The enabling environment for gender and youth inclusion in the irrigated vegetable value chain in Mali

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Through action research and development partnerships, Africa RISING is creating opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment.

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Acronyms

2IS	Initiative for Irrigation in the Sahel
AHA	Hydro-Agriculture Development
CAAD	Comprehensive Africa Agriculture Development
CC	Climate Change
CNOP	Coordination of Farmers' Organizations
CREDD	Strategic Framework for Economic Recovery and Sustainable Development
CSCRP	Strategic Framework for Growth and Poverty Reduction
CSLP	Strategic Framework for Poverty Reduction (Cadre Stratégique de Lutte contre la Pauvreté)
DNSA	National Directorate of Food Security
EAF	Familial Agricultural Exploitation (Exploitation Agricole Familiale)
ECOWAP	Regional Agricultural Policy for West Africa
EIA	Environmental Impact Assessment
FNAA	National Fund for Support to Agriculture
FNAHA	National Hydro-Agricultural Development Fund
GIE	Interest and Economic Group (Groupement d'Intérêt Economique)
GOM	Government Of Mali
IWRM	Integrated Water Resource Management
IFR	Rural Financial Institutions
IVVC	Irrigated Vegetable Value Chain
LFA	Agricultural Land Law (Loi du Foncier Agricole)
LOA	Agricultural Orientation Law (Loi d'Orientation Agicole)
MEA	Ministry of Environment and Sanitation (Ministère de l'Environnement et de l'Assainissement)
MMEE	Minister of Mining, Energy, and Water
MS	Minister of Health
NCCS	National Climate Change Strategy
NGO	Non-Government Organization
NPCC	National Policy of Climate Change
PNE	National Water Policy (Politique National de l'Eau)
PAGIRE	National Action Plan for Integrated Water Resources Management
PDA	Agricultural Development Policy
PFA	Agricultural Land Policy
PI	Proximity Irrigation
PNDA	National Policy of Agriculture Development
PNIP	National Proximity Irrigation Program in Mali
PNIP-SA	National Priority Investment Plan in the Agricultural Sector
PNISA	National Investment Plan in The Agricultural Sector
PNPE	National Policy of Environmental Protection (Politique Nationale de Protection de l'Environnement)
PNSA	National Food and Nutritional Security Policy
PO	Peasant Organization
PolNSAN	National Food and Nutrition Security Policy
PPIV	Small Irrigated Village Perimeters
PPM	Small Market Garden Perimeters
PSNAN	National Strategic Plan for Food Security
SDAGE	Master Plan of Water Resources Management

SLM	Sustainable Land Management
SNDI	National Irrigation Development Strategy
SNSA	National Food Security Strategy
MEFPJCC	Ministry of Employment, Vocational Training, Youth and Citizen Building
MEM	Ministry of Water of Mali (Ministère de l'Eau du Mali)
VC	Value Chain

Summary

This report assesses the enabling environment for youth and gender inclusion in the irrigated vegetable value chain (IVVC). A total of 40 policy and 48 intervention documents were analyzed. The assessment includes policy and intervention analysis using an inventory database template. Cluster and cross-cluster analyses were conducted focusing on the strategies that enable or hinder women and youth inclusion in the IVVC. Following these steps, the results from the policy analysis were compared with the intervention analysis to complete a synthesis analysis. The latter focuses on the actor and stakeholder landscape, highlighting opportunities and barriers created by the policies and interventions toward an inclusive IVVC.

The findings show an Agricultural Value Chain (VC) offering several opportunities for the IVVC. The current policy framework pays little attention to IVVC and is characterized by inconsistency in framing gender guiding principles, including insufficient policies that favor youth and gender inclusion. The current IVVC focus is on a crop diversification strategy where cotton, cereals, and rice receive significant budgetary resources under subsidy programs. IVVC actors are not as well-organized as groups supporting other crops like mangoes, cashews, and gum Arabic. The challenges to better IVVC coordination include insufficient financial resources, participation related-problems, weak monitoring and evaluation, and the need for improved communication and information among actors. The effects of weak coordination exacerbated by security problems in some locations have limited the development of irrigation-related infrastructure.

To ensure an inclusive IVVC, it is necessary to:

- Enable a supportive policy and institutional environment and governance mechanisms for youth and gender IVVC inclusion and public and private investment,
- Enable private sector investments in irrigation supply chains, irrigated vegetable value chains, and horticultural subsectors,
- Enhance inclusive interventions to support youth and gender IVVC inclusion and economic empowerment, and
- Transform youth and gender inclusion and economic empowerment at the system level.

Introduction

Irrigation throughout sub-Saharan Africa (SSA) has the potential to boost agricultural productivity by at least 50%, thereby significantly contributing to the continent's food security and economic growth (Shah et al. 2020). However, the area equipped for irrigation is slightly over 13 million hectares, making up just 6% of the total cultivated area (Shah et al. 2020). The literature has identified key challenges to irrigation development in SSA (e.g., Nakawuka et al. 2018; Merrey and Lefore 2018; Lefore et al. 2019). They include land tenure insecurity, changing demographics in agriculture, labor shortages, and lack of infrastructure (e.g., roads, access to electricity and inadequate or poorly maintained irrigation infrastructure). Others include limited access to irrigation technologies and after-sale services (e.g., maintenance and spare parts), well-drilling services, lack of reliable markets (both in terms of the crop value chains and inputs), and limited access to credit and extension services.

The challenges above create barriers that prevent smallholders, women, and young farmers from entering or advancing within the irrigated agricultural value chain. Additionally, the heterogeneity of farmers and demographics influence the preferences for technologies, and therefore the level of entrepreneurship. Although there has been ongoing water policy reform in the region to accelerate irrigation production, the policy implementation has lagged for various reasons, including limited capacity and differing visions and expectations around irrigation development. Finally, these constraints are highly contextual and vary from country to country. These findings highlight the need for an enabling environment analysis to understand what influences participation of youth and women in the chains leading to successful interventions.

