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Smart specialisation strategies in sub-Saharan Africa: Opportunities, challenges and initial mapping for Côte d'Ivoire

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This paper calls for a better integration of place-based, evidence-based and inclusive dimensions in the implementation of the Science, Technology and Innovation (STI) plans and industrial policies in sub-Saharan Africa. To this end, the analysis contrasts with and takes inspiration from the recent and ongoing international experiences in the elaboration of Innovation Strategies for Smart Specialisation (S3). Then a preliminary mapping of the economic, scientific and innovative potentials for Côte d'Ivoire (West Africa) is achieved in line with the smart specialisation approach to evidence collection for innovation policy. The conceptual and mapping exercise can help innovation practitioners and stakeholders to identify important gaps of evidence needed to inform place-based or territorial development policies. The integration of smart specialisation principles into STI and industrial policymaking can indeed open several opportunities to identify and nurture innovative activities and novel industries. Pragmatic recommendations are drawn from these perspectives for more effective innovation-based local development strategies in Côte d'Ivoire and the region.

Keywords: Smart Specialisation Strategies, science technology innovation (STI) policies, industrial transformation, sub-Saharan Africa, Côte d'Ivoire

Introduction

Learning and innovation[1] are considered fundamental processes in the transition of countries towards becoming more prosperous and knowledge-based societies (UNCTAD 2017). The 2030 Agenda for Sustainable Development[2] underlines the need for countries, independently of their development stage, to *Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation* (SDG 9). The African Union Agenda 2063 also refers to science, technology and innovation (STI) as multi-functional enablers for achieving continental development goals. In Africa, awareness of the role of innovation has only recently led to the elaboration of STI strategies at the continental[3] level and in a few countries. Nevertheless, policymakers will still need to translate this shift in narrative into effective implementation and monitoring mechanisms.

This paper acknowledges and restates the broad challenges of existing STI plans and policies in sub-Saharan Africa. It calls for a better integration of place-based or spatial, evidence-based and inclusiveness components for effective innovation-based development strategies. In order to do so, it takes inspiration from the recent and ongoing European and international policy experiences in the elaboration of Innovation Strategies for Smart Specialisation[4] or Smart Specialisation Strategies (S3) (Dosso 2020; Dosso, Kleibrink, and Matusiak 2018; Gianelle et al. 2016; Matusiak and Kleibrink 2018; Aprahamian and Correa 2015).[5] S3 are place-based economic transformation agendas, which aim at developing competitive advantages through matching the research and innovation assets of a territory to the local challenges and the needs and capabilities of the business sector. The main aim of this paper is to discuss the challenges and opportunities of such territorial or place-based approach in the sub-Saharan African contexts. A broader concern is thus about the extent to which the current 'innovation' policies (and monitoring mechanisms) may support territorial development through a sound evidence-based approach and the mobilization and effective use of local assets.

The paper raises such issues in an application of the smart specialisation mapping approach to Côte d'Ivoire (West Africa). The discussion allows underlining important gaps for evidence-based innovation and industrial diversification policies. Applied to Côte d'Ivoire, the S3 mapping entails characterizing the economic, scientific and innovation potentials of the country and its regions (sub-national) in order to better select the innovation priority areas and transformative industrial activities, ideally those activities that present the strongest sustainability potentials along the social, economic and environmental dimensions (United Nations 2015).

The remainder of the paper is organized as follows. Section 2 introduces the smart specialisation approach and discusses the new perspectives it opens for local innovation policy making and implementation in sub-Saharan Africa. In a synthetic perspective, Section 3 discusses the key bottlenecks of current innovation policies or plans in sub-Saharan Africa. Section 4 focuses on the case study of Côte d'Ivoire, the largest economy of the West African Economic and Monetary Union (WAEMU). The preliminary S3 mapping provides a relevant assessment basis of the country's potentials along the economic, scientific and innovation dimensions. This mapping allows identifying key evidence-for-policy gaps in the existing strategies and discussing further perspectives for more integrated and innovation-oriented diversification

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strategies. In doing so, the paper calls for a more strategic approach to sustainable development through a marked shift towards more knowledge-intensive and innovation-led activities and a better account for within-country specific strengths and challenges. Section 5 concludes with pragmatic recommendations on the way forward to start a pilot project on smart specialisation in sub-Saharan African countries.

Opportunities and challenges of a smart specialisation approach in the sub-Saharan African context

Smart specialisation strategies: meaning and implementation principles

Smart Specialisation Strategies (S3) are based on the concept of knowledge-based economic transformation agendas (see Foray 2015). They aim at developing the competitive advantages of a territory – country or sub-national region – by matching the research and innovation assets with the local challenges and business sector needs and capabilities. To achieve this, policies must be evidence-based and tailored to the local context, acknowledging that different pathways for regional innovation and development exist. In the European Union (EU), the S3 approach has been promoted under the Cohesion policy[6] to reduce the socio-economic disparities between the EU regions through a more efficient use of regional funds for innovation.

Figure 1 synthetizes the main building blocks of a smart specialisation strategy: it starts from the constitution of an evidence base on the territorial potentials (Evidence) in order to identify priority research and innovation domains (Innovation priority domains). The S3 priorities should also be based on the specific needs of local companies and other stakeholders representing the priority domains. The Smart Specialisation process is led and coordinated by a dedicated governance structure (Governance), which includes a high-level coordination team responsible for setting up the institutional framework for the design and implementation of S3, local or regional coordinating teams and dedicated entrepreneurial discovery groups (multi-stakeholders and multi-level governance approach).

Supported by dedicated Policy mixes and Financing instruments,[7] the process ultimately leads to the selection or identification and implementation of investment projects (and transformative activities) in view of exploring or supporting future areas of competitive advantages for the territory. As for the overall strategy, the investment projects should be monitored and evaluated to ensure transparency and measurable impacts throughout the different phases of the process. The specific policy and financing instruments would depend, among other, on the countries' existing policy mix, the specific local challenges and needs addressed under the selected priority domains, the related projects and transformative activities.

Although various implementations mechanisms exist in Europe and the world,[8] the approach builds upon a few basic principles:[9]

(i) A **critical mass** of knowledge- and innovation-related investments (human capital, infrastructure, and funds) is needed to transform and adapt existing productive or industrial structures;

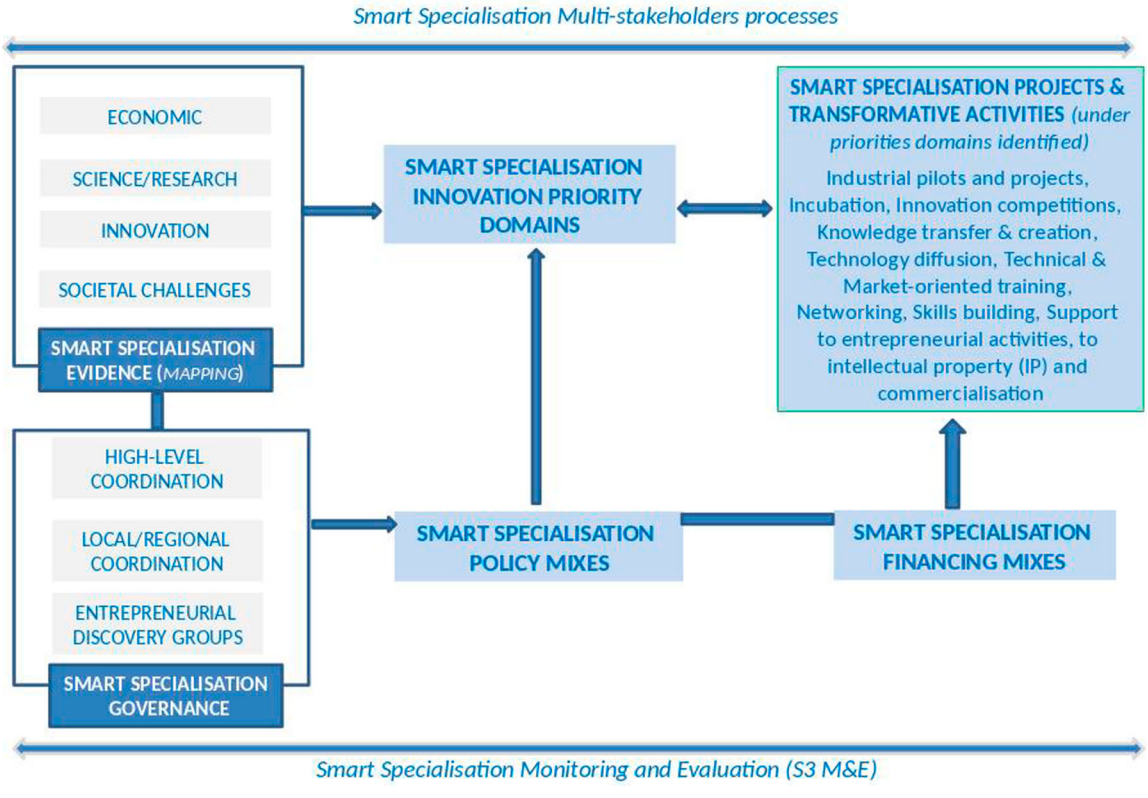


Figure 1: Smart specialisation strategy (S3): overview of the main building blocks. ***Source:*** Authors' elaborations

(ii) Dedicated and **monitored R&D and Innovation budgets** should be oriented towards a few priority areas and transformative activities or domains to build up sustainable competitive advantages.

