

## Programming cooperation with Sub-Saharan countries: are we overlooking Sub-Sahara Africa's environmental production potential constraints?<sup>1</sup>

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**Trefwoorden:** Ontwikkelingssamenwerking, impact, Sub-Sahara Afrika, programmering, milieuproductiepotentieel.

**Mots-clés:** coopération au développement, impact, Afrique Sub-Saharienne, programmation, potentiel environnemental.

### Abstract

*The impact of the post-colonial development cooperation between Sub-Sahara African countries and West European development actors is often assessed as poor. A diverse array of explanations has been proposed in the development literature, focusing on the choice of cooperation instruments, the post-colonial and post-Cold War geo-political context, historical and cultural challenges to State building and the disregard of local conditions, knowledge and livelihood systems. This paper adds a further dimension to this already quite complex set of analyses, i.e.: the intrinsically low production potential of much of Sub-Sahara Africa's environment and the challenge this represents in the face of the ever-growing needs of its populations when considered in conjunction with the dearth of alternative opportunities for income generation and growth. This physical reality makes successful economic development even more difficult and has important implications for the priority setting and the formulation and implementation of international aid programmes.*

### Samenvatting.

*De impact van de postkoloniale ontwikkelingsamenwerking tussen landen in Sub-Sahara Afrika en West-Europese ontwikkelingsactoren wordt vaak beoordeeld als onvoldoende. In de ontwikkelingsliteratuur wordt een breed gamma verklaringen voorgesteld, met de nadruk op de keuze*

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<sup>1</sup> This Essay is the written version of the presentation made on June 7th 2018 before the Belgian Royal Academy for Overseas Sciences, on the impact of West European development cooperation with Sub-Sahara countries.

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*van samenwerkingsinstrumenten, de post-koloniale en post-koude oorlog geopolitieke context, historische en culturele uitdagingen voor staatsopbouw en het negeren van lokale omstandigheden, kennis en levensonderhoud systemen. Dit artikel voegt een verdere dimensie toe aan deze reeds vrij complexe reeks analyses, namelijk: het intrinsiek lage productiepotentieel van een groot deel van de Sub-Sahara-Afrikaanse natuurlijke omgeving en de uitdaging die dit vertegenwoordigt in het licht van de steeds groeiende behoeften van zijn bevolkingen, in combinatie met het gebrek aan alternatieve mogelijkheden voor het genereren van inkomsten en groei. Deze fysieke realiteit maakt succesvolle economische ontwikkeling nog moeilijker en heeft belangrijke implicaties voor het stellen van prioriteiten en de formulering en uitvoering van internationale hulpprogramma's.*

### **Résumé.**

*L'impact de la coopération au développement postcoloniale entre les pays d'Afrique subsaharienne et les acteurs du développement d'Europe occidentale est souvent jugé médiocre. Diverses explications ont été proposées dans la littérature sur le développement, mettant l'accent sur le choix des instruments de coopération, le contexte géopolitique post-colonial et post-guerre froide, les défis historiques et culturels à la construction de l'État et le mépris des conditions locales et systèmes de subsistance. Ce papier ajoute une dimension supplémentaire à cet ensemble d'analyses déjà assez complexe, à savoir: le potentiel de production intrinsèquement faible d'une grande partie de l'environnement de l'Afrique subsaharienne et le défi que cela représente face aux besoins toujours croissants de ses populations en conjonction avec le manque de possibilités alternatives pour la génération de revenus et croissance. Cette réalité physique rend encore plus difficile le développement économique et a des implications importantes pour l'établissement des priorités, ainsi que pour la formulation et la mise en œuvre des programmes d'aide internationale.*

### **Introduction: Sub-Sahara Africa's development increasingly lags behind**

Between 1990 and 2016 the average annual GDP/capita of Sub-Sahara Africa increased by a factor of 1.4, from 2 539 USD to 3 453 USD. The total imports of all products from Sub-Sahara Africa between 1990 and 2016 increased by a factor of 14, from 0.019 trillion USD to 0.263 trillion USD (a factor of 11 for the world as a whole, 5 for the USA) (source: World Bank [i]). Sub-Saharan Africa's GDP average annual growth between 1961 and 2016 was 3.6% (compared with 3.5% for the world and 2.7% for West Europe). In the same period 1961-2016 the life expectancy increased by a factor of 1.50 from 40 years to 60 years (1.37 and 1.16 for the world and for West Europe respectively), and literacy increased from 52 % to 64 % - a factor of 1.2 (1.1 and 1.0 for the world and for West Europe respectively).

However, these apparently promising relative figures hide a rather gloomy reality. Between 1990 and 2016, the average annual GDP/capita of the world increased by a factor of 1.7, from 8 913 USD to 15 067 USD (x 1.5 for West Europe, from 24 880 USD to 36 345 USD). With approx. 15% of the world population Sub-Sahara's share in total 2016 imports at global level was only approx. 1.8% (1.4% in 1990). The life expectancy in the world as a whole increased between 1960 and 2016 from 53 years to

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72 years (69 and 81 years respectively for West Europe). Sub-Sahara Africa's Human Development Index, although increasing, was estimated at 0.50 in 2016 and compares with an average of 0.70 for the world and 0.88 for West Europe. And in 2016 the world's average literacy was estimated at 86% (99% for West Europe). Even more gloomy are the numbers of deaths resulting from violence between 1989-2016, estimated by the Uppsala Conflict Data Programme to be above 1.2 million for Sub-Sahara Africa only. They compare with less than 40 000 deaths for West Europe during the same period, most of them in former Yugoslavia.[ii]).