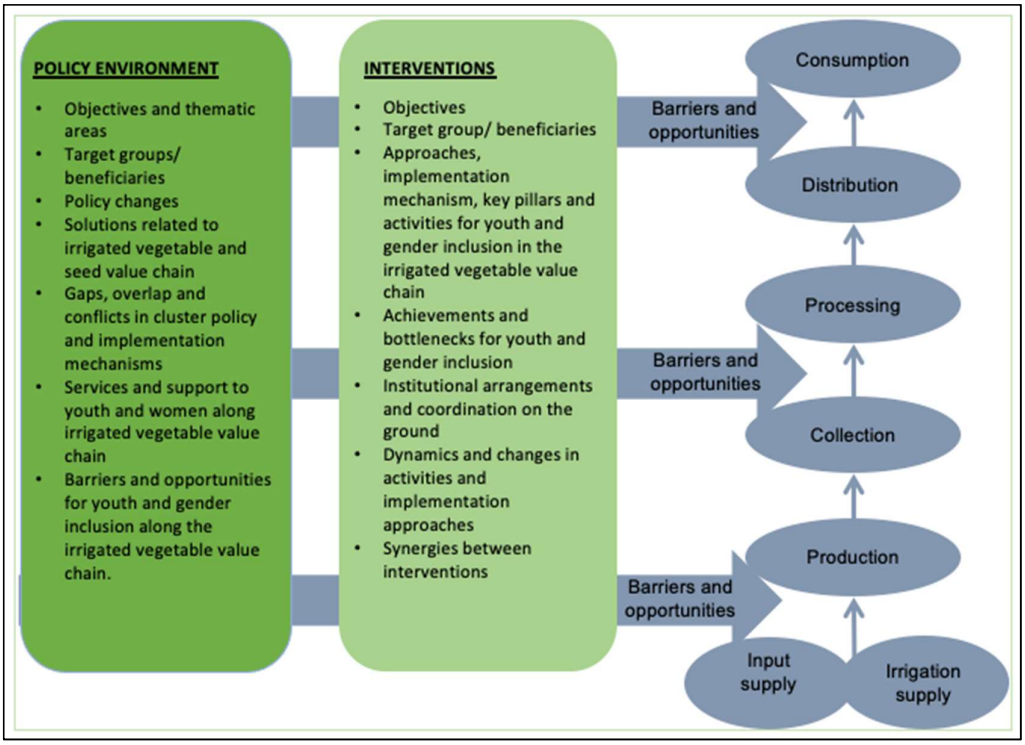
In Mali, the enabling environment assessment is being conducted to understand what influences farmers' adoption of irrigation technologies. To ensure youth and gender inclusion in the irrigated vegetable value chain (IVVC) it is necessary to understand the enabling factors and where in the IVVC these factors contribute to what level of participation. This requires a contextualization of the enabling environment analysis to recognize the enabling factors and link these factors to functions with specific participation levels of youth and women. This study, therefore, aimed to identify factors that enable the inclusion of women and youth along the IVVC, especially in the output and input markets for irrigated vegetable production. The analysis seeks to provide insights using these questions:

- What characterizes the enabling environment that facilitates the participation of farm families and enables the inclusion of women and youth within the IVVC?
- What factors enable youth and women's participation in different IVVC functions?

The report presents an analytical framework adapted from the enabling environment framework developed by Minh et al. (2021). It is followed by a description of the methodological approach and qualitative content analysis of policy framework and intervention landscape - two components in the enabling environment. The result section presents the single and cross-cluster analysis of the policies, interventions, key actors, and their roles in agriculture and water development. The report concludes with a synthesis analysis on barriers and opportunities and recommendations for youth and gender inclusion in the IVVC.

Analytical framework

In this report, we understand youth and gender IVVC inclusion as a form of social inclusion (Das et al., 2013). Specifically, women and youth VC inclusion refer to processes that enable individuals or groups to fully or partially participate in and benefit from the chain's activities. On the one hand, this process involves women's and youth's ability to engage with the value chain and use their resources to actualize their engagement. On the other hand, it involves removing contextual barriers and enhancing incentives from the supporting system (Sajuyigbe 2017). Understanding factors that influence the women and youth VC inclusion in Mali requires a comprehensive analysis of the enabling environment in which the IVVC operates. We, therefore, adapted the tools for analyzing the enabling environment (Minh et al. 2021) to the context of youth and gender IVVC inclusion. Figure 1 illustrates the analytical framework facilitating youth and gender IVVC inclusion.



Source: Adapted from Minh et al. 2021.

Figure 1. Framework to analyze enabling environment facilitating gender and youth IVVC inclusion.

We define the enabling environment in an irrigated agricultural value chain as comprising the policies, informal institutions, support services, and other conditions that create, improve, and maintain a general operational environment, bringing together value chain actors in a cooperative manner (Minh et al. 2021; Minh and Osei-Amponsah 2021). Therefore, the enabling environment can be divided into policy environment and intervention components.

The policy framework encompasses policies and regulations that establish the basis for youth and women VC inclusion and the chain actors' behaviors and power relationships affecting the inclusion. Hence, we analyzed policy frameworks, institutional arrangements, and governance to: (i) assess the focus, priority and perspectives of national and sectoral policies influencing the development of irrigated agriculture and irrigated vegetable value

chains; (ii) identify policy agenda and approaches for youth and women VC inclusion; and (iii) identify the enabling actors for the youth and women VC inclusion.

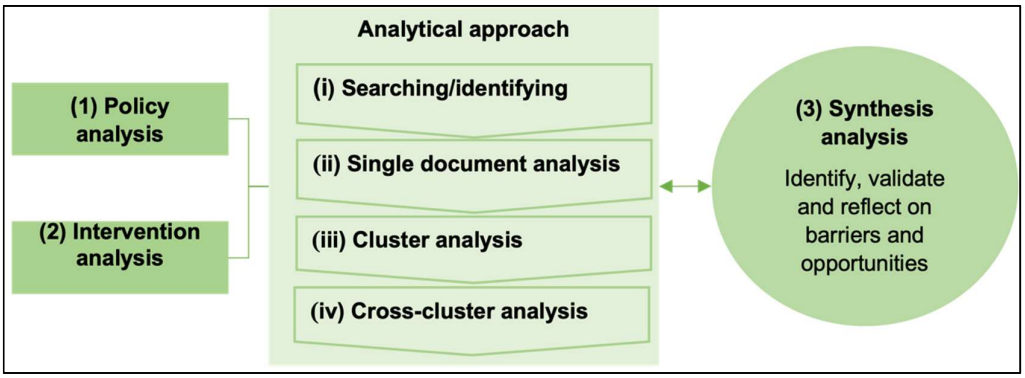
The interventions encompass government programs and projects and services and support provided by the private sector and other practitioners that enable youth and women VC inclusion. In the analysis of the youth and gender VC inclusion in these interventions, we explored: (i) diverse actors and their roles in the youth and women VC inclusion; (ii) dynamics and approaches that focus interventions and activities for youth and gender inclusion; (iii) achievements and bottlenecks for youth and gender inclusion; (iv) dynamics and changes in activities, implementation approaches, and new intervention directions; and (v) synergies between interventions.

Therefore, the factors influencing the youth and gender VC inclusion are barriers and opportunities that enable or hinder young and women actors' participation in the chain functions. The IVVC functions include input provision, irrigation supply, production, collection and trade, processing, distribution and consumption, and chain linkages. The input provision function includes activities supporting or facilitating access to seed, fertilizers, chemicals, and other inputs. Irrigation supply creates access to irrigation equipment and irrigated land. The production factors encompass access to land, credit, production equipment, and extension services. It also involves irrigation practices and water application. The collection and trading require information systems, trade negotiation, and knowledge of trade standards. It also includes access to infrastructure (storage, warehouses, transportation, etc.). Processing consists of any action aiming to transform and add value to agricultural products. Distribution and consumption relate to market development.

Methodology

Overall analysis process

The enabling environment assessment was carried out using the technical guide presented in Minh et al. (2021). The assessment is a stepwise process of analyzing policies and interventions and synthesis analysis, validation, and reflection, as illustrated in Figure 2. The policy and intervention analysis follow a similar analytical process of searching followed by single, cluster, and cross-cluster analysis. A qualitative content analysis approach was applied (Krippendorff 2004). Specifically, the text is coded to manageable categories—word, word sense, phrase, sentence, or theme—and then examined using elements in the analytical framework (Figure 2).



Source: Adapted from Minh et al. 2021.

Figure 2. Overall analysis process.

