REPUBLIC OF BENIN

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MINISTRY OF AGRICULTURE, LIVESTOCK AND FISHERIES (MAEP)

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GENERAL SECRETARIAT OF THE MINISTRY

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PROJECT TO SUPPORT FOOD PRODUCTION AND BUILD RESILIENCE IN THE DEPARTMENTS OF ALIBORI, BORGOU AND COLLINES (PAPVIRE-ABC)

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MISSION TO CARRY OUT ANNUAL SURVEYS TO MONITOR ACHIEVEMENT OF INDICATORS FOR THE PROJECT TO SUPPORT FOOD PRODUCTION AND BUILD RESILIENCE IN THE DEPARTMENTS OF ALIBORI, BORGOU AND COLLINES (PAPVIRE-ABC)

Final evaluation of the impact of PAPVIRE-ABC on beneficiaries

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Acronyms and abbreviations

ABE	Benin Environment Agency
ABSSA	Agence Béninoise de Sécurité Sanitaire des Aliments (Benin Food Safety Agency)
ACAER	Agence Communale chargé des Aménagements et des Equipements Ruraux (Community Agency for Rural Amenities and Equipment)
ACE	Contractual government employees
AGEO	Extraordinary and Ordinary General Meetings
AGETUR	Agence d'Exécution des Travaux Urbains (Urban Works Execution Agency)
ANDF	Agence Nationale du Domaines et du Foncier (National Land and Property Agency)
ANO	: No Objection Notice
AMI	Notice of Expression of Interest
APAH	Agence de Promotion des Aménagements Hydroagricoles (Agency for the Promotion of Hydroagricultural Development)
APD	Avant-Projet Détaillé
APIDev	Association for the Promotion of Sustainable Development Initiatives
APIC	Association for the Promotion of Community Initiatives
APNV	Participatory approach Village level
APS	Avant-Projet Sommaire
ART	Ateliers de Revues Technologiques
ATDA	Agence Territoriale de Développement Agricole
BAD	African Development Bank
CAA	Caisse Autonome d'Amortissement
CARDER	Regional Agricultural Center for Rural Development
CE	Environmental Unit
CEP	: Champ Ecole Paysans
CCE	: Environmental Certificates of Conformity
CGES	Environmental and Social Management Framework
CePED	Center de Partenariat et d'Expertise pour le Développement Durable (Partnership and Expertise Center for Sustainable Development)
CM	Market garden crops
COP	Steering Committee
CPEA	Center for the Promotion of Agricultural Entrepreneurship
CoopDICPA	Coopérative de Distribution d'Intrants et de Commercialisation des Produits Agricoles (Cooperative for the distribution of inputs and marketing of agricultural products)
CPV	Plant Production Advisor
CVA	: Value-added chain
DDAEP	Direction Départementale de l'Agriculture de l'Elevage et de la Pêche (Departmental Directorate of Agriculture, Livestock and Fisheries)
DDP	: Publication request
DANA	Department of Food and Applied Nutrition
DAO	Tender documents
DGFD	Financing and Development Department
DGR	Direction du Génie Rural
DIP	IT and Pre-archiving Department
DLROPEA	Direction de la Législation Rurale, de l'Appui aux Organisations Professionnelles et à l'Entrepreneuriat Agricole (Department of Rural Legislation, Support for Professional Organizations and Agricultural Entrepreneurship)
DNCMP	Direction Nationale de Contrôle des Marchés Publics (National Public Procurement Control Department)
PLR	Programming and Forecasting Department
DPV	Direction de la Production Végétale
DQIFE	Quality, Innovation and Entrepreneurial Training Department
DSME	Health, Mother and Child Department
EIA	Environmental Impact Assessment

ESOP	Service companies and producer organizations
FAO	Food and Agriculture Organization of the United Nations
FIDA	International Fund for Agricultural Development
FUPRO	Fédération des Unions de Producteurs
GAFSP	Global Agriculture and Food Security Program
FNDA	National Fund for Agricultural Development
GCF	Accounting and Financial Management
GPS	Global Positioning System (Système de Positionnement par satellite)
GIE	Economic Interest Grouping
DSO	: Managing for Development Results
HIMO	High labor intensity
IAL	Food insecurity
IAM	Moderate food insecurity
IECCC	Information, Education, Communication for Behavior Change
INRAB	Institut National des Recherches Agricoles du Bénin
MFI	Microfinance Institution
LCSSA	Laboratoire Central de Contrôle de la Sécurité Sanitaire des Aliments (Central Laboratory for Food Safety Control)
MAEP	Ministry of Agriculture, Livestock and Fisheries
MEF	Ministry of Economy and Finance
MPD	Ministry of Planning and Development
MS	Ministry of Health
OHADA	Organization for the Harmonization of Business Law in Africa
NGO	Non-governmental organization
MDG	Millennium Development Goals
OP	Professional Organization
PAPA	Agricultural Policy Analysis Program
PAPVIRE-ABC	Projet d'Appui à la Production Vivrière et de renforcement de la Résilience dans les départements de l'Alibori, du Borgou et des Collines (Project to support food crop production and strengthen resilience in the Alibori, Borgou and Collines departments)
PASCIB	Plateforme des Acteurs de la Société Civile au Bénin (Platform of Civil Society Actors in Benin)
CAADP	Programme Détaillé de Développement de l'Agriculture Africaine (Detailed program for the development of African agriculture)
PF	: Focal Point
LIC	Plan Foncier Rural
ESMP	Environmental and Social Management Framework Plan
NIPA	National Agricultural Investment Plan
PNOPPA	Plateforme Nationale des Organisations Paysannes et de Producteurs Agricoles (National Platform of Farmers' and Agricultural Producers' Organizations)
PPEA	Projet de Promotion de l'Entreprenariat Agricole (Agricultural Entrepreneurship Promotion Project)
PPM	Plan de Passation de Marché
ProCaR	Rural Framework Program
PSRSA	Plan Stratégique de Relance du Secteur Agricole (Strategic plan to revive the agricultural sector)
PTBA	Annual Budgeted Work Program
PV	Minutes
SA	Food Safety
SAG	: Severe Food Situation
CPRS	Growth Strategy for Poverty Reduction
SGM	General Secretariat of the Ministry
SNV	Dutch Development Organization
SIGFiP	Integrated Public Finance Management System
ToR	Reference term
PET SCAN	Physical Execution Rate
TEF	Financial Execution Rate

TSANA	Technicien Spécialisé en Alimentation et Nutrition Appliquée (Specialized Technician in Food and Applied Nutrition)
TSPV	Technicien Spécialisé en Production Végétale (Specialized Technician in Plant Production)
UA	Application Unit
UD	Demonstration unit
PMU	Project Management Unit
ZIP	Project Intervention Zone

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0. ANALYTICAL SUMMARY

To achieve the objective of sustainably boosting food production in the departments of Alibori, Borgou and Collines, through improved productivity, resilience to climate change and sustainable management of agricultural natural resources, the Projet d'Appui à la Production Vivrière et de renforcement de la Résilience dans les départements de l'Alibori, du Borgou et des Collines (PAPVIRE-ABC) project has implemented the activities set out in its 2016-2020 operational plan in line with the logic defined in its various fields of action, divided into three (03) components, namely: Rural Infrastructure Support (Component A), Agricultural Value Chain Development and Resiliences (Component B) and the Project Management Unit (Component C).

With a duration of 05 years, the PAPVIRE-ABC project is one of the priority projects of the Programme d'Actions du Gouvernement (PAG) "volet agriculture". This project is innovative compared to other projects underway at the MAEP, in that it is based on an innovative form of agricultural advice under which beneficiaries monitored by an agricultural advisor received a whole package of specific and adapted support, consisting of agricultural inputs for food products, advice and facilitation, guaranteeing improved agricultural productivity. Since the project began in 2016, several actions have been carried out in the field. These include support for agricultural infrastructure, the development of agricultural value chains and capacity building for stakeholders.

The aim of the evaluation mission was to assess the effects and impact of PAPVIRE's interventions in its areas of intervention and on the living conditions of beneficiaries. Specifically, this involved (i) analyzing the effects of the project on agricultural performance (productivity, volume of harvested production, volume of marketed production, etc.) and household incomes in the ZIP; (ii) assessing the impacts of project implementation on the living conditions of beneficiaries. In particular on (i) the average prevalence of food insecurity in the ZIP, (ii) the prevalence of chronic malnutrition (children aged 5-59 months) in the ZIP, (iii) the percentage of poor populations in the ZIP; and (iii) to formulate lessons learned (experience of best practices, failures) and provide elements of capitalization of PAPVIRE activities since its launch.

To achieve this, the mission relied on the "theory-based impact assessment" developed by White (2009, 2012). This approach involves (i) causal chain mapping (i.e. project philosophy), (ii) understanding the project context, (iii) anticipating heterogeneity, (iv) rigorous impact assessment using a credible counterfactual, (v) rigorous factual analysis, and (vi) mixed methods. The mission also took into account the project's theory of change, which explains how the activities were intended to produce a set of intermediate results contributing to the achievement of the planned final impacts. In practice, the activities were carried out in four main complementary phases: (i) preparation for the evaluation or preparatory phase, (ii) sampling and field investigations, (iii) data processing and analysis,
(iv) overall evaluation and production of reports. Data were collected from 1983 stakeholders (all categories), including 1113 for the quantitative phase (445 beneficiaries and 668 non-beneficiaries). Both qualitative and quantitative analyses were carried out, using descriptive tools (content analysis, descriptive statistics, etc.) and econometric tools, notably the non-parametric Propensity Score Matching (PSM) method. The variables on which the project's impact was assessed included agricultural productivity, food security, income, the poverty level of beneficiaries' households and the vulnerability of their households.

Results show that the project reached a total of 56,244 beneficiaries, 31% of whom were women and 69% men. The overall achievement rate is 112% of the target. The activities that have reached the most beneficiaries are the dissemination of technology packages and support for beneficiaries, advice and registration. In addition to the direct beneficiaries, the project created a total of 1,939 jobs during its implementation. In terms of other effects of the project on beneficiaries, the setting up of UDs and CEPs enabled producers to increase their crop yields (corn, rice and market garden crops). There has also been an increase in the various products marketed annually. These include 299,768 tonnes of food products (maize and rice) and
16,061 tonnes of market garden produce marketed per year. The project's actions to promote agricultural entrepreneurship are remarkable in the field. A total of four (04) incubation centers are dedicated to training young entrepreneurs with the aim of improving their living conditions. It should also be noted that the implementation of the project has helped to strengthen the skills of POs in management methods, increased their legitimacy through targeted actions, facilitated the implementation of activities through the construction of infrastructures such as processing units, development of market garden sites, increased and efficient mobilization of own resources through the strategy of collecting membership fees and contributions from POs.

The various results of the project's impact assessment on beneficiaries' living conditions revealed a statistically significant difference in income from cereal crops (rice and maize) between men (163.557 FCFA/year) and women (121,765 FCFA/year), and between beneficiaries (maize: 939,008 FCFA/year; rice: 917,659 FCFA/year) and non-beneficiaries (maize: 222,437 FCFA/year, rice: 308,630 FCFA/year). In terms of market garden production, beneficiaries have an annual income of 1,051,858 FCFA, compared with only 352,630 FCFA for non-beneficiaries. For men, the annual income from market garden production is 387,092 FCFA, compared with 425,940 FCFA for women.

These results show that women's income and production levels are significantly higher than those of men. In terms of food crop productivity, there was also a statistically significant difference between beneficiaries (maize: 3.47 tonnes/ha; rice: 8.19 tonnes/ha) and non-beneficiaries (maize: 0.864 tonnes/ha, rice: 1.96 tonnes/ha). Yields were reported to have been influenced by the following main factors: (i) training around UD and CEP (59.62%), (ii) access to inputs (35.30%), close supervision (60.78%), application of technology packages (60.70%), and access to seeds (40%).

In terms of food security, 93.35% of beneficiaries are food-secure, compared with 91.39% of non-beneficiaries. A very small proportion of beneficiaries are in the mildly food-insecure category (6.65%), compared with 8.61% of non-beneficiaries. It was also noted that there are fewer food-insecure beneficiaries than non-beneficiaries. This can be explained by the fact that beneficiaries prefer to consume large quantities of the food they produce. In terms of impact on the incidence of poverty, it was shown that project beneficiaries have a higher income than non-beneficiaries, and are therefore less poor than non-beneficiaries.

Finally, the analysis of the level of vulnerability showed some interesting results. In terms of health vulnerability, the index is relatively low, but higher for beneficiaries than for non-beneficiaries. Overall, the index is 30.43%, indicating that the respondents are vulnerable from a health point of view. In other words, the health conditions of the respondents need to be reviewed, even if there has been an improvement.

thanks to the project's implementation. In economic terms, the economic vulnerability index shows that 46.27% of beneficiaries surveyed are in a situation of economic non-vulnerability, compared with only 34.90% of non-beneficiaries. Overall, the economic vulnerability index of surveyed households is relatively low, at 38.83%. In material terms, the vulnerability index is also relatively low, reflecting the poverty of households in terms of ownership of durable goods. This index is 27.97% for beneficiaries and 31.14% for non-beneficiaries. This suggests that non-beneficiaries are less vulnerable than beneficiaries. In terms of housing, analysis of the vulnerability index shows that non-beneficiaries are more vulnerable to housing conditions than beneficiaries, but the overall level of vulnerability of those surveyed is 42.30%. This shows that respondents' living conditions are more or less better overall, but more so for non-beneficiaries than for beneficiaries. Overall, the level of vulnerability of the households surveyed is acceptable. Only 37.52% of beneficiaries are in a situation of non-vulnerability, compared with 33.95% of non-beneficiaries.

In view of the results achieved and the context in which the project has evolved, the development objective remains relevant. The project's current achievements are geared towards helping beneficiaries to significantly improve production and market their produce at remunerative prices. As a result, the project's direct beneficiaries will be able to improve their incomes and emerge from food insecurity.

At the end of all these analyses, the aim of which is to assess the effects and impact of the PAPVIRE-ABC project on beneficiaries, it is clear that the project has produced clearly positive effects on beneficiaries. Moreover, the project's impact on beneficiaries' living conditions varies according to income level. Women and men who were able to capitalize on the support received from the project saw their living conditions improve just as much as the male beneficiaries. In addition, all beneficiaries, without distinction, report an improvement in their ability to invest in their children's education and household expenses, thanks to the project's spin-offs. This also testifies to the contamination effects of the project on non-beneficiaries.

1. INTRODUCTION

1.1. Mission background and justification

The Projet d'Appui à la Production Vivrière et de renforcement de la Résilience dans les départements de l'Alibori, du Borgou et des Collines (PAPVIRE-ABC) is initiated by the Government of Benin and financed by the Global Agriculture and Food Security Program (GAFSP) Fund under the supervision of the African Development Bank (AfDB). Through this assistance from the Bank, Benin was notified on November 19, 2014, of an allocation of 24 million USD or 14,070.04 million FCFA to finance the PAPVIRE- ABC project. This project aims to contribute to improving food and nutritional security and reducing poverty. Spanning five years (2016-2020), the project's specific objective is to sustainably boost food production in the departments of Alibori, Borgou and Collines, by improving productivity, resilience to climate change, sustainable management of agricultural natural resources, reducing gender inequalities and increasing household incomes, particularly among the most vulnerable in the project intervention zone (ZIP). It is being implemented in the communes of Bantè, Ouèssè, Glazoué (in the Collines department), Tchaourou, N'dali, Kalalé (in the Borgou department), Karimama, Banikoara and Gogounou (in the Alibori department).

PAPVIRE-ABC aims to find sustainable solutions to concerns in the three departments of Alibori, Borgou and Collines, characterized by a prevalence of food insecurity, frequent droughts and floods with significant consequences, and a deterioration in household incomes due to climatic factors and limited access to markets. It operates on the basis of three components: support for rural infrastructure, development of value chains and resilience, and management.

The project's overall approach is based on a geographical concentration of its interventions in priority communes, in order to maximize the impact on target groups and guarantee the sustainability and visibility of the project's actions. The project's intervention principles are as follows: (i) watershed, terroir and production basin approach; (ii) value chain approach to generate substantial added value for vulnerable groups; (iii) balance between sustainability, enhancement of potential on the basis of comparative advantages and equity; (iv) participatory and contractualized approach, based on beneficiaries' demand; (vi) synergy and complementarity of actions with other partners; and an "agricultural cluster" approach to overcome constraints on financing agricultural entrepreneurship and access to markets.

In order to periodically measure the progress of all activities and assess the level of achievement of the project's impact and effect indicators, a results-based monitoring and evaluation system will be set up. The deployment of this system requires the organization of periodic surveys to assess, in a participatory and inclusive way, the level of achievement of the project's performance indicators in relation to the baseline study, and the changes brought about by the project on the beneficiaries. Against this backdrop, and in accordance with the evaluation report and its technical appendices, the PMU requested technical assistance from a consulting firm to assess not only the effects of the PAPVIRE- ABC project, but also its impact on the living conditions of grassroots beneficiaries. This report presents the results of the final phase of the project.

1.2. Mission objectives

The main aim of this study is to assess the mid-term effects and impact of PAPVIRE interventions in its areas of intervention and on the living conditions of beneficiaries. Specifically, it involves :

- Analyze the effects of the project on agricultural performance (productivity, volume of production, volume of marketed production, etc.) and household incomes in the ZIP;
- Assess the impact of PAPVIRE's implementation on beneficiaries' living conditions. In particular on (i) the average prevalence of food insecurity in the ZIP, (ii) the prevalence of chronic malnutrition (children aged 5-59 months) in the ZIP, (iii) the percentage of poor people in the ZIP, disaggregated: M/F.
- Formulate lessons learned (best practice experience, failures) and provide elements for capitalizing on PAPVIRE activities since its launch.

1.3. Expected results

The various expected results can be broken down as follows:

- The effects of the project on agricultural performance (productivity, volume of production, volume of marketed production, etc.) and household incomes in the ZIP are analyzed;
- The impact of PAPVIRE on the living conditions of beneficiaries is analyzed.
- Lessons learned (best practice experience, failures) are formulated and elements for capitalizing on PAPVIRE's activities since its launch are provided.

2. METHODOLOGY

2.1. Overall approach to project impact assessment

Overall, it should be noted that the approach used is the same as that used for the mid-term evaluation of the project. Thus, taking into account the mission's objectives and the context of PAPVIRE-ABC's implementation, the overall approach we feel is also appropriate for the final evaluation of the effects and impact of its interventions is that of
The "***theory-based impact assessment***" developed by White (2009, 2012). Indeed, the main difficulty in this type of impact assessment is to isolate the impact actually due to the implementation of interventions. To overcome this limitation, the "theory-based impact assessment" approach considers six principles for a correct and relevant evaluation of an intervention. These are (i) mapping the causal chain (i.e. the PAPVIRE-ABC philosophy), (ii) understanding the PAPVIRE-ABC context, (iii) anticipating heterogeneity, (iv) rigorous impact assessment using a credible counterfactual, (v) rigorous factual analysis, and (vi) mixed methods.

Mapping the causal chain (cf. figure 1) presupposes a good understanding of the PAPVIRE-ABC and its intentions, the expected chains of effects and change underlying the intervention, but also of the actual implementation processes and of the
We're also interested in the nature of the "deviations", the nature of the real intentional and unintentional effects, the target and actual beneficiary groups, and so on.

It should be noted that **effects** are the direct consequences of the results (or products of the project) on the beneficiaries (changes in behavior and practices), whereas **impacts** are the consequences of the effects on the state of the beneficiaries (level of resources, level of poverty, dynamics of enrichment, etc.).

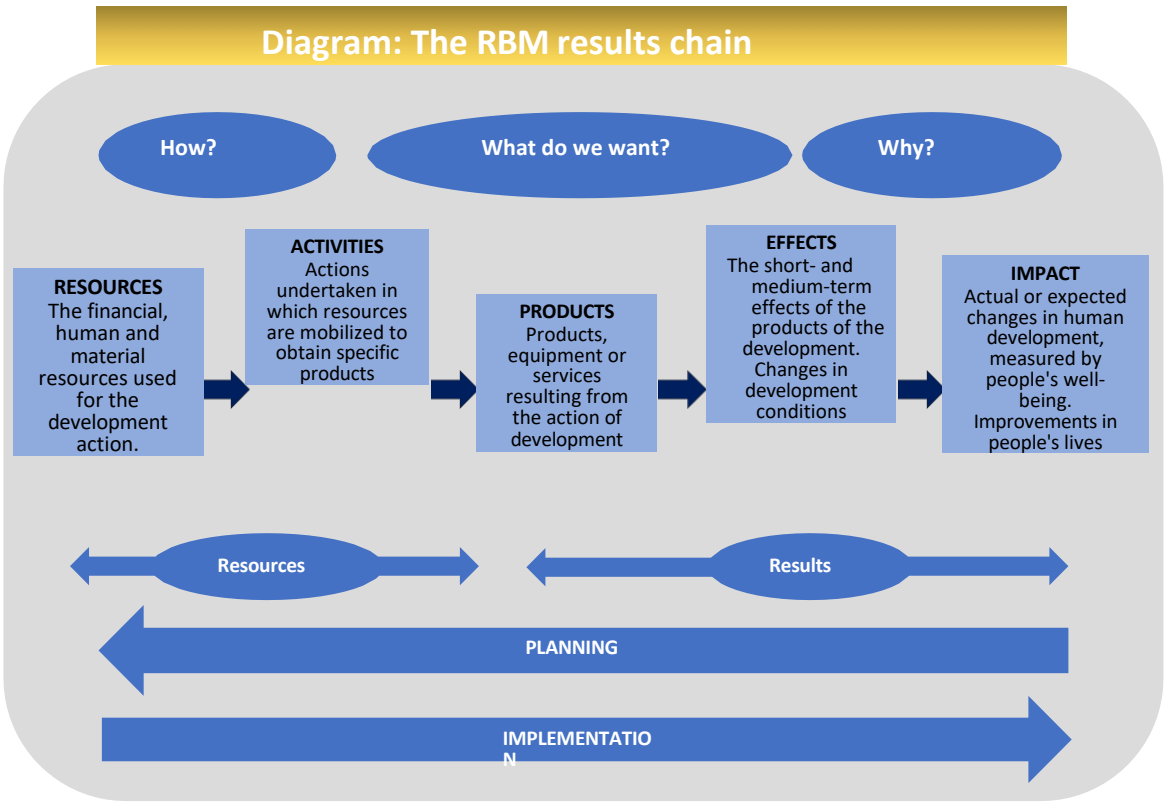


Figure 1: Illustration of the intervention results chain

Understanding the context is essential for understanding the impact of PAPVIRE, and therefore for designing its evaluation. Context refers to the social, political and economic framework in which the PAPVIRE-ABC is embedded, all of which can influence the functioning of the causal chain. Understanding context requires a thorough reading of the PAPVIRE documentation, as well as exposure to a wider literature. The elements of context are discussed in chapter three of this report.

