Financial Aid and R&D Investment as an Alternative to DFA in Africa: Literature Review Paper

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1. Introduction

Financial aid can be characterized as money, physical capital, or resources sent to individuals, businesses, or governments that need them but lack funds (Hysa & Hoxha, 2014). In Africa, financial aid serves a double purpose of humanitarian and development assistance.

Since the post-colonial era, developed countries have made enormous contributions to help developing African countries in their path to development. This assistance has primarily been provided in the form of Development Financial Assistance (DFA)- commonly referred to as Official Development Assistance (ODA) among the 32 member-states of the Organization for Economic Cooperation and Development (OECD)'s Development Assistance Committee (DAC). The OCDE defines ODA as *technical aid*, *official grant*s, or *loans* promoting *economic development and welfare* of developing countries, and having *concessional terms*, with a grant element of at least 25 percent. The aid can be provided directly to countries in need or given to bilateral or multilateral aid agencies, like the World Bank or the United Nations, which then allocate the aid to countries and projects.

DFA has made progress in addressing key development challenges such as high inequality, low income, poor governance, high corruption levels, and low levels of financial development. However, its effectiveness is questionable when considering Sub-Saharan Africa's development. To define whether DFA is enhancing the opportunities for further development of a country, internal and external factors as well as the background of the country must be considered (McGillivray, 2005). Factors such as the *motives of aid*, *recipient countries' institutions and financial development, donor's economic conditions*, and *aid dependence* are essential when accounting for aid's impact on African countries.

First, aid's ineffectiveness might be attributed to *vested interests* behind their motives, whether financial or political. "A lot of investment in developing countries comes in the form of loans instead of grants" (Thirlwall, 1994). A "crisis of governance" can also be argued as a critical factor in low assistance impact. "Poor quality of institutions, weak rule of law, an absence of accountability, tight controls over information, and high levels of corruption" of nations in Sub-Saharan Africa (SSA) still undermine promises of development (Bräutigam, D. A., & Knack, S. 2004).

Moreover, financial development "plays an essential role in economic development by transferring funds from the surplus units to deficit units facilitating savings and investment" (Appiah-Otoo & Song, 2020). Microfinance and financial development can enhance the efficient allocation of private savings to both new and existing economic activities, expanding access to credit and providing consumption-smoothing safety nets. These mechanisms help address disparities in access to development assistance while also contributing to a reduction in income inequality by narrowing the gap between the rich and the poor (Lassoued, 2021). However, financial frameworks in SSA are largely flawed and underdeveloped, hosting state-controlled banks with weak legal and regulatory systems.

Finally, the economic conditions of donor countries have had deeper ripple effects on recipient nations. Namely, financial crises in the developed world have taken a higher toll on developing countries, working restrictions on financial aid flows. *More volatile and unpredictable DFA shocks prove to be a severe macroeconomic challenge to countries of the continent*. Aid dependence is also seen as a core problem for the development of Sub-Saharan African countries. It is defined as "a situation in which a government is *unable to perform many of the core functions of government*, such as the maintenance of existing infrastructure or the delivery of basic public services, without foreign aid funding and expertise" (Bräutigam, D. A., & Knack, S. 2004). This is a problem because highly dependent nations struggle to raise internal funds and lose autonomy on resource allocation matters. This makes it difficult for these countries to achieve what Roger Riddell called a "self-sustaining development".

In contrast, Research and Development (R&D) investment presents a promising alternative to DFA. R&D involves systematically and logically applying creative thinking processes to expand human, cultural, and societal knowledge while developing new applications based on existing insights (UAE Ministry of Finance, 2024). This type of investment has the potential to deliver what Simpkin (2019) referred to as "Africa-led solutions" by adapting advanced technologies from the "developed world" to address Africa's unique needs and challenges. Theoretically, R&D fosters precisely what Africa requires most: innovation and entrepreneurship.

However, R&D investment in Africa remains minimal, particularly in Sub-Saharan Africa, where the average share of R&D expenditure is only 0.4% of GDP—significantly lower than Portugal's 1.7% (Statista, 2025) and the United States' 3.4% (National Science Board, 2024). Furthermore, there's a lack of robust R&D institutionalization within the continent. This underinvestment perpetuates a cycle of aid dependency, as public expenditure on R&D in Sub-Saharan Africa heavily relies on foreign-funded projects. According to UNESCO Institute for Statistics data, such contributions account for a notable or even substantial share of total R&D inputs.

Achieving self-sufficiency and sustainable growth in Africa requires a concerted effort to break this pattern of dependence. A substantial and strategic "big push" in R&D investment could serve as a crucial starting point to drive innovation and lay the foundation for long-term development.

This paper evaluates the effectiveness of DFA as a source of financial aid in Africa and explores the potential of R&D investment as a viable alternative. The analysis is structured as follows: (1) a historical review of the economic and political contexts that have influenced the type and magnitude of aid provided to African countries; (2) a literature review on the effectiveness of DFA in addressing various dimensions of regional development; and (3) an examination of the recent history of R&D investment in Africa, with a comparative analysis of its impact and interrelation with traditional aid mechanisms.