Policy analysis

Policy documents were collected from online sources and key informants. The research was national level targeting thematic areas from development policies and strategies specific to irrigation. Keywords used to select the documents included: food security, climate change adaptation, poverty reduction, rural development, water management policies, land ownership, and use policies. Additional keywords included agricultural development policies and strategies, environmental policies and strategies, irrigation development policies and strategies, agricultural extension policies and strategies, agricultural credit policies, and public-private partnership policies and strategies. One hundred and thirty-one documents were downloaded, of which 40 policy documents were analyzed and added to the policy database. The selection criteria were the relevance of the policy or strategy documents to directly contribute to youth VC inclusion or create a pathway to affect it indirectly. The criteria included keywords in the documents: irrigation, hydro-agricultural development, gender and youth inclusion, value chain approach, input supply, equipment supply, inclusive private sector development, vegetable production, horticultural product, market gardening, market access, and infrastructure development. Documents with no keywords were not considered relevant to this study.

The single policy analysis was carried out to capture each objective, targets, thematic areas, context, target group, target area, priority, implementation strategy, implementation mechanism, gaps related to women and youth IVVC inclusion, and other conflicting issues. The analyzed policies were categorized into seven clusters. Descriptive analysis at the cluster level presents the objectives, the priority areas, and the implementation strategies.

The policy cross-cluster analysis was carried out to investigate how the policy framework enables or hinders youth and gender VC inclusion in each chain function. The emphasis is to identify the whole policy framework's objectives, type of promotion, solutions, and gaps related to youth and gender inclusion in the various IVVC functions as illustrated in Figure 1. For each function, the analysis focuses on the policy instruments that enable youth and gender engagement into the function, the approach used, and the gaps.

Intervention analysis

The intervention document search was conducted using online sources with 129 documents downloaded and filtered based on the thematic areas. Following review, 48 interventions were inventoried in the database. The most used documents to support the intervention analysis were project appraisal reports, mid-term evaluation reports, project completion reports and a literature review.

Single intervention analysis explored objectives, target groups, key pillars, operational mode, irrigation technologies, youth and gender inclusion, achievements, bottlenecks, and lessons learned. Based on the thematic area of the interventions, seven clusters were derived from the single policy analysis.

Intervention cluster analysis explored objectives, thematic areas, target groups, policy changes, solutions related to irrigated vegetable and seed value chain (IVVC), gaps and issues. Single cluster narrative presents objectives, target groups, key activities categorized into components and gaps.

Like the policy cluster analysis, the intervention cross-cluster analysis was based on the different functions of the IVVC. The focus was to identify how the different activities undertaken through the interventions involve gender and youth in the different functions of the VC and the value chain as a whole. From this analysis, gaps were identified.

Synthesis analysis

In this section, two levels of the analysis are conducted. First on the different actors involved in the design and implementation of the policies and programs and the interaction between the actors. This step helped to highlight the different issues related to their functioning. Second, a holistic analysis is done by comparing the policy approaches with the intervention policies. This step helped to highlight how the policy environment creates favorable conditions (enabling opportunities) and how it hampers youth and gender inclusion (barriers). From this analysis, conclusions are drawn followed by recommendations to transform the barriers into opportunities to improve the inclusion in the IVVC.

Validation of the results generated from the analysis was conducted through interactions with relevant stakeholders. A multi-stakeholder meeting was organized to discuss the initial results emanating from the policy, interventions, and informal institutions analysis.

Scientific documents were accessed to support the analysis. The accessed documents were filtered based on their relevance to the focus of this study. The review process focuses on the research objective, research questions, key messages, interpretation or citation, thematic area and key findings, gaps, and recommendations. The different outputs from the literature have been used to support the analysis conducted on the policy content.

Policy framework toward gender and youth value chain inclusion

The Government of Mali has expressed a commitment to make poverty reduction a priority. This commitment is witnessed by reforming legislative and regulatory policies, strategies, and programs based on the short, medium, and long-term vision.
Table 1 presents an overview of the policy framework which influences youth and gender inclusion within the IVVC. The framework is categorized into seven clusters, namely general development, gender and social inclusion and decentralization, environment and climate change adaptation, food security, agricultural development, water resource management, and irrigation development.

General development policy

The general development cluster explores seven policies progressively developed and implemented since 2003. This cluster gives an orientation to the Malian economy and development toward poverty reduction by prioritizing economic growth, poverty reduction and food security:

- inclusive growth and structural transformation of the economy (CREDD 2019),
- food security and rural development, including infrastructure (GOM-CSLP 2002; GOM-CSLP 2006; MPIS-PNDM/PA 2016),
- promotion of accelerated sustainable growth favorable to the poor by creating jobs and income-generating activities, including self-employment (GOM-CSRP 2011),
- development of small- and medium-sized enterprises (SMEs) and performance of the agro-food sectors in which the poor are concentrated (GOM-CSLP 2000),
- preservation and sustainable natural resource management, and
- development of the financial sector.

This cluster highlights two strategies that enable youth and gender IVVC inclusion. The promotion of irrigated vegetable production emphasizes the expansion of irrigated agriculture and the diversification of fruit, vegetable, and protein products. There is an emphasis on organizing fruit, vegetable, and oilseed production to ensure market linkages, especially to export markets. Others focus on developing private sector SMEs, supporting infrastructure, financing rural development (GOM-CSRP 2011), establishing a 'free zone for export' in Sikasso, and abolishing airport fees to export fruits and vegetables.

Gender equity and inclusion are promoted at several levels. Applying Gender-Sensitive Planning and Budgeting is recommended to improve gender equality in Economic Recovery and Sustainable Development (GOM-CREDD 2015 and 2019) and strengthen the involvement of women's organizations in formulating the poverty and gender monitoring mechanisms (GOM-CSRP 2011; GOM-CREDD 2019). Gender empowerment in the rural development strategy emphasizes women's access to agroforestry plots, the organizational capacities of women's groups in agro-sylvo-pastoral areas, and their involvement in the forest and wildlife resource conservation and restoration programs. Agricultural development promotes women's access to modern conservation and processing techniques, formalizing and upgrading women's SME processing businesses and women's entrepreneurship by providing business skills training and a guarantee fund to improve their access to credit and facilitate the circulation of products (GOM-CSCRP 2011; GOM-CREDD 2019).

The new and current long-term vision in GOM-CREDD (2019) intends to 'create a favorable environment for economic diversification and strong and inclusive growth. However, it does not address agricultural water management issues. Strategies promoting youth and gender IVVC inclusion are absent as gender inclusion only emphasizes agro-forestry production and forest and wildfire resource conservation. This will make it difficult to monitor the policy's impact on youth and gender inclusion. Youth and women engagement in policy processes is logged as stakeholder engagement and is not employed in the policies development. The participation in the CREDD (2016–2018) development process, for example, was only limited to documents validation workshops, and the civil society representation was limited (Togola 2018).

Table 1. Overview of the policy framework for youth and gender IVVC inclusion.