A good understanding of the context helps to *anticipate the potential heterogeneity of impact*. The impact (i.e. the effect of the PAPVIRE program) may vary according to the intervention protocol, the characteristics of the beneficiaries or the socio-economic context. The possible complementarity of interventions is another aspect of heterogeneity.

Rigorous impact assessment using an appropriate counterfactual is a key element of theory-based impact evaluation. The appropriate counterfactual is most often defined in relation to a control group, which must be determined in such a way as to avoid selection bias, i.e. using quasi-experimental methods such as Propensity Score Matching (PSM).

Counterfactual impact analysis must be complemented by rigorous factual analysis. Indeed, many of the links in the causal chain are based on factual analysis. In other words, quantitative counterfactual analysis needs to be complemented by factual analysis. This can be done using life stories, success/failure case analysis and focus group interviews.

Mixed methods involve combining quantitative and qualitative methods in a single assessment. The use of qualitative data implies a wide range of activities, not limited to the organization of focus groups. For example, this study also makes use of various qualitative analyses to complement the quantitative analysis. These include SWOT (Strengths, Weaknesses, Opportunities and Threats) analyses, life stories and success/failure stories.

It is on the basis of this global approach to the study that the empirical methodological approach of the present mission has been proposed. This approach is based on the theory of change, with the results chain as its sub-base.

2.1.1. Theory of change

The project theory of change explains how activities are expected to produce a set of intermediate results that contribute to the achievement of the intended final impacts. It can help you try to grasp the complexity of change in a somewhat systematic and structured way, and to formalize your own vision of change, but in principle departs from linear approaches such as the logical framework.

A theory of change (ToC) is an explicitly documented (and therefore assessable) vision of how change is thought to occur. A ToC can be defined in many different ways, from the most general to the most precise. The most precise involve the definition of multiple steps; they are more valuable as a guide to project implementation, and are easier to evaluate. But the more generic ones can also have very useful implications." (Rick Davies, Monitoring the KCPP, 2008)

Box 1: Definition of Theory of Change

For all levels of intervention, the PAPVIRE-ABC theory of change focuses on the process of change at stakeholder level, and the drivers of this change, by making explicit the values underlying the vision of change, as well as the assumptions about

the change process and its drivers. It was developed on the basis of the GAFSP Fund's theory of change, the evaluation report and its appendices, with technical support from the DPP, the PMU and partner structures.

The ultimate goal of the project is to improve food security and reduce poverty in the project area.

To effectively achieve this objective in the current PAPVIRE-ABC context, farmers' incomes need to be increased and food and nutritional security improved.

As indicated in the introductory chapter, the aim of the present study is to assess whether the changes targeted through the theory of change have actually been achieved by the PAPVIRE-ABC interventions. Thus, the aim of the results chain of an intervention in Figure 1 is to see "to what level" the food and nutritional security of the target population has been improved, and what is the contribution of PAPVIRE-ABC to poverty reduction in its intervention zone, namely Alibori, Borgou and Collines. But for these changes to take place, the project's interventions must have an impact on agricultural production (productivity, volume of production, etc.) and access to markets for agricultural products. The impact will be identified using a non-parametric method (PSM) as well as qualitative data collected in the field from various stakeholders.

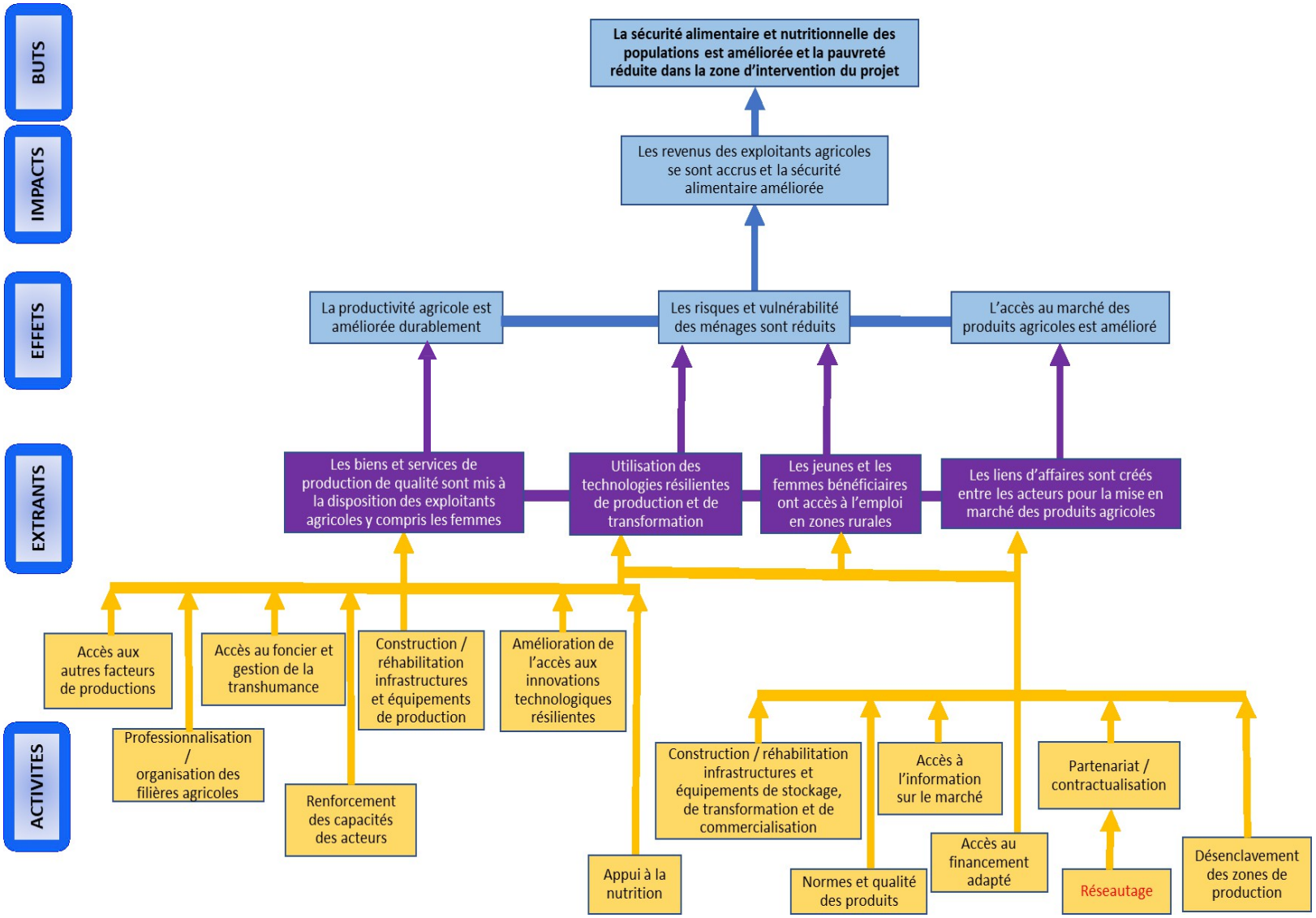


Figure 2: Schematic diagram of the PAPVIRE-ABC theory of change

2.2. Sampling

The sampling method used for the final evaluation of the project is the same as that used for the mid-term evaluation. It took into account the main players involved in the PAPVIRE-ABC implementation mechanism, as well as the beneficiaries. It involved :

- PMU;
- Institutions or structures: DGR, DDAEP (Collines, Borgou et Alibori), ATDA (1, 2 et 4), CEC/ATDA, AGETUR, ABE, DQIFE, PNOPA, DLROPA, INRAB (CRA-Sud et CRA-Nord Est) and PASCIB ;
- Grassroots growers (members of DUs and PDCs, trained growers, growers reached through PDCs and DUs, growers subsidized with seed);
- UD trainers/animators ;
- CEP trainers/animators ;
- Leaders trained in innovative farming techniques and good pesticide use practices;
- Contractors ;
- Input management committees ;
- Beneficiaries of processing machinery and equipment ;
- Beneficiaries of nutrition support.

For certain categories of players, all those involved in the project will be interviewed, given their relatively small numbers. These include the PMU, central MAEP directorates and others (DGR, DPP, ABE, AGETUR, Cellule Environnement du MAEP, DQIFE, PNOPA, DLROPA, PASCIB), UDs, DDAEPs, ATDAs and the 9 CECs, INRAB (CRA-Sud, CRA-Centre and CRA-Nord Est), UD and CEP trainers/animators. For the other actors, the size was determined by applying a sampling rate of 5%, then readjusted in cases where the values obtained were less than 35 observations.

With regard to grassroots beneficiaries in particular, the representativeness of the sample and the validity of the investigative mechanism were important in determining the sample size. Indeed, the aim was to obtain an acceptable level of precision in terms of the project's impact. For this reason, the information available in the PAPVIRE baseline study carried out by the Agricultural Policy Analysis Program (PAPA/INRAB) was used to calculate the minimum representative sample size not only for the project area, but also for each of the project's intervention communes.

The minimum farm size (n) to be selected is determined by the following formula (Gorstein *et al.*, 2007; SMART, 2012; DGSCN, 2014):

$$n = \frac{t^{\alpha 2}\, p(1-p)deff}{d^2}(1+h) \qquad (1)$$

In this formula,

- t_{α} represents the quantile of order $(1-\alpha)$, with α the level of confidence that one confidence level. This confidence level is generally set at 5 %, giving a value of of 1.96 for t_{α} ;

- p is the reference value for the indicator in question. In this study
  different types of impact indicator were used in the formula below. However, it was the indicator relating to malnutrition (i.e. 8% chronic rate; see Reference Study, PAPA, 2016) that gave the highest minimum sample size. The other indicators gave lower values. Consequently, the sample size obtained from the malnutrition rate will be used in this study. The choice of the malnutrition rate to determine the minimum sample size is also justified by the fact that the study focuses on the project's impact on food and nutritional security;
- $deff$ corresponds to the cluster effect, with a value generally between
  1.5 and 3. According to Gorstein *et al* (2007), for studies in which 30 individuals/farmers are required per cluster, the $deff$ value can be set at
  between 1.5 and 3. The higher this value is, the greater the number of individuals to be selected per cluster is greater than 30, and the lower the number of individuals to be selected per cluster is less than 30. For example, $deff$ can
  take the value 1.5 if the number of individuals to be taken per cluster is less than 30 (SMART, 2012). In this study, the value of $deff$ is set at 1.5 ;
- h is the expected non-response rate. The non-response rate is often low in Benin surveys. But to be on the safe side, in this study, the non-response rate is set at 5% to determine the minimum sample size ;
- d represents the desired level of precision. According to SMART (2012), there are no
  There is no standard level of precision (d) to be applied; it all depends on the objectives of the study and the financial resources available. In order to achieve a relatively appreciable level of precision in this study, the value of d has been set at 2%.

Based on the beneficiary database, and taking into account the information provided below, the minimum sample size for beneficiaries is 445. However, given that the propensity score approach is used (in combination with other approaches), the minimum number of non-beneficiaries required for a good propensity score match is 668 (1.5*445 = 667.5 or approximately 668 non-beneficiaries).

- ***Sampling procedure for beneficiaries and non-beneficiaries***

To facilitate data collection in the field, the 445 beneficiaries are divided into clusters of around 16, giving a total of around 28 clusters. Clusters are defined as contact groups such as UDs (Unité de Démonstration), CEPs (Champ Ecole Paysan) and processing groups. The beneficiaries were then selected in two main stages:

- First, the clusters were distributed among the intervention communes in proportion to the size of the beneficiaries in each commune. Then, in each commune, the desired clusters were drawn at random using the random number table;
- secondly, in each cluster 16 beneficiaries were drawn at random using the random number table. The sampling frame is made up of people benefiting from the project in the Project Intervention Zone (ZIP), and is available from the PMU.

For non-beneficiaries, their numbers are distributed in proportion to the number of beneficiaries available in each commune. In each commune, the clusters of non-beneficiaries were divided between two categories of villages, namely, villages of direct project intervention and villages of non-intervention. The aim was not only to enable intra- and inter-village comparisons, but above all to obtain representative values for each intervention commune and for the ZIP as a whole. In each sample village, the sampling frame was established by means of a census. They were then selected according to virtually the same criteria as those used to select the beneficiaries. Table 1 shows the distribution of the sample by commune. Farm managers were used as the entry point, but data were collected on the farm manager, household farms or the whole household, depending on the indicator targeted.

Table 1: Sample distribution by commune

	Beneficiaries	Non-beneficiaries	Total
BANIKOARA	32	81	**113**
GOGOUNOU	48	80	**128**
KARIMAMA	96	29	**125**
KALALE	96	21	**117**
N'DALI	31	85	**116**
TCHAOUROU	21	99	**120**
BANTE	27	103	**130**
GLAZOUE	77	55	**132**
OUESSE	17	115	**132**
Total	**445**	**668**	**1.113**

2.3. Preparing the field phase

2.3.1. Scoping and discussion session with stakeholders

At the very start of the mission, a scoping session was held with the sponsor and the various Project stakeholders in Cotonou. It brought together the Project Management Unit (PMU), senior staff from the Ministry of Agriculture, Livestock and Fisheries (MAEP) and other stakeholders invited by the sponsor. The session enabled the various players involved to iron out differences of opinion and understanding of the content of the Terms of Reference. During this session, IBT presented its understanding of the mission's objectives and expected results, as well as the operational approach for the field phase (timetable, itinerary and scheduling of *on-site* visits, stakeholders to be met, etc.). Comments were made on the methodology, in particular on the sampling procedure.

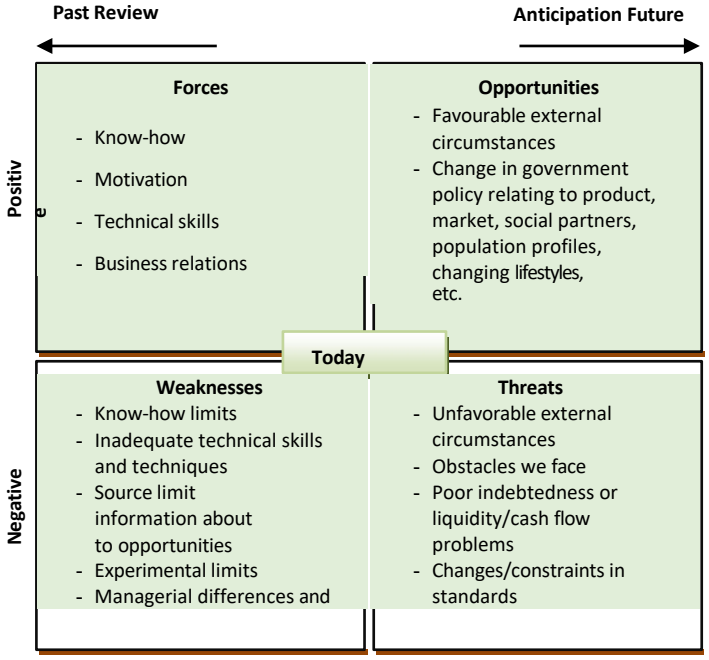
2.3.2. Development of data collection tools

Various data collection tools were developed, including interview guides incorporating the SWOT matrix (Strengths, Weaknesses, Opportunities and Threats) and the quantitative survey questionnaire. Specifically, the tools used include :

- interview guides for key project players. In all, five types of interview guide were drawn up, including one for focus group discussions with direct beneficiaries and UDs, one for interviews with Agences

Territorial for Agricultural Development (ATDA) and their communal cells (CEC), one for UD and CEP trainers/facilitators, one for interviews with communal authorities, one for the PMU and MAEP central departments and others (DGR, DPP, ABE, AGETUR, MAEP Environment Unit, DQIFE, PNOPA, DLROPA, PASCIB, DDAEP, INRAB). These different guides addressed aspects specific to each stakeholder to be interviewed. Overall, these various interview guides enabled Project stakeholders to give, among other things, their perceptions of PAPVIRE-ABC, as well as their assessments of the Project's effects and impact;

- SWOT (Strengths, Weaknesses, Opportunities and Threats) enabled the stakeholder groups to systematically analyze the actions implemented (their strengths and weaknesses) and to anticipate future developments (possible opportunities and threats) (see figure 3);



Source: Adapted from: Schall N. and Becker M., 2001. Method Finder, Practitioner's guide: Strengths, Weaknesses, Opportunities and Threats (SWOT). 7p. GTZ-BMZ

Figure 3: SWOT analysis matrix

- A questionnaire. The questionnaire was designed to collect detailed data from a sample of PAPVIRE beneficiaries and non-beneficiaries. The elements covered in the questionnaire concern the actors' assessment in terms of effects and induced impacts on beneficiaries, on the agricultural sector and on the living conditions of beneficiary and non-beneficiary households, their socio-demographic characteristics, their proposals for facilitating the induction of the desired impacts of the interventions, the effects of the use of tools and induced impacts, etc...

2.3.3. Design of electronic data collection masks

As part of this assignment, the various tools developed, notably the interview guides and questionnaire, were implemented in an electronic application to enable data collection via tablets or Android cell phones. For this purpose, input masks were created in the Kobocollect software.

The application was installed on the cell phone or tablet after the data collectors had been trained. Completed questionnaires were transferred to a database located on a web server. The aim was not only to reduce data collection time in the field, but also to avoid the time-consuming post-field data entry phase.

2.3.4. Recruitment and training of data collectors

Data collection agents were recruited and used to support ATDA/CEC agents in collecting data in the field. These interviewers had at least a Bachelor's degree (Bac + 3), with a good command of the languages of the study area, notably Peulh, Bariba, Boko, Mokolé, etc. They also had good experience in the project area and were experienced in data collection. They also had good experience in the project area, and were experienced in collecting socio-economic and/or agronomic data. These agents were then trained over three days on the study guides and questionnaire, and especially on the use of the electronic questionnaire. The training was carried out using a participatory approach and involved understanding the principles and objectives of the study, as well as the questionnaire questions. A participatory reading and translation into local languages of the collection tools was explained, in order to reach a consensus on each question. The training ended with a pre-test of the data collection tools in the field.

2.4. Data collection methods and tools

On the basis of the theory developed in section 2.1 and depending on the objectives of this study, three types of data collection methods were used in this assignment: literature review, exploratory/qualitative surveys and quantitative/complete surveys.

2.4.1. Literature review

The analysis of the documentation involved the use of Project documents as well as specific documents, complementary technical documents made available by the PMU, various past study reports, the mid-term evaluation report, strategy documents, available annual reports etc. Exploiting this documentation enabled us to gain a better understanding of the PAPVIRE implementation approach, the players involved at various levels, the beneficiary selection criteria, the strategies for setting up the funds, and the monitoring and evaluation system put in place. Data will also be collected on the activities carried out, the target groups, and the indicators used to evaluate effects, impacts and results. All the documentary data collected were reviewed prior to the fieldwork. Documents dealing with impact evaluation theory available on the Internet or in documentation centers were also used.

2.4.2. Qualitative/exploratory surveys

The qualitative methods used included semi-structured interviews (individual and focus group) with key stakeholders and resource persons, and case studies, using interview guides. The focus groups were conducted in the nine communes where PAPVIRE-ABC is active. Each focus group

was made up of around a dozen people from various socio-professional categories.

These qualitative methods made it possible to gather, among other things, the perception of beneficiaries and stakeholders on PAPVIRE, other similar actions underway in the intervention zones and the potential for synergy, the contribution of PAPVIRE actions to improving the livelihoods of beneficiaries, internal and external constraints detrimental to the smooth implementation of PAPVIRE, the effects, economic and socio-cultural impacts observed, the inclusion of young people and the consideration of gender aspects.

2.4.3. Quantitative surveys

Quantitative surveys were carried out on the sample defined for the study. Surveys were carried out mainly via tablets or cell phones, using the electronic questionnaire prepared in the Kobocollect application. The questionnaire made it possible, among other things, to collect data on beneficiaries' and non-beneficiaries' perceptions of PAPVIRE-ABC, and the contribution of PAPVIRE-ABC actions to improving their livelihoods. The survey set-up consisted of a headquarters, supervisors and interviewers (see figure 4).

2.5. Data processing and analysis

After the fieldwork phase, the data collected was first cleaned and then subjected to qualitative and quantitative analysis, as described below.

2.5.1. Database cleanup

Data cleansing took place at various stages: during implementation of the questionnaire on the Kobocollect platform, during the field phase and after extraction of the raw database.

a) Data quality control on the Kobocollect platform and during the field phase

In implementing the questionnaire on the "Kobocollect" platform, quality control tags were introduced to limit errors in data collection in the field. An initial check was carried out using the validation rules and activation conditions developed on this platform. For example, interviewers were prevented from entering values less than 0 or greater than 100 for percentage data.

The supervisors and headquarters then viewed the data synchronized by each data collector, day by day and one by one. In this way, some questionnaires whose answers to questions were not logical or consistent were systematically returned to the agents, who corrected them in the field before leaving the village/study cluster.

