Innovation Platforms as a Tool to Support Technological Change in the Agri-Food Sector in Developing Countries: A Case Study of the Plantain Value Chain in Côte d’Ivoire

Since 2011, innovation policies in the agri-food sector in Côte d’Ivoire have been based on designing a technology transfer mechanism named “innovation platforms” in order to introduce improved plant varieties and hybrids. This chapter particularly focuses on the implications of “plantain innovation platforms (PIP)” in the reorientation of local technology choices in order to ensure national food security through increased domestic food product supplies. We use the conceptual framework of the sectoral innovation system (SIS). This framework helps to characterize the functioning of the PIPs. We identified four components that structure sociotechnological innovations: research, intermediation, value chain (VC) and financing. Our results show that PIPs help to structure SIS by influencing the public policy decision process (research and innovation) in the selection of cultivars to be introduced, the cultural practices and also the food preferences, thus integrating the geographic diversity of recipients of these innovations in this developing country. These policy changes involve considering the needs of local producers and consumers for choosing plants and new technical processes. The future of these PIPs is thereby questioned.

1.1. Introduction

Over the past few years, the renewal of public policies in West Africa has reestablished the need to increase food security without relying on

Chapter written by Euphrasie C.M. ANGBO-KOUAKOU, Ludovic TEMPLE, Syndhia MATHÉ and Alexandre ASSEMIEN.
international markets but instead on an increase in food production relative to the needs of the internal market [HUG 94, BRI 13]. These policies are supported by the West African Agricultural Productivity Program (WAAPP), which was initiated in 2011 by the Economic Community of West African States (ECOWAS) with financial support from the World Bank. In particular, these programs concern the generation and/or transfer of technological innovations (pure breeds of animals and plant hybrids or varieties: cultivars), as well as their dissemination to populations and target audiences in the agricultural and food chains in this subregion [TEM 11a].

In Côte d’Ivoire, actions are undertaken on behalf of the State by the Interprofessional Fund for Agricultural Research and Development (FIRCA) and a technical and fiduciary executive agency (FIRCA_WAAPP_Côte d’Ivoire). In this country, the WAAPP program is supervised by the Ministry of Agriculture in collaboration with some 20 national and international institutions [CGI 13], which include research, technical and financial partners. One of the goals of this program for improving agricultural and food productivity is to establish conditions for the development of an agricultural innovation system (AIS) [HAL 05] through the selection and introduction of new improved varieties and hybrids in food crop plantations.

A central element for these innovation systems (ISs, which are run by different projects and programs in sub-Saharan Africa) to function is the creation of multistakeholder innovation and exchange platforms [NED 11, ADE 12, KLE 12, KIL 13, SCH 15]. These platforms are intended to organize stakeholder connections in order to use research and innovation results in agriculture and food. Their objectives are to create frameworks for the transfer, extension, co-construction, coproduction of technologies and/or consultation between stakeholders, and to support innovations in the development of an agri-food industry.

However, technological changes imply the coevolution of three dimensions of innovation: “hardware, software and orgware” [KLE 12]. Diffusionism-based approaches tend to focus on “hardware” and very little on software and orgware. For example, technologies have been around for a long time but have not yet been spread. The current strategy is to work on “software” and “orgware” to foster technological development. This involves examining how innovation platforms can help achieve this. It also raises the question of understanding how innovation platforms contribute to
structuring SISs [MAL 05] and how they reorient technological choices in the agricultural and agri-food value chains in Côte d’Ivoire, a developing country.

It is important to note that the “hardware” dimension of innovation is jointly linked to a technology that is specifically driven by agronomic research and to technological devices that support innovation. In this case, the innovation platform is an organization that supports this technology (hardware). The “software” dimension refers to the knowledge transmitted by broker services (consultancy) to beneficiaries of these innovations through training, learning and capacity-building sessions. The “orgware” dimension refers to strategies for coordinating stakeholders in the sector, and for restructuring components of an AIS through exchanges between research institutions, extension or advisory support services and beneficiaries/target stakeholders.

In this study, we propose to evaluate the impact of these transfer mechanisms (platforms) on the organization and evolution of an AIS, which is shaped by research and financial institutions, professionals in the sector and broker services that provide agricultural extension. We also evaluate their impact on the direction of technological research and innovation. It is also necessary to analyze the capacity of this mechanism to include different categories of stakeholders within a sector (such as producers, traders and processors) for it to develop in a way that is suitable for the geographical diversity of agricultural production regions in Côte d’Ivoire.

