Service ecosystems in support to agricultural innovation in Africa: who are they and how do they emerge?

ST-AIMS 3 : L'action collective et ses dispositifs

1. AUTHORS

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2. RÉSUMÉ

Les organisations qui accompagnent l'innovation se regroupent afin d'accroitre leur efficacité dans le soutien aux innovateurs. Ce phénomène méta-organisationnel qui repose sur des processus de coopération mais aussi de compétition entre des organisations de différentes nature (publique, privée, hybride) pose de nouvelles questions : comment prennent forme ces regroupement (réseaux ? plateformes ? centres ? etc.), et comment se constituent-ils en écosystème « efficace » d'accompagnement de l'innovation agricole ?
Pour répondre à ces questions, nous proposons un cadre d'analyse original intégrant quatre courants de recherche : les réseaux, les méta-organisations, les communautés d'innovation et les écosystèmes. Nous l'avons appliqué à une diversité de dispositifs méta-organisationnels décrits dans la littérature afin de consolider dans un premier temps les critères de diversité de ces dispositifs.
Pour cela, nous avons sélectionné 164 articles et articles de conférence identifiés par mots clé dans WoS. Nous avons identifié quatre critères pour décrire ces dispositifs (origine, fonctionnement, durée de vie, caractéristiques de l'organisation hub) et deux critères pour les différencier : leur mode d'émergence (ad-hoc, planifiée et intermédiaire) et leur gouvernance (partagée, concentrée et partiellement partagée). Cela nous a conduit à caractériser quatre types différents d'écosystèmes de services en soutien à l'innovation agricole en Afrique.
Cette caractérisation nous permet de poser des questions spécifiques sur leur efficacité, et de proposer des pistes d'analyse.

3. MOTS CLÉS

Théories des réseaux – Papier conceptuel/théorique – innovation – gouvernance – comportement organisationnel collectif

4. INTRODUCTION

The world in general and agriculture in particular are currently facing urgent challenges (population growth, climate change, soil degradation, etc.) to which answers are needed. There is, to date, not enough innovation in agriculture to meet these challenges and the innovations observed, only come about after a long process. This observation is particularly true in Sub-Saharan Africa, which is facing the above-mentioned challenges in an accentuated manner: demographic growth is the highest in the world (2.7% per year compared to a world average of 1.1% (Tabutin & Schoumaker, 2020)), desertification of the countries in the Sudan-Sahel band has a strong impact on the available agricultural land, irregular rainfall and increased pest pressure - particularly locust invasions - reduce crop yields, etc. At the same time, these countries face security and political situations that are often not conducive to responding effectively to these challenges.

The structure of innovation support services in Sub-Saharan Africa is based on historical actors and their mandates, mostly public agricultural advisory services, Farmer Organisations' services to their members, and NGOs' development projects. Recently a diversity of new actors became engaged in agricultural innovation support: incubators, living labs, private organisations, private input suppliers (Toillier et al., 2021). Although these actors exist and provide services to innovators, the innovation environment remain less enabling in Sub-Saharan Africa than it can be in other regions of the world (Cornell University et al., 2018).

In response to this problem, the literature describes the emergence of new forms of collaboration and arrangements between service providers in order to be more effective in their support. It can take the form of the Afric'Innov network in French-speaking countries of Africa, of hubs of incubators like the hub Meet Africa, third-places like La Fabrique in Burkina Faso, etc. The organizations complement their service offering with other service providers, in order

to be able to meet the needs of their incubees, they learn from each other in order to upgrade their skills, they gather in order to perpetuate the network beyond time-bound project funding. Moreover, funding often comes from one-off development projects and often lags behind the needs. There is therefore a shared desire to perpetuate and strengthen local structures that do not depend on external funding and can continue to operate independently. Some mechanisms encourage this type of interaction (poles, clusters, districts)(Brondeau, 2018; Galvez, 2010), supported by public policies and investments.

However, there are very few examples of successful ecosystems that sustain over the long time. Several studies identify siloed service delivery and orphan service segments in some innovation domains (Toillier et al., 2022). Our research aims at better understanding why a lot of ecosystems fail to emerge properly or decline rapidly. We will wonder what are the existing service ecosystems in support to agricultural innovation in Africa and how do they emerge? What kind of service ecosystems in support to agricultural innovation exist: what are they, what reality do they describe, how do they emerge, who is responsible for their emergence? Is there any hub organisation that play a leading role? What impact does it have on their governance, and the quality of the support services they provide?

The literature on service ecosystems (Frow et al., 2019; Mele et al., 2018) in other sectors (tourism, care) showcases the advantages of networking service delivery but some authors detected specific challenges linked to the efficiency and sustainability of these ecosystems of services (lack of a joint vision, or effects of inertia due to some dormant organizations of the networks, etc.).

Nevertheless, there is no such research work applied to innovation support services in the agricultural sector, whereas it presents specific characteristics (Faure et al., 2018; Toillier et al., 2018): agricultural innovation involves multiple organizations of different nature, and has

always systemic consequences on food systems, which affect all the population from the farmers and the consumers up to the policy actors.

In order to analyse the drivers of the emergence and efficiency of these networks of service providers for agricultural innovation, we developed an integrated framework, building on two main fields of research: organizational studies and agricultural innovation studies. We applied it to a large number of cases in order to identify criteria that will help to grasp the diversity of these ecosystems and to reflect the drivers of success.

Our paper is organized in three parts. First, we present our conceptual framework and the analytical model we developed. Then we present the results of our meta-analysis of literature on the characteristics, success and pitfalls of multi-organisational structures that offer support services in the agricultural sector. We analyse the eight case studies that illustrate the diversity of service ecosystems in support to agricultural innovation. Finally, we conclude on the strengths and weaknesses of our analytical model

5. CONCEPTUAL FRAMEWORK

Regarding agricultural advisory services, conception of supporting modes evolved along the years, from a linear and diffusionist paradigm of innovation process to a more interactive and participative paradigm (Le Gal et al., 2011). In the former, innovations were designed by researchers and diffused by advisors in the form of technological packages to farmers who were supposed to implement the innovations proposed. In the latter, the paradigm changed, considering farmers as an integral part of the innovation production and researchers and advisors as important actors for knowledge transfer and design support. Involving farmers in the process of innovation design has been proven to maintain their motivation and improve their learning process and capacity building (Cardoso et al., 2001; Le Gal et al., 2011).

Between these two extremes, a continuum of methodologies exists, more or less including the farmers in the design of innovation (Figure 1). The training and visit methodology, introduced

1975 in India and promoted by the World Bank, is based on technology transfer (innovation developed in research centres is disseminated to farmers who then share their knowledge with their neighbours). This model has proven not to be the most effective (Faure et al., 2012). Then, the Farmer Field School methodology was introduced in the 1980s in the Philippines and promoted by the FAO. It belongs to the learning facilitation approach and relies on exchange meetings and field experiments conducted by volunteer farmers and advisors (Anandajayasekeram et al., 2007; Davis, 2006; Faure et al., 2012). Participatory Learning and Action Research methods integrate farmers even sooner and deeper in the innovation process and advisors are considered as brokers of knowledge facilitating relations and knowledge exchange (Faure et al., 2012).