2. History of Financial Aid in the African context

The history of foreign aid in Africa reflects a complex interplay between economic dependency, external interventions, and the continent's quest for sustainable growth. The legacy of colonialism profoundly shaped Africa's initial economic structures, leaving economies focused on raw material exports with limited industrial capabilities. Following decolonization, African nations sought to redefine their place within international economic frameworks, navigating a complex landscape of foreign aid, debt, and structural reforms. Over the decades, financial aid has served as both a lifeline and a source of contention, reflecting the tension between external interventions and Africa's own development goals.

2.1. Defining the post-colonial framework

Following independence in the mid-20th century, African nations faced burdensome economic challenges. The colonial focus on export-oriented economies left them reliant on primary commodities with limited industrial capacity. *Political independence did not equate to financial autonomy*, as newly sovereign states grappled with weak institutions and limited resources. During the Cold War, aid from Western and Eastern blocs often served geopolitical purposes, with donor countries supporting regimes aligned with their ideological interests. Nations like Tanzania, under Julius Nyerere's socialist experiment, sought self-reliance, while others embraced capitalist models. However, neither system could insulate economies from global shocks, such as declining commodity prices and the oil crises of the 1970s. These events exacerbated fiscal instability, leading to mounting debt and declining social services (Park, 2018).

2.2. International Organizations Interventions and Structural Adjustment Programs

In response to worsening economic crises in the 1980s, the International Monetary Fund (IMF) and the World Bank adopted an interventionist approach in support of African nations with the so-called Structural Adjustment Programs (SAPs).

Rooted in neoliberal principles, these programs were aimed at economic stabilization, via macroeconomic stability, balance of payments adjustment, and economic reforms to ensure growth on a sustainable basis. To achieve this, they relied on three key components. First, *policy-based loans* were introduced to provide financial assistance contingent upon specific policy agreements or concessions. Second, *conditionalities* were established, requiring the implementation of predetermined measures either before the loans were granted or progressively over a transitional period, in the case of adjustment loans. Lastly, they emphasized *policy advice*, which was based on the premise that market inefficiencies, excessive state control, and price distortions were the fundamental causes of poor economic performance (Noyoo, N., 2022). Ghana was the first African country to adopt SAPs in 1983 (Frimpong, F. B., 2021). In Zambia, SAPs led to the privatization of state-owned copper mines (Noyoo, N., 2021). In Nigeria, currency devaluation was a key condition of its adjustment program (Unya, I.U. and Atuonwu, C.I., 2020). In the late 1980s, 44 African countries had their economies restructured under loan agreements (Lartey, 2024).

Influenced by the Washington Consensus in 1989, these policy-based loans tied to stringent conditionalities sought to address structural weaknesses in African economies by promoting competitiveness and market efficiency. SAPs focused on internal devaluation, including cuts to public expenditure, wage freezes, and reduced domestic demand, alongside external devaluation through exchange rate liberalization. Governments were encouraged to dismantle price controls, abolish subsidies, and privatize state enterprises. The intent was to foster macroeconomic stability by correcting distorted price mechanisms, reducing deficits, and containing inflation (Noyoo, 2022). However, the implementation of SAPs often yielded mixed results. *While they temporarily alleviated fiscal crises, the associated social and economic costs were severe* (Frimpong, 2021).

The debt burden further constrained policy autonomy. By the 1980s, African economies were mired in a cycle of borrowing to repay existing loans, deepening their dependence on international financial institutions. Subsequent adjustments by the IMF broadened conditionality measures, emphasizing reforms in exchange rates, interest rates, and pricing mechanisms. Nonetheless, *economic stagnation persisted*, leaving many African nations trapped in a precarious relationship with aid and debt (Unya & Atuonwu, 2020; Bawa & Ateku, 2020).

2.3. Debt Relief Programs

In the 1990s, as Sub-Saharan Africa's external debt escalated dramatically—from 24.9 percent of GDP in 1973 to 70 percent by the mid-1990s, according to the JICA Research Institute—the IMF and the World Bank introduced the Heavily Indebted Poor Countries (HIPC) Initiative.

According to these two Bretton Woods organizations, this debt relief program aimed to alleviate the unsustainable debt burden of the world's poorest economies, ensuring they were not overwhelmed and could focus on sustainable development. The HIPC initiative involved a two-phase process. The first phase, known as the *decision point*, entailed a formal assessment of a country's eligibility for debt relief. At this stage, temporary relief was provided, contingent on the fulfillment of specific criteria, such as demonstrating a satisfactory track record under IMF and World Bank programs. The second phase, the *completion point*, signified the stage at which countries were granted permanent debt relief (Rustomjee, 2017). This program along with the Multilateral Debt Relief Initiatives (MDRI) that came along helped HIPC countries lower fiscal deficits and public debt to sustainable levels. Moreover*, they allowed low-income African economies* to *reallocate funds from debt repayment to development*.