Policy and cluster	Objective	Thematic areas	Target groups	Changes	Solutions related to IVVC	Gaps and issues
General development policy						
1. GOM-CSLP (2000) Strategic Framework for the Poverty Reduction: Interim CSLP 2. GOM-CSLP (2002) Strategic Framework for the Poverty Reduction: Final CSLP. 3. GOM-CSLP II (2006) Strategic Framework for Growth and Poverty Reduction 2007–2011 4. GOM-CSCRP (2011) Strategic Framework for Growth and Poverty Reduction 2012–2017 5. GOM-CREDD (2015) Strategic Framework for Economic Recovery and Sustainable Development (2016–2018) 6. GOM-CREDD (2019) Strategic Framework for Economic Recovery and Sustainable Development (2019–2023) 7. MPISP (2016)-PNDMF PA - National Micro Finance Development Policy and Action Plan-2016–2020	Inclusive and sustainable development for poverty and inequality reduction in a united and peaceful Mali, based on the potential and capacities for resilience	- Sustainable and inclusive development - Poverty alleviation - Food security - Reduction of inequality - Social well-being	Producer organizations in agriculture, farmer, rural population	- Two successive renewals and deepening of a basic strategy (2000–2006) until 2017 - Adoption of two new strategies (2015) based on Mali new medium-term (2025) and long-term 2040 visions	- Technology: Irrigated agricultural developments - Activities and practices: promote vegetable production, organize the of fruits, vegetables and oilseed sectors and its market, improve access of women to managed land, access of women to modern techniques, develop processing units, build business capacity - Services : access credit and finance, build organizational capacities, professional women's groups, technical and management capacities, - Approaches: Gender Sensitive Planning and Budgeting, decentralization, stakeholders' engagement and ownership and accountability	- Lack of specific strategy targeting youth and gender VC inclusion - Participation limited to documents validation workshops - Absence of agricultural water management strategy in the new long-term vision
Gender and social inclusion and decentralization						
1. MEFP (2000) PNA/ERP - National Action Programme for Employment to Reduce Poverty 2. MPFEF PNG (2011) National Gender Policy 3. MPFEF PNG/AP (2011) Action Plan for National Gender Policy 2011–2013 4. MAHSPA-PNPESS (2013) National Policy for the Promotion of the Social and Solidarity Economy 5. MATD-PND (2014) Framework Document for the National Decentralization Policy 2015–2024 6. MSAHRN-PNPS (2015) National Social Protection Policy	- Guarantee equality in development - Social and solidarity economy - Manage social risks - Prevent and manage calamities, disasters, catastrophes	- Equal rights - Participatory citizenship - Wealth and jobs - Fight against poverty - Territorial development - Social risks and assistance	Women and men and the most vulnerable population	- A shift from women's promotion to their systemic integration - Regionalization as part of the decentralizatio n reform	- Activities: train women in land-related technology packages promotes the proper application of the principles of integrated water resource management (IWRM), social protection to support the dynamism of populations, especially rural ones, in their activities - Service : facilitate access to loans at preferential rates to disadvantaged groups - Approach: decentralization	- Absence of agricultural water management strategy in the new long-term vision - Coordination problems within the ministries

7. MEFPJCC PRODEFPE (2015) -Ten-Year Vocational Training Development Programme for Employment (PRODEFPE) 1st Phase: Triennial Programme 2015–2017 8. The National Employment Policy (PNE)		- Creation and promotion of productive jobs - Poverty reduction				
Environment and Climate Change Policy						
1. GOM-PNPE (1998) National Environmental Protection Policy 2. GOM-PNF (2007) National Forest Policy 3. MEA-PNCC (2011) National Policy on Climate Change 4. MEA-SNCC (2011) National Climate Change Strategy 5. GOM (2016) Nationally Determined Contribution–CDN (2015–2020) **6.** Mali Climate Funds Investment Plan (2019–2023)	- To contribute to sustainable economic and social development - Environmental protection	- Climate changes - Poverty reduction and food security - Sustainable development - Environmental protection and restoration, and pollution control	Malian population including farmers and vulnerable population	- PNCC- single reference and integrated framework for climate actions	- Technology: development of water mobilization - Activities and practices : develop agribusiness, popularize improved varieties, good sustainable land management practices, strengthening policy for hydraulic facilities, promote local irrigation, rainwater recovery and irrigation system efficiency - Approaches: ensure equity, involvement and empowerment, multi-sectoral actors' participation	- Unclear strategy on women and youth inclusion in VC - Absence of specificity of crops to be valued - Poorly coordinated multi-sectoral approach - Disconnection between the central and local government - Institutional inactivity
Food security						
1. GOM- SNSA (2002) National Food Security Strategy 2. MS-PSNAN (2005) National Strategic Plan for Food and Nutrition (PSNAN) 2005–2009 3. GOM-PNSA II (2011) National Food Security Programme Phase II – 2011–2015 4. GOM-PNSAN (2017) National Food and Nutritional Security Policy **5.** GOM-PNSAN/AP (2019). National Food and Nutrition Security Policy : Action Plan 2019–2028	- Ensuring access to the necessary food - Improving the nutritional status resilience capacities	- Poverty reduction - Food and nutritional security - Resilience capacities - SDGs - Mortality reduction - Water control	- Vulnerable population - Private sector producer organization	- From programs and projects approach to a sectoral approach	- Technology: infrastructures development - Services : decentralized financial systems, guarantee fund for loans and access to MFIs - Activities and practices : strengthen production and productivity (research, private irrigation promotion, and vegetable crops intensification), market integration and information	- Focus on crops other than vegetables - Low involvement of private sector and poor implementation of policies - Youth and gender inclusion in the vegetable segment is narrowed to inputs and production
Agricultural development						
1. GOM-LOA (2006) Agricultural Orientation Law 2. GOM-FNAA (2010) National Fund to Agriculture	- To guarantee food sovereignty - The agricultural sector as the	- Rural poverty and food sovereignty - Family farming	Farmers, promoters, producers, and other users of	- Changes of agricultural orientation from a project	- Technology: irrigation infrastructure and mechanization equipment - Services : creating the National Agriculture Support Fund, financing	- Inclusion concentrated in production and processing

3. GOM-PNIP-SA (2010) National Priority Investment Plan in the Agricultural Sector 2011–2015 and 2015–2022 4. GOM-PDA (2013) Mali Agricultural Development Policy 5. GOM-PFA (2014) Agricultural Land Policy 6. GOM- PNISA (2014) National Investment Plan in The Agricultural Sector. 7. GOM-LFA (2017) Agricultural Land Law 8. MA (2020) National Seed Policy of Mali (PNSM)	engine of the national economy - Guarantee long-term availability and accessibility of certified seeds	- Environmental protection and natural resources management - Economic growth, agro-industry, agricultural development - Seed production	managed agricultural land	to a sectoral approach with sector budget support - Adoption of a new strategy for agriculture funding	seeds production, the promotion of rural credit and microfinance - Activities and practices : develop family farms, promote agricultural entrepreneurship, supply agricultural equipment, solve land speculation and transaction issues - Approaches: subsidiarity, complementarity, participatory approaches, consultation and shared responsibility, solidarity, equity and partnership and accountability	- Collection and market strategies not addressed - Subsidy is general - Vegetables are not a priority - Conflict in promotion of family farm and agro-business
Water resources management 1. GOM-CE (2002) WATER CODE. LAW N° 02-006 / JANUARY 31, 2002 2. MMEE-PNE (2006) National Water Policy 3. MMEE-PAGIRE (2007) National Action Plan for Integrated Water Resources Management 4. MEE-MPDMWR/SB (2012) Master Plan for Development and Management of Water Resources in the Sourou Basin - National Portion of Mali	- Ensure sustainable and equitable management of water resources to contribute to poverty reduction and sustainable development	- Use, conservation, protection, and management of water resources - Poverty reduction, IWRM and sustainable development	Vulnerable population, farmers, and their organizations	- A new approach integrating all actors in development sectors - Shifting sectoral approach to integrated management	- Technology: market garden wells, motor pumps and micro-irrigation equipment - Land and credit problems: promote land ownership, applied research in hydraulic installations and equipment, pricing policy for the recovery of hydro-agricultural fees, and integrate women more into irrigation projects, encouraging agro-business and agro-industrial exploitation and capacity strengthening - Approaches: IWRM with river basin or aquifer system approach, social equity and gender inclusion	- Lack of youth involvement - Lack of conflict management in the water code and awareness on water management and use during PAGIRE process - Weak communication among actors - Ineffective consultation framework - Weak leadership and conflicting roles in the water administration
Irrigation development 1. GOM (1999) National Irrigation Development Strategy	- The search for food security which necessarily	- Food security, poverty reduction,	Professional agricultural organizations,	- The sectoral approach transition	- Technologies : water mobilization infrastructure, application	- Difficulty transferring