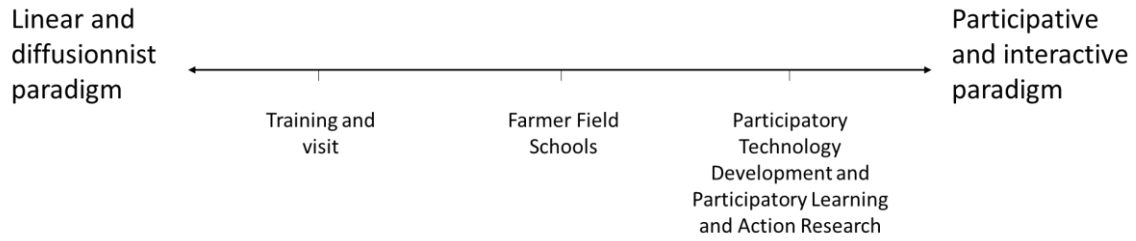


Figure 1 : Methods of advisory services ranked according to the level of inclusion of farmers in the innovation design (adapted from (Faure et al., 2012)

This paper aims to describe how different organisations coordinate their service delivery in order to create a more enabling environment for innovators. We first present here the existing frameworks in the field of organisations' studies and then the frameworks in agricultural innovation systems studies.

Inter-organizational arrangements to support innovations

Different theoretical trends have been developed along the years to understand how and why organisations and firms choose to collaborate. First, authors valued geographical proximity in a same territory with the notion of industrial district introduced by Marshall (1890) and further developed by Becattini (1979). Then, Porter (1998) proposed the notion of Cluster to describe a territory where firms and universities have similar activities, interact, cooperate and produce similar or complementary goods (Daidj, 2011). In the 90s, the concept of technopoles and

scientific or technology parks appeared, which can be described as "local geographical concentrations of innovative firms located near scientific research and training centres, willing to create together an innovative micro-system" (Ruffieux, 1991)[1].

Later, the territorial dimension of these gatherings of organizations became less significant and other theories appeared to describe the phenomenon: networks, meta-organisations, communities of organisations, ecosystems. Network theories consider networks as sets of both organisations and the individuals from these organisations, interacting with a common goal (in our case, it would be developing an enabling environment for innovation in agriculture and agro-industry) (Cap et al., 2019; Provan & Kenis, 2007). Networks can either be described through their structure and architecture (Ahuja et al., 2012) or through their governance either centralised around a hub organisation orchestrating relationships or more decentralised with power more equitably shared between members (Favre-Bonté et al., 2016; Provan & Kenis, 2007).

The concept of meta-organizations adds an interesting perspective to the one of networks as it allows to consider "environments" composed of different types/categories of organizations while networks are usually composed of similar types (Ahrne & Brunsson, 2005). One of the main characteristics of meta-organizations is that the relationships between members are not relying on employment relationships, unlike in traditional organizations. However, Gulati, Puranam, et Tushman (2012) underline the fact that there can still be some hierarchical relations between members with tiers having different powers and/or roles in the meta-organization.

While meta-organizations mainly consider relationships between organisations, communities of innovation focus on interactions of individuals from different organisations with the aim of sharing information, practices and innovate together (Cohendet et al., 2017). Grab (2017)

[1] Original citation : « des concentrations géographiques locales d'entreprises innovantes situées à proximité de centres de recherche et de formation scientifiques, dans le but de former ensemble un micro-système innovant ».

indicates that the proper functioning of these communities is based on three components: (i) a shared diagnosis to know the actors, their resources, capacities, etc.; (ii) clearly established "rules of the game" between the members about relations, the future of innovations, the distribution of the added value created, etc.; (iii) a common vision and objectives towards which all the members are striving. These components are key to consider in the analysis of our research topic.

Finally, the conceptual framework of ecosystems developed by Moore (1993), is particularly interesting for us as it considers the networks of organisations with a more dynamic view than the literature on networks (considering that some members are going in or out of the system) (Frow et al., 2016) which is in line with what we observe on the field. Ecosystem literature is divided between several trends working on different objects: business ecosystems (Mira-Bonnardel et al., 2012), service ecosystems focusing on firms dedicated to service production (Vargo et al., 2015; Vargo & Lusch, 2016), entrepreneurial ecosystems focusing on entrepreneurs (Cohen, 2006; Mason & Brown, 2014; Spigel & Harrison, 2018; Stam & Spigel, 2016), etc. Our work will focus on service ecosystems as we are studying ecosystems of organisations dedicated to providing several services to support innovators.

In all the different conceptual frameworks that we previously presented, there is a recurring notion: networks and ecosystems are usually organised around and orchestrated by one of its organisations. This specific organisation is called “hub firm” “catalysing agent” or “lead organisation” in networks literature (Dhanaraj & Parkhe, 2006; Ekboir & Cruz, 2012; Popp et al., 2014); “central actor” or “focal firms” in research on meta-organisations (Gulati et al., 2012; Valente & Oliver, 2018); “leader firms” in communities of innovations (Grab, 2017) and “keystones” or “ecosystem leaders” (Iansiti & Levien, 2004; Moore, 1993) in research on ecosystems. Orchestration is seen as essential to guarantee that the network or the ecosystem reaches its full capacities and several roles are mentioned in the literature: facilitation (linking

the organisations), mediation (management of the relationships between the members), intermediation (making a connection between the members) and identification and elimination of opportunistic behaviours (Antunes et al., 2021; Favre-Bonté et al., 2016).

The Systemic perspective of agricultural innovation

In the agricultural domain, innovation studies use mostly the concept of agricultural innovation system to describe and analyze the functioning of innovation networks (Klerkx et al., 2009, 2017; Klerkx & Begemann, 2020) which became a reference framework to think and renew innovation support policies and strategies both in Europe (Détang-Dessendre et al., 2018) and in the Global South (Plate-forme pour l'agriculture tropicale, 2017; World Bank, 2012), focusing on the interaction processes among actors intervening in knowledge creation, diffusion and application (OCDE & Statistical Office of the European Communities, 2005).

However, in countries of the Global South, the difficulty encountered is that of a strong heterogeneity in the maturity of AIS, linked to the different levels of available resources and intensity of interactions between actors (Spielman et al., 2009). The available analytical frameworks suffer from a lack of operationalisation to help propose actions adapted to each context and which directly mobilise the actors at the heart of the innovation processes. The approach in terms of the innovation system essentially serves as a reference for political actors and decision-makers to become aware of the different dimensions of an environment favourable to innovation on a macro-economic scale and to identify the challenges (Toillier & Kola, 2020). In order to be able to draw operational conclusions for public action, these observations must be supplemented by contextualised analyses, at sub-national levels (regions, territories, agri-food systems, sectors), of the dynamics of actors involved in innovation networks, in order to understand the collaborative and/or competitive mechanisms on which to act, analyses of their capacities to produce knowledge and transform it into new services and products, the role and effectiveness of intermediaries, etc.