2.4. The New Century in Africa

The Millennium Development Goals (MDGs) marked the new trend in aid to Africa at the beginning of the 21st century. According to the World Health Organization, these 8 goals were agreed upon by United Nations Member States as part of a global commitment to address key challenges, such as poverty, education, gender equality, and health, to achieve them by the year 2015. Moreover, non-governmental organizations (NGOs) became more important in closing the gaps left by government-led initiatives and donor priorities. *Despite the OECD countries holding a monopoly position in ODA since the 1960s*, *this stance started to be challenged by many new aid organizations*, *including multilateral*, *bilateral*, *non-governmental*, *and philanthropic organizations*, for example, the Bill & Melinda Gates Foundation. Also, several nations joined the donors club, categorized as "emerging donors" by the OECD these included South Africa, Brazil, the Commonwealth of Independent States (CIS) countries, China, Korea, India, Malaysia, Thailand, and Turkey (Chaponnier, C. 2009). During this period, the primary focus of the discourse on financial aid was improving its effectiveness. So, "for the first time in history, with the Paris Declaration on Aid Effectiveness in 2005, benchmarks were set for donor practice" (Kaberuka, D. 2011).

The current framework for international aid in Africa aligns closely with the United Nations' Sustainable Development Goals (SDGs), which emphasize addressing climate change, fostering sustainable economic growth, and promoting inclusive development. These goals span a wide range of development targets aimed at eradicating poverty and deprivation by 2030 while respecting the planet's ecological boundaries. This 2030 Agenda is harmonized with the African Union's Agenda 2063, which aspires to accelerate the implementation of both past and ongoing continental initiatives to achieve growth and sustainable development (Prady, D., & Sy, M. 2023).

2.5. China as a new player

In the 2000s, China assumed a prominent role in Africa. In the first seven years of the new century, trade between these two fractions increased from ten billion to seventy billion US dollars, *making China the biggest supplier of the African continent and its second trading partner behind the US.* Also, Chinese investment in Africa has been increasing accordingly. In the first decade, there were around 800 Chinese firms in Africa, mainly present in the oil and mining sectors, textiles, electronics, and telecommunications. Regarding aid, China emerged as one of Africa's largest bilateral donors. However, there's a lack of quantitative data on this aid's type and amount. The known developments are based on issuing press releases after ministerial visits and conferences. In the Beijing Summit of the Forum on China-Africa Cooperation in 2006, China stressed the growth of its commitment to Africa announcing substantial aid packages, debt forgiveness, and infrastructure funding (Chaponnier, C. 2009).

2.6. Final remarks

The history of financial aid in Africa reveals a continuous interplay between external assistance and the continent's pursuit of self-reliance and sustainable development. From post-colonial economic challenges to structural adjustment programs, debt relief initiatives, and the evolving dynamics of global partnerships, Africa's journey highlights both the opportunities and pitfalls of foreign aid. As the continent faces the future, its alignment with global frameworks like the Sustainable Development Goals and its increasing engagement with non-traditional partners, such as China, signal a shift toward a more diversified and dynamic approach to development. As this chapter concludes, the success of Africa's financial aid strategy will depend on harmonizing external contributions with domestic priorities, ensuring that aid fosters empowerment, resilience, and long-term growth.

3. Effectiveness of Financial Aid in fostering African development

As discussed in the previous chapter, the conditions and the donors of financial aid have changed a lot throughout history, influenced by the economic contexts of both donor and recipient countries. In this present chapter, the analysis will now be focused on financial aid effectiveness, a topic that has generated considerable debate in the development economics field. This will also explore how historical changes discussed earlier intersect with the conclusions regarding aid effectiveness.

This part of the review will be based on various papers that approach the effectiveness of the aid measured by its impact on (1) Financial Development; (2) Institutional Development, Corruption, and Governance; (3) Inequality; (4) Growth; (5) Aid Dependence and Moral Hazard.

Overall, the research gathered in this study thoroughly points to the initial levels of financial and institutional development, as well as the transparency and accountability standards set out in contracts as being key determinants of aid's effectiveness. Nonetheless, particularities both in time as much as in country/region must also be considered before drawing any aggregate conclusions regarding the effectiveness of the financial aid.

3.1. Financial Development

Financial Development is the set of processes of "reducing the costs of acquiring information, enforcing contracts, and making transactions" (World Bank, 2016). In Africa, it's described as "underdeveloped, and it is mainly dominated by government-owned banks, with a weak legal and regulatory system, high levels of corruption, insufficient accounting measures, and inefficient allocation of funds" (Song et al., 2022). Financial development is a *core facilitator of growth*, most importantly by channeling savings into investment through credit, increasing capital accumulation, and hedging against risk, while facilitating labor and capital productivity (Song et al., 2022).

