and many people do not want that. (Interview, mechanical lead of makerspace, April 2017)

The mechanical engineer illustrates that the development of a technology does not happen all of a sudden, but involves a process that needs time, material resources, and thorough planning. According to her, few people are able to invest such resources into research. Thus, she claims that a thorough research and planning phase of a design guarantees a fast implementation without anyone being able to copy an idea:

> The speed that you will be running with your project is all about the plan that you had before. If you have the right plan for what you want to execute, the execution shouldn't be a problem. If you want to build a car, you cannot build it inside, it has to be outside. So people will see all those things. Your speed should be too fast for me to copy and repeat the manufacturing as you have already done your research; you've already done your to-do-list, the don'ts and the do's. For me to steal it, I have to go through the same process. So if you did not do your research well, you did not plan well, I can steal and beat you in your speed. (ibid.)

The planning phase is only successful if the maker considers carefully what to pass on; only general knowledge and no details. She went on:

> I can tell you about the car that I want to make because cars already exist on the road. They are not something new. But because I don't tell you the details of making that car, you would not even dare to make it and steal that idea. Unless I tell you the whole story of how I want to make the car. Then you can see how it's made and how you can steal my idea. So telling someone about my idea is my responsibility; to know what is important to say, what is not important to say. It's all about packaging and planning. (ibid.)

Listening to the mechanical engineer's descriptions of how planning is a strategy to care for one's idea, it again became clear that the individual makers should take on the responsibility of protecting their ideas. Decisions have to be made carefully: what to tell and what not to tell. Also, a makerspace does not represent a safe space:

> We are just the helping platform, connecting you with people, giving you machines, providing you with the basic knowledge that you will need to

> make a product come true. But it's up to you to take care of your project from other people. Because we can't lock the whole facility for one person. We want to have it open to everybody. So it's up to you how to plan your ideas and how to package them – that's all your responsibility. (ibid.)

Without legal protection or a safe space that gives makers privacy, protecting their ideas becomes difficult. The moment an idea materializes as a tangible and visible prototype constitutes the critical moment when it becomes vulnerable to being stolen and thus, to fail. Therefore, planning is advocated as an entrepreneurial strategy that grants competitive advantage. Planning is recommended over filing a patent because the patent system often cannot keep up with the dynamic development of technologies. As such, makers are responsibilized to take care of their ideas – whether by the destruction of one's functioning prototype or by calculating every step of an idea's implementation. Constantly reflecting on and calculating what to share with others and what not, is the main mode of countering the fear of failure through IP theft.

9.3 Conclusion: The Responsibilization of Surviving in Technocapitalism

Calculative making as the situated form of making technology in Kenya means that the daily agenda of technology developers is determined by the calculation of necessary materials and budgets and the setting up of exact plans for transforming an innovative idea into a prototype. These practices of calculating a perfect (digital) model are necessary to circumvent a resource-intensive prototyping process and intellectual property theft and thus, a failure of one's innovative idea. The thorough planning of a design's competitive advantage highlights the care and calculation that entrepreneurs have to invest in order to survive in technocapitalism. The state, juridical and business experts responsibilize them to take care of their ideas individually without relying on external support.

Chapter 10
Resisting – Incalculable and Unloved Working Conditions

The feelings of love and fear show that care is invested in the making of innovative technology. This care is characterized by human-machine relationships that defy the challenges of technology development through calculative making. However, technology developers are not only confronted with challenges such as resource scarcity stemming from Kenya's positionality, but also with daily life hierarchies that manifest in the workplace. The existence of hierarchies is somewhat surprising given that makerspaces are praised for being non-hierarchical organizations in which collaboration and knowledge-sharing are central values (see Chapter 4): as Fred Turner (2006: 239) notes, "[i]n many industries today … hierarchies have been replaced by flattened structures, long-term employment by short-term, project-based contracting, and professional positions by complex, networked forms of sociability". Nevertheless, an increase in makers' flexibility also represents a capitalist recuperation of a seemingly liberating work organization (Wenten 2019). Thus, the entrepreneurialization of making in Kenya results in employees as well as members of makerspaces being confronted with competition and hierarchies when working for their economic livelihood.

In this chapter, I shed light on workplace hierarchies and depict the incalculable and unlovable working conditions of technology developers. I analyze how makers use technology development not only to re-work Kenya's positionality within global technocapitalism, but also to position themselves within their workplace. First, I show that the aim to produce predictability through calculations such as plans, lists, and CAD drawings is disrupted due to incalculable decision-making processes within makerspaces and startups. Second, further empirical insights demonstrate that authorities fail to appreciate de-

sign work and thereby invisibilize those work efforts. Third, I show that technology developers regain agency by appropriating the methods of rapid prototyping and their context-specific calculative making to visibilize their work, try to minimize interactions with those in authority over them, and silently resist workplace hierarchies.

10.1 The Incalculability of Technology Development

All efforts to plan a digital model as perfectly as possible and to calculate the resources and costs needed in order to eradicate failures can be thwarted by unpredictabilities. Drawing a CAD model and compiling lists of necessary prototyping material cannot circumvent all possible failures; 'unpredictable electrons' (see Chapter 9), or simply discussing a prototype can have unpredictable results. In this regard, the vignette in Chapter 9 about the calculative making of a co-working table highlights that the CAD model as a calculative tool has always initiated discussions, but does not necessarily convince the viewers. It showed that the co-workers and bosses involved constantly criticized the functionality, aesthetics, and predicted costs of a design, for example, the criticism that the suggested metal supports would not be stable enough for supporting a wooden tabletop. This seemingly impossibility of making a perfect model of an idea reveals "engineering design [a]s a decision making process" (Kroes et al. 2009: 567) in which numerous actors have to be convinced to co-operate. As depicted in Chapter 8, turning an idea into a tangible technology is a process based on affective collaboration rather than a single stroke of genius as told in innovation stories (see Chapter 3). Thus, the care of makers and machines is necessary to produce a professional prototype. However, the following pages illustrate that agreements between technology developers, their co-workers, financial bodies, and prospective users are also inevitable.

One of the various stages of incalculable design work is the rapid prototyping method of user-centered design (UX or design thinking) that incorporates failure, meaning the constant readjustment of prototypes based on the feedback of potential users. Although the iterative process of going back and forth between your idea, model, and prototype is praised by UX proponents (see Chapter 9), makers in Nairobi often report that the process of having to 'go back to the drawing board' is tiring:

> Another reason for failing or not coming to an end, is because you started off very hype-ish and then you realize that research and development ain't that easy. You make something, it doesn't work right, you come back again, it doesn't come right – that's a research and development graph. It's not that you make something and tomorrow it's in the market. There is always a hiccup; there is always human-centered design. When [the user] tells you 'Okay, yes you've come up with a solution for me, but I can't operate it', you go back to the drawing board and start thinking again. So all this is research and development which people get tired of. You get tired of always going back and forth and you're like 'What the hell?! I just leave it'. (Interview, mechanical engineer, April 2017)

This maker calls human-centered design a 'hiccup' in technology development and therefore defines human preferences as irregularities that complicate the design process. In this vein, Kroes et al. (2009: 568) state that "unpredictable changes in the context of the design process that may affect resources and time schedules, make engineering design practices often messy and unruly" – and, I would add, incalculable.

The unpredictability of technology development is not only influenced by user feedback, but also decisions by CEOs and other high-ranking co-workers. In the case of the future co-working space table for the makerspace's new premises, a day came when it was finally agreed to make the table legs out of metal sheets with wooden edging and structural supports from water pipes. Initially, everyone at the makerspace was amazed by the materialized metal construction of the future co-working space table. Two weeks later, the construction became irritating:

Figure 12: Co-working space table without its tabletop or wooden edging, 2017 (author's photo).

> Singular and lonely, the construction was placed in the middle of an almost empty room that promises to be a co-working space one day. However, the table was still missing its top and thus not able to fulfill its functionality. The irritation about the unfinished table was the topic of numerous conversations. (Research Diary, April 28, 2017)

The reason for the unfinished prototype of the future co-working table was a disagreement about the material to be used for the tabletop: "*Mbao*[1] is too expensive", said one of the makerspace managers (Research Diary, April 19, 2017). According to him, wood is one of the most expensive materials in Nairobi and the makerspace could not afford to buy eight to twelve wooden tabletops. However, the designers of the co-working table could not imagine a table without a wooden tabletop: "How can you have a tabletop made only of metal sheets? A table needs mbao" (ibid.). The lack of financial means to buy wood and the disagreement on how to handle that restriction, led to the stalling of the build of

1 *Mbao* means 'wood' in Kiswahili.

the first table prototype. Even disagreements between technology developers and their bosses can cause the stagnation of projects:

> [The boss] enters [an employee's] office. He just wants to give back some keys, but [the employee] asks him to sign checks. He looks at them and says 'What's that?' [and the employee] answers that this is a check for the engine bought for 36,000 Kenyan shillings. He looks astonished and asks 'What engine?' She tells him about the specifications of the engine and the car it is from. 'But for what?!' 'For building the coffee table that we already told you about.' 'Yeah, you sent me the designs, but I haven't checked them yet. I'm not going to sign for something that I haven't agreed on', he says and leaves. [The employee] sighs. (Research Diary, April 11, 2017)

The above conversation between a makerspace manager and one of his employees demonstrates the hierarchies in place. Due to the employees' financial dependence, the management is able to stop work projects and issue unloved work assignments as shown in the following.

10.2 Unloved Design and Calculation Work

Financiers of technology development – be they CEOs or investors – demand digital design models and calculations from their employees and startups, but often without acknowledging that designing a model, planning its implementation, and negotiating about it is arduous work. According to Susan Leigh Star and Anselm Strauss (1999: 24), the design work of makers is invisibilized as soon as it is embedded in "organization[s] with certain structures, a formal and informal balance of power, explicit and implicit goals". A makerspace employee exemplified this invisible work of calculating and designing by describing how the makerspace staff have to go through many steps of 'thought-through' planning before these efforts become visible:

> Somebody will think we are not working, but funnily enough a lot of things have happened: the floor has been repaired to be polished, to be smooth, and to be shiny. The next thing you will see, before we place the machines, are lights. So the lights have to be agreed on. Which lights? Placed where? How many? The budget? We painted the walls. You have to agree what should be done to the ceiling. We have to put up safety markings. All that is in preparation for placing the machines. A lot of things are happening in

> the space before you see them. The machines just have to be placed, but the preparation has to be very thought through. The walls, the ceiling, the floor have first to be thought through. The electrical wiring has to be thought through. The ventilation, the extraction units have to be thought through. The water, the plumbing have to be thought through. (Interview, April 2017)

Planning the implementation of a makerspace is similar to the work of drawing digital designs; it is usually work that is taken for granted or routinized: "the workers themselves are quite visible [at the workplace], yet the work they perform is invisible or relegated to a background of expectation" (Star and Strauss 1999: 15). During the development of technology, higher ranking staff relegate (digital) design work into the background by thoughtlessly demanding the creation of new models and calculations. A maker explained this hierarchical circumstance:

> As [the boss] doesn't do designs, he thinks that's not *kazi*[2]: "*Ah, kuchora design nyingine sio kazi sana*.[3] You'll do it very fast". But I know that the [employees], they barely sleep, so they are not feeling well and then no one likes their ideas. We don't get any acknowledgement. (Research Diary, March 30, 2017)

The lack of acknowledgment can cause worlds and people to collapse, so that makers describe their higher-ranking co-workers and CEOs as "destabilizing everything" (Research Diary, April 11, 2017). The technology developers who digitally model their designs encounter this lack of acknowledgement in particular because progress in computing is less visible than, for example, lights that have been fixed by electricians (Research Diary, April 10, 2017).

According to a mechanical engineer, the people who do not understand the process of designing and planning a technological idea:

> want things done as fast as possible. So they come to me and tell me, 'I want a bottle'. They go away, come back tomorrow and want to find a bottle. It never happens like that and they get angry about that. But they don't want to sit down and listen to the process that comes with making that bottle. So many people, they don't give time to ideas. They don't give time to the people who are building them. (Interview, April 2017)

2 Kazi means 'work' in Kiswahili.

3 Kiswahili for 'Ah, drawing another design is not much work'.

The fast-paced world of capitalist work that requires quick results and the continuous making of products often ignores the workload that is entailed in the intangible work of designing and planning the manufacturing of an idea. In this regard, Yana Boeva (2018: 75) describes how the many intermediary steps in creating CAD files "remain undocumented and incorporeal unlike their equivalents of printed design visuals". The practices of planning and drawing a design include "practices of scribbling and sketching on paper, of model construction, but also the materiality of the computer-aided design are beginnings or steps of a materialization … [but] not the full realization of manufacturing" (ibid.: 74). Thus, technology developers and managers who are not responsible for creating designs easily overlook and disregard design and calculation work because it is not tangible.

Despite the necessity of calculative making in Nairobi, design work is not appreciated by the authorities of makerspaces or startups. Thus, the work of the entrepreneur who must thoroughly design and plan the fast and failureless manufacturing of technology gets 'deleted'. According to John Law (1994), who refers to Star's (1991) 'deleting of work', deletions in organizations are always connected to rankings and hierarchy. He argues that the deleted work is mainly "the work of subordinates: to assume that technical or low-status work gets done 'automatically', as if people were programmable devices" (ibid.: 131). In Kenya's tech scene, managers and project leaders delete design work from the efforts of technology development because the work's simplified representation in digital models and calculations means that the challenges of getting components, incorporating feedback, or handling daily power cuts are not visible or tangible.[4]

10.3 (Resisting) Positionalities within the Workplace

Technology developers, who have to deal with the incalculable und unloved facets of their work, appropriate methods of rapid prototyping and calculation to make their work visible, avoid stressful interactions with those in a position of authority where possible, and silently resist workplace hierarchies. As such, they form socio-material relationships with prototypes, recycled material, and computers to change their (subordinate) positionalities within the workplace.

4 As analyzed in Part I, the storytelling about technology development in Kenya also deletes the uncomfortable and precarious aspects of the makers' work.

As elaborated above, the basis of every technological project, that is, design work and its accompanying decision-making processes, is not valued because it is difficult to quantify. Therefore, I argue that technology developers use the tangibility of their prototypes to earn appreciation for their work. I draw again on the above-depicted example of the co-working space table to exemplify this argument:

> The situation when the metal table construction was arriving at the makerspace was remarkable. Some weeks after the first design meeting about the co-working space table, the two designers entered the makerspace, carrying the first parts of their design. Everyone at the makerspace gathered around the table legs made from metal sheets and expressed amazement at how beautiful the design looked in reality. They wondered why there had been concerns that the metal construction would not be stable enough because it was now clearly visible that it was, indeed, stable. (Research Diary, April 27, 2017)

Although the CAD drawings of the co-working table were unable to convince the doubters of its stability, the tangible metal legs functioned as a piece of material evidence and therefore, proved convincingly that they would serve the function of stabilizing the table. Thus, a prototype serves as a proof of a digital model and makes the invisible background work of design tangible for those who were previously excluded from the work process. In this regard, the great care that makers and machines invest in the building of prototypes signifies not only the desire for professionalism, but also the desire for appreciation of invisibilized (design) work efforts. As such, the caring socio-material relations between developers and prototypes go beyond the mere increase in technology development's efficiency and jointly worry about the appreciation of their deleted knowledge work.

As well as making design work tangible and loveable, makers try to avoid the time-consuming negotiations with their superiors. As such, the recycling of materials has been always appreciated because then the costs of procurement can be minimized and negotiations with bosses avoided. For example, the construction of the makerspace's new workshop floor resulted in an abundance of 'old' material; because the floor of a makerspace has to be of firm cement to withstand the vibrations and movements of its machines, the wooden floor had been torn out. The recycling of these floorboards and other things, such as lamps and glass, was not done out of ecological idealism, but as a way

out of scarcity and the negotiations revolving around resource acquisition. In this vein, in every design meeting, someone referred to material like wood or glass that could be recycled to build something new. Glass was laminated to build display cases and new offices were created by building partitions out of the former floorboards: "We don't invent something new, it's just assembling", explained a makerspace employee (Research Diary, April 7, 2017).

Additionally, makers resist their authorities by appropriating the necessity to calculate. Every time appreciation of work efforts was felt to be missing, the sitting in front of a computer was used to do things other than designing. Conscious decisions to not work were made. This resistant behavior was carried out silently through simply not working or not taking responsibility for pending tasks. A manager told me that she thought that her employees were lazy:

> They legitimize it with not being paid well, but I don't understand why they don't work self-responsibly. If you tell them you are responsible for what a specific design looks like, they work really slowly until I tell them 'Okay, do that this way and that thing like this'. If they get orders then they work. (Research Diary, April 10, 2017)

One of the criticized employees claimed that she was grateful for working at a makerspace instead of sitting at home being bored, but doing work for which she was not appreciated, displeased her. Therefore, employees strategically use their work time in front of computers to educate themselves, play games, or watch movies:

> One day, [a maker] was sitting in the computer lab, just staring in front of her. I asked her if she had no work to do today. She laughed loudly and said that her job today was the main door: "Look, I have the keys. Everyone can give me a phone call and I have to open the doors".[5] She laughed again and pointed to the people on the other side of the room: "They're not working; they just look busy with their laptops. Look, he is watching a movie". (Research Diary, April 20, 2017)

The silent resistance against the lack of appreciation from authorities is incorporated in the objects of work, for example in a computer or a door key.