The methodology involves using the SIS approach [MAL 02, MAL 05, TOU 15] to represent the relationships between our four components in this sectoral technology transfer mechanism, which are the research component, the intermediation component, the VC component and the financing component. Analyzing this sociotechnological innovation helps to check how multistakeholder dynamics structure an AIS and coordinate the stakeholders within the five existing PIPs retained for the study, in a global VC [GER 05] or an agricultural sector in Côte d’Ivoire.

The referenced case study is based on data from qualitative surveys carried out by focus groups, semidirective interviews and surveys of various stakeholders that were identified in each of these components (MINADER – Ministry of Agriculture; ANADER (National Agency for Rural Development) – Agency of extension; FIRCA – WAAPP Program Execution Agency; CNRA – Center for the Coordination of Agricultural
Research Programs), as well as the leaders and managers in charge of PIPs in four of the main plantain-producing regions (Abengourou, Adzopé, Agboville and Soubré). The collected material was supplemented with a dozen interviews conducted with researchers and experts in the agricultural and agri-food sector in France and Côte d’Ivoire between 2015 and 2016.

We postulate that the creation of collaborative platforms or transfers is a structuring element in the existence of this IS. Our argument is based on two secondary working hypotheses: first, we assume that by bringing together professionals and research institutions, platforms adapt innovation processes and collective learning to the diversity of each context. Second, these platforms redirect the mechanisms for creating or introducing varieties operated by national agronomic research structures through a retroactive process on the AIS.

This chapter is divided into four sections. In section 1.2, we present the developments that have occurred due to the introduction of technological innovations in the plantain sector in Côte d’Ivoire. Section 1.3 describes the SIS framework and its four identified components, as well as the methodology used for data collection. In section 1.4, we present our results, which are discussed in section 1.5. In conclusion, we propose some recommendations and perspectives for future research.

1.2. Technological innovations in the Ivorian plantain sector

1.2.1. Development of plantain cultivar transfers

This literature review on the introduction of plantain varieties and hybrids in Côte d’Ivoire and on the process of creating PIPs, highlights the macroeconomic elements, public policy, program or project aspects that have built up cultivar transfers since the 1980s [LAS 73, LAS 89, CHA 80, OSS 98, KOF 01, KOF 04, CNR 08, TRA 09].

The literature highlights the development of the socioinstitutional environment of innovation processes in the food sector [CHA 96, PNI 10, PNS 11, SND 14, BLO 14, PER 15].

In the present framework, we are interested in the latest introductions of three improved cultivars of plantain plants: PITA 3 (2012), FHIA 21 (2012) and Big Ebanga (2014). The processing of this (secondary) information
collected makes it possible to identify the components of an AIS on plantains, which are under construction in Côte d’Ivoire.

The socioinstitutional environment of this sector is shaped\(^1\) to include the major actors and stakeholders who were surveyed.

1.2.2. History of the WAAPP plantain program

In 2012, producers in the Côte d’Ivoire plantain sector were informed of the existence of new and improved cultivars of high yield plantains that were potentially tolerant to Cercosporiosis (a leaf disease), namely PITA 3 and FHIA 21. These two hybrids were then experimentally tested in 10 producer groups in seven zones: Abengourou (2), Bouaflé (2), Issia (2), Adzopé, Agboville, Divo and Tiassalé, representing a total of 224 producers of which 155 were women (over 69\%) [WAA 13]. These tests continued in 2013 and were prolonged until 2014. Approximate 92,680 PITA 3 and FHIA 21 seedlings were distributed by ANADER free of charge to over 160 producer groups between 2012 and 2014. As one of the main partners in rural development, ANADER provided advisory support (general extension) in agricultural production localities.

The demonstration plots were subdivided into three sections in each grouping and covered on average, a quarter of a hectare (ha) of land. This was required to accommodate the two improved hybrids, which were subject to diffusion together with a local variety (Affoto/N’Dè Fôtô or Agnin/Agninnin) as a control variable. These were all selected through