Financial aid is argued to have a positive effect on financial development, especially from sector-specific aid (Maruta, 2019). Aid's impact on the financial sector is usually seen through the *coverage of the shortcomings of native markets and governance*, *expanding financial inclusion, improving of financial system infrastructure, and enhancing access to credit to families and microentrepreneurs.*

The reverse causality is also true. In *Foreign Aid—Economic Growth Nexus in Africa: Does Financial Development Matter?* by Song et al. (2022), domestic credit as a percentage of GDP and money supply (World Bank standard indicators for depth of financial development) are the used proxies for financial development levels. The study shows that financial development correlates with greater foreign aid growth elasticities at higher indicator values. A study by Aluko et al. (2020) also establishes a threshold financial development level for FA to correlate positively with Foreign Direct Investment growth, suggesting a nexus between FA effectivity and attraction of FDI. Overall, *Financial development seems to ensure better management and allocation of donors' resources in FA programs*. This might suggest a positive feedback loop between aid and financial development in Africa.

3.2. Institutional Development, Corruption, and Governance

Financial aid can also affect a country's institutional development, corruption, and governance standards. A nation's good performance in those three fields is key to increasing transparency, accountability, and efficiency in the allocation of public resources. Furthermore, these frameworks foster private investments, as they ensure property rights and reduce regulatory unpredictability. These remarks are extensively discussed in development economics literature (Gupta et al., 2002; Kaufmann et al., 2009; Acemoglu & Robinson, 2012). Finally, it's worth noting that since these factors are interconnected the analysis will approach them collectively.

Overall, literature usually points to the fact that if the aid is practiced without clear performance goals or policy requirements, i.e., the 'traditional' way of simply transferring funds, it is unlikely to contribute to the development of the recipient country's institutions or governance parameters, often harming them instead (Mosley et al.,1995; Devarajan et al., 2000; Dollar and Svensson, 2000).

Bräutigam's book (2000) expands on the channels that lead to this drawback in recipient countries: (1) accommodation with aid inflows by politicians who aren't committed to reform policies; (2) aid becoming part of the system of patronage and political survival; (3) lack of accountability and transparency in many aid contracts; (4) reduced government ownership of reform and development initiatives.

In light of these undesirable effects of aid in recipient countries donor nations and their institutions have changed the way the financial assistance has been given over time to a more *performance-based approach*, *which requires higher levels of accountability and transparency*, as well as reforms and public policies to be implemented along with them. Historically, this was most notably seen during Debt Relief Programs, as discussed in section 2.3.

Finally, there's also a reverse causality to be pointed out: institutional development and governance are key determinants to aid's effectiveness in improving several measures of social and economic development (Burnside & Dollar, 1999), as it will be seen throughout this chapter.

3.3. Inequality

In the 21st century, the rise of the aforementioned Sustainable Development Goals (SDGs) brought the objective of "leaving no one behind" to the center of the discussion. In that regard, the issue of inequality has risen among one of the most important ones to be addressed by aid, as it is well documented by the literature that extreme inequality is detrimental to a nation's development, harming its peace and security, as well as it generates unemployment and compromises economic growth. (Kuznets, 1955; Clarke 1995; Barro, 2000; Stewart, 2011)

Academic studies on the effectiveness of foreign aid in reducing inequality often indicate that contrary to its intended purpose, aid tends to exacerbate inequality. This conclusion is reached by Herzer and Nunnemkamp (2012), Pham (2015), and Sharma and Abekah (2017). In Younsi et al. (2019), researchers find that unless aid goes hand-in-hand with the implementation of institutional reforms and regulations, it will have a negative effect on inequality.

Moreover, Lassoued (2021) finds a heterogeneous impact of financial aid on inequality: in the countries where there's a greater initial financial development, the results point towards a fall in inequality from the aid inflows. Alternatively, if a country's financial system is poorly developed and too reliant on banks solely, aid will produce harmful effects on inequality.

These papers highlight some of the reasons *why aid*, which was supposed to foster economic and social prosperity, *is hampering income inequality in recipient countries*. Key factors include (1) the capture of the aid by the economic/political elites due to weak institutional capacity; (2) favoritism in aid allocation to sectors/recipient groups that are politically favored by donor countries; (3) lack of financial development which could channel income-generating activities sparked by capital inflows given by aid; (4) inflationary pressures caused by large inflows of aid; and finally (5) aid dependency and discouraging of investments and local reforms. As seen above, aid's effectiveness on inequality depends on a lot of factors that can be summarized into the *recipient's capacity to properly address the capital inflow*, *but also the donor's responsibility in giving adequate amounts of aid in an unbiased manner*.

3.4. Growth

Theoretical and empirical inconsistencies undermine any conclusions on the Financial Aid-growth nexus. Two different sides seem to have formed among researchers, even between contemporaries (Song et al., 2022), as opinion is still fractured as the discussion advances.