This presentation of the conceptual frameworks stresses that prior research focused either on organizational studies in non-agricultural sectors or on agricultural innovation studies at national or niche level. Thus, it lacks a combination of these two streams of research in order to have a way of developing intermediate ('meso-level') analysis frameworks that make it possible to grasp the inter-organisational dynamics at work while identifying the real margin of action of the various innovation actors and their possible contribution to strengthening the service ecosystem in support to agricultural innovation. This is the literature gap that we propose to fill in with this research paper.

6. METHODOLOGY

Our methodology to design an assessment tool of the emergence and functioning of the service ecosystems in support to agricultural innovation consisted in four steps: 1) a meta-analysis of published studies of existing service ecosystems in support to agricultural innovation, 2) the pre-identification of criteria to characterize their diversity; 3) the application of these criteria to a sample of “most representative” service ecosystems ; 4) back to the assessment tool : improvements and next steps.

In the literature, various conceptualizations exist regarding gatherings of organisations related to supporting agricultural innovators but the borders of these concepts were quite blurry and a clarification was needed. Thus, we decided to conduct a systematic review of the literature in order to clarify the concepts and expose the diversity of the situation in the agricultural sector.

Starting with our research questions and through the key concepts of our study (agriculture, relationships between organisations and innovation support) and the keywords, we arrived at the thesaurus of our query. The exact concept we aimed to study was not yet conceptualised in the literature, and no clear keywords for the thesaurus were identifiable, we thus decided to include in our query some examples of service ecosystems in support to agricultural innovation

that were previously identified in scientific and grey literature, in order to have a more exhaustive scan of the literature.

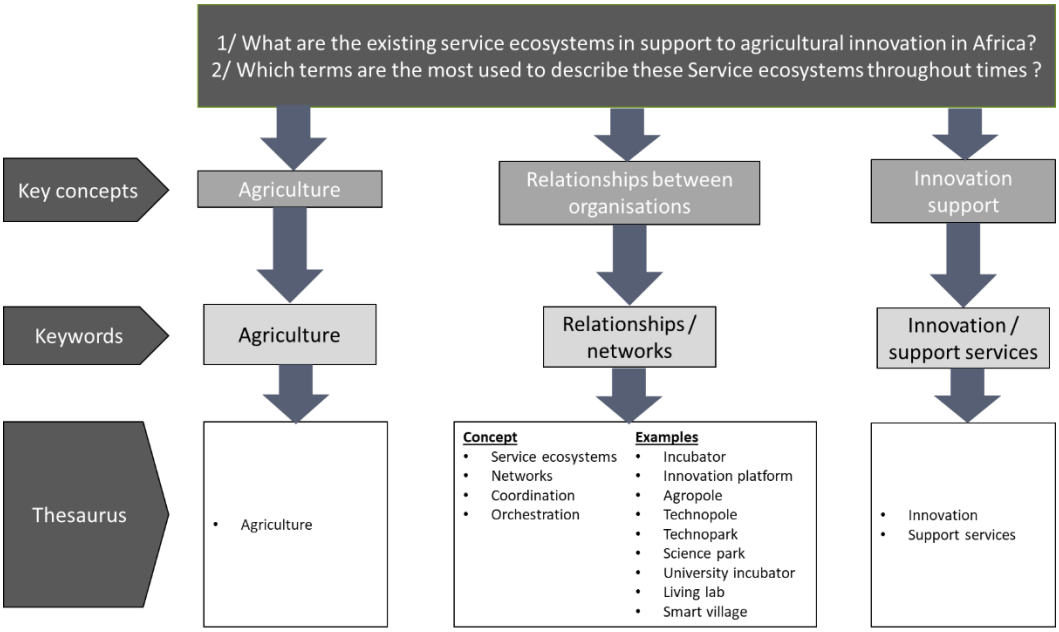


Figure 2: Translate a research question into keywords and thesaurus for query construction (source: authors adapted from Martin et al, 2020)

Web of Science database was chosen to make the search as it gathers multidisciplinary academic articles which was compatible with our willingness to make a broad search. This also led us to choose not to put any limitations on disciplines, methods, countries, years, and document type. Moreover, with the same idea, we chose to make the search in abstracts rather than only in titles and keywords of the article in order to include all relevant articles. The words of the thesaurus used are in English so most of the documents are in English but documents in French were also accepted.

The agricultural domain was a necessary condition for our analysis, it was thus a keyword always used. The other keywords were either included or excluded in order to guarantee the most exhaustive search.

Some terms of the thesaurus initially considered were abandoned or replaced because the query didn't return any result. The query "service ecosystems" didn't return any result when associated with "agriculture", it was thus abandoned. Similarly, the query "university

incubator" didn't return any result and was thus replaced by two queries: (university AND innovation) and (university AND incubator).

First, duplicates were manually excluded, then titles were read in order to exclude non-relevant articles. In case of doubts, the abstract was read and in case of subsistence of any doubt the whole article was read.

Three exclusion criteria were considered: 1) the article is not about innovation support services (it means that if the article describes an innovation without considering the support services which led to the development of the innovation, it will be excluded); 2) the article is not about agriculture; and 3) the article is not about the coordination between several organisations in networks or ecosystems.