2. GOM (2008) National Irrigation Development Strategy-Review 3. GOM (2012) Local Irrigation Development Programme (PNIP) 4. GOM-PNIP/Training (2015) National Training Plan for Intermediate Proximity Irrigation Stakeholders for The Implementation of the National Proximity Irrigation Programme	involves the sustainable securing of agricultural production	growth and resilience - Irrigation and hydro-agricultural development - Proximity irrigation - Migratory phenomena	family farms and agricultural enterprises	- A shift from irrigation to a production system and stakeholder consultation	technologies and small-scale irrigation - Activities and practices : improve the production and productivity of vegetable crops, conservation and processing techniques for the export market - Services : development of an apprenticeship curriculum - Approach: participation and consultation	infrastructure to communities - The concentration of resources in one institution - Women and youth promotion limited to production - Inclusion limited to production - Limited value addition

Gender, youth and social inclusion and decentralization

This cluster encompasses seven policies and plans on gender inclusion, social and solidarity economy, decentralization, social protection, and employment since 2000 (Table 1).[1] It aims to strengthen inclusive governance by improving gender involvement and leadership in local, administration management, promoting social, solidary economies, and creating productive jobs for poverty reduction. The cluster prioritizes:

- equal access and fundamental rights for women and men,
- development of human capital to address the socio-economic challenges and local cooperative and gender employment (GOM-PNG 2011; PNG/AP 2011; MAHSPA-PNPESS 2013; MSAHRN-PNPS 2015),
- promotion of labor-intensive jobs, vocational/technical training, and business development, and
- development of professional qualifications and human resource skills to achieve growth (PRODEFPE 2015).

Financial access is a key factor in agricultural development and poverty reduction. Women's land right has often been excluded, causing land-use conflicts and negative impacts on household food security (FAO and ECOWAS Commission 2018). Addressing these issues, policies strengthen women's organization and social capacity to support their degraded land recovery and land access for productive activities (GOM-PNG 2011; GOM-PNG/AP 2011; GOM-LFA 2017). Policies set up support programs to increase women's access to agricultural credit and create financing sources (Support Fund for the Empowerment of Women and the Development of the Child (FAFE) to support women's entrepreneurship activities, improving the labor output and productivity of rural women (GOM-PNG 2011; GOM-FAFE 2012). This fund contributes to strengthening women's capacities to manage their organization through technical and professional training and supporting women entrepreneurs for access to financing from financial institutions.

The cluster also addresses employment development. Through the PRODEFPE, the government intends to promote the professional integration of women and youth. Strategies consist of rehabilitating and creating training centers comprising Rural Animation Centers (CAR), Agricultural Apprenticeship Centers (CAA), Vocational Training Centers, Development Education Centers and Women's Learning Center (CAFé) (GOM-PRODEFPE 2015). These centers are mandated to provide training in the agricultural and livestock sectors, fishing techniques and others. Measures including providing equipment to work at their own business and supporting women's associations will follow to facilitate the professional integration of the trained women and youth from the centers.

This cluster highlights the institutional framework for women empowerment and inclusion. The sectoral policies (e.g., water, agriculture, environment, and energy) promote gender mainstreaming in development. Unfortunately, those concepts were not objects of common understanding and consensus implementation (GOM-PNG 2011). Therefore, there is a shift to the systematic integration of women. One of the focuses of the systemic integration approach is institutionalizing gender equality in administrative management fields.

[1] Some policies recently issued in agricultural development and climate change clusters also target youth and gender inclusion but those are excluded in this cluster.

This cluster sets the basic conditions for gender inclusion, allowing women to legally access production factors such as water, land, and credit, which constitute components of the agricultural value chain and capacity building for youth and women empowerment. There are complementarities to strengthen inclusive governance, social inclusion, and decentralization through strengthening partnership, participation (MPFEF PNG 2010; PNG/AP 2011; MSAHRN-PNPS 2015), solidarity, equity (MAHSPA-PNPESS 2013; MSAHRN-PNPS 2015), and collective responsibilities (MAHSPA-PNPESS 2013) and gender equity (MSAHRN-PNPS 2015).

However, the sectoral policies' youth and women empowerment approach does not have a consistent framing of guiding principles. This can result from the lack of coordination among ministries. Women and youth employment targets training in the agricultural sector but is still general and does not specifically target the IVVC and irrigation development. The 2019 gender report shows that women are still constrained by limited access to factors of production, particularly land, technology, and credit. This constitutes a handicap to the integration and employment of women. For example, in 2017, women owners of rice plots were 14.71% in the Office riz Mopti zone and 8% in the Office riz Ségou zone (GOM-Gender Report 2019). In addition, the unemployment rate in 2018 was 10.6% for women compared to 8.3% for men.

Environment and climate change policy

This cluster explores six policies and strategies in the fields of environment, forest, and climate change. It aims to achieve sustainable economic, social development, and food security in an environmental-friendly way. The cluster prioritizes aspects that support the development of agriculture in general and irrigated farming, such as:

- natural resources management and environmental protection (including forest resources management, wildlife, and its habitat, fishing, and aquaculture and soil/water/biodiversity conservation) (PNPE 1998; GOM-PNF 2007; MEA-PNCC 2011[2]), and
- agriculture, climate change management and adaptation (MEA-PNCC 2011; MEA-SNCC 2011; GOM-CDN 2016; Climate Funds 2019).

The cluster promotes strategies that support agricultural value chain development. It targets agricultural intensification and diversification through disseminating improved seed varieties, good agricultural practices, and sustainable land management (e.g., cultivation techniques, rainwater harvesting techniques, dune fixation, reforestation and sustainable land management) (MEA-SNCC, 2011). It also promotes the agribusiness and private sector development through strengthening agro-industry creating a value-added component for certain agricultural products.

The cluster supports irrigation development by promoting local irrigation, rainwater recovery, and efficient irrigation systems (e.g., limit losses and resort to gutters) (MEA-SNCC 2011). It develops the inter-sectoral approach by integrating the Agriculture Orientation Law[3] (GOM-LOA 2006) and the National Water Policy in the National Policy of Climate Change (2011). Article 173 of the law states that "*the agricultural sector promotion policy takes into account the strategic sectors, in particular, cotton, rice, fruits and vegetables,*

[2] National Climate Change Policy is a long-term vision, which aims to define by 2025 a framework for sustainable socio-economic development that integrates the challenges of climate change in all sectors of its development to improve the well-being of populations.