These statistics contrast with the in appearance vast amounts of resource transfers, especially Official Development Assistance (ODA), from OECD countries to Sub-Sahara African developing countries. Between 1960 and 2016 the ODA increased from approx. 36 to 145 billion USD, an increase by a factor of 4 (2016 prices and exchange rates). Sub-Sahara Africa's share in the 2016 OECD total official development assistance is estimated at 50%, the other half being shared by the developing countries in the rest of the world [iii].

The analysis of the apparent poor development return on aid has generated numerous narratives covering a wide range of explanatory drivers, including demography, governance, the colonial legacy, the cooperation instruments, euro-centrism, the post-colonial and post-Cold War international context, global capitalism and the scant use of anthropological knowledge. In a first section, this paper presents an overview of the most important (and often partly overlapping) narratives and corresponding debates. The paper then describes the increasing imbalance between Sub-Sahara's environmental potential and the ever-growing needs of Sub-Saharan countries resulting from their exponential demographic growth as an important additional dimension that represents a real challenge to accelerating and sustaining growth and development. It then argues that 'simply' increasing aid to Sub-Sahara Africa (through an appropriate – possibly reframed – cooperation, through increased equality, through improved governance, through empowerment and auto-determination) is not necessarily a sufficient condition for a sustainable development path. We have overlooked the continent's poor natural capital / environmental resource pool in determining its development potential. The argument of the paper is thus not that past development cooperation with Sub-Sahara Africa did not have an impact, but that Sub-Sahara Africa's development path needs to be rethought in terms of sectoral priorities, realistic development expectations and programmes that are better in line with Sub-Sahara Africa's real environmental potential.

### **Main narratives about Africa's difficult post-colonial development journey**

Science-based narratives look at Africa's difficult post-colonial development journey from the following main perspectives that often complement each other:

- Development seen from an instrumentalist perspective, focusing on the weaknesses of mechanisms and instruments of international cooperation;

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- Development seen within the context of an evolving international political framework (pre- and post-cold-war), exploring why the assets at independence eventually did not provide the expected strong fundamentals for a steady post-colonial development;
- Development seen in the context of state-building, capturing in the concept of 'transiting states' the essential aspects of what is meant by fragile, weak, failing, fragmenting, decaying, hybrid-political-order, soft, quasi-, failed or collapsed states;
- Development seen from a Marxian economic perspective, concluding that the development of (Sub-Saharan) developing countries is an almost-impossibility because capitalist countries have a vested interest in preserving their economic advantages;
- Development seen from a social-anthropology perspective, introducing anthropological science as part of the explanation why modern development architecture and the formulation and implementation of cooperation instruments often still fail to lead to sustained development.

### *The 'cooperation instruments' debate*

For many organisations and professionals, development policies and instruments were premised on the notion that the evolution towards modernity and material wealth of the OECD countries was replicable and that, with sufficient time and external help, all developing countries would eventually achieve similar pathways and become part of a wealthy global village. This view basically reduces the explanations of the large differences between developed and developing countries to an analysis of how developed countries achieved progress since the era when they lived in similar conditions of poverty as the currently developing countries. The analyses led during the last century to a succession of development paradigms: sufficient financial means will result in sufficient development (including human capacity building); integrated development programs in rural areas will turn them into oases of participatory societies; public budget support is the sole universal way for governments to take control of their country's development.

Budget support has, for some years now and for several but not all development cooperation funders, represented the preferred instrument for international cooperation. It is based on the assumption that budget support puts the responsibility (leadership) for development almost entirely in the hands of national governments, giving them the means to progressively gain more experience and confidence in modern methods of state or sector governance [iv]. This form of aid is considered by many (not all) development specialists – amongst donors as well as recipient governments – as an optimal alternative for discrete time- and space-bound development projects [v]. To offset perceived inefficiencies of national governments, budget support is often complemented by support to decentralization to seek a greater involvement of local communities and administrations in development decisions. This was thought to offer unique chances to accelerate progress by including all actors in society – i.e.: not only the leaders and central administrators – thus enabling entrepreneurship and change.

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So far, none of the above instruments have proven to be fully successful or to result in a sustained development. Project realizations often disappear within a few years after a project ends, states frequently see their budget support reduced or halted following inappropriate use, unsatisfactory governance or corruption. And central administrations and leaders often tend to delay the concrete implementation of decentralization policies because participation and empowerment represent a challenge to their own power.