Financial Aid is argued to be a viable tool for economic growth, however, undermined by a lack of institutional and financial development. At the start of the millennium, Burnside and Dollar published a seminal paper on *Aid, Policies, and Growth* (2000), having established a positive correlation between FA levels and growth in a study of 56 nations in the wider developing world. Financial aid is argued to have a positive effect on growth when it enables the transfer of knowledge, managerial expertise, technical know-how, and funding. However, other authors, such as Song et al. (2022), found a negative nexus between sector-specific aid in health, agriculture, education, and humanitarian assistance and economic growth, suggesting financial aid to be detrimental to sustainable growth, due to the lack of reliable and consistent investment on infrastructure and education, among others. Overall, *the literature splits on where the balance of the effects of financial aid rests concerning growth*, *especially in the medium and long term*.

3.5. Aid Dependence and Moral Hazard

Research also tackles donor-recipient relations in a framework of aid dependence and globalization, specifically in how they serve donor and recipient interests asymmetrically. Weiler and Sanubi (2019), for instance, *rejected the previous older presumption that aid allocation models follow donor interests instead of recipient needs or recipient merit*.

Moral hazard is also analyzed in donor-recipient relations, *concerning recipients' dependency-reinforcing behavior and donor institutions' low accountability for aid projects'* *success or failure* (Bräutigam & Knack, 2004). In this regard, high debt levels in recipient countries perpetuate borrowing cycles, as nations take new loans to cover interest on existing debt – a dynamic that *exacerbates these countries' dependence on aid* (Bräutigam and Knack, 2004). Additionally, within donor agencies, the absence of internal sanctions on staff when grants or aid programs fail induces risk-seeking behavior at additional cost and efficiency loss that remains unattached to the aid agencies themselves.

Additionally, most literature either references or examines the aforementioned *Aid Dependence* in recipient countries, which has become a common trend in African countries. Aid dependence is defined as "a situation in which a country cannot perform many of the core functions of government (…) without foreign aid funding and expertise. As a proxy for this, we use a measure of "intensity" of aid: countries receiving aid at levels of 10 percent of GNP or above" (Bräutigam, 1999).

The main reasons for a country to be found in aid dependence situations usually relate to (1) lower tax ceilings (tax revenues as a proportion of GDP); (2) poor governance; (3) lack of political effort to make budget adjustments, leaning on aid to cover for overspending and corrupt bureaus within public administration (Bräutigam and Knack, 2004). These characteristics are highlighted, as they hamper a country's financial and institutional capacities, preventing it from becoming self-sufficient in providing basic humanitarian needs in the long run.

Finally, it is worth noting that this unfortunate reality of Aid Dependence was salient during the 2008 Global Financial Crisis, as the recession propagated to the aid-seeking developing world because *FA inflows were strained by the crisis and shortage of resources in donor countries* (Das & Dutta, 2013).

3.6. Final Remarks

As discussed in this chapter, aid's effectiveness across the various fields that measure economic and social development varies a lot depending on the country and period. However, some traits are decisive to a positive outcome of this capital assistance: (1) the initial level of financial development of a country, which will be key for private agents to be able to encompass income-generating activities based on the aid inflows, thus generating multiplier effects; (2) the initial level of institutional development and governance of a country, which will ensure that aid's money is used according to its goals and that the necessary policies and reforms are being carried out along with the aid; (3) the level of transparency and accountability in the form that aid's contracts are designed, which reduces the possibility of aid's overdependence and moral hazard in recipient contracts, as well as enhances efficiency of money allocation. Therefore, to improve the effectiveness of aid, donor and recipient countries must be mindful of these three aspects and how to address them.

4. R&D Investment as an alternative to DFA

4.1. R&D in Africa Overview

Why do developing countries, with great potential gains from adopting technologies from industrialized countries, fail to do so? According to a World Bank study, firms and countries *need to develop an "absorptive" or "national learning" capacity*, which is hypothesized to be a function of spending on research and development (R&D). Knowing where the frontier is and determining what adaptations are necessary is an important "second face" of R&D (Lederman and Maloney 2003). Moreover, Pavitt (2001) argues that investment in pure research is also important for developing countries. A strong foundation in basic scientific research helps train a skilled workforce capable of solving industry-specific challenges. Moreover, *even basic research does not flow easily or without cost across borders, making it difficult for developing nations to rely solely on advancements from developed countries*. Factors such as intellectual property restrictions, high costs, and the need for local adaptation further limit access to foreign research. By building their own research capabilities, developing countries can generate locally relevant solutions, strengthen their technological progress, and reduce dependence on external knowledge.

Therefore, R&D is crucial for African countries striving to reach higher levels of economic development. However, investment in R&D remains significantly low. Despite accounting for 15% of the global population, Africa contributes only about 1% of total global R&D investment.

Beyond the limited financial resources that compel African governments to prioritize the immediate needs of their populations over long-term solutions, this poor level of investments can be attributed to what Mouton called in 2008 a state of "de-institutionalization" of science that Africa experienced during the challenging decades of the 1980s and 1990s. During these decades, Africa's scientific production was marked by weak, fragmented, and chronically underfunded institutions. Several factors contributed to this landscape, including structural adjustment policies imposed by the World Bank, the enduring legacy of colonial-era science, the disruptive impact of political instability and civil wars, the influence of international organizations in shaping research priorities, low public investment by African governments, and the persistent effects of brain drain

As part of the SAPs, the World Bank decided to prioritize expenses on basic education rather than higher education. As a result, many African universities—traditionally the primary, and often sole, sites for scientific knowledge production in Africa—were driven into a financial crisis.