\(^1\) The national institutions involved in this plantain innovation process include the Ministry of Agriculture (MINADER) and the Ministry of Economy and Finance (MEF), the Interprofessional Fund for Research and Agricultural Development (FIRCA), the National Center for Agricultural Research (CNRA), the Ivorian Institute for Tropical Technology (I2T), the National Center for Specialization in Plantain Banana (CNS BP), the Félix Houphouët-Boigny National Polytechnic Institute (INPHB), the École Supérieure d’Agronomie (ESA_INPHB), the École Nationale de la Statistique et Économie Appliquée (ENSEA), the National Agency for Rural Development (ANADER), African Institute for Economic and Social Development (INADESS-Formation), the Plantain Innovation Platforms (PIP), the Association for the Development of Intensive Crops (ADCVI), the Professional Agricultural Organizations (OPA), the Rongead International Trade & Sustainable Development NGO, the Chigata Women and Development NGO, etc. External partnerships were established with CIRAD, CGIAR, IITA and CARBAP.
agronomic studies (CNRA). This methodology helped to compare cultural methods. On the control plot, producers were free to grow plantain in accordance with traditional cultivation practices, whereas on plots containing improved hybrid cultivars, new and more specific cultivation techniques were applied to the management of a monoculture farm, under the supervision of ANADER’s extension and advisory officers.

The use of plantain plants selected by research has radically modified local cultivation techniques. It has reduced vulnerability to disease and therefore increased yield per hectare, according to researchers. These results have been confirmed by the producers surveyed.

As a result of this experiment, five PIPs were created in 2013 in five of the main plantain production areas: Abengourou, Adzopé, Agboville, Issia and Soubré, financed on the basis of a public–private partnership (PPP) between the Côte d’Ivoire Government and the World Bank (the WAAPP project).

1.2.3. **Innovation platform features: objectives, composition and governance**

1.2.3.1. **State objectives for the creation of innovation platforms**

Agronomic research has produced a number of technologies for which the effectiveness has been proven in experiments but not always in real environments. Thus, by setting up innovation platforms in the agricultural and agri-food sector (plantain, cassava, maize and rice), the Ivorian authorities aim at taking into account the real needs of economic stakeholders (producers, processors, etc.) by improving the transfer of research results.

The initial objectives of these innovation platforms are mainly to facilitate access to agricultural (hybrid) inputs, to increase the production of these strategic crops, to support the sale of these products on local and regional markets, and above all to build a permanent framework for multistakeholder dialog in the Ivorian agri-food chains.

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2 In 2007, the PITA 3, FHIA 21 and CRBP 100 hybrids were used in a participatory selection of plantain plants in western Côte d’Ivoire. According to the CNRA, this pilot test was what motivated the choice of the varieties PITA 3 and FHIA 21 in the implementation of the WAAPP project. [http://www.cnra.ci/downloads/Rap_programmes%20de%20recherche%202007.pdf](http://www.cnra.ci/downloads/Rap_programmes%20de%20recherche%202007.pdf) p57.
The PIPs constitute a new technological mechanism (hardware) that was set up as part of the implementation of programs to improve productivity in the plantains sector. These PIPs experimentally structured the AIS in the sector by developing the “orgware” and “software” dimensions of innovation. Through this process, they ensure synergy between the sector stakeholders while broadening their spectrum to all the different links in the VC.

Thus, the design of PIPs aims at increasing the domestic supply of local food and hence improving food independence in Côte d’Ivoire.

1.2.3.2. Creation of PIPs and evolution of the number of members

The establishment of PIPs was made possible from September to December 2013 through joint action from the Ministry of Agriculture, CNRA, IITA, ANADER and FIRCA_WAAPP. The Abengourou YEBOYEKON innovation platform was the first to be set up (September 13, 2013), then successively the Agboville N’DÉ N’FENIN-TÔH PIP in the Agneby Tiassa region (September 25), the Adzopè WOYÈ PIP (October 3), the Issia PIP (September 5) and the Soubré PIP in the region of Nawa (December 17, 2013). This action marked the beginning of the local organization and restructuring of the sector.

Since their creation, a range of actors have emerged, varying depending on the implementation area and the stakeholders. These PIPs are composed of direct actors in the VC (producers, nursery men, traders and processors) and indirect actors who do not own the product, but whose involvement is necessary for marketing it (transporters); law free trade (law enforcement agencies); microfinance institutes (MFIs); farmer organization by broker services (ANADER, ADCVI), etc. These platforms aim at integrating the different links in the chain of implementation of changes (technical, organizational) that are necessary for the diffusion of new cultivars.

The number of producer groups ranged from two to 10 per PIP, with an average number of members ranging from 150 to 600 for the Soubré platform, which currently has about 20 groups. This number appears to have increased from 35 to 68 between 2013 and 2016, reflecting the interest of this category of stakeholders in the success of the PIP. With a total of about 1,500 members [FIR 15], these groups account for between 40 and 65% of women plantain producers, often reaching about 150 women per PIP. This could be justified by the presence of at least two groups of food-producing women per PIP in Côte d’Ivoire. All these producers are grouped within an
agricultural professional organization (APO). In addition, nursery activity has developed rapidly, as is currently the case in Agboville’s PIP. These actors ensure a sustainable supply of improved plants.