Explanations for the failure of these development instruments to result in rapid development outcomes are usually drawn from historical, political-economic, sociological and anthropological contexts, which are set out in the following sub-sections

### *The 'development state and post-Cold War' debate*

Sub-Sahara's dependence on assistance from its former colonial masters has meant that its development pathways were heavily conditioned by international political drivers and events. An important historical process affecting the evolution of developing countries in this post-colonial period has been the transition from a bipolar 'capitalist-socialist' global state system during the cold-war era to a post-cold-war state system in which a neo-liberal democracy discourse dominates.

The early post-colonial period permitted the continued use of the colonial assets, as well as the creation of employment and wealth supported by internal resources (mining, agriculture) and by loans whose reimbursement was not expected to pose a problem. In addition, keeping or bringing a country into one of the cold-war blocks (capitalist or communist) generated ways of access to external financial, logistic or military resources.

The result of this first phase in Africa's post-colonial history was that State-spending in many countries grew well above what could be generated by internal resources and human capacities alone, especially in countries with neo-patrimonial regimes [vi]. The growth beyond a country's own capacity of financing employment in health, education, the military and rural development services and the lack of capacity to reimburse loans became even more evident when revenues linked to the 'capitalist-socialist' divide diminished drastically and eventually completely disappeared with the end of the Cold War. The era of easy money was succeeded by a new period of painful 'structural adjustments' aimed at bringing developing country governments back to more affordable development spending budgets and strengthening the role of the private sector.

Structural adjustments brought about dramatically reduced public spending at a time when Sub-Sahara African's human population had more than doubled as compared to 1960 (source: World Bank population statistics [vii]). Their impacts in terms of reduced access to schooling and health services, employment, salaries, etc. were far-reaching and the opposition to them was intense.

The social impacts of the structural adjustment programmes were largely underestimated not only by the architects of the structural adjustments programmes themselves but also by the conceivers (and funders) of development programmes. Moreover, the potential benefits of 'good governance'

and all what it implies in terms of democracy, elections, transparency, participation and anti-corruption were probably also overestimated. They implicitly assumed a State corresponding to, or evolving towards a western-type liberal democracy. But as it will be argued in the section hereafter, state building in Sub-Saharan countries takes place in an entirely different context compared to similar state-building stages of the OECD liberal democracies. The assumption that the colonial heritage of Western-type administrations, jurisdictions, infrastructures, education and health systems provided a sufficient, sound and straightforward basis for implementing development cooperation programmes was probably not justified.

### *The 'post-colonial transiting States' debate*

The concept of 'transiting states' conveniently captures the essential aspects of what is meant by fragile, weak, failing, fragmenting, decaying, hybrid-political-order, soft, quasi, failed or collapsed states. 'Transiting' leaves open the direction of the trajectory taken by a State, which is not necessarily towards a Western type of State. Since the mid-1980s, an extensive literature has been build-up to try to understand why in Sub-Sahara Africa so many states are 'transiting'. The central question is why many of those States, in spite of some 60 years of presumed independent development, have not reached a development state a Western European lay-observer would expect. The literature contrasts the constraints of developing countries' pre-colonial past and colonial legacy against the requirement in the post-colonial international era to at once insert themselves in a globalized capitalism and to adhere to the post World War 2 international discourse of democracy, human rights and good governance.

The 'transiting states debate', initially guided by the question of why certain states were not '*successful in comparison to Western states*' (Hill 2005, p 148), has progressively evolved into analyses based on historical, anthropological and socio-economic studies. Key analyses have been carried out by Mitchell (1991), Young (1994), Ayoob (1995), Herbst (1997), Reno (1997), Chabal & Daloz (1999), Migdal & Schlichte (2005), Hagman & Péclard (2010) and de Waal (2015). Although not necessarily converging towards identical conclusions, these analyses agree on a number of basic considerations that go some way in explaining why developing countries have struggled to attain a level of development that we expected them to reach some years ago. Three of them follow.

First, developing countries' current development is rooted in their long-term historical reality, i.e.: well before they acquired independence and inherited the institutions, social overhead investments and public services such as justice, security, health and education from their colonial masters (Bayart 2000; Hagman & Péclard 2010). Major aspects of the colonial legacy jeopardized rather than helped state-building because the colonial state apparatus was conceived in the interest of the colonizer and not in function of a possible (even if in a far future) autonomous state. For the coloniser 'the African problem' was how to administer, with a minimum of administrators and infrastructures and at the lowest possible cost, huge territories with low population densities, and with low expected economic returns. Therefore, as Herbst (2000, p 96) observes, "*Colonialism was marked by extreme violence, the*

*development of new economic systems, and fundamental changes in many social practices as foreign languages, religions, and ideologies were introduced.*" In *The Colonial State Institutionalized*, Young (1994) lists the long register of colonial instruments. These comprise not only public overhead investments such as education, health, security, justice and large infrastructures but also tax collection, violent punishments, *'mise en valeur'* with (private) metropolitan capital, enterprises and trading corporations, as well as reorienting African agriculture towards export-crops. These instruments were conceived to serve the colonial state's needs, and not rooted in local history nor envisaging a possible autonomous governance in the future. The difficult colonial heritage goes thus far beyond the debates of *"arbitrary [colonial] borders"* (Migdal & Schlichte 2005, p 18) cutting through ethnic groups, religions and geographical characteristics or the use of *"traditional"* structures of authority as instruments of rule that may have favoured certain tribes and have become a source of frustration for the others.