5 At that time of the makerspace's construction, the reception area had yet to be completed and so, for security, the door was kept locked.

10.4 Conclusion: The Resistant Appropriation of Making

The absence of appreciation, agreements on designs, and perceived insufficient salaries result in the appropriation of prototyping methods and calculative making to resist the hierarchies in the workplace. Technology developers position themselves in the powerful field of work deletions by using prototypes to make their invisibilized work tangible, by using the calculation of scarcity to avoid negotiations with those in authority over them, and by appropriating their work objects to silently resist workplace hierarchies. As such, the developers' care of making technology in a professional and calculative manner establishes socio-material relationships that enable them to change the workers' positionalities within work organizations.[6]

6 For a thorough conceptualization of emancipatory caring relationships within (agile) workplaces, see Coban and Wenten (2021).

Part II
Conclusion: Technocapitalism's Responsibilization to Calculate and Care (for Liberating Products)

Kenyan makers mostly sit in front of their computers to digitally draw an idea and calculate its implementation. As such, they do not conform to the global imagination of work in a makerspace – tinkering with cheap materials and fast prototyping machines. In Kenya, design work stands for the professionalization of manufacturing and is thus part of the vision to develop professional technologies in Nairobi. As such, this Part II's overall claims can be summarized as follows: first, Kenyan tech entrepreneurs deal with colonial trajectories and neoliberalism affectively and socio-materially, specifically through practices of care and calculation. Second, Kenyan makers aim at making professional products because these promise to achieve the aspired future of integrating Kenya into technocapitalist commodity flows.

The previous chapters on making have shown that the emerging makerspaces in Nairobi personify the vision of reworking Kenya's positionality by building a local innovation culture that is independent of technology from the Global North. In this regard, makerspaces aim to eradicate the challenges faced by hardware makers, for example, the lack of resources, machines, and capital, and to offer digital fabrication tools to support the local development of technologies. Kenyan makers feel empowered by their interactions with automated machines – because they liberate the makers from repair work and other manual labor, transform intangible ideas into tangible prototypes, and open up the chance to do something previously not possible: innovating professional products that target the local market. Therefore, making in Kenya differs from making in post-industrial contexts where it mainly happens as an anti-capitalist practice or leisure time activity that empowers makers through the return to manual work. The context-specific feelings of empowerment

and liberation signify that making in contexts without a prior industrialization represents a political endeavor to alleviate postcolonial asymmetries. As such, *performances of professionalism* position tech developers and their national economies in the realms of technocapitalism from which they had previously been excluded and make them independent of epistemological and technological supremacy of the West.

Furthermore, I analyzed the bodies, machines, and affects of postcolonial technology entrepreneurship. I argued that makers handle their neoliberal responsibilization to care for their own income, but also for national progress, in an affective and socio-material way. Loving affects express the desire to be liberated from postcolonial asymmetries that hinder the smooth entry into the technocapitalist market. In this vein, the pleasure in the aesthetics of technology and the love for machines show that making 'professional' technology is a precious endeavor. However, love can be complicated or even driven by the affect of fear. Kenyan makers constantly fear the failure of their ideas because they work in a context where developing technology is not a self-evident practice. Competition, resource scarcity, and hierarchies complicate the process of technology development. I have shown that surviving the challenging process of making products requires caring human-machine relationships that make technology in a calculative way. Instead of embracing and fostering failure as in the global maker ethos, makers, material, and machines unite in the *calculative making* of perfect digital models for competitive implementations that do not waste resources. These socio-material relationships care for making an idea into a marketable product – a product with social impact, a product that drives national progress, and a product that helps the country to gain independence from the centers of technology development. In regard to the hierarchies at tech workplaces, makers and their objects of work make their invisibilized work tangible, circumvent having to negotiate with authorities, and silently resist oppressing hierarchies. As such, prototyping methods and machines enable makers to resist inconveniences and to change their positionalities in the workplace. Fear and love, two seemingly antagonistic emotions, show that making practices in former colonies are sticky with emotions stemming from racialized national pasts, current global inequalities, and futuristic visions of an independent country.

Overall, the analyses of Chapters 7, 8, 9, and 10 have shown that the making of technology creates possibilities to change positionalities – whether within the workplace or global economies. And, as already elaborated above, the development of technology re-makes Kenya's positionality in technocapitalism:

performing professionalism to global standards earns global acknowledgement which results in a change of commodity flows and imaginations about an African country. However, being embedded in precarious neoliberal and postcolonial power asymmetries, postcolonial technology entrepreneurs have to invest all their commitment and bodily powers to care for the making of technology in order to fulfill their neoliberal responsibilization of national and technology development.

Chapter 11
Conclusion: Performing Technocapitalism

The entrepreneurial making of technology is a delicate undertaking. It needs a strong team of computers, metal pins, breadboards, CNC machines, darkrooms, technology developers, Excel sheets, CAD drawings, and money – to name a few of the team members. Further, the development of technology requires the support of knowledgeable co-workers, enabling juridical systems, affluent investors, and well-meaning bosses.

Workplaces such as makerspaces promise to fulfill these demands by offering access to digital fabrication tools, co-workers, and a network of funders. As a result, makerspaces serve as birthplaces of ideas – places where ideas hatch and develop into tangible prototypes. At these intimate workplaces, machines and makers form socio-material relations of trust while carefully drawing digital models of printed circuit boards or building water pumps. Touching emotions, such as love, are in the makerspaces' air when a prototype is born. The careful and loving entrepreneurial undertakings of making technologies, however, cannot be protected in an all-encompassing way by makerspaces because they are not self-contained workplaces (see McDowell 2009: 220). On the contrary, makerspaces are permeated with technocapitalist requirements, postcolonial power asymmetries, and tech-deterministic visions of the future. As such, they represent both places of intimate familiarity and, at the same time, of postcolonial exposure.

In this book, I have claimed that technology development in Kenya represents an example of how postcolonial positionalities in global power structures are desired to be re-scripted and thought anew. I argue that technocapitalism is an economy of promises and performances about technological futures, which requires *othered* tech scenes to convince doubters of their work by affectively promising and performing their capability of developing technology. My analyses of the work of telling public stories about technology and the actual

development of technologies have shown that the making of technologies in Kenya entails collaborative and loving care relations between co-workers, machines, and material, as well as strenuous efforts of positioning oneself within workplace hierarchies, technocapitalism, and colonial legacies.

11.1 Postcolonial Technocapitalist Positionalities

Kenya holds a postcolonial positionality in global technocapitalism. This means that the country's positionality (as is the case with almost every other country) continues to be shaped by colonial trajectories that privilege Western epistemologies of scientific work, technology, and societal progress. As Kenya is a former colony, its technologies contain colonial histories of technology transfer – whether through colonizers who used technology to 'civilize' racialized people or international organizations that use technology to enact development agendas by taking European industrialization and its knowledge economies as role models. Consequently, technologies evoke both affects of oppression, and also of 'liberating' modernity. They are not neutral tools; they are sticky with affects of the past (see Ahmed 2004b: 120). Against this ambivalent backdrop, the book examined Kenya's manufacturing policies and its ecosystem of tech investment to highlight that Kenyan technology entrepreneurship is situated in histories of colonialism and subsequent development experiments as well as in current innovation discourses that praise tech entrepreneurs for fostering national progress and societal well-being.

Kenya's situatedness in its past and present influences its discursive and material positionalities. Due to the pervasive imagination of Kenya as a technologically deficient place, the very existence of Nairobi's tech development sector rebuts colonial stereotypes (see Chapter 3). Nairobi is positioned as the center of African tech innovation as it receives most of the international media recognition (Pollio 2020: 2724f.) and funding for Africa's tech economies (Disrupt Africa 2021: 18). However, as positionalities are multiple and in flux, Nairobi also inhabits a peripheral positionality: the lack of state support, outdated laws, missing machines and components, the supreme economic position of countries in the Global North, and the continuous exoticization of African contexts all exclude Kenyan technology developers from global tech markets.

With this book, I argue that it is important to understand the situatedness of Kenya's technology development in colonial histories and the global politics

of technocapitalism because it shapes the visions, workplaces, technologies, labor, identities, and affects present in Nairobi's tech scene. I have shown that Kenya's positionalities influence the possibilities and futures of Nairobi as a place of technology development. In this vein, Kenya's peripherality in global technocapitalism not only complicates the local development of technology (see Chapter 7), but also makes it understandable why Kenyan politicians, investors, and entrepreneurs envision local technology development as driving national progress and global acknowledgement (see Chapter 2). I have highlighted that a neoliberal set of visions aims at national progress and the improvement of living standards in Kenya. In this manner, technology developers aim for a positive impact on marginalized citizens with their products. Together with the Kenyan government, they envision a Fourth Industrial Revolution to establish a new labor market for engineers and the country's position as a global tech player. Further, I have identified a decolonial set of visions that pushes tech developers to highlight their expertise and agency in building technology in order to gain acknowledgement from role models such as Silicon Valley, to emancipate themselves from tech imports, and to refute colonial stereotypes. Throughout the book, I have shown that the manifold visions assembled in technology development are driven by seemingly contradictory motivations: modernist assumptions of economic progress, entrepreneurial selves, and digital technologies meet desired futures of a decolonized country that cares for the needs of the African continent.

11.2 Technocapitalism and its Affective Promises and Performances

This book has emphasized the work that is necessary to re-script Kenya's postcolonial positionality within technocapitalism. What sounds simple, namely that ambitious engineers, high quality machines, and materials combine to build a prototype of an idea in order to participate in global tech markets, turns out to be complicated. The development of a technology requires money to afford material infrastructures, such as machines and workplaces, and it needs immaterial support in the form of knowledge sharing. As such, technology developers have to attract investment, political support, and co-workers to build a community around their technological vision. In order to gain this supportive network, tech developers have to make their work publicly visible. Therefore, the daily work practices of storytelling about innovative technologies are just

as necessary as the actual designing, prototyping, and coding of a technological idea (see Part I).

My argument is that technocapitalism represents an *economy of promises and performances* about technology yet to be. Instead of valorizing services or commodities, technocapitalism is about the capitalization of intangible promises about anticipated technological products and their envisioned futures. I extend current debates in the sociology of expectations and STS by arguing that in order to convince potential supporters and investors – and thus gain economic value – technology developers not only have to write about promising technological futures (e.g., Brown 2003; Felt and Fochler 2012; Wynne et al. 2007), but also make them tangible through socio-material affective performances. With my research focus on the performances of bodies, machines, and affects, I additionally broaden the academic perspective on workplaces of digital manufacturing (e.g., Aroles et al. 2019; Frey and Osborne 2013). Comparably, to work in the service sector, the work of technology developers requires self-presentations and social interaction (McDowell 2009: 225).

The empirical data from Nairobi's tech scene illustrates the affective practices demanded of places, bodies, and technologies that are peripheral to Western technoscience. My analysis shows that international doubts about the adequacy of the technology developed in Kenya are strong. Consequently, for Kenyan developers, simply promising technoscientific progress is not enough to gain legitimacy and convince investors. They also have to perform their work in a tangible and bodily perceivable way according to the audiences' expectations. Thus, tech developers invest their time and energy in public performances such as hackathons, pitching competitions, and storytelling at co-working spaces. Whether on a stage, at the workbench, or through social media, they constantly perform themselves, their visions, and technologies to make stories about Kenya's tech scene touchable, observable, and understandable for the spectators who mainly come from the Global North.

My research into the socio-material practices at innovative workplaces has shown that tech developers enter caring relationships to enact their own envisioned Kenyan futures. In this regard, technology developers, narratives, prototypes, and digital fabrication tools unite to create awareness of Kenya as a global tech player. They use Nairobi's central position within Africa's tech scenes to create media awareness and change Afro-pessimistic narratives, to gain investors' attention and change the tech scene's material scarcities, and to build an empowered Kenyan community of tech developers in global technocapitalism. Thus, intimate socio-material relations make technological

ideas tangible in order to re-work Kenya's postcolonial positionality, even if that means having to endure the (colonial) gaze of doubters (see Chapter 4).

11.3 Performing Poverty and Professionalism: The (Re-)Production of Norms

Another aspect of this book has been the study of how norms that determine how to be innovative in an African context come into being. Through the lens of performativity, I argue that these norms result from the repetitive staging of particular expectations, people, promises, and emotions within technoscientific performances. The norms of Kenyan tech entrepreneurship implicitly determine that the innovated technologies have to have a social impact, that the targeted users have to be impoverished, and that technology developers are supposed to be self-fulfilled and brilliant workers.

Empirically, I have shown that multiple reasons and emotions drive the (re-)production of these norms. On the one hand, the produced norms can be ascribed to external expectations, such as investors who demand impact technologies, global technology standards that define what a professional technology should look like, and the worldwide praise of innovation cultures that governs work to be flexible and precarious. On the other hand, tech developers in Kenya understand social impact as a societal heuristic; they want to build technology according to set standards, and they feel excited and self-fulfilled by their responsibility to solve challenges in Kenya. Overall, the examination of the affective part of knowledge production has highlighted that tech development is such a precious endeavor for Kenyan makers that they will agree to reproduce unpleasant norms in order to convince investors of their idea. Two main norm-producing performances have been detected in Nairobi's tech scene: the *performance of poverty* and the *performance of professionalism*.

Branding strategies, blog stories, media articles, visitor tours, and investment flows all perform poverty and thus, constitute Kenya as a homogenous African place of impact technologies for the rural poor. I claim that although the beliefs in social entrepreneurship and technology as universal solutions to societal challenges are a global phenomenon, their application in Kenya reproduces (post)colonial imaginations and limits the work of tech developers. Against the background of investors predominantly coming from countries such as the USA, Japan, or Germany and having little knowledge about Kenyan contexts, technology developers see the need to 'talk the funders' language'

and meet their expectations. As I have shown, the tech funders in Kenya are primarily interested in investing in technologies that have a social impact for impoverished and/or rural communities. As such, technology developers align their performances and stories with (inter)national development agendas because by doing so they have a higher chance of gaining funding: the enormous investment in social impact technologies consequently prompts tech developers to display their contexts as being in need of technological solutions to poverty. This performance of poverty is an expression of 'racial capitalism' (Robinson 1983/2021) and produces norms defining Kenyan innovations as having to foster the country's progress by solving long-standing societal problems and prospective users of new technologies as only marginalized communities, especially the rural poor.

Concerning the performance of professionalism, I have also identified practices entangled in global discourses as well as in local context specificities. Making technology in a place that is positioned as a periphery to global technocapitalism is aimed at offering a convincing case for the opposite of peripherality being true. In this manner, Kenyan technology developers feel empowered by making polished high-tech prototypes that refute the stereotypes of improvised low-tech handcraft from Africa. They desire the development of 'professional' technologies, meaning the fulfillment of a certain technological aesthetic and functionality, in order to present themselves as high-tech elites in an otherwise unusual – because exoticized – context for technology (see Chapter 8). This pursuit of professionalism stands in contrast to most academic accounts on makings' affects: it is not manual labor, tinkering, or the anti-capitalist appropriation of commodity production that empowers Kenyan makers (Carr and Gibson 2016; Grimme et al. 2014; Maxigas 2014), but the possibility to produce advanced technology. The loving affects that revolve around a professional prototype imply the love of liberation from postcolonial power asymmetries. The creation of high-tech products signifies the hope for an emancipation from the supremacy of Western technology and knowledge, and for inclusion in technocapitalism. Thus, a professional technology promises that global tech players, such as Chinese mass production facilities and Global North investors, will take Kenyan technologies seriously. Consequently, tech developers care for new technologies, startups, and co-working places because these things counter colonial imaginations of Africa as a passive and non-technological place. The predominant emotion of love in Kenyan makerspaces expresses the empowering feeling of making that reclaims "agency and a sense of control in the world" (Davies 2017: 161).

Thus, the self-fulfilling happiness and love for one's own work stands for the neoliberal subjectification of technology developers to work for national goals and societal well-being.

The norms about what form Kenyan innovation is supposed to take also evoke negative feelings, such as fear (see Chapter 9). As explained above, a makerspace cannot protect entrepreneurial endeavors from capitalist requirements and colonial trajectories. I claim that the emotion of fear encountered in Kenyan makerspaces points to the entrepreneurialization of technology developers and their workplaces. I observed that the fear of failure is most dominant when confronted with the lack of state support, difficult access to global commodity flows, and scarcity of investors who dare to invest in hardware made in an African country. To illustrate this point, I have argued that a postcolonial context differs from the Silicon Valley global role model through specific affective and collaborative socio-technical care – for example, making professional technologies in a resource-constrained context. These care practices are characterized by the emotional work of building prototypes and telling stories about Nairobi's technologies, but also by *calculative making*. The makers are responsible for taking care of their idea; that is, calculating every step of an idea's implementation to circumvent failure through theft or imperfection. Thus, my analyses of making practices have shown that calculative work usually associated with rationalized scientific practice is closely entwined with practices of care that are more usually seen in domestic or service work. I argue that the emotional and rationalized investments are inseparable, and both are necessary to survive in the competitive world of technology entrepreneurship.