Africa's contribution to global science declined by 11%—with Sub-Saharan Africa experiencing a sharper drop of 31%—as the number of papers published in the citation indexes of the Institute for Scientific Information steadily decreased relative to global trends. R&D and scholarship suffered a major setback. Moreover, while international development and aid organizations such as Sida/SAREC, NORAD, and Carnegie in African countries provide significant benefits such as funding, facilities, and employment to local scientists, they operate independently of the national science system of the host country and *do not significantly contribute to the development of national institutions* (Musyoka and Marsh 2018).

The *Brain Drain*, defined by the European Commission as the emigration of qualified people whose skills are scarce in their place of origin, is probably the most critical source of the decline of African R&D during the 1980s and 1990s and continues to be a major challenge. Since 1990, Africa has experienced an annual loss of at least 20,000 skilled individuals, with over 10% of Sub-Saharan Africans holding graduate degrees choosing to leave the continent. This exacerbates the challenges faced by African universities, including *a shortage of highly qualified researchers*. A 2013 survey by the UN Economic Commission for Africa revealed that *fewer than 50% of researchers and lecturers in nine African universities held PhDs*, highlighting the critical gap in advanced academic qualifications.

The lack of researchers in Africa is also an issue that hampers R&D investments. According to UNESCO, Africa had 198 researchers per million inhabitants in 2014. This compares with 428 in Chile and more than 4000 in the UK and the USA. Within Africa, there is a further disparity between countries. An estimated 878 researchers per million inhabitants in North Africa compares with 88 per million in Sub-Saharan Africa.

In Africa, *most research publications are produced through collaborations with international coauthors*, *rather than with local counterparts*. A majority of these coauthors are affiliated with institutions outside Africa. While international collaborative projects with high-income countries hold significant potential, they also raise legitimate concerns. Such partnerships can often be imbalanced and inequitable, disproportionately advancing the careers and priorities of researchers outside Africa (Simpkin et al.2019).

With all the adversities faced by R&D investments in Africa as described above, countries are failing to realize their goal set in 2007 of committing at least 1% of GDP in R&D. *Across Sub-Saharan Africa, the average share of GDP devoted to R&D activities was only 0.4% in 2015*. Countries closer to the 1% target included Egypt, Kenya, Mali, Morocco, South Africa, and Tunisia while countries including Algeria, Cabo Verde, and Lesotho invested less than 0.1% of GDP in R&D. Big regional disparities characterize R&D Investment in Africa. In 2016, Egypt, Nigeria, and South Africa contributed 65.7% (14.66 billion US dollars) of the overall R&D spending. Unlike what happens in most developed countries, R&D in Africa is mainly funded by the public sector, with significant proportions coming from international funding. In 2015, *foreign sources contributed significantly to R&D expenditures* in Ghana (31%), Senegal (41%), and Burkina Faso (60%). South Africa has been an exception, hosting substantial private-sector support. Moreover, data on R&D investment are extremely limited for many African countries.

Despite this unfortunate scenario, things are slowly beginning to change in Africa around the dawn of what many consider the 'African century,' and R&D investment was no exception. In 2012, according to a study conducted by the Centre for Research on Evaluation, Science and Technology (CREST), there were about 120 initiatives aimed at enhancing higher education in Africa over the previous three decades. In 2013, the governments of Benin, Burkina Faso, Cameroon, The Gambia, Ghana, Nigeria, Senegal, and Togo launched the Africa Centres of Excellence (ACE) with the support and financing of the World Bank. This landmark project aims to foster regional specialization and enhance participating universities' capacity for quality training and applied research on regional development challenges. In April 2014, the World Bank announced the provision of 150 million US dollars to finance 19 of these Africa Centres of Excellence (ACE). Today, there are a total of twenty-two ACEs in the region.

Additionally, African-led initiatives like the African Academy of Sciences' Alliance for Accelerating Excellence in Science in Africa (AESA), created in 2015, and the Coalition for African Research and Innovation (CARI) are working to address these imbalances. By fostering a coalition of African leaders, philanthropists, and international funders, these initiatives aim to build a well-coordinated, adequately funded, and innovative African R&D community while strengthening research infrastructure across the continent (Simpkin et al.2019).

4.2. Benefits of R&D investment in Africa

R&D investments play a determinant role in fostering innovation and driving sustainable economic growth. Globally, economic scholars argue that *innovation is a key determinant of productivity and economic advancement* (Callegati, Grandi, and Napier, 2005). In developed countries, high levels of R&D expenditure have been strongly correlated with technological transformation, which is a primary driver of economic growth (Siyanbola, 2011; Akcali and Sismanoglu, 2015). However, this relationship has been less studied in the context of Sub-Saharan Africa (SSA), where R&D expenditure remains low and inconsistent. Understanding the broader global significance of R&D and innovation offers insights into how these investments can be effectively harnessed in SSA.

4.2.1. Global Impact and Relevance of R&D and Innovation

Across countries, research and development are critical for fueling innovation, national development, and economic growth. However, achieving success requires strong political will and effective synergy between academia and industry. On the one hand, for research to yield practical benefits, its results must shape socio-economic policies and address societal needs. South Africa's universities, for instance, play a primary role in national development and are vital to success in a knowledge-based economy (African Journal of Hospitality, Tourism and Leisure, 2014).

On the other hand, the relationship between innovation and economic growth has long been established. In "The Wealth of Nations" (1776), Adam Smith highlighted how technological and intellectual advancements fuel economic prosperity. Building on this foundation, Schumpeter (1934) emphasized that innovation—through new products, production techniques, and market creation—is a key driver of economic progress. Later, Solow (1957) incorporated technological improvements into formal economic growth models, identifying them as key contributors to GDP growth.

Universities and industries contribute significantly to innovation ecosystems by fostering research, technological advancements, and knowledge spillovers. South Africa's initiatives, such as the Square Kilometre Array project and the Support Programme for Industrial Innovation, exemplify the impact of aligning national strategies with R&D priorities. These efforts underscore the importance of creating environments conducive to innovation and research to compete in global markets effectively (African Journal of Hospitality, Tourism and Leisure, 2014).

4.2.2. R&D Investments in Sub-Saharan Africa

Studies have demonstrated that R&D investment in SSA yields significant benefits, particularly in sectors like agriculture. For instance, agricultural R&D has been shown to improve productivity, reduce rural poverty, and enhance food security. Benfica and Nin-Pratt (2021) found that a 1% increase in agricultural R&D knowledge stocks has been associated with a 0.218 percentage point reduction in extreme rural poverty and a 0.132 percentage point decrease in undernourishment annually. These outcomes underline the critical role of R&D in addressing structural challenges such as food insecurity and poverty, which are prevalent across the region.

Moreover, empirical evidence highlights the impressive returns on R&D investments in SSA. A review of food and agricultural R&D reported an average internal rate of return of 42.3% per year (Wageningen University Research, 2020). These returns not only justify increased investment but also showcase R&D as a highly efficient tool for driving economic development. However, the volatile nature of R&D funding in the region—primarily due to low government commitment and reliance on short-term donor financing—hinders sustained progress (Springer, 2015). *Stable, long-term investments are essential for ensuring that R&D can effectively contribute to economic transformation*.

Innovation stemming from R&D is also a critical enabler of technical progress. Defined by the OECD (2015) as the creation or significant improvement of products, processes, or organizational methods, innovation enhances efficiency and competitiveness. *In SSA, technological advancements facilitated by R&D have the potential to lower production costs, improve product quality, and boost market competitiveness*. These benefits extend to other sectors, including manufacturing and services, where innovation can drive diversification and resilience against global market fluctuations.

While much of the existing research focuses on developed economies, the limited studies on SSA highlight an urgent need for more localized investigations into the interplay between R&D expenditure, innovation, and governance. Effective governance is a critical enabler of R&D's success. As highlighted in Chapter 3, Section 3.2, and by Rodrik (2008) and Acemoglu and Robinson (2012), good governance facilitates resource allocation, policy implementation, and the overall effectiveness of developmental initiatives. Poor governance, by contrast, undermines the transformative potential of R&D, leading to suboptimal outcomes.

To unlock the full benefits of R&D investments, SSA governments must prioritize sustained funding and create conducive environments for innovation. *Combining increased R&D expenditure with improved governance structures can foster technological transformation*, *enhance productivity*, *and drive long-term economic growth*.

4.3. Comparison of R&D investment with DFA

After thoroughly discussing the effectiveness of financial aid in its traditional form in African countries in Chapter 3 of this report and after debating the benefits of R&D investment for those nations in the previous sections of this chapter, it is possible to draw a comparison between those two types of support that are being given to countries in need of humanitarian aid. However, before reaching any conclusions, it is important to point out that while the literature on the traditional form of aid is extensive and deeply discussed, the academic review on R&D investments is not so, as this type of help is still very discreet in African countries, as shown through the numbers laid out in section 1 of this chapter.

It was discussed earlier how financial aid can be key to fostering a nation's development, by propelling economic growth, reducing inequality, and having a positive effect on the levels of financial development. However, the effectiveness of these impacts largely depends on a country's ability to ensure that funds are allocated appropriately and to maximize the multiplier effects of capital inflows. Therefore, the initial level of financial development of a country, the quality of institutions and governance in place, and the level of transparency and accountability on aid contracts play a major role in defining its effectiveness. If those traits are not in place, aid could have a detrimental effect by worsening institutions, corruption, and inequality.