As for associations that group traders, there exists one or even two associations per platform, with a majority of women members (80–90%). At this level, it is worth noting that in the case of food traders’ associations, the stakeholders could simultaneously be producers and traders. These associations are mainly owned by women and are referred to as “food trader cooperatives”. Some are pooled as a federation of cooperatives (FENACOVICI, COCOVICO, CNAVICI) while others are not affiliated in any way. This would probably make it more difficult for this category of stakeholders in the industry, as well as restaurant owners, to take ownership of a PIP.

In addition to these direct stakeholders, a platform may have a union of plantain transporters with five to 15 members, an MFI or a commercial bank, as well as a subsidiary of phytosanitary product resellers with one to five members. It should also be noted that in some PIPs, customary chiefs and advisory committees are also present in the localities (for example in the town of Issia). Our investigations also revealed the introduction of certain stakeholders from civil and community life into the organization of certain PIPs. These are local governments, law enforcement agencies and state local representatives (regional prefect), as is currently the case with the YEBOYEKON PIP in the Abengourou region.

1.2.3.3. Governance of PIPs facing the diversity of contexts

Three years after being set up, the perception of the role of a PIP varies from region to region and differs from that of research institutions and broker services. For some platform chairmen, the PIP is a central purchasing body, while for others, it is a regulatory framework in which all the industry’s stakeholder groups meet to exchange ideas and establish a solid business relationship between each other.

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3 FENACOVICI: National Federation of Food Co-operatives in Côte d’Ivoire (from the French Fédération Nationale des Coopératives de Vivriers de Côte d’Ivoire); COCOVICO: Cocody Food Trade Co-operative (from the French Coopérative des Commerçants de Vivriers de Cocody); CNAVICI: National Coordination of Food Stakeholders in Côte d’Ivoire (From the French Coordination Nationale des Acteurs du Vivrier de Côté d’Ivoire).
For the economic operators that make up the PIP, it appears to be “a framework for consultation, exchanges and sharing information between the different stakeholders (direct and indirect) in a same VC in order to resolve their production, processing, marketing, transport and financing problems. This mechanism should make it possible to defend their common interests through the search for a shared added value, which would improve their income and livelihoods and hence, their living conditions and well-being” [FIR 15].

Partner (IITA) and research (CNRA) institutions see PIPs as a tool for the dissemination of new technologies (innovation and knowledge) and a mechanism for building up the beneficiaries’ capacities. It is therefore a suitable tool for providing solutions to the constraints faced by most of the stakeholders in a VC and a tool for managing the multistakeholder process in this chain. It also shows that a PIP is mainly a means or framework for exchanges to improve the identification of farmers’ needs and to disseminate new technologies in rural areas. It is also a mechanism where several categories of stakeholders work together to create value for equitable sharing.

The operation of these platforms was done in two phases. After they were implemented, executive offices (EOs) were set up as the first direct actors (producer groups) saw fit. These executive officers are those who had benefited from improved seedlings and training sessions on new cultivation practices brought about by the use of new hybrid varieties in 2012. Thus, the number and categories of stakeholders involved in the EO differed from one platform to another, but each EO remained on the whole dominated by producers with the presence of a few traders, processors and transporters.

In May 2015, research institutions (IITA, CNRA) suggested a new form of PIP organization with a theoretical maximum of seven members in each EO, so an average of one representative per stakeholder group including the PIP chairman. In addition, the frequency of EO meetings in the PIPs remains monthly, while the General Assemblies (GAs) take place on a quarterly basis. These GAs are made up of two representatives from each producer group, traders’ cooperatives and associations of processors or restaurant owners, who have subscribed and are up to date with their membership fees, in addition to each representative of the indirect stakeholders who are members of the PIP.
However, the organization and motivation of the stakeholders remain a major challenge for the survival of each PIP. In practice, the PIPs should be self-financed through enrolment fees for groups and associations, and membership fees. Although this self-financing took place in 2014, it was partial in 2015 and remained hypothetical in 2016, at the time of our field investigations. The collected amounts are deposited in a bank account at an authorized financial institution in the region where the PIP is located. This disposition is intended to promote the creation of their files for legal formalities, as is currently the case for the PIPs in Adzopé, Agboville and Soubré.