The performances of poverty and professionalism demonstrate that technology developers and machines invest care and calculation in the socio-material promises and performances of technologies yet to be. I identified that these performances most often resonate with others' expectations of Kenyan innovation due to the economic necessity of gaining investment to build technological ideas. Hence, I claim that the told and performed stories about Nairobi's tech scene constantly reproduce the master narrative of technoscientific progress as well as the colonial imaginations of a single 'Africa' in order to make these technological endeavors plausible to international audiences. The stories do not mention the context specificities that complicate the entrepreneurial work at makerspaces – such as the lack of prototyping material or the unfulfilled desire to make tech for industrial processes. Instead, they repeat the promising visions of 'Africa Rising' and a Fourth Industrial Revolution, present flaw-

less high-tech prototypes that enact technoscientific modernity, invite others to gaze at innovative work in Nairobi, and evoke emotions of excitement and wonder about technology development in Kenya. The media, investors, politicians, and the tech developers themselves, portray Nairobi's tech scene as a surprising phenomenon in which Kenya represents a place that has to catch up in terms of technology, its national economy, and societal concerns.

This book has demonstrated that the narrative and embodied performances in Nairobi's tech scene create norms that see technology as the only solution to meet Kenyan development goals. I argue that an ahistorical, apolitical, and exoticized image of postcolonial inequalities is drawn, which normatively and affectively narrows tech developers', technologies', and Kenya's possibilities in re-scripting their positionalities within technocapitalism. Although anger about the restrictive norms of 'how to be innovative' surfaces from time to time, technology developers are invested in social impact norms and affectively comply with the norms of technoscientific progress and teleological Eurocentric development. The manifold and often ambiguous emotions emphasize that the technology developers' work life consists of negotiations between global norms of innovative work, colonial imaginations of Kenya, and context specific challenges to entrepreneurship. Further, it involves continuous negotiations between the developers' dependence on capital from the Global North and their wish to be emancipated from it (see Chapter 6). Thus, postcolonial technology entrepreneurs have to handle and withstand the tensions between neoliberal aspirations, technocapitalist world markets, and decolonial motivations in their workplace.

11.4 The Politics and Affects of Postcolonial Technology Entrepreneurship

At a symposium on 'The Value of Critique',[1] Bruno Latour said that critique is an affect. According to him, critique should not be understood as something imposed from the outside, but as interactions from the inside. Thus, he called for ethnomethodological descriptions of how critique is lived, experienced, and practiced. I realized much later that researching postcolonial tech-

1 The symposium was organized by the Cluster of Excellence "The Formation of Normative Orders" and the Staatliche Hochschule für Bildende Künste, Städelschule and took place on January 19, 2017.

nology entrepreneurship is doing exactly that: tracing the affective force of critique throughout practices of technology development. In this regard, I have examined the criticism within Kenya's tech sector; in particular, how it drives (ambivalent) visions of Kenyan futures and daily life in innovative workplaces.

My argument is that the ambivalent ambitions of decoloniality and capitalist market integration become entangled in the critique of exclusions due to Kenya's postcolonial positionality. Technology developers problematize their exclusion from commodity flows, the postcolonial asymmetries within investor-relationships, and the overall obligation to adapt to Western norms of technological progress. Consequently, actors in Nairobi's tech scene envision, on the one hand, a decolonial emancipation from the West and, on the other, a capitalist integration into global tech markets to independently foster national well-being. This has led me to define *postcolonial technology entrepreneurship* as politically inflected neoliberal work as it aims at re-making Kenya's oppressive positionality through affective and caring socio-technical practices of technology development. In this book, I have shown that the performativity of storytelling and technology development leaves space to intervene in hegemony, but that most often emancipatory aims succumb to postcolonial capitalist structures.

Every day, different constellations of actors criticised varying circumstances related to Kenya's tech scene. On a state level, the Kenyan government problematizes the country's economic performance that is characterized by its dependence on primary (agricultural) commodity exports, a stagnating manufacturing sector, high unemployment rates, and overall 'exclusion' from technocapitalist markets. Development organizations, the Government of Kenya, and the country's technology developers all problematize the poor living standards of the majority of Kenyans. Further, technology developers and other actors within the tech sector, who feel pressured to live up to external expectations and responsibilizations, angrily inspect global norms of technoscience, colonial imaginations of a non-technological African continent, and workplace hierarchies that lack acknowledgment for intangible knowledge work. All of these critics have in common that they see technology as the right tool for change – be it through large technological projects such as a Fourth Industrial Revolution or through technological products that serve the needs of marginalized communities.

As shown throughout the chapters, the development of technologies is a political expression. The built technologies and the told stories promise and perform Kenya as a place of technology development and, as such, re-script

Kenya's peripheral positionality in technocapitalism. To counter the global dominant imaginations about Africa as a single passive recipient, technology developers demonstrate their local expertise that does not depend on knowledge 'from outside'. As such, they proudly market their technological innovations as continental achievements "Made in Africa, for Africa" (see Chapter 6). Furthermore, they build an empowering collective identity of local tech developers who care for each other and their contexts. Numerous hashtags on Instagram illustrate the overall aim to abolish postcolonial asymmetries by demarcating technology development in African countries from global technoscientific centers in the Global North (see Part I). The hashtags #blackengineers, #blackexcellence, and #blackmindsmatter tagged in the first photo showing a high-tech innovation at #africanengineering demonstrate that technology development is an empowering practice for hitherto discriminated against people (Funches 2018).[2]

However, being situated within capitalist structures, the feelings of empowerment, self-fulfillment, love, and excitement about the emancipatory, decolonial possibilities of technology development eventually come to a halt. As stated above, the technology developers' economic necessity to gain income and the (postcolonial) requirements to become included in technocapitalism cause them to comply with the norms of technoscientific progress and societal development driven by international investors. Against this backdrop, Mark Karake, a proponent of local investment, compares the investor activities in Nairobi's tech scene with the colonial era:

> Observing the actors, forces, and outcomes so far in the East African startup ecosystem one is forced to contend with the uneasy sense that history could be repeating itself with the digital scramble for Africa threatening to mirror the original scramble for Africa. (2018b: n.p.)

It seems that technology development may lose its emancipatory potential due to historically manifested structures and hegemonies, such as racialized pasts, current postcolonial disadvantages, and neoliberal desires for thriving economies, that affectively lead (and financially force) tech developers to invest

2 In September 2018, the first Instagram post at #africanengineering about a high-tech innovation stated that the "26-year-old Robotics Engineer, Silas Adekunle, the Founder and CEO of Reach Robotics, the developer of the world's first augmented reality gaming robots, is the Highest Paid Robotic Engineer in the world" (Funches 2018).

themselves in conservative norms. Achille Mbembe (2001: 12) describes how the goal of an 'African modernity' finds itself situated between emancipation and assimilation; whereby the assimilation into Western modernity still gains the upper hand. "Afrocentric entrepreneurship" (Ouma 2020: n.p.) can thus be seen not as breaking with colonial trajectories, but as a slight elevation "beyond a state of simple mimicry" (Ouma et al. 2019: 354) of Western capitalism. Ouma et al. explain:

> Even the most promising local initiatives, trying to create better futures for people in many African countries, such as M-Pesa, usually do not escape this coloniality of "global value relations" (Araghi 2003). (ibid.: 355)

Instead of joining pessimistic and deterministic interpretations of technology development in Kenya, this book has emphasized performativity. The strenuous emotional work of negotiating (post)colonial representations and positionalities manages to leave space for emancipatory moments; for example, making local expertise visible, creating images other than an impoverished rural environment, and building communities and economic networks that are based on local understandings of investment and social impact. Further, the analyses of the experienced and observed emotions in Nairobi's tech scene have shown that fearing failure or loving technology are not individual feelings, but signifiers of structural effects. Sara Ahmed claims that the realization that "what happens to us might be connected in some way to what happens to others" (2010: 87) can result in a collective force for liberation. In response, I have rendered visible the (oppressive) structures that cause tech developers to feel as they do.

In addition to the emancipatory potential of emotions and the focus on the performative changeability of postcolonial positionalities, I have shown that technoscientific endeavors are always historically situated and context-specific. Kenyan technology development looks back to histories of African entrepreneurship that have always seen business as a political sphere. Sub-Saharan ontologies understand social impact not only as a business model, but also as a heuristic in which everyone and everything is part of a whole that is cared about. Furthermore, even the historical struggle for Kenya's independence combined the decolonial vision to emancipate intellectually and economically from colonizing countries with a Eurocentric teleology of (economic) development (see Chapter 2). As such, the emancipatory goals in Kenya's makerspaces follow different logics from the maker- and hackerspaces

in post-industrial countries. It is not the anti-capitalist appropriation of manual work, but the use of digital fabrication tools to be included in global markets that defines emancipation. Based on these insights, I claim that postcolonial technology entrepreneurship is enmeshed in the ambiguity of technocapitalist and decolonial logics. The ambition to re-make Kenya's positionality through the capitalization of local knowledge and high tech shows that critique affectively entangles (politically) heterogeneous practices, multiple futures of societal progress, capitalist markets, and emancipatory ambitions.

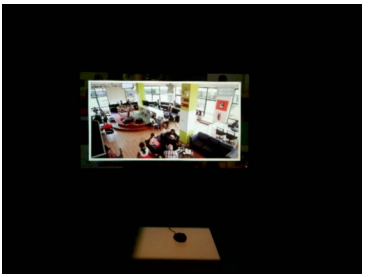
11.5 Africanfuturist Speculation on Emancipation

Acknowledging the multiplicity and context-specificity of emancipatory ambitions and moments that exist within capitalist structures does not mean that I am ignoring the devastating effects of capitalism on the planet (including humanity). As a big fan of science-fiction (sci-fi) literature, I claim that the sci-fi novels and short stories written by writers from African countries, termed variously *Afrofuturism*, *Africanfuturism* or speculative fiction from the African continent,[3] offer insights into what emancipated technology-driven futures could look like. Instead of advocating for a further musealization of technologies from Africa by presenting startups and their innovations in exhibitions all over the world (Figures 12 and 13), or for a simplified (ethnicized) comparison of Nairobi's tech scene to *Black Panther*'s prosperous Wakanda (Kreye and Rabe 2018), I call for taking the narratives and imaginations in Africanfuturism seriously.

3 The term *Afrofuturism* describes sci-fi that depicts Afro-American alienation experienced since slavery (Eshun 2003: 298f.). Thus, sci-fi writers from African countries declared that they do not want to be defined as Afrofuturists as their daily lives differ from those of Afro-Americans. Mohale Mashigo (2018: n.p.) for example, states that she did not grow up as an alienated minority in her country and thus, "has never suffered from a lack of representation" (ibid.). Nnedi Okorafor highlights that sci-fi from the African continent is directly rooted in "African culture, history, mythology and point-of-view" and therefore de-centers the West (Okorafor 2020: n.p.). She created the term *Africanfuturism* to emphasize these attributes in contrast to Afrofuturism as diasporic literature and art genre (ibid.).

Figure 13: A BRCK version exhibited at "Afro-Tech and the Future of Re-Invention" at HMKV in Dortmund (author's photo).

Figure 14: The iHub exhibited at "Digital Imaginaries – Africas in Production" at ZKM in Karlsruhe (author's photo).



Africanfuturistic stories can be distinguished from other sci-fi due to their references to the non-human (and non-alien) world: mythical creatures, animals, spirits, plants, and cyborgs (Woods 2020). In this vein, these stories are epistemologically based on oral histories of diverse African contexts (Okorafor 2020: n.p.). In Okorafor's *Lagoon* (2014), for example, a skate opens the book by expressing anger about the environmental pollution from offshore oil platforms. Later, figures from Nigerian myths, incarnated in the form of a bat and spider, intermingle with humans and aliens in Lagos. Wangechi Mutu (2013) also depicts the inseparability of all living beings and (technological) things in her animated short film "The End of Eating Everything". The visual artist explains that she wanted to illustrate the earth as "a living being", a planetary persona that is not a simple and single character (Mutu 2015: n.p.). Thus, she created a being (performed by Santigold) that has been deformed by capitalism's environmental destruction and exploitation (Hartware MedienKunstVerein 2017: 22). In the film, this Medusa-headed planetary persona flies through a brownish polluted atmosphere and ends up eating everything, thereby representing the capitalist loss of control (Mutu 2015: n.p.).

The relationality of living creatures, materialities, and nature is reminiscent of the theorizations of Actor-Network-Theory that argue for relational agency in more-than-human assemblages (Latour 2005). In this regard, Africanfuturism depicts the world as a planetary whole in which there are no boundaries between differing existences. By knitting epistemologies, figures, and things together, the imagined Africanfuturist future is "multiple, nonlinear, and ultimately focused on the transcendence of boundaries" (Woods 2021: n.p.).

Using Africanfuturism to speculate about emancipatory futures, it becomes clear that a decolonial world would have no 'others' (Woods 2021: n.p.). It would neither demarcate nations from each other, nor a Global South from a Global North; it would have abandoned the binary thinking of the West (Woods 2020: 46). This planetary view acknowledges the interdependence between everything and anything. Feminist scholars understand this interdependence as emancipatory when seen as constituent to life (e.g., Haraway 1991; Mol et al. 2010; Precarias a la deriva 2014). They claim that from the perspective of mutual solidarity, affection, and affinity no boundaries exist between those who give and those who receive care, because relationships are reciprocal and infinitely indebted with care (Lorey 2019: 13).

Combining Africanfuturism's imaginations of decoloniality with feminists' ontology of care, an emancipatory planet would foster the "sociotechnical, affective, and situated relationships forming the base of life" (Coban and Wenten 2021: 67). Technology development in a decolonial and feminist world would not be valued along categories of wealth accumulation. As a result, the socio-technical care for the implementation of a technological idea would not be a vehicle to survive and eventually thrive in technocapitalism, but a part of caring for the whole. I argue that if we take Africanfuturistic epistemologies and ontologies as role models for an emancipatory future, we could create societies that are aware of the postcolonial situatedness of bodies, machines, and affects while remembering that collective planetary care is of the utmost importance to survive and provide well-being. In this respect, I speculatively ask, why not reconcile with all beings, spirits, matters, and technologies and re-make the world by caringly depending on each other?

References

Aderemi, A. and Agaigbe, F. (2018) 'Challenges of Economic Development in Africa: The Dichotomy of a Debate and the Africanist View', in Oloruntoba, S.O. and Falola, T. (eds.) The Palgrave Handbook of African Politics, Governance and Development. New York: Palgrave Macmillan, pp. 589–605.

Adler, P.S. (1990) 'Marx, Machines, and Skill', Technology and Culture, 31(4), pp. 780–812.

Africa Capital Digest (2015) Is a Silicon Valley in East Africa a Pipedream. Available at: https://africacapitaldigest.com/is-a-silicon-valley-in-east-africa-a-pipedream [Accessed November 12, 2015].

Ahmed, S. (2004a) 'Collective Feelings: Or, The Impressions Left by Others', Theory, Culture and Society, 21(2), pp. 25–42.

Ahmed, S. (2004b) 'Affective Economies', Social Text, 22(2), pp. 117–139.

Ahmed, S. (2010) The Promise of Happiness. Durham: Duke University Press.

Ahmed, S. (2014) The Cultural Politics of Emotion (second edition). Edinburgh: Edinburgh University Press.

Aker, J.C. and Mbiti, I.M. (2010) 'Mobile Phones and Economic Development in Africa', Journal of Economic Perspectives, 24(3), pp. 207–232.

Alexander, J.K. (2009) 'The Concept of Efficiency: An Historical Analysis', in Meijers, A. (ed.) Philosophy of Technology and Engineering Sciences. North Holland: Elsevier, pp. 1007–1030.

Alushula, P. (2019) M-Pesa users outside Kenya hit 13.4 million. Available at: http://www.businessdailyafrica.com/corporate/companies/M-Pesa-users-outside-Kenya-hit-13-4-million/4003102-4956208-16s8a9/index.html [Accessed May 12, 2020].

Amaizo, Y.E. (2012) 'An Alternative African Developmentalism: A Critique of Zero-sum Games and Palliative Economics', Africa Development, 37(4), pp. 117–140.

Ames, M.G. (2015) 'Charismatic Technology', Proceedings of the Fifth Decennial Aarhus Conference on Critical Alternatives. Aarhus University Press, pp. 109–120.

Ames, M.G., Lindtner, S., Bardzell, S., Bardzell, J., Nguyen, L., Ishtiaque Ahmed, S., Jahan, N., Jackson, S.J. and Dourish, P. (2018) 'Making or Making Do? Challenging the Mythologies of Making and Hacking', Journal of Peer Production, 12, pp. 1–21.

Ames, M.G., Rosner, D.K. and Erickson, I. (2015) 'Worship, Faith, and Evangelism: Religion as an Ideological Lens for Engineering Worlds', Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing. ACM, pp. 69–81.

Anderson, B. (2017) 'Affect', in Richardson, D., Castree, N., Goodchild, M.F., Kobayashi, A., Liu, W. and Marston, R.A. (eds.) The International Encyclopedia of Geography. John Wiley & Sons, pp. 1–3.

Anderson, D.M. (2008) 'Editorial', Journal of Eastern African Studies, 2(2), p. 165.

Anderson, W. (2002) 'Introduction: Postcolonial Technoscience', Social Studies of Science, 32(5-6), pp. 643–658.

Anderson, W. (2009) 'From Subjugated Knowledge to Conjugated Subjects: Science and Globalisation, or Postcolonial Studies of Science?', Postcolonial Studies, 12(4), pp. 389–400.