Second, the concept of the 'State' as an entity that is aloof to society, as is commonly accepted in Western liberal democracies, is probably not fully applicable to (all) Sub-Sahara countries. *"The state has always been difficult to define. Its boundary with society appears elusive, porous, and mobile"* as Mitchell wrote already in 1991 (Mitchell 1991, p 77). In reality *"a wide range of actors, state officials and non-state actors are involved in 'doing the state'. (...) State actors such as higher and lower echelon bureaucrats, political parties, customary authorities, professional associations, trade unions, neighbourhood and self-help organizations, social movements, national and international NGOs, churches and religious movements, but also guerrillas, warlords, 'big men', businessmen, multinational corporations, regional and international (government) institutions and foreign states"* are involved. (Hagman & Péclard 2010, p 543 and 546).

Third, the international context and conditions for state making in post-colonial countries are entirely different compared to the context under which state building in Western countries took place. Ayooob's *State Making and Third World Security* (Yahoob 1995) and Tilly's *War Making and State Making as Organized Crime* (Tilly 1985) are reference publications in this context. The international system of states and institutions (UN, UN Agencies, IMF, World Bank,...), mostly still mainly steered by Western capitalistic countries, now expect from developing countries that their 20<sup>th</sup> and 21<sup>st</sup> century state making is *"humane, civilized and consensual"* (non-violent, democratic and involving all stakeholders), three essential social and ethical values Western countries themselves rarely demonstrated during their own, often extremely violent, undemocratic and elitarian state building history. Also, the second half of the 20<sup>th</sup> and 21<sup>st</sup> centuries have opened the door to *"mass politics"*: citizens with very diverse and often conflicting opinions are involved in politics through media and increasingly organised as an informed civil society. Popular political engagement and civil society's demands for political participation, equal distribution of the economic revenues and the respect of human rights contrast with the conditions that prevailed during state-formation phases of OECD countries. It is therefore very unlikely that the state building process in developing countries would

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invariably go through a process similar to the ones most Western States went through and that this can be accelerated by simply replicating OECD country current governance and institutional fabric.

### *The 'colonial capitalism on a global scale' debate*

Several authors follow a Marxian economic analysis, which posits that accumulation by dispossession (Harvey 2004), division of labour in the Global Commodity Chains (Selwyn 2014), unequal core-periphery relations and neo-colonialism are the hallmarks of a strong global colonial capitalism that is alive and well (see for example Nkrumah 1965; Amin 1974; Ince 2018) and inhibit the development of developing countries. This narrative provides a ready-made canvas for exploring why so many Sub-Saharan states are still branded as 'failing' or 'transiting' today and why cooperation efforts have had such disappointingly low impacts in spite of almost 70 years of post-colonial development.

Class, racial, gender, cultural, historical, technological and geographical differences permitted "*Europe to underdevelop Africa*" (Rodney 1982). Countering this underdevelopment gradually became an even more unsurmountable task compared to 70 years ago because the complexity of these differences has become a new 'asset' for optimizing the surplus value of global capitalist commodity chains. Selwyn (2014) describes this process as '*hyperbabbagisation*', ie: the application of Adam Smith's 'division of labour' principle along global commodity chains to optimize their profitability. Hyperbabbagisation works in different ways: geographically spatialized international wage hierarchy; gender division of labour ("*Asian nimble fingers*", "*female docility*", ...); ethnicity-based divide-and-rule strategies (wages, skills, initiative/ entrepreneurship, ...); import of goods from labour earning lower wages in peripheral countries; exploitation of the fear for losing jobs (delocalisation of industries); spacialisation of labour as instrument to reduce risk of united labourers actions (hence reduce the risk for wage increases).

'*Europe underdeveloping Africa*' and all what it implies in terms of the establishment of colonial capitalism, mean that the development of (also Sub-Saharan) developing countries in line with capitalist countries is an almost-impossibility because capitalist countries have a vested interest in preserving their economic advantages.

### *The anthropological debate*

Anthropologists note that, despite the many attempts at incorporating local viewpoints, modern development architecture and the formulation and implementation of cooperation instruments still fail to do so convincingly.

Salemink (2006) in *A Tale of Calculated Misunderstandings* and Woost (1997) in *Alternative Vocabularies of Development? 'Community' and 'Participation' in Development Discourse in Sri Lanka* provide examples of the concepts of participatory development and empowerment that may be understood quite differently by the funders, the implementers and the beneficiaries of a development

program. In *What do buzzwords do for development policy? a critical look at 'participation', 'empowerment' and 'poverty reduction'* Cornwall and Brock (2005) warn that while buzzwords have the potential to federate opposite interests, they nevertheless permit international, national and local actors to follow their own sometimes divergent policies. In *Anthropology and the Development Encounter: The Making and Marketing of Development Anthropology* Escobar (1991) showed that apparently powerful planning models such as '*project cycle*', with the theoretical potential to put in adequacy the interests of funders and beneficiaries and to capitalize on progressively gained experience, may be foreign to local ways of thinking and programming.