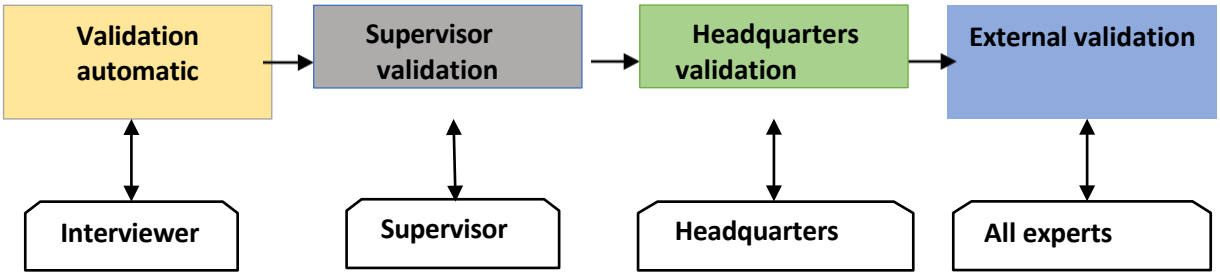


Figure 4*:* Different levels of quality control

b) Quality control and consistency tests with STATA software

Stata version 14 was used to clean up the entire database. It should be noted that at this level, two types of error are distinguished. There are observation errors attributable to the respondent and transcription errors attributable to the data collector. Two tests were carried out for this purpose. Consistency tests to detect data entry errors and inconsistencies in respondents' statements. Then there was the filter verification test, which checked whether the filters had been respected. For example :

- check that beneficiaries have heard of the PAPVIRE project;
- check that the fields reserved for beneficiaries have b e e n filled in;
- check the number of people in the household with other related variables.

In addition, other steps followed the previous ones to facilitate the use of the database by all stakeholders. These included :

1) Converting data to wide format

The data export model on the "Kobocollect" platform required data conversion from "long" to "wide" format. The number of files exported depends on the number of groups created. So, in order to have a single database with a single observation per line, the different files had to be converted. The files were then merged into a single database containing all the sections of the questionnaire.

2) File documentation

This phase of file documentation made it possible to display all the variables resulting from the data collection and to compare them with those provided for in the questionnaire, in order to see whether all the expected variables were indeed present, along with their modalities in the case of categorical variables. Next, some variables whose names had been predefined in the questionnaire were renamed. As the files were converted, the labels of some variables were redefined.

New variables were also created, taking into account the actual values of modalities such as "other to specify", as well as comments written by collection agents.

3) Data imputation

This phase consists of replacing certain modalities with missing values. An example is the "Not applicable" modality. Here too, certain modalities were labelled to facilitate tabulation.

2.5.2. Qualitative methods

The qualitative data collected was subjected to content analysis. The SWOT matrix and boxes were also used in the analysis of qualitative data. In particular, these data were used to obtain the perceptions of the various stakeholders on the effects of PAPVIRE-ABC on the target populations.

2.5.3. Quantitative methods

Quantitative data were subjected to descriptive analyses (mean, standard deviation, frequencies, contingency table, etc.), graphical illustrations and econometric analyses to highlight the real impact of PAPVIRE. Descriptive statistics were used to assess the effects of PAPVIRE-ABC on the target population.

Among other things, this study looked at the impact of PAPVIRE on beneficiaries. The estimated parameter is the "Average Treatment Effect on Treated" ($_{ATTt}$), i.e. the average impact of the PAPVIRE program on beneficiaries. It is given by :

$$_{ATTt} \equiv E(\ _{yt} \boxtimes\ _{y0} |\ _{dt} = 1)\ , \qquad (2)$$

with *E*(.) the population expectation, t the treatment and y the *outcome* variable. The $ATTt$ answers the following question (Heckman, 1997): how does a given project *t* change the outcome of participants compared to what they would have been had they not participated in the project?

program t, i.e. had it not received treatment *t*? In other words,

^{ATTt} indicates the average effect of participating in program *t* compared with not participating.

participation for households that did not receive the *t* treatment.

The $_{ATTt}$ was estimated using a non-parametric method called *Propensity Score Matching* (PSM). The choice of this method is justified by the fact that PAPVIRE beneficiaries were not randomly selected at the outset. In other words, people voluntarily decide whether or not to participate in PAPVIRE, and this participation is partly determined by the benefit they obtain or expect to obtain from PAPVIRE. Under these conditions, conventional impact assessment methods are not suitable, and ignoring this could lead to a biased estimate of the impact of PAPVIRE (cf. Faltermeier and Abdulai, 2009; Sodjinou, 2011). Thus, the present study relied on the non-parametric PSM method to evaluate the impact of PAPVIRE, in order to avoid the selection bias that often arises when Project/program participants are not randomly selected (Sodjinou, 2011). In the impact evaluation literature, SHP refers to methods that aim to identify

for each beneficiary, one or more similar/clone individuals (in terms of covariates x) in the group of non-beneficiaries (Rosenbaum and Rubin, 1983). This

then uses this resemblance (i.e. these clones) to calculate the impact of PAPVIRE.

2.6. Project impact variables

The impact variables (or outcome indicators or variables on which the effects and impact of PAPVIRE are assessed) are (i) income, (ii) poverty level, (iii) prevalence of food insecurity in the ZIP, (iv) productivity and (v) household vulnerability.

2.6.1. Income

Two types of income are targeted: agricultural income and overall household income. Agricultural income corresponds to gross agricultural product. It was calculated by type of activity (crop production, animal production, processing, etc.) and then aggregated for each household interviewed.

According to INSAE (2016), overall household income can be defined as the sum of income in cash and in kind, which, as a general rule, is of a recurring nature and is received regularly by the household or its members at intervals of less than or equal to one year. In a study to assess the level of monetary poverty, the income to be considered may be monthly income (e.g. the month preceding the survey), annual income (income over the year of the survey for a retrospective or repeat survey) or permanent income. In this study, overall household income is obtained by adding together agricultural income, non-agricultural income (sale of labour, taxi-driving, craft activities, trade, etc.), gifts received, loans, etc., in order to arrive at the total household income.

2.6.2. Household poverty level

Poverty can be defined as a pronounced deprivation of well-being (WDR, 2001). In other words, to be poor is "to be hungry, to lack shelter and clothing, to be ill and unable to care for oneself, to be illiterate and unable to attend school" (WDR, 2001). In his analysis, McGregor et al (2007) suggest that two dimensions should be taken into account: an objective dimension and a subjective dimension. In a way, this means taking into account qualitative analyses based on the perceptions of the various stakeholders, as well as quantitative analyses of poverty based on either household income or expenditure (Sodjinou, 2011). When assessing the impact of a given intervention on poverty, most authors recommend using a combination of qualitative and quantitative approaches.

Thus, this mission used qualitative approaches based on the perception of the actors and a quantitative approach (the FGT poverty index) which starts from the overall household income as calculated above. The income thus calculated was divided by the number of adult equivalents in the household. For this purpose, different weights will be assigned to children according to their age. The weights used are those suggested for developing countries by Glewwe (1988), corresponding to: children under seven count as 0.2; 0.3 for people aged 7 to 13; 0.5 for people aged 13 to 17; and 1 for people over 17. Based on these adult-equivalent incomes, three poverty indicators are calculated: poverty incidence, poverty gap and poverty severity.

of poverty. These indicators are calculated using the FGT (Foster-Greer-Thorbecke) poverty index which, for a household, is given by (Foster *et al.*, 1984):

$$IFGT = \left(\frac{z - w}{z} \right)^{\alpha} \text{ si } w < z \qquad (6)$$

$$= 0 \text{ otherwise.}$$

with z the poverty line, w the expenditure per adult equivalent for the household in question, and α a parameter. When :

- $\alpha = 0$, the index is simply binary indicating whether the household is below the poverty line or not. In this study, the poverty line considered is that indicated by INSAE (2015) , which is 140,808 FCFA per adult equivalent. This made it possible to calculate the incidence of overall poverty (P0), which is the percentage of households unable to cover their food and non-food needs;

The incidence of overall poverty (P0) for farm households is the percentage of farm households unable to cover their food and non-food needs as represented by the p o v e r t y line. Generally, P0 is presented as a percentage.

- $\alpha = 1$, we obtain the depth of poverty (P1) which indicates the distance households are from the poverty line (World Bank, 2010b) ;
- $\alpha = 2$, we obtain an index that not only gives an indication of the deviation of poverty, but also measures inequality among the poor. Taking severity into account makes it possible to assess the living conditions of the poorest who cannot escape poverty without external action or assistance (World Bank, 2010b; Sodjinou, 2011; INSAE, 2015).

With regard to perception, respondents (beneficiaries and non-beneficiaries) were asked to assess their household's level of prosperity before PAPVIRE interventions and at the time of the surveys. In other words, they will indicate whether their household is '1=very poor', '2=poor', '3=average' or '4=more than average' before the PAPVIRE interventions. He then has to make the same classification considering the situation prevailing at the time of the surveys. From these two variables, an indicator was calculated by taking the situation at the time of the survey minus the situation before the PAPVIRE interventions (table 2). If the difference is negative, the household has become poorer; if the difference is zero, then its situation has not changed; and if the difference is positive, then the promoter's household has become more prosperous. In this sense, this poverty indicator is an important complement to the other indicators used in this study.

Table 2: Evaluation of promoters' perceptions of household poverty

Variables	Description	Value
PROSP0	Poverty class as perceived by interviewee themselves, before PAPVIRE	1=very poor, 2=poor, 3=average, 4=more than average
PROSP1	Poverty class as perceived by the interviewee, currently	1=very poor, 2=poor, 3=average, 4=more than average
DIFFPROS	Change of class (according to	<0= Decrease (poorer),
Variables	**Description**	**Value**

	perception of interviewees)	0=Unchanged, >0=Growth (richer)

2.6.3. Food safety

Food security is defined as a situation where "all people at all times have physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life" (USAID, 1992). In the present study, food insecurity was assessed using data obtained by the
"experiential" or "perception-based" data collection method. This method aims to capture the reactions provoked by a household's experience of food deprivation. The tool consists of eight questions on events and eight questions on the frequency of these events (see questionnaire in appendix). The event questions ask whether or not a specific condition associated with the experience of food insecurity has ever occurred in the last 30 days. The event frequency questions ask how often a reported condition has occurred in the past 30 days: 0=No (never), 1=Rarely (once or twice in the past 4 weeks); 2= Sometimes (three to ten times in the past 4 weeks); 3= Often (more than ten times in the past 4 weeks).

Three types of indicators were calculated:

- the household's food insecurity (access) scale score,
- the prevalence of household food insecurity (access), and
- Food Consumption Score.

The Household Food Insecurity Score or HFIES score provided a continuous measure of the level of food insecurity (access) in the household over the last 30 days prior to the surveys. Firstly, a HFIES score variable was calculated for each household by summing the codes for each question on frequency of occurrence.

HFIES score (0-24)	Sum of frequency of occurrence related to food insecurity in the last 30 days
	Sum of responses to frequency of occurrence questions (HFIES1A +) HFIES2A + HFIES3A + HFIES4A + HFIES5A + HFIES6A +HFIES7A + HFIES8A)

The prevalence of household food insecurity (access), or Household Food Insecurity Access category, classifies households into four categories or levels of food insecurity: food secure, mildly food insecure, moderately food insecure and severely food insecure (see Table 3).

Table 3: Calculation of household food insecurity prevalence (access) score

Calculate the Access Category for Household Food Insecurity **(AIAM)** for each household. 1 =Food insecure; 2=Slightly food insecure (access); 3= moderate food insecurity	**Category AIAM = 1** if [(HFIES1a=0 or HFIES1a=1) and HFIES2=0 and HFIES3=0 and HFIES4=0 and HFIES5=0 and HFIES6=0 and HFIES7=0 and HFIES8=0]
	AIAM category = 2 if [(HFIES1A=2 or HFIES1A=3 or HFIES2A=1 or HFIES2A=2 or HFIES2A=3 or HFIES3A=1 or HFIES4A=1) and HFIES5=0 and HFIES6=0

(access); 4=severe food insecurity (access). NB: Code the questions as follows: 0= Occurrence; 1= Rarely (once or twice in the last 4 weeks); 2= Sometimes (three to ten times in the last 4 weeks); 3= Often (more than ten times in the last 4 weeks). last few weeks)	and HFIES7=0 and HFIES8=0]
	AIAM category = 3 if [(HFIES3A=2 or HFIES3A=3 or HFIES4A=2 or HFIES4A=3 or HFIES5A=1 or HFIES5A=2 or HFIES6A=1 or HFIES6A=2) and HFIES7=0 and HFIES8=0]
	AIAM category = 4 if [HFIES5A=3 or HFIES6A=3 or HFIES7A=1 or HFIES7A=2 or HFIES7A=3 or HFIES8A=1 or HFIES8A=2 or HFIES8A=3]

Finally, the Food Consumption Score aims to calculate the cumulative frequency of the different food groups consumed during a week in the different households surveyed. It is an indicator that expresses the level o f accessibility, availability and use of foodstuffs at household level. It indicates the diversity of the diet in terms of macronutrients and energy, and analyses whether this diversity has a positive effect on the nutritional value of the diet. The frequency of consumption of each food group is multiplied by its nutritional value. For each household, the composite score is calculated by filling in Table 5. The SCA threshold and categorized profile are given in Table 6.

Table 4: Technique for calculating the composite food consumption score

	Food groups	**Weight (A)**	**Number of days consumed in the last seven (07) days (B)**	**Grade A*B**
Corn, millet, sorghum, rice, bread/doughnuts, pasta, other cereals	Cereals and tubers	2		
Cassava, yams, banana plantain, other tubers				
Peanuts/Legumes (beans, cowpeas, peas, lentils, etc.)	Vegetables dry	3		
Vegetables (+ leaves), Condiments, spices	Vegetables	1		
Fruits (mangoes, oranges, bananas, etc.)	Fruits	1		
Meat, fish, seafood, snails, eggs	Meat and fish	4		
Milk/Dairy products	Milk	4		
Sugar, honey, other sweets	Sugar	0,5		
Oils and greases	Oil	0,5		
	Composite scores			

Table 5: SCA threshold and categorized profile

Threshold	Profile
0-28	Insufficient power supply
28,5-42	Power supply limit
More than 42	Acceptable power supply

2.6.4. Productivity

There are several types of productivity, including average productivity, marginal productivity and so on. In this article, we will limit ourselves to average productivity, which is simply the ratio between the quantity produced and the quantity of input used. Three types of average productivity have been considered: land productivity, i.e. yield, labor productivity and fertilizer productivity.

2.6.5. Household vulnerability

Vulnerability is more appropriate for taking into account changes when
In other words, "households move in and out of poverty" (Moser, 1998). Vulnerability analysis involves identifying not only threats, but also the responsiveness to exploit opportunities and resist or recover from the negative effects of a changing environment (Moser, 1998). In the present study, various types of vulnerability will be analyzed, namely economic vulnerability, health vulnerability, housing vulnerability and durable goods vulnerability (see below). Finally, a global indicator of household vulnerability has been calculated, corresponding to the weighted value of the four indices above.

The method used to calculate household vulnerability indices is based on the sum of positive responses divided by the total number of questions asked (see appendix). As a result,

$$Vulnérabilité\ matériel = \frac{Somme\ des\ valeures\ positives}{31}$$

$$Vulnérabilité\ par\ rapport\ aux\ conditions\ d'habitation = \frac{Somme\ des\ valeures\ positives}{10}$$

$$Vulnérabilité\ économique = \frac{Somme\ des\ valeures\ positives}{7}$$

$$Vulnérabilité\ à\ la\ santé = \frac{Somme\ des\ valeures\ positives}{4}$$

2.6.6. Gender and youth analysis

The various calculations made at different levels have been disaggregated by gender and age category (young/non-young). The gender aspect was approached in all its simplicity "male/female". As for the notion of youth, it varies from one structure to another. In a study carried out by INSAE (2015), as part of the "Work4Youth" project, the definition of youth used corresponds to all people aged between 15 and 29. Other institutions go as far as 35. In this study, the calculations were made by considering people under the age of 30 as young people.

3. PRESENTATION OF PAPVIRE-ABC

3.1. Project objectives

The overall aim of PAPVIRE-ABC is to help reduce poverty and strengthen food and nutritional security.

The specific objective is to sustainably boost food production in the departments of Alibori, Borgou and Collines, by improving productivity, resilience to climate change, sustainable management of agricultural natural resources, reducing gender inequalities and increasing household incomes, particularly among the most vulnerable in the project area.

3.2. Project components

The overall objective of the Appui à la Production Vivrière dans les départements de l'Alibori, du Borgou et des Collines (PAPVIRE-ABC) project is to contribute to improving food and nutritional security and reducing poverty. The specific objective of the project is to sustainably boost food production in the departments of Alibori, Borgou and Collines, and to develop agricultural value chains for three PSRSA priority commodities, namely rice, corn and market gardening. The initial activities set out in the initial assessment report are structured as follows:

3.2.1. Component A: Support for rural infrastructure

The project component aims to achieve sustainable development of production in the three main agricultural sectors (rice, maize and vegetables) through water management and strengthening the resilience of ecological systems. This component comprises three sub-components described as follows.

- ✓ **A1: Hydro-agricultural developments**

This sub-component includes activities such as the rehabilitation of 7 agro-pastoral dams; the development of 1,927 ha of irrigated perimeters, market gardening perimeters, flood plains and lowlands.

- ✓ **A2: Protecting vulnerable areas, securing land tenure and managing transhumance**

This sub-component of the project includes activities such as water and soil conservation work on 350 ha; the development of rural land plans (45 PFR); the materialization, marking out and revegetation of transhumance corridors and the implementation of collective agreements on transhumance management.

- ✓ **A3: Rural roads :**

Activities under sub-component 3 of component A of the project include the complete rehabilitation of 58 km and the selective rehabilitation of 60 km of old tracks.

3.2.2. Component B: Development of agricultural value chains and resilience

The aim of this component is to improve farm productivity and generate added value for the project's beneficiaries by enhancing the value of the products concerned in the three targeted value chains, within the framework of the value chain approach, with a particular focus on vulnerable groups, notably young people and women. This component comprises five sub-components, as follows.

- ✓ **B1: Improving farm productivity**

This sub-component of the project focuses on activities such as extension/advisory support for resilient technologies; improving access to certified seeds; supporting access to quality agricultural inputs (fertilizers and pesticides) and developing agricultural mechanization.

- ✓ **B2: Stakeholder capacity building**

Sub-component B2 focuses on socio-professional organization, access to microfinance institutions and capacity building for the APRM.

- ✓ **B3: Agricultural value chains**

Sub-component B3 of the project groups together activities concerning the construction of storage and marketing infrastructures, the supply of post-harvest equipment for adding value to products and the development of market access.

- ✓ **B4: Support for agricultural entrepreneurship and employability of young people and women**

The various activities under sub-component B4 of the project include support for the installation of 400 young agricultural entrepreneurs (including 150 women); the development of 5 caged fish farms in dam reservoirs and the establishment of a competitive fund to support innovative initiatives by young people and women.

- ✓ **B5: Support for nutrition**

Support for nutrition is the final sub-component of component B of the project. This sub-component focuses on awareness-raising campaigns on food hygiene and food preservation and quality.

3.2.3. Component C: Project Management Unit

The various activities included in Component C of the project essentially comprise coordination of project activities; administrative, accounting and financial management; procurement of goods, works and services; implementation of a communication plan; and monitoring and evaluation of project implementation.

3.3. Cost and financing

The total cost of the project is estimated at US$27.13 million (CFAF 15.91 billion), excluding taxes and customs duties. This cost is broken down into foreign currency in the amount of 13.72 million
US$ (8.05 billion FCFA) and US$ 13.41 million in local currencies (7.86 billion FCFA). A summary of the estimated cost of the project by component is presented in the table below:

Table 6: Schedule of expenditure by component (in thousands of US$)

COMPONENTS	PROJECT YEARS (dollars)					Total
	2016	2017	2018	2019	2020	
A. SUPPORT FOR RURAL INFRASTRUCTURE	**3.271**	**5.287**	**2.707**	**467**	**153**	**11.885**
Hydro-Agricultural Development	2.245	4.732	2.577	410	94	10.057
Protection of Vulnerable Zones and Transhumance Management	464	555	130	57	59	1.266
Improvement of Rural Trails	561	-	-	-	-	561
B. PROMOTING VALUE CHAINS AND RESILIENCE	**4.000**	**4.604**	**1.950**	**607**	**501**	**11 660.52**
Improving Farm Productivity	966	976	420	256	154	2.773
Agricultural value chains	862	1.151	490	114	74	2.691
Capacity Building	807	726	437	168	203	2.341
Agricultural Entrepreneurship and Employment	1.195	1.650	536	-	-	3.382
Nutrition support	170	101	66	68	69	474
C. PROJECT MANAGEMENT	**1.473**	**558**	**568**	**486**	**501**	**3.586**
TOTAL PROJECT COST	**8.743**	**10.449**	**5.224**	**1.559**	**1.155**	**27.131**

Source: PAPVIRE-ABC Prodoc, August 2015

3.4. Areas of intervention and targets

The project is being carried out in the Communes of Bantè, Ouèssè, Glazoué, Tchaourou, N'Dali, Kalalé, Karimama, Banikoara and Gogounou.

The project area covers the Departments of Alibori, Borgou and Collines, which occupy an area of 66,029km², or 58% of the national territory, with a population of 2,786,699 hbts, or 28%. In view of the size of the area and the population covered by the project, priority communes were identified for intervention. There are 9 of them, 3 per department. They are (i) for Alibori, Banikoara, Gogounou and Karimama; (ii) for Borgou, Kalalé, Ndali and Tchaourou; and (iii) for Collines, Bantè, Ouèssè and Glazoué. These communes were selected on the basis of a combination of several criteria, including : the existence of lowland potential; the existence of permanent surface or underground water resources; the rate of exploitation of lowlands or market gardening sites; the degree of land ownership of existing sites; the level of organization of producers (sites and dry crops); the existence of APD studies; synergy and complementarity with other projects; the degree of project concentration; the rate of severe and moderate food insecurity; the incidence of monetary poverty; the overall rate of underemployment. The localities concerned are those with developable areas.