(iii) These priority activities are identified through **evidence-informed** and participatory processes involving (ideally) actors from the quadruple helix – Business (industry and services), Research, Education and training institutions, Government and Civil society (users, citizens) – in an entrepreneurial discovery process (cf. Box 1 below). The interactions among the different stakeholders and levels envisaged in the S3 approach also intend to limit ex-ante picking-the-winners or an exclusive support towards incumbent (large) firms. This also means that fundamental elements of the process are trust and transparency in the selection and implementation of priority activities.

(iv) The strategies are **place-based** (or territory-specific) and oriented towards the mobilization, the exploitation and the promotion of local resources, entrepreneurs and interactions. At the same time, cross-sectorial activities should be stimulated and nurtured to favour the emergence of specific advantages (related diversification). This principle also implies that countries or regions should be able to map their current needs and assets (for instance when possible through a SWOT analysis that builds on a comprehensive study of the economic, scientific and innovation potential of a territory).

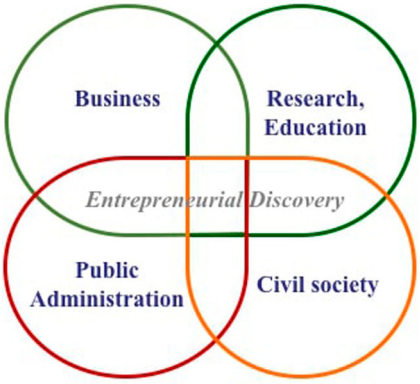
(v) Innovation in the S3 framework is **not limited to technology creation** but it also encompasses the adoption and diffusion of existing technologies and relevant knowledge as well as **non-technological innovations** (e.g. marketing, organizational, social). This broad view requires enlarging the scope of innovation policy beyond the exploitation of R&D- and S&T-related outcomes.

(vi) Thanks to the **entrepreneurial discovery process** (see Box 1), innovation is also business-led (not only driven by scientific actors), which allows for an easy applicability of the new ideas and increases their commercial value. At the same time, deeper understanding of business needs can stimulate more precise and therefore more effective public investment and support, since it is not given to all the possible beneficiaries, but a few carefully chosen cross-sectorial domains where the greatest value added and economic impact can be generated.

(vii) The strategy relies on tailored **monitoring and evaluation** mechanisms and a governance and management structure exhibiting unified leadership, while ensuring broad participation and ownership (for instance, through steering group, management team, etc.) for a continuous process. The results of monitoring and evaluation exercises allow for evidence-based updates that are needed to elastically adjust RIS3 to fast economic changes and needs of emerging sectors.

Box 1: Entrepreneurial discovery process (EDP)

The EDP is a participatory process for local decision-making, which ideally brings together business, government, research and education institutions and civil society/consumer groups (users) to identify new domains for innovation and market opportunities.



Source: Smart Specialisation Platform of the European Commission, Joint Research Centre

These interactive processes are at the core of Smart Specialisation, ultimately leading to selecting and encouraging (existing or new) entrepreneurial activities that yield important potential for local development. The EDP goes beyond the prioritization phase and requires the commitment of stakeholders during the implementation of the strategy to ensure the actors' trust and commitment to the strategic objectives of the S3, and to align market needs and opportunities with policy interventions. EDPs will differ much across places/regions and such processes should be designed according to the specific local context (see also Rissola, Kune, and Martinez 2017, and the survey results of Marinelli and Perianez-Forte 2017, on the entrepreneurial discovery process in the design and implementation of Smart Specialisation).

The additional benefit of the process is that by engaging key actors and encouraging them to take part in the decision-making, it influences behavioural changes in the local innovation ecosystems (see also http://s3platform.jrc.ec.europa.eu/entrepreneurial-discovery-process-focus-groups)

Beyond these principles, a few practical lessons can already be drawn from this ongoing experience that Charles Sabel called 'the biggest experiment in industrial and innovation policy' worldwide (cited in Joint Research Centre 2018). Analysts point out the challenges and risks associated with the elaboration of such strategies (see for instance, Capello and Kroll 2016; Guimón 2013; Aprahamian and Correa 2015) and the need to think and design differentiated options and mechanisms according to the development stage of the territory (Kleibrink, Larédo, and Philipp 2017; World Bank 2010). Overall, these works suggest that similar conceptual steps are necessary at the beginning of this process in order to use smart specialisation as an effective tool for development in developing countries and regions, and even more so in the specific socio-economic and cultural contexts of sub-Saharan Africa. At least a few challenges are worth underlining such as the limited availability of official information and data on the productive structure and assets

Table 1: Mapping IP challenges and Smart Specialisation implementation principles.

Challenges of IP implementation	Smart specialisation approach
Build institutional capacity for the design, monitoring and implementation of STI policies and international cooperation between AU Member States	Flexible, step-based & gradual, S3 allows for policy experimentation and learning
Sound evidence for policy and Monitoring & Evaluation frameworks and exercises	Initial mapping of the economic, scientific and innovation potentials based on quantitative and qualitative inputs as well as international and local experts' assessments Periodic revisions or reviews of the Strategies are encouraged
Make sure that the implementation plans match the needs of varied and diversified territories of the African states	Place-based policy: Valorise existing assets & focus implementation plans on local idiosyncrasies/needs Macroregional strategies, which bring together several regional or sub-national territories, can be adopted for broader missions or societal challenges (e.g. health, energy, security, etc.)
Generate commitment of local & small entrepreneurs and other actors for development	Attention to and monitoring of local (micro-) entrepreneurial dynamics Including local actors in the decision-making process
An inclusive approach to knowledge- & innovation-based development	Collective and inclusive governance and experimentation (learning by doing & by interacting) Stakeholders from the Quadruple Helix
Develop practical steps allowing for the successful implementation of the strategy	Step-based approach and tailored monitoring & evaluation instruments should be implemented Include various actors (quadruple helix) in the operational planning phase – they will help verify the generated ideas in terms of their usefulness and applicability

Source: own elaborations from STI Strategy for Africa, STISA (AUC 2014), Dosso, Kleibrink, and Matusiak (2018) and Dosso (2017)

and the trust, commitment, leadership needed to sustain the strategy. While the latter factors relate more to medium term governance and cultural issues, the informational problem implies that designing S3 cannot be done (in an efficient manner) without some consistent knowledge about the existing economic fabric.

Mapping innovation policy challenges through the lenses of smart specialisation

As illustrated in Table 1, the smart specialisation approach can be linked to several aspects of current innovation policies (IP) at the local level in the sub-Saharan African contexts.[10] The table compares the smart specialisation approach to the principles enshrined in the AU Strategy for Science, Technology and Innovation for Africa 2024, STISA 2014–2024.[11]

The first column summarizes some key implementation challenges of innovation policies in sub-Saharan Africa and the second column suggests how these latter ones may be potentially addressed in a smart specialisation framework.

Human and organizational capacity-building for innovation policy development is required for evidence-based decisions (AUC 2014). Yet, the innovation systems in the majority of Sub-Saharan African countries are often dominated by weak administrative capabilities and uncoordinated measures and actions (weak institutional links). The S3 framework promotes a step-based process where policy experimentation and learning take place, including across and within the public and the private spheres. Such approach may be relevant from the perspective of sub-Saharan Africa's innovation policymakers willing to set up STI governance structures, which enable a flexible and dynamic decision-making.

In the smart specialisation perspective, the focus is put on the assets and resources available to regions and countries and on their specific socio-economic challenges in order to identify unique opportunities for development and growth. In sub-Saharan Africa, the calls for local embeddedness in the formulation of policies and strategies are not new. However, it is still difficult to apprehend the extent to which current innovation policies (when they exist) include such bottom-up component.

While the entrepreneurial activity is peaking in many sub-Saharan African countries (Kelley et al. 2015), entrepreneurs often face a lack of appropriate support both in terms of funding, infrastructure and entrepreneurial training, incubation and networking structures. When such concerns are combined with unclear rules of governing innovation activities and the absence of entrepreneurial activity monitoring, the socio-economic potential of local entrepreneurs is likely to remain underexplored.