A case in point of what precedes is the failure to successfully introduce agronomic practices that resulted in research stations in higher yields across many parts of Sub-Sahara Africa. In Niger, for example, a 1 meter spacing between millet plants, with in-between them traditional varieties of cowpeas, is common. Such cropping arrangement results in fairly low yields and research efforts in agricultural research stations have demonstrated how monoculture of improved millet and bean varieties in the Sahel can offer higher yields. Uptake of these new technologies has, however, been very slow. From Vossen (1979) can be concluded that replacing the low-yielding extensive intercropped varieties by new varieties grown as mono-crop yields higher production only during growing seasons with abundant rainfall that is regularly distributed in time. In the long run, those yields are less stable than under traditional agricultural practices that guarantee a small but reliable yield for most of the years. Indeed, millet and beans have a complementary rooting system and plant growth phases permitting both of them to reach maturity even under adverse rainy season conditions. The ingenuity of such local production systems is almost never recognized because it doesn't result in measurable development or economic growth, as seen by the development specialist. And it is almost never included in discussions on how to integrate non-industrialized and/or less developed societies in a globalized economy.

Apart from illustrating the dangers of an insufficient consideration of local viewpoints, knowledge, needs and conditions, the case also shows the importance of adapting agricultural practices and development ambitions to the specific production growth potential of climate and soil, which evolved over centuries and continued to serve local communities well as long as population growth and newly created development expectations have stayed within manageable boundaries – a point we shall come back to in the next, and second part of this essay.

### ***"Escaping the fragility trap"? Or reducing the demography-environment gap?***

The above debates summarize the main narratives trying to explain why many Sub-Saharan countries are considered to be fragile. In these debates population growth is sometimes *mentioned* as a constraint, or indirectly included as a complicating factor through indicators such as the evolution over time of the GDP/person, the Human Development Index or poverty rates. But none of them analyses the possible impact on governance of the increasing imbalance between the needs of

populations resulting from the exponential demographic growth in Sub-Saharan Africa since 1960, and the potential and accessibility of the surface resources for producing food as a society's most basic need.<sup>viii</sup>

In the second part of this paper, we will argue that the increasing imbalance between Sub-Saharan's environmental potential and the ever-growing needs of its populations resulting from exponential demographic growth represents a very real constraint to successful economic development that has to be taken into account in prioritising aid efforts and designing development cooperation programmes. The consequence is that 'simply' increasing the financial resources available to Sub-Saharan Africa, through an appropriate cooperation model, through increased equality, through improved governance, through empowerment and auto-determination, will not be sufficient and that Sub-Saharan Africa's development model, priorities and programme formulation will need to be adjusted in line with the continent's real environmental potential. Failing to do so risks exacerbating the imbalance between the continent's potential to produce food and other resources sustainably and the demands put on its physical resource base by an inappropriate development model.

### *Crop yields as a measure for the environmental potential of a region.*

Rainfed agricultural crop yields are a good measure of the ability of the land to produce a society's most basic need, i.e.: food, as they integrate available resources such as water, solar radiation, quality of the rainy season (rainfall distribution, predictability of start and end of a season and/or of flood levels) and soil characteristics (depth, fertility, etc.) under prevailing farming practices. Data on current crop yields are collected annually by national statistics agencies and compiled by the FAO. These can be compared to potential rainfed (i.e.: water limited) crop production levels estimated by crop growth simulation models that have been shown to reliably estimate the land's potential to produce crops after remedying all but the limitations caused by water availability. The difference between the 'potential' and 'actual' crop yields obtained in any given location is defined as the 'yield gap' for that crop and location. This 'yield gap' represents the "*untapped crop production potential on existing farmland based on current climate and available soil and water resource*" [ix] and can be used as a measure of the technological challenge facing agricultural development.

Crop yield gap data for a given area obviously vary depending upon the method used for the estimation of the potential yield, the reliability of the available agricultural statistics and the assumptions made for assessing the impact of the limitations caused by water availability. Moreover, rainfall and rainfall distribution, irrigation opportunities, solar radiation, soil characteristics as well as farming practices have a high spatial variability, and yield gaps will therefore highly differ depending upon the place where a crop is grown. Straight forward quantitative comparisons of calculated yield gaps between countries or regions are therefore not appropriate. But in national averages, provided they are statistically sound, some high values in a series of numbers making a low average cannot compensate for the overall low average as such in terms of the overall environmental potential of a country. It is thus not because yield gap average values do not reveal an existing spatial variability that

comparisons between countries become impossible. But such comparisons can only be qualitative, i.e., as indicators of differences between the technological challenges facing agricultural development of countries as a whole.