Anwar, M.A. and Graham, M. (2021) 'Between a Rock and a Hard Place: Freedom, Flexibility, Precarity and Vulnerability in the Gig Economy in Africa', Competition & Change, 25(2), pp. 237–258.

Appiah, K.A. (2006) The Case for Contamination. Available at: http://www.nytimes.com/2006/01/01/magazine/01cosmopolitan.html?e…eb5e1741c&ex=1293771600&partner=rssnyt&emc=rss&pagewanted=print [Accessed June 26, 2021].

Armano, E. and Murgia, A. (2013) 'The Precariousness of Young Knowledge Workers: A Subject-oriented Approach', Global Discourse, 3(3-4), pp. 486–501.

Aroles, J., Mitev, N. and de Vaujany, F-X (2019) 'Mapping Themes in the Study of New Work Practices', New Technology, Work and Employment, 34(3), pp. 285–299.

Arora, S. and Romijn, H. (2011) 'The Empty Rhetoric of Poverty Reduction at the Base of the Pyramid', Organization, 19(4), pp. 481–505.

Avle, S. (2020) 'Making as Imaginative Crossroads: Ghanaian Makers and the Geopolitics of Technological Progress', Proceedings of the Association for Information Science and Technology, 57(1), e298.

Avle, S. and Lindtner, S. (2016) 'Design(ing) 'Here' and 'There': Tech Entrepreneurs, Global Markets, and Reflexivity in Design Processes', Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems. ACM, pp. 2233–2245.

Avle, S., Hui, J., Lindtner, S. and Dillahaunt, T. (2019) 'Additional Labors of the Entrepreneurial Self', Proceedings of the ACM on Human-Computer Interaction, 3(CSCW), pp. 1–24.

Avle, S., Lindtner, S. and Williams, K. (2017) 'How Methods Make Designers', Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, pp. 472–483.

Barbrook, R. and Schultz, P. (1997) The Digital Artisans Manifesto. Available at: http://www.imaginaryfutures.net/2007/04/16/the-digital-artisans-manifesto-by-richard-barbrook-and-pit-schultz [Accessed June 25, 2012].

Bardzell, S., Rosner, D.K. and Bardzell, J. (2012) 'Crafting quality in design: integrity, creativity, and public sensibility', Proceedings of the Designing Interactive Systems Conference. ACM, pp. 11–20.

Barnes, B. (2005) 'Elusive Memories of Technoscience', Perspectives on Science, 13(2), pp. 142–165.

Basulto, D. (2012) The New #Fail: Fail Fast, Fail Early and Fail Often. Available at: http://www.washingtonpost.com/blogs/innovations/post/the-new-fail-fail-fast-fail-early-and-fail-often/2012/05/30/gJQAKA891U_blog.html?noredirect=on&utm_term=.37565a1dd9a5 [Accessed May 4, 2019].

BBC (2016) Kenyan App Ushahidi Monitoring US Elections. Available at: http://www.bbc.com/news/world-africa-37910068 [Accessed June 2, 2021].

Bean, J. and Rosner, D. (2012) 'Old Hat: Craft Versus Design?', Interactions, 19(1), pp. 86–88.

Bejarano, J.P.P. (2021) 'Ruins Across the Atlantic: Speculations on the Colonial and Mythological Genealogies of the Internet's Submarine Infrastructure', Proceedings of Politics of the Machines – Rogue Research 2021, pp. 138–144. Available at: http://www.scienceopen.com/hosted-document?doi=10.14236/ewic/POM2021.18 [Accessed March 17, 2023].

Benton, C., Mullins, L. Shelley, K. and Dempsey, T. (2013) Makerspaces – Supporting an Entrepreneurial System. Co-Learning Plan Series of MSU EDA University Center for Regional Economic Innovation (REI).

Beresford, A. (2016) 'Africa Rising?', Review of African Political Economy, 43(147), pp. 1–7.

Berndt, C. and Boeckler, M. (2011) 'Geographies of Markets: Materials, Morals and Monsters in Motion', Progress in Human Geography, 35(4), pp. 559–567.

Birch, K. (2017) 'Techno-economic Assumptions', Science as Culture, 26(4), pp. 433–444.

Birgen, S. (2017) 05 April. Available at: https://twitter.com/SheilahBirgen/status/849657773617008640 [Accessed April 5, 2017].

Birkelo, P. (2017) Building Makerspaces for the 4th Industrial Revolution. Available at: https://medium.com/@cpbirkelo/building-makerspaces-for-the-4th-industrial-revolution-be51e5d76e22 [Accessed February 14, 2019].

Biwu, S. and Prince, G. (2018) 'Core Concepts and Basic Theories of Narrative: A Conversation with Gerald Prince', Interdisciplinary Studies of Literature 文学跨学科研究, 2(1), pp. 13–25.

Blake, M.K and Hanson, S. (2005) 'Rethinking Innovation: Context and Gender', Environment and Planning A, 37, pp. 681–701.

Blaut, J.M. (1976) 'Where was capitalism born?', Antipode, 8(2), pp. 1–11.

Blikstein, P. (2013) 'Digital Fabrication and 'Making' in Education: The Democratization of Invention', in Walter-Herrmann, J. and Büching, C. (eds.) FabLab: Of Machines, Makers and Inventors. Bielefeld: Transcript Verlag, pp. 203–222.

Boeva, Y. (2018) 'Break, Make, Retake: Interrogating the Social and Historical Dimensions of Making as a Design Practice', PhD thesis, York University, York.

Bouncken, R.B. and Reuschl, A.J. (2018) 'Coworking-Spaces: How a Phenomenon of the Sharing Economy Builds a Novel Trend for the Workplace and for Entrepreneurship', Review of Managerial Science, 12, pp. 317–334.

Boyce, M.E. (1996) 'Organizational Story and Storytelling: A Critical Review', Journal of Organizational Change Management, 9(5), pp. 5–26.

Branham, B. (2017) Design Thinking Mantras That Make Success. Available at: http://www.linkedin.com/pulse/design-thinking-mantras-make-success-ben-branham [Accessed May 5, 2019].

Braverman, H. (1974) Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century. New York: Monthly Review.

Braybrooke, K. and Jordan, T. (2017) 'Genealogy, Culture and Technomyth: Decolonizing Western Information Technologies, from Open Source to the Maker Movement', Digital Culture & Society, 3(1), pp. 25–46.

BRCK (2016) BRCK Home. Available at: https://brck.com/index.html [Accessed: 7 October, 2016].

Breckenridge, K. (2021) 'What Happened to the Theory of African Capitalism?', Economy and Society, 50(1), pp. 9–35.

Bristow, T. (2017) 'Post African Futures: Positioning the Globalized Digital within Contemporary African Cultural and Decolonizing Practices', Critical African Studies, 9(3), pp. 281–301.

Brophy, E. (2006) 'System Error: Labour Precarity and Collective Organizing at Microsoft', Canadian Journal of Communication, 31, pp. 619–638.

Brown, N. (2003) 'Hope Against Hype – Accountability in Biopasts, Presents and Futures', Science Studies, 16(2), pp. 3–21.

Brown, N., Rip, A. and Van Lente, H. (2003) Expectations In & About Science and Technology. Available at: http://www.york.ac.uk/satsu/expectations/Utrecht%202003/Background%20paper%20version%2014May03.pdf [Accessed November 14, 2019].

Bublitz, H. (2003) Diskurs. Bielefeld: transcript.

Buechley, L. and Perner-Wilson, H. (2012) 'Crafting Technologies: Reimagining the Processes, Materials, and Cultures of Electronics', ACM Transactions on Computer-Human Interaction, 19(3), Article 21.

Buser, M. and Boyer, K. (2021) 'Care goes Underground: Thinking Through Relations of Care in the Maintenance and Repair of Urban Water Infrastructures', Cultural Geographies, 28(1), pp. 73–90.

Butler, J. (1990) Gender Trouble: Feminism and the Subversion of Identity. New York: Routledge.

Butler, J. (1995) 'For a Careful Reading', in Benhabib, S., Butler, J., Cornell, D. and Fraser, N. (eds.) Feminist Contentions: A Philosophical Exchange. New York and London: Routledge, pp. 127–144.

Butler, J. (2010) 'Performative Agency', Journal of Cultural Economy, 3(2), pp. 147–161.

Butoliya, D. (2018) 'Critical Jugaad: A (Post) Critical Investigation into Marginal Making Practices from Beyond the Anglo-European Sphere', Making Futures, 5, pp. 1–16.

Cadman, L. (2009) 'Nonrepresentational Theory/Nonrepresentational Geographies', in Kitchen, R. and Thrift, N. (eds.) International Encyclopedia of Human Geography. Oxford: Elsevier, pp. 456–463.

Cairns, K. (2013) 'The Subject of Neoliberal Affects: Rural Youth Envision their Futures', The Canadian Geographer/Le Géographe canadien, 57(3), pp. 337–344.

Cameron, E. (2012) 'New Geographies of Story and Storytelling', Progress in Human Geography, 36(5), pp. 573–592.

Carr, C. and Gibson, C. (2016) 'Geographies of Making: Rethinking Materials and Skills for Volatile Futures', Progress in Human Geography, 40(3), pp. 297–315.

Carr, C. and Gibson, C. (2017) 'Animating Geographies of Making: Embodied Slow Scholarship for Participant-researchers of Maker Cultures and Material Work', Geography Compass, 11, e12317.

Castells, M., Fernández-Ardèvol, M., Qiu, J.L. and Sey, A. (2007) Mobile Communication and Society: A Global Perspective. Cambridge: MIT Press.

Cessou, S. (2018) 'Das digitale Glück der Kenianer', Le Monde diplomatique. 13 December, p. 14.

Chan, A.S. (2013) Networking Peripheries: Technological Futures and the Myth of Digital Universalism. Cambridge and London: MIT Press.

Chanda, C. (2016) Mentoring and Defending the African Entrepreneur. Lusaka: Africa Institute for Culture and Economic Literacy.

Cherlet, J. (2014) 'Epistemic and Technological Determinism in Development Aid', Science, Technology, & Human Values, 39(6), pp. 773–794.

Chouliaraki, L. (2010) 'Post-humanitarianism: Humanitarian Communication Beyond a Politics of Pity', International Journal of Cultural Studies, 13(2), pp. 107–126.

Christensen, J. (2012) 'Telling Stories: Exploring Research Storytelling as a Meaningful Approach to Knowledge Mobilization with Indigenous Research Collaborators and Diverse Audiences in Community-based Participatory Research', The Canadian Geographer/Le Géographe Canadien, 56(2), pp. 231–242.

Coban, A. (2018) 'Making Hardware in Nairobi: Between Revolutionary Practices and Restricting Imaginations', Journal of Peer Production, 12, pp. 60–76.

Coban, A. and Wenten, K-A. (2021) 'Who Cares for Agile Work? In/Visibilized Work Practices and Their Emancipatory Potential', Nanoethics, 15, pp. 57–70.

Cockayne, D.G. (2016) 'Entrepreneurial Affect: Attachment to Work Practice in San Francisco's Digital Media Sector', Environment and Planning D, 34(3), pp. 456–473.

Cofie, E. (2016) Is an African Silicon Valley a Pipe Dream Today? Available at: http://blog.ethelcofie.com/2016/11/14/is-the-african-silicon-valley-a-pipe-dream-today [Accessed September 2, 2019].

Cofie, E. (2019) Why is it Important that African Startups Build for Africa First (Part 1). Available at: http://blog.ethelcofie.com/2019/07/18/why-is-it-important-that-african-startups-build-for-africa-first-part-1/#.XuUXRedCS70 [Accessed June 13, 2020].

Cofie, E. (n.d.) Ethel Cofie. Available at: http://ethelcofie.com [Accessed September 2, 2019].

Collier, S.J., Cross, J. Redfield, P. and Street, A. (2017) 'Preface: Little Development Devices/Humanitarian Goods', in Collier, S.J., Cross, J., Redfield, P. and Street, A. (eds.) Limn 9: Little Development Devices/Humanitarian Goods. Available at: https://limn.it/articles/precis-little-development-devices-humanitarian-goods [Accessed April 11, 2020].

Crang, M. and Cook, I. (2007) Doing Ethnographies. London, Thousand Oaks, New Delhi and Singapore: SAGE Publications.

Crang, M. (2004) 'Cultural Geographies of Tourism', in Lew, A.A., Hall, C.M. and Williams, A.M. (eds.) A Companion to Tourism. Malden, Oxford and Victoria: Blackwell Publishing, pp. 74–84.

Crang, P. (1994) 'It's Showtime; On the Workplace Geographies of Display in a Restaurant in Southeast England', Environment and Planning D, 12, pp. 675–704.

Cringely, R.X. (1992) Accidental Empires: How the Boys of Silicon Valley Make Their Millions, Battle Foreign Competition and Still Can't Get a Date. New York: Harper Business.

Czarniawska, B. (1999) Writing Management: Organization Theory as a Literary Genre. Oxford and New York: Oxford University Press.

Czarniawska, B. (2004) Narratives in Social Science Research. London: SAGE Publications.

d'Hauteserre, A-M. (2004) 'Postcolonialism, Colonialism, and Tourism', in Lew, A.A., Hall, C.M. and Williams, A.M. (eds.) A Companion to Tourism. Malden, Oxford and Victoria: Blackwell Publishing, pp. 235–245.

Dahm, S. (2017) '"Just Do It!"- Considerations on the Acquisition of Hackerspace Field Skills as an Ethnomethodological Research Technique', Digital Culture and Society, 3(1), pp. 109–124.

Dana, L-P, Ratten, V. and Honyenuga, B.Q. (2018) 'Introduction to African Entrepreneurship', in Dana, L-P, Ratten, V. and Honyenuga, B.Q. (eds.) African Entrepreneurship: Challenges and Opportunities for Doing Business. Cham, Switzerland: Palgrave Macmillan, pp. 1–7.

Davies, S.R. (2017) Hackerspace: Making the Maker Movement. Cambridge and Malden: Polity Press.

Davies, S.R. (2018) 'Characterizing Hacking: Mundane Engagement in US Hacker and Makerspaces', Science, Technology, & Human Values, 43(2), pp. 171–197.

Davies, S.R. and Horst, M. (2016) Science Communication: Culture, Identity and Citizenship. London: Palgrave Macmillan.

de Bastion, G. (2013) Technology Hubs – Creating Space for Change: Africa's Technology Innovation Hubs. Bonn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

de la Chaux, M. and Okune, A. (2017) 'The Challenges of Technology Entrepreneurship in Emerging Markets: A Case Study in Nairobi', in Ndemo, B. and Weiss, T. (eds.) Digital Kenya: An Entrepreneurial Revolution in the Making. London: Palgrave Macmillan, pp. 265–289.

de Leeuw, S., Parkes, M.W., Morgan, V.S., Christensen, J., Lindsay, N., Mitchell-Foster, K. and Russell Jozkow, J. (2017) 'Going Unscripted: A Call to Critically Engage Storytelling Methods and Methodologies in Geography and the Medical-health Sciences', The Canadian Geographer/Le Géographe canadien, 61(2), pp. 152–164.

de Peuter, G. (2011) 'Creative Economy and Labor Precarity: A Contested Convergence', Journal of Communication Inquiry, 35(4), pp. 417–425.

de Soto, H. (1989) The Other Path: The Invisible Revolution in the Third World. New York: Harper & Row.

Decoloniality Europe (2013) Charter of Decolonial Research Ethics. Available at: http://www.decolonialityeurope.wixsite.com/decoloniality/charter-of-decolonial-research-ethics [Accessed August 21, 2019].

Dees, G.J. (1998) The Meaning of "Social Entrepreneurship". Available at: https://centers.fuqua.duke.edu/case/wp-content/uploads/sites/7/2015/03/Article_Dees_MeaningofSocialEntrepreneurship_2001.pdf [Accessed July 8, 2021].

Delaney, K. (2018) Closing Africa's Connectivity Gap. Available at: https://connectedfutures.cisco.com/article/closing-africas-connectivity-gap/?dysig_tid=519f2621fd304b2e82b2cf3e7373db7f&DTID=esosah000746&REFERRING_SITE=Twitter&CREATIVE=275365+SAH&POSTID=9c37bcc3-5f56-4c40-8b66-01783eed2e5d [Accessed September 2, 2019].

Demirović, A., Lettow, S. and Maihofer, A. (2019) 'Einleitung', in Demirović, A., Lettow S. and Maihofer, A. (eds.) Emanzipation: Zur Geschichte und Aktualität eines politischen Begriffs. Münster: Westfälisches Dampfboot, pp. 7–9.

Dickel, S. (2019) Prototyping Society – Zur vorausseilenden Technologisierung der Zukunft. Bielefeld: transcript.

Dickel, S. and Schrape, J-F. (2017) 'The Logic of Digital Utopianism', Nanoethics, 11, pp. 47–58.

Dieterich, J. (2018) M-Pesa: Wir sind drin! Available at: http://www.brandeins.de/magazine/brand-eins-wirtschaftsmagazin/2018/mobilitaet/m-pesa-wir-sind-drin?utm_source=zeit&utm_medium=parkett [Accessed September 2, 2019].

Digital Inclusion Survey (n.d.) Digital Inclusion Builds Communities Today (and Tomorrow). Available at: https://digitalinclusion.umd.edu [Accessed August 12, 2019].

Disrupt Africa (2021) African Tech Startups – Funding Report 2020. Available at: https://disrupt-africa.com/funding-report [Accessed April 16, 2021].

Disrupt Africa (2022a) The African Tech Startups Funding Report 2021. Available at: https://disrupt-africa.com/wp-content/uploads/2023/02/The-African-Tech-Startups-Funding-Report-2022.pdf [Accessed July 16, 2023].

Disrupt Africa (2022b) The Kenyan Startup Ecosystem Report 2022. Available at: https://disrupt-africa.com/wp-content/uploads/2022/12/The-Kenyan-Startup-Ecosystem-Report-2022.pdf [Accessed July 16, 2023].

do Mar Castro Varela, M. and Dhawan, N. (2015) Postkoloniale Theorie: Eine kritische Einführung. Bielefeld: transcript.

Doevenspeck, M. and Hollstegge, J. (2019) 'Digitalisierung in Ostafrika', Geographische Rundschau, 71(11), pp. 30–33.

Dolan, C. and Rajak, D. (2016) 'Toward the Anthropology of Corporate Social Responsibility', in Dolan, C. and Rajak, D. (eds.) The Anthropology of Corporate Social Responsibility. New York and Oxford: Berghahn, pp. 1–28.

Dourish, P. and Mainwaring, S. D. (2012) 'Ubicomp's Colonial Impulse', Proceedings of the 2012 ACM Conference on Ubiquitous Computing, pp. 133–142.

Dutta, M. (2016) 'Place of Life Stories in Labour Geography: Why Does it Matter?', Geoforum, 77, pp. 1–4.

Eckhardt, J., Kaletka, C., Pelka, B., Unterfrauner, E., Voigt, C. and Zirngiebl, M. (2021) 'Gender in the Making: An Empirical Approach to Understand Gender Relations in the Maker Movement', International Journal of Human-Computer Studies, 145, Article 102548.

Edgerton, D. (2007) 'Creole Technologies and Global Histories: Rethinking how Things Travel in Space and Time', History of Science and Technology, 1(1), pp. 75–112.

Ehn, B. (2011) 'Doing-It-Yourself: Autoethnography of Manual Work', Ethnologia Europaea, 41(1), pp. 53–63.

Electronics Tutorials (2021) 555 Timer Tutorial. Available at: http://www.electronics-tutorials.ws/waveforms/555_timer.html [Accessed May 12, 2021].

Elkan, W. (1988) 'Entrepreneurs and entrepreneurship in Africa', The World Bank Research Observer, 3(2), pp. 171–188.

Elyachar, J. (2012) 'Next Practices: Knowledge, infrastructure, and Public Goods at the Bottom of the Pyramid', Public Culture, 24(1), pp. 109–129.

England, K.V.L. (1994) 'Getting Personal: Reflexivity, Positionality, and Feminist Research', The Professional Geographer, 46(1), pp. 80–89.

Escobar, A. (2015) 'Commons im Pluriversum', in Helfrich, S., Bollier, D. and Heinrich-Böll-Stiftung (eds.) Die Welt der Commons: Muster gemeinsamen Handelns. Bielefeld: transcript, pp. 334–345.

Eshun, K. (2003) 'Further Considerations on Afrofuturism', The New Centennial Review, 3(2), pp. 287–302.

Esteva, G. (1992) 'Development', in Sachs, W. (ed.) The Development Dictionary: A Guide to Knowledge as Power. London: Zed Books, pp. 1–23.

Fanon, F. (1966) Die Verdammten dieser Erde. Frankfurt am Main: Suhrkamp. (Original work published 1961).

Faria, C. and Mollett, S. (2016) 'Critical Feminist Reflexivity and the Politics of Whiteness in the "Field"', Gender, Place & Culture, 23(1), pp. 79–93.

Farias, I. and Wilkie, A. (2015) 'Studio Studies: Notes for a Research Program', in Farias, I. and Wilkie, A. (eds.) Studio Studies: Operations, Topologies & Displacements. London: Routledge, pp. 1–21.

Fayomi, O.O., Adebayo, G. and Okorie, U. (2018) 'The Resilient Informal Economy in the Milieu of African Development', in Oloruntoba, S.O. and Falola, T. (eds.) The Palgrave Handbook of African Politics, Governance and Development. New York: Palgrave Macmillan, pp. 661–676.

Felt, U. and Fochler, M. (2012) What Science Stories Do: Rethinking the Multiple Consequences of Intensified Science Communication. Re-print published by the Department of Social Studies of Science, University of Vienna. Available at: https://sts.univie.ac.at/fileadmin/user_upload/i_sts/Ueber_uns/pdfs_Felt/Felt__Fochler_Stories.pdf [Accessed June 13, 2020].

Ferguson, J. (1999) Expectations of Modernity: Myths and Meanings of Urban Life on the Zambian Copperbelt. Berkeley, Los Angeles and London: University of California Press.

Fernández-Barrera, M., De Filippi, P., Gomes de Andrade, N.N. and Viola de Azevedo Cunha, M. (2009) 'Introduction: Looking into the future', in

Fernández-Barrera, M., Gomes de Andrade, N.N., De Filippi, P., Viola de Azevedo Cunha, M., Sartor, G. and Casanovas, P. (eds.) Law and Technology: Looking into the Future – Selected Essays. Pistoia: European Press Academic Publishing, pp. 11–30.

Fioramonti, L. (2018) 'Africa's Development Narratives: From Growth to Well-being', in Oloruntoba, S.O. and Falola, T. (eds.) The Palgrave Handbook of African Politics, Governance and Development. New York: Palgrave Macmillan, pp. 737–749.

Foster, W., Goodman, S., Osiakwan, E. and Bernstein, A. (2004) 'Global Diffusion of the Internet IV: The Internet in Ghana', Communications of the Association for Information Systems, 13(38), pp. 654–680.

Foucault, M. (1981) Archäologie des Wissens. Frankfurt am Main: Suhrkamp.

Foucault, M. (1991) Die Ordnung des Diskurses: Inauguralvorlesung am Collège de France, 2.Dezember 1970. Frankfurt am Main: Fischer Verlag.

Foucault, M. (1993) 'About the Beginning of the Hermeneutics of the Self: Two Lectures at Dartmouth', Political Theory, 21(2), pp. 198–227.

Frank, A.G. (1967) Capitalism and Underdevelopment in Latin America: Historical Studies of Chile and Brazil. New York and London: Monthly Review Press.

Freeman, C. (2014) Entrepreneurial Selves: Neoliberal Respectability and the Making of a Caribbean Middle Class. Durham and London: Duke University Press.

Fressoli, M., Dias, R. and Thomas, H. (2014) 'Innovation and Inclusive Development in the South: A Critical Perspective', in Medina, E., da Costa Marques, I. and Holmes, C. (eds.) Beyond Imported Magic – Essays on Science, Technology, and Society in Latin America. Cambridge and London: MIT Press, pp. 47–65.

Frey, C.B. and Osborne, M.A. (2013) The Future of Employment: How Susceptible are Jobs to Computerisation? Oxford: Working Paper published by the Oxford Martin Programme on Technology and Employment.

Friederici, N. (2016) 'Innovation Hubs in Africa: Assemblers of Technology Entrepreneurs'. PhD Thesis, Oxford Internet Institute, University of Oxford.

Friederici, N. (2019) 'Hope and Hype in Africa's Digital Economy: The Rise of Innovation Hubs', in Graham, M. (ed.) Digital Economies at Global Margins. Cambridge and London: MIT Press, pp. 193–221.

Funches, M. (2018) 19 September. Available at: http://www.instagram.com/p/Bn6n-QrlPGk [Accessed July 1, 2021].

Gabriel, Y. (2004) 'Narratives, Stories, Texts', in Grant, D., Hardy, C., Oswick, C. and Putnam, L.L. (eds.) The Sage Handbook of Organizational Discourse. London, Thousand Oaks and New Delhi: SAGE Publications, pp. 61–79.

Gachigi, K. (2017) Changing Gears for the Fourth Industrial Revolution. Available at: http://www.makingitmagazine.net/?p=10250 [Accessed February 14, 2019].

Garud, R., Schildt, H.A. and Lant, T.K. (2014) 'Entrepreneurial Storytelling, Future Expectations, and the Paradox of Legitimacy', Organization Science, 25(5), pp. 1479–1492.

Gathege, D. and Moraa, H. (2013) ICT Hubs Model: Understanding the Key Factors of the iHub Model, Nairobi Kenya. Available at: http://www.research.ihub.co.ke/uploads/2013/may/1367834943__374.pdf [Accessed February 23, 2017].

Gearbox (2016) Detailed Overview. Unpublished internal document.

Gearbox (2021) Insights. Available at: http://www.gearbox.co.ke/insights [Accessed July 6, 2021].

Gibson, C. (2016) 'Material Inheritances: How Place, Materiality, and Labor Process Underpin the Path-dependent Evolution of Contemporary Craft Production', Economic Geography, 92(1), pp. 61–86.

Gibson-Graham, J.K. (2002) 'Beyond Global vs. Local: Economic Politics Outside the Binary Frame', in Herod, A. and Wright, M. W. (eds.) Geographies of Power: Placing scale. Malden, Oxford, Melbourne and Berlin: Blackwell Publishers, pp. 25–60.

Gillies, D. (2011) 'Agile Bodies: A New Imperative in Neoliberal Governance', Journal of Education Policy, 26(2), pp. 207–223.

Giuliani, D. and Ajadi, S. (2019) 618 Active Tech Hubs: The Backbone of Africa's Tech Ecosystem. Available at: http://www.gsma.com/mobilefordevelopment/blog/618-active-tech-hubs-the-backbone-of-africas-tech-ecosystem [Accessed October 9, 2020].

Goldstein, J. and Rotich, J. (2008) Digitally Networked Technology in Kenya's 2007–2008 Post-election Crisis. Berkman Center Research Publication 9, pp. 1–10.

Good Things Foundation (2018) Digital Nation 2018. Available at: http://www.goodthingsfoundation.org/researchpublications/digital-nation-2018 [Accessed August 12, 2019].

Government of the Republic of Kenya (GRoK) (2007) Kenya Vision 2030 – A Globally Competitive and Prosperous Kenya. Available at: http://www.re

searchictafrica.net/countries/kenya/Kenya_Vision_2030_-_2007.pdf [Accessed October 21, 2019].

Government of the Republic of Kenya (GRoK) (2012) Sessional Paper No. 9 of 2012 on the National Industrialization Policy Framework for Kenya 2012–2030. Available at: https://repository.kippra.or.ke/handle/123456789/1037 [Accessed April 23, 2023].

Government of the Republic of Kenya (GRoK) (2018) Kenya Vision 2030 Third Medium Term Plan 2018–2022. Transforming Lives: Advancing Socio-economic Development Through the "Big Four". Available at: https://vision2030.go.ke/publication/third-medium-term-plan-2018-2022 [Accessed October 21, 2019].

Graham, M. (2011) 'Time Machines and Virtual Portals: The Spatialities of the Digital Divide', Progress in Development Studies, 11(3), pp. 211–227.

Graham, M. (2015) 'Contradictory Connectivity: Spatial Imaginaries and Technomediated Positionalities in Kenya's Outsourcing Sector', Environment and Planning A, 47, pp. 867–883.

Graham, M. (ed.) (2019) Digital Economies at Global Margins. Cambridge and London: MIT Press.

Graham, M. and Mann, L. (2013) 'Imagining a Silicon Savannah? Technological and Conceptual Connectivity in Kenya's BPO and Software Development Sectors', The Electronic Journal of Information Systems in Developing Countries, 56(2), pp. 1–19.

Graham, M., Andersen, C. and Mann, L. (2015) 'Geographical Imagination and Technological Connectivity in East Africa', Transactions of the Institute of British Geographers, 40(3), pp. 334–349.

Gramsci, A. (1991–2002): Gefängnishefte: Kritische Gesamtausgabe. Bochmann, K. and Haug, W.F. (eds.). Hamburg: Argument Verlag. (Original work published 1975 by Fondazione Istituto Gramsci).

Granovetter, M. (1990) Entrepreneurship, Development and the Emergence of Firms. Wissenschaftszentrum Berlin für Sozialforschung: Berlin: FS I 90–2.

Gregg, M. (2011) Work's Intimacy. Malden: Polity Press.

Grimme, S., Bardzell, J. and Bardzell, S. (2014) 'We've Conquered Dark: Shedding Light on Empowerment in Critical Making', Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational. ACM, pp. 431–440.

Guma, P.K. (2022) 'Nairobi's rise as a digital platform hub', Current History, 121(835), pp. 184–189.

Gymnich, M. (2002) 'Linguistics and Narratology: The Relevance of Linguistic Criteria to Postcolonial Narratology', in Gymnich, N., Nünning, A. and Nünning, V. (eds.) Literature and Linguistics: Approaches, Models, and Applications. Trier: Wissenschaftlicher Verlag, pp. 61–76.

Hain, D.S. and Jurowetzki, R. (2018) 'Local Competence Building and International Venture Capital in Low-Income Countries: Exploring Foreign High-Tech Investments in Kenya's Silicon Savanna', Journal of Small Business and Enterprise Development, 25(3), pp. 447–482.

Hall, S. (2018) 'The West and the Rest: Discourse and Power', in Gupta, T.D., James, C.E., Andersen, C., Galabuzi, G-E. and Maaka, R.C.A. (eds.) Race and Racialization: Essential Readings. Toronto: Canadian Scholars, pp. 85–93. (Original work published 1992).

Halverson, E.R. and Sheridan, K.M. (2014) 'The Maker Movement in Education', Harvard Educational Review, 84(4), pp. 495–504.

Haraway, D. (1988) 'Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective', Feminist Studies, 14(3), pp. 575–599.

Haraway, D. (1991) Simians, Cyborgs, and Women: The Reinvention of Nature. New York: Routledge.

Hartware MedienKunstVerein (2017) Afro-Tech and the Future of Re-Invention (Exhibition Booklet). Dortmund: n.p.

Hersman, E. (2013) 'Mobilizing Tech Entrepreneurs in Africa (Innovations Case Narrative: iHub)', Innovations: Technology, Governance, Globalization, 7(4), pp. 59–67.

Hielscher, S. (2017) 'Experimenting with Novel Socio-Technical Configurations: The Domestication of Digital Fabrication Technologies in FabLabs', Digital Culture and Society, 3(1), pp. 47–72.

Hope, C. (2017) Where did the Dependency Approach Go? Available at: https://roape.net/2017/02/09/dependency-approach-go-global-capitalism-african-economics [Accessed November 30, 2020].

Hruby, A. and Bright, J. (2015) The Rise Of Silicon Savannah And Africa's Tech Movement. Available at: https://techcrunch.com/2015/07/23/the-rise-of-silicon-savannah-and-africas-tech-movement [Accessed May 12, 2020].

iHub (2017) About Us. Available at: http://www.ihub.co.ke/about [Accessed January 20, 2017].

Ikiara, G.K., Olewe-Nyunya, J. and Odhiambo, W. (2004) 'Kenya: Formulation and Implementation of Strategic Trade and Industrial Policies', in Soludo, C.C., Ogbu, O. and Chang, H-J. (eds.) The Politics of Trade and Industrial

Policy in Africa: Forced Consensus? Trenton and Ottawa: Africa World Press and International Development Research Centre, pp. 205–225.

Instagram (2021) #africanengineering 04 June. Available at: http://www.instagram.com/explore/tags/africanengineering [Accessed June 4, 2021].

International Telecommunication Union (2019) Digital Inclusion. Available at: https://www.itu.int/en/ITU-D/Digital-Inclusion/Pages/Reports_and_Resources.aspx [Accessed August 12, 2019].

Irani, L. (2015) 'Hackathons and the Making of Entrepreneurial Citizenship', Science, Technology, & Human Values, 40(5), pp. 799–824.

Irani, L. (2019) The Politics of Trade and Industrial Policy in Africa: Forced Consensus? Princeton and Oxford: Princeton University Press.

Jack, M. and Avle, S. (2021) 'A Feminist Geopolitics of Technology', Global Perspectives, 2(1), 24398. Available at: doi.org/10.1525/gp.2021.24398 [Accessed November 4, 2021].

Jackson, T. (2017) What Does It Mean for Technology to be Innately African? Available at: http://disrupt-africa.com/2017/01/what-does-it-mean-for-technology-to-be-innately-african [Accessed June 13, 2020].

Jiménez, A. (2019) 'Inclusive Innovation From the Lenses of Situated Agency: Insights From Innovation Hubs in the UK and Zambia', Innovation and Development, 9, pp. 41–64.

Jones, C. and Spicer, A. (2005) 'Outline of a Genealogy of the Value of the Entrepreneur', in Erreygers, G. and Jacobs, G. (eds.) Language, Communication and the Economy. Amsterdam and Philadelphia: John Benjamins Publishing Company, pp. 179–197.

Juma, C. (2017) The Misplaced Promise of Africa's Mobile Revolution. Available at: https://thebreakthrough.org/index.php/journal/past-issues/issue-7/leapfrogging-progress [Accessed August 30, 2019].

Juma, C. (2019) 'Digital Services and Industrial Inclusion: Growing Africa's Technological Complexity', in Graham, M. (ed.) Digital Economies at Global Margins. Cambridge and London: MIT Press, pp. 33–37.

Junne, G. (2018) 'African Entrepreneurship: Constraints and Improvements', in Dana, L-P., Ratten, V. and Honyenuga, B.Q. (eds.) African Entrepreneurship: Challenges and Opportunities for Doing Business. E-book: Palgrave Macmillan, pp. 117–130.

Kanyinga, K. and Okello, D. (eds.) (2010) Tensions and Reversals in Democratic Transitions: The Kenya 2007 General Elections. Nairobi: Society for International Development and University of Nairobi.

Kappel, R. and Müller, M. (2007) 'Breites Wirtschaftswachstum in Afrika – die große Wende?', GIGA Focus Afrika 6. Available at: http://www.giga-hamburg.de/de/system/files/publications/gf_afrika_0706.pdf [Accessed June 5, 2019].

Karake, M. (2018a) Silicon, meet Savanna: A Love Story. Available at: https://medium.com/@mark_65941/silicon-meet-savanna-dc5e8fc90157 [Accessed June 13, 2020].

Karake, M. (2018b) The Digital Scramble for Africa. Available at: https://medium.com/impact-africa-network/the-digital-scramble-for-africa-31f3e4c33e99 [Accessed June 13, 2020].

Kenya Association of Manufacturers (KAM) (2018) Manufacturing Priority Agenda 2018 – Sparking Kenya's Industrial Transformation for Job Creation. Available at: http://www.tralac.org/documents/resources/by-country/kenya/1751-kam-manufacturing-priority-agenda-2018/file.html [Accessed October 21, 2019].

Kenya Association of Manufacturers (KAM) (2023) Kenya manufacturers aim to contribute 20% of country's GDP by 2030. Available at: https://kam.co.ke/kenya-manufacturers-aim-to-contribute-20-of-countrys-gdp-by-2030/ [Accessed March 21, 2023].

Kenya Industrial Research and Development Institute (KIRDI) (2006) Improving access to technology for enhanced industrial development of Kenya. Presentation to Ministry of Trade and Industry and Stakeholders, October 17, 2006. Available at: http://www.infodev.org/infodev-files/resource/idi/document/Access%20to%20technology%20for%20enhanced%20industrial%20development,%20case%20Kenya,%20KIRDI%20Board.pdf [Accessed October 21, 2019].

Kenya Industrial Research and Development Institute (KIRDI) and Kenya Vision 2030 (2019) Kenya Industrial Research and Development Institute: Strategic Plan 2016–2021. Available at: https://kirdi.go.ke/images/demo/documents/KIRDI%202016-2021%20%20DRAFT%20%20STRATEGIC%20PLAN.pdf [Accessed June 13, 2019]

Kenya Industrial Training Institute (KITI) (n.d.) About KITI. Available at: http://kiti.ac.ke/node/1 [Accessed October 21, 2019].

Kenyatta, J. (1971) Facing Mount Kenya: The Tribal Life of the Gikuyu. Nairobi: Heinemann Educational Books. (Original work published 1938 by Secker and Warburg).

Kepple (2018) Create New Industries. Available at: https://kepple-group.com/en [Accessed May 4, 2021].

Kepple Africa Ventures (2020) Kepple Africa Ventures. Available at: https://kepple-africa-ventures.com [Accessed May 4, 2021].

Kera, D. (2012) 'NanoSmano Lab in Ljubljana: Disruptive Prototypes and Experimental Governance of Nanotechnologies in the Hackerspaces', Journal of Science Communication, 11(4), pp. 1–5.

Khan, S. (n.d.) Contradictions of Africa Rising Narrative. Available at: https://www.au-watch.org/contradictions-of-africa-rising-narrative [Accessed June 10, 2021].

Kiggundu, M.N. (2002) 'Entrepreneurs and Entrepreneurship in Africa: What is Known and What Needs to be Done', Journal of Developmental Entrepreneurship, 7(3), pp. 239–258.

King, K. (1996a) Jua Kali Kenya: Change and development in an informal economy, 1970–1995. Nairobi: East African Educational Publishers.

King, K. (1996b) 'Microenterprise: Macroeconomic Environment: Revisiting Kenya's Informal (Jua Kali) Sector Against the Background of the Formal Globalising Economy', International Journal of Educational Development, 16(4), pp. 417–426.

Kish, Z. and Fairbairn, M. (2018) 'Investing for Profit, Investing for Impact: Moral Performances in Agricultural Investment Projects', Environment and Planning A, 50(3), pp. 569–588.

Kleine, D. und Unwin, T. (2009) 'Technological Revolution, Evolution and New Dependencies: What's New about ICT4D?', Third World Quarterly, 30(5), pp. 1045–1067.

Knott-Craig, A. (2015) What Boxes Africa's Unicorn Must Tick. Available at: https://disrupt-africa.com/2015/09/what-boxes-africas-unicorn-must-tick [Accessed June 13, 2020].

Köckritz, A. (2017) 'Bits and Bytes in Kenya', DIE ZEIT. 30 March, 2017, p. 8.

Kocksch, L., Korn, M., Poller, A. and Wagenknecht, S. (2018) 'Caring for IT Security: Accountabilities, Moralities, and Oscillations in IT Security Practices', Proceedings of the ACM on Human-Computer Interaction 2, Computer-Supported Cooperative Work and Social Computing, 92, pp. 1–20.

Kohtala, C., Boeva, Y., Holm, F. and Stassen, S. (2020) 'Makers and Design in South Africa: Technology and Craft Cultures and their Antecedents', Digital Culture & Society, 6(1), pp. 135–152.

Komaza (n.d.) Komaza. Available at: www.komaza.com [Accessed April 20, 2021].

Korf, B. and Rothfuß, E. (2016) 'Nach der Entwicklungsgeographie', in Freytag, T., Gebhardt, h., Gerhard, U. and Wastl-Walter, D. (eds.) Humangeographie Kompakt. Berlin and Heidelberg: Springer Verlag, pp. 163–183.

Kreye, A. and Rabe, J-C. (2018) "Black Panther" im Kino – Ein Mythos für die Zukunft der Menschheit. Available at: http://www.sueddeutsche.de/kultur/black-panther-im-kino-ein-mythos-fuer-die-zukunft-der-menschheit-1.3880277 [Accessed July 5, 2021].

Kroes, P., Franssen, F. and Bucciarelli, L. (2009) 'Rationality in Design', in Meijers, A. (ed.) Handbook of the Philosophy of Science Volume 9: Philosophy of Technology and Engineering Sciences. Burlington and Oxford: Elsevier BV, pp. 565–600.

Kusimba, S. (2018) '"It is Easy for Women to Ask!": Gender and Digital Finance in Kenya', Economic Anthropology, 5, pp. 247–260.

Kwet, M. (2019) 'Digital Colonialism: US Empire and the New Imperialism in the Global South', Race & Class, 60(4), pp. 3–26.

Laketa, S. (2018) 'Between "This" Side and "That" Side: On Performativity, Youth Identities and "Sticky" Spaces', Environment and Planning D, 36(1), pp. 178–196.

Laliberté, N. and Schurr, C. (2016) 'The Stickiness of Emotions in the Field: Complicating Feminist Methodologies', Gender, Place and Culture, 23(1), pp. 72–78.

Lall, S. and Wangwea, S. (1997) 'Industrial Policy and Industrialisation in Sub-Saharan Africa', Journal of African Economies, 7(1), pp. 70–107.

Latour, B. (2005) Reassembling the Social. Oxford: Oxford University Press.

Latour, B. (2009) 'Ein vorsichtiger Prometheus? Einige Schritte hin zu einer Philosophie des Designs, unter besonderer Berücksichtigung von Peter Sloterdijk', in van Tuinen, S., Hemelsoet, K. and Jongen, M. (eds.) Die Vermessung des Ungeheuren – Philosophie nach Peter Sloterdijk. Paderborn: Wilhelm Fink Verlag, pp. 357–374.

Law, J. (1994) Organizing Modernity. Oxford and Cambridge: Blackwell Publishers.

Law, J. (2006) Making a Mess with Method. Draft version of 19th January 2006. Available at: http://heterogeneities.net/publications/Law2006MakingaMesswithMethod.pdf [Accessed June 24, 2020].

Lemke, T. (2000) 'Neoliberalismus, Staat und Selbsttechnologien. Ein kritischer Überblick über die governmentality studies', Politische Vierteljahresschrift, 41(1), pp. 31–47.

Lindtner, S. (2013) 'Making Subjectivities: How China's DIY Makers Remake Industrial Production, Innovation & the Self', Eleventh Chinese Internet Research Conference (CIRC11), University of Oxford. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2282420 [Accessed January 19, 2018].

Lindtner, S., Hertz, G. and Dourish, P. (2014) 'Emerging Sites of HCI Innovation: Hackerspaces, Hardware Startups & Incubators', Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 439–448.

Linton, I. (2017) The Advantages of Rapid Prototyping. Available at: https://bizfluent.com/list-6902725-advantages-rapid-prototyping.html [Accessed May 4, 2019].

Lippert, I. (2014) 'Studying Reconfigurations of Discourse: Tracing the Stability and Materiality of ›Sustainability/Carbon‹', Zeitschrift für Diskursforschung, 1, pp. 32–54.

Longhurst, R. (2016) 'Semi-structured Interviews and Focus Groups', in Clifford, N., Cope, M., Gillespie, T. and French, S. (eds.) Key Methods in Geography (third edition). Los Angeles, London, New Delhi, Singapore, Washington DC and Melbourne: SAGE Publications, pp. 143–156.

Longhurst, R., Ho, E. and Johnston, L. (2008) 'Using 'the Body' as an 'Instrument of Research': Kimch'i and Pavlova', Area, 40(2), pp. 208–217.

Lorey, I. (2006) Governmentality and Self-precarization: On the Normalization of Cultural Producers, in Raunig, G. and Ray, G. (eds.) Art and Contemporary Critical Practice: Reinventing Institutional Critique. London: Mayfly, pp. 187–202.

Lorey, I. (2019) 'Emanzipation und Schulden', in Lettow S., Maihofer, A. and Demirović, A. (eds.) Emanzipation: Zur Geschichte und Aktualität eines politischen Begriffs. Münster: Westfälisches Dampfboot, pp. 10–15.

Lummis, D.C. (1992) 'Equality', in Sachs, W. (ed.) The Development Dictionary: A Guide to Knowledge as Power. London: Zed Books, pp. 38–54.

Maas, G., Jones, P. and Lockyer, J. (2019) 'The Journey to Transformational Entrepreneurship', in Maas, G. and Jones, P. (eds.) Transformational Entrepreneurship Practices – Global Case Studies. E-book: Palgrave Macmillan, pp. 1–14.

Macharia, J. and Mutuku, L. (2014) Financing Technology Businesses in Kenya. Available at: http://www.ihub.co.ke/ihubresearch/jb_FinancingTechnologyBusinesspdf2014-2-7-09-49-09.pdf [Accessed May 12, 2020].

Macharia, K. (2016) Facebook's Zuckerberg in Kenya, To Meet Tech Entrepreneurs. Available at: http://www.capitalfm.co.ke/business/2016/09/facebooks-zuckerberg-kenya-meet-tech-entrepreneurs [Accessed March 17, 2021].

Madichie, N.O., Taura, N.D. and Bolat, E. (2019) 'What Next for Digital Entrepreneurship in Sub-Saharan Africa?', in Taura, N.D., Bolat, E. and Madichie, N.O. (eds.) Digital Entrepreneurship in Sub-Saharan Africa – Challenges, Opportunities and Prospects. E-book: Palgrave Macmillan, pp. 221–240.

Maker Faire Africa (2012) Our Maker Manifesto. Available at: http://makerfaireafrica.com/2012/10/20/our-maker-manifesto [Accessed November 30, 2020].

Manske, J. (2014) Innovations out of Africa. The Emergence, Challenges and Potential of the Kenyan Tech Ecosystem. Vodafone Institute for Society and Communications. Available at: https://www.vodafone-institut.de/wp-content/uploads/2015/09/VFI_InnovationsAfrica_EN.pdf [Accessed July 16, 2021].

Marchant, E. (2014) The Geography of Technology Creation: An Ethnographic Look at Two Technology Communities. Conference presentation at the Annenberg School for Communication on April 4, 2014.

Marchant, E. (2015) Who is ICT Innovation For? Challenges to Existing Theories of Innovation, a Kenyan Case Study. CGCS Occasional Paper Series on ICTs, Statebuilding, and Peacebuilding in Africa, Number 4. Available at: https://ora.ox.ac.uk/objects/uuid:413e3b42-bbe5-4234-9988-6192b24cb837/download_file?file_format=application%2Fpdf&safe_filename=Marchant_Who-is-ICT-Innovation-for.pdf&type_of_work=Report [Accessed October 24, 2019].

Marchant, E. (2018) 'Anyone Anywhere: Narrating African Innovation in a Global Community of Practice', PhD thesis, University of Pennsylvania, USA. Available at: https://repository.upenn.edu/edissertations/2746 [Accessed June 12, 2020].

Marris, P. and Somerset, A. (1971) African Businessman: A Study of Entrepreneurship and Development in Kenya. London: Routledge and Kegan Paul.

Marshall, D.J. (2014) 'Love Stories of the Occupation: Storytelling and the Counter-geopolitics of Intimacy', Area, 46(4), pp. 349–351.

Martin, L. (2015) 'The Promise of the Maker Movement for Education', Journal of Pre-College Engineering Education Research, 5(1), pp. 30–39.

Marwick, A. (2013) Silicon Valley Isn't a Meritocracy. And It's Dangerous to Hero-Worship Entrepreneurs. Excerpted by Sonal Chokshi. Available at: http://www.wired.com/2013/11/silicon-valley-isnt-a-meritocracy-and-the-cult-of-the-entrepreneur-holds-people-back [Accessed July 8, 2021].

Marx, K. (2011) Capital Volume One: A Critique of Political Economy. Mineola: Dover Publications. (Original published 1867 by Otto Meissner Verlag).

Mashigo, M. (2018) Afrofuturism: Ayashis' Amateki. Available at: https://johannesburgreviewofbooks.com/2018/10/01/afrofuturism-is-not-for-africans-living-in-africa-an-essay-by-mohale-mashigo-excerpted-from-her-new-collection-of-short-stories-intruders [Accessed July 2, 2021].

Mauksch, S. (2017) 'Managing the Dance of Enchantment: An Ethnography of Social Entrepreneurship Events', Organization, 24(2), pp. 133–153.

Mavhunga, C.C. (2017) 'Introduction: What Do Science, Technology, and Innovation Mean from Africa?, in Mavhunga, C.C. (ed.) What Do Science, Technology, and Innovation Mean from Africa? Cambridge and London: MIT Press, pp. 1–27.

Maxigas (2012) 'Hacklabs and Hackerspaces: Tracing Two Genealogies', Journal of Peer Production 2. Available at: http://peerproduction.net/issues/issue-2/peer-reviewed-papers/hacklabs-and-hackerspaces [Accessed January 31, 2018].

Maxigas (2014) Hacklabs and Hackerspaces: Shared Machine Workshops. Available at: http://www.researchgate.net/publication/265378243_Hacklabs_and_Hackerspaces_Shared_machine_workshops [Accessed July 12, 2017].

Mbembe, A. (2001) On the Postcolony. Berkeley, Los Angeles and London: University of California Press.

McCarrick, H. and Kleine, D. (2019) 'Digital Inclusion, Female Entrepreneurship, and the Production of Neoliberal Subjects – Views from Chile and Tanzania', in Graham, M. (ed.) Digital Economies at Global Margins. Cambridge, London, Ottawa, Amman, Montevideo, Nairobi and New Delhi: MIT Press and International Development Research Centre, pp. 103–127.

McDowell, L. (2009) Working Bodies: Interactive Service Employment and Workplace Identities. Wiley-Blackwell: Chichester.

McGregor, A. and Hill, D. (2009) 'North-South', in Kitchen, R. and Thrift, N. (eds.) International Encyclopedia of Human Geography. Oxford: Elsevier, pp. 473–480.

McMorran, C. (2011) 'Work It Out: Using Work as Participant Observation to Study Tourism', in Hall, C.M. (ed.) Fieldwork in Tourism – Methods, issues and reflections. Oxon and New York: Routledge, pp. 220–231.

McMorran, C. (2012) 'Practising Workplace Geographies: Embodied Labour as Method in Human Geography', Area, 44(4), pp. 489–495.

McNamara, J. (2017) 'Digital Media, Development and Political Creativity – Between Utopia and Digital Disruption in Urban Nairobi', Critical African Studies, 9(3), pp. 268–280.

McNeil, M. (2005) 'Introduction: Postcolonial Technoscience', Science as Culture, 14(2), pp. 105–112.

McQuillan, M. (2000) 'Introduction: Aporias of Writing: Narrative and Subjectivity', in McQuillan, M. (ed.) The Narrative Reader. Oxon and New York: Routledge, pp. 1–33.

Medina, E., da Costa Marques, I. and Holmes, C. (2014) 'Introduction: Beyond Imported Magic Beyond Imported Magic', in Medina, E., da Costa Marques, I. and Holmes, C. (eds.) Essays on Science, Technology, and Society in Latin America. Cambridge and London: MIT Press, pp. 1–23.

Melber, H. (2001) Der Weissheit letzter Schluss: Rassismus und kolonialer Blick. Frankfurt: Brandes & Apsel.