As previously suggested, the elaboration and implementation of S3 take the form of collective and inclusive experimentations, where stakeholders from each branch of the quadruple helix commit and interact through an entrepreneurial discovery process to identify the domains of strong potential for development. This inclusiveness of the process intends to facilitate the realization of synergies and to limit the negative effects of vested interests and lobbying actions in the selection of industrial domains and activities. Also in the AU's STISA (AUC 2014), inclusiveness is seen as a fundamental principle for the achievements of development goals. Yet, very few practical policy examples of such an approach exist in the sub-Saharan regional context.

STI policy making and implementation in sub-Saharan Africa: main bottlenecks

With an average growth of 5%, the first decade of the new millennium marked a period of sustained growth in sub-Saharan Africa. This rise was mainly driven by rising

commodity prices combined with greater public investments and domestic demand. The recent slowdown in the region, recording an average rate of 1.4% in 2016, reminds of the dependence of several countries on global market developments and the need to strengthen their resilience to external shocks as well as to reduce reliance on natural resources. Even fast-growing economies like Côte d'Ivoire, Ethiopia, Kenya, and Senegal have had important drawbacks in the medium and short runs in the form of growth breaks, budget deficits and large public debts, all of which question the sustainability of current trajectories (IMF 2016 [2017]). In addition, unemployment is high, especially for the youth. This reflects among others the lack of productive opportunities, decent work as well as limited entrepreneurial and training opportunities (out of the informal sector) and fundamental mismatches between skills provision and market needs.

An overview of the inputs for innovation shows that the establishment of innovation policies in sub-Saharan Africa has come with increasing but still limited investments in R&D (0.41% of GDP in 2014) as well as very low ratio of researchers per inhabitant (less than 90[12] researchers per million inhabitants (FTE) in 2014, STI data UIS.stat). As a comparison, lower middle-income countries had 193 researchers per million inhabitants in 2013; in upper middle-income countries this figure was 888. Yet, these aggregate figures hide major disparities between countries, substantial dependence on donor funding, shortage of high-quality infrastructures (transport, communications, universities, laboratories, S&T centres) and a low level of private sector funding, with the sole exception of South Africa (AU-NEPAD (2010) and AU-NEPAD (2014)). Other related indicators suggest that sub-Saharan Africa is still lagging in terms of tertiary education institutions, intellectual property protection and innovativeness, productivity and competitiveness (ACBF 2017; UNECA 2016).

Apart from these structural shortcomings in terms of human capital and resources, policymaking in this region suffers from low administrative capacities to design and implement innovation policies with proper monitoring and evaluation mechanisms (M&E). In existing national strategic plans for innovation these are often neither integrated nor specified (AOSTI 2014; AUC 2014). The lack of M&E mechanisms renders it more difficult, if not impossible, to assess with accuracy the STI budgets, the implementation costs of policies and the relevance of impact studies (see also Daniels, Mawoko, and Konté 2018, for a discussion on the M&E mechanisms in the context of the Science, Technology, and Innovation Strategy for Africa 2024 (STISA-2024)). A key challenge in this respect is the recruitment of qualified analysts who can handle innovation data collection and analysis to inform the formulation and implementation of innovation policies (see also Oyelaran-Oyeyinka 2014, for a discussion in the role and capabilities of the state in industrial and innovation policy in Africa).

Although different institutional and legal arrangements exist, the selection of investment priorities is often done in a top-down and centralized manner. Generally, prioritization, if in place, does not rely on a thorough analysis of the local productive structure and assets that, ultimately, are supposed to materialize such priorities. Priorities at this level may be formulated in such a way that they can be related to any sub-activity of a given priority field (e.g. Agriculture, Health, Economy). The concern here is not so much about their formulation, but rather about how they can be translated into tangible industrial activities undertaken at the microeconomic level, which is well beyond the strategic documents writing. An important risk of such top-down strategies without evidence-informed prioritization is that they disregard the specific local and socio-economic challenges and problems that innovation policy may address (UNCTAD 2017; World Bank 2010); this might also be described as a 'one-size-fits-all' approach to innovation policymaking, whilst we are aware that human capital, infrastructures and resources greatly differ across and within territories (e.g. countries, regions, cities).

Another issue consists in the lack of local human resources for STI and the skills of the existing labour force when it comes to implement the STI priorities as well as to meet the market needs for technicians, scientists and engineers (S&E). An estimation of the ACBF quantifies this shortage to about 4.3 million engineers and 1.6 million agricultural scientists and researchers, due mainly to excessive enrolment rate in social sciences and humanities (ACBF 2017). Urgent actions are needed to reverse these trends through the introduction of career and incentive mechanisms as well as better quality school teaching in mathematics and science to attract African youths towards S&E education. Such interventions would benefit from collaboration with the private sector that should enhance its commitment to vocational and lifelong training of employees.[13] Empirical evidence strongly suggests that high quality education in science and mathematics is a critical factor determining economic growth (Hanushek and Wößmann 2010, see also the report of Blom, Lan, and Adil 2016, on the research performances of African regional groups in Science, Technology, Engineering, and Mathematics, STEM).

For many years, policymaking in STI has been focused on the S&T component, overlooking the 'I' dimension of the policy (Iizuka, Mawoko, and Gault 2015). This orientation has favoured a narrow perspective on innovation policies that are generally still perceived as linear interventions to improve the knowledge transfer from universities or research centres. Although such interventions are difficult to assess in the current informational context, they minimize the importance of non-R&D-based and non-technological innovation as well as the benefits of enhanced interactions for innovation, both with the formal private sector and the civil society. The situation is even more unbalanced if we account for the weight of the informal sector in African countries and its hidden innovation potential (Kraemer-Mbula and Wunsch-Vincent 2016). In many traditional economies, it is the non-technological (especially process, organizational, marketing) innovation that answers better the needs of companies, including micro- and small entities that make the greatest share of economic fabrics. The R&D-based technological solutions are often non-affordable or the

companies lack capacities to implement them, which changes only at the level of 'big medium' or large companies, that often have their own R&D staff. The focus on non R&D-based or 'soft innovation' changes therefore the landscape of actors that will benefit from the policies that are put in place.

Towards a smart specialisation mapping for Côte d'Ivoire: Challenges of evidence-based innovation policies

As previously underlined, smart specialisation processes should rely on the analysis of the initial conditions for policy intervention. This is initially done by mapping the economic, science and innovation potentials of a country or region (Smart Specialisation Evidence, see Figure 1 above). At the territorial level, such exercise should ultimately allow a better match of the innovation assets and the local societal and industrial or development challenges.

This section illustrates this by discussing key evidence-based and innovation-related challenges in Côte d'Ivoire's current development path and strategy. In doing so, it also highlights the need to conduct more research on the innovation potential and capabilities of local entrepreneurs, firms and research and higher education organizations.

Economic potential

Côte d'Ivoire has a surface area of about 322,000 km^2 and a population estimated at more than 24 million inhabitants (2017). With a GDP of about 38 USD billion and a per capita GDP of 1,550 USD, current prices in 2017, Côte d'Ivoire is one of the largest economies of the Economic Community of West African States (ECOWAS). In spite of a fast-expanding economy, the country does not perform so well when considering the Human Development Index (HDI) and the inequality-adjusted HDI (IHDI, see Table 1). The IHDI integrates the loss in human development due to inequalities along the three dimensions – *long and healthy life, access to knowledge, decent standard of living* –.

Table 2 shows additional statistical aggregates for the country. Although the picture is partial, some key challenges for the country can be underlined. These include the provision from basic needs, youth (future) employment, vulnerable employment, informal employment, and marked rural-urban inequalities.

After the economic slowdown due to the 2000s socio-political and post-electoral crises in 2011, the country has now recovered with sustained annual growth rates well above 6% in the last three years. This lower middle-income country now belongs to the top fast-growing African economies with countries such as Ethiopia, Senegal, Kenya, Rwanda and Tanzania – all with growth rates of 6% or more in the latest years. Yet, as many economies of sub-Saharan Africa, Côte d'Ivoire needs to diversify away from dependence on commodity exports if it is to sustain its actual growth (IMF 2016 [2017]). In terms of domestic fabric, the economy is oriented towards the services and agricultural sectors, which provide most of the (rural and informal) employment opportunities. As the largest cocoa producer with more than 30% of world production, the country's exports are driven by cocoa and cocoa products representing more than 30% of total exports in 2016 (see also Banque Mondiale 2019). Other important export items include oil, cashew nuts, gold and rubber, respectively 8%, 6%, 6% and 2% of the country exports (UN COMTRADE: https://comtrade.un.org).