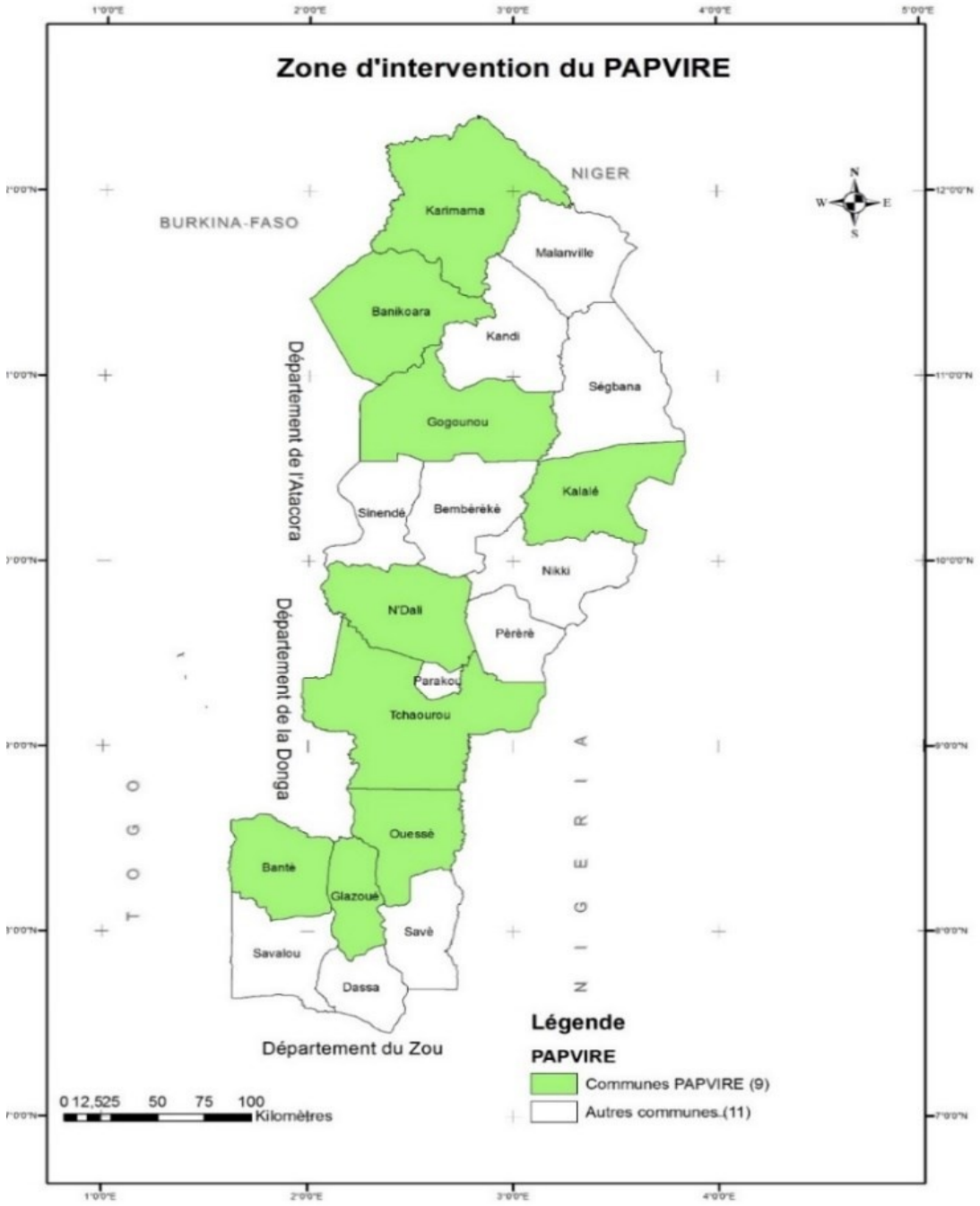


Figure 5: PAPVIRE-ABC intervention zone

3.5. Project monitoring and evaluation system

The project's monitoring and evaluation system is designed to take account of the project's specific objectives, the expected results of the GAFSP, the PSRSA/PNIA and the CAADP. Performance indicators include at least one key GAFSP indicator (agricultural productivity, market access, value added, food and nutritional security), to enable monitoring by the GAFSP Coordination Unit.

At the start of the project, a baseline situation was established to track progress on the indicators. The system included a gender profile in agriculture to deepen our understanding of the beneficiary groups, particularly the socio-economic aspects.

(income, capital, agricultural activities). Almost all indicators are disaggregated by gender and vulnerable people. The project's objective in terms of monitoring and evaluation is to produce a map with geo-referencing of the activities carried out, in order to make the project's actions more visible to beneficiaries.

Independent evaluations (rapid and in-depth) have been carried out to measure the project's impact, in line with GAFSP coordination requirements. The Project produces activity reports, highlighting in particular the implementation rates and results of the various components, in relation to the logical framework performance indicators. Quarterly reports following the Bank's format are regularly transmitted to the GAFSP CU. With a final impact evaluation scheduled for 2022, a mid-term review of the project is carried out during 2018-2019 and a completion report in 2021. The project is equipped with a participatory monitoring and citizen control mechanism in line with the principle of accountability now advocated as part of results-based management. This mechanism is implemented by the Plateforme des Acteurs de la Société Civile (PASCIB). Consultation and monitoring mechanisms have been set up at departmental level, including projects in progress, to create greater synergies and complementarity. The project's monitoring-evaluation mechanism comprises three levels.

3.5.1. Internal monitoring and assessment

Internal monitoring and evaluation is carried out by the Monitoring and Evaluation Manager in conjunction with the project's focal points. This monitoring-evaluation covers physical monitoring (activities and results) and financial monitoring by component, as well as the evaluation of the project's impact on beneficiaries and the environment according to relevant indicators established in a concerted manner.

The various reports generated by the monitoring-evaluation mechanism are :

- the quarterly CAA and MPD project sheet;
- ADB semi-annual report;
- half-yearly and annual performance reports ;
- quarterly activity reports ;
- annual activity reports.

In order to assess the achievements of the agricultural campaigns, templates are provided for drawing up the agricultural campaign plan and the agricultural campaign report. These are made available to the ATDAs responsible for carrying out activities in support of the PMU. These various documents are produced according to templates that take into account the requirements of the ADB and the DPP. The content of the quarterly/semi-annual reports takes into account the level of achievement of the indicators, and highlights the implementation rates and results of the various components. It should be noted that an Excel database is kept for monitoring agricultural campaigns.

The monitoring-evaluation system is supported by tools to enhance its effectiveness. These tools include

- the project operations plan,
- weekly PMU update,
- weekly planning,
- monthly and quarterly PMU reports,
- quarterly reports from partner structures,
- the semi-annual activity report in accordance with ADB requirements,
- the Annual Work Program and Budget of partner structures,

- the project's Annual Work Program and Budget,
- the Crop Year Plan,
- the crop year report.

3.5.2. External monitoring and assessment

External monitoring and evaluation is based on measuring the effectiveness and efficiency of the project's outputs and their contribution to the achievement of development results, i.e. the project's effects and impacts. It is carried out by the Direction de la Programmation et de la Prospective (DPP) with the involvement of other stakeholders, notably MDAEP and MEFPD, in addition to the two annual supervision missions organized by the Bank. Following the mid-term review of the project, a timely completion report will be produced by the Bank and the Government. The main stages in the implementation of external monitoring are summarized below.

Table 7: Project schedule

N°	ACTIVITIES	RESPONSIBLE	DEADLINE
1	Evaluation	BANK	Mid-June 2015
2	Negotiations	GVT /BANKING	August 2015
3	Presentation of the Conseil Banque project	BANK	October 2015
4	Signing of GAFSP donation agreement	GVT/BANK	November 2015
5	Satisfaction of conditions	GVT	December 2015
6	Authorization for 1st disbursement.	BANK	January 2016
7	Signing of agreements with CARDER	GVT	January 2016
8	Project launch	GVT / BANKING	February 2016
7	Performance of services	GVT/Providers	Feb. 2016-Dec. 2021
8	Mid-term evaluation	GVT/BANK	June 2018
9	Completion of activities	Governments/BANK	October 2021
10	Completion report	Governments /BANKING	December 2021
11	Audits	GVT	Annually

Source: Project monitoring and evaluation manual

3.5.3. Participatory monitoring and citizen control

The participatory monitoring and citizen control system is implemented by the Plateforme des Acteurs de la Société Civile au Bénin (PASCiB). Within this framework, an agreement has been signed with the project's PMU. The main activities carried out by PASCiB cut across all the project's components, and included the following:

- organization of sessions on the implementation of MfDR and accountability by project partners;
- citizen monitoring of the effective and efficient implementation of project agreements;
- raising beneficiaries' awareness of the need to respect their commitments, which contribute to the Project's results;

- participatory monitoring of PAPVIRE-ABC implementation with town councils, DDAEP, ATDA and other partners;
- organization of discussion sessions with beneficiaries on the satisfaction of their expectations through the Project's achievements.

3.6. Project development context

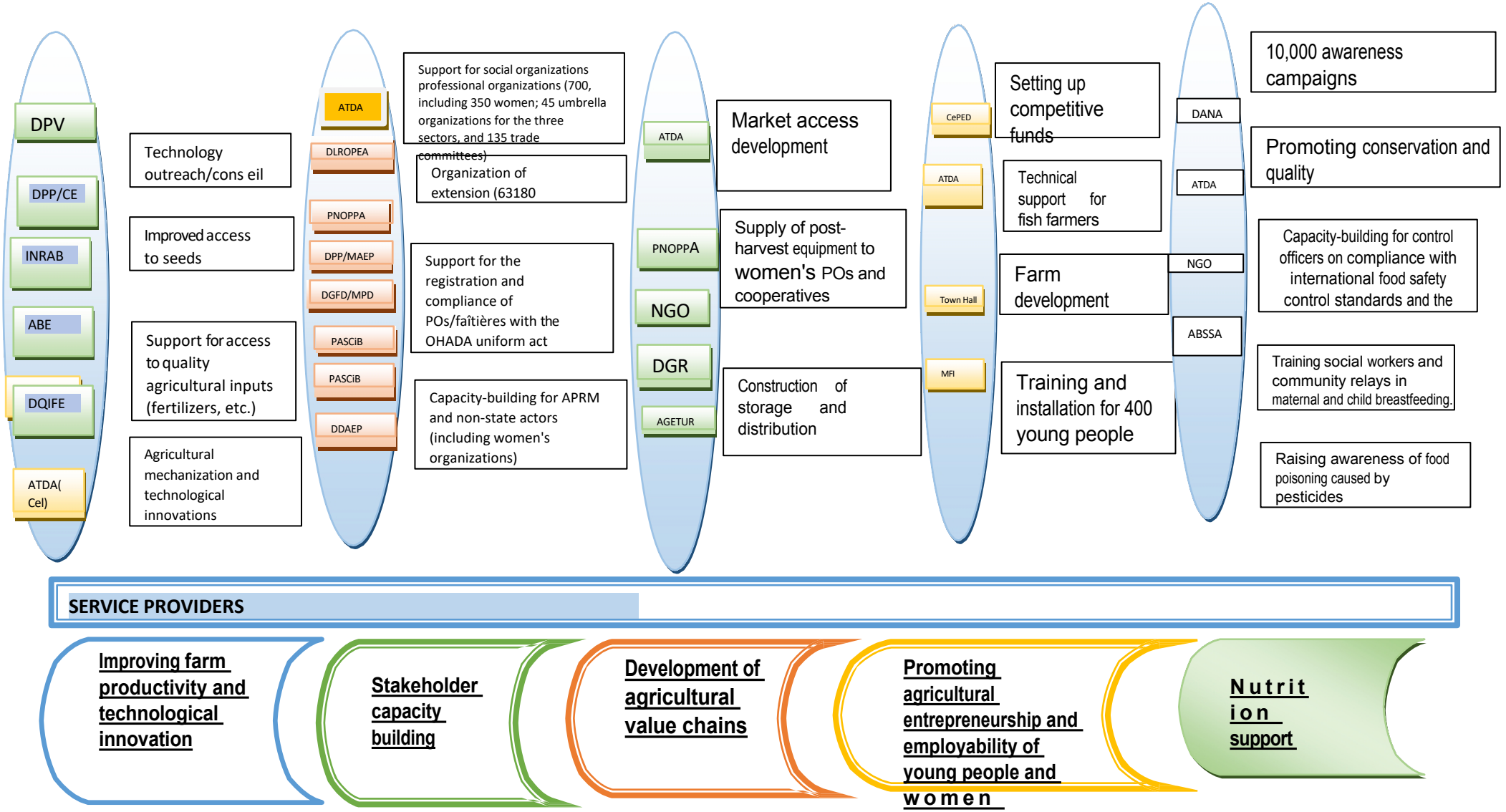
3.6.1. Evolution of the project's institutional framework

The Ministry of Agriculture, Livestock and Fisheries (MAEP) manages and coordinates the project. Its capacities are reinforced by a Project Management Unit (PMU) based in Cotonou within the Direction de la Programmation et de la Prospective (DPP). In addition to the Coordinator, the PMU includes a procurement specialist, a monitoring-evaluation specialist, an administrative and financial manager, an accountant and support staff (1 cashier, 3 drivers, 1 secretary, 1 liaison officer), all recruited on a competitive basis, and performance contracts are signed. PAPVIRE-ABC is implemented in the field by the two CARDERs (Regional Agricultural Center for Rural Development) in the Departments of Zou-Collines and Borgou- Alibori, in line with the Ministry's 2016 guidelines. In August 2018, the liquidated CARDERs whose liquidation process began in January 207 were replaced by DDAEPs and ATDAs following reforms implemented by the new government that took office in April 2016. The ATDAs and DDAEPs are the deconcentrated structures of the MAEP, with administrative, technical, financial and management autonomy, and are represented at the communal level by the Cellules Communaux (CeC). The project is further strengthening their capacities in planning, contract management, financial execution and monitoring-evaluation, with the aim of enabling them to play their role to the full.

The implementation of certain structural investments is often carried out with the technical assistance and delegated project management of the Agence d'Exécution des Travaux Urbains (AGETUR) through an agreement. An agreement also links the PMU and the DGR for quality control and supervision of work contracted under the project. Likewise, specialized structures and services such as INRAB for research and development and pre-basic seed production, and the DPV for seed and phytosanitary aspects. The DICAF supports the ATDA for advisory support and agricultural training, the PNOPPA for strengthening producer structuring, setting up agricultural innovation platforms and monitoring markets, and the ABSSA for food safety, the DANA for aspects of food and applied nutrition, the Direction de Santé de la Mère et de l'Enfant (Nutrition Department) for questions of nutrition promotion, and the Fonds National de Développement Agricole (FNDA), each of these structures intervening in their respective fields through agreements with the ATDAs. The Environment Unit of the MAEP and the ABE ensure environmental monitoring of the project, through agreements with the PMU. The same applies to the MAEP's Gender Unit, which monitors gender issues. Communities are involved in labour-based development activities, as well as in the management of socio-economic infrastructures.

Project activities are monitored and steered by an Orientation and Steering Committee (COP) made up of representatives from the Ministry of Development, Economic Analysis and Forecasting (MDAEP), the MAEP, the Ministry of the Economy and Finance (MEF), the Ministry of the Environment, Housing and Urban Planning (MEHU), and the Ministry of Decentralization and Governance.

local authorities. The COP also includes representatives from the Ministries in charge of Water (MERPEDRE), Public Works, Women's Promotion, Youth Employment, as well as agricultural producers (PNOPPA), the Benin Chamber of Agriculture, women's organizations and the Plate-Forme des Acteurs de la Société Civile au Bénin (PACIB). The COP is chaired by the Minister of MAEP or his designated representative, and the secretariat is provided by the Project Coordinator. The institutional framework for project implementation takes into account the various strategic partners of the project, as shown in the figure below.



Source: Operational mechanism document

Figure 6: Stakeholder diagram and level of involvement in project implementation

3.6.2. Analysis of project implementation framework

The environment in which PAPVIRE-ABC is being implemented is marked by a series of movements that can directly affect the project's actions or hinder the expression of its impacts. The first is reforms in the agricultural sector. Reforms in the agricultural sector, notably the creation of Pôles de Développement Agricole and the dissolution of CARDER, have led to a slowdown in the participation of SCDA agents in the PAPVIRE-ABC scheme. Faced with these changes, PAPVIRE-ABC has adapted to the new context by involving the three ATDAs concerned, with the ATDAs' communal units at their core.

In addition, a number of similar interventions have been noted in the various PAPVIRE-ABC intervention communes (table 8). These interventions are characterized by capacity-building for stakeholders, infrastructure construction (warehouses, development of lowlands) and the implementation of micro-projects. These initiatives are financed by agricultural credit and micro-projects. To qualify, promoters must submit agricultural micro-projects.

The National Fund for Agricultural Development has launched an appeal to finance micro-projects in the nine PAPVIRE-ABC communes, among others.

Table 8 :. Interventions similar to PAPVIRE-ABC

	Similar interventions	**Intervention mode**
Banikoara	DEDRAS-ONG, Projet d'Appui à la Diversification Agricole (PADA), Fonds Communal pour le Développement Agricole (FCDA)	Agricultural credit, youth employment, infrastructure construction, provision of subsidies, micro-project financing, strengthening the professionalization of the function within value chains
Karimama	DEDRAS-ONG, FADEC-agriculture, PROSOL, PMIL	Youth employment, infrastructure construction
Gogounou	DEDRAS-ONG, FADEC-agriculture, PROSOL, Projet d'Appui à la Diversification Agricole (PADA), Fonds Communal pour le Développement Agricole (FCDA)	Agricultural credit, youth employment, infrastructure construction, provision of subsidies, micro-project financing, strengthening the professionalization of the function within value chains
Kalalé	PA3D, UFECABC, Projet d'Appui à la Diversification Agricole (PADA), Fonds Communal pour le Développement Agricole (FCDA)	Agricultural credit, youth employment, infrastructure construction, provision of subsidies, micro-project financing, strengthening the professionalization of the function within value chains
N'Dali	Projet d'Appui à la Diversification Agricole (PADA), Fonds Communal pour le Développement Agricole (FCDA)	Agricultural credit, youth employment, infrastructure construction, provision of subsidies, micro-project financing, strengthening the professionalization of the function within value chains
Ouèssè	NGO SOJAGNON, Projet d'Appui au Développement Agricole des Collines (PADAC).	Capacity building for producers, access to environmentally friendly agricultural investments environment, implementation of
	Similar interventions	**Intervention mode**
		rural land

Bantè	Projet d'Appui au Développement Agricole des Collines (PADAC).	Capacity-building for producers, access to environmentally-friendly agricultural investments, implementation of plans rural land
Tchaourou	DEDRAS-ONG, Projet d'Appui au Développement Agricole des Collines (PADAC).	Capacity-building for producers, access to environmentally-friendly agricultural investments, implementation of plans rural land

3.6.3. Project implementation strategy

The project implementation strategy is described as follows.

- ✓ **Acquisition of goods**

All acquisitions of goods, works by International Invitation to Tender (IIT) and consultancy services financed from GAFSP resources are carried out in accordance with the Rules and Procedures in force for the acquisition of goods and works or, as the case may be, the Rules and Procedures in force for the use of consultants using the Bank's standard bidding documents. Procurement by National Invitation to Tender (AON) shall be carried out in accordance with national legislation on public procurement (Law N°2009-02 of August 07, 2009 on the Code of Public Procurement and Public Service Delegations in the Republic of Benin), using the Donor's standard bidding documents. This provision follows on from the conclusions of t h e Bank's assessment of Benin's national procurement procedures (PNPM) in August 2011, and facilitates the implementation of the many infrastructure projects to be built, it being understood that the Bank carries out ex-post reviews. A procurement plan (PPM) has been drawn up, regularly updated and submitted to the Bank, which ensures that it complies with its procurement rules. Project coordination is supported by a procurement expert who assists in the acquisition of goods, works and services.

- ✓ **Financial Management**

In terms of financial management, the PMU is responsible for the overall coordination and financial management of the project. Its financial management staff includes the coordinator, the administrative and financial manager and the accountant, all recruited on a competitive basis. The ATDAs are exclusively responsible for coordinating technical activities using financial resources managed at PMU level. Agreements signed between the PMU and the ATDAs specify the terms and conditions of this collaboration.
As part of project implementation, the PMU adopts the APRM expenditure execution procedure for mobilizing national counterpart funds. Execution and monitoring of the national counterpart budget are carried out through the Système Intégré de Gestion des Finances Publiques (SIGFIP). The data generated by SIGFIP is entered into the PMU's integrated management system and consolidated with the data resulting from the execution of the GAFSP budget held in the same system, with a view to producing quarterly Financial Monitoring Reports (FMRs).The APRM's internal control system is reinforced by a manual of administrative, financial and accounting procedures applicable to the PMU's various management cycles; and

a commitment from MAEP to have the Ministry's Inspectorate General (IGM/MAEP) take charge of the project's internal audit.

- ✓ **Disbursements**

The disbursement methods used to mobilize GAFSP financing are: (i) the direct payment method; (ii) the special account/working capital method and (iii) the reimbursement method. Direct payments are made under contracts for works, goods and services signed between the Recipient and suppliers in accordance with the Bank's procurement rules and procedures and national legislation on public procurement. The special account method is used for the settlement of operating expenses, training costs, field mission expenses, etc. It gives rise to the opening of special accounts. A Special Account is opened with the BCEAO, which in turn transfers all the funds received from the GAFSP to the PMU's bank account at a bank acceptable to the ADB. The reimbursement method is used when eligible expenditure from GAFSP resources has been pre-financed by the recipient with the prior agreement of the Bank. These disbursements are made in accordance with the list of goods and services and the Bank's rules and procedures, as described in the Disbursement Manual.

- ✓ **Audits**

The MAEP, through its departments, is responsible for preparing the PAPVIRE-ABC's annual financial statements in accordance with the Bank's rules and regulations. The said annual financial statements and the APRM's internal control system are audited annually by a reliable, competent and independent private audit firm on the basis of criteria satisfactory to the Bank. Audited financial statements for each fiscal year are submitted to the Bank no later than six months after the close of the fiscal year to which they relate.