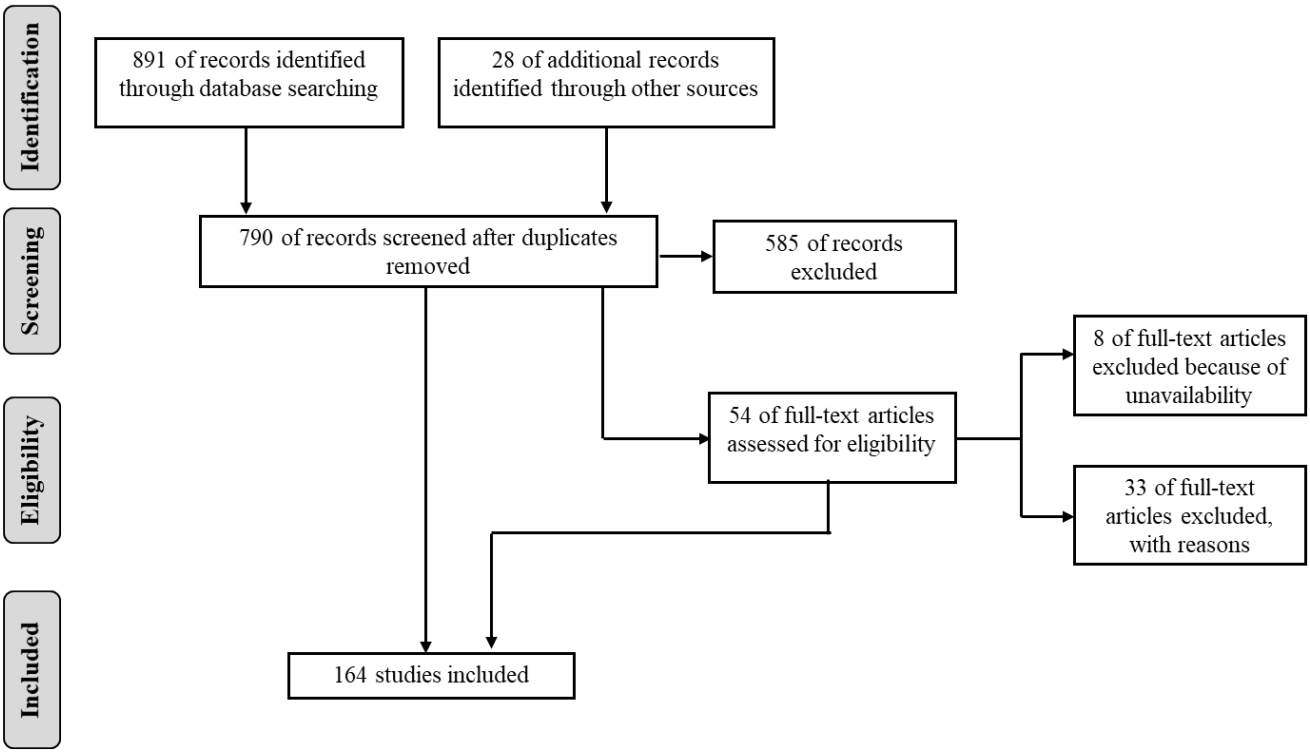


Figure 3: Selection of papers for the systematic literature review

From this extensive systematic literature review we extracted several relevant papers with enough details to allow us to characterize 8 case studies.

7. RESULTS

Among the documents read, two criteria emerged as important keys to understand and classify ecosystems: how the ecosystem emerged and the type of governance. We make no claim that these are the only contingencies that are relevant but based on our knowledge of these ecosystems and on the literature, we believe that these factors can be both relevant for academic and managerial understanding of the phenomenon.

First, we will detail our choice of considering the **emergence** of service ecosystems in support to agricultural innovation as a relevant criterium to describe them. These service ecosystems are structured differently according to how they emerged which leads to different characteristics: different conceptions of how to support innovation, nature of the services offered, duration of the ecosystems, geographic implementation, types of innovation supported, etc. Moreover, this emergence phase is a critical prerequisite for a functioning ecosystem, it is thus important to understand the different options of emergence which work. We defined three modes of emergence for service ecosystems in support to agricultural innovation: the ones created ad-hoc, the ones that are planned and an intermediary between the first two modes of emergence with characteristics of both (Table 1).

Conditions for emergence	Characteristics	Origin	Durability	Type of support to innovators	Necessary investments	Link with institutional context
Service ecosystems in support to agricultural innovation created ad-hoc	Emergence happens along the way including new actors in the ecosystems according to the support needs of one or several innovators supported	Responding to a need of coordination between the organisation to support an innovator	Generally not very sustainable (important level of creation and failure). The ecosystem is maintained if the organisations have another innovator to support together or disappears if not; or if too many tensions appeared during the first collaboration.	Often custom-made, adapted to the innovators needs	Low, but organisations can feel a lack of financing anyway	Independent, taking their roots in initiatives of the private sector or the civil society
Planned service ecosystems in support to agricultural innovation	Underlying hypothesis: grouping in the same place all the services needed for agricultural production and innovation will create a favourable innovation environment. Emergence is planned, directed, with planification of the vision and functioning of the service ecosystems in	Responding to (State) objectives to establish creativity poles in order to solve a problem identified in the country (i.e. developing irrigation, increasing rice production, etc.)	Generally lasting for a long time: it takes several years to create them and they need important investments in infrastructure so they persist even though they are not optimal	Often standardised, quite rigid, related to the preparation « *ex-nihilo* » of the project, (without consultation of the innovators before the beginning of the project to identify their needs and the functioning mode) not allowing to adapt along the way	Important investments in infrastructure	Directly related to the institutional context and public policies of the country

	support to agricultural innovation, before the emergence and little evolving					
"Intermediary" service ecosystems in support to agricultural innovation usually linked to incubators related to universities	Emergence is planned at a local scale by local actors, sometimes benefitting from national support.	Generally related to the willing of universities to value the research produced in universities (ex: smart village Senegal).	Generally lasting for quite a long time but can lose efficiency if actors are less motivated or have less time to dedicate to the ecosystem	Generally custom made	Low, but organisations can feel a lack of financing anyway	Can be in relation with the national context but it is not compulsory

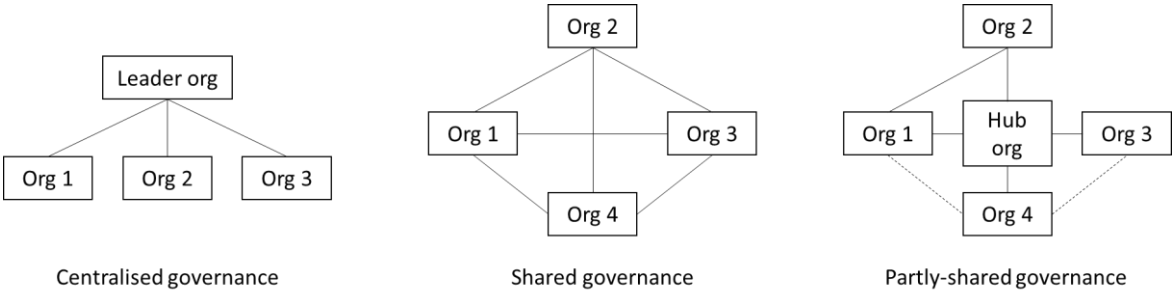
Table 1 : Characteristics of the three ways of emergence of service ecosystems in support to agricultural innovation

We will now detail why we chose to consider the governance among ecosystems as a relevant criterium for our typology. Service ecosystems in support to agricultural innovation are a gathering of organizations working together to support innovators. Coordination in a network is essential as it allows a better use of resources, a better response to complex problems, a better service provisions, etc. (Provan & Kenis, 2007). It is also acknowledged that network governance is key for effectiveness of the network (*ibid*).

While Provan et Kenis (2007) differentiate between brokered and unbrokered networks (also called self-governed networks) and within the brokered networks, between brokered by participants or external brokering, we prefer to distinguish three ways of governance: centralised, shared or partly-shared. What we call shared governance is quite comparable to Provan and Kenis' unbrokered networks; similarly, our partly-shared networks can easily be compared to their networks brokered by participants. However, we find that their external brokered networks are not suited to our analysis as there are no examples in the papers we studied. We preferred to make a distinction between two levels of internal brokering: governance totally centralised by a leader organisation or partly centralised by a hub organisation.