Available information reveals high crop yield gaps both in semi-arid and in humid Africa where they are substantially higher than the average yield gaps in West Europe. For example, Van Ittersum *et al.* (2016) consider an average yield gap of 80% for rainfed maize in 2010 for 10 Sub-Sahara African countries (Burkina Faso, Ethiopia, Ghana, Ivory Coast, Kenya, Mali, Nigeria, Tanzania, Uganda, Zambia). For the same countries the Global Yield Gap and Water Productivity Atlas (GYGA) (<http://www.yieldgap.org/>) estimates the yield gaps to be 70-90% for rainfed maize and sorghum, and 50-90% for rainfed millet. For semi-arid Africa, Annex 2 in Hengsdijk & Langeveld (2009) suggests an average yield gap of 65 % for wheat, barley and maize, and of approx. 90% for tropical cereals. For tropical cereals in humid Africa the annex suggests an average yield gap of approx. 85%.

For West Europe Schils *et al* (2018) estimate the average yield gap for Europe (including Central and Mediterranean Europe) at 42%. The Global Yield Gap and Water Productivity Atlas (GYGA) (<http://www.yieldgap.org/>) estimates the yield gaps for European countries to range between 0% and 70% for rainfed maize, and between 10% and 80% for rainfed wheat and barley. Annex 2 of Hengsdijk & Langeveld (2009) suggests an average yield gap for wheat, barley and maize in West Europe of 5-10% .

These values illustrate the significance of the yield gap over much of Sub-Sahara Africa and show the potential benefits from the introduction of technological innovations such as improved cropping systems, soil and water management, selected seeds, fertilizers and pest and disease control to reduce the yield gap, i.e.: to realize yields that are closer to the environmental potential of an area<sup>x</sup>. Low agricultural production is combined with the lack of access to market, market information, low financial demand for products, lack of access to land, credit and adequate extension services, opportunities for education. In this whole picture, the risk factor is a further complicating factor in the decision process of small-scale farmers; due to their level of poverty they are not easily in a position to take risk.

Much of the differences in yield gap reduction between Western Europe and Sub-Sahara Africa can be explained by differences in the enabling conditions for technology development, transfer and adoption, such as rural roads and other essential infrastructure, research and extension, financial services, input and output markets. The adequacy of these enabling conditions depends largely on the ability of the state and the willingness of the private sector to invest, which are intimately tied to a country's GDP and growth potential.

But, while the various narratives that development scholars have constructed to explain the low impact of aid on Africa's development and economic growth (see the first part of this paper) go a long way to explaining the generally poor enabling conditions for agricultural development in Sub-Sahara

Africa, there are good reasons to believe that the natural environment itself might represent an additional challenge to realising Sub-Sahara African yield potentials. This could provide an additional explanation for the poor response to aid over the last 50 years. If true, this explanation will represent an additional challenge that will need to be taken into consideration when preparing development programmes.

*Environmental challenges to improving crop yields in Sub-Sahara Africa*

Table 1 compares the 1961-2016 cereal crop yields, crop yield time trends as well as the main agronomic, pedological and climatological characteristics of Central Africa [xi], Sahel Africa [xii] and Western Europe [xiii]. The table was compiled on the basis of FAO national and annual agricultural statistics [xiv], the world maps of inter-annual rainfall variation coefficients and of Precipitation Concentration Indices (Fatichi et al. 2012), the FAO world data base on soils [xv] and the US Department of Agriculture’s Global Desertification Map (Reich et al. 2001 updated, 2003) [xvi].

**Table 1. Aggregated agronomic, pedological and climatological characteristics of Central Africa, the Sahel and West Europe (countries as listed in endnotes x, xi and xii).**

	<b>Central Africa</b>	<b>Sahel</b>	<b>West Europe</b>
<b>Cereal yields</b> 1961-2016 average (Y); 1960-65 vs 2011-16 average yields; 1961/66 – 2011/16 yield increase (I) inter-annual coefficient of variation after trend removal (%CV)	Y: 1136 kg/ha 937 kg/ha; 1505 kg/ha I = x 1,6 %CV: 11,8%	Y: 715 kg/ha 619 kg/ha; 936 kg/ha I = x 1,5 %CV: 13,4%	Y: 4618 kg/ha 2727 kg/ha; 6116 kg/ha I = x 2,2 %CV: 7,2%
<b>Time trend of annual national cereal yields</b>	Significantly positive (except for Congo, DR Congo and Gabon)	Significantly positive (except for Gambia)	Significantly positive (all countries)
<b>Rainfall:</b> Inter-annual variability (coefficient of variation, %CV) and concentration index (PCI)	%CV: 10-20% PCI: 10-20	%CV: 25-35% PCI: 20-35	moderate climate area: %CV: 5-15% ; PCI: 5-10 Mediterranean area: %CV: 15-35; PCI: 10-20
<b>Soil characteristics:</b> Nutrient availability (A) Nutrient retention (R) Desertification vulnerability class (D)	A: moderate to very severe constraints R: moderate to very severe constraints. D: no to low vulnerability	A moderate to severe constraints R: no to severe constraints. D: moderate to very high vulnerability	A: no to moderate constraints R: no to moderate constraints. D: no to high vulnerability