3.6.4. Identification of beneficiaries

The process of identifying beneficiaries was participatory and bottom-up (from the communes to the PMU). The project began in 2016. At the start of the project, awareness-raising sessions were held with ex-CARDERs and town halls to explain the objectives, and then ex-CARDER agents proceeded to identify, at village level, the producers to be supported around the UDs and CEPs. This identification was carried out in accordance with the standards of the national extension system. The identification/confirmation of the sites to be developed and the census of the farmers present on these sites (in collaboration with the town halls), the identification of the sites of the various infrastructures to be built (in collaboration with the town halls) and the census of the beneficiaries in need of the resulting services, the identification at village level of the groups of women processors are activities that were carried out prior to the implementation of the project. All these different lists of beneficiaries were centralized at the level of the Focal Points and the PMU. Following the disappearance of the CARDERs and the creation of the DDAEPs and ATDAs, these lists were updated periodically (e.g. annually for the GCs), with the various project beneficiaries receiving support each time. It should be noted that the identification of beneficiaries integrating the gender approach was and remains a participatory process that has never been contested.

Compared with the other projects in the active project portfolio of the Ministry of Agriculture, Livestock and Fisheries, PAPVIRE-ABC is innovative in that it is the very first project to adopt an innovative form of farm advisory service, whereby beneficiaries monitored by a farm advisor will receive a package of specific, tailored support, comprising agricultural inputs for food products, advice and facilitation, guaranteeing improved agricultural productivity.

Notices of the PMU's calls for projects are posted in the communal units of the Agence Territoriale de Développement Agricole (ATDA) and the town halls in the nine communes where the PAPVIRE-ABC-ABC is implemented. In addition, the focal points remain permanently available to provide clarification requested by all interested parties who contact them either by WhatsApp or telephone calls.

Within the framework of PAPVIRE-ABC implementation, the degree of synergy and consultation is satisfactory. The implementation strategy, based in the past on CARDERs and currently on ATDAs, enables a constant flow of information from the PMU to the beneficiaries and from the beneficiaries to the PMU. This implementation strategy can also be seen in the monitoring of activities implemented and the various recommendations of consultation meetings at various levels (COPs, reviews, working sessions, monitoring missions, etc.).

3.6.5. Information system

Several players are involved in the PAPVIRE-ABC project. Each stakeholder, individually or in groups, produces reliable information and collects it from the PMU in order to make the necessary decisions and provide solutions to the problems encountered in implementing project activities.

The figure below illustrates this diversity of players.

- ✓ The Steering Committee (COP) ;
- ✓ Unité Présidentielle de Suivi (UPS);
- ✓ Project Management Unit (PMU);
- ✓ Focal points of partner structures ;
- ✓ DPP/MAEP;
- ✓ ADB;
- ✓ CAA/MEF;
- ✓ DGFD/ MPD.

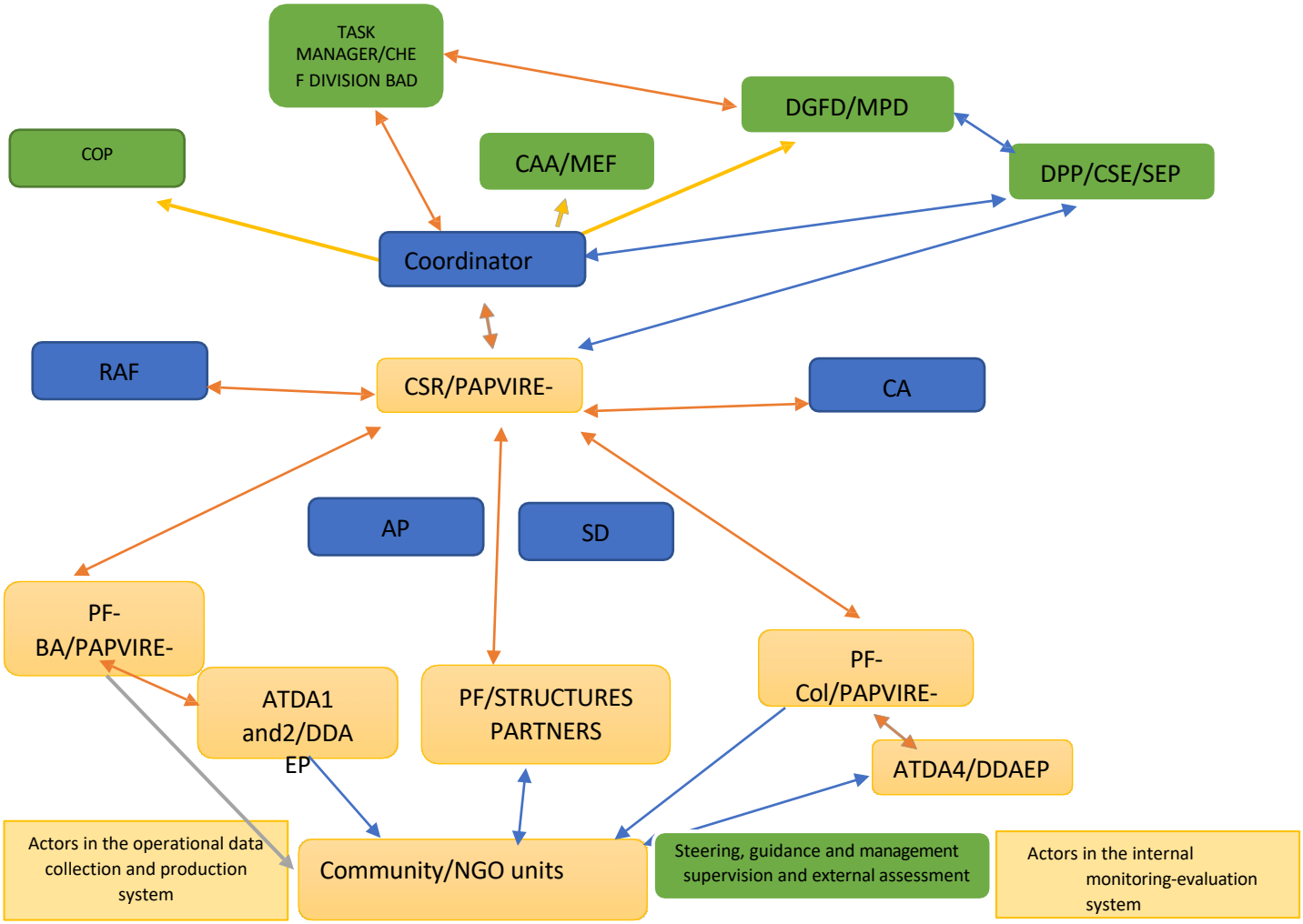


Figure 7: Current information flow diagram between the various M&E players

4. EFFECTS OF PAPVIRE-ABC ON AGRICULTURAL PRODUCTION

4.1. Beneficiaries affected by the project

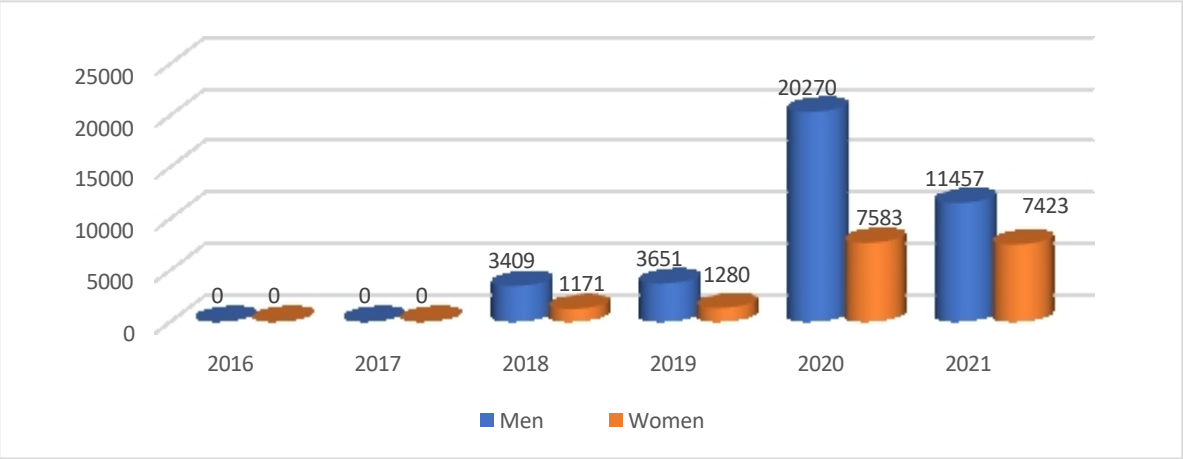
PAPVIRE-ABC's actions in the nine intervention communes have reached a large number of direct beneficiaries. These beneficiaries are spread across project activities such as hydro-agricultural development, the creation of ESOPs and other infrastructure, the establishment of UDs and CEPs, support for POs, agri-food processing, agricultural production, the dissemination of technology packages and entrepreneurship. In all, the project reached 56,244 direct beneficiaries, including 17,457 women (or 31% of those reached) and 38,787 men (or 69% of direct beneficiaries) (table 9). The overall achievement rate is 112% of the target (50,000 beneficiaries).

Table 9: Breakdown of direct beneficiaries affected by the project, by activity category

Indicators	Type	2016	2017	2018	2019	2020	2021	Total
Members of contact groups	H	0	0	3 266	3 300	3 455	3 654	13 675
	F	0	0	1 154	1 162	1 162	1 260	4 738
Trainees	H	0	0	0	0	15 648	2 469	18 117
	F	0	0	0	0	5 858	900	6 758
Members of perimeter management committees and trained infrastructures	H	0	0	0	0	0	3 668	3 668
	F	0	0	0	0	0	3 668	3 668
Young entrepreneurs trained in incubation centers, including women	H	0	0	143	0	84	66	293
	F	0	0	17	0	36	66	119
People trained in processing, marketing and post-harvest losses y including women	H	0	0	0	328	823	1 073	2 224
	F	0	0	0	107	473	1 164	1 744
Trained specialist technicians	H	0	0	0	23	260	527	810
	F	0	0	0	11	54	205	270
Women trained in breastfeeding and nutrition		0	0	0	0	0	160	160
Total	H	0	0	3 409	3 651	20 270	11 457	38 787
	F	0	0	1 171	1 280	7 583	7 423	17 457

Source: Project data

As this figure shows, the number of beneficiaries reached by the project has varied from year to year. The project's visibility in terms of beneficiaries reached began in 2018 with a total of 3,409 male and 1,171 female beneficiaries. This number has evolved in a sawtooth pattern until 2021, one year after the end of the project. The peak in terms of the number of beneficiaries was reached in 2020, with 20,270 men and 7,583 women. Implementation of the project has enabled more than
50,000 beneficiaries. This result demonstrates the importance of this project for the population of the target area and for the Beninese government.



Source: Project data

Figure 8: Breakdown of beneficiaries by year and gender

During the implementation of the project, particular attention has been paid to women (and more so to heads of households) and young people, who make up the bulk of the vulnerable population. They thus benefited from 30% of the land developed and 60% of the actions linked to product processing and marketing. To estimate the number of indirect beneficiaries of the project, the food security indicator was used. According to the data collected, 40% of non-beneficiaries felt that their food security situation had improved. With a total population of 1,599,856 in the ZIP, the total number of indirect beneficiaries of the project is estimated at 639,942 out of the planned 400,000. This represents a proportion of around 160%. In view of these results, the project's impact is appreciable in terms of timeframe.

4.2. Number of jobs created by project implementation

Implementation of the project led to the creation of 1,939 jobs, as shown in the table below. An analysis at this level shows that the project's implementation has had a positive impact on other segments of the population, improving their living conditions.

Table 10: Jobs created by project implementation

Category	MANAGERS AND SUPERVISORS PAID/ENGAGED DURING THE YEAR OF THE PERIOD			PAID MOBILIZED WORKERS			TOTAL NUMBER OF JOBS CREATED		
	H	F	T	H	F	T	H	F	T
Rehabilitation of water reservoirs	28	1	29	355	0	355	383	1	384
Company layout	42	3	45	420	183	603	462	186	648
Construction of 18 stores	204	42	246	450	72	522	654	114	768
HIMO development	24	0	24	85	30	115	109	30	139
Total	298	46	344	1 310	285	1 595	1 608	331	1

Category	MANAGERS AND SUPERVISORS PAID/ENGAGED DURING THE YEAR OF THE PERIOD			PAID MOBILIZED WORKERS			TOTAL NUMBER OF JOBS CREATED		
	H	F	T	H	F	T	H	F	T
									939

Source: Service providers

4.3. Volume of food production (maize and rice) marketed per year

The warrantage and "agricultural" cluster mechanisms set up by the ATDAs with the support of town councils and POs have enabled the marketing of around 300,000 tonnes of food crops (rice and maize) during the five years of project implementation, with a target value of 85,000 tonnes of food crops. This value obtained from the communal units is confirmed by the statistics of the final surveys carried out in 2021 by IBT. It should be noted that the objectives have largely been achieved with the commissioning of the storage and input warehouses and the improvements made.

Table 11: Volume of food production marketed per year

	2016	2017	2018	2019	2020	2021	Total
Banikoara	0	10 649	11 912	11 530	12 410	0	46 501
Gogounou	0	5 300	2 195	2 859	3 130	0	13 484
Karimama	0	15 615	12 193	12 437	13 422	0	53 666
Kalalé	0	4 509	8 364	8 532	9 215	0	30 620
Ndali	0	2 092	9 814	10 010	10 811	0	32 727
Tchaourou	0	4 203	8 685	8 859	9 426	0	31 173
Bantè	0	7 253	8 998	9 178	9 912	0	35 341
Ouèssè	0	4 871	6 032	6 152	6 644	0	23 700
Glazoué	0	6 968	8 197	8 361	9 030	0	32 557
Total	0	61 461	76 389	77 918	84 000	0	299 768

Source: Survey 2021

4.4. Volume of market garden production per year

The volumes of market garden produce marketed annually by 62 OPs and 308 producers who are members of the contact groups, and by the dissemination effect over the two campaigns, amounted to 16,061 tonnes for the five years of project implementation. Due to the perishable nature of market garden produce, a specific system was set up by the ATDAs. Midway through the project, this indicator was revised to 7,800 tonnes instead of the 15,600 tonnes initially forecast. As a result, the volume of marketed vegetable production far exceeded the target set. This achievement was made possible by the development of hydro-agricultural facilities.

Table 12: Volume of marketed vegetable production per year

	2016	2017	2018	2019	2020	2021	Total
Banikoara	0	0	43	185	185	256	669
Gogounou	0	0	53	231	231	321	836
Karimama	0	0	231	1 005	1 005	1 694	3 935

Kalalé	0	0	10	44	44	61	160
Ndali	0	0	53	231	231	321	836
Tchaourou	0	0	64	277	277	385	1 003
Bantè	0	0	404	1 756	2 060	2 732	6 952
Ouèssè	0	0	53	231	231	321	836
Glazoué	0	0	53	231	231	321	836
Total	0	0	964	4 191	4 495	6 410	16 061

Source: Survey 2021

4.5. Volume of fish production marketed per year

The volume of production marketed each year is 0% of the target 2,200 tonnes. Actions concerning the rehabilitation of 08 water reservoirs in which floating cages will be set up to develop fish farming for the benefit of 70 young entrepreneurs did not come to a successful conclusion until the end of the project. This objective could not be reached by December 31, 2021, due to delays in the rehabilitation work and the acquisition of floating cages.

4.6. Effects of the project on agricultural productivity

Based on data collected from farmers, average yields for beneficiaries (2.93 tonnes/ha for maize and 4.44 tonnes/ha for rice) are far higher than those for non-beneficiaries (2.01 tonnes/ha for maize and 3.7 tonnes/ha for rice). With a forecast average productivity of over 4.5 tonnes per hectare for food crops, the project achieved 3.84 tonnes per hectare, i.e. a realization rate of 85%. With a target of 4,250 kg per hectare, the average productivity of cereal crops reached 3,840 kg per hectare, an achievement rate of over 90% by the end of the project. It should be noted that some communes exceeded their targets. These include the communes of Gogounou in 2021, Banikoara in 2020, Karimama and Bantè in 2019 and Karimama in 2019.

Table 13: Average productivity of cereal crops

	2016	2017	2018	2019	2020	2021	Total
Banikoara	0	3 160	3 586	4 125	4 260	4 124	3 851
Gogounou	0	2 964	3 402	3 981	4 124	5 596	4 014
Karimama	0	4 003	4 603	5 398	5 596	3 758	4 672
Kalalé	0	2 755	3 156	3 664	3 758	3 622	3 391
Ndali	0	2 640	3 022	3 499	3 622	3 635	3 283
Tchaourou	0	2 700	3 017	3 578	3 635	5 253	3 637
Bantè	0	3 593	4 248	5 024	5 253	4 426	4 509
Ouèssè	0	3 151	3 614	4 240	4 426	3 927	3 872
Glazoué	0	2 802	3 214	3 757	3 927	4 146	3 569
Total	0	3 085	3 540	4 141	4 289	4 146	3 840

Source: Survey 2021

The level of satisfaction with the project's impact on agricultural productivity is shown in the table below. The various parameters used to estimate this level of satisfaction include the influence of training around UDs and CEPs on farmers' productivity.

yields, access to inputs, access to seeds, close supervision and application of technology packages.

According to the data collected, yields were generally influenced by the following main factors: (i) training on UD and CEP (59.62%), (ii) access to inputs (35.30%), access to seeds (40%), close supervision (60.75%) and application of technology packages (60.70%). It should be pointed out that the level of satisfaction was higher among beneficiaries than among non-beneficiaries.

Overall, these results show just how important this project was for the target group and the government of Benin. The various strategies for building the capacity of agricultural players, promoting agricultural entrepreneurship and involving young people in agriculture were the factors that boosted the project's success.

Table 14: Level of satisfaction with effects according to respondents

Parameters	Terms and conditions	Beneficiaries	Non-beneficiaries	Set
Influence of UD and CEP training courses on the yields	Satisfied	98,92	20,32	59,62
	Not very satisfied	5,04	92,12	48,58
	Not satisfied	0,00	0,32	0,16
Access to inputs	Satisfied	69,38	1,22	35,3
	Not very satisfied	20,00	36,20	28,1
	Not satisfied	1,65	82,25	41,95
Access to seeds	Satisfied	77,68	2,32	40
	Not very satisfied	19,35	70,23	44,79
	Not satisfied	2,87	45,23	24,05
Close supervision	Satisfied	98,37	23,20	60,78
	Not very satisfied	3,31	42,12	22,715
	Not satisfied	0,32	48,23	24,27
Package application technology	Satisfied	98,23	23,17	60,70
	Not very satisfied	3,51	48,78	26,14
	Not satisfied	0,23	68,25	34,24

Source: Survey 2021

4.7. Improving incomes for women and young farmers in rural areas

4.7.1. Income/year per food farm managed by men and women

Gross operating income (GOI) per cereal farm (rice and maize) for male and female farmers over the course of the crop years following sample surveys carried out by the ATDAs averaged 163,557 FCFA for men and 121,765 FCFA for women. This level of income enabled the project to achieve a completion rate of 76% for farms managed by men and 69% for those managed by women. These incomes improved significantly following the completion of the development work for the benefit of these project beneficiaries. It should be pointed out that the method used to calculate this income is based on total farm revenues, less total expenses linked to the costs of inputs, labor, transport, etc.

Table 15: Annual income per food crop farm

	Type	2016	2017	2018	2019	2020	2021	Total
Banikoara	H	0	0	0	182 880	253 418	0	218 149
	F	0	0	0	157 390	168 055	0	162 723
Gogounou	H	0	0	0	240 450	333 200	0	286 825
	F	0	0	0	206 940	217 899	0	212 420
Karimama	H	0	0	0	110 900	153 672	0	132 286
	F	0	0	0	95 440	106 155	0	100 798
Kalalé	H	0	0	0	158 380	219 470	0	188 925
	F	0	0	0	136 300	153 626	0	144 963
Ndali	H	0	0	0	112 160	155 420	0	133 790
	F	0	0	0	96 520	104 500	0	100 510
Tchaourou	H	0	0	0	84 970	117 745	0	101 358
	F	0	0	0	73 120	77 000	0	75 060
Bantè	H	0	0	0	107 950	149 590	0	128 770
	F	0	0	0	92 900	72 842	0	82 871
Ouèssè	H	0	0	0	100 650	139 470	0	120 060
	F	0	0	0	86 620	96 345	0	91 483
Glazoué	H	0	0	0	135 680	188 015	0	161 848
	F	0	0	0	116 770	133 341	0	125 056
Total	H	0	0	0	137 113	190 000	0	163 557
	F	0	0	0	118 000	125 529	0	121 765

Source: Survey 2021

4.7.2. Annual income per vegetable farm managed by men and women

Gross operating income was estimated from market gardeners (members of contact groups and those reached by the dissemination effect). The results show that gross income for male market gardeners was 387,092 FCFA, compared with 425,940 FCFA for women. This represents a realization rate of 69% for men and 102% for women. The highest average annual incomes are recorded in Karimama, up to a million or more. It should also be noted that this level of income shows that women's income is higher than men's, which is in line with the project's objective of taking vulnerable groups into account. In addition, the development of the areas developed in certain communes in 2021 has increased production and, in turn, producers' incomes, all other things being equal. As a result, the objectives set have been achieved.