[3] Agricultural Orientation Law translated from French "Loi d'Orientation Agricole (LOA)"

livestock, meat, poultry, fishery products, oilseeds and dry cereals." Different programs planned for climate change adaptation are integrated into the Nationally Determined Contribution—2015-2020 (GOM-CDN[4] 2016). Further, Mali Investment Plan (2019–2023) sets the Climate Funds (Fonds Climat Mali) to mobilize funds for implementing related programs continuously. The Investment Plan promotes gender equality through income-generating activities for women, the socio-economic integration of youth, and indirectly supervising private sector investment into climate change adaptation (Climate Funds 2019).

This cluster addresses irrigation equipment supply and value chain development. However, the crops to be diversified and the ones to be processed are general without specifying vegetables. The cluster promotes equity but has no clear strategy and guidance for gender and youth IVVC inclusion. By targeting sectoral policies, this cluster creates a coordinated multi-sectoral approach that favors the repetition of actions. Interventions across sectors are not well-coordinated given the limited participation and ownerships from different actors, especially the beneficiaries (Traoré et al. 2016). There is a disconnection between the central and the local levels due to weak coordination. This is due to the poor resource allocation concentrated at the national level and the lack of institutional mechanisms and policies knowledge. Policies always develop a monitoring and evaluation (M&E) system, which is a prerequisite to getting support from technical and financial partners. Unfortunately, M&E is not usually carried out (Traoré et al., 2016). The absence of M&E makes it difficult to evaluate the effectiveness and integrate the lessons learned from the policy implementation into future policy development. Finally, there is institutional inactiveness in ministries and public services. The National Climate Change Committee (CNCC) and the Environment and Sustainable Development Agency (AEDD) were established to support the implementation of the National Strategy of Climate Change (SNCC). However, the CNCC has not been very active. The AEDD is the executive entity in charge of coordinating the national response to climate change and evaluating the implementation of the PNCC, the SNCC, and the PANC (2011, 2015). It has encountered difficulties fulfilling its mandate, partly due to recurrent changes in ministers and public services (Zamudio 2016).

Food security cluster

The cluster includes five policies targeting the period from 2002 to 2028. It aims to ensure permanent food access to the Malian population and improve the nutritional status and resilience capacities of the most vulnerable strata. The cluster prioritizes:

- improving the impact of agricultural production on the availability, stability, accessibility, and use of food to adjust the supply to the food demand of the population,
- preventing and reducing all forms of malnutrition,
- preventing crises and reducing or mitigating their effects on vulnerable populations and facilitating food accessibility to households to prevent food and nutrition insecurity (MS-PSNAN 2005; PNSA II 2011; PNSAN 2017; PNSAN/AP 2019), and
- improving the institutional and financial governance of food and nutritional security (PNSAN 2017; PNSAN/AP 2019).

Three aspects supporting the inclusion of women and young people in IVVC are highlighted. Agricultural value chains development is promoted to improve the production and productivity of agricultural products, including market gardening and fruit crops (PSNAN

[4] Nationally Determined Contribution–CDN (Contribution Déterminée au niveau National). According to the Paris Agreement, CNDs *embody efforts by each country to reduce national emissions and adapt to the impacts of climate change.* They are renewable each 5 years. CDN-Mali review is underway for the next 5 years.

2005; PNSA II 2011; PAMN 2014; PNSAN/AP 2019), by strengthening the seed production system and phytosanitary protection. It also involves operational research, training, disseminating research results, local manufacturing, and providing production tools to improve agricultural mechanization and support community seed storage. As part of diversifying food production, strategies promote high nutritional value crops such as fruits, vegetables, and legumes through market gardening schemes to ensure year-round availability for household consumption (PNSAN 2017; GOM-PNSAN/AP 2019). The schemes include youth and women's vegetable gardens and community market gardens.

Market linkage and integration promote processing, storage, transport, and marketing infrastructure investments. It consists of developing investment programs to improve national and regional market infrastructure and institutions, construction and rehabilitation of production roads and tracks, rail transport, and the main cross-border corridors to facilitate export for the private sector. The investment programs target professional organizations, particularly youth and women, to benefit from the credits necessary for infrastructure for processing, conservation, storage, and packaging of agricultural products. Improving access to reliable and market information systems, strengthening international trade negotiation capacities, and training in trade standards that govern sub-regional, regional, and international trade are also indicated (GOM-PNSAN/AP 2019).

Improvement of youth and women access to production factors emphasizes increasing access to agricultural land, inputs and equipment, market garden schemes, and paid employment in the agricultural sector (GOM-PNSAN 2017). It also involves strengthening their production capacities and technical itineraries and funding for projects and programs for conservation, processing, and marketing agricultural products (e.g., cereals, meats, milk, and derivatives) and aquaculture production.

The cluster promotes women and youth in conservation, processing, and marketing with a focus on other crops rather than vegetables. Further, youth and women's inclusion in the vegetable segment is narrowed to inputs and production despite the functions addressed in this cluster. The policy development encountered limited private sector involvement due to the lack of consultation, low human capacity, and insufficient political will. This caused the lack of interest of the private sector and the low motivation of actors to participate in the policy processes (Samaké et al., 2019). The inefficient policy implementation is also linked to an insufficient mobilization of financial resources and insufficient human resources in quantity and quality at all levels of the agricultural profession (both public and private sectors) and a weak M&E system. Such situations are likely to influence the value chain's effectiveness and therefore will not benefit women and youth.

Agricultural development cluster

The cluster analyzed eight policies, regulations, and plans for the agricultural sector, targeting 2006 to 2020. This cluster aims to develop the agricultural sector as an engine of the national economy and guarantor of sustainable food sovereignty. It prioritizes:

- agricultural water resources management, including irrigation systems (GOM-LOA 2006),
- agricultural investment, financing, and credit (GOM-FNAA and PNIP-SA 2010),
- land development and management (GOM-PFA 2014; LFA 2017), and
- seed development and investment (GOM-PNSM 2020).

This cluster highlights three aspects supporting youth and gender VC inclusion. Agricultural value chain development has been stated in the strategic orientation of the GOM-PDA

(2013), which focuses on improving the competitiveness of agricultural and agro-industrial products on domestic, sub-regional, and international markets. It promotes competitive and efficient crop production sectors, agricultural subsidies to achieve the objectives of the GOM-PDA, and mechanization (e.g., equipment supply, support for private and public sectors, and training farmers on equipment maintenance). It also involves the creation of added value through the certification of national products and promoting Malian product consumption. Emphasis is placed on developing agricultural research and advice systems for sustainable and competitive agriculture to select, disseminate and conserve plant and animal genetic resources.