1.3. Conceptual and methodological framework

1.3.1. SIS: framework for analyzing technological changes based on the strategies of stakeholders in agri-food chains

The conceptual framework of ISs [LUN 92, HAL 05, TOU 15] was used to shape the functioning of PIP [HEK 07] through the description of components, stakeholders and their interactions [RÖL 09]. This conceptual framework allowed us to identify four components of AIS in the plantain sector in our study in order to analyze the dynamics of interactions between categories of stakeholders and their coordination strategies in agriculture and the agri-food sector in developing countries.

The AIS is composed of the following main stakeholders: (1) research; (2) broker services (extension and advice); (3) professionals or economic stakeholders made up of agro-procurement stakeholders, producers, traders and processors; and (4) institutions for financing agricultural innovation in the plantain sector.

This step should lead to an assessment of the operation constraints of this AIS, which is still under construction in the plantain sector in Côte d’Ivoire.

The characterization of how PIPs function also helps to identify institutional arrangements (IAs) and changes [HOU 12] between categories of stakeholders, while integrating the diversity of the sociocultural contexts in which these PIPs develop.

This approach makes it possible to highlight the mechanisms for coevolution of the dimensions of innovation “hardware, software and orgware” [KLE 12], which would underpin innovation processes in the plantain sector.
1.3.2. Conceptualization of the four components of an AIS

The AIS, which we discuss in the Ivorian context, is a mechanism that links four components that structure current sociotechnological innovations, namely (1) research, (2) intermediation, (3) VC and (4) innovation financing (Figure 1.1). These elements act and interact in this agri-food system for the creation of goods and/or services.

![Figure 1.1. AIS in Côte d’Ivoire](image)

Thus, AIS in developing countries can be conceptualized in the agri-food sector as follows:

By producing basic knowledge, technologies and diverse products, the “research component” guides innovation processes in the food sector [MAL 05]. In Côte d’Ivoire, this action is devolved in the agricultural field by national research institutions in agronomy (CNRA, I2T, CNS BP), universities and higher engineering and technical colleges (INPHB, ENSEA, UFHB, UNA), as well as subregional (CARBAP) and international research and cooperation organizations (CIRAD, IITA, CGIAR).

In order to ensure that the generated knowledge is circulated among professionals or direct stakeholders in VCs, an “intermediation component” has also been identified. The intermediate innovation stakeholders, which are also called “brokers” [KLE 12, KIL 13], have the particularity of making theoretical knowledge more accessible by transforming it into a more adequate language to ensure the dissemination or transfer of technologies to direct actors in the VC or to the beneficiaries of innovation. The structures within this component are partly owned by the state in developing countries.

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They provide guidance, training, capacity-building, extension and advice on agricultural practices in the sector on which the Ivorian economy is based: agriculture. These are ministries in charge of agriculture, livestock, economy and finance, industry, crafts and SMEs, ANADER, INADES Formation, ADCVI, NGOs, EPOs, some agricultural cooperatives and village groups.

Professionals and private entrepreneurs, which are still direct or indirect stakeholders of the VC in the plantain sector, have all been grouped together in this AIS as part of the “value chain component”. Within this component, although the economic agents are heterogeneous, they benefit from training, apprenticeship (learning by doing), capacity-building for production, marketing and processing techniques, and also support (material and/or financial). This component brings together economic stakeholders who generally develop commercial relations and aim at making profits. It brings together both upstream and downstream actors. At the center of this VC component are the plantain growers, including both men and women, but many more women from the food sector in general. The upstream actors provide the agro-supply service for inputs such as nursery men and suppliers of phytosanitary products. Downstream of the VC, there are transporters, traders, processors (industry and artisanal) and stakeholders of large and medium distribution, with raw or processed products (flour, pastry, plantain chips) that are either intended for local markets or for export to West African subregion countries (Burkina Faso, Mali, etc.) or even to the European Union and America.

The “financing component” of innovation supports, on the one hand, research, development, technological innovation and knowledge dissemination activities, and, on the other hand, the agricultural sector. It consists of international donors (World Bank, AFD), regional banks (BAD, BCEAO, BOAD) and national commercial banks (BNI, BICICI, SIB) as well as FIRCA at the national level. Local MFIs also contribute to granting microcredits and the development of savings, such as the women’s food credit union (MUCREF) and the Financial Institution for Savings and Credit Co-operators and farmers (IFECC, COOPEC).

In addition to formal intragroup relations, informal interactions also take place between the components, which allows this sectoral mechanism to be defined as a system. These interactions between the main actors and stakeholders of the components often occur in the context of public policy implementation, a national development program or a project.
It would certainly be beneficial to apply this AIS to the new policy for reducing food dependency in Côte d’Ivoire in order to obtain a positive impact of this program for improving agricultural productivity (WAAPP) and achieving food security challenges.

NOTE.– The AIS that is applied to the interaction strategies of plantain stakeholders in Côte d’Ivoire is done through its four components and its relationship with the experimental scheme called PIP, which is implemented by WAAPP.

1.3.3. Methodological and analytical framework

Within the framework of primary data collection and for the purposes of this study, several bodies were selected to conduct semidirective interviews: the Ministry responsible for this productivity improvement program (MINADER), the executive body (FIRCA_WAAPP), the coordination center for research programs on plantains (CNRA) and the technical extension agency (ANADER). According to experts, surveys were carried out in France (VITROPIC, CIRAD and experts) and in Côte d’Ivoire (researchers and experts) in 2015 and 2016 to better understand and define the process of sociotechnological innovation under way in the plantain sector in Côte d’Ivoire.

A field survey mission was also carried out in four of the five PIPs, from April 25 to 30, 2016. These surveys were made possible through the use of semidirective face-to-face interview guides. The interviews were conducted at the headquarters of each PIP EO, usually located at ANADER’s departmental or regional offices in Soubré, Agboville, Adzopé and Abengourou. The collections were held before the elected presidents of each PIP with one or two members of each EO also participating, amounting to a total of 12 direct stakeholders. These included producers, nursery men, traders and restaurant owners who were members of the PIP. Sometimes ANADER’s advisory agent in charge of implementing the WAAPP project was also present.

Table 1.1 summarizes the survey methods used and the nature of the information collected. These surveys were used to better understand the organization of this AIS and analyze its development.
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<td>- History of choice and introduction of improved and resistant hybrid varieties: <em>PITA 3, Fhia 21, Big Ebanga</em></td>
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<td>- Perception of the role of Plantain Innovation Platforms</td>
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<td>- Functionality of agricultural innovation systems (AISs)</td>
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**Table 1.1. Data collection (source: author)**
1.4. Results

1.4.1. Functionality of Côte d'Ivoire's PIPs

The PIP is a multifunctional tool with two goals for economic operators in this agricultural sector. The first is to bring in stakeholders who steer innovation (intermediaries, researchers, etc.) and have them interact with the actors of the VC (producers, traders, processors and consumers) based on study results (CNRA, IITA, CNS BP). The process of this technology transfer is mainly carried out through (1) the selection and introduction of two improved hybrids through research, (2) the dissemination of these new technologies (innovations and knowledge) within producer groups and (3) training, learning and capacity-building of stakeholders on the use of the technical package surrounding this technology.

The second goal of PIPs is to restructure the coordination between VC stakeholders in order to speed up the use or non-use of initial (varietal) technical proposals by managing the multistakeholder process within them.

Investigations reveal several constraints on the governance and effectiveness of PIPs, which are reflected in the dilution of General Assemblies (AGs), even though monthly meetings in EOs are held regularly. Conventional operational problems linked to the lack of transport facilities for EO members have strongly penalized the tasks assigned to them by producers and members, as is the case in the Nawa PIP in Soubré.

1.4.2. Reorganization of the AIS components by PIPs

Reorganization of the four plantain SIS components into the platforms has resulted in it organizing and coordinating the activities of stakeholder groups involved in the diffusion of new technologies. This organization takes place across multiple levels: (1) analysis of the choice of new varieties introduced in each locality; (2) consideration of their acceptability conditions by beneficiaries; (3) the need to integrate endogenous innovation processes carried out by stakeholders; (4) reorientation of technological trajectories by public policies that are introduced into the sector; (5) emergence of IAs between the platform’s member stakeholders; (6) identification of the real needs of the platform’s members; and (7) taking into account the food preferences of potential consumers and, in particular, local consumers.
Regarding the coordination of activities of heterogeneous groups of stakeholders, three relationships between stakeholders in the VC have emerged as the most significant in the field during the WAAPP variety experiment. These were (1) collaboration between research and development structures and intermediation agencies or producer coaching services in rural areas; (2) interactions between these structures and groups of producers who benefit from innovation; and (3) exchanges between research structures and professionals in the VC for better guidance of public policies in the choice of cultivars.

Thus, the PIPs caused the SIS components to interact in 2014 and organized a participatory construction of local adoption conditions for hybrids that had been selected in 2007 (Figure 1.2). However, the national dissemination that followed in 2012 did not take into account the needs linked to diversity of contexts and regions, let alone the preferences of local consumers [JIG 16].

1.4.3. Redirecting technological trajectories in the plantain sector in Côte d’Ivoire

Redirecting public policy decisions has been made possible because of ongoing exchanges between several categories of actors and stakeholders in the VC within the VC component. It has also taken place due to the multiple interactions developed between the different components (professionals,
intermediaries, research institutions and funding bodies) of this AIS. In this way, the PIPs have led to the emergence of coordination dynamics among stakeholders in various regions, which made it possible to specify the needs for improving the productivity of plantations and to respond to the food preferences of local plantain consumers.

In 2012, after the dissemination of the *PITA 3* and *FHIA 21* varieties and the transfer of cultivation technologies linked to the use of these varieties by ANADER (which was carried out under the impetus of agronomic research), the participatory establishment set up in 2013 of a PIP in the main production areas encouraged the identification of plantain cultivars that were similar to the main local varieties (*Agnrin* and *Affôô*). Thus, the interactions between stakeholders in the sector within the PIPs made it possible to express the needs of local producers and consumers in terms of choice of plantain plant material.

Unilaterally, FIRCA_WAAPP also changed its innovation policies in 2014 by introducing the *Big Ebanga* variety, a cultivar from Cameroon.

Illustration of PIP governance: case of the N’DÈ N’FENIN-TOH PIP in Agneby Tiassa

To illustrate our statements, we have chosen to highlight the case of the governance of Agboville’s PIP as a model for the success of these experimental schemes.

In Agboville, this theoretical institutional capacity was below what was required in May 2016, with five members (one producer, one nurseryman, one trader, one processor for transforming PITA 3 into chips and one transporters’ representative), while in Soubré, there were 10 stakeholders (two producers, two traders, two processors, one seller of phytosanitary products, two microfinance representatives and one CNRA representative), which could be due to the Soubré PIP chairman’s interest in turning it into a purchasing center, beyond a simple consultation framework between stakeholders. In addition, the Agboville PIP General Assembly was made up of two representatives per stakeholder group involved in PIP in 2013; in other words, 20 members for the 10 producer groups, four members for two merchant associations and two members for the transporters’ union.

Subsequently, five producer groups (10 members) and an industrial unit for processing PITA 3 into chips were integrated, as well as two nurserymen. This PIP did not include sellers of phytosanitary products as the plots did not require fertilizer nor pesticides during experimental testing (FAO 2011). However, in order to control plantain diseases, some Agboville producers used ashes, as did the PIPs of Adzopé and Abengourou. There were more men than women in this EO, as opposed to in the plantain producer groups in the region [KOF 08]. This situation may be explained by the fact that many women in the Agneby
Tiassa plantain producer groups are unaware of the very existence of a PIP in their region, especially since most of the time, it is the broker service (ANADER) that coordinates the activities carried out within the PIP framework, and especially on behalf of the WAAPP project.

Box 1.1. Agboville PIP governance

1.5. Discussion of the functionalities of the system and IAs

1.5.1. Functionalities of the agricultural SIS for the plantain sector in Côte d’Ivoire

The renewal of technological innovation trajectories is changing the structure of SIS in the plantain sector and thus, the initial functionalities (see section 1.3.2) of this SIS are modified [HEK 07]. Indeed, the role of the AIS is (1) to slow down or (2) to promote the diffusion of a technology subsequent to a better understanding of local needs. This change reflects a shift in the diffusionist model of innovation based on the introduction of hybrids from “technology pools” to a “bottom-up” process that favors the adaptation of introduced technologies.

During the first stage of participatory selection in 2007, which preceded the widespread diffusion of PITA 3 and FHIA 21 hybrids within producer groups in 2012, the innovation policy was mainly of the technology pool type. This combined a top-down design characterized by the transfer of technologies identified by research and popularized by “brokers” through training, learning and capacity-building sessions for beneficiaries of these hybrids, which is linked to the “software” dimension of innovation.

According to the Adzopé and Soubré PIP managers, this approach, which prevailed before the platforms were set up, led to widespread rejection of the PITA 3 hybrid by beneficiary producer groups in certain localities and mixed acceptance of the FHIA 21 hybrid. This situation called for the identification of producers’ real productivity needs and local consumer preferences through a “bottom-up” approach involving interactions between all four components of the AIS within PIPs.

In a second phase, it structured an innovation policy that was based on the introduction of Big Ebanga, a traditional variety grown in Cameroon.
However, this did not result from the creation of varieties based on agronomic research in Côte d’Ivoire.

### 1.5.2. IAs and changes

The use of platforms as a means for IA or change [HOU 12] highlights the interaction between different components of the SIS and the coevolution of the three dimensions of innovation (hardware, software and orgware) and, where appropriate, specifically the “orgware” dimension. In fact, the IAs between stakeholders have been strengthened between producer groups and nurseries trained in plant breeding and propagation methods. These new informal IAs take the form of low-cost exchanges of plant material (vitro plants or vivo plants) between these two groups of stakeholders. The WAAPP program has strengthened the professionalization of plantain nurserymen in Côte d’Ivoire since 2015.

The aim of promoting permanent contact between stakeholders in the research component and producers of the selection has made it possible to better guide agronomic studies in order to better satisfy the needs of these stakeholders. Thus, several researchers who were interviewed have now declared that they are looking back over studies that increase the productivity of local varieties. Identifying these local varieties and their genetic improvement potential is actually becoming the common target for these two components of the AIS (research and VC).

These situations have also shown that widespread dissemination of new so-called improved varieties has, of course, responded to the experimentation needs and availability of planting material. However, poor knowledge of cultivation techniques during the harvest has subsequently increased postharvest losses and has deteriorated relations between producers and buyers (traders and consumers). Therefore, all of the stakeholders surveyed (researchers, producers, etc.) were each confronted with the difficulty of having to find new cooking and food preparation techniques for the consumption of the introduced hybrids.

### 1.5.3. Renewal of technological innovation processes

The two hybrids, introduced PITA 3 and FHIA 21, which have been described as having an improved yield and as potentially being plantain
plants that are Cercosporiosis-tolerant, have proven their worth in food crop plantations in Côte d’Ivoire through higher yields than older varieties. However, this does not necessarily meet the needs of local producers for new plant varieties and the food preferences of Ivorian consumers [LOP 11]. In addition, the rejection of these varieties of hybrids depending on the experimental regions varies, of course, according to the dietary habits of populations.

This local reality is reflected in the words of the Agboville and Adzopé PIP chairmen: “Here in Agboville, the two varieties have been accepted by the majority of the local population, since we eat the plantain when it is green (non-ripe)” (Mr. Ado Joseph); “We, the Attié of Adzopé, prefer the very ripe and yellow plantain, and the new varieties of PITA never go yellow, which makes it very difficult for us to market it and consume it locally” (Mr. Achy Jean Sylvio).

In fact, the work carried out shows that introducing hybrids to increase yields of plantain was more for industrial processing into chips or pastry, and for export purposes, than to meet the population’s needs for fresh consumption. This is explained by PIP chairman Achy: “In Adzopé, we agreed to continue the production of PITA and sell it to the new processing unit to turn plantain into chips”. According to Dame Nemeu Déborah of the PIP Executive Board in Soubré, “Faced with poor sales of new varieties of plantain, I decided to make flour out of them, which was later used to make cakes and I was filmed by FIRCA_WAAPP several times to show my example to other plantain producers and processors”.

Thus, meeting local needs would then imply combining production targets with the variable and diverse food preferences of rural households [DUR 12] in an economy with very heterogeneous customs and usages [GIB 05, CAR 08].

The PIPs therefore highlight the preferences of VC professionals, thus marking the inadequacies of diffusionist technology transfers in developing countries.

1.6. Conclusion

The aim of spreading disease-resistant and high-yielding varieties of plantain hybrids in Côte d’Ivoire has led to the creation of experimental
mechanisms: PIPs. This study analyzes the impact of four PIPs on the restructuring of AISs and the reorientation of technological trajectories in the plantain sector in Côte d’Ivoire.

Thus, it contributes to the evaluation of the impact of innovation platforms on the organization of the four components of the plantain AIS (research, intermediation, VC and financing). These are identified by their complementarity in several production areas where these PIPs are, respectively, implemented (Abengourou, Adzopé, Agboville, Soubré and Issia).

Our study shows that coevolution between these four components of the AIS and the three dimensions of innovation (hardware, software and orgware) restructure and influence public decision-making processes in the selection and emergence of new technological innovations. Through the introduction of so-called improved hybrids (PITA 3, FHIA 21), the plantain sector’s development strategy has not really been successful. On the other hand, it has induced the introduction of the Big Ebanga variety.

PIPs have also reoriented stakeholder strategies and made them coherent (research, VC, intermediation) by taking into account the needs of producers for varietal improvement based on local food preferences and not the preferences of potential industries or processing units for export.

Thus, PIPs are helping to generate multistakeholder coordination dynamics and strengthen the capacity of the sector’s stakeholders to make technical choices, which has enabled the AIS to restructure its plantain sector. However, our results raise questions about the future effectiveness of these PIPs in Côte d’Ivoire.

1.7. Bibliography