Table 16: Annual income per market garden farm

	Type	2016	2017	2018	2019	2020	2021	Total
Banikoara	H	0	0	0	408 250	510 500	0	459 375
	F	0	0	0	298 800	292 600	0	295 700
Gogounou	H	0	0	0	248 500	295 500	0	272 000
	F	0	0	0	181 500	170 850	0	176 175
Karimama	H	0	0	0	461 500	580 500	0	521 000
	F	0	0	0	337 975	3 476 150	0	1 907 063
Kalalé	H	0	0	0	274 000	370 000	0	322 000
	F	0	0	0	207 875	232 400	0	220 138
	Type	2016	2017	2018	2019	2020	2021	Total
Ndali	H	0	0	0	497 000	650 000	0	573 500

	F	0	0	0	364 000	369 700	0	366 850
Tchaourou	H	0	0	0	214 950	262 950	0	238 950
	F	0	0	0	157 353	141 495	0	149 424
Bantè	H	0	0	0	426 000	560 000	0	493 000
	F	0	0	0	311 700	321 800	0	316 750
Ouèssè	H	0	0	0	248 500	305 500	0	277 000
	F	0	0	0	181 915	184 500	0	183 208
Glazoué	H	0	0	0	284 000	370 000	0	327 000
	F	0	0	0	207 900	228 400	0	218 150
Total	**H**	**0**	**0**	**0**	**340 300**	**433 883**	**0**	**387 092**
	F	**0**	**0**	**0**	**249 891**	**601 988**	**0**	**425 940**

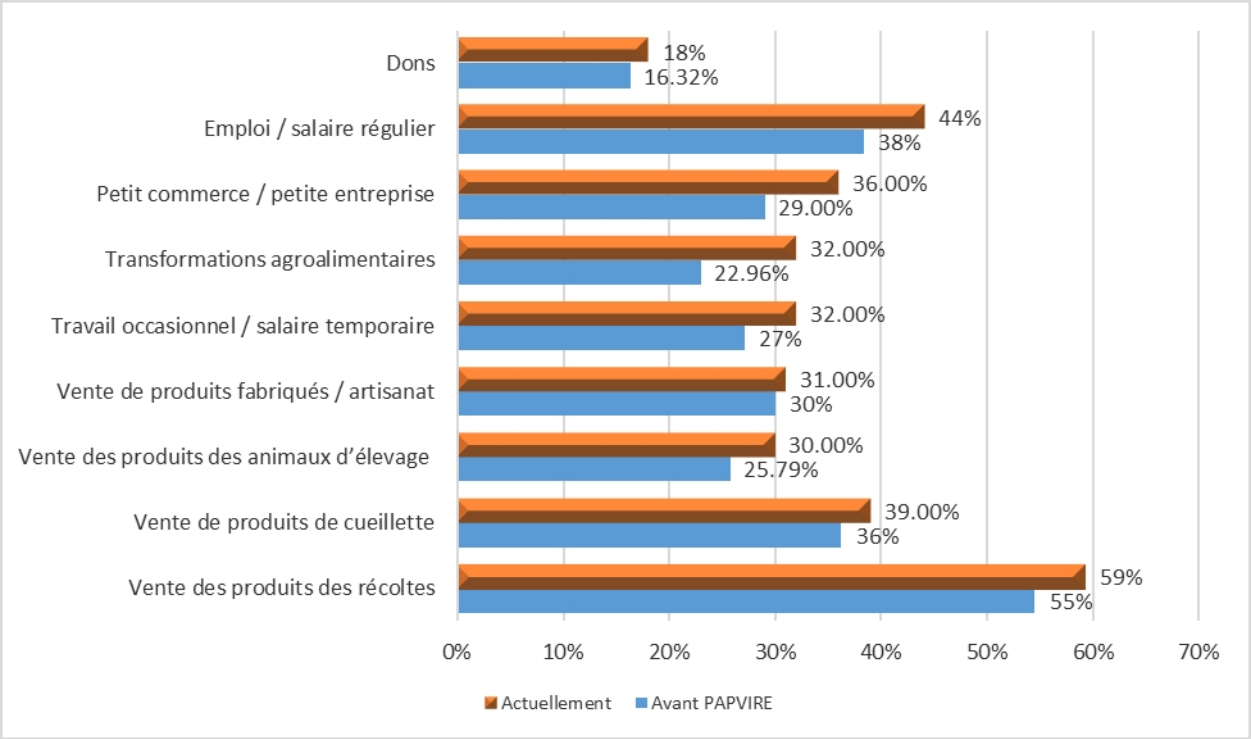
Source: Survey 2021

4.7.3. Annual income per fish farm managed by men and women (FCFA)

No fish farming activities have been launched due to delays in the rehabilitation of reservoirs. This means that the achievement rate for this indicator is 0%. The implementation of hydro-agricultural schemes has not enabled us to achieve the objectives set by the project in this area.

4.7.4. Contribution of different income sources to household income

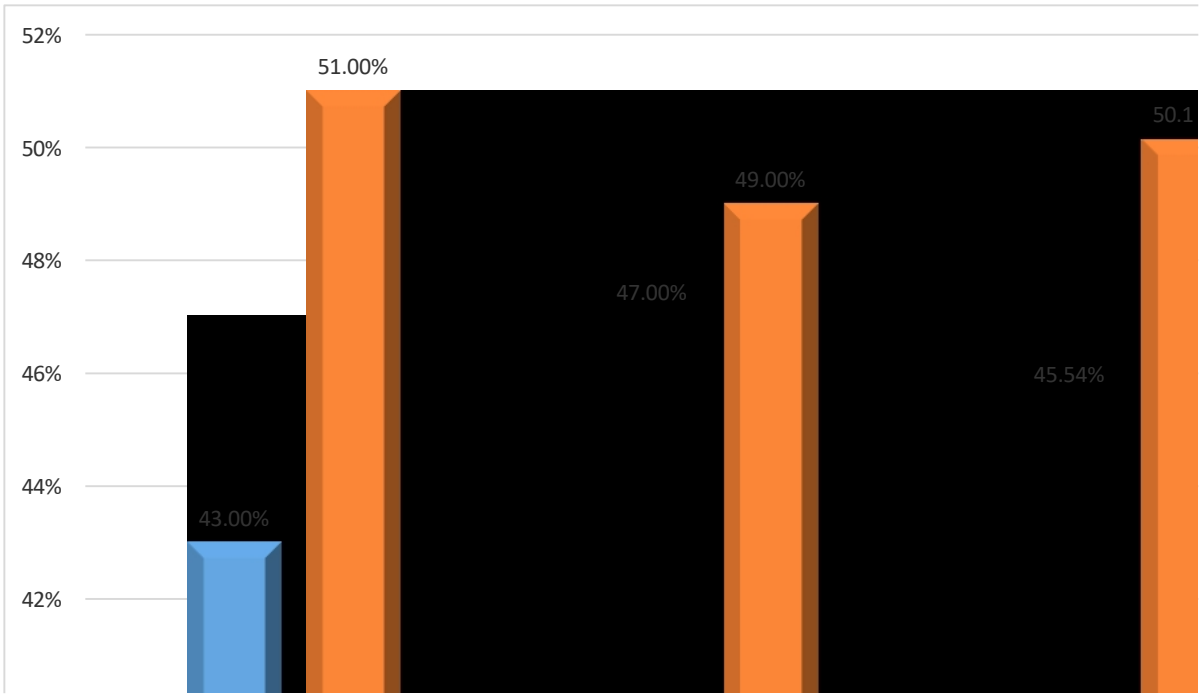
The share of the different sources of income of the respondents before PAPVIRE-ABC and now is shown in the figure below. This figure shows that all sources have contributed significantly to the improvement in household income after five years of PAPVIRE-ABC implementation. It should be noted that income from the sale of harvest products contributes more (59%) to household income now than before the project was implemented.



Source: Survey 2021

Figure 9: Contribution of income sources to household income

Income levels of beneficiary households before and after project implementation have also improved. 51% of beneficiaries felt that their income had improved since before the project. This result can also be seen among non-beneficiaries. Here, 49% of non-beneficiaries recognized an improvement in their income thanks to a contamination effect created by project implementation. The difference between before and after PAPVIRE for non-beneficiaries is 2%, compared with 8% for project beneficiaries.

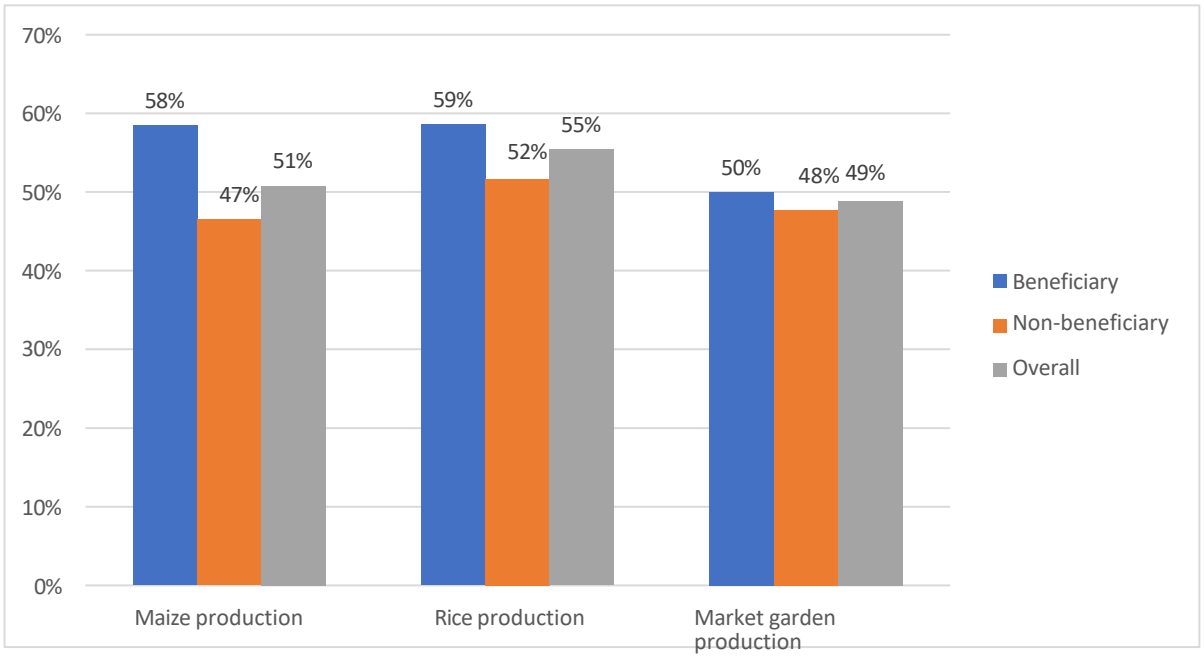


Source: Survey 2021

Figure 10: Income levels before and after the project

4.7.5. Perception of income level by speculation

At the end of the PAPVIRE project, income levels have risen sharply for all crops, according to beneficiaries. Over 51% of those surveyed felt that their income from maize production had increased, compared with 55% for rice and 49% for market gardening. It should be noted that, overall, the income level of beneficiaries in all three crops has increased more than that of non-beneficiaries.



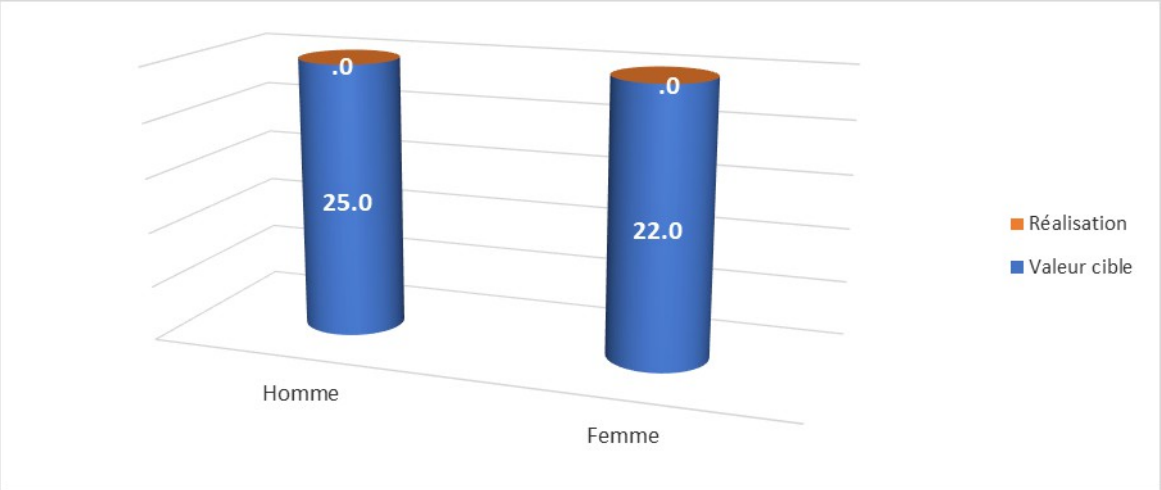
Source: Survey 2021

Figure 11: Evolution of farmers' income by type of production

4.8. Promotion of agricultural enterprises for young people and women

4.8.1. Situation of operating companies managed by men and women

Several business plans from young agricultural entrepreneurs (over 174) are currently being finalized and will be submitted to microfinance financial institutions. However, according to the project target, the number of operational businesses managed is estimated at 25 for men and 22 for women. This indicator could not be reached due to the Covid-19 situation.



Source: Survey 2021

Figure 12: Operating companies with promoters managed by men and women

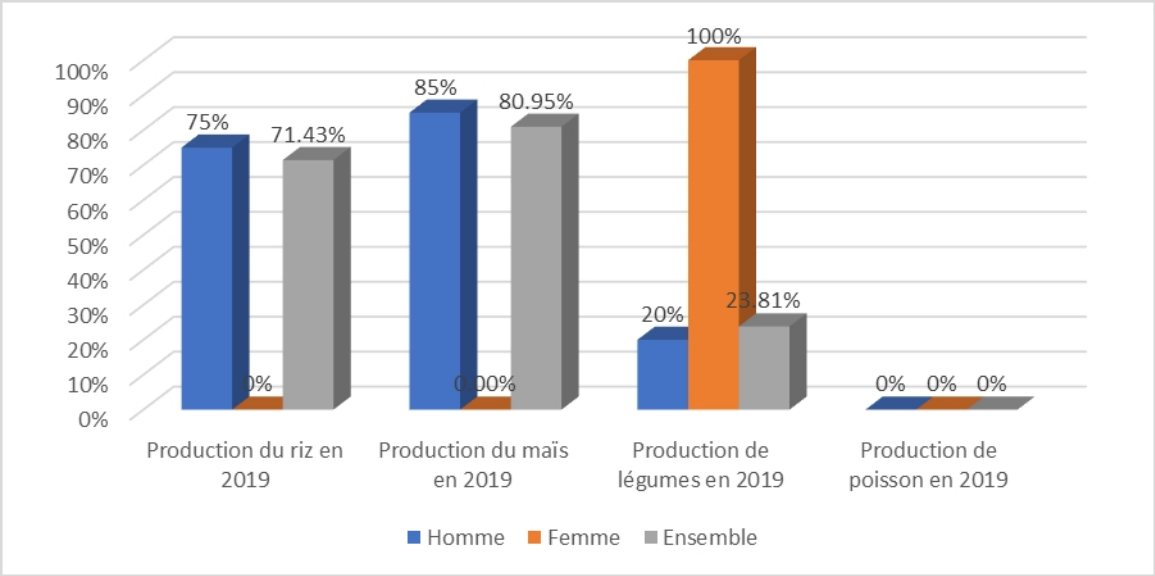
The situation at the various companies affected by the project is shown in table 17. This table shows that all the women have received capacity building and have been positioned as initially planned by the project. But overall, 47.62% of the enterprises surveyed have received training in the CEP; 71.43 have received training in the technology review workshops; 80.95% of these enterprises have received training in resilient technologies; 42.86% have attended seed production within the framework of the project; only 28.57% are members of perimeter and infrastructure management committees; and finally, 80% of these enterprises are members of POs. these results show the extent to which the project has taken an interest in young people in their situation.

Table 17: Company situation

	Men	Woman	Set
CEP training	45%	100%	47,62%
Training in magazine workshops technology	70%	100%	71,43%
Training in resilient technologies	80%	100%	80,95%
To have witnessed seed production	45%	0%	42,86%
Member of the perimeter management committee infrastructures	25%	100%	28,57%
OP member	78,95%	100%	80%

Source: Survey 2021

With a year to go before the end of the project, as in the other years of its implementation, the various enterprise promoters have continued to produce cereals and vegetables. This bears witness to the project's primary objective. However, fish farming has not been a reality due to delays in the construction of watering holes to house the infrastructure for this activity. In addition, market gardening is an activity in which the women are much more committed.

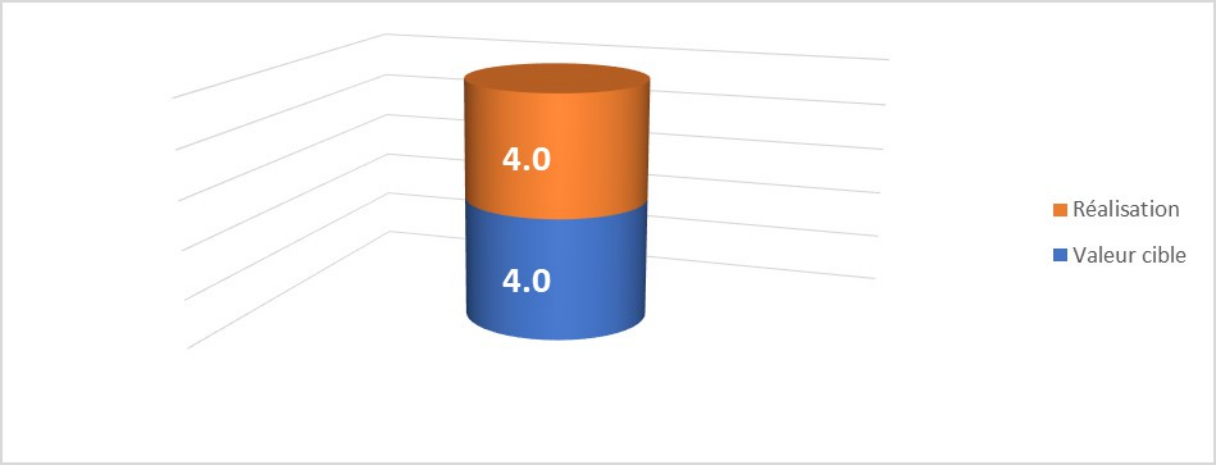


Source: Survey 2021

Figure 13: Operating companies with promoters managed by men and women

4.8.2. Status of business incubation centers with signed partnerships

The PMU has signed an agreement with CePED, which has 03 incubation centers for training and setting up young entrepreneurs. It has also signed a service contract with the KOBERSIDE training institute, following a call for tenders, for the incubation of 65 young entrepreneurs. This enabled the project to meet the targets set for this indicator. In other words, a 100% achievement rate.

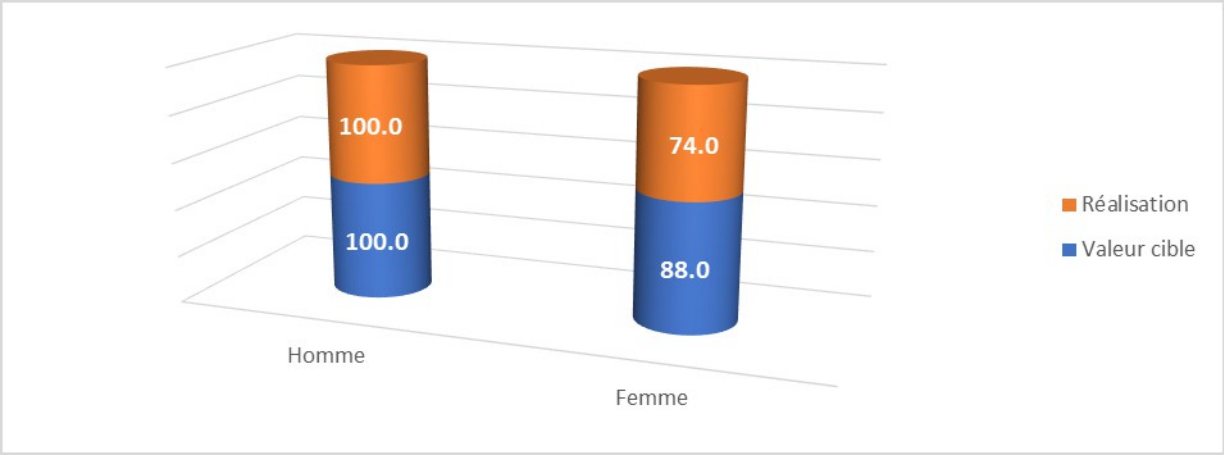


Source: Survey 2021

Figure 14: Incubation center with signed partnership agreement

4.8.3. Status of bankable agricultural business projects developed

In terms of bankable projects, 174 business plans from young agricultural entrepreneurs are being finalized in conjunction with MFIs. These business plans have been supported in the presence of microfinance institutions. However, given the situation at COVID19, activities in this area have not progressed. However, it should be noted that the completion rate for the number of bankable agricultural business projects developed for men is 100%. For women, the rate is estimated at 84%.



Source: 2020 survey

Figure 15: Bankable corporate projects developed

4.8.4. Project impact on beneficiaries' activities

Implementation of the PAPVIRE project has had a considerable impact on beneficiaries and their activities. The results presented in Table 18 bear witness to this. Firstly, in most cases, the knowledge acquired by beneficiaries thanks to the implementation of this project has enabled them to develop their personal activities in around 92% of cases, compared with only 19% of non-beneficiaries. This is the case, for example, in the regular keeping of management documents by auditors at the Conseil à l'Exploitation Familiale (CEF), and in advocacy at SFD level (CLCAM and SIA N'SON, SODECO, PADA). It should be pointed out that the implementation of PAPVIRE-ABC has enabled the implementation of activities and formalities for the creation of Enterprises de Services et Organisations de Producteurs (ESOP) in certain communes. In other words, PAPVIRE has strengthened the skills of farmers' organizations in management methods, increased their legitimacy through targeted actions, facilitated the implementation of activities through the construction of infrastructure such as processing units, development of market garden sites, increased and efficient mobilization of own resources through the strategy of collecting membership fees and contributions.

In contrast to the pre-PAPVIRE period, the POs are now more professional. Thanks to PAPVIRE, they have understood the need to organize themselves into cooperatives, especially as regards compliance with OHADA standards. Female leadership has improved thanks to the implementation of this project. Women, the vulnerable groups targeted by the project, are increasingly taken into account in the implementation of activities. Overall, the results testify not only to the far-reaching effects of the project's actions on the economic performance of beneficiaries' activities, but also on their skills. Some 82% of beneficiaries feel that the various training courses they have received have had a very positive impact on their business performance. In economic terms, 74.21% of beneficiaries felt that the project's impact was very high, leading to improved sales figures. Implementation of the project has greatly improved market access for agricultural products (food crops) in the intervention zone. Over 74% of beneficiaries testified to this. As skills development in the agricultural world is a factor in improving productivity, the PAPVIRE project has provided access to it, as most of the beneficiaries have testified.