Supported by the *Emergence 2020 Vision*, the government has launched massive infrastructure investments in all economic sectors since 2011 and has actively committed to reforms of the business environment, the transport and road infrastructure, the public service and

Table 2: Comparative perspective on key socio-economic indicators of Côte d'Ivoire (2017).

	Côte d'Ivoire	Lower middle-income country group
Access to electricity (% of population)	65.6	86.1
Access to electricity, rural (% of rural population)	36.6	79.1
People using at least basic drinking water services (% of population)	72.9	88.6
People using at least basic drinking water services, rural (% of rural pop.)	57.8	84.9
Agriculture, forestry, and fishing, value added (% of GDP)	21.6	15.3
Industry (including construction), value added (% of GDP)	24.7	28.6
Services, value added (% of GDP)	31.9	49.1
Human Development Index (inequality-adjusted)*	0.492 (0.311)	–
Informal employment (% of total non-agricultural empl.)	84.8	n.a.
Manufacturing, value added (% of GDP)	12.3	15.3
Population ages 0–14 (% of total population)	42.2	30.4
Population in the largest city (% of urban population)	38.9	n.a.
Rural population (% of total population)	49.7	59.9
School enrolment, tertiary, female (% gross)	7.6	24.7
Vulnerable employment, female (% of female employment)	84.9	67.7
Vulnerable employment, male (% of male employment)	64,4	63.5

Source: Selected from World Development Indicators (WDI): https://databank.worldbank.org/home, World Bank. (*) UNDP country notes: http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/CIV.pdf

Notes: The Lower Middle-Income Group as defined by the World Bank country classification. Agriculture corresponds to ISIC divisions 1–5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production (International Standard Industrial Classification (ISIC), revision 3 or 4). Industry corresponds to ISIC 10–45 and includes manufacturing (15–37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Services correspond to ISIC divisions 50–99 and they mainly include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services

procurement. At the same time, the country has gradually reinforced its regional and international political and economic positions and influence. Nevertheless, the path to the 'Ivorian miracle' is full of pitfalls. Exacerbated by the last decade crisis, poverty and inequalities have reached unprecedented levels and the education system has been seriously affected both in terms of infrastructure and quality of students training. In addition, youth unemployment is still massive and the informal economy prevailing, leaving the most vulnerable population behind.

In order to address these societal challenges, the government has also recently undertaken several programmes country-wise including for instance a series of institutional reforms extending to the traditional chiefs and local kings, the launch of youth people employment agencies and the recent 'Programme social' targeting, among other, a rapid improvement of access to electricity, water, education, health and mobility-related infrastructure.

Agricultural specialisations in Côte d'Ivoire's regions

Figure 2 shows the specialisations within the country: six zones are identified according to their main agricultural activity (see the JRC science for policy report by Ducroquet et al. 2017).

- zones 1 and 2 in the southern forest area, where family-type cocoa and coffee plantations prevail with an increasing competition from hevea (rubber tree) and palm oil culture. Tubers crop is also developed, while rice growing complements the main export-oriented cultures in zone 2;
- zone 3 or 'the agricultural belt of Abidjan', where export-oriented cultures still co-exist with increasing higher value activities such as intensive soilless culture, suburban fruits and vegetable culture;
- zone 4, the 'V Baoulé', where cash crop is not well implanted, while food crop is increasingly favoured due to the proximity of Yamoussoukro and Bouaké cities' markets;
- zone 5, 'the transition forest-savanna' where cocoa–coffee cultures coexist with cotton-cashew plantations;
- zone 6, cashew and cotton plantations prevail with food crop cultivation.

(see Ducroquet et al. 2017).

In terms of regional economic activities outside the agricultural sector, publicly available data or systematic evidence are scarce. With a local and international support, the regions of the country have been promoted through the Assembly of Regions and Districts (two autonomous districts of Abidjan and Yamoussoukro) of Côte d'Ivoire. So far, regions could report their economic, cultural and touristic potentials, priorities and (planned) projects, but there is no specific actors and activities mapping and the terms employed are often vague or too broad.

Nevertheless, in order to achieve one of its key missions – *study and recommend a range of development promotion actions and plans to the government* – the regions would need sound evidence bases, especially on the place-based entrepreneurial, innovation and industrial potentials and resources. Besides limiting the imitation of policy initiative or 'one-size-fits-all', such evidence can help unveiling relevant windows of opportunities for intra-territorial cooperation, cluster- and synergy-building, as well as the complementarities across the different value chain activities within the country.

Science and innovation potential

Côte d'Ivoire's state institutions have so far not conducted comprehensive R&D and innovation surveys. Given the scarcity of data, we treat science and innovation potential together in this section – despite their differences in conceptual terms. Different ministerial and international sources (Iizuka et al. 2018; WDI database) indicate that the country is far from the AU target of 1% of the GDP invested in R&D. The country counts more than 5000 HC R&D personnel (about one fourth of women); this is less than 200 researchers per million inhabitants (Table 3). The equivalent figure for sub-Saharan Africa is 87 and the world average 1098 in 2015 (UNESCO 2015, for comparatives across African countries).

Reflecting a greater commitment to the exploitation of research, the state has set up a dedicated fund for research and innovation (previously FONARI)[14] and is gradually building up fundamental components of an effective learning and innovation system with a focus on an increased exploitation of the academic research outcomes and a better R&I legal framework. Arguably, the policy orientation still reflects a linear understanding of innovation, an assumption that most contemporary innovation studies have refuted as too simplistic and one-sided (Fagerberg 2006).

While the efforts of government are focusing on science supply, a S&T and I policy is still on the way. In practice, the related policy issues or responsibilities mainly fall under the Ministry of Higher Education and Scientific Research and are implemented through its Directorate-General for Scientific Research and Innovation, the state's research centres, the research departments or units of universities and the related research Institutes. Within this Directorate-General, a dedicated sub-direction is responsible for the exploitation of research outcomes and industrial relations, innovation and intellectual property as well as technology transfer issues.

Côte d'Ivoire has six main public universities and a virtual university. Hosted in the economic capital city Abidjan, the University Félix Houphouët-Boigny has the highest enrolment rates,[15] with about 70,000 students. More than 1,300 lecturer-researchers and 80 FTE researchers are working mainly across the 13 research and training units (UFR) and two autonomous research centres. The second main one is the University Alassane Ouattara in Bouaké, where about 30,000 students are registered. The other universities include the University of Nangui Abrogoua (city of Abidjan), the University of Jean Lorougnon Guédé (city of Daloa), upgraded in 2012 from the status of regional teaching unit, and the University of Péléforo Gbon Coulibaly and the University of Man (city), created respectively in 2012 and 2015.

Besides, Côte d'Ivoire is also home to advanced higher education schools such as INP HB (Polytechnic national

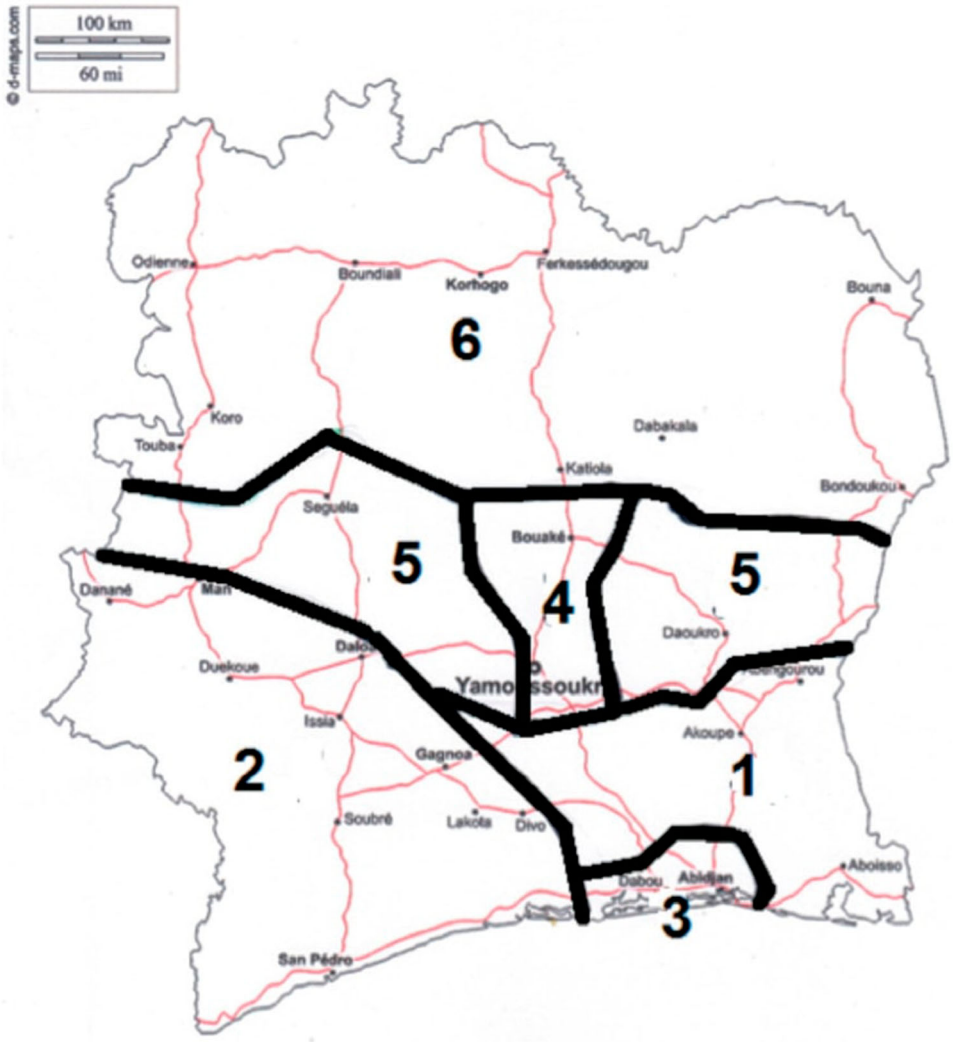


Figure 2: Cross-regional agricultural specialisations in Côte d'Ivoire. ***Source:*** Ducroquet et al. 2017, Figure 13, p. 36.
Notes: Yamoussoukro (zone 4) is the political capital city and Abidjan (zone 3) is a coastal and the largest city, also considered as the economic capital of the country

institute) in the political capital Yamoussoukro, ENSEA (National Advanced School of Statistics and Economics) in the economic capital, Abidjan, and the recently opened advanced secondary and high school, *Lycée d'Excellence Alassane Ouattara de Grand-Bassam*. The IPCI (Institut Pasteur de Côte d'Ivoire, health research) and the CNRA (National Agriculture Research Center) feature among the main Ivorian public research centres. The IPCI is a public establishment with industrial and commercial purposes and is recognized as a regional and international reference health research centre. The IPCI's CeReB is the first Biobank in West francophone Sub-Saharan Africa. Research in social sciences and economics is performed across different university departments through the country, but the CIRES is the dedicated country thematic centre attached to the University Félix Houphouet-Boigny.

In spite of several visible improvements, Côte d'Ivoire's research and innovation system is still underfinanced and needs to strengthen or operationalize its framework laws (e.g. for public-private partnerships, research contracts etc.) as well as fundamental public and private infrastructure. Moreover, there is no tradition or culture of innovation monitoring and regular surveys, so that the impacts of the FONARI or other thematic innovation support and initiatives remain hardly measurable beyond the granting period.

The monitoring of science or research potentials can be done to some extent by relying on international, continental and official local sources. However systematic evidence bases on (i) the innovation capabilities and performances – e.g. ability to create and/or to commercialize new or significantly improved products, processes or to implement new marketing and organizational improvements, to adopt new techniques and technologies – and; (ii) regional specific innovation challenges of Côte d'Ivoire's domestic firms is non-existent (or not publicly available). Nevertheless, local positive dynamic trends and opportunities are visible in the recent years for instance through:

- a more pro-active role of the CGECI, which is the local confederation of large firms, with its new CGECI Academy and innovation prizes, and the FIPME, the Ivorian federation of SMEs Federation;
- a greater availability of thematic private or public-private innovation funds and prizes;

Table 3: Overview of S&T performances of Côte d'Ivoire (2016).

Total R&D personnel (HC: Headcount) – Total		5,729
Total R&D personnel (HC) – % Female		22.4
Total R&D personnel per million inhabitants (HC)		241.8
Researchers per million inhabitants (HC)		180.9
Researchers as a % of total R&D personnel (HC)		74.8
Technicians as a % of total R&D personnel (HC)		21.2
Other supporting staff as a % of R&D personnel (HC)		4.0
Scientific and technical journal articles*		177
GERD in '000 PPP$ (in constant prices – 2005)		67,056
	GERD – performed by business enterprise %	*n.a.*
	GERD – performed by government %	*76.7*
	GERD – performed by higher education %	*21.6*
STI operational policy instruments *(examples)*	Strategic Support Program for Scientific Research – PASRES – which was set up as part of the project to create the National Fund for Scientific and Technological Research (FNRST) Interprofessional Fund for Research and Agricultural Council (FIRCA) FONARI * : Funds for the support of R&I including a women-dedicated Funds:	

Source: Extraction from UNESCO Institute of Statistics: http://data.uis.unesco.org, GO-SPIN initiative: https://en.unesco.org/go-spin/about; (*) World Development Indicators of the World Bank and Côte d'Ivoire's FONARI web page: https://fonari.mesrs-ci.net/
Notes: GERD: Gross Expenditure on R&D. The country also has, among other, a law related to the higher education and a law for the orientation and programming of scientific research and innovation as well as the establishment of a policy for technology exploitation

- the creation of dedicated funds and institutions for women empowerment and entrepreneurship (including a dedicated state secretary);
- the multiplication of start-ups funds, of entrepreneurial activities and digital start-ups;
- the development of a few small-scale incubation infrastructures and start-ups incubators such as the VITIB (ICT & biotechnologies) and Innovis;
- the emergence of Fablabs (e.g. Baby Lab), Tech hubs, digital tech communities and coworking spaces (Ovillage, Akendewa, Jokkolabs Abidjan).
- a nascent Tech ecosystem (Figure 3) enabled among other by an increasing venture capital funding for start-ups;
- the regular organization of annual local innovators' and inventors' fairs (Abidjan Innova) and thematic weeks;
- the uptake of innovation issues in local and international academics debates, conferences and workshops held in Côte d'Ivoire.

The bottom-up initiatives have come together with a more pro-active attitude of the local inventors' federation (FEDINCI) and women entrepreneurship associations. These elements signal a gradual shift in the local culture and attitudes and mark the awareness about the importance of innovation for socio-economic progress. Nevertheless, their impacts in terms of (sustainable) economic development are hardly seen beyond the urban centres (would they be evaluable), neither are their degree of integration and synergy with the local industrial and agriculture sectors. Given the limited resources for science and innovation, such integration may be determinant for the sustainable development ambitions of Côte d'Ivoire.

Towards innovation-based industrial diversification strategies in Côte d'Ivoire?

As many countries in sub-Saharan Africa, Côte d'Ivoire has an infant manufacturing industry focused on the production or primary transformation of agricultural products (cocoa, palm oil, coffee, rubber). Côte d'Ivoire's performance has greatly improved in the last decade and the country is now well positioned in key agricultural products and value chains on the continent and worldwide (cocoa, cashew nuts, palm oil, coffee, etc., see Ducroquet et al. 2017 for a detail panorama of the agricultural system and performances). Yet, the country is far from exploiting the various potentials of industrialization and diversification that are necessary to render the country more resilient, less depend on international commodities prices, but also to meet the growing domestic consumer and BTB demand.[16] In terms of employment, industry does not represent more than 10% of the total employment, far below the agricultural sector covering about half or more of the employment.[17] A gradual transition away from the resource-intensive growth trajectory may also carry important entrepreneurial and professional opportunities for a particularly young population. For now, the industry relies mainly on low value-creation activities and limited jobs creation in the formal sector.

Supported by the ambitious second National development plan (PND 2016–2020)[18] and improved governance for industrial activities and infrastructure, Côte d'Ivoire's government has restated its will to diversify its production by capitalizing on comparative advantages and to raise the productivity levels in the agriculture sector. Among its key five strategic axes, the government highlights the need to 'accelerate the structural transformation of the economy through greater industrialization' (Ministère du Plan et du Développement (MPD-CI) 2016). The structural transformation strategy seeks to improve (agricultural) products, increase industrial activities with higher job- and value-creation potential and produce more complex products as well as to better exploit services activities through formalization and professionalization.

In order to support its industrial strategy, the government has accelerated the construction, and development of industrial parks and zones, so far mainly located in the economic capital city, Abidjan, or its region (industrial

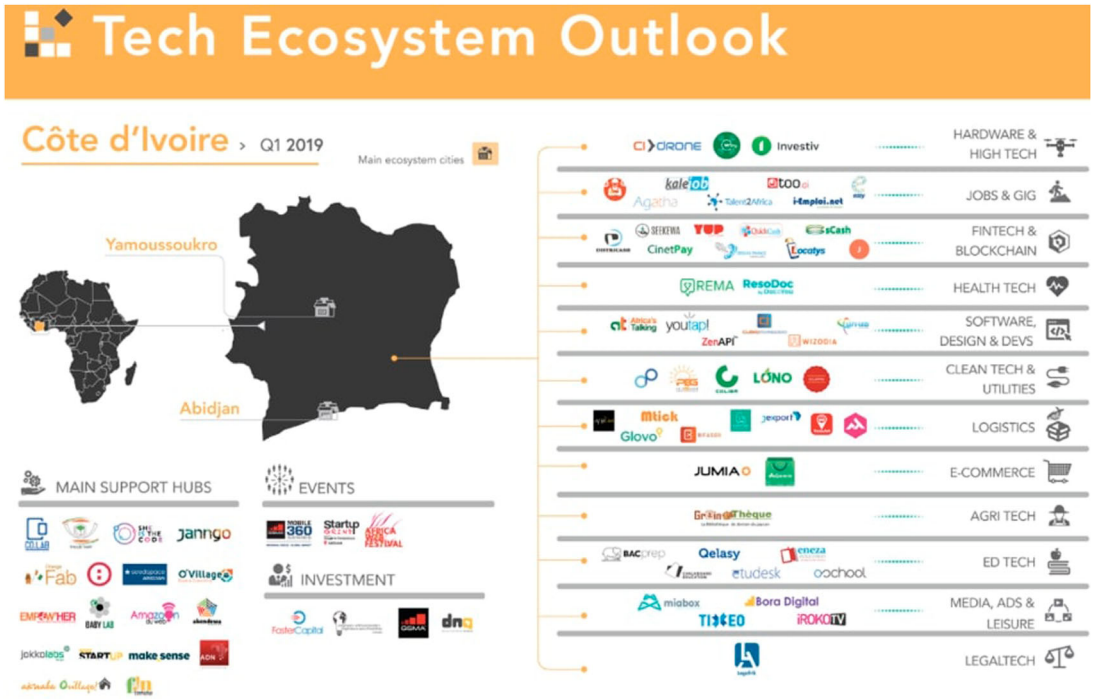


Figure 3. Côte d'Ivoire Tech Ecosystem mapping by Briter Bridges®. ***Source:*** https://www.gsma.com/mobilefordevelopment/blog/akwaba-to-the-cote-divoire-tech-ecosystem/

zones of Yopougon, Vridi, Koumassi and PK24 Akoupé-Zeudji). Outside Abidjan, the industrial zones are being rehabilitated, extended or planned, for instance in the political capital Yamoussoukro, in the cities of Bonoua (south east), San Pedro (south west), Bouaké (centre), Korhogo (north) and Aboisso (south east). A dedicated agency, the AGEDI, the agency for the management and development of industrial infrastructure is in charge of administrating the existing and new structures; it operates under the ministry in charge of industry development.[19] Bottom-up initiatives also exist as small private organizations and professional and associative networks are also quickly developing their transformation activities; this is the success case of the RET-PACI, the National Network of Agro-Transformers of Côte d'Ivoire, where women prevail.

However, the majority of small businesses in cities are still struggling to scale up and the innovation and technology dimensions remains lowly integrated in their activities. For the food or subsistence crop, the returns are relatively low and the rooms for improvement depend much on the possibilities to introduce new higher-returns varieties and the modernization of planting techniques. In addition, new activities should be supported with a more integrated and strategic approach in terms of training, funding of agriculture entrepreneurs (mainly mechanics or machinery engineers) and financial or payment guarantee system (Ducroquet et al. 2017).

Besides, for the export-oriented crop such as cocoa, hevea (rubber tree), cotton, cashew nuts, the local production focuses on increasing the low value-chain transformation activities; leaving away untapped opportunities for innovation-oriented diversification or complementary knowledge-based productive activities. In the related sectors, the revenues are actually mainly shared in between a few private sector businesses or rich landowning families and or foreign companies, while small farmers' incomes often do not meet their subsistence needs.

In such a framework, it is much unlikely that the Schumpeterian creative destruction processes (Schumpeter 1942) effectively take place to enable the renewal of incumbent firms and the entry, upgrade and scale up of local SMEs and (agricultural) entrepreneurs with the appropriate technical and market training, innovation skills and funding capital.

Furthermore, the implementation mechanisms and the monitoring tools necessary to support Côte d'Ivoire's current plans are not sufficiently defined and the identification and selection procedures of new and more complex products and higher jobs- and value-creation activities are not clarified. In many cases, the objectives focus on improving national and regional market shares of agricultural products (cocoa, sugar, rubber, cashew nuts, palm oil). Such short-term focus does not facilitate the targeting of knowledge-intensive and innovation-led industrial activities that yield valuable potential both for diversification and for the attractiveness of the labour-related opportunities, especially for the youth. In terms of policy, this means that more efforts should be done to reconcile the industrial modernization plan and the current research exploitation policy towards a more consistent support to industrial innovations (innovation policy) in view of better addressing local population and business challenges and needs.

Côte d'Ivoire owns sufficient raw resources to develop a consistent and more sustainable agricultural waste recycling sector (circular economy) and to establish related local value chains. At the same time, the country can address important quality upgrading and environmental issues related to its agriculture

production, while nurturing innovative transformative activities in the field. Although several examples are scattered over in the country, the scales remain small and significant upgrading and industrial diversification possibilities are yet untapped (see also the discussion by Dosso 2019). The adoption of certifications and labelling of local products and industrial processing can be effective tools to enhance consumer trust, commercial reputation and local and international markets reach. They can also further act as incentive for local firms and small farmers to undertake continuous quality upgrades and incremental innovations.

Relevant opportunities also exist for recycling-based industrial diversification, such as the transformation of cocoa pods (for instance, the use of cocoa pods as growing media supplement on mushrooms, Mudakir et al. 2014) or the development of cocoa-based cosmetics activities and clusters. Moreover, and since the country is now leading the continental exports, other avenues for structural change could target the innovative exploitation of cashew apple as a raw material for alternative food processing and production. Similarly, and in front of the continue drop in commodity prices, the country could go beyond the export of natural rubber by modernizing and re-orienting the local transformation in order to solve pressing local challenges (for instance, Malaysia's rubber asphalt paving). Moreover, Côte d'Ivoire holds an advanced national and international institute, which is endowed with skilled human capital in the fields of microbiology and health research (Institute Pasteur de Côte d'Ivoire, IPCI). The skills of the IPCI can be instrumental to enhance the effectiveness and quality control of the transformation processes of 'Attiéké' (couscous made from cassava fermentation) and to enhance its variety; Attiéké constitutes a major national food product and a relevant export item of the country. The country has recently applied for a geographical indication.[20] Furthermore several opportunities exist in Côte d'Ivoire for instance in higher-value services to businesses (e.g. in the tourism and logistics industries), agro-processing, agricultural and agro-industry machinery and tools or in the mining sector's value chain and related industries (e.g. mining technology services).

Whichever directions or transformative innovation activities would be selected, such alternative narratives will require a better integration of Côte d'Ivoire industrial and research policy strategies and implementation plans. In addition, a dedicated support and monitoring of young innovative entrepreneurs and 'agripreneurs' in selected smart specialisation domains will be essential in order to reach the critical masses of local innovative SMEs and large firms for long term and sustainable structural change in Côte d'Ivoire.

Concluding remarks

Sub-Saharan Africa has witnessed a mushrooming of new initiatives to build better science, technology and innovation capabilities. In 2015, *the Economist* talked about Africa as the 'pioneering continent' for technology policy with strong local potentials. Yet, these potentials remain largely untapped given the fragmented innovation systems and policy frameworks. We argue that place- and evidence-based innovation strategies can contribute to tapping the full potential of sub-Saharan African economies. Côte d'Ivoire serves as an illustration of untapped potentials that could be released if an effective innovation-led territorial approach was applied in the current industrial development trajectory targeting the Emergence 2020 Vision. Drawing a preliminary picture of the country's economic, science and innovation potentials, this article argues that place-based economic transformation agendas can help African countries to develop competitive advantages by better matching research and innovation assets to the local challenges and the needs and capabilities of the business sector. More comparative research is needed to identify what works under given local conditions. Other critical cases like Rwanda, hailed as 'a startup country', should be systematically studied to draw parallels and identify differences and scope conditions for effective innovation strategies.