Table 1 shows that, on average [xvii], Sub-Sahara Africa experiences more limited and unpredictable rainfall (higher coefficient of variation), lower soil fertility, lower nutrient retention capacity and higher desertification vulnerability than Western Europe. We believe that these conditions are a significant contributing factor to the slow increase in crop yields in Sub-Sahara Africa since 1961, in addition to the other development challenge faced by the continent as explained in section 1, and that these conditions will continue to affect the potential for agricultural growth in this region. The different conditions between Sub-Sahara Africa and West Europe resonate with Brown & Lall’s (2006) world-wide analysis that most wealthy nations (with a high GDP) tend to have a low

coefficient of inter-annual rainfall variation. They are corroborated also by Vossen (1989, p 191), who showed how significant positive yield trends can be neutralized by adverse rainy season conditions in Botswana and by Van Ranst (1994) and Van Ranst et al. (2017), who noted the negative impact of highly weathered tropical soils on soil fertility, nutrient retention and availability for crops that can neither be easily and rapidly cured, nor permanently altered by common fertilisation and organic matter increase techniques.

*The demographical challenge*

The transdisciplinary [xviii] analysis we have presented has shown how, in addition to instrumental, geo-political, state-building, economic and socio-anthropological explanations, the intrinsic limitations of the natural environment in terms of food production may have contributed to a poor response to development assistance in Sub-Sahara Africa. While increasing crop yields is possible, as shown by the significant positive time trend, the additional resources (inputs, methods, research, training, crop varieties, ...) mobilised so far have not managed to compensate for these environmental limitations.

The impact of the intrinsic limitations of the potential of the natural environments of Sub-Sahara Africa for satisfying basic needs (food in the first place, but also feed for animals producing manure; green matter for housing and roofs and windbreaks; organic matter for soil improvement, etc.) combined with the slow progress is particularly stark when considered in conjunction with population growth which, since 1961, has grown by a factor of approximately 4.4 in the African Continent, compared to a factor 1.3 for Western Europe (Table 2), a trend which is likely to persist into the near future. The picture gets worse still when we also consider the increasing demand rural societies exact from the land in order to satisfy their growing needs for goods and services beyond their immediate basic needs.

**Table 2 : 1961 and 2016 populations of Sub-Sahara Africa and of West Europe (countries as in endnotes x, xi and xii) [xix].**

	<b>1961</b>	<b>2016</b>	<b>Increase</b>
<b>Sahel</b>	21 524 703	94 057 493	X 4.4
<b>Central Africa</b>	91 819 057	409 199 653	X 4.5
<b>West Europe</b>	320 514 287	409 774 548	X 1.3

We believe that this growing imbalance between needs and available environmental resources further completes the framing of why many Sub-Saharan states remain or enter into the group of transiting states. When the capacity of the environment is not sufficient to satisfy ever increasing basic needs, and other sources of economic growth cannot compensate for what the land is incapable of producing, resources have to be found elsewhere for the provision of public services and personal revenues. It becomes more likely, then, that the means to satisfy them are sought through innovative “non-Western” taxation types, corruption or in renting out or selling mining and land resources to

foreign entities. Combatant recruitment by rebellions becomes easier, “vigilante” positions are created as alternative jobs, children become an attractive labour force in artisanal mining, cultural heritage becomes a market commodity [xx], criminality becomes more common.

### Conclusion and recommendation

Sub-Sahara Africa as a whole without any doubt shows a number of promising signs of development: positive technological trends for crop yield, a GDP growth of the same order as the growth at world level, an increasing share in international trade, an improving Human Development Index, a decreasing child mortality, an increasing life expectancy. However, progress is too slow and there are clear signs of an increasing imbalance between the basic needs of its populations that grew by a factor of 4.4 since 1961 and the potential of its (surface) natural resources reflected in crop yields that increased much less significantly. Improving / increasing the ability of the land to produce is possible but more difficult than in rich countries where soil and climatic conditions are more favourable.

More will have to be done than simply adding more financial resources into the development pot. Our transdisciplinary analysis questions the adequacy of current (Western) reference indicators for setting cooperation priorities and for the *ex-ante* and *ex-post* assessment of the impact of cooperation programmes, which are restricted to notions of productivity, trade, GDP, life expectancy, access to justice and Western-defined principles of good governance. Our analysis shows that a primary impact assessment criterion of much of our development assistance should become that the changes these programmes induce involve little or no risk of creating new or enhancing existing imbalances between the needs of a society and the capacity of the natural environment in which it develops, and/or that these programmes are more focused on redressing this imbalance through assistance to production enhancing programmes. Failing to do so may, we believe, contribute to many Sub-Saharan states remaining or even (temporarily) entering into the group of transiting states, which further complicates good governance and their development potential. Where there are no easy solutions for closing the economic development gap created by stagnating agricultural growth, “alternative” sources of income will continue to be sought such as “non-Western” taxation types, selling natural resources to foreign entities, rebellions, children becoming an attractive labour force in artisanal mining and emigration [xxi].

Translating this concern into concrete cooperation programmes is a difficult and ethically loaded exercise. It will require to establish a balance between the (limited) capacity of the natural environment and both the political priorities of the partner governments and the needs of populations that not only are large but are also well informed about levels of welfare and well-being elsewhere in the world.