Furthermore, another issue discussed with the traditional forms of aid is that it often leads to a high level of dependency, where recipient nations become reliant on external funds to perform several governmental functions, undermining their capability of being self-sufficient in the long run. Finally, aid inflows can also be highly influenced by economic fluctuations in donor countries, *making them an unstable source of capital inflows*.

On the other hand, while the institutional traits mentioned earlier are also crucial for the effectiveness of R&D investments, the literature review done in the previous sections points to a potential upside in such inflows compared to the shortcomings of traditional aid forms. In a nutshell, this can be stated because *R&D creates knowledge and long-term perspectives that empower societies to be self-sufficient in addressing their system challenges and humanitarian needs*.

When comparing R&D investments to the weaknesses discussed in traditional forms of aid, it can be said, first, *that R&D inflows are potentially less vulnerable to governance and corruption issues*. That is the case because they're done in partnership of government, private companies, and universities and research centers, creating environments that produce accountability and efficiency.

In that sense, capital can be more efficiently allocated to innovations that are fundamental to the country's needs, as researched by the universities in contact with society. This poses a contrast to the traditional forms of aid in which money is distributed without a clear direction and with dubious goal-setting mechanisms attached to it.

Additionally, R&D investments can reduce the recipient countries' long-term dependence on external inflows by reducing their needs to import goods and technology, but also by diversifying and modernizing their economies, improving their capacity to compete in global markets. Finally, since those inflows are a part of long-term projects which require a greater level of commitment and predictability in the contracts' design, they tend to be less susceptible to economic cycle fluctuations in donor countries, granting a steadier inflow of capital over the years.

However, despite the notion that R&D inflows present potential upsides compared to all the flaws in the traditional forms of aid discussed above, SSA countries face short-term challenges on the most basic humanitarian needs, such as starvation, poverty, and health-related emergencies. Considering that scenario, the traditional forms of aid, which are more important in tackling short-term needs, can't be ruled out of the equation. This suggests that FA and R&D investments *are not perfectly substitutable, they complement each other and will continue to do so in the future.*

4.4. Final Remarks

As discussed throughout this chapter, R&D investments have historically been insignificant in SSA countries. This is an adverse reality given that those inflows are key for the long-term economic independence of a country, while also presenting themselves as potentially a more efficient alternative to the traditional forms of aid. Finally, it's worth mentioning that the traditional forms of aid can't be completely ruled out, as SSA countries have a lot of short-term humanitarian needs that are better tackled by those types of capital inflows. Therefore, our literature review points out to the conclusion that those two types of funds should be complemented, thus addressing urgent social needs while improving a country's long-term economic stability, independence, and institutional development.

5. Conclusion

Financial Aid has prompted more than half a century's worth of discussion, and yet a conclusive opinion remains at large. A study of its effectiveness in tackling inequality and delivering growth has turned out to be a study of the quality of the local political and economic institutions. Because aid relies on local governance, and on the channels created by the political establishment, effects on growth and inequality are largely case-specific. *Aid fails when it reinforces rent-seeking behavior from the politically influential*, leading to a situation of aid dependency. Donor institutions must create a system of checks and balances that enforces accountability and ensures results. Otherwise, *recipients face a double loss of sovereignty*: *over national debt*, *and control over key industries and resources if collateralized*, *and over their own financial destinies*, *under increased exposure to crisis not of their own making*.

Meanwhile, *Research and Development could be possible in a framework of financial and scientific collaboration between African nations and the European/Western world countries*. Additionally, these countries should aim to cooperate much more with one another, in a multi-national system like the European Union's. And if sustainable growth is attributable to technology and its progress, it is only from research and implementation of new technologies in industry, health, and agriculture that African nations can close the gap on the developed and emerging worlds. *A* *strong institutional backing from research centers and universities is necessary to train and retain researchers*, *but not sufficient*. Wider political security is fundamental for enabling effective government that employs its assets functionally and without blatant corruption. This is true for any other provision of services, from health to education.

Still, a complete comparative study between R&D-applied FDI and FA is lacking. Even broader studies on FDI and FA, that are specific to other areas of foreign investment activity, like infrastructure or mining, lack a comparative objective. Most often, the cross-effects under study are either of a reinforcing or obstructive nature – whether FA can attract FDI or not. This suggests that FA and FDI (including R&D-applied investment) *are not perfectly substitutable and have required and will continue to require one another*.

Finally, aid dependence and its symptoms can still be reduced, however, if political institutions establish effective budgeting, taxation, and economic institutions that are inclusive to all. FDI has an obvious role in developing native businesses and industries, creating promising and fairly paid jobs that retain individuals.

Sub-Saharan African nations will only rid themselves of aid dependence when foreign and domestic investment is attracted and protected using a legal and physical infrastructure that works and market incentives that are not obstructed by rent-seeking behavior from those in power. This creates jobs, which in turn gives incentives for education and training. However, realizing this potential will require consistent commitment to funding, improved governance, and a strategic alignment of national priorities with long-term growth objectives. If these elements are effectively integrated, Sub-Saharan Africa can move closer to sustainable development and reduced aid dependence.

6. References

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