Further, there are extension and specific advisory support and crop protection (MDR-PNISA 2014) and support transactions, land tenure, and abusive customary land tenure (GOM-PDA 2013). Policies encourage local production of agricultural inputs such as seeds, equipment, and tax reduction for raw materials used for agriculture (GOM-LOA 2006). Vegetable production development is stated in article 173.b in Agricultural Law and the GOM-PDA (2013): "*The agricultural sector promotion policy takes into account the strategic sectors, in particular, cotton, rice, fruits and vegetables, livestock, meat, poultry, fishery products, oilseeds and dry cereals."* Production of crops including potatoes, onions, and tomatoes is promoted through supporting access to inputs such as improved plant material, fertilizers, and phytosanitary products (GOM-PNISA 2014).

Over the cluster, policies promote investment in agriculture. The National Agriculture Support Fund (FNAA) is promoted to guarantee loans for farmers (Article 2-FNAA), finance seeds production (PNSM 2020), and subsidize crops (GOM-PDA 2013). The investment also emphasizes irrigated agriculture, family farms, small-scale irrigation, market gardening, and agricultural entrepreneurship particularly in large-scale irrigation areas (GOM-PNISA 2014; GOM-PDA 2013). Investment into agricultural mechanization focuses on supplying farmers with agricultural equipment, strengthening the private sector roles, coordinating and supporting the state structures, and training farmers in maintaining agricultural equipment and materials. Investments in agro-industrial processing, storage and marketing infrastructure are also highlighted (GOM-PNISA 2014; GOM-PDA 2013).

Finally, different policies promote equal access to production resources for women and the youth. This includes strengthening women's and youth's access to production factors such as technical and financial support (Article 24, GOM-LOA 2006) and equitable access to agricultural land and allocating land according to the preference of women, young and vulnerable groups with public funds (GOM-LOA 2006; GOM-PDA 2013; PNSM 2020). *"At least 15% of land development by the state or local authorities are allocated to groups and associations of women and young people established in the area concerned"* (Article 13, LFA 2017). Specific targeting women's empowerment consists of promoting the participation of rural women's and vulnerable groups in decision-making, training rural women in leadership, and supporting rural women entrepreneurship with production, service, and processing equipment (PFA 2014).

However, this cluster lacks strategies and guidance on agricultural product marketing and processing. Further, vegetables are less privileged by policies compared to cotton and cereals. Around 95% of the subsidized inputs are for cotton and cereals production (USAID and Cross boundary 2018). Vegetables were not a target of the National Priority Investment Plan in the Agricultural Sector (PNIP-SA) adopted by the government. As a consequence, there is no specific subsidy program for vegetable production. Vegetable producers have no information on the existing subsidies (Adétonah et al., 2015). Therefore, they must buy their

fertilizers at market prices (Theriault et al., 2018). There is a conflict in promoting family farms and agriculture investment. Despite the recognition of family farms, the government seems to pay more attention to agro-investors, which results in land tenure insecurity for family farmers. Public interventions intend to attract more private investments through tax exemption and land access (Mamadou and Guillaume 2020). Finally, most strategies targeting gender and youth inclusion focus on access to production factors with exceptions for women who are supported in service and processing functions.

Water resource management and development policy cluster

This cluster explores four policy documents. The cluster aims to achieve sustainable and equitable water resources management and contribute to poverty reduction and sustainable development. The cluster prioritizes:

- development of master plans for river basin management to identify priorities of development and promotion of an efficient regional economy (GOM-CE[5] 2002; MEME-PNE[6] 2006; MEM-Master Plan[7] 2012),
- creation of an enabling environment and reforming the institutional and organizational framework (MEME-PAGIRE 2007), and
- promotion of water resources management in a concerted and holistic manner.

This cluster addresses youth and gender VC inclusion in two aspects. Private sector development is promoted by improving access to land and credit. The private sector intervention capacity and field of action are extended to the design, construction, and operation of hydraulic structures (MEME-PNE 2006; MEME-PAGIRE 2007). Policies also promote private sector investment in developing technologies such as market garden wells, motor pumps, and micro-irrigation equipment (MEM-Master Plan 2012). The investment will be based on two forms: the demand-based approach to respond to the beneficiaries' demands and the labor-intensive approach to ensure economic profitability and reduce the investment costs of projects (MEME-PNE 2006).

Gender and social equity in water management are highlighted by developing opportunities for women to participate and undertake income-generating activities in the water sector (MEME-PNE 2006; PAGIRE 2007). It also promotes good water resources management through building farmers' capacity to manage equipment, applying a pricing policy to recover the cost of investment in irrigation (MEME-PNE 2006; Master Plan 2012), and strengthening research for development for hydraulic installations, equipment, and soil conservation. Irrigation, water-saving, mechanization, and cultivation techniques are also promoted (Master Plan 2012).

Although this cluster promotes social equity, it lacks a specific strategy and implementation guidance targeting youth involvement and their access to production factors. Further, the cluster lacks guidance on managing the conflictual issues which emerge from different actors' access to natural resources. For example, the water code does not address conflict management (Nientao 2017). The decentralization process is promoted in water resources management through the Local Committee of Water (CLE). However, there is a lack of awareness of local water management and its use during the process of the integrated water resource management (IWRM) action plan (GWP/AO 2009). There is also ineffective

[5] CE—Water Code (Code de l'Eau, 2002) is under review.

[6] PNE—National Water Policy (Politique Nationale de l'Eau) is also under review, but the new version is not yet published.

[7] The Master Plan of Sourou (Schéma Directeur D'aménagement et de Gestion des Ressources en Eau du Bassin Du Sourou) is a long-term vision (2035) of water management at the basin level.

communication among actors in the sector, insufficient management of an emerging private sector, and poor information and communication. This results from a lack of financial resources, leading to institutional corruption in the sector (GOM 2018).

The resources management promoted by the policies is ineffective. The water administration's viewpoint is not considered in irrigation infrastructure realization. It results in the building of wild dams on watercourses and the waste discharge by mining operators. Such a situation leads to inefficient water use and environmental pollution. Years after adopting the holistic management approach, water resources are subject to more threats linked to silting, displacement of beds, and deterioration of water tables. Additionally, pollution of various kinds and many conflicts are noted (Nientao 2017). There is a loss of holistic control and an absence of leadership for which the water administration is responsible. The water administration positions itself as lead on drinking water supply in rural areas. This results in a conflicting role as the rural water supply has been transferred to local authorities (GOM 2018).

Irrigation development cluster

This cluster explores three policy documents as presented in Table 1. The cluster aims to improve food security, develop productive and sustainable agriculture, and provide financial and material resources support for local irrigation development. It prioritizes:

- increase of production and productivity in the irrigated areas and efficiency of irrigation systems through optimizing the design of the facilities and reducing their installation costs,
- improvement of the management of irrigation facilities and facilitation of financial access, and
- legal and institutional reforms to boost irrigation development and minimize negative environmental impacts and social conflicts generated by developing irrigation.

This cluster contributes to youth and gender inclusion in several ways. It promotes IVVC development through production diversification. This is done by developing village irrigation schemes, including off-season or market gardens[8] in areas managed by women. Individual irrigation projects, Village Irrigated Schemes (PIV), and treadle pumps are also included (SNDI 1999 and SNDI 2007/2008 review; GOM-PNIP 2012; GOM-PNIP/training 2015). It contributes to building local irrigation actors' capacity by developing production and post-harvest training curriculum, improving the production of vegetables, conditioning, and processing techniques and increasing the export market share. Root, bulb, leafy, and fruit vegetables are the cluster's focus (GOM-PNIP/Training 2015).