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<sup>i</sup> Source: <https://wits.worldbank.org/>

<sup>ii</sup> Source: <http://ucdp.uu.se/>

<sup>iii</sup> Source : <http://www.oecd.org/dac/financing-sustainable-development/development-finance-data/>

<sup>iv</sup> The term “preferred” instrument implies that this instrument should only be used where possible, i.e., if a number of basic conditions such as budget transparency, provision of accounts and fight against corruption are realised. The popularity of budget support as a development varies according to the donor. It is for example almost not applied by the UK Department for International development (DFID), but where feasible encouraged by the European Commission for implementing the European Development Fund.

<sup>v</sup> Significant push-back by the electorate in some donor countries (eg: UK) against the transfer of large amounts of funding to what are generally perceived as inefficient and corrupt governments has slowed down the expansion of budget support. The focus in some bilateral organisations such as UK's DFID is now on achieving concrete results that are defined in tangible and easily communicated 'results' such as 'increased number of functioning taps delivering drinking water', which resonate with public understanding of development outcomes in donor countries.

See also <https://www.deval.org/en/synthesis-and-exit-evaluation-budget-support.html> for an on-going evaluation of this important aid mechanism commissioned by the German Institute for Development Evaluation.

<sup>vi</sup> According to Bratton & van de Walle (1997, p 62) “*patrimonialism may provide an accurate description of the political systems of small, isolated communities with rudimentary economies, including African chiefdoms in the precolonial era, and the practices of patrimonialism may persist at the local level in a number of different settings. (...) [s]ome nations in the developing world, most notably in sub-Saharan Africa, retain in modified form many of the characteristics of patrimonial rule. As a result, political scientists have found it useful to characterize as neopatrimonial those hybrid political systems in which the customs and patterns of patrimonialism co-exist with, and suffuse, rational-legal institutions*”.

<sup>vii</sup> Source :<http://databank.worldbank.org/data/>

<sup>viii</sup> The report “*Escaping the fragility trap*” published in April 2018 by the Commission on State Fragility co-chaired by the London School of Economics and Oxford University contains twelve substantiated recommendations for “*international actors such as the international financial institutions (IFIs), the UN, and donor governments, and the governments of states facing situations of fragility and related domestic actors*” that are “*based on contemporary analytical thinking and evidence of what works and what does not*”

*in promoting transformative politics, security, economic growth, and resilience*" (LSE 2018, p 21). But also this report does not make any single mention of 'demography' or 'population growth', or 'environmental potential' as an essential aspect of the conditions contributing to fragility, except to signal that more and more people are living in fragile states, or that environmental shocks such as hurricanes can derail a fragile economy

ix Source: <http://www.yieldgap.org/>

x These potential benefits are discussed in detail by Tadele (2017).

xi Angola, Burundi, Cameroon, CAR, DR Congo, Congo, Gabon, Malawi, Rwanda, Uganda, Zambia

xii Burkina Faso, Cabo Verde, Chad, Gambia, Mali, Mauritania, Niger, Senegal

xiii Belgium-Luxembourg, Austria, Denmark, Finland, France, Italy, Germany, Ireland, Netherlands, Norway, Portugal, Switzerland, Spain, Sweden, UK.

xiv Source: FAO (2017). Agricultural Statistics. <http://www.fao.org/faostat/en/#data/QC>

xv Source: [www.fao.org/fileadmin/user\\_upload/soils/docs/HWSD](http://www.fao.org/fileadmin/user_upload/soils/docs/HWSD)

xvi FAO yield statistics are available at aggregated country level. The Köppen-Geiger climate classification and topsoil potential maps are available in aggregated form and at very low resolution (scale 1:1.000.000 or lower). It follows that the analysis results based on such input data can only be assessed at scales lower than the input information. This is even more the case because the quality of an output cannot be higher than the quality of the inputs. Yield statistics are based on surveys and therefore never exact, rainfall stations may have missing data corrected for by interpolations, low resolution soil maps are ultimately based on point-observations and therefore have no spot-validity. Also, a value aggregated into a national indicator hides the variability within a country. In other words, it is not possible to interpret the results of this analysis at a local scale.

xvii The use of aggregated values is justified on the basis of the same reasoning as used for the yield gap. See section *Crop yields as a measure for the environmental potential of a region*.

xviii According to the definition provided by the Belmont Forum (2017), this paper can be considered as 'transdisciplinary' because it builds on natural sciences, social sciences and the humanities as well as on stakeholder views for creating knowledge and solutions for sustainable development that benefit society.

xix Source: [data.worldbank.org](http://data.worldbank.org).

xx For example: sale of authentic wooden East-Congolese graveyard statutes on tourist markets in Bujumbura (personal observation, February 2015.)

xxi This paper thus suggests an alternative interpretation of the "climate refugee" concept. A risky emigration with an unknown outcome has become an acceptable answer to the lack of balance between the real day-to-day needs of people and what the environment can provide them. Climate *change* is then not the trigger of increasing migration: rather, the naturally highly variable and unpredictable rainfall conditions are part of an overall frame including also marginal soil conditions and a limited environmental potential for translating technological innovations into a positive technological time trend exceeding the values summarized in Table 2.