Each mode of governance can be described as follows (Figure 4):

- Centralised governance: governance is concentrated in the hand of only one organization, with the ecosystem having a very hierarchical structure (members have strong relationships with the leader organization but little or no relationships between them)
- Shared governance: governance is shared between all members (all organizations have relationships with each other)
- Partly-shared governance: a hub organization shares part of the governance with others but have a leading role of organizing the relationships between the members (members have strong relationships with the hub organizations but also with some of the other organizations)



Centralised governance | Shared governance | Partly-shared governance

Figure 4 : Modes of governance of Innovation Support Services Ecosystems

Shared governance is an ideal-type that we didn't observe in our literature review, probably because the ecosystems we studied are constituted by too many organisations and it is challenging to maintain totally shared governance above five or six organisations (Popp et al., 2014). These three modes of governance must thus be considered as a continuum between two ideal-types which may not exist by themselves.

Based on eight case-studies found during our literature review, four types of service ecosystems in support to agricultural innovation have been identified: the ones which emerged along the way with shared governance; the ones planned locally; the planned ones with centralised governance; the planned ones with shared governance (cf Figure 5).

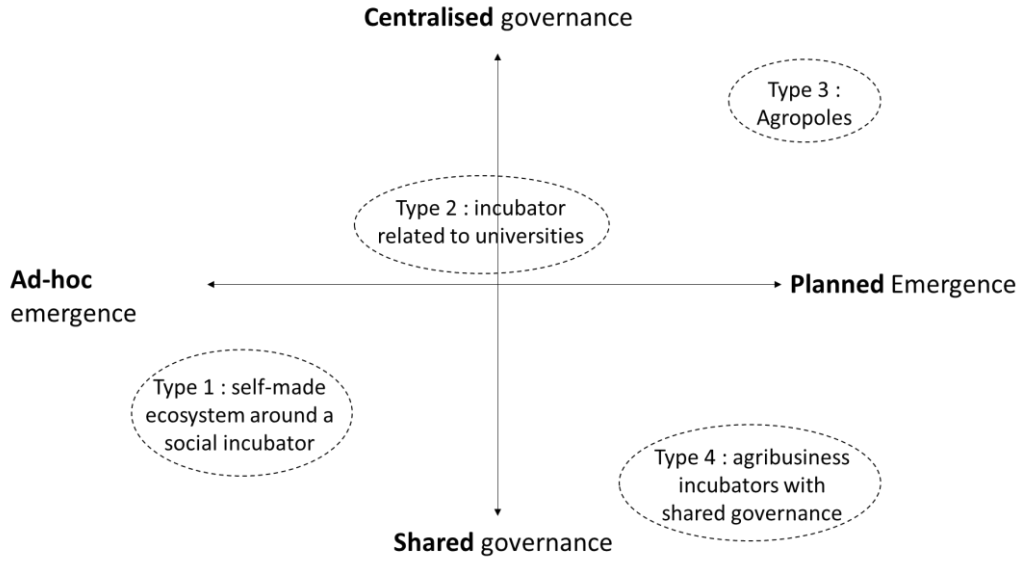


Figure 5 : Typology of service ecosystems in support to agricultural innovation

7.1. TYPE 1: SELF-MADE ECOSYSTEM AROUND A SOCIAL INCUBATOR

This type of service ecosystem is locally created responding to the need of coordination of the innovation support service organizations to answer to the needs and demands of the entrepreneurs they support. The different actors taking part of the ecosystem are chosen and join along the way according to the skills missing. The ecosystem is maintained if the

organisations have another innovator to support together or disappears if that is not the case or if too many tensions appeared during the first collaboration.

Governance is usually (at least partly) shared between the members. Often, there is a hub organization managing the network but the decisions are taken in group and members have relationships with each other.

The mission of the service ecosystem is propelled by the hub organization and is usually toward impact (social, food security, food safety, environment, etc.) to reach a more equal world. Hub organizations are often social incubators but can also be other kind of intermediaries (research centres, development projects, etc.) with diverse mandates (entrepreneurial support, development, agricultural advisory, etc.).

Difficulties are met regarding collaboration between members. As they come from different universe, with different visions and working methods, it is not always easy and takes a lot of energy from the hub organization to gather all members around a common objective and have them make the necessary adjustments.

Support to innovators is generally custom-made in order to better respond to each innovator need. This is very time and resource-consuming for the service ecosystem but usually guarantees better results because it is more adapted to the innovator need. Some of the trainings may be standardised if members think that they can benefit to all the innovators, allowing economies of scales.

7.2. TYPE 2: ECOSYSTEM CENTRALISED AROUND A UNIVERSITY INCUBATOR

This type of service ecosystems in support to agricultural innovation is generally created around a university incubator and respond to the desire to value the scientific knowledge developed in universities and research centres. This scientific knowledge is usually kept within research centres because of a lack of time and skills from researchers to create enterprises in order to

value their discoveries. By creating incubators inside universities and research centres, it would be possible to support scientist or students in the creation of firms.

These service ecosystems are usually planned at local level (regional or communal) promoted by universities and research centres. They can benefit from public support (financing, tax exemptions, favourable public policies, etc.) if the Government of the country agrees on the necessity to better value public research. But one of the main constraints is for them to find a sustainable business plan (through payment of trainings, renting of workspace, etc.). Thanks to the proximity between researchers, entrepreneurs and potential clients (farmers, consumers, etc.) innovation are expected to be more adapted to the local constraints and needs. Like in the type 1, support to entrepreneurs and innovators is generally custom-made in order to match their needs.

7.3. TYPE 3: AGROPOLES

Some of the service ecosystems are created following Government decisions and supported by several public policies. They usually are in line with the objectives of the government to improve business capacities in the country and create a favourable environment for firms to grow, collaborate and innovate or to have impact on priority problematics (increase of agricultural production, reduction of post-harvest waste and losses, reduction of the impact of agriculture on environment, etc.).

The agropole model is based on a quite simple assumption: by gathering in a same territory all the support services to innovation (research, training, input suppliers, financing, processing plants, etc.) a favourable environment is created for innovators to exploit all the potential of their innovation (Gálvez, 2014). It is also expected that this grouping of firms will allow alliances to form between organizations and a most efficient sharing of information (*ibid*).

In Sub-Saharan Africa, one of the main impacts expected from this type of service ecosystem is increasing the level of agricultural productions of the countries. After the severe 2008 food

crisis which negatively and strongly impacted African countries, governments and international donors decided to increase the budgets allocated to agriculture, in order for their population to reach food self-sufficiency. They identified and organised territories dedicated to food production in order to produce staple food in quantity and at low prices for the population and improve their food security.

This model is quite top-down with the Government deciding the location of the agropole, its characteristics, the actors who will be in, the value chains which will be targeted, the rules of governance, etc. Farmers and agro-processors already in the location are perceived as little competitive, which need to be replaced by a "professional", "entrepreneurial" agriculture or food-processing, viewed as more efficient and performing. They are hardly ever consulted in the conception of the agropole but according to projects, can be more or less integrated to the project or at least compensated when they lose access to land or resources.