Importantly, an initial step for the implementation of a Smart Specialisation Strategy would be a comprehensive assessment of the current strengths and challenges of the territory (including at the sub-national level). Combining quantitative and qualitative (expert) information, such territorial mapping constitutes a critical input for informed strategic policy decision, as for the identification of priority domains for economic transformation through the entrepreneurial discovery processes (EDPs). The current analysis has underlined relevant avenues to collect the evidence needed to support the EDP for the selection of smart specialisation priority domains. Nevertheless, localized Smart Specialisation roadmaps will certainly allow for the customization of evidence collection targeting a full mapping of Côte d'Ivoire's territorial development potentials (see also the presentation by Daniels and Dosso 2018). A key implication is that pilot projects on smart specialisation in sub-Saharan African countries would require local policymakers and stakeholders to constitute a sound and comprehensive basis of evidence. In this process, local and international (diaspora) expertise should also be integrated for benchmarking purposes, knowledge transfer and for future collaborative exercises.

The exact approach to smart specialisation in Sub-Saharan contexts has to be further studied and developed. The ongoing Smart Specialisation pilots and international cooperation are already providing important insights and lessons for the design and implementation of such integrated place-based and transformative policy approaches in sub-Saharan African contexts. They will certainly require the undertaking of preliminary steps including capacity-building programmes, the strengthening of inclusive dialogues frameworks and thematic institutional learning programmes for innovation policy coherence. However, the basic idea of involving local stakeholders (especially companies) in their own development through innovation is well matched with other, more generic development policies and can generate important synergies. In this context, having in mind the size of the countries involved, an appropriate institutional framework should be developed, where the national authorities provide the general directions and enable the development

of the more specific, local and regional agendas with involvement of public administrations in situ. The institutional framework needs to provide enough stability to generate and sustain motivation, commitment and trust of the private sector. A basic encouragement measure here can be to organize a few pilot actions that would lead to local 'success stories' that are applicable and understandable for the local communities and build on the existing capabilities. The range of possible applications can vary from using raw food products to create natural cosmetics (coffee waste is recently used by some EU companies to create organic body scrubs), analysing their medical and health properties and starting the development of functional foods, or promoting food design. All such exercises should lead to the identification of concrete examples of higher value-added products created by combining local resources and skills with knowledge and innovation. This will be a solid base for larger programmes in the future and can generate natural spillover and synergetic effects even without public sector interventions.

Notes

1. The term Innovation in this paper has a broad meaning, which refers both to technological and non-technological forms of innovations. It encompasses products, processes, organizational, marketing, institutional and social innovations, whether they are either radically or incrementally novel or only new to the firm and/or only new to the target market.
2. http://www.un.org/sustainabledevelopment/sustainable-development-goals/ (latest access August 2019).
3. The recent shift in the policy thinking has been marked by the early Africa's Science and Technology Consolidated Plan of Action endorsed in 2006 (Khartoum Summit) and the adoption of the Science, Technology and Innovation Strategy for Africa – 2024 (STISA-2024, June 2014, 23rd Ordinary session) (AUC 2014). See also UNECA (2016) and the UNESCO's African STI Policy Initiative, http://www.unesco.org/new/en/natural-sciences/science-technology/sti-policy/africa/launch-of-the-african-science-technology-and-innovation-policy-initiative/ (latest access August 2019).
4. Smart specialisation platform http://s3platform.jrc.ec.europa.eu.
5. In collaboration with the Joint Research Centre (JRC) and DG NEAR, a recent Smart Specialisation process has been officially launched by Tunisia. A series of workshops, dialogues and analyses are being undertaken in collaboration with African, Rwanda's national institutions (e.g. Rwanda Academy of Sciences) and international experts to inform future pilots.
6. In the EU context, RIS3 were required as a legally binding ex-ante conditionality (regulation EU 1301/2013): National/regional authorities across Europe shall design S3 in entrepreneurial discovery process in order to use more efficiently the European Structural Investment Funds (ESIF), to drive synergies between EU, national and regional policies, and to enhance public & private investments.
7. The broad types of innovation policy instruments underlined here – Regulation, Economic transfers and Soft instruments – have been discussed more in depth by Borrás and Edquist (2013).
8. Smart specialisation platform: http://s3platform.jrc.ec.europa.eu. S3 beyond EU: http://s3platform.jrc.ec.europa.eu/s3-beyond-eu; S3 worldwide: http://s3platform.jrc.ec.europa.eu/s3-worldwide.
9. See Foray et al. 2012 for the first official Guide on RIS3.
10. See also the background and synopsis of the debate on 'Territorial Innovation Policies and Smart Specialisation: a promising area for Africa-EU cooperation' organized by the European Commission's DG JRC at the European Development Days 2017, June, Brussels. The debate was organized with the official support of the AU's AOSTI and Côte d'Ivoire's institutions. (see https://s3platform.jrc.ec.europa.eu/documents/20182/217512/Background±note±EDD±Debate±D4±June±8th.pdf/48bdddfa-107e-4cd6-8cd6-ca3d4ff3c843 and https://s3platform.jrc.ec.europa.eu/documents/20182/217512/EDD2017_Prosperity_D4_ppt±June±8th.pdf/8e9b046d-0778-4831-b8e2-35737120171a).
11. STISA 2014–2024 has followed the AU/NEPAD Africa's Science and Technology Consolidated Plan of Action (CPA) which was endorsed by the African Union Summit of Heads of State and Government in 2006 and adopted by the African Ministerial Council on Science and Technology (AMCOST). The CPA built upon five clusters of flagship research and development programmes to be implemented between 2006 and 2010: Biodiversity, biotechnology and indigenous knowledge; Energy, water and desertification; Material sciences, manufacturing, laser and post-harvest technologies; Mathematical Sciences and; ICT and Space Sciences.
12. This is equivalent to about 81,000 researchers (UNESCO, Unesco Institute for Statistics, *UIS.stat*). See also the overview on R&I performance in Africa (Dosso et al. 2017).
13. The recent declaration signed by the representative of the AU and more than 100 companies during the Africa Talks Jobs 2017 conference in Addis Ababa (Ethiopia) constitutes an exemplary step towards a greater and more concrete commitment of the private sector in the employability and training of youth on the continent.
14. See at https://fonari.mesrs-ci.net/. The creation of an innovation funds has been announced several times in the last two years (see a ministerial TV announcement at https://news.abidjan.net/h/664453.html).
15. See the Ministry for more details on the universities and research centres: http://www.enseignement.gouv.ci/index.php?open=recherche&rec=uivoiro; http://www.enseignement.gouv.ci/index.php?open=recherche&rec=organes.
16. See also the detailed reports of McKinsey Global Institute (2016) and IMF (2016 [2017])
17. See at https://www.agenceemploijeunes.ci/site/themes/themeforest/assets/files/RAPPORT_FINAL_ENSESI_2016.pdf.
18. Above 60% of the PND should be funded through public-private partnership. The strategic orientations of the PND 2016–2020 are available at: http://www.gcpnd.gouv.ci/fichier/doc/TOME2_compresse.pdf.
19. Côte d'Ivoire's AGEDI information (http://www.agedi.ci/map.html / http://www.agedi.ci/interieur.php).
20. See at http://www.oapi.int/index.php/fr/component/k2/item/498-bientot-l-attieke-des-lagunes-et-les-pagnes-baoules-labelises.

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References

ACBF, African Capacity Building Foundation. 2017. *Africa Capacity Report 2017, Building Capacity in STI for Africa's Transformation*. Harare: ACBF.

Aprahamian, A. and Correa G., P., eds. 2015. *Smart Specialization in Croatia: Inputs from Trade, Innovation, and Productivity Analysis*. Washington, D.C., World Bank Group. DOI: https://doi.org/10.1596/978-1- 4648-0458-8

AOSTI (African Observatory of Science, Technology and Innovation). 2014. *Science, Technology and Innovation Policy-Making in Africa: An Assessment of Capacity Needs and Priorities*. WP No. 2. Malabo: AOSTI.

AU-NEPAD. 2010. African Innovation Outlook 2010. Pretoria: African Union-New Partnership for African Development.

AU-NEPAD. 2014. African Innovation Outlook II. Pretoria: African Union-New Partnership for African Development.

AUC (African Union Commission). 2014. *AU Strategy for Science, Technology and Innovation for Africa 2024, STISA-2024*. Addis Ababa: African Union.

Banque Mondiale. 2019. *Situation économique en Côte d'Ivoire – Au pays du cacao, comment transformer la Côte d'Ivoire*. 9th ed. juillet 2019.

Blom, A., G. Lan, and M. Adil. 2016. *Sub-Saharan African Science, Technology, Engineering, and Mathematics Research: A Decade of Development*. World Bank Study. Washington, DC: World Bank. https://pdfs.semanticscholar.org/9643/54f01e58df3b2777279d5f55b18bb31a4a0e.pdf.