This cluster also promotes specific youth and gender inclusion. Regarding youth, there is the promotion of pay-as-you-own schemes, which are in high demand by youth in the irrigated farming sector (SNDI 1999 and SNDI 2007/2008 review; PNIP[9] 2012). The cluster also favors equitable and secure land access to youth (PNIP 2012). Equal land access is promoted for women farmers. It promotes benefits to women from capacity building in the planning process during irrigation infrastructure development and the added value of products from

[8] Market gardens/vegetable (*jardins potagers ou jardins maraîchers* in French) are the relatively small-scale production of fruits, vegetables and flowers as cash crops, frequently sold directly to consumers and restaurants.
[9] PNIP- Small-Scale Irrigation Promotion Programme was developed to cover the 2012–2021. The scope of the PNIP is limited to the development of lowlands, controlled submersion along large rivers, small village irrigated market garden schemes, small dams, recession cropping systems and ponds in lake areas, water retention works in wadis and oases in all eight regions of Mali (GOM 2012).

vegetable farming (GOM-PNIP 2012). The mid-term evaluation report on PNIP confirmed the proper integration of the program into the gender approach (Hertzog et al. 2019), especially in applying the Agricultural Land Law (GOM-LFA 2017).

However, PNIP still insufficiently integrates strategic aspects. Transferring infrastructure or the sustainable management of natural resources to communities is not yet effective. The resources are more concentrated at the level of a single institution (National Directorate of Rural Engineering and its branches) than others (National Directorate of Agriculture and the Planning and Statistics Unit of the Rural Development Sector). The latter are less well-funded to perform the functions incumbent on them under the PNIP (Hertzog et al., 2019). Although this cluster promotes youth and gender inclusion, its scope is very limited. The cluster develops capacity building within the agricultural VC (production, conditioning, and processing), but women and youth engagement in the chain are limited to production.

Overall assessment of policy environment toward gender and youth value chain inclusion

In IVVC development, five functions have been identified across the clusters analyzed. In addition, strategies directly targeting the whole chain linkages are also mentioned. Table 2 presents an overview of the VC function with the approaches and services toward youth and gender inclusion.

Input supply provides chemicals, equipment, and seed for production. Across the clusters, strategies contributing to youth and gender inclusion in the VC include the promotion of local inputs for production, research for development (R&D), and agriculture intensification and diversification. Local inputs production is encouraged and promoted t by reducing taxes for raw materials. There is financial support for seed production through the National Agricultural Fund Support (FNAA). This contributes to improving the availability of selected seeds for irrigated and rain-fed crops (storage, quality control, and certification). The R&D contributes to increasing the availability of quality and certified seed.
Agricultural intensification and diversification promoted across the clusters create the opportunity for high nutritive crops development generating opportunities for vegetable seed production. Policies promote equity and youth inclusion in accessing inputs. However, some shortcomings are noticed.

The strategies promoting inputs are general, and no specification is made regarding vegetables. Also, the policy framework seems to prioritize crops other than vegetables. While the government pursues a crop diversification policy, it allocates significant budgetary resources to input subsidies for cotton (FAO 2017a; USAID and Crossboundary 2018). There are no specific strategies targeting women and youth. Theoretically, access to inputs is guided by equity, meaning that men and women can benefit from subsidies on inputs for applicable crops. Unfortunately, it is difficult for women and youth to get access to these inputs for men.

Irrigation supply addresses the provision of irrigation equipment, products, and services to farmers who irrigate their farms. Different irrigation systems are promoted across the clusters for private irrigation development and high nutritional value crops, therefore creating opportunities for women and youth. There is an investment in irrigation technology, including market gardening wells, motor pumps, and micro-irrigation equipment. Various irrigation systems targeting women and young people, particularly individual irrigation and village irrigated perimeters, are being promoted. The private sector's roles are extended to

designing, constructing, and operating hydraulic water structures. Different irrigation schemes, including individual irrigation and village irrigated schemes, targeting women and youth are promoted.

There is a new trend in accessing the schemes as current policies promote local irrigation that encompasses old and new systems through the 'Programme National de l'Irrigation de Proximité' (PNIP). It involves lowlands development, controlled submersion along large rivers, small village irrigation, and market garden schemes. Also included are small dams, flood recession cropping systems, ponds in lake areas and water retention works in wadis and oases. Criteria to enforce beneficiaries to act as a community collectively (being an association–OPA, EAF, and EA), physical, and financial commitment and the technical suitability of the site of the irrigation schemes (topography, water, and soil resources) are developed. The mid-term implementation report showed a successful integration of the gender approach and the involvement of women in the decision-making process.

However, the weak M&E system makes it impossible to determine the percentage of women and youth who have had access to the irrigation system since the program started. As defined in the program, the transfer of the scheme's management responsibility to the local authorities is not effective. The local authorities still lack technical, human, and financial resources to take charge of the irrigation systems (Hertzog et al., 2019). Other institutional issues are mentioned in the sub-section of key actors and roles.

Table 2. Overview of the policy environment for youth and gender IVVC inclusion.

Categories	Strategies	Shortcomings
Input provision (seed, fertilizers, chemicals, tractors and harvesting machines)		
Local input production	- Reduce tax on raw materials for inputs production - Support funding to seed production	- Unclear taxation scheme for raw material inputs - Absence of specific strategy for women and youth access to inputs
R&D Agricultural intensification and diversification	- Strengthen seed production research - Improve selected seeds availability for irrigated and rain-fed crops (e.g., storage, quality control and certification) - Supply inputs and equipment like improved plant material, fertilizers and phytosanitary products for crops	- Inputs supply priority given to other crops (e.g., cereals and cotton) rather than vegetables
Irrigation supply (equipment, scheme, irrigation supply chain and private sector investment)		
Promotion of private sector	- Promote private sector investment in developing technologies - Strengthen private sector capacity and role in the design, construction and operation of hydraulic water structures - Promote private irrigation as well as individual irrigation schemes	- Gap to address water governance conflicts and clear women and youth guidance for implementation
Promotion of youth and gender inclusion	- Promote pay-as-you-own for youth in irrigation farming - Promote village irrigation schemes and treadle pumps for women - Promote local irrigation, rainwater recovery and efficient irrigation systems	
Production (land policy, ILM, production equipment, extension, credit access, collective economy, and action)		
Agricultural intensification and diversification	- Invest in irrigated agriculture (small and large schemes) and mechanization - Support fund and loans to farmers and subsidy of crop production through the creation of the FNAA - Support R&D in hydraulic installations, equipment and soil conservation, irrigation research on techniques promoting water-saving, mechanization and cultivation techniques	- Limited tailor-made storage and infrastructure for vegetables - Training centers are general - Conflicting policies in the family farm and agro-business promotion
Youth and gender inclusion	- Support women in degraded land recovery and land access - Strengthen private sector and women and youth access to production factors (e.g., land and financial support) - Establish agricultural training centers for women and youth - Provide the trained women and youth with equipment - Promote rural women leadership and decision-making - Create opportunities for women's income-generating activities in the water sector	- Absence of women and youth and vegetable tailor-made subsidy strategies - Equity promotion but an absence of clear guidance for implementation
Collection and trade (formal and informal trade)		
Market information and linkages	- Improve access to reliable market information systems - Strengthening of international trade negotiation capacities	- No vegetