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## PUBLIC HEALTH & PRIMARY CARE | RESEARCH ARTICLE

# Governing pharmaceutical innovations in Africa: Inclusive models for accelerating access to quality medicines

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**Abstract:** The recent expiration of several blockbuster pharmaceutical patents offers new opportunities for generic drug production in Africa. Moreover, 2015 marked a critical juncture; a transition from the Millennium Development Goals to Sustainable Development Goals. The implications for African economies in the area of generic drug production and global health outcomes are vast given the potential to increase access to medicines for neglected diseases and other emerging health crises. This issue-based article analyses the extent to which several coeval variables of governance and macro-economic nature can potentially create the market and institutional conditions to spur innovations for improving access to medicine via cross-sector social partnerships. Proposals for solving grand challenges in Africa's pharmaceutical markets often fail to address the most fundamental impediments to innovation, besides being mostly donor-driven. Through document analysis, we problematize conventional formulae for healthcare governance with a measured critique of prevailing orthodoxies by offering implementable alternatives. We

### ABOUT THE AUTHORS

Frederick Ahen, PhD, is a research fellow at the Turku School of Economics at the University of Turku, Finland. Frederick's research straddles the areas of sustainable global health governance and the ethical role of business and non-business actors in changing global and public health institutions through sustainable innovations. The present interdisciplinary study is part of a research project on the role of major actors in global health in providing access to medicines to under-served patients. This study builds on Frederick's previous work on the role that governments and the pharmaceutical industry can play in curbing damages done to patients through the proliferation of counterfeits in developing economies. Together, this combined effort provides medico-techno-scientific, market and governance solutions to the problem of access to medicines.

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### PUBLIC INTEREST STATEMENT

Proposals, strategies and policies for solving grand challenges in Africa's pharmaceutical markets often fail to address the most fundamental impediments to pharmaceutical innovations. This policy paper problematizes conventional formulae for healthcare governance with a measured critique of prevailing orthodoxies by offering implementable alternatives. We identify bottom-up and entrepreneurially viable strategic reversal of decades of systematic damages that have contributed to the underdeveloped pharmaceutical market whilst highlighting what can set the stage for a durable change through game-changing innovative models. We shed light on the evidence of emerging governance and macro-economic indicators as catalysts for creating the market and institutional conditions to spur sustainable, inclusive and innovative models for marshalling access to high-quality affordable medicine. Put together, innovative drug development through cross-sector social partnerships involving public health strategies, university projects and SMEs will mark the beginning of a new era of pharmaceutical innovations to make medicines accessible to the underserved.

propose inclusive, innovative models for marshalling sustainable access to high-quality affordable medicine. We identify bottom-up and entrepreneurially viable strategic reversal of decades of systematic damages that have contributed to the underdeveloped pharmaceutical market, whilst striking a reasonable balance between what the desirable future is and what can set the stage for a durable change through game-changing market and innovative mechanisms.

**Subjects: Pharmaceutical Technology; Strategic Management; International Business; Marketing**

**Keywords: Africa; inclusive business; institutional innovations; international business; markets and institutions; mitigation policies; pharmaceutical market; sustainable global health**

### 1. Introduction

The outbreak of the Ebola virus epidemic that started in March 2014, in the epicentres of Guinea, Sierra Leone and Liberia (Calcagno, 2016; Wilkinson & Leach, 2015), revealed to the world three grand challenges: (i) the conspicuous absence of health infrastructure and resources in West Africa; (ii) the region's level of dependency on medico-techno-scientific resources from external sources; and (iii) the lack of political will to invest massively and aggressively in innovative ventures or create the congenial and supporting socioeconomic, political and techno-scientific institutional environment for inclusive solutions to the longstanding lack of access to medicines.

In the next epidemiological crisis that could probably be bigger than Ebola and other health crises before it, West, East, Central, and Southern Africa (WECS Africa, henceforth) will certainly be on their own. This is because the current global economic situation will only let donors act too late with too little since they have economic troubles of their own. The Ebola outbreak resulted in several mortalities and morbidities. During the crisis, it was estimated that by 2015, without an efficacious cure, the disease could have affected 1.4 million people according to the United States Centre for Disease Control (Begley, 2014). This was fortunately scaled back as the epidemic got under control. Unless there are serious medico-techno-scientific efforts to preempt a possible future scenario, the next outbreak will have enormous impacts on global health security. Further, the economic costs and losses caused by the Ebola crisis ran into several billions according to the World Bank (Mayhew, 2016). In the aftermath of the epidemic, several fast-track solutions for acquiring medicines in the US and Europe begun in earnest but there was nothing similar going on anywhere across WECS Africa where the epidemic actually occurred (Wilkinson & Leach, 2015). Subsequently, Ebola vaccines that are being developed in the West were tested in clinical trials during and after the epidemic (see e.g. Collier et al., 2017; Mooney et al., 2018; ClinicalTrials.gov).

Following the World Health Organization (WHO, 2013a), we use the acronym WECS Africa to accentuate the similar epidemiological profile of the West, East, Central and Southern African regions. At the same time we acknowledge the regional and national epidemiological variations as well as the institutional heterogeneity; thus, Ghana is unlike South Sudan, neither is Botswana like Somalia. WECS Africa is functionally the same as Sub-Saharan Africa but technically different since the former places emphasis on the regions whilst the latter is about the monolithic geographical and economic space.

It is argued that the huge dependence on pharmaceutical imports and donations in particular and the donor-driven nature of WECS African health systems in general are a regressive substitute for developing local pharmaceutical industry to provide high-quality access to the much needed generic medicines to an exponentially growing population (Kenyatta, 2015; D. Moyo, 2009; J. Moyo & Gathigah, 2014; WSJ, 2015). This lack of access is an existential problem especially with malaria, tuberculosis and HIV medicines (Class, 2012; Osuji & Umahi, 2012; Stiglitz & Jayadev, 2010; Yadav,

2010; Yamey, 2002). What are the implications of all these as the world has now moved from the Millennium Development Goals to Sustainable Development Goals? With the stake so high, some “disruptive innovation” is urgently required. Therefore, this study answers the questions:

- (1) *How do changes in discourse on emerging governance, institutional and macro-economic conditions serve as foundations for spurring innovations that will create access to medicines?*
- (2) *Which form of governance structures are the most viable mechanisms for creating pharmaceutical solutions to ensure access to quality and affordable medicines?*

Here, access to medicine refers to the proximal availability of safe, efficacious and affordable high-quality drugs and associated health services that represent maximum social value (health benefits) for patients of varying income levels (Ahen, 2015).

### **1.1. What explains the lack of access to medicines?**

Access to medicine for the under-served consumers at the bottom of the pyramid (BOP) (Kolk, Rivera-Santos, & Rufin, 2014; London, 2008; Prahalad, 2004) in WECS Africa represents one of the most complex socioeconomic problems. The neglect of millions of people who live in areas with the prevalence of so-called neglected diseases is an age-old question (Stiglitz & Jayadev, 2010; Yamey, 2002). Yamey (2002) defines neglected diseases, which are prevalent in WECS Africa, as infectious diseases considered to be “neglected” when there is a lack of effective, affordable, or easy-to-use drug treatments. As most patients with such diseases live in developing countries and have too limited resources to pay for drugs, the pharmaceutical industry has traditionally ignored these diseases (A. Shah, 2010). The “90-10 rule” of pharmaceutical research has been in place for decades. It represents the notion that 90% of the biomedical R&D is aimed at serving the markets of the rich 10% of the global population due to poverty and the lack of market for the diseases of the poor (Stiglitz & Jayadev, 2010). Moreover, the lack of investments in pharmaceutical innovations is partly due to the (i) scarce financial resources; (ii) lack of foresight on the part of governments; and (iii) in part the systemic problem of tax avoidance and the endemic international corruption facilitated by some big corporations and governments (Dearden, 2017; Green, 2013; Schock, 2015). What worsens the problem is the aid programs that encourage boutique projects that hardly add to fundamental structural change (Becker, 2016) especially in the health sector.

Why is the WECS African pharmaceutical market so important? It is simply because there is a great need that requires an urgent solution. Africa represents 11% of the planet’s population. Nevertheless, it bears 24% of the global disease burden but hosts only 3% of the world’s health-care personnel due to constant brain drain according to the WHO (International Finance Corporation—IFC, 2008). Besides, more than 70% of the world’s HIV patients are in Africa, and 90% of the mortalities caused by malaria occur there (Dong & Mirza, 2016). Another major issue is the price of and access to life-saving medicines (Class, 2012). By conservative estimates, almost 79% of the medicines on the African market are imported (Dong & Mirza, 2016). The need to develop contextually useful, differentiated life-saving drugs is more urgent than ever in order to strengthen national health systems (Dong & Mirza, 2016; Lartey & Graham, 2007; Mackintosh, Banda, Wamae, & Tibandebage, 2016; Mackintosh, Mugwagwa, Banda, & Tunguhole, 2017; Morrison 2012a, 2012b). These facts suggest that Africa seems to be the epicentre of global health crisis albeit with enormous opportunity for inclusive local pharmaceutical industry. At the same time, Africa represents a major scientifically untapped and socially valuable business context for foreign direct investments (FDIs) in the pharmaceutical sector (Macdonald, 2011b; Morrison 2012a, 2012b; Palmer, 2014).

Notwithstanding all the above, within the context of the issue at hand, reconciling access to medicine as a public health issue and the intertwined problem of financial and techno-scientific resources of production requires a market mechanism (a viable pharmaceutical industry),

institutional conditions (right policies, finance and infrastructure that facilitate the industry) and civil society involvement (non-governmental organizations [NGOs] and consumers/stakeholders), thus, CSSPs (Austin, 2000, 2010; Reed & Reed, 2009; Selsky & Parker, 2005). Unfortunately, negative discourses and perceptions about Africa, their interpretations and how that affects investors' decisions have thus far had enormous effects in determining the under-financing of the pharmaceutical industry through FDIs. Small businesses and even reverse innovations are negatively affected by the unfavourable view (Harris, Weisberger, Silver, & Macinko, 2015) and manufactured risks of doing business in Africa (Adams, Nayak, & Koukpaki, 2018). Small and medium-sized enterprises (SMEs) comprise 80% of business in Africa (Luke & Sommer, 2018) and they provide jobs, a stable tax base and a direct attack on poverty apart from being the source of inclusive innovations and knowledge diffusion.

### **1.2. Apocalyptic tales that eclipse emergent business-friendly transformations**

There is significant evidence to suggest that Africa is changing in a revolutionary way (Adeleye, Ibeh, Kinoti, & White, 2015; McNamee, Pearson, & Boer, 2015; Nwankwo, 2012) although this fact is under-reported in the media and under-studied by academics. In 2012, Africa had “8 countries with a higher GDP per capita than China and 15 higher than India” (The Nielsen Company, 2012, p. 2). The population growth of 2.3% is over four times higher than China's (0.5%) and twice more than India's (1.3%) according to the emerging market insights study by The Nielsen Company (2012). More important than the above are the fundamental institutional changes and governance reforms as well as shifts in leadership styles (Boateng, 2013; Gates & Gates, 2014; Radelet, 2010; Rotberg, 2013) that are shaping the dynamics in many African economies. This is neither a hypothetical scenario nor naïve optimism based on premature exuberance but empirically verifiable emergent novelties (Kaufmann & Penciakova, 2011).

However, simultaneously with this development that is enjoyed by the middle and upper classes, the healthcare systems remain stagnant or even backwards in a way that adversely affect those at the BOP. According to Lembit Rago, Head of Regulation of Medicines and other Health Technologies at the WHO: “Eighty percent of all active pharmaceutical ingredients are manufactured in India and China” (Osterath, 2014). Besides, these two nations have a more advanced generic drug industry than most African countries—only South Africa stands out here. Additionally, India has several local medical pharmaceutical manufacturers through private and social enterprises—demonstrating a certain degree of independence compared to WECS Africa. China on the other hand makes a massive use of traditional medicines as part of its healthcare system, drastically reducing the burden on orthodox medicines (Xu et al., 2017). These two large economies position themselves in the generic production industry to serve low-income nations (Emanuel, Wendler, Killen, & Grady, 2004).

Moreover, another problematic issue remains: African countries are considered as a monolithic cluster for investments decisions. This immediately confuses, neglects and hides the wide contextual differences among the WECS African countries. Additionally, this leads to the perennial, one-sided overemphasis on issues such as cash-strapped consumers (Curnow & Kermeliotis, 2012), corruption and mismanagement (Curtis & Jones, 2017; Dearden, 2017) among other challenges that are akin to what happens to other developing nations. The problem is that such discourses ignore novelties such as upward mobility (an emerging middle class) and emerging business opportunities that must be factored into any comprehensive and balanced analyses. The emerging sociopolitical and economic dynamics are rather eclipsed by tales of horror “in apocalyptic titles” which tend to suggest that the WECS African market is backward and eternally unattractive for business (Adams et al., 2018; Harris et al., 2015). Most importantly, the issue of compressed development, which denotes the coexistence of poverty and affluence in the same context (Whittaker, Zhu, Sturgeon, Tsai, & Okita, 2010) is neglected along with the extremely different country-specific differences.

For the above reasons, pharmaceutical multinational companies (MNCs), or Big Pharma, are not directly and massively committed to WECS Africa through FDIs, although they have been operating on the continent for almost a century now (IMS Health, 2012; Macdonald, 2011b); Abbott entered

South Africa in 1930s and GlaxoSmithKline Nigeria in 1971. All the rest among the first entries invested rather in the North (e.g. Sanofi-Aventis and Pfizer in Morocco in 1953 and 1963, respectively, and Novartis in Egypt in 1962), even though it is the WECS African regions that suffer the most from tropical diseases such as malaria and dengue fever, acute respiratory diseases, etc. (S. Shah, 2010; A. Shah, 2010). Big Pharma's recent history with WECS Africa in particular and the developing world in general has however been extremely controversial (Goldacre, 2012; Vogt, 2007), although there are signs of improvements via the Access to Medicines Index project (<https://accesstomedicineindex.org>) and other collaborative research projects. Additionally, there are corporate and private initiatives (e.g. Bill and Melinda Gates Foundation, Global Fund to Fight AIDS, Tuberculosis and Malaria, Gavi, the Vaccine Alliance and UNITAID) that ensure access to medicines in low- and middle-income countries (Heymann, 2017). These are very impressive philanthropic gestures but there is a potential danger of donor fatigue and creation of dependency in the long run, besides governments abdicating responsibility to invest in innovations at home.

The general atmosphere of political stability in WECS Africa now allows smooth mobility and international trade. The mass movement of people across borders and influx of rural dwellers to big cities (The Nielsen Company, 2012) also calls for urgent solutions to epidemiological questions. The lack of access to legitimate healthcare services and products is forcing millions of consumers to patronize counterfeit drugs (Ahen, 2015; Mackey & Liang, 2011) and questionable informal healthcare praxes. The focus must now be on one major issue; increasing access to medicine through local pharmaceutical CSSPs. In what follows, we present the research design, the synthesis of our analysis and offer viable governance structures for pharmaceutical innovation in Africa.

## 2. Material and methods

A commonly used research approach in literature review is to search for top publications in top journals using keywords concerning a particular subject. Our research question and knowledge of relatively few publications by academia made this option less viable. This issue-based study employs document analysis of professional and academic interdisciplinary reports concerning access to life-saving drugs and pharmaceutical innovations. These types of documents are what Silverman (2001) refers to as naturally occurring data. We triangulate data from a variety of sources. This process is also called cross-validation. The nature of this substantive domain makes this approach the most appropriate way forward. A similar approach has been followed by Syed et al. (2012) in *Globalization and Health*, Vol. 8. Here, standard database and internet-based searches were performed in search of the most recent English language publications between 2010 and 2018. Studies or expert essays from professional organisations (e.g. McKinsey and Nielsen) and media reports on doing (pharmaceutical) business in the WECS African region were studied for inclusion or rejection in the study. Taking a cue from Mantere, Pajunen, and Lamberg (2009), we analysed the abstracts, conclusions and major themes of selected articles to extract the main thrust of the contributions. Of the eclectic publications, 50 fit-for-purpose (classified in Table 1) were judged appropriate for use on the basis of their validity, focus, and conclusions.

Validity was judged especially based on the prominence of the credibility of the source (e.g. Nobel Prize winner Joseph Stiglitz). Apart from the above general criteria, three major criteria were followed to accentuate the trustworthiness of the selected articles: The texts (i) demonstrate profound awareness of public health issues and the macro-economic dynamics whilst offering current and historical overview and forward-looking ideas about socioeconomic determinants of health in WECS Africa; (ii) offer a critical appraisal of institutional and market environment of the pharmaceutical sector through connections to international marketing literature or on-field experiential knowledge; (iii) problematize global health governance and offer useful recommendations on determinants of sustainable access to medicines and emerging market opportunities. After the data triangulation, the process of analysis primarily relied on thematizing to identify key neglected items as evidence of pivotal dimensions of institutional and macro-economic change across the WECS African region. We

**Table 1. An overview of the selected documents**

No.	Substantive domain	Author (year)	Source/outlet	Type of article
1	Pharmaceutical manufacturing plan for Africa	AUC (2012)	African Union Commission	ER
2	Emerging changes in Africa	Boateng (2013)	CNN	COM
3	Emerging challenges/opportunities in pharma, industry	Bruche (2011)	Columbia FDI Perspectives	E
4	Investment in Africa	CNN (2013)	CNN	PI
5	Pharmaceutical R&D in Africa	De Vré, Verde, Emiliano, and Santos Da Silva (2010)	McKinsey Insights	E
6	Increasing remittances	Doyle (2013)	BBC News	E
7	Emerging changes in Africa	Gates and Gates (2014)	Bill and Melinda Gates Foundation	ER
8	R&D and copyrights in Ghana	Gyasiwaa (2013)	Myjoyonline.com	ER
9	Sustainable pharmaceutical business models in Africa	IMS Health (2012)	IMS Health	PI + ER
10	Misleading statistics about Africa	Jerven (2013)	Cornell University Press	E
11	Latecomer advantage in biotechnology	Juma (2013)	CNN	COM
12	Emerging challenges and opportunities in Africa	Kaufmann and Penciakova (2011)	Brookings Institution	ER
13	Western diseases drive pharma market in Africa	Kermeliotis and Porter (2013)	CNN	PI + ER
14	Social determinants of health	Krech (2012)	Journal of Public Health Policy	C
15	Fostering drug manufacturing in Africa	Macdonald (2011a)	in-Pharma Technologist.com	IR
16	Support for drug manufacturing in Africa	Macdonald (2011b)	in-Pharma Technologist.com	IR
17	Diversification from dependence on natural resources	Mijiyawa (2013)	Columbia FDI Perspectives	E
18	The attractiveness of Sub-Saharan Africa for the pharma market	Morrison (2012a)	in-Pharma Technologist.com	IR
19	Call to make more drugs locally	Morrison (2012b)	in-Pharma Technologist.com	IR
20	Pharmaceutical companies and access to medicines	Osuji and Umahi (2012)	Journal of Global Ethics	C
21	Building new pharmaceutical plants in Africa	Palmer (2014)		
	fiercepharmamanufacturing.com	IR		
22	Emerging Africa	Radelet (2010)	Center for Global Development	E
23–24	Analysis the emergence of Africa's economic strength	Roxburgh et al. (2010); Bughin et al. (2016)	McKinsey Global Institute	PI + ER
25	The new infrastructural development in Africa	Sassoulas (2012)	BBC News	PI

(Continued)

No.	Substantive domain	Author (year)	Source/outlet	Type of article
26	Infrastructural opportunities in Africa	Konijn and van Tulder (2015)	Critical perspectives on international business	E
27	Critique of the pharmaceutical industry's role in developing countries	A. Shah (2010)	globalissues.org	E
28	Promoting socially beneficial research and development in pharmaceuticals	Stiglitz and Jayadev (2010)	Journal of Generic Medicines	PI + ER
29	Popular drugs that are going off-patent in 2013–2016	Stone (2014)	pharma.about.com	IR
30	Analysis of the diversity of people and markets in Africa.	The Nielsen Company (2012)	The Nielsen Company	IR
31	Reports on industry players' social irresponsibility	Vogt (2007)	The Washington Post	IR
32	Compressed development of the developing economies	Whittaker et al. (2010)	Studies in Comparative International Development	E
33	Africa emerges: challenges and opportunities.	Rotberg (2013)	Wiley & Sons	E
34	African diasporans: remittances	World Bank Fact Book (2016)	World Bank	GIR
35	Using finances from Africa's extractive resources for pharmaceutical and medical investments	APP (2013)	Africa Progress Panel	ER
36	Renewable energy as a boost to pharmaceutical manufacturing	APP (2015)	Africa Progress Panel	ER
37	African leaders urged to increase domestic funding to sustain interventions and defeat malaria	WHO (2013b)	WHO	ER
38	The positive changes in international business across Africa	Adeleye et al. (2015)	Palgrave Macmillan	E
39	The underestimated consumption power of African consumers	Curnow and Kermeliotis (2012)	CNN	COM + ER
40	Reverse innovations in health care in Africa	Harris et al. (2015)	Globalization and Health	E
41	China's investments in Africa	Jackson, Louw, Zhao, Boojihawon, and Fang (2014)	AIB Insights	E
42	Advancing management practices in African business operations	Jackson (2015)	Africa Journal of Management	E
43	Advancing trade as the fundamental catalyst for socioeconomic change	Moyo and Gathigah (2014)	Inter Press Service News Agency; ipsnews.net	E
44	New emphasis on intra-African business	McNamee et al. (2015)	Palgrave Macmillan	E

(Continued)

**Table 1. (Continued)**

No.	Substantive domain	Author (year)	Source/outlet	Type of article
45	Reararticulating the resurgence of international business in Africa	Nwankwo (2012)	Thunderbird International Business Review	E
46	Emphasis on trade in contrast to aid	WSJ (2015)	The Wall Street Journal	E
47	Tapping into the new sources of energy technologies in Africa	Amankwah-Amoah (2015)	Thunderbird International Business Review	E
48	New major sources of FDIs to Africa	De Jonge (2016)	Critical perspectives on international business	E
49	Analysis of the intra-African trade	Luke and Sommer (2018)	African Arguments	ER
50	African diaspora in the US as a talent pool	Anderson and Connor (2018)	Pew Research Center	E

Notes: ER: Expert recommendation; C: conceptual; E: empirical; PI: professional insight; IR: industry report; COM: commentary; GIR: global institutional report.

adopted this approach based on expert opinions and recommendations after presenting the early draft of this manuscript in two international conferences in the USA and Europe.

The use of document analysis has its own caveats in terms of coverage and selectiveness. Whilst some are specifically about the big players, some refer to regions and Africa as a whole. It is hard to generalize, although there is one major point of convergence. Thus, across the board, access to medicine is a massive problem that develops into other web of complex challenges in global health. In what follows, we provide results on how some of these issues affect investments in medical innovations across Africa.

### 3. Results

#### 3.1. Emerging conditions with the potential to spur innovations for access to medicines

Seeing Africa as a single cluster for investment purposes obscures the country-specific contexts where the opportunities are ripe for advancements in the pharmaceutical sector due to changes and reforms in the institutional underpinnings. Sticking closely to the evidence, this section presents the major neglected themes that emerged from the document analysis. Four major discoveries are made: (i) there is emerging evidence that within the pharmaceutical sector, attention is gradually being paid to African continent mostly in non-academic or professional outlets (e.g. McKinsey). This suggests the need for a more robust research (in academia) that explores the local pharmaceutical market and its potentials. (ii) Both academic and non-academic articles suggest that currently, there are several coeval variables that are transforming the WECS African economies—making them viable markets for the pharmaceutical industry. However, not all of them are eligible for inclusion in this review. We will restrict ourselves to the 10 major novelties or what, after a judicious evaluation, we see as neglected themes that we coded in the process of analysis. We refer to them as “pivotal dimensions of change” (see Table 2). (iii) The growing population, the emerging middle class and remittances, as well as compressed development suggest that there are incentive structures for pharmaceutical investments. (iv) Continent-wide, there are more substantial market opportunities than previously thought and presented in international statistical reports (Jerven, 2013; Radelet, 2010). Other issues on which most authors agree are the Chinese-driven growth (Chironga, Leke, Lund, & van Wamelen, 2011) or resources for infrastructure (Konijn & van Tulder, 2015) and the improved political and micro-economic reforms as well as stability at the structural level as summarized in Table 2.



**Table 2. Pivotal dimensions of change in WECS Africa**

Dimension	Characteristics
Intra-African free trade	<p>“On 21 March, 2018 at a special African Union summit convened in Rwanda, 44 governments signed the African Continental Free Trade Area (AfCFTA) agreement. The majority of the remaining 11 AU [African Union] member states signed the Kigali Declaration, a promissory note to ratify the AfCFTA. 27 additionally signed a separate AU Protocol on the Free Movement of People. Africa’s two biggest economies—Nigeria and South Africa—did not sign the AfCFTA agreement. However, it is expected that they—along with the remaining member states—will do so following national consultations or the fulfilment of constitutional requirements for signing international treaties”. (Luke &amp; Sommer, 2018)</p>
The growth of the service sector and e-banking as catalysts for drug dispensary	<p>Africa’s GDP is now 50% in the service sector (Luke &amp; Sommer, 2018). Mobile phone banking and e-commerce play a major role in ensuring access to medicines even at the bottom of the pyramid</p>
Compressed development	<p>—Compressed development is a ubiquitous condition all across Africa (Whittaker et al., 2010); alongside the emerging affluence, there are the middle class and the very needy at the bottom.                      —For example across WECS Africa there are hospitals serving children who suffer from curable infectious diseases whilst in the same hospital there are queues of people spending frivolously on beauty enhancing surgeries or receiving treatments for diseases of the rich such as obesity.</p>
Upward mobility	<p>Growing middle class and rising household incomes due to economic boom in both formal and informal sectors (Boateng, 2013; Bughin et al., 2016; CNN, 2013; Jerven, 2013; Radelet, 2010; Roxburgh et al., 2010).                      —Increased urbanization, increased levels of education and lifestyle changes provide opportunities for pharmaceutical business.</p>
The diaspora effect	<p>—WECS African diasporans constitute the sixth largest region of Africa (residing outside of Africa), counting in millions (World Bank, 2011)                      —Exponential increase in family remittances; they far supersede the total amount of official aid money offered in recent years to developing economies (Doyle, 2013). In 2015, the estimated remittances to WECS Africa were US\$34.8 billion. (World Bank, 2016)                      —Households have more disposable income (for education, health care, etc.) than experts conventionally thought.                      —WECS African immigrants in the US are more highly educated than the native-born (Anderson &amp; Connor, 2018). This represents a huge human resource to tap into for innovations.</p>
Improved governance	<p>Transparency, rule of law, and efficient administrative systems as foundations for economic development are increasing (Gates &amp; Gates, 2014; Kaufmann &amp; Penciakova, 2011; Radelet, 2010).</p>
Demographic dividend	<p>The dividend of young and educated population is now translating into high productivity and increasing local entrepreneurship (Gates &amp; Gates, 2014; The Nielsen Company, 2012). This means there are both diaspora returnees and locally trained pharmacists and engineers.</p>
Globalization and information technology	<p>Globalization is changing consumer culture and preferences; for example, mobile phones, pedigree technologies and increasing public awareness have had direct effects on counterfeit drug consumption; consumers now demand evidence-based medicines and not what poverty previously forced them to accept (Ahen &amp; Zettinig, 2011).</p>
FDIs and infrastructure—intra-regional trade	<p>—The massive Chinese and Western investments in WECS Africa translate into infrastructural development including roads, hospitals, energy plants, telecommunication systems, and schools (Amankwah-Amoah, 2015; De Jonge, 2016; Jackson et al., 2014; Jackson, 2015; Konijn &amp; van Tulder, 2015; Sassoulas, 2012)                      —Example 1. West African Gas Pipeline Project (<a href="https://ejatlas.org/conflict/west-african-gas-pipeline">https://ejatlas.org/conflict/west-african-gas-pipeline</a>), a new regional infrastructure project comprising a 681-km pipeline to transport natural gas from Nigeria through Benin, Togo and Ghana, will certainly serve as potential source of energy for pharmaceutical sector. Trade between the different trading blocs is increasing.                      —Example 2. The current low-cost of using solar energy (APP, 2015) is also boosting energy infrastructure in Africa. This used to be a problem in the past.</p>
“Late-comer” advantage	<p>For example, in the area of biotechnology, experts suggest that Africa has the latecomer advantage for explorative, disruptive and exploitative innovations (Amankwah-Amoah, 2015; Juma, 2013).</p>

### **3.2. Beyond institutional responsibility: is there a market incentive?**

The above congratulatory analysis of WECS Africa means that the perceived lack of market or the putative poor region that can hardly afford medicines has now been debunked or at least requires a more nuanced view (Jerven, 2013). Jerven (2013) argues that WECS Africa is certainly much richer than mostly presented in statistics because of the large and booming informal sector that offers no accurate statistics for official verification. However, an empirical observation offers ample demonstration of the spending power of the continent that now has 6 of the 10 fastest growing economies on the planet (Adegoke, 2018; Boateng, 2013; Gates & Gates, 2014; Radelet, 2010). Moreover, the perceived lack of market and the presentation of the whole of Africa as only a poor “country” does not account for the millions who are having an upward mobility from poverty but only erroneously assumes (based on a static model) that the poor will always remain poor irrespective of the dynamic changes in the macro-economic environment (Gates & Gates, 2014).

Further, the growing affluence in emerging WECS Africa has now increased the demand for medicines for the so-called diseases of the rich (e.g. hypertension and obesity)—opening a new market frontier given the homogeneity in demand (IFC, 2008; Kermeliotis & Porter, 2013). Figures provided by the IMS Health in 2012 demonstrate that spending on pharmaceuticals in Africa is on the rise. The pharmaceutical industry was forecast to increase from the then \$18 billion to an estimated \$30 billion in 2016, and by 2020, the market could be worth \$45 billion (Frost & Sullivan, 2016).

Additionally, better healthcare infrastructure in the bigger cities is providing new opportunities for pharmaceutical and medical businesses. Western markets are also becoming more saturated and the need to enter new markets is becoming an imperative:

While political troubles, wars, natural disasters, and poor policies could slow Africa down, the prospects for consumer-facing companies are bright. Africans spent \$860 billion on goods and services in 2008—35% more than the \$635 billion that Indians spent, and slightly more than the \$821 billion of consumer expenditures in Russia. If Africa maintains its current growth trajectory, consumers will buy \$1.4 trillion worth of goods and services in 2020, which will be a little less than India’s projected \$1.7 trillion but more than Russia’s \$960 billion. (Chironga et al., 2011)

### **3.3. Capturing the profitable niches in emerging WECS Africa**

The availability of market incentives and hence “private profitability” as a pull factor for R&D investments by the private sector is not to suggest that profitability is a measure of social return on investment, unless, as Stiglitz and Jayadev (2010, p. 219) argue, “the social value of health increases commensurately with the ability to pay”. Much of the involvement of pharmaceutical MNCs is primarily sales-related (FDI) market-seeking behaviour and less of manufacturing based FDIs (Morrison, 2012a, 2012b). Apart from the problem of arbitrage, one important problem with pricing in low-income countries is the aggregation of populations instead of disaggregation on the basis of population segments and the level of income in the same country (Class, 2012). This is particularly true in WECS Africa where the regions are usually monolithically lumped together as if they were one country (Sub-Saharan Africa), without regard to the institutional and market heterogeneity. Nevertheless, within the same economy, there can be different income levels: rich, middle class, and the BOP, the latter being the majority across the WECS African regions. The African Development Bank defines middle class as individuals with spending power between \$2 and \$20 a day at 2005 prices. This number has risen to 34% according to the population figures of 2010. That is about 313 million people and counting. The Nielsen Company (2012) offers seven consumer groups in African countries. See Figure 1.

Affordability therefore has diverse articulations when seen this way in the discourse of differential pricing of essential pharmaceuticals (Yadav, 2010).

**Figure 1. Types of African consumers; data from The Nielsen Company (2012) “The diverse people of Africa”.**

TOP: top of the pyramid; MOP: middle of the pyramid; BOP: bottom of the pyramid.



### 3.4. A model for building local pharmaceutical industry

In the year 2000, less than 1% of people in Africa lived within the reach of a wireless phone. That figure stood at 65% by 2011 (Chironga et al., 2011) and around 80% in 2014 (Pew Research Center, 2015). This is transforming banking and other industries and even the pharmaceutical market in the securitization of drugs to guarantee consumer safety. Given the emerging conditions, we suggest that developing local industries through cross-sector collaborations in selected countries where most of these favourable conditions apply may help reverse the current level of dependency and perennial lack of access to finance. The attractiveness of the WECS African markets for drug manufacturing and commercialization is now receiving global attention (Morrison, 2012a). The growth of the pharmaceutical sector (Morrison, 2012b) will certainly bring about economic development, which is at the heart of all the social determinants of health (Krech, 2012). This will also allow job creation that will help retain new graduates from the schools of Pharmacy—knowledge spill-overs are clearly expected.

Practitioners in the pharmaceutical industry across Africa are becoming proactive. They recognize the problems such as the competition with cheaper medicines from China and India as well as the challenges associated with cost-effective local drug production compared to drug imports. The problem is that in the short term, importing instead of producing seems like a rational choice. However, it is a bad idea in the long term in at least three ways: (i) local industries are weakened or die out, along with the loss of tacit knowledge and potential diffusion of innovation due to non-competitiveness; (ii) dependency on imports ensues; and (iii) a possible increase in prices as is the case in all forms of dumping. In response to these problems with weak local pharmaceutical manufacturing capacity and other associated problems (Dong & Mirza, 2016), the Federation of African Pharmaceutical Manufacturers Associations (FAPMA) was inaugurated in 2013 with the mission to: “facilitate collaboration between regional pharmaceutical manufacturing associations, to address the common challenges faced by the industry and to enhance opportunities towards self-sufficiency through advocacy and partnership with other stakeholders in promoting the production of quality, affordable medicines” (FAPMA, 2015).

This is just one example of the various cross-sector initiatives to boost pharmaceutical innovations in Africa.

### 3.5. Viable inclusive models for pharmaceutical innovations

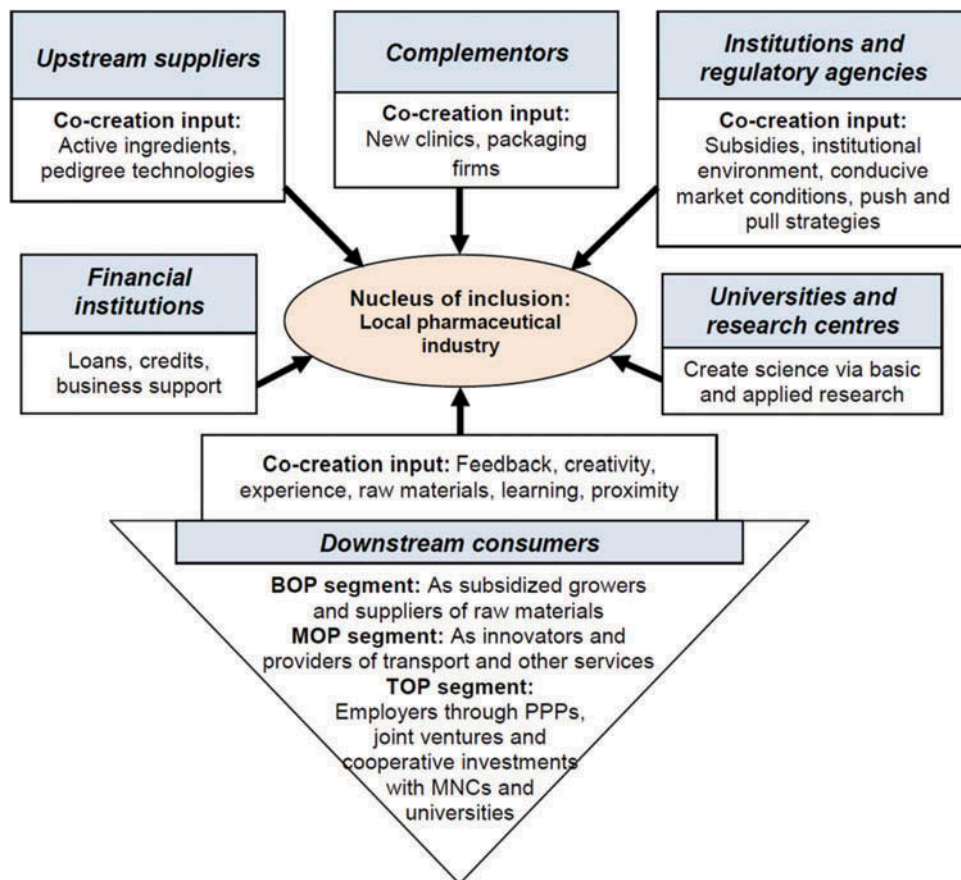
We follow Afuah, Bogers, and Bastian (2010) and Wilson and Doz (2012), in proposing viable alternative models through CSSPs. This involves collaboration with the upstream suppliers of active pharmaceutical ingredients (APIs), complementors of technologies and drug design knowledge, clinics, etc. and downstream consumers of the three major segments. The first is the BOP consumers. These are mainly informal markets gradually being reached and transitioned to a formal economy. The BOP consumers have unmet needs that require the reconfiguration of dynamic capabilities to produce generic drugs faster, cheaper, and in a smarter way (Pralhad, 2004), especially against malaria and other diseases that cause the highest rate of morbidity and mortality.

Moreover, the BOP segment will represent trained local growers of medical plants (raw materials) with modernized agricultural methods. This is a direct source of income and a direct attack on poverty through the availability of an immediate market that avoids middlemen through direct sales. Subsidized plantations will allow growers to stay ahead of external competition. Farming will no longer be construed as subsistence but a form of entrepreneurship that will alleviate poverty and encourage self-sufficiency and upward mobility (Hart & Prahalad, 2002; Prahalad & Hammond, 2002). Consistent with the BOP literature, the proposed pharmaceutical venture must be a revenue-generating activity that targets BOP consumers with locally sensitive pharmaceutical products at affordable prices (BOP as consumers) or sources raw materials from the BOP producers (BOP as producers).

Apart from the BOP segment of the unreached, the second segment consists of the under-reached middle class (MOP) and the third segment comprises the high-end consumers (TOP). However, innovations and novel technologies can help reach all of them at lower cost. The MOP segment represents innovators and providers of transport, enterprise solutions and other logistical services whilst the TOP segment with their capital infusion into profitable social enterprises will represent employers through public-private partnerships (PPPs), joint ventures, social entrepreneurship (hybrid organizations) and cooperative investments with MNCs (equity investments) and universities to manufacture drugs (see Figure 2).

Other possibilities include galvanising social technologies, institutional mechanisms and community-based recipes to create a system for drug production that meets the needs of those at the bottom (Chataway, Kale, & Hanlin, 2011). As Reich (2000) proposes, policies need to put together both “push”

**Figure 2. Inclusive business models for sustainable global health.**



approaches that consist of subsidies to support local pharmaceutical SMEs and “pull” strategies of financial incentives such as market guarantees, and strategies with the objective of strengthening institutions. Sustainable health is about containing and improving the current health situation whilst innovating new ways of cure and prevention and as well as ensuring their wider accessibility in the future. For example, the Danish company Novo Nordisk through a PPP between Novo Nordisk, Palb Pharmaceuticals and the National Diabetes Association of Ghana launched two diabetes support centres in Accra, Ghana for BOP markets (Denmark in Ghana, 2014). The aim is to increase access to high-quality insulin and care for diabetes patients. Similar strategies have been adopted in Nigeria, and Kenya.

### **3.6. Institutional and innovative market solutions for new medicines**

“The tragedy of the commons” paradox, as used by Heller (1998) in application to global patents rights in biomedical research, explains why people over-utilize common pool resources (Ostrom, 1990). Nevertheless, with regard to global patents of private biomedical innovations, there seems to be what the authors refer to as the “tragedy of anti-commons” where scarce resources are underutilized since it is assumed that a higher number of users will block one another. Without the strong institutions and inclusive health policies that allow efficient and equitable upstream research and downstream product development, the social benefits of biomedical research will be minimal for the majority. This is wholly true when our analysis focuses on patent-protected orthodox drugs.

In what follows, suggestions are offered on how WECS Africa can become independent or have successful collaborations in the drug industry/national health care as is the growing phenomenon in India (Bruche, 2011; Kettler & Modi, 2001) and Taiwan (Shih, Lew-Ting, Chang, & Kuo, 2008):

- (1) *Advancing and mainstreaming herbal medicine*: The WECS African pharmacognosy experts with the help of local herbalists could explore the medicinal plants that are used for various ailments and identify the pharmaceutically active substances in them. Subsequently, the local medicinal chemistry teams of the pharmaceutical companies could use those active substances for developing new drugs. All this will require both political will and strong CSSPs. This maybe the best way forward alongside the production of generics (or biosimilars, when considering biopharmaceuticals). Nevertheless, this requires a systematic effort to determine the effect and the principal components of the plant extracts. The major challenge is whether or not an effective treatment can be achieved with such substances. The probability of success is, however, high since a great number of current drugs have originated from natural substances (Newman & Cragg, 2016; Rishton, 2008). In addition to developing single isolated substances as drugs (orthodox medicine), plant-based crude drug extracts that usually contain several substances could be standardized and produced in quality-assured laboratories to offer traditional herbal medicines of high quality (instead of buying home-made decocts from the street vendors).
- (2) *Producing generics locally*: Once the patent rights for essential drugs expire, pharmaceutical firms could start producing the generics locally. That will also require a massive government financial support for local manufacturers to expand whilst attracting expert scientists with new incentive structures. This will help them to acquire the WHO prequalification status that will qualify them for competitive biddings. Exploiting these opportunities can take immediate effect as several blockbuster pharmaceutical patents have recently expired (2013–2016) (Stone, 2014). Such expiring patents included drugs against high cholesterol or high blood pressure and antiviral medicines. It is noteworthy that it is not just the infectious diseases that are prevalent in WECS Africa but also the chronic diseases are now on the increase due to the lifestyle changes; for example asthma, cardiovascular disease, diabetes and cancer (Adeloye et al., 2013; De Graft Aikins, Anum, Agyemang, Addo, & Ogedegbe, 2012; Smedley, 2013).
- (3) *Scaffold hopping*: One way of circumventing the problematics related to drug compound patents is so-called “scaffold hopping” (Xie et al., 2013), an approach routinely used in lead compound generation (Zhao, 2007) and optimization of the drug candidates’ activity and ADMET (absorption, distribution, metabolism, elimination, toxicity) properties. Thus, instead

of waiting for compound patents to expire, local medicinal chemistry research teams could start exploring alternative molecular scaffolds for the particular parent drugs. Once they find an active molecule scaffold that could replace the patented one, they may patent it and its derivatives and start the drug development process from the beginning to the end (via all compound optimization steps, pharmacokinetic profiling, and preclinical and clinical trials). There are several tools and methods to perform scaffold hopping, including computer-aided and structure-based drug design techniques (see Sun, Tawa, & Wallqvist, 2012). This approach is about prioritizing and developing essential drugs from concept to consumption. In practice, this could work out with a compound series that is synthetically sensible and where the indication would be important due to commercial viability. The drawback in this proposal is that developing a novel drug from the beginning to the end requires strong organic chemistry, a lot of biological testing and careful preclinical and clinical trials and that involves a massive financial outlay. The robust financial support could ideally come from the transparent deals in natural resources. For example, the Africa Progress Report 2013 exposes:

five deals between 2010 and 2012, which cost the Democratic Republic of the Congo over US\$1.3 billion in revenues through the undervaluation of assets and sale to foreign investors. This sum represents twice the annual health and education budgets of a country with one of the worst child mortality rates in the world and seven million pupils out of school. (APP, 2013)

- (4) *A revolutionized African pharmaceutical industry*: “Africans must create innovative domestic/national health financing model. We cannot and should not continue to rely on external funding for health” (Chairperson of the African Union, Dr Mustapha Sidiki Kaloko, Commissioner of Social Affairs; WHO, 2013b). For De Vré et al. (2010) “A system governed by Africans in Africa is needed to provide a sustainable funding mechanism that would encourage African scientists to collaborate on common health concerns, share expertise, and build capacity”. To make the above possible, public–private partnerships are required. Nevertheless, a more robust attempt is prescribed here: Countries in each regional trading bloc of WECS Africa may dedicate a percentage of their GDP based on population to a regional project that targets the most important disease in a region. The idea is to avoid the duplication of efforts across regions whilst there are other private sector investments. Therefore, channelling rents from natural resources through diversification (Mijiyawa, 2013) towards local drug development is highly recommended. This will allow local experts to learn new skills since they have been idle for decades due to the lack of finance—leading to brain drain to places where their expertise is needed. Enforcing intellectual property laws will attract FDIs, generate revenue, motivate scientists, and create competition to improve the quality of research. On the other hand, the absence of a legal framework discourages scientific and intellectual investments (Gyasiwaa, 2013).

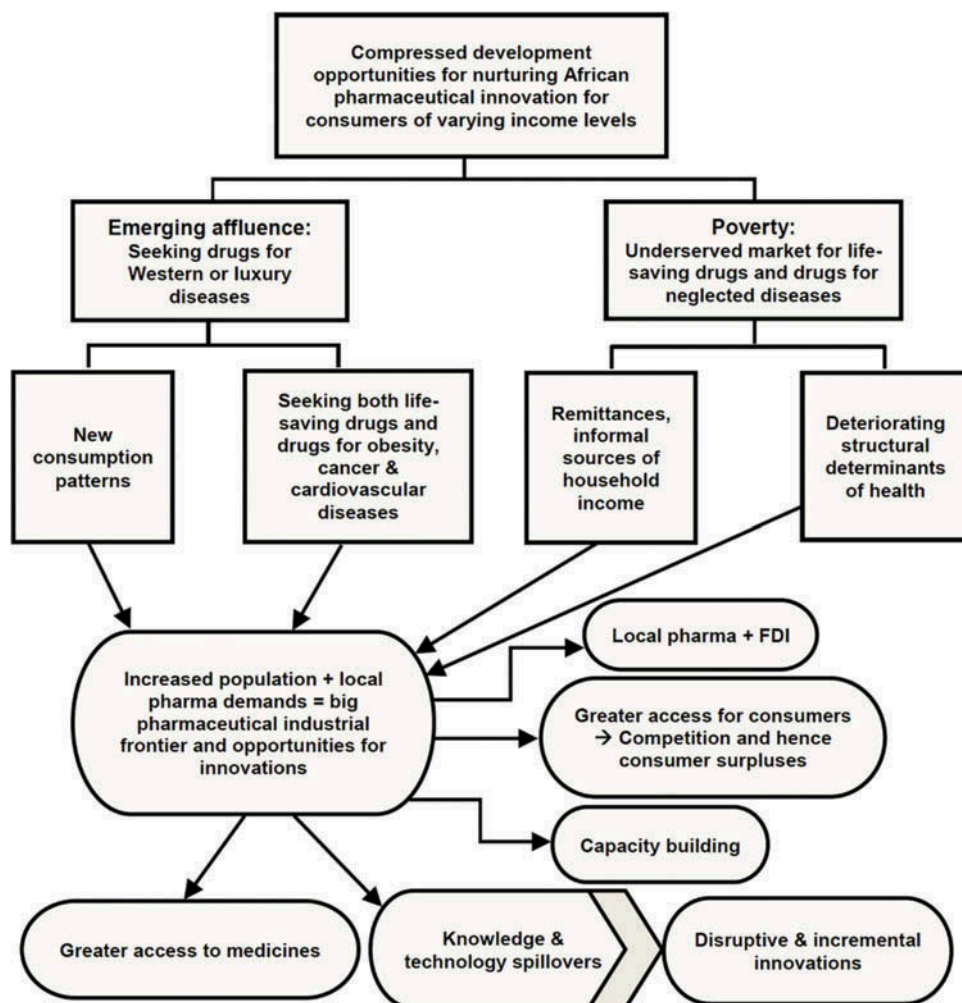
## 4. Discussion

### 4.1. New governance structure: CSSP approach for access to medicine

Generally, scholarship on access to medicine in developing economies employs two dominant approaches. First, *the governmental approach* (e.g. Stiglitz, 2006) emphasizes the responsibility of governments through formal public interventions. For example, Stiglitz and Jayadev (2010, p. 218) note that “fewer drug price controls, the extension of monopoly patent rights globally, limiting domestic market competition and maintaining exclusive marketing arrangements all have effect of increasing the price of pharmaceuticals, while potentially stimulating innovation”. Second, *the corporate approach* focuses on the theories and practices of the firm to explain the corporate responsibility of firms in increasing access to medicine (Osuji & Umahi, 2012). Both approaches are necessary but not sufficient when they are separated. Singularly, they both are inherently inefficient and ineffective since the lack of access can easily be attributed to both government (public health policy) failure and market failure

(Trouiller et al., 2002). For our purposes, this study argues for both approaches, leading us to CSSPs as a theoretical lens when looking at solutions to complex medico-techno-scientific and socioeconomic issues that can hardly be solved by single institutional or market actors. Such problems require the pooling of resources and actors from different sectors to create change (Reed & Reed, 2009; Selsky & Parker, 2005). Therefore, this issue-oriented study is positioned to contribute to the literature on CSSPs for value co-creation in the pharmaceutical sector—especially PPPs for neglected diseases (Kettler & Modi, 2001; Wheeler & Berkley, 2001). New themes in this theoretical domain are emerging, suggesting the state-of-the-art thinking about solutions to some of the world’s most intractable health problems—access to medicine. They include strategic collaboration between NGOs, government organizations and businesses (Austin, 2000), value creation from organization to organization (Austin, 2010), open innovation for global collaborations (Dandoloni, 2013), and stakeholder management in the hyper-turbulent healthcare environment (Rotarius & Liberman, 2000). At this juncture, what is missing are implementable strategies for making access to medicine a reality in WECS Africa (Macdonald, 2011a, 2011b; Morrison, 2012a, 2012b). A lot can be learned from both India and China, especially in generic production and packaging and making use of Africa’s untapped human resources. In Figure 3, we elucidate the structure of the pharmaceutical markets in WECS Africa and the institutional drivers that shape them.

**Figure 3. Innovations for sustainable global health in WECS Africa.**



#### **4.2. Limitation and future research agenda**

We want to be more nuanced about the claims in this issue-based article. It is hard to make any sweeping generalizations especially when looking at the changing social order, population growth, political reforms and fundamental changes in each country's institutional underpinnings. Africa as a continent is as diverse as it is complex. It is the neglect of this that leads to oversimplification and therefore to naïve one-size-fits-all solutions. The underdeveloped market has also meant that there is a dearth of literature dealing with current trends on the market. That means this issue-based article mostly sought to raise questions for future research whilst highlighting emerging pivotal trends that could possibly shape the industry. Further limitations of this article are that it is still an explorative study that will require follow-up studies in the future. Studies that seek to make theoretical and empirical advances in the pharmaceutical markets of Africa are long overdue and this study mainly points to that need without making theoretical or methodological contribution its main purpose. Emerging socioeconomic and techno-scientific realities call for sustainable ways of developing new therapeutic and prophylactic products and services for the unreached markets. This is a multidisciplinary field that can attract rich contributions from the fields of international business and management (focusing on the pharmaceutical sector), sociology, marketing, global health, social pharmacy and biosciences.

In terms of traditional medicines that are used side-by-side the Western orthodox medicines, there is no doubt that WECS Africa needs R&D investments in that area. The Taiwanese national insurance model with its extensive coverage of Western and traditional medicines is a good example of such public health innovations (Shih et al., 2008). Questions on how herbal medicines will decrease dependency on one hand and increase sustainable health on the other will be another area of focus in the future research.

Additionally, it will be interesting to study how various WECS African countries and regional trading blocs are dealing with their healthcare issues and how the normative regulatory and various institutional variables affect successes or failures of such projects. This will help in learning from the best practices and in tracking advancements.

Up till now, pharmaceutical production in Africa has mostly meant packaging. However, there is a new breed of young scientists who are developing new drugs in neglected diseases such as malaria (Chibale, Davies-Coleman, & Masimirembwa, 2012; Nordling, 2013). What is the role of institutions in ensuring that locally available human resources benefit from knowledge spill-overs? Interesting cases that will benefit from multiple methodological approaches and comparative studies are also needed. Moreover, the security of the pharmaceutical products hides itself inside our imagination but the reality cannot be grimmer. How can cross-sector collaborative investments encourage the opening of markets for quality and safe drugs for different market segments through local production?

What are the innovative business models for succeeding in the pharmaceutical market in Africa? Studies on this topic could identify the salient characteristics of successful business models of local firms/foreign MNCs that are already operating locally; such studies could also look at related examples in other emerging markets (e.g. Brazil, China). Drawing on case studies, interview data and available secondary sources, such studies could identify the unique capabilities and resources that help firms succeed in this context.

Further, the role of business/NGO partnerships in helping developed and developing countries-based MNCs to achieve legitimacy and fulfil their market potential in the pharmaceutical market in Africa could be a viable area worth pursuing. Again, such studies could identify existing local examples of successful partnerships, and/or look at related partnerships in other similar markets. The ultimate goal of such a study would be to make sense of what works/why/where and then develop "lessons" for success for firms facing similar challenges/opportunities in other contexts.



## 5. Conclusions

This issue-based article offers useful technical strategies and practical policy guidelines for actors in academia, business, NGOs, and policy making. Ten major issues were highlighted as they represent the major but neglected dynamics in the WECS African regions. The increasing intra-African trade, the booming e-commerce, the increasing purchasing power of households due to economic boom in both formal and informal sectors, the diaspora remittances that increase disposable incomes in households, the growing middle class, compressed development, the demographic dividend, increasing awareness about counterfeit drugs, WECS Africa's latecomer advantage, and changes in other socioeconomic determinants of health, all depict the attractiveness of the WECS African market for pharmaceutical business. Another major discovery is that infectious diseases are not the only health challenges in WECS Africa; chronic diseases such as diabetes are now very common. The indispensable roles of private sector in ensuring access to quality drugs in the context of WECS Africa have been explored. The advantages (new market frontier) and challenges (infrastructural and financial resources) have been highlighted. Existing discourses in professional journals and academia tend to favour CSSPs as the form of governance structure as the most viable mechanisms for creating pharmaceutical solutions to ensure access to medicines.

The perceived risk of doing business in Africa holds if we hold all things static. Nevertheless, Africa is socially dynamic, economically diverse, and institutionally vibrant and sometimes turbulent. Indeed, the socioeconomic climate in WECS Africa is changing fast. This is not an attempt at sugar-coating the myriad challenges being faced in Africa. Then again, how does dwelling on the problems help? There is a lot of literature about solving the problems, but most are simply impractical and artfully conjured writing rather than methodical science. There is enough evidence that without local efforts, Sustainable Development Goals and African Union Commission's plan (AUC, 2012) for reinvigorating the African pharmaceutical industry on health are never achievable. Many of the proposals are an intellectual accommodation aimed simply at calming nerves but not to permanently fix the problems from the BOP consumers' perspective through a restructured local pharmaceutical industry.

This article has proposed a change in paradigm from "what we can do for the others" to "how we can contribute through CSSPs", in making medicines available to various income groups in developing economies. To ensure sustainable development, an important sector that needs to be prioritized is the pharmaceutical industry. This can be done through frugal innovations (high quality-low tech, high volume-low cost that reaches those with low disposable income). Further, the creation of a favourable environment for FDIs and massive financial inputs for local industries to take off for real is an emergency. This is expected to boost sustainable economic development and to save lives as local resources are harnessed in the most cost-effective ways to create socially beneficial value. Public health policies should therefore be geared towards investment in local pharmaceutical industries to test active agents in plants that are believed to hold some hope for cure. Put together, innovative drug development through public health strategies, university projects and SMEs will mark the beginning of a new era of pharmaceutical innovations to make medicines accessible to the underserved.

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### Competing interests

The authors declare no competing interests.

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