Mellis, D.A. (2011) 'Case Studies in the Digital Fabrication of Open-Source Consumer Electronic Products', Master's Thesis, Media Arts and Sciences School of Architecture and Planning, Massachusetts Institute of Technology. Available at: https://alumni.media.mit.edu/~mellis/mellis-thesis-screen.pdf [Accessed May 20, 2019].

Mer, S. (2003) 'The Structural Engineer in the Design Office: A World, Its Objects, and Its Work Practices', in Vinck, D. (ed.) Everyday Engineering – An Ethnography of Design and Innovation. New Baskerville: MIT Press, pp. 79–91.

M-Farm (2020) Homepage. Available at: https://mfarm.co.ke [Accessed June 13, 2020].

Microsoft (2019) Furthering our Investment in Africa: Microsoft Opens First Africa Development Centre in Kenya and Nigeria. Available at: https://news.microsoft.com/en-xm/features/furthering-our-investment-in-africa-microsoft-opens-first-africa-development-centre-in-kenya-and-nigeria [Accessed February 8, 2021].

Militz, E. (2017) 'Affective Nationalism: Bodies, Materials and Encounters with the Nation in Azerbaijan', PhD Thesis, University of Zurich. Available at:

http://www.zora.uzh.ch/id/eprint/148790/1/2017_Militz_20173117.pdf [Accessed June 19, 2020].

Miller, P. and Rose, N. (2008) Governing the Present: Administering Economic, Social and Personal Life. Cambridge and Malden: Polity Press.

Ministry of Industrialization and Enterprise Development (MIED) (2015) Kenya's Industrial Transformation Programme. Available at: https://industrialization.go.ke/index.php/downloads/282-kenya-s-industrial-transformation-programme [Accessed October 21, 2019].

Ministry of Industry, Trade and Cooperatives (MITC) (2018) Draft of the Environmental and Social Management Framework (ESMF) for Kenya Industry and Entrepreneurship Project (P161317). Available at: http://www.industrialization.go.ke/images/downloads/ESMF-KIEP_DRAFT-050318-WEBSITE.pdf [Accessed October 21, 2019].

Ministry of Industry, Trade and Cooperatives (MITC) and the World Bank Group (n.d.) The Kenya Industry & Entrepreneurship Project. Available at: http://www.industrialization.go.ke/index.php/kenya-industry-and-entrepreneurship-project-kiep/491-background-kenya-industry-and-entrepreneurship-project-kiep [Accessed October 21, 2019].

Mkandawire, T. (1988) 'The Road to Crisis, Adjustment and De-Industrialisation: The African Case', Africa Development/Afrique et Développement, 13(1), pp. 5–31.

Mkandawire, T. (2014) 'The Spread of Economic Doctrines and Policymaking in Postcolonial Africa', African Studies Review, 57(1), pp. 171–198.

Mobius Motors (2019) Designed for Africa. Built in Africa. Available at: https://mobiusmotors.com/# [Accessed June 13, 2020].

Mol, A., Moser, I. and Pols, J. (2010) Care in Practice. On Tinkering in Clinics, Homes and Farms. Bielefeld: Transcript.

Mozorov, E. (2013) The Perils of Perfection. Available at: http://www.nytimes.com/2013/03/03/opinion/sunday/theperils-of-perfection.html [Accessed January 4, 2017].

Müller-Mahn, D. (2020) 'Envisioning African Futures: Development Corridors as Dreamscapes of Modernity', Geoforum, 115, pp. 156–159.

Mungai, C. (2015) What's Holding Back Africa's Tech Startups? Available at: http://www.weforum.org/agenda/2015/09/whats-holding-back-africas-tech-startups [Accessed July 6, 2017].

Mushakavanhu, T. (2017) African Manufacturing its own Hardware: BRCK Internet in a Box. Available at: http://africanarguments.org/2017/01/06/af

rican-manufacturing-its-own-hardware-brck-internet-in-a-box-haller-prize-3rd-place [Accessed April 25, 2020].

Okari, A. (2015) Co-working space in Nairobi's most famous tech hub. Available at: www.flickr.com/photos/ihub/albums/with/72157630527449606 [Accessed November 18, 2015].

Mutu, W. (2013) The End of Eating Everything. Exhibited Dortmund: Hartware MedienKunstVerein (HMKV) (viewed 20 April, 2018). Animated video (color, sound), 8:00 minutes.

Mutu, W. (2015) Interview: On the End of Eating Everything. Available at: http://www.youtube.com/watch?v=yvGcO73MM-I [Accessed July 5, 2021].

Mutua, W. and Alliy, M. (2012) Innovative Africa: The New Face of Africa. Nairobi: Afrinnovator.com.

Mwago, S. (2021) Google Unveils a 10 Million Dollar Grant to Support Kenya's Post Covid-19 Recovery. Available at: http://www.invest.go.ke/google-unveils-10-million-dollar-grant-support-kenyas-post-covid-19-recovery [Accessed February 14, 2023].

Mwangi, A. (2023) How Manufacturing can Contribute 20% to the GDP by 2030. Available at: https://kam.co.ke/how-manufacturing-can-contribute-20-to-the-gdp-by-2030 [Accessed March 21, 2023].

Myers, N. (2008) 'Molecular Embodiments and the Body-work of Modeling in Protein Crystallography', Social Studies of Science, 38(2), pp. 163–199.

Nafukho, F.M. and Muyia, M.A.H. (2010) 'Entrepreneurship and Socioeconomic Development in Africa: A Reality or Myth?', Journal of European Industrial Training, 34(2), pp. 96–109.

Narla, A. (2013) 'Technology in Africa: Set to Change the World', Digital Development Debates 12. Available at: http://www.digital-development-debates.org/issue-12-power--mediatization--technology-in-africa-set-to-change-the-world.html [Accessed September 2, 2019].

Nascimento, S. (2014) 'Critical Notions of Technology and the Promises of Empowerment in Shared Machine Shops', Journal of Peer Production, 5, pp. 1–4.

Naylor, S. (2008) 'Historical Geography: Geographies and Historiographies', Progress in Human Geography, 32(2), pp. 265–274.

Ndemo, B. and Weiss, T. (eds.) (2017) Digital Kenya – An Entrepreneurial Revolution in the Making. Basingstoke: Palgrave.

Ndemo, E.B. (2015) 'Political Entrepreneurialism: Reflections of a Civil Servant on the Role of Political Institutions in Technology Innovation and Diffusion

in Kenya', Stability: International Journal of Security & Development, 4(1), Article 15, pp. 1–14.
Ndlovu-Gatsheni, S.J. (2014) 'Global Coloniality and the Challenges of Creating African Futures', Strategic Review for Southern Africa, 36(2), pp. 181–202.
Nduka-Agwu, A. and Bendix, D. (2008) 'Die weiße Darstellung „Afrikas" in der deutschen Öffentlichkeit. Wie ein Kontinent genormt, verformt und verdunkelt wird', HUch! Sonderausgabe Rassismus, Winter 08/09, pp. 18–19.
Nichols, G. (2015) A Rapid Prototyping Primer: From Batman's Belt to a Hardware Revolution. Available at: http://www.zdnet.com/article/a-rapid-prototyping-primer-from-batmans-belt-to-a-hardware-revolution [Accessed July 15, 2021].
Nitsche, L. (2019) Finding Digital Solutions to Local Problems, Kenya's Innovation Scene is No One-Hit Wonder. Deutsche Welle. Available at: https://p.dw.com/p/3BhtL [Accessed February 18, 2021].
Njugunah, M. (2016) Kenyan Start-Ups Struggle to get 'Reasonable' Investors. Available at: http://www.capitalfm.co.ke/business/2016/03/kenyan-start-ups-struggle-to-get-reasonable-investors [Accessed July 5, 2017].
Noble, D.F. (1984) Forces of Production: A Social History of Industrial Automation. New York: Knopf.
Nothias, T. (2014) '"Rising", "Hopeful", "New": Visualizing Africa in the Age of Globalization', Visual Communication, 13(3), pp. 323–339.
Obeng-Odoom, F. (2015) 'Africa: On the Rise, But to Where?', Forum for Social Economics, 44(3), pp. 234–250.
Ochonu, M.E. (2020) African Entrepreneurship: The Fetish of Personal Responsibility. Available at: http://roape.net/2020/05/26/african-entrepreneurship-the-fetish-of-personal-responsibility [Accessed 26 October 2020].
Okorafor, N. (2014) Lagoon. London: Hodder & Stoughton.
Okorafor, N. (2020) 'Africanfuturism Defined', in Talabi, W. (ed.) Africanfuturism: An Anthology. E-book: Brittle Paper: n.p.
Omole, B. (2019) Start-up Blazes Kenya's Path To Fourth Industrial Revolution. Available at: http://www.gearbox.co.ke/stories/2019/6/26/start-up-blazes-kenyas-path-to-fourth-industrial-revolution?fbclid=IwAR0JBDvgfJu8y2GzRU1iVWNi98ByO3gltdnLgF7wbJi-skOwYX7WCwFLA78 [Accessed September 2, 2019].
Ondeng, P. (2015) Yes, Kenya is on the Move to Prosperity. Available at: http://www.nation.co.ke/oped/opinion/Yes-Kenya-is-on-the-move-to-prosperity/440808-2814714-15fvuhiz/index.html [Accessed May 12, 2020].

Otieno, D. (2019) What Needs to Change with M-Pesa in 2020. Available at: https://tech-ish.com/2019/12/28/mpesa-2020 [Accessed May 12, 2020].

Ouma, S. (2012) '"Markets in the Making": Zur Ethnographie alltäglicher Marktkonstruktionen in organisationalen Settings', Geographica Helvetica, 67(4), pp. 203–211.

Ouma, S. (2016) Capitalism in Africa – A Critique of Critical Political Economy. Available at: https://roape.net/2016/10/19/capitalism-africa-critique-radical-political-economy [Accessed October 26, 2020].

Ouma, S. (2020) 'Africapitalism' and the Limits of any Variant of Capitalism. Available at: http://roape.net/2020/07/16/africapitalism-and-the-limits-of-any-variant-of-capitalism [Accessed October 26, 2020].

Ouma, S., Stenmanns, J. and Verne, J. (2019) 'African Economies: Simply Connect? Problematizing the Discourse on Connectivity in Logistics and Communication', in Graham, M. (ed.) Digital Economies at Global Margins. Cambridge: MIT Press, pp. 341–363.

Parke, P. (2016) More Africans Have Access to Cell Phone Service than Piped Water. Available at: https://edition.cnn.com/2016/01/19/africa/africa-afrobarometer-infrastructure-report/index.html [Accessed May 12, 2020].

Pearson, B.A.J. and Avle, S. (2016) Chasing the "Bottom Billion": Tech Companies and the Selling of Global Connectivity. Available at: http://www.researchgate.net/profile/Seyram_Avle/publication/315377681_Chasing_the_Bottom_Billion_Tech_companies_and_the_selling_of_global_connectivity/links/58cd89f34585157b6dae6743/Chasing-the-Bottom-Billion-Tech-companies-and-the-selling-of-global-connectivity.pdf [Accessed June 12, 2020].

Pedwell, C. and Whitehead, A. (2012) 'Affecting Feminism: Questions of Feeling in Feminist Theory', Feminist Theory, 13(2), pp. 115–129.

Pelz, D. (2019) Deutscher Afrika-Preis 2019 an Juliana Rotich verliehen. Available at: http://www.dw.com/de/deutscher-afrika-preis-2019-an-juliana-rotich-verliehen/a-50956507 [Accessed May 10, 2020].

Peppler, K., Halverson, E. and Kafai, Y.B. (eds.) (2016) Makeology: Makerspaces as Learning Environments (Volume 1). New York and Oxon: Routledge.

Pfeiffer, S. (2017) 'The Vision of "Industrie 4.0" in the Making – A Case of Future Told, Tamed, and Traded', Nanoethics, 11, pp. 107–121.

Philip, K. (2016) 'Telling Histories of the Future: The Imaginaries of Indian Technoscience', Identities, 23(3), pp. 276–293.

Philip, K., Irani, L. and Dourish, P. (2012) 'Postcolonial Computing: A Tactical Survey', Science, Technology, & Human Values, 37(1), pp. 3–29.

Pickering, A. (1995) The Mangle of Practice: Time, Agency, and Science. Chicago and London: The University of Chicago Press.

Pike, A. (2009) 'Geographies of Brands and Branding', Progress in Human Geography, 33(5), pp. 619–645.

Pile, S. (2010) 'Emotions and Affect in Recent Human Geography', Transactions of the Institute of British Geographers, 35(1), pp. 5–20.

Pinel, C., Prainsack, B. and McKevitt, C. (2020) 'Caring for Data: Value Creation in a Data-intensive Research Laboratory', Social Studies of Science, 50(2), pp. 175–197.

Poggiali, L. (2016) 'Seeing (from) Digital Peripheries: Technology and Transparency in Kenya's Silicon Savannah', Cultural Anthropology, 31(3), pp. 387–411.

Pollio, A. (2020) 'Making the Silicon Cape of Africa: Tales, Theories and the Narration of Startup Urbanism', Urban Studies, 57(13), pp. 2715–2732.

Prahalad, C.K. (2006) The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits. Upper Saddle River: Wharton School Publishing.

Pratt, G. (2009) 'Circulating Sadness: Witnessing Filipina Mothers' Stories of Family Separation', Gender, Place & Culture, 16(1), pp. 3–22.

Precarias a la deriva (2014) "Was ist dein Streik?" – Militante Streifzüge durch die Kreisläufe der Prekarität. Wien: transversal texts.

Price, L. and Hawkins, H. (eds.) (2018) Geographies of Making, Craft and Creativity. London: Routledge.

Price, P.L. (2010) 'Cultural Geography and the Stories We Tell Ourselves', Cultural Geographies, 17(2), pp. 203–210.

PricewaterhouseCoopers LLP (2009) From Champion for Digital Inclusion: The Economic Case for Digital Inclusion. Available at: http://parliamentandinternet.org.uk/wp-content/uploads/Final_report.pdf [Accessed August 12, 2019].

PSCU (2021) Google Unveils A 10 Million Dollar Grant To Support Kenya's Post Covid-19 Recovery. Available at: http://www.president.go.ke/2021/01/28/google-unveils-a-10-million-dollar-grant-to-support-kenyas-post-covid-19-recovery [Accessed February 8, 2021].

Puig de la Bellacasa, M. (2011) 'Matters of Care in Technoscience: Assembling Neglected Things', Social Studies of Science, 41(1), pp. 85–106.

Puig de la Bellacasa, M. (2012) '"Nothing Comes Without its World": Thinking with Care', The Sociological Review, 60(2), pp. 197–216.

Pye, D. (2010) 'The Nature and Art of Workmanship', in Adamson, G. (ed.) The Craft Reader. Oxford and New York: Berg Publishers, pp. 341–353. (Original work published 1968 by Cambridge University Press).

Radelet, S. (2010) 'Success Stories from "Emerging Africa"', Journal of Democracy, 21(4), pp. 87–101.

Radjou, N. and Prabhu, J. (2015) Frugal Innovation: How to do Better with Less. Gurgaon and London: Hachette India and The Economist.

Radjou, N., Prabhu, J. and Ahuja, S. (2012) Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough Growth. San Francisco: Jossey-Bass.

Rahnema, M. and Bawtree, V. (1997) The Post-Development Reader. London: Zed Books.

Rajão, R., Duque, R.B. and De', R. (2014) 'Introduction: Voices from Within and Outside the South – Defying STS Epistemologies, Boundaries, and Theories', Science, Technology, & Human Values, 39(6), pp. 767–772.

Ramos, E.G. (2017) Kenya Industry and Entrepreneurship (P161317): Project Information Document/Integrated Safeguards Data Sheet. Washington DC: the World Bank Group Available at: http://documents.worldbank.org/curated/en/938311504009462057/Concept-Integrated-Safeguards-Data-Sheet-Integrated-Safeguards-Document-Kenya-Industry-and-Entrepreneurship-P161317 [Accessed October 21, 2019].

Ratto, M. (2011) 'Critical Making: Conceptual and Material Studies in Technology and Social Life', The Information Society, 27, pp. 252–260.

Robinson, C.J. (2021) Black Marxism: The Making of the Black Radical Tradition. Chapel Hill: University of North Carolina Press. (Original work published 1983).

Rosati, C. (2007) 'Media Geographies: Uncovering the Spatial Politics of Images', Geography Compass, 1(5), pp. 995–1014.

Rose, G. (1997) 'Situating Knowledges: Positionality, Reflexivities and Other Tactics', Progress in Human Geography, 21(3), pp. 305–320.

Rostow, W.W. (1990) The Stages of Economic Growth: A Non-Communist Manifesto. Cambridge, New York and Melbourne: Cambridge University Press: (Original work published 1960).

Rudnyckyj, D. and Schwittay, A. (2014) 'Afterlives of Development', PoLAR: Political and Legal Anthropology Review, 37(1), pp. 3–9.

Ruto, W.S. (2017) 05 April. Available at: https://twitter.com/WilliamsRuto/status/849565695046299654 [Accessed November 27, 2020].

Ryan, M-L. (2007) 'Toward a Definition of Narrative', in Herman, D. (ed.) The Cambridge Companion to Narrative. Cambridge: Cambridge University Press, pp. 22–35.

Rybak, A. (2019) Hier liegt das Zentrum von Afrikas boomender Techszene. Available at: http://www.capital.de/wirtschaft-politik/afrikas-techszene [Accessed May 10, 2020].

Said, E.W. (1979) Orientalism. New York: Vintage Books. [Original work published 1978].

Sanderson, O.M. (2015) On Hubs, BRCKs, and Boxes: The Emergence of Kenya's Innovation and Technology Ecosystem. The Fletcher School of Law and Diplomacy. Available at: https://dl.tufts.edu/pdfviewer/9z903b011/fn1079440 [Accessed July 17, 2021].

Saxenian, A.L. (1996) Regional Advantage: Culture and Competition in Silicon Valley and Route 128. Cambridge and London: Harvard University Press.

Schiølin, K. (2019) 'Revolutionary Dreams: Future Essentialism and the Sociotechnical Imaginary of the Fourth Industrial Revolution in Denmark', Social Studies of Science, 50(4), pp. 1–25.

Schmitz, S. and Ahmed, S. (2014) 'Affect/Emotion: Orientation Matters: A Conversation between Sigrid Schmitz and Sara Ahmed', Freiburger Zeitschrift für GeschlechterStudien, 20(2), pp. 97-108.

Schoonhoven, C.B. and Romanelli, E. (2001) The Entrepreneurship Dynamic: Origins of Entrepreneurship and the Evolution of Industries. Stanford: Stanford University Press.

Schubert, C. (2018) 'Frankreich setzt auf einen Aufschwung in Afrika', Frankfurter Allgemeine Zeitung. 8 May, 2018 (106), p. 18.

Schurr, C. and Strüver, A. (2016) '"The Rest": Geographien des Alltäglichen zwischen Affekt, Emotion und Repräsentation', Geographica Helvetica, 71, pp. 87–97.

Schurr, C. and Verne, J. (2017) 'Wissenschaft und Technologie im Zentrum der Geographischen Entwicklungsforschung', Geographische Zeitschrift, 105(2), pp. 125–144.

Schwab, K. (2016) The Fourth Industrial Revolution: What it Means, How to Respond. Available at: http://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond [Accessed November 25, 2020].

Schwittay, A. (2011) 'The Marketization of Poverty', Current Anthropology, 52(3), pp. 71–82.

Schwittay, A. (2014) 'Designing Development: Humanitarian Design in the Financial Inclusion Assemblage', Political and Legal Anthropology Review, 37(1), pp. 29–47.

Schwittay, A. and Braund, P. (2017) 'Iterate, Experiment, Prototype', in Collier, S.J., Cross, J., Redfield, P. and Street, A. (eds.) Limn 9: Little Development Devices / Humanitarian Goods. Available at: https://limn.it/articles/iterate-experiment-prototype [Accessed April 11, 2020].

Science Buddies (2021) How to Use a Breadboard. Available at: http://www.sciencebuddies.org/science-fair-projects/references/how-to-use-a-breadboard [Accessed May 13, 2021].

Scott, J.C. (1989) 'Everyday Forms of Resistance', The Copenhagen Journal of Asian Studies, 4, pp. 33–62.

Scott-Smith, T. (2016) 'Humanitarian Neophilia: The 'Innovation Turn' and its Implications', Third World Quarterly, 37(12), pp. 2229–2251.

Sennett, R. (2008) The Craftsman. New Haven and London: Yale University Press.

Shapshak, T. (2015) Why Kenyan Tech Entrepreneurs Deserve All Obama's Praise. Available at: http://www.forbes.com/sites/tobyshapshak/2015/07/29/why-kenyan-tech-entrepreneurs-deserve-all-obamas-praise [Accessed August 30, 2019].

Shapshak, T. (2017) How Kenya's SupaBRCK Aims To Solve Africa's Internet Problems. Available at: http://www.forbes.com/sites/tobyshapshak/2017/03/07/how-kenyas-supabrck-aims-to-solve-africas-internet-problems/2/#1a7ad1221270 [Accessed April 25, 2020].

Sheppard, E. (2002) 'The Spaces and Times of Globalization: Place, Scale, Networks, and Positionality', Economic Geography, 78(3), pp. 307–330.

Simakova, E. (2013) Marketing Technologies: Corporate Cultures and Technological Change. Oxon and New York: Routledge.

Sivek, S.C. (2011) '"We Need a Showing of All Hands": Technological Utopianism in MAKE Magazine', Journal of Communication Inquiry, 35(3), pp. 187–209.

Slaby, J. (2018) 'Drei Haltungen der Affect Studies', in Pfaller, L. and Wiesse, B. (eds.) Stimmungen und Atmosphären: Zur Affektivität des Sozialen. Wiesbaden: Springer VS, pp. 53–81.

Slater, D. (2014) 'Modernity under Construction: Building the Internet in Trinidad', in Misa, T.J., Brey, P. and Feenberg, A. (eds.) Modernity and Technology. Cambridge and London: MIT Press, pp. 139–160.

Smith, A., Hielscher, S., Dickel, S., Söderberg, J. and van Ooost, E. (2013) Grassroots Digital Fabrication and Makerspaces: Reconfiguring, Relocating and

Recalibrating Innovation? University of Sussex: Science and Technology Policy Research, Working Paper Series SWSP 2013–02.

Smith, J.H. (2022) The Eyes of the World: Mining the Digital Age in the Eastern DR Congo. Chicago and London: University of Chicago Press.

Sommer, R. (2007) 'Contextualism Revisited: A Survey (and Defence) of Postcolonial and Intercultural Narratologies', Journal of Literary Theory, 1(1), pp. 61–79.

Sørensen, B.M. (2008) '"Behold, I am Making All Things New": The Entrepreneur as Savior in the Age of Creativity', Scandinavian Journal of Management, 24, pp. 85–93.

Speich, D. (2009) 'The Kenyan Style of "African Socialism": Developmental Knowledge Claims and the Explanatory Limits of the Cold War', Diplomatic History, 33(3), pp. 449–466.

Squire, C., Andrews, M. and Tamboukou, M. (2013) 'Introduction: What is Narrative Research?', in Andrews, M., Squire, C. and Tamboukou, M. (eds.) Doing Narrative Research (second edition). London, Thousand Oaks, New Delhi, Singapore, Washington DC: SAGE Publications, pp. 1–26.

Staeheli, L.A. and Lawson, V.A. (1995) 'Feminism, Praxis, and Human Geography', Geographical Analysis, 27(4), pp. 321–338.

Star, S.L. (1999) 'The Ethnography of Infrastructure', American Behavioral Scientist, 43(3), pp. 377–391.

Star, S.L. (2002) 'Infrastructure and Ethnographic Practice: Working on the Fringes', Scandinavian Journal of Information Systems, 14(2), pp. 107–122.

Star, S.L. and Strauss, A. (1999) 'Layers of Silence, Arenas of Voice: The Ecology of Visible and Invisible Work', Computer Supported Cooperative Work, 8(1-2), pp. 9–30.

Statista (2020) Share of Global Production in China in 2018, by Selected Industry. Available at: http://www.statista.com/statistics/1106909/china-global-production-share-by-industry [Accessed June 26, 2021].

Statista (2022) Real Gross Domestic Product (GDP) Growth Rate in Africa from 2010 to 2027. Available at: http://www.statista.com/statistics/1300818/real-gdp-growth-rate-in-africa [Accessed March 21, 2023].

Statista (2023a) M-Pesa Customer Numbers from 2017 to 2022. Available at: http://www.statista.com/statistics/1139190/m-pesa-customer-numbers [Accessed March 14, 2023].

Statista (2023b) Safaricom M-Pesa revenue generated from FY 2010 to FY 2021. Available at: http://www.statista.com/statistics/1139160/safaricom-m-pesa-revenue-historical [Accessed March 14, 2023].

Steyaert, C. (2007) 'Of Course, That is not the Whole (Toy) Story: Entrepreneurship and the Cat's Cradle', Journal of Business Venturing, 22, pp. 733–751.

Steyaert, C. and Katz, J. (2004) 'Reclaiming the Space of Entrepreneurship in Society: Geographical, Discursive and Social Dimensions', Entrepreneurship & Regional Development, 16, pp. 179–196.

Suarez-Villa, L. (2001) 'The Rise of Technocapitalism', Science Studies, 14(2), pp. 4–20.

Suchman, L. (2007) Human-Machine Reconfigurations: Plans and Situated Actions (second edition). New York: Cambridge University Press.

Suchman, L. (2009) Agencies in Technology Design: Feminist Reconfigurations. Available at: http://www.lancaster.ac.uk/fass/resources/sociology-online-papers/papers/suchman-agenciestechnodesign.pdf [Accessed July 30, 2021].

Swainson, N. (1976) The Role of the State in Kenya's Post-War Industrialisation. Working Paper No. 275 of the Institute for Development Studies. Nairobi: University of Nairobi.

Takhteyev, Y. (2012) Coding Places – Software Practice in a South American City. Cambridge and London: MIT Press.

Tamboukou, M. (2013) 'Foucauldian Approach to Narratives', in Andrews, M., Squire, C. and Tamboukou, M. (eds.) Doing Narrative Research (second edition). London, Thousand Oaks, New Delhi, Singapore and Washington DC: SAGE Publications, pp. 88–107.

Taylor, A. (2011) 'Out There', Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 685–694.

Taylor, I. (2016) 'Dependency Redux: Why Africa is Not Rising', Review of African Political Economy, 43(147), pp. 8–25.

TED (n.d.) Erik Hersman. Available at: http://www.ted.com/speakers/erik_hersman [Accessed February 10, 2021].

The Economist (2011) Africa rising. Available at: https://www.economist.com/leaders/2011/12/03/africa-rising [Accessed November 11, 2017.

The Economist (2016) Mobile Phones are Transforming Africa. Available at: http://www.economist.com/middle-east-and-africa/2016/12/10/mobile-phones-are-transforming-africa [Accessed May 12, 2020].

The Lemelson Foundation (2014) The Lemelson Foundation Funds Establishment of Pre-eminent Design and Prototyping Facility in East Africa. Avail-

able at: http://www.lemelson.org/resources/news/lemelson-foundation-funds-establishment-pre-eminent-design-and-prototyping-facility [Accessed July 5, 2017].

The Rotary Water Barrel Project (2016) 14 June. Available at: https://twitter.com/TheRotaryBarrel/status/742699337625538564 [Accessed June 13, 2020].

Thien, D. (2005) 'After or Beyond Feeling? A Consideration of Affect and Emotion in Geography', Area, 37(4), pp. 450–456.

Thrift, N. (2003) 'Practising Ethics', in Pryke, M., Rose, G. and Whatmore, S. (eds.) Using Social Theory: Thinking through Research. London, Thousand Oaks and New Delhi: SAGE Publications, pp. 105–121.

Tolia-Kelly, D.P. (2006) 'Affect: An Ethnocentric Encounter? Exploring the "Universalist" Imperative of Emotional/Affectual Geographies', Area, 38(2), pp. 213–217.

Toombs, A., Bardzell, S. and Bardzell, J. (2014) 'Becoming Makers: Hackerspace Member Habits, Values, and Identities', Journal of Peer Production, 5, n.p.

Trenk, M. (1991) '"Dein Reichtum ist dein Ruin" – Zum Stand der Forschung über afrikanische Unternehmer und wirtschaftliche Entwicklung', Anthropos, 86, pp. 501–516.

Tristl, C. (2020) 'Automatic Water Dispensers? The Private Sector as Development Agent and the Marketization of Water at the "Bottom of the Pyramid"', PhD Thesis, Department of Human Geography, Goethe University, Frankfurt.

Tristl, C. (2023) 'Financializing Water Service Provision with Digital Devices: Pro-commercialization Alliances and the "Exclusive Inclusion" of the Unbankable in Mathare, Nairobi', Globalizations. Available at: 10.1080/14747731.2023.2187560.

Tsing, A. (2000) 'The Global Situation', Cultural Anthropology, 15(3), pp. 327–360.

Turkle, S. and Papert, S. (1990) 'Epistemological Pluralism: Styles and Voices within the Computer Culture', Signs: Journal of Women in Culture and Society, 16(1), pp. 128–157.

Turner, F. (2006) From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism. Chicago: University of Chicago Press.

UNICEF (n.d.) Innovation Portfolios. Available at: http://www.unicef.org/innovation/innovation-portfolios [Accessed April 21, 2021].

UNICEF Innovation Fund (2021) Apply for UNICEF's Innovation Fund. Available at: http://www.unicefinnovationfund.org/apply/unicef-innovation-fund-opportunity-tech-startups [Accessed April 21, 2021].

United Nations (2014) Secretary-General Praises Kenya's iHub as Continent's 'Silicon Savannah', Future of Africa. Available at: http://www.un.org/press/en/2014/sgsm16300.doc.htm [Accessed May 12, 2020].

Ushahidi (2020) About Ushahidi. Available at: http://www.ushahidi.com/about [Accessed May 12, 2020].

van Eeden, J. (2004) 'The Colonial Gaze: Imperialism, Myths, and South African Popular Culture', Design Issues, 20(2), pp. 18–33.

Vannini, P. (2015) 'Non-representational Ethnography: New Ways of Animating Lifeworlds', Cultural Geographies, 22(2), pp. 317–327.

Verne, J. (2014) 'Neue Netze, neue Räume? Mobiltelefonie in Afrika', Geographische Rundschau, 6, pp. 42–47.

Vision 2030 Delivery Secretariat (n.d.) Available at: http://vision2030.go.ke/ [Accessed August 12, 2019].

Vossoughi, S. and Bevan, B. (2014) Making and Tinkering: A Review of the Literature. Successful Out-of-School STEM Learning: A Consensus Study, Board on Science Education, National Research Council. Available at: http://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_089888.pdf [Accessed July 26, 2017].

Wajcman, J. (2006) 'TechnoCapitalism Meets TechnoFeminism: Women and Technology in a Wireless World', Labour & Industry, 16(3), pp. 7–20.

Waldby, C., Wakeford, N. and Green, N. (2006) 'Feminist Technoscience: Intimacy, Embodiment and Abjection in Science Studies', Science Studies, 19(2), pp. 3–5.

Walton, P. (2014) The Case for Engineering the BRCK in Africa – Part 2. BRCK Blog. Available at: http://www.brck.com/?p=285 [Accessed April 25, 2020].

Wan, E. (2019) 'Labour, Mining, Dispossession: On the Performance of Earth and the Necropolitics of Digital Culture', International Journal of Performance Arts and Digital Media, 15(3), pp. 249–263.

Weber, J. (2007) 'Einführung – Feministische STS', in Bauer, S., Heinemann, T. and Lemke, T. (eds.) Science and Technology Studies: Klassische Positionen und aktuelle Perspektiven. Berlin: Suhrkamp, pp. 339–368.

WebJunction (2019) Digital Inclusion. Available at: http://www.webjunction.org/explore-topics/digital-inclusion.html [Accessed August 12, 2019].

Wenten, K-A. (2019) 'Controlling Labor in Makeathons. On the Recuperation of Emancipation in Industrial Labor Processes', in Meyer, U., Schaupp, S.

and Seibt, D. (eds.) Digitalization in industry. Between Emancipation and Domination. London: Palgrave McMillan, pp. 153–177.

Wetherell, M. (2012) Affect and Emotions. A New Social Science Understanding. London: SAGE Publications.

Williams, L.D.A. (2018) 'Mapping Superpositionality in Global Ethnography', Science, Technology, & Human Values, 43(2), pp. 198–223.

Winschiers-Theophilus, H. and Bidwell, N.J. (2013) 'Toward an Afro-Centric indigenous HCI Paradigm', International Journal of Human-Computer Interaction, 29(4), pp. 243–255.

Woods, J. (2020) 'On Contemporary Speculative Short Fiction in Southern Africa', Scrutiny2, 25(3), pp. 36–48.

Woods, J. (2021) The Transcendence of Boundaries. Available at: https://africasacountry.com/2021/03/the-transcendence-of-boundaries [Accessed July 2, 2021].

Woolgar, S. (2004) 'Marketing Ideas', Economy and Society, 33(4), pp. 448–462.

World Population Review (2021) Most Technologically Advanced Countries 2021. Available at: https://worldpopulationreview.com/country-rankings/most-technologically-advanced-countries [Accessed June 26, 2021].

Wynne, B., Felt, U., Callon, M., Gonçalves, M.E., Jasanoff, S., Jepsen, M., Joly, P-B., Konopasek, Z., May, S., Neubauer, C., Rip, A., Siune, K., Stirling, A. and Tallacchini, M. (2007) Taking European Knowledge Society Seriously. Report of the Expert Group on Science and Governance to the Science. Brussels: Directorate-General for Research, Science, Economy and Society, European Commission.

Young, R.J.C. (2001) Postcolonialism: An Historical Introduction. Malden, Oxford and Victoria: Blackwell Publishing.

Zanoni, P., Thoelen, A. and Ybema, S. (2017) 'Unveiling the Subject Behind Diversity: Exploring the Micro-politics of Representation in Ethnic Minority Creatives' Identity Work', Organization, 24(3), pp. 330–354.

Zoran, A. and Buechley, L. (2013) 'Hybrid Reassemblage: An Exploration of Craft, Digital Fabrication and Artifact Uniqueness', Leonardo, 46(1), pp. 4–10.