In Sub-Saharan Africa a major problem of agropoles is the gap between the expectations of improving food security and what examples show: this type of service ecosystems in support to agricultural innovation work better when they are focused on export products. The relation to food security is thus not as clear as expected and would probably be more related to the increase of income of the people in the area than an increase of production or a decrease of prices. Thus, there is a gap between the declared objectives of this type of service ecosystems and the reality of its efficiency. Another problematic is that usually, financing of this type of ecosystems, is based on creating a favourable environment for foreign direct investment (with favourable taxation conditions, etc.) but foreign investments usually remain below expectations.

Infrastructures and services made available to innovators are usually decided upstream, without consulting them in order to better apprehend their needs and very standardised leading sometimes to offsets between the innovators needs and what the agropole offers and a level of innovation lower than expected.

7.4. TYPE 4: ECOSYSTEM CREATED AROUND AGRIBUSINESS INCUBATORS WITH SHARED GOVERNANCE

This type of service ecosystem has been planned by international donors wanting to establish agribusiness incubators in Africa in order to "facilitate agricultural market development, enhance commercialization and value creation, establish university-industry linkages, foster entrepreneurship and job opportunities for youth, and form entrepreneurial ecosystems" (Hernández-Chea et al., 2021). Willingness to gather different types of organization and facilitate their relationships was thus allochthonous from the territory and even from the country. It responded to the postulate that each actor had underutilized resources: technologies and know-how in public research organization, educated graduates in universities, knowledge on market insight and business experience in local businesses.

However, unlike type 3, in this type, governance was designed to be shared between all members of the ecosystem: Articles of Association (AAs) and Memorandums of Understandings (MOUs) were used to define each partners' roles, a Board of Directors (BoD) gathered representatives from each main partner organization, a Technical Advisory Committee was made up of technical staff from the partner organizations to advise the incubator management team.

Moreover, the case-studies (CS) reveal that service ecosystems in support to agricultural innovation are generally *mission-oriented* as we can see in Table 2. This mission can be identified before the creation of the ecosystem or in its early stage but seems important to gather the organisations members of the ecosystem around a common vision and common objectives.

Type	**Case studies**	**Mission of the service ecosystems in support to agricultural innovation**
	CS 1: EADD program, dairy innovation platform (Kenya)	Increase milk production and improve commercialisation

Type 1: self-made ecosystem around a social incubator	CS 2: Self-created ecosystem around a social incubator (Burkina)	Support social innovations
Type 2 : ecosystem centralised around a university incubator	CS 3: incubator linked to UGB (Senegal)	Value scientific knowledge developed in the university
	CS 4: Smart Village (Senegal)	Develop technological solutions for agriculture
Type 3 : Agropoles	CS 5: Agropole Office du Niger (Mali)	Increase food production and reduce poverty
	CS 6: Meknes Agropole (Morocco)	Improve food processing
Type 4 : ecosystem created around agribusiness incubators with shared governance	CS 7: Agribusiness incubator promoted by a project (Uganda)	Improve the value-chain of an export commodity
	CS 8: Agribusiness incubator promoted by a project (Kenya)	Improve production of a traditional subsistence crop

Table 2 : Missions of the service ecosystems in support to agricultural innovation considered in the eight case-studies

Another characteristic of the ecosystem emerging from this analysis is their link to a specific territory. For each case study, we can delimit a sector of intervention of the service ecosystem (where are located its members, where the innovators come from, the location of the different services provided, etc.) but also a territory on which the service ecosystem aims to impact (local, regional, national). The sector of intervention of the ecosystem is quite easy to determine and quite similar among the different types of ecosystems, usually very local. But the territory on which the service ecosystem aims to impact can be more difficult to identify and is related to its type: type 1 and 2 usually aim to impact local level (at least in the first place, then upscaling of the innovation can affect a larger audience and territory) while planned ecosystems of type 3 and 4 have more ambitious objectives and aim to impact a whole region (economic development) or country (increase of the production, food security, etc.).

As we showed in the description of the different types of service ecosystems in support to agricultural innovation, governance is variable according to the type and we can identify one

or several hub organisations playing the role that we described in the theoretical framework (Table 3).

Type	Characteristics of the hub organisation
Type 1: service ecosystems in support to agricultural innovation which emerged along the way with shared governance	Either one hub organisation, a few organisations working together as a hub (generally not more than 3 organisations) or a succession of organisations which take over this role
Type 2: service ecosystems in support to agricultural innovation planned locally	Either one hub organisation, a few organisations working together as a hub (generally not more than 3 organisations)
Type 3: Planned service ecosystems in support to agricultural innovation with centralised governance	An organisation manages the service ecosystem but the governance mode is not in line with what literature considers a hub, governance is too concentrated
Type 4: Planned service ecosystems in support to agricultural innovation with shared governance	A succession of organisations which take over the role of hub

Table 3 : Characteristics of the hub organisations according to the type of service ecosystems in support to agricultural innovation considered

Creation of service ecosystems in support to agricultural innovation of Type 1 and 4 are sometimes relying on temporary actors and organisations (projects, incubators with a short life expectancy, etc.) which can explain that organisations need to take over the role of hub in order for the dynamic of the service ecosystem to live on. On the contrary, it is usually a same organisation which manages service ecosystems of types 2 and 3 along time.

8. DISCUSSION

This paper aimed at characterizing the diversity of service ecosystems in support to agricultural innovation and detailing their characteristics, how they emerge, their functioning, the way they support innovation. In order to answer these questions, we carried out an exploratory literature review and identified eight case studies to represent the different situations of service ecosystems in support to agricultural innovation in Africa. Our results showed that two criteria were appropriate to describe and differentiate service ecosystems: the mode of emergence (ad-

hoc, planned and intermediary) and the governance of the ecosystems (shared, concentrated and partly-shared). Furthermore, we identified four different types of service ecosystems in support to agricultural innovation: the ones which emerged along the way with shared governance, the ones planned locally, the ones planned with centralised governance and finally the planned ones with shared governance. Each of these types is characterised by their origin and functioning leading to different ways of supporting innovation, life expectancy of the ecosystem, characteristics of the hub organisation, etc.

As we stated, emergence of the service ecosystems in support to agricultural innovation is a key component explaining their functioning and the way they support innovation. It has been little studied in the literature except by Mira-Bonnardel, Géniaux, et Serrafero (2012) stating two ways of emergence : opportunistic reacting to signals sent by the environment and strategic with a voluntary approach, programmed and well-argued. Based on this previous work, we chose to define three modes of emergence in this study: service ecosystems created ad-hoc which is in line with Mira-Bonnardel et al's opportunistic way of emergence, planned ecosystems based on their strategic way of emergence and we added an intermediary as third way because some of our case studies did not meet with the first two options. In the literature, one of the reasons explaining the emergence of a network are the past ties that may have or have not existed between the members of the network (Gulati, 1995; Valente & Oliver, 2018). This was not studied in our work because of lack of information on that aspect in the case studies.