Table 18: Level of assessment of project effects

	Modality	Profits	No profit.	Set
Using knowledge acquired	Yes	91,99	19,15	68,17
Influence of training on business performance	Positive	81,93	26,67	67,80
	No	10,43	45,19	19,32
	Negative	0,76	0,00	0,57
	DK	6,87	28,15	12,31
Assessing the effect of project on business profitability	Very low	0,76	19,72	3,64
	Low	15,15	8,45	14,13
	Medium	84,09	71,83	82,23
	High	88,10	10,21	72,45
	Very high	74,21	0,75	72,15
Assessing the effect of sales project	Very low	2,28	18,75	4,59
	Low	14,97	10,94	14,41
	Medium	82,74	70,31	81,00
	High	88,10	10,21	72,45
	Very high	74,21	0,75	72,15
Assessing the effect of product market access project	Very low	16,10	24,59	17,35
	Low	44,63	24,59	41,69
	Medium	39,27	50,82	40,96
	High	88,10	10,21	72,45
	Very high	74,23	0,75	72,15
Assessing the effect of skills/knowledge project	Very low	0,78	17,65	3,30
	Low	8,53	5,88	8,13
	Medium	90,70	76,47	88,57
	High	88,10	10,21	72,45
	Very high	84,21	0,75	72,15
Assessing the effect of attitudes/behaviors project	Very low	4,17	17,91	6,21
	Low	9,64	10,45	9,76
	Medium	86,20	71,64	84,04
	High	88,10	10,21	72,45
	Very high	84,24	0,72	82,15

Source: Survey 2021

5. IMPACT OF THE PROJECT ON BENEFICIARIES' LIVING CONDITIONS

5.1. Impact of the project on agricultural productivity

The impact of the project on agricultural productivity is measured in terms of beneficiaries (treated) and non-beneficiaries (controls). The difference in yield between beneficiaries and non-beneficiaries for maize production is 2.608 tonnes per hectare, and is significant at the 1% threshold. For rice production, the difference in yield between beneficiaries and non-beneficiaries is 6.291 tonnes per hectare, and is significant at the 5% threshold. With regard to market garden productivity, the difference in yield is 3.273 tonnes per hectare and is significant at the 5% level, indicating a high level of yield among project beneficiaries. Overall, the project's impact is highly visible in terms of food crop productivity.

Table 19: Impact of the project on productivity by category of respondent

ATT	Treaty	Control	Difference	Standard deviation	T-stat
Corn yield	3,472	0,864	2,608***	1,650	-4,10
Rice yield	8,196	1,905	6,291**	5,167	-0,36
Market garden yield	8,597	5,325	3,273**	5,747	-0,34

** Significance at the 5% level
Source: Survey 2021

5.2. Impact of the project on beneficiaries' income

The results of the income estimates for project beneficiaries and non-beneficiaries are presented in the table below. The table shows that each project beneficiary has an additional annual income of over 930,000 FCFA for maize production and over 910,000 FCFA for rice production. Overall, the difference in income per adult equivalent between beneficiaries and non-beneficiaries is over 170,000 FCFA. This analysis confirms the various qualitative interviews conducted with project beneficiary households.

An analysis of beneficiaries and non-beneficiaries shows in the following table that the difference in income from maize production is more than
700,000 FCFA per year and is significant at the 5% threshold. With regard to rice production, the income level of beneficiaries is higher than that of non-beneficiaries, but is not significant in terms of difference. As for the level of income per adult equivalent, the results show that beneficiaries have a significantly higher income than non-beneficiaries, and is significant at the 5% threshold. These results show that the project has had a significant impact on beneficiary producers.

Table 20: Effect of project on household income

ATT	Treaty	Control	Difference	Standard deviation	T-stat
Income Corn	939.008	222.437	716.570**	407.423	1,99
Income Rice	917.659	308.181	609.478	624.758	0,50
Income from market gardening	1.051.858	352.630	699.229	536.781	-0,04
Revenue per equivalent	464.741	294.618	170.124**	392.467	1.81
ATT	Treaty	Control	Difference	Standard	T-stat

				deviation	
adult					

** Significance at the 5% level
Source: Survey 2021

5.3. Project impact on household food and nutrition security

5.3.1. Average prevalence of food insecurity in ZIP

Household food consumption is estimated using the Food Consumption Score (FCS) method, a proxy indicator based on consumption frequency and dietary diversity over a seven-day reference period. Based on this indicator, household consumption is classified as acceptable, borderline or poor. According to the 2017 Global Analysis of Vulnerability and Food Security (AGVSA) report, 86% of households have acceptable food consumption and 14% of households have inadequate food consumption. Of the latter, 11.6% have borderline food consumption and 2.4% have poor food consumption.

In the case of this study, the average prevalence of food insecurity was assessed in order to present the effects of the project in this respect. The results of this assessment are presented below.

✓ ***Food insecurity situation in the ZIP***

An analysis of the food insecurity situation carried out at the level of the project intervention zone (the nine communes) shows that only 2.06% of households are in a food security situation, 31.35% are in a borderline food insecurity situation, 46.45% are in a moderate food insecurity situation and 20.14% in a serious food situation. These results, being those obtained by INSAE in its AGVSA report in 2017, show the level of validity of the selection criteria for the PAPVIRE-ABC project's intervention communes.

Table 21: Food insecurity situation in the ZIP

	SA	IAL	IAM	IAG
Borgou	**2,30**	**33,33**	**49,43**	**14,94**
Kalalé	28,57	14,29	57,14	0,00
N'dali	0,00	37,78	62,22	0,00
Tchaourou	0,00	31,43	31,43	37,14
Alibori	**0,00**	**6,38**	**49,65**	**43,97**
Banikoara	0,00	37,50	31,25	31,25
Gogounou	0,00	10,71	46,43	42,86
Karimama	0,00	0,00	53,61	46,39
Hills	**3,35**	**47,37**	**43,06**	**6,22**
Bantè	0,00	11,29	85,48	3,23
Glazoué	0,00	34,04	57,45	8,51
Ouessè	7,00	76,00	10,00	7,00
Set	**2,06**	**31,35**	**46,45**	**20,14**

Source: AGVSA survey 2017

According to the same report, the results of the food insecurity situation in the departments of Alibori, Borgou and Collines (project targets) show that 49.80% of households are in a food security situation, 39.73% are borderline food insecure, 9.40% are moderately food insecure and only 1.07% are in a serious food situation. This analysis takes into account all the communes in the three departments covered by the PAPVIRE-ABC project.

Table 22: Food insecurity situation in the three project departments

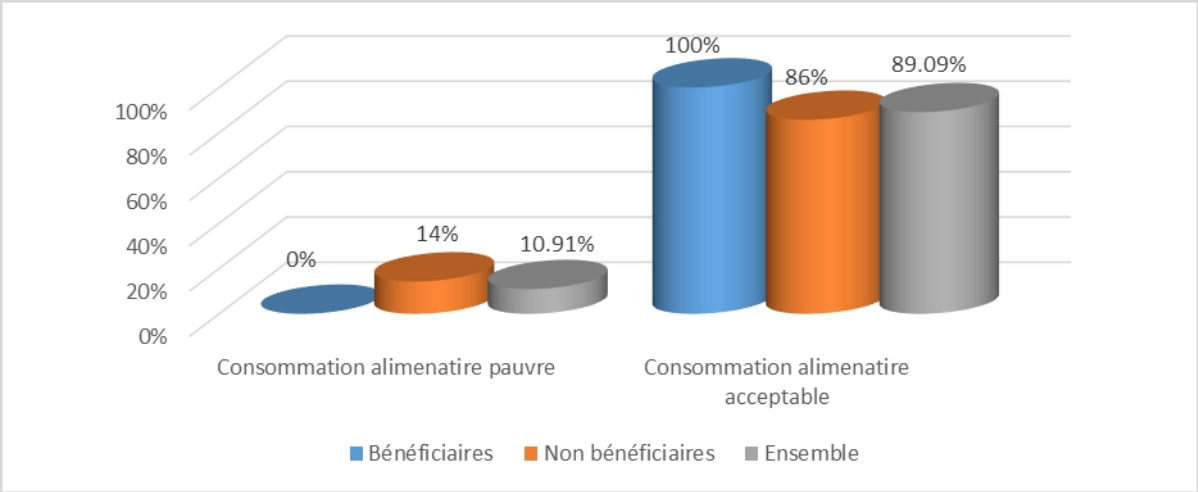
	Alibori	Borgou	Hills	Total
Household in SA	47,90%	47,00%	54,50%	49,80%
Household in IAL	44,10%	45,00%	30,10%	39,73%
Household in IAM	7,60%	7,70%	12,90%	9,40%
Household in IAG	0,40%	0,30%	2,50%	1,07%

Source: AGVSA Report 2017

- ✓ ***Food consumption score***

According to the FAO, food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. It guarantees a population's access to food at all times, in terms of both quality and quantity. It must be sufficient to ensure a healthy and active life, taking into account dietary habits.

Thus, in order to establish food security classes, a confirmation of the food consumption score as a proxy indicator of food security was carried out to assess the level of food consumption of project beneficiaries. Details of this analysis are shown in the figure below. The results revealed that all beneficiaries (100%) had an acceptable food consumption score, compared with 86% of non-beneficiaries. With an acceptable food consumption situation (FCS > 42), most people in the ZIP are in a much better food security situation than before PAPVIRE. These results not only explain why the project has had an effect in contaminating non-beneficiaries, but are also justified by the different levels of production and yields obtained. Thus, the proportion of food-insecure households decreases as economic well-being improves (increased wealth). As a result, SCA accurately reflects food availability, food access and food consumption at household level. It should also be noted that AGVSA's results are much improved thanks to the implementation of the PAPVIRE project.



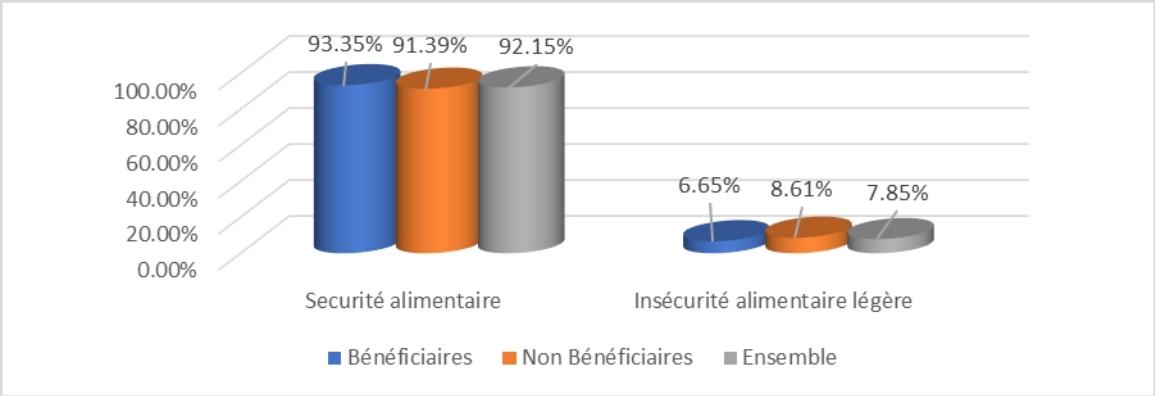
Source: Survey 2021

Figure 16: Composite food consumption score

- ✓ ***Situation of food between food beneficiaries and non beneficiaries***

Generally speaking, of the four classes of household food insecurity, the results of this study revealed only two classes. These are those who are food secure (FS) and those who are mildly food insecure (MFI). An analysis of project beneficiaries and non-beneficiaries shows in the figure below that 93.35% of beneficiaries are food-secure. A very small proportion of those surveyed are in the mildly food-insecure category. We also note that there are fewer food-insecure beneficiaries than non-beneficiaries. This can be explained by the fact that beneficiaries prefer to consume a large part of their production, unlike non-beneficiaries, who prefer to market their production for cash profits.

It's easy to see that 49.80% of the ZIP population were in a food security situation according to the AGVSA 2017 report, compared with 92.15% for the PAPVIRE results.

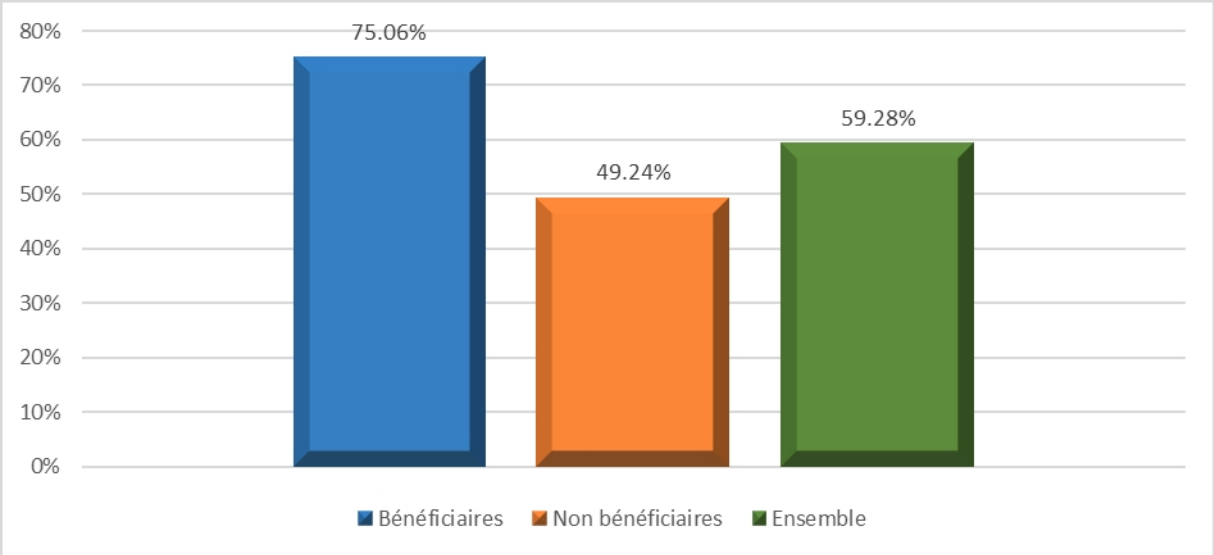


Source: Survey 2021

Figure 17: Food insecurity between beneficiaries and non-beneficiaries

✓ ***Improvement in the level of food insecurity in the ZIP***

The figure below shows the proportion of respondents who feel that their level of food security has improved compared with the previous year. A reading of this figure shows that overall, beneficiaries had a more improved level of food security from 2019 to 2020. Thus, 75.06% of beneficiaries experienced an improvement in their level of food insecurity, compared with 49.24% of non-beneficiaries. Overall, more than 59% of respondents experienced an improvement in their level of food insecurity.



Source: Survey 2021

Figure 18: Improved food security in the ZIP

In order to estimate the average effect of the project on beneficiary households' food insecurity, the SHP method was used. From the analysis of these results presented in the table below, it is clear that this score is lower (0.27) for the treated households than for the controls (1.45), and is globally significant at only 1% in terms of difference. These results show that the controls are more exposed to food insecurity than the treated. This confirms the improvement in the beneficiaries' level of food insecurity as a result of the project's implementation.

Table 23: Impact of the project on household food insecurity levels

ATT	Treaty	Control	Difference	Standard deviation	T-stat
HFIES	0,27	1,45	-1,18***	0,94	-5,26

** Significance at the 5% level
Source: Survey 2021

5.4. Project impact on poverty and vulnerability of beneficiaries

5.4.1. Poverty situation in the ZIP

The poverty situation in the project area was assessed in the absence of official INSAE data. The parameters studied were the overall incidence of poverty (P0), the depth of poverty (P1) and the severity of poverty or inequality among the poor (P2). The incidence of overall poverty (P0) is the percentage of the population (or household) unable to cover its food and non-food needs, as represented by the poverty line. Generally, P0 is presented as a percentage. The depth of poverty (P1) indicates the distance households are from the poverty line. It records the average collective income or consumption deficit in relation to the poverty line for the whole population. Poverty severity (P2) gives an indication of the poverty gap, but above all measures inequality among the poor. It assigns a higher weighting to households located at a greater distance from the poverty line. Taking severity into account makes it possible to assess the living conditions of the poorest who cannot escape poverty without external action or assistance. This is the case, for example, of the populations in the project intervention zone.

Compared to 2015, there has been a reduction in the proportion of poor people throughout the project area. In order of magnitude, we note the collines department (23.09 points), the Borgou department (12.68 points) and the Alibori department (12.23 points). Overall, the poverty level was reduced by 12.66 points.

Table 24: Percentage of poor people in the ZIP area

Department	2015			2020		
	P0 (%)	P1	P2	P0 (%)	P1	P2
Alibori	39,88	0,20	0,13	27,65	0,13	0,10
Borgou	38,63	0,23	0,16	25,95	0,14	0,11
Hill	47,20	0,20	0,12	24,11	0,14	0,07
Set	41,90	0,21	0,14	29,24	0,13	0,10

P0= Incidence, P1=Depth, P2=Severity Source:
2021 survey and EMICoV-follow-up 2015

In order to fully understand the poverty situation within the beneficiary population compared to that of non-beneficiaries, each respondent was asked to assess his or her poverty class before PAPVIRE-ABC and currently (after project implementation). The results of this assessment are presented in the table below. Analysis of this table shows that poverty levels have improved, especially among project beneficiaries. In general, the poverty level remained more or less unchanged (70.73% of respondents). Analysis of beneficiaries shows that over 52% of beneficiaries experienced a considerable improvement in their poverty level, compared with only 12.39% of non-beneficiaries. Overall, only 28% of those surveyed saw an improvement in their poverty level. In other words, thanks to the project's implementation, few respondents changed their poverty class for the better, compared with 52.97% of project beneficiaries.

Table 25: Changes in the poverty level of respondents

	Beneficiaries	Non-beneficiaries	Set
Decrease	0,71%	1,36%	1,11%
Unchanged	46,32%	86,25%	70,73%
Increase/improvement of poverty class	52,97%	12,39%	28,16%

Source: Survey 2021

5.4.2. Project impact on the incidence of poverty

The project's impact on the incidence of poverty takes into account the parameters described below. These parameters concern education, health, housing and human capital (education, health and food). It should be noted that expenditure on education and health has been evaluated over the last twelve (12) months, while expenditure on food has been evaluated over the last thirty (30) days.

The table below shows the results of the poverty index estimated from the SHP. From analysis of these results, it is easy to conclude that beneficiaries have a lower level of poverty than non-beneficiaries of the project, and are therefore less poor. This confirms the results obtained when estimating the incomes of the households surveyed. Thus, the difference in poverty class between beneficiaries and non-beneficiaries is significant at the 1% threshold.

Table 26: Impact of the project on the incidence of household poverty

ATT	Treaty	Control	Difference	Standard deviation	T-stat
Incidence of Poverty	9,09%	63,63%	-54,55%***	22,95%	-5,09

** Significance at the 5% level
Source: Survey 2021

5.4.2.1. Consumer spending by beneficiaries

The table below shows household food expenditure over the last 30 days. Analysis of this table shows that the difference in food expenditure between beneficiaries and non-beneficiaries is 721 FCFA and is not significant. However, beneficiaries spent less on food than non-beneficiaries.

Table 27: Beneficiaries' household consumption expenditure

	Average	Standard deviation
Beneficiary	16.914	730
No beneficiary	17.634	834
Average	17.354	432
Difference	-721	886

Source: Survey 2021

5.4.2.2. Education expenditure

The following table shows the various expenses incurred and not incurred thanks to income from activities financed by PAPVIRE-ABC. The table shows that only 14.31% of respondents have incurred school expenses in the last 12 months thanks to income from PAPVIRE-ABC activities. In terms of school expenses not incurred for lack of money, only 6.93% of respondents are

concerned. These results could be reflected in the school enrolment rate in the ZIP and the problems caused by the Covid-19 pandemic.

Table 28: Household expenditure on education

	Beneficiary	No Beneficiary	Set
School expenses over the last 12 months thanks to income from activities financed by the PAPVIRE	34,20%	1,66%	14,31%
Uncommitted school expenses in the last 12 months, due to lack of money	6,89%	6,95%	6,93%

Source: Survey 2021

5.4.3. Health expenses

The table below shows the different types of health expenditure and the places where respondents seek care. According to this table, the most frequent place of care for respondents in the event of illness is the public health center. In the case of women giving birth, they often go to health training centers. However, it should be noted that only 12.93% of respondents in the ZIP have incurred health expenses in the last twelve months thanks to income from PAPVIRE-ABC activities. Due to a lack of funds, only 6% of respondents have not been able to incur health expenses in the last twelve months. The observation here is that health expenditure is becoming increasingly low. This also reflects the respondents' improved well-being.

Table 29: Household health expenditure

Variables	Terms and conditions	Treaty	Control	Set
Place of care in the event of illness	Hospital	70,78	60,12	64,27
	Modern self-medication	5,70	13,29	10,34
	Traditional self-medication	12,59	15,41	14,31
	Traditional healer	2,14	2,11	2,12
	Other	8,79	9,06	8,96
Location in the event of pregnancy	Home	4,00	6,17	5,13
	Health training	96,00	93,83	94,87
Healthcare expenditure thanks to income from activities financed by PAPVIRE		31,12	1,36	12,93
Health expenses not incurred due to lack of funds		5,23	6,50	6,00

Source: Survey 2021

5.4.3.1. Respondents' housing *characteristics*

The various characteristics of the main dwelling of ZIP respondents are analyzed. The aim here is to determine the extent to which respondents are generally self-sufficient in terms of housing. Analysis of the results shows that over 91% of respondents live in their own homes, which are of the medium type. The main wall component of the houses built is either cement brick, earthen bar or banco with partial or full rendering. The roofs of respondents' homes are often made of sheet metal (96.58%). The main floor component of the respondents' main dwelling is cement (70.18%). In terms of number of

The number of rooms in the main dwelling varies from two (02) to more (59.83%). The various households in the ZIP live with a source of lighting that varies between the SBEE energy source (36.82%), the torch (31.27%) and solar energy (28.86%).

When it comes to preparing meals for consumption and processing household foodstuffs, wood is the most widely used energy source (91.14%).

Table 30: Respondents' housing characteristics

Variables	Terms and conditions	Proportion
Occupancy status of main household dwelling	Rental	1,67
	Personal property	91,65
	Parent ownership	6,68
Type of habitat	High standing	1,57
	Medium	53,00
	Contents	45,43
Main component of the walls of the household's main dwelling	Cement brick	23,73
	In mud brick	31,96
	In banco	42,94
	In straw	1,11
Wall plastering	Entirely	40,63
	Partially	37,49
	No	21,88
Main roof component of the household's main dwelling	Slab	0,18
	Sheet metal	96,58
	Tile	0,09
	Straw	2,86
Main floor component of main household dwelling	Cement	70,18
	Tiling	0,74
	Clay/sand	26,78
	Wood/board	1,11
	Bamboo/Palm	0,28
Number of rooms on the main household dwelling?	Less than 2	40,17
	Greater than 2	59,83
Main source of household lighting	Electricity SBEE	36,82
	Kerosene lamp	2,50
	Torch	31,27
	Solar energy	28,86
	Lights	0,56
Main source of energy for household cooking and food processing	Wood	91,14
	Charcoal	8,22
	Electricity	0,18
	Animal waste	0,09
	Solar energy	0,18

Source: Survey 2021

5.4.3.2. *Comparison* of household economic situation

The results of the household economic situation compared to 5 years ago are presented in the table below. An analysis of the table shows that 63.28% of beneficiaries saw their household's economic situation as slightly better than that of the average household. Only 16.38% of these households felt that their household's economic situation is much better now than it was 5 years ago. These same results compared to the average ZIP household show the same trends. Overall, there has been a considerable improvement in the economic situation of households benefiting from the project.

Table 31: Comparison of household economic situation

	5 years ago		
	Beneficiary	No Beneficiary	Total
Much worse	0,25	0,16	0,20
Identical	20,10	47,30	36,49
A little better	63,28	48,77	54,54
Much better	16,38	3,76	8,78

Source: Survey 2021

5.4.4. Impact of the project on household vulnerability

Before looking at the project's impact on the vulnerability of the households surveyed, an analysis is first made in terms of the positive impact the project has had on these households. In fact, the implementation of the PAPVIRE project has had a generally positive impact on various aspects of beneficiaries' lives. These include, for example, a considerable improvement in income, the esteem in which spouses are held, the relationship with neighbors in terms of mutual consideration, the assumption of household food expenses by women, contributions to children's school expenses, the assumption of other miscellaneous household expenses, various achievements, participation in tontines and solidarity groups, and an improvement in the level of professionalization of promoters. Overall, the impact is visible and positive for both beneficiaries and non-beneficiaries.

Table 32: Positive impact of PAPVIRE on beneficiaries

	Beneficiary	No Beneficiary	Set
Your own sources of income	72,21	10,27	34,35
Your spouse's self-esteem	65,80	8,31	30,66
Your relations with your neighbors or the way they view you	67,70	9,37	32,04
Covering household food expenses	74,11	9,67	34,72
Coverage of children's schooling expenses	67,93	8,01	31,30
Your various achievements (purchase of durable goods, construction, etc.), etc.)	64,85	7,40	29,73
The payment of other expenses incurred by members of the including yourself	72,92	8,91	33,80
Participation in tontine and solidarity groups	58,19	6,95	26,87

	Beneficiary	No Beneficiary	Set
The promoter's level of professionalism	72,45	6,19	31,95

Source: Survey 2021

In addition, the impact of the project on vulnerability in the beneficiaries' households is analyzed, taking into account health-related vulnerability, economic vulnerability, material vulnerability, vulnerability in relation to housing conditions and overall vulnerability.

The level of vulnerability of the respondents varies from one level to another. These levels of vulnerability are presented in the table below.

- Analyses of health vulnerability take into account the different places of care and treatment visited in the event of illness, as well as health-related expenses incurred or not thanks to income from PAPVIRE during the last twelve months prior to data collection. The vulnerability index is relatively low, but higher for beneficiaries than for non-beneficiaries. Overall, the index is 30.43%, indicating that the respondents are vulnerable from a health point of view. In other words, health conditions need to be reviewed at the level of the respondents, even though an improvement has been noted thanks to the implementation of the project.

- In economic terms, the analysis of the vulnerability of households in the ZIP takes into account assessments of the economic situation of households before the PAPVIRE program and at present, not forgetting the various health-related expenses incurred or not incurred by the respondents over the last twelve months. The result for economic vulnerability shows that 46.27% of beneficiaries surveyed were in a situation of economic non-vulnerability, compared with only 34.90% of non-beneficiaries. Overall, the economic vulnerability index of surveyed households is relatively low, at 38.83%.

- In material terms, the vulnerability situation takes into account the various possessions of the respondents in terms of material goods for the household. At this level, the vulnerability index is relatively low, reflecting the poor state of households in terms of possession of durable goods. This index is 27.97% for bank beneficiaries and 31.14% for non-bank beneficiaries. At this level, we can conclude that non-bank beneficiaries are less vulnerable than bank beneficiaries.

- In terms of housing, analysis of the vulnerability index shows that non-beneficiaries are more vulnerable to housing conditions than beneficiaries, but the overall level of vulnerability among respondents is 42.30%. This shows that the housing conditions of the respondents are more or less better overall, but more so for non-beneficiaries than for beneficiaries.

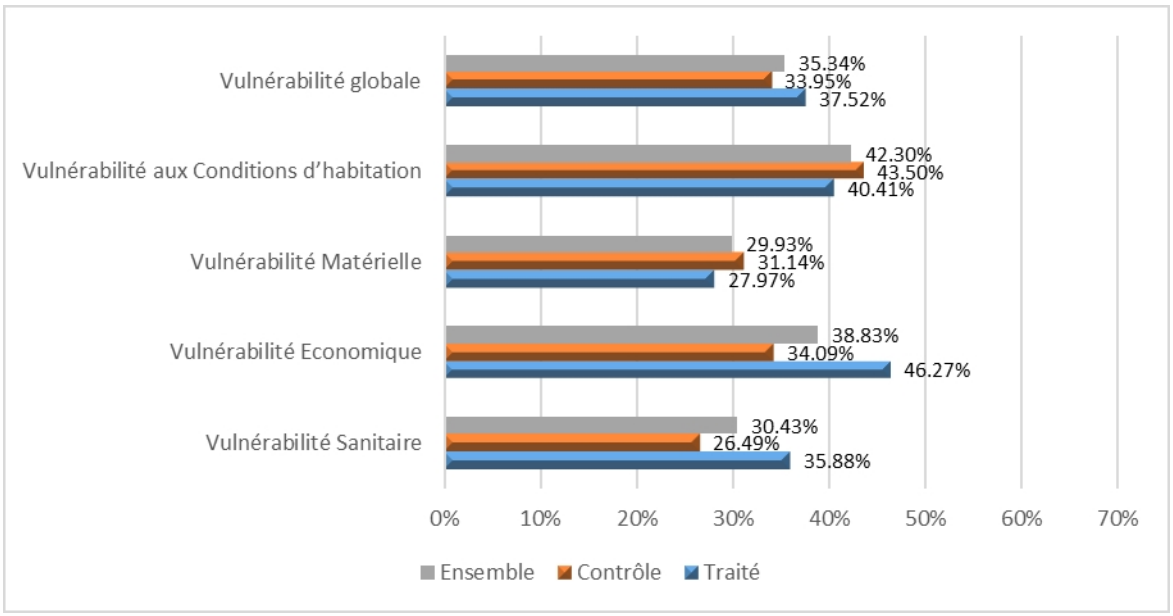
Overall, the level of vulnerability of the households surveyed is acceptable. Only 37.52% of beneficiaries are in a situation of non-vulnerability, compared with 33.95% of non-beneficiaries.

Table 33: Calculated vulnerability indices

ITEMS	Beneficiaries	Non-beneficiaries	Set
Health vulnerability	35,88	26,49	30,43
Economic vulnerability	46,27	34,09	38,83
Material Vulnerability	27,97	31,14	29,93
Housing vulnerability	40,41	43,50	42,30
Overall vulnerability	37,52	33,95	35,34

Source: Survey 2021

The figure below summarizes vulnerability indices at household level.



Source: Survey 2021

Figure 19: Calculated vulnerability indices

The results of the impact of the different levels of vulnerability of the households surveyed, estimated using the SHP method, are presented in the table below. Analysis of this table shows that the difference between beneficiaries and non-beneficiaries in terms of overall vulnerability is7.48 and is significant at the 1% threshold. This means that non-beneficiaries are less vulnerable overall than beneficiaries. It should be noted that beneficiaries are less vulnerable than non-beneficiaries only in terms of material goods (31.09%/29.91%) and economics (50.00%/35.88%). The same situation is observed in health (39.77%/15.06%). In terms of vulnerability to housing conditions, beneficiaries are more vulnerable than non-beneficiaries (38.89%/48.99%). But overall, the situation of vulnerability is accentuated at the level of durable goods, where beneficiaries are more vulnerable than non-beneficiaries (73.45%/95.34%).

Table 34: Impact of the project on household vulnerability

ATT	Treaty	Control	Difference	Standard deviation	T-stat
Health vulnerability	39,77	15,06	24,72***	11,21	4,10
Economic vulnerability	50,00	35,88	14,12***	8,78	13,48
Material Vulnerability	31,09	29,91	1,17***	6,76	4,10

Vulnerability to living conditions	38,89	48,99	-10,10***	7,19	-3,54
Overall vulnerability	39,94	32,46	7,48***	4,57	5,22

Source: Survey 2021

6. LESSONS LEARNED

Like any project, the implementation of PAPVIRE-ABC has not been without lessons to be learned. The following lessons can be drawn from the results achieved:

- The empowerment of certain structures within the institutional framework of the agricultural sector in the execution of key control and promotion activities, the establishment of operational mechanisms for the implementation of specific components, the innovative monitoring-support-advice built around UDs and CEPs and input facilitation, as well as the revitalization of producers' organizations have all contributed to the effective implementation of project interventions.

- A strengthening of the agricultural advisory and training system for beneficiaries has been necessary to improve the dissemination of agricultural innovations and result in the scaling-up of high-performance innovations approved by beneficiaries.

- Direct beneficiaries have benefited in terms of improved income, productivity and living conditions, thanks to the development and construction of infrastructure that is already available and in use.

- The active setting up of infrastructure management committees (store, development, processing unit) in the intervention communes, the commitment and enthusiasm of the players, the knowledge acquired by the POs, coaches and beneficiaries; the transfer of skills (capacity building); the mastery of innovative production techniques (maize, rice and market garden crops), augur well for the sustainability of the investments.

- Given the institutional upheavals resulting from agricultural sector reforms, and the negative impact of sanitary measures against covid 19, it is desirable that the operational capacities of ATDAs and DDAEPs be strengthened to capitalize on the project's achievements, in order to ensure the sustainability of its effects, with a view to obtaining convincing impacts from its actions.

- Quality at the outset is an important success factor that must always be taken into account in the preparation of projects with a high rate of structuring investment, such as hydro-agricultural developments, infrastructure construction, equipment acquisition, etc., which require major technical studies to be carried out upstream of the work.

7. CONCLUSION AND RECOMMENDATIONS

The project's development objective remains relevant. The project's current achievements are geared towards helping beneficiaries to significantly improve production and market products at remunerative prices. As a result, the project's direct beneficiaries will be able to improve their incomes and emerge from food insecurity.

At the end of all these analyses, the aim of which is to assess the effects and impact of the PAPVIRE-ABC project on beneficiaries, it is clear that the project, despite being only halfway through, is already producing positive effects on beneficiaries. Moreover, the impact of PAPVIRE-ABC on beneficiaries' living conditions varies according to income level. Women and men who have been able to capitalize on the support received from the project have seen their living conditions improve as much as male project beneficiaries. Furthermore, all beneficiaries, without distinction, report an improvement in their ability to invest in their children's education and household expenses, thanks to the project's spin-offs.

In terms of agricultural production, there has been an increase in production and an improvement in the quality of processed products, as well as an improvement in yields through compliance with production and processing technical itineraries, and the adoption and application of innovations. The implementation of PAPVIRE-ABC has favored market access for promoters through exchanges of contacts at fairs organized thanks to the quality of processed products, and improved incomes, hence better food security compared to the pre-project situation. It should be noted that most of the promoters are agricultural entrepreneurs by virtue of their organization.

The good collaboration of all the players involved, the willingness of the beneficiaries, the availability of the POs and the physical support of the PMU are the factors that contributed to the smooth implementation of PAPVIRE-ABC. The internal constraint that had little negative impact on the implementation of PAPVIRE-ABC was the delay in the provision of financial resources by the RAF. This is the most significant weakness in the execution of the monitoring schedule.

Recommendations include resolving the backlog in the disbursement of financial resources, so that partners at various levels can complete the remainder of their respective agreements on schedule. It's also time to redouble our efforts to build the capacity of beneficiaries, so that the real impact of the project is more consistent by the end of the project.

It should be noted that most of the target values for the achievement indicators will be reached ahead of schedule. The project will see a significant improvement in disbursement levels with the start-up of water reservoir development and rehabilitation work. As a result, investments will have reached a satisfactory level of execution by the end of June 2020.

The innovations introduced in the project area still need to be scaled up, in line with the recommendations of the latest AfDB supervision mission.

Finally, it is desirable that anticipatory measures be taken to mitigate the negative effects of measures taken to combat the covid 19 pandemic in Benin.

Appendices

Table 35*:* Food safety ratings

CODE	Questions	Terms and conditions	Answers
HFIES	Please notify respondents that the questions are not applicable for cases of fasting, voluntary abstention from eating, or episodes of illness		
HFIES1	**In the past 30 days**, have you ever worried that you or someone else in your household would not have enough to eat because you lacked money or other resources (assistance, work, food stocks)?	1= yes 0= no	
HFIES1A	If Yes to **HFIES1,** how many times did this happen during the month?	1= Rarely (once or twice in the last 4 weeks); 2= Sometimes (three to ten times in the last 4 weeks); 3= Often (more than ten times in the last 4 weeks). weeks)	
HFIES2	**In the past 30 days,** has there been a time when you or someone else in your household could not eat your favorite food because you lacked money or other resources? resources?	1= yes 0= no	
HFIES2A	If Yes to **HFIES2,** how many times did this happen during the month?	1= Rarely (once or twice in the last 4 weeks); 2= Sometimes (three to ten times in the last 4 weeks); 3= Often (more than ten times in the last 4 weeks). weeks)	

HFIES3	**In the last 30 d a y s** , did you or any member of your household eat a limited variety of foods (i.e. were unable to diversify your diet sufficiently) because you were short of money? or other resources?	1= yes 0= no	
CODE	**Questions**	**Terms and conditions**	**Answers**
HFIES3A	If Yes to **HFIES3,** how many times did this happen during the month?	1= Rarely (once or twice in the last 4 weeks); 2= Sometimes (three to ten times in the last 4 weeks); 3= Often (more than ten times in the last 4 weeks). weeks)	
HFIES4	**In the past 30 d a y s** , did you or anyone in your household eat any food that you did not want to eat because of a lack of resources to obtain it? other types of food?	1= yes 0= no	
HFIES4A	If Yes to **HFIES4,** how many times did this happen during the month?	1= Rarely (once or twice in the last 4 weeks); 2= Sometimes (three to ten times in the last 4 weeks); 3= Often (more than ten times in the last 4 weeks). weeks)	
HFIES5	**In the past 30 days**, have you or anyone else in your household eaten less than you thought you should because it wasn't there enough to eat?	1= yes 0= no	

HFIES5A	If Yes to **HFIES5,** how many times did this happen during the month?	1= Rarely (once or twice in the last 4 weeks); 2= Sometimes (three to ten times in the last 4 weeks); 3= Often (more than ten times in the last 4 weeks). weeks)	
HFIES6	**In the last 30 d a y s** , has there ever been a situation where there was nothing left to eat in your household (i.e. no food at all) because you ran out of money? or other resources?	1= yes 0= no	
CODE	**Questions**	**Terms and conditions**	**Answers**
HFIES6A	If Yes to **HFIES6,** how many times did this happen during the month?	1= Rarely (once or twice in the last 4 weeks); 2= Sometimes (three to ten times in the last 4 weeks); 3= Often (more than ten times in the last 4 weeks). weeks)	
HFIES7	**In the past 30 days,** has there been a time when you or someone else in your household was hungry, but didn't eat (went to bed hungry because) you lacked money or other resources to buy food? food?	1= yes 0= no	
HFIES7A	If Yes to **HFIES7,** how many times did this happen during the month?	1= Rarely (once or twice in the last 4 weeks); 2= Sometimes (three to ten times in the last 4 weeks); 3= Often (more than ten times in the last 4 weeks). weeks)	

HFIES8	**In the last 30 days**, have you or anyone else in your household gone <u>without food all day</u> (gone a whole day and night without eating) for lack of money? or other resources?	1= yes 0= no	
HFIES8A	If Yes to **HFIES8,** how many times did this happen during the month?	1= Rarely (once or twice in the last 4 weeks); 2= Sometimes (three to ten times in the last 4 weeks); 3= Often (more than ten times in the last 4 weeks). weeks)	

Table 36: Material vulnerability (durable goods)

CODE	ITEMS	Value
DBEQ1	Boxes/buildings	1=yes, 0=no
DBEQ2	Radio	1=yes, 0=no
DBEQ3	Television	1=yes, 0=no
DBEQ4	Cell phone	1=yes, 0=no
DBEQ5	SIM card for cell phone	1=yes, 0=no
CODE	ITEMS	Value
DBEQ6	Tablet	1=yes, 0=no
DBEQ7	Motorcycle	1=yes, 0=no
DBEQ8	Bikes	1=yes, 0=no
DBEQ9	Vehicle	1=yes, 0=no
DBEQ10	Pirogue	1=yes, 0=no
DBEQ11	Gas bottle	1=yes, 0=no
DBEQ12	Stove	1=yes, 0=no
DBEQ13	Fridge/freezer	1=yes, 0=no
DBEQ14	Saucepan	1=yes, 0=no
DBEQ15	Bowls	1=yes, 0=no
DBEQ16	Basin	1=yes, 0=no
DBEQ17	Dishes	1=yes, 0=no
DBEQ18	Plastics	1=yes, 0=no
DBEQ19	Spoon	1=yes, 0=no
DBEQ20	Forks	1=yes, 0=no
DBEQ21	Wheelbarrows	1=yes, 0=no
DBEQ22	Chemical sprayer	1=yes, 0=no
DBEQ23	Wheelbarrow	1=yes, 0=no
DBEQ24	Tractor	1=yes, 0=no
DBEQ25	Plough/carriage	1=yes, 0=no
DBEQ26	Product storage area agricultural	1=yes, 0=no

DBEQ27	Livestock pens	1=yes, 0=no
DBEQ28	Computer/Internet	1=yes, 0=no
DBEQ29	Water pump/motor pump	1=yes, 0=no
DBEQ30	Generator	1=yes, 0=no
DBEQ31	Sofa	1=yes, 0=no
Durable goods vulnerability index		***Sum of values / 31***

Table 37: Vulnerability to living conditions

CODE	Questions	Value
CLOG1	What is the occupancy status of the household's main residence?	1= Personal property, 0=other
CLOG2	Type of habitat	1=High standing, 0.5=Medium, 0=Summary
CLOG3	What is the main component of the walls of the household's main dwelling?	1 = cement brick, 0.5=earth brick or banco, 0=other
CLOG4	Wall plastering	1= Entirely, 0,5=Partially, 0=None
CLOG5	What is the main component of the roof of the main household dwelling?	1= Slab, sheet or tile, 0=Other
CLOG6	What is the main component of main household dwelling?	1=Cement, Tile, Earth beaten/sand, 0= Other
CLOG7	How many rooms does the main household dwelling?	1≤= 2 ; 0 >=2
CODE	**Questions**	**Value**
CLOG8	What is the main source of lighting of the household?	1= SBEE, Solar energy and Gas lamp, 0= Other
CLOG9	What's the main source of energy for cooking and processing household food?	1= Electricity, Gas, =Hot water heater oil, solar energy, 0= Other
CLOG10	Cooking aids	1=Oil, Electricity SBEE, Gas, 0=Other
Vulnerability index for living conditions		Sum of values/10

Table 38: Economic vulnerability

Variables	Description	Value
ECON1	Household's general economic situation compared to 5 years ago	0=Much worse now, 0.25=Slightly worse now, 0.50=Idequate, 0.75=Slightly better now, 1=Much better now better now
ECON2	How do you rate the general economic situation of the Household compared to that of an average household? village/community?	0= Below that of the average household, 0.50= Practically similar, 1 = Slightly better than the average household that of the average household

ECON4	The income generated by your business enables you to cover what proportion of your family's needs, currently?	1=over 75%, 0.75=between 50% and 75%, 0.5=25% and 50%, 0.25=between 5% and 25%, 0=less than 5%.
EDUC1	Were there any non in the last 12 months for lack of money?	0=yes, 1=no
EDUC2	Were any school expenses incurred over the past 12 months thanks to income from activities financed by the PAPVIRE?	1=yes, 0=no
SANTE9	Were there any non in the last 12 months for lack of money?	1=yes, 0=no
SANTE10	Has there been any health expenditure over the past 12 months thanks to income from activities financed by the PAPVIRE?	1=yes, 0=no
	Economic vulnerability index	Sum of values / 7

Table 39: Health vulnerability

CODE	Questions	Value
SANTE1	In the event of illness, you and your family, where do you go for treatment?	1= Public health center, Health center private healthcare, hospital, 0.25 = traditional healer, 0=Other
SANTE8	If yes, where was it treated?	1= Public health center, 0.75=Private health center,
		0.50=hospital, 0.25 = healer traditional, 0=Other
SANTE9	Were there any uncommitted healthcare expenses in the last 12 months? for lack of money?	0=yes, 1=no
SANTE10	Have you spent any money on healthcare in the last 12 months thanks to income from your business? funded by the FCDA?	1=yes, 0=no
Health vulnerability index		Sum of values / 4

Histogram of PSM