Borrás, S., and C. Edquist. 2013. "The Choice of Innovation Policy Instruments." *Technological Forecasting and Social Change* 80 (8): 1513–1522.

Capello, R., and H. Kroll. 2016. "From Theory to Practice in Smart Specialization Strategy: Emerging Limits and Possible Future Trajectories." *European Planning Studies* 24 (8): 1393–1406.

Daniels, C., and M. Dosso. 2018. "Mapping Territorial Potentials for Evidence-Informed Innovation Policies in Africa: Insights from Côte d'Ivoire and Nigeria." *Paper presented at the EU SPRI Conference 2018*, Paris. European Forum for Studies of Policies for Research and Innovation. https://euspri2018.paris/wp-content/uploads/2018/08/euspri-session-61-daniels-et-al.pdf.

Daniels, C., P. Mawoko, and A. Konté. 2018. "Evaluating Public Policies in Africa: Insights from the Science, Technology, and Innovation Strategy for Africa 2024 (STISA-2024)." Policy Brief. Policy@Sussex. December. http://blogs.sussex.ac.uk/policy-engagement/files/2019/02/2018-12-STISA-PB-Chux-Daniels.pdf.

Dosso, M. 2017. *Smart Specialisation in Sub-Saharan Africa: Opportunities and Challenges – An Introductory Note*. Seville: European Commission, JRC. https://ec.europa.eu/jrc/sites/jrcsh/files/smart_specialisation_in_sub_saharan_africa_introductory_note.pdf.

Dosso, M. et al. 2017. "Research and Innovation". pp. 217-224, In European Commission, Joint Research Centre. 2017. Science for the AU-EU Partnership: building knowledge for sustainable development, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-86961-7, doi:10.2760/360029, JRC107753

Dosso, M. 2019. Industrie et innovation pour un changement structurel et un développement territorial durable en Afrique. Annales des Mines, série Réalités Industrielles – Aout 2019. http://www.annales.org/ri/2019/resumes/aout/04-ri-resum-FR-AN-aout-2019.html.

Dosso, M. 2020. *STI Roadmaps for SDGs: Smart Specialisation for Territorial and Industrial Development in Rwanda*. Luxembourg: Publications Office of the European Union. ISBN: 978-92-76-18116-3.

Dosso, M., A. Kleibrink, and M. Matusiak. 2018. "Smart Specialisation in Sub-Saharan Africa: Opportunities and Challenges." *Research Article in EAI International Conference on Technology, R&D, Education and Economy for Africa*. https://eudl.eu/doi/10.4108/eai.21-3-2018.2275700.

Ducroquet, H., P. Tillie, K. Louhichi, and S. Gomez-Y-Paloma. 2017. *L'agriculture de la Côte d'Ivoire à la loupe: Etats des lieux des filières de production végétales et animales et revue des politiques agricoles, EUR 28754 FR*. Luxembourg: EU Publications Office. https://publications.jrc.ec.europa.eu/repository/handle/JRC107214.

Fagerberg, J. 2006. "Innovation. A Guide to the Literature." In *The Oxford Handbook Of Innovation*, edited by J. Fagerberg, D. C. Mowery, and R. R. Nelson, 1–26. Oxford: OUP.

Foray, D. 2015. *Smart Specialisation, Opportunities and Challenges for Regional Innovation Policy*. Abingdon: Routledge.

Foray, D., et al. 2012. *Guide to Research and Innovation Strategies for Smart Specialisation (RIS3)*. European Commission. http://s3platform.jrc.ec.europa.eu.

Gianelle, C., D. Kyriakou, C. Cohen, and M. Przeor, eds. 2016. *Implementing Smart Specialisation: A Handbook*. Brussels: European Commission.

Guimón, J. 2013. "Smart Decentralization of Innovation Policies." Policy Brief. World Bank, the Innovation Policy Platform. Accessed November 2017. https://www.innovationpolicyplatform.org.

Hanushek, E. A., and L. Wößmann. 2010. "Education and Economic Growth." In *International Encyclopedia of Education*, edited by P. Peterson, E. Baker, and B. McGaw, 3rd ed., 245–252. Oxford: Elsevier.

Iizuka, M., A. Konté, P. Mawoko, E. Calza, and F. Gault. 2018. *Innovation for Developmentin West Africa: Challenges for Promoting ST&I Policy*. UNU-MERIT Policy Brief, No. 3. Maastricht. United Nations University 2018, ISBN 978-92-808-5009-3

Iizuka, M., P. Mawoko, and F. Gault. 2015. *Innovation for Development in Southern & Eastern Africa: Challenges for Promoting ST&I Policy*. UNU-MERIT Policy Brief, No. 1. Maastricht. United Nations University 2015, ISBN 978-92-808-5003-1

International Monetary Fund. 2016 (2017). *Regional Economic Outlooks, Sub-Saharan Africa*. Washington DC: IMF.

Joint Research Centre. 2018. "Synergies of Instruments and Competences: Connecting Smart Specialisation Strategies and Technology Transfer, Innovation Ecosystems, Research, Education and Skills." JRC.B.3 - Territorial Development Unit, European Commission. https://ec.europa.eu/jrc/sites/jrcsh/files/26012018-innovationweek-rainoldi_en.pdf.

Kelley, D., et al. 2015. *The Global Entrepreneurship Monitor 2015/16 Global Report*. London: Global Entrepreneurship Research Association.

Kleibrink, A., P. Larédo, and S. Philipp. 2017. *Promoting Innovation in Transition Countries: A Trajectory for Smart Specialisation, EUR 28638 EN*. Luxembourg: Publications Office of the European Union.

Kraemer-Mbula, E., and S. Wunsch-Vincent, eds. 2016. *The Informal Economy in Developing Nations – Hidden Engine of Innovation*. Cambridge: Cambridge University Press.

Marinelli, E., and I. Perianez-Forte. 2017. *Smart Specialisation at Work: The Entrepreneurial Discovery as a Continuous Process*. JRC Technical Reports, S3 Working Papers Series, n° 12/2017. https://s3platform.jrc.ec.europa.eu/documents/20182/222593/S3+at+work_ED/9f0c2ccc-97a0-4322-919d-4e89f3d6bf1c.

Matusiak, M., and A. Kleibrink, eds. 2018. *Supporting an Innovation Agenda for the Western Balkans: Tools and Methodologies*. Luxembourg: Publications Office of the European Union. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC111430/2018-04-24_western-balkans-report_online.pdf.

McKinsey Global Institute. 2016. *Lions on the Move II: Realizing the Potential of Africa's Economies*.

Ministère du Plan et du Développement, MPD-CI. 2016. *Plan national de Développement 2016–2020, Orientations Stratégiques* [National Development Plan 2016–2020, Strategic Orientations]. Côte d'Ivoire.

Mudakir, I., U. S. Hastuti, F. Rohman, and A. Gofur. 2014. "The Effect of Cocoa Pods Waste as a Growing Media Supplement on Productivity and Nutrient Content of Brown Oyster Mushroom (Pleurotus cystidiosus)." *Journal of Biology, Agriculture and Healthcare* 4 (26), 134–140.

Oyelaran-Oyeyinka, B. 2014. "The State and Innovation Policy in Africa." *African Journal of Science, Technology, Innovation and Development* 6 (5): 481–496.

Rissola, G., H. Kune, and P. Martinez. 2017. *Innovation Camp Methodology Handbook: Realising the Potential of the Entrepreneurial Discovery Process for Territorial Innovation and Development*. Luxembourg: EU Publications Office. https://s3platform.jrc.ec.europa.eu/documents/20182/198909/Innovation+Camp+Methodology+Handbook/3e201fe6-ff13-429d-8105-a09140eb1dd7.

Schumpeter, J. 1942. *Capitalism, Socialism, and Democracy*. New York: Harper & Bros.

UNCTAD. 2017. *New Innovation Approaches to Support the Implementation of the SDGs*. United Nations, 2017. http://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=1775.

UNECA (United Nations Economic Commission for Africa). 2016. *Assessing Regional Integration in Africa (ARIA VII): Innovation, Competitiveness and Regional Integration*. Addis Ababa: United Nations Economic Commission for Africa.

UNESCO (United Nations Educational, Scientific and Cultural Organization). 2015. *UNESCO Science Report: Towards 2030*. Paris. https://en.unesco.org/unesco_science_report.

UN (United Nations). 2015. "Transforming Our World: The 2030 Agenda for Sustainable Development." Resolution Adopted by the General Assembly on 25 September 2015. Accessed July 2020. http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.

World Bank. 2010. *Innovation Policy: A Guide for Developing Countries*. Washington, DC.

World Bank, WDI (World Development Indicators). https://databank.worldbank.org/source/world-development-indicators.