The other main characteristic defining the service ecosystems in support to agricultural innovation are the governance which prevails. Literature is more abundant on this question, governance of networks, alliances and ecosystems have been studied and is presented as critical to explain effectiveness of a network (Provan & Kenis, 2007). Difficulties and inefficiencies observed in services ecosystems or type 3 may be explained by these deficiencies in governance

and the lack of effective participation of members of the partnership (Franke et al., 2021). Governance can be described through three dimensions: their structure, process and strategic axis (Ekboir et al., 2009). Our case studies allowed us to detail some of the components of the structure like distribution of functions and coordination but others were missing like the rules and regulations for negotiations and the historical basis for making decisions (Shaikh & Levina, 2019). Some information was also available on the strategic axis of the ecosystems (mission and vision) while others were absent (strategic focus, action plans). On the contrary, processes were usually lacking in the articles and grey literature we used, thus leadership, learning policies and operating processes couldn't be described for each type.

In our study, we identified four types of service ecosystems in support to agricultural innovation. Among them, type 1 describe service ecosystems emerging along the way with the highest level of shared-governance. However, governance is not totally shared, one organisation is taking the role of hub organisation and orchestrates the network. This is in line with the literature stating that totally shared governance is really effective when number of participants is low (Provan & Lemaire, 2012), trust is really densely distributed, network goal consensus is clear (Provan et Kenis., 2007) which is rarely the case in service ecosystems in support to agricultural innovation. Moreover, literature indicates that shared-governance models take less resources than other models (Popp et al., 2014), which is in line with our observations: service ecosystems in support to agricultural innovation of type 1 and 2 required less investments than types 3 and 4.

As stated by Shaikh et Levina (2019), the mission the ecosystem envision is one of the attribute of the strategic axis of its governance. In our study, we demonstrated that missions can differ between the service ecosystems in support to agricultural innovation but are usually linked to an improvement of populations quality of life or ability to make business. This is in line with Hekkert et al. (2020) definition of Mission-oriented Innovation Systems (MIS) which are

described as “the network of agents and set of institutions that contribute to the development and diffusion of innovative solutions with the aim to define, pursue and complete a societal mission” (p77).

One of our results focuses specifically on the role of the hub organisations in the different types of service ecosystems in support to agricultural innovation. Following (Kilelu et al., 2013), we assert that the hub organisations have a critical role to play in gathering organisations which were not previously connected for various reasons and in orchestrating their relationships in the ecosystem. Networks can meet several problematics and tensions, mainly related to the relationships between members: information asymmetry, cognitive distance, reaching consensus on the network vision and mission, culture clashes, trusting relationships, power imbalance, lack of organizational capacity to work collaboratively, etc. (Kilelu et al., 2013; Popp et al., 2014). Hub organisations undertake various roles like “coordinating the network, inserting and creating mechanisms of governance” (Antunes et al., 2021) and their effectiveness in assuming this role is directly related to the quality of skills needed for orchestrating the ecosystem that they possess (Popp et al., 2014).

Leadership have been thoroughly studied in the literature on collaborative networks and can explain the different effectiveness of hub organisations, in particular the important role of informal interpersonal relations between members (Popp et al., 2014) and the perception the leaders have of their own role (“leader as host” rather than “leader as hero” leading to invite others to participate and contribute, trust other people creativity and commitment, etc.) (Frieze & Wheatley, 2011). Unfortunately, the papers we used for this study did not give many information on this aspect.

This exploratory analysis is key because it is the first paper to try and build an integrative framework of the different theories on networks, meta-organisations and ecosystems in the case of Innovation Support Services allowing to define the new concept of Innovation Support

Services Ecosystems. (ISSEs) It is also the first paper targeting agriculture in Africa as its main context and detailing the different forms ISSEs can take in this specific context. Furthermore, another strength of our work is that the case-studies on which this paper is based are built on quality work as it originates mainly from peer-reviewed articles.

However, this search field being few documented in Africa (even in grey literature), some initiatives may not have appeared in our research. It would thus be worthwhile to conduct complementary interviews with actors of potential ISSEs in order to deepen our analysis.

Moreover, our paper remains quite descriptive of the different types of ISSEs, their characteristics, their governance, modes of emergence and hub organisations. It was key to state the *status quo* before trying to understand what led to this situation and identify the essential elements leading to each situation and extrapolate to managerial recommendations. Important further research would thus focus on understanding why some organisations can play the role of hub organisations while other cannot - are there some specific capacities that these organisations possess?

9. CONCLUSION

Our research aimed at designing an assessment model of the emergence and functioning of ISSEs. We used an original approach based on a literature review combined with meta-analysis of published studies on innovation support services in the agricultural sector. Our assessment model combined four criteria and appear to be powerful to grasp the diversity of the ISSEs.

Two criteria emerged as critical to differentiate ISSE's types: the way they emerged and the governance prevailing, leading to classify ISSE in four types: self-made ecosystem around a social incubator, ecosystem centralised around a university incubator, Agropoles and ecosystem created around agribusiness incubators with shared governance. Our analysis also underlined the importance of the missions of the ISSEs usually related to societal or social problematics identified in the country or region of the ISSE. Finally, we highlighted the importance of one

or few organisations called hub organisations which orchestrate the ecosystem in order to improve its functioning and efficiency.

These results allow us to better understand the situation of ISSEs in agriculture in Africa and their problematics, an essential prerequisite to identifying actions to support them and improve their impact towards innovators. Furthermore, these gatherings of organisations have been named a lot of different ways according to the time and context, making it difficult to see the similarities and differences between them. We proposed in this article an integrative framework of research trends like the analysis of networks, meta-organisations, ecosystems, in order to best describe the reality that we observed.

As we said, it was essential to identify and describe the ISSE in order to support them. While the results obtained are very interesting, we consider deepening our understanding of the situation by collecting primary data with members of these organisations.

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11. APPENDIX: CASES USED

11.1. CASE STUDY 1: EADD PROGRAM, DAIRY INNOVATION PLATFORM (KENYA)

This case study is based on the Kenyan experience of the EADD program (East Africa Dairy Development) which began in 2008. The program is implemented by a consortium of five organizations: Heifer International, International Livestock Research Institute (ILRI), Technoserve (TNS), African Breeders Services Total Cattle Management Limited (ABS TCM LTD.) and World Agro-forestry Centre (ICRAF) (Kilelu et al., 2013). These organisations dedicate skills (including agriculture research, business development and dairy production) and resources (human and financial) to form an ecosystem in order to support innovation in different ways. Staff made available by each organisation is gathered in a same location in order to work collaboratively.

Governance is largely shared among the members of the consortium acting as “hub organisations” as we defined them in the theoretical framework. Here there is not one hub

organisation but a gathering of five organisations working together. They perform together the functions that we expect from a hub organisation: facilitating the articulation of the innovation vision, mobilizing funding and other necessary resources, orchestrating the network, selecting actors, etc. (Kilelu et al., 2013)

They work in close relationship with the DFBAs (Dairy Farmer Business Associations) which act as an intermediary between different actors of the ecosystem: government agencies, private sectors, etc. and offer several services to famers.

11.2. CASE STUDY 2: SELF-CREATED ECOSYSTEM AROUND A SOCIAL INCUBATOR (BURKINA)

La Fabrique is a social incubator based in Burkina Faso willing to support entrepreneurs with social projects oriented toward impact. In order to support these entrepreneurs, La Fabrique creates more or less temporary ISSEs with research centres, technical and training institutions, NGOs, donors, etc. Actors mobilised depend on the needs expressed by the innovator or anticipated by the coaches of La Fabrique.

Governance is shared between members but there is a need to have one organisation initiating the collaboration, organising meetings, propelling a dynamic in the ISSE, etc. and La Fabrique is playing this role.

11.3. CASE STUDY 3: INCUBATOR LINKED TO UGB (SENEGAL)

This case study is an incubator related to the Université Gaston Berger in Senegal, created in 2007 with the aim of being a hub for all entrepreneurial initiatives in Northern Senegal and support entrepreneurial initiatives from both the students and researchers of the university.

The incubator managed to develop partnerships with USAID, the ADB (African Development Bank) and Senegalese State, the ACSA project (Sécurité Alimentaire au Changement Climatique) but as stated by (Dia, 2012), the UGB (as well as other initiatives of innovation

support related to universities in Senegal) encounters difficulties in mobilising financial resources or engaging with a strategic partner.

It would be interesting to compare the functioning of the ecosystem around this incubator with other university-related incubators like the one created in France by an agronomy school Montpellier Supagro and a research center INRAE (Theodoraki et al., 2018) but data on its governance is still scarce and would need to be deepened.

11.4. CASE STUDY 4: SMART VILLAGE (SENEGAL)

Smart village Senegal is an initiative carried out by the Wazihub project (financed by EU) to develop and promote technological solutions for agriculture in a "smart" village in Northern Senegal. Wazihub project is working with the Université Gaston Berger to propose several supports for innovators.

11.5. CASE STUDY 5: AGROPOLE OFFICE DU NIGER (MALI)

Case study 5 is essentially based on the paper of (Brondeau, 2018). The Office du Niger agropole in Mali was conceived after the "food riots" of 2008 in Bamako as a mean to support food security in the country and fight against poverty in Mali. Agropoles are based on the idea of lifting the main constraints to agricultural production (by setting large-scale irrigation, formalising land titles, contracting family producers, etc.). In order to finance it (in particular the infrastructures) the Governments resort to international donors and large private investors in return for advantages and access to large producing areas.

Governance is highly centralised with a coordination of the agropole depending directly on the decisions of the Malian government and creating partnerships with the actors independently from each other. Each actor has few or no contact with the other actors and deals only with the coordination of the agropole. Objectives definition and project implementation of the agropole was made either unilaterally by the Malian government or according to one-to-one agreements

with private firms. Other stakeholders are seldom considered and consulted, in particular farmers that have customary rights to the land.

11.6. CASE STUDY 6: MEKNES AGROPOLE (MOROCCO)

Case study 6 on the Meknès Agropole is essentially based on the work of Galvez (2010) and Jaafari (2000). Three agropoles have been planned within the Plan Maroc Vert, in the most productive and flourishing areas of the country, as territories dedicated to food processing. Meant to respond to the demands of the professionals, their design and implementation involved a wide range of actors such as universities, research centres, firms and the local branch of Multinational Agribusinesses (Galvez, 2010).

The agropole located in Meknès benefits from favourable rainfalls (> 450 mm) with high productivity potential. Presence of diverse institutions is also an asset: education (Universitiesn schools of agriculture and horticulcure), research and extension. Food processing is one of the main industrial activity in the region (Jaafari, 2000) and the agropole aims at developing processing of both export-oriented products (horticulture and olive oil) and local-market dedicated products (milk, cereals, red meat).

The agropole gather several services for innovators, entrepreneurs and firms: an agro-industrial zone, a logistical hub, a smart city clustering ICT and other agribusiness support services, food quality laboratories, etc. The site covers 640ha, has a cost estimated to almost 500 million euros and is expected to create 18 000 jobs (Caisse de Dépôt et de Gestion, 2022). Governance is highly centralised in the hands of MEDZ, responsible of the agropole management. Entrepreneurs and firms can access the infrastructures and services offered by the agropole but did not have the opportunity to contribute to the choice of these infrastructure and services.

11.7. CASE STUDY 7: AGRIBUSINESS INCUBATOR PROMOTED BY A PROJECT (UGANDA)

Case study 7 is one of the case studies of an article by Hernández-Chea et al. (2021). This article studied the implementation of 4 agribusiness incubators in Eastern Africa in the context of an international development program financing the first phases of implementation. Case study 7 focuses on what is called case Alpha in the paper and is targeting the experience in Uganda. Case 8 (called case Beta in the paper by Hernandez-Chea et al) that we will detail later on, is focusing on the experience in Kenya.

Contexts of cases Alpha and Beta are quite similar as described in the article : "The contexts present the well-known general challenges for entrepreneurship in resource-constrained countries fundamental characteristics representative of the majority of developing countries' agribusiness sectors, which the program aimed to address: (a) little interest, notably among young people, in engaging in agriculture-based entrepreneurship; (b) difficulty in raising investment capital for agriculture-related ventures; (c) generally high levels of uncertainty and risk associated with agriculture; and (d) very limited interaction between academia, research organizations, and the agribusiness sector" (Hernández-Chea et al., 2021).

In case study 7, the agribusiness incubator focused on an important cash-crop commodity for foreign export markets. The aim of the incubator was to support increase of production and productivity, develop local processing and value addition and complementary business models as well as process products of reintroduced crops.

ISSE is composed of an incubator mobilizing and exchanging resources with the other members: a research organization (public agency: relatively small and sector-specific), a university (supporting the experimentation and commercialization of new products), and a large cooperative.

Functioning of the ISSE is described as follows, in the article: "Articles of Association (AAs) and Memorandums of Understandings (MOUs) defined the different partners' roles, including their resource contributions, as well as the ways in which the resources were to be mobilized to

support the incubators. A Board of Directors (BoD), with representatives from each main partner organization, was responsible for approving strategic decisions for the incubators. A Technical Advisory Committee, made up of technical staff from the partner organizations, advised the incubator management teams on selection, enrolment, training, product promotion, financial support to tenants, and other incubation services. Within ALPHA and BETA, the management teams consisted of technical and administrative employees headed by an incubator manager responsible for planning, fiscal management, and implementing daily activities" (*ibid*). Even though emergence of the incubator was planned externally as part of a project, efforts have been made to implement a shared governance in the ecosystem.

11.8. CASE STUDY 8: AGRIBUSINESS INCUBATOR PROMOTED BY A PROJECT (KENYA)

Case study 8, called Beta in the paper by Hernández-Chea et al. (2021) was located in Nairobi, Kenya. Context is the same as for case study 7 but in the case of case study 8, the target commodity was a lesser-used traditional subsistence crop, and supply chain was less developed (raw material supply, and final processed products were not well established).

ISSE is composed of a research organisation (the largest national agricultural research institute), two universities which supported experimentation and commercialisation of new products, and two companies.

Functioning of the ISSE is the same as in case study 7 with efforts been made to implement shared governance in the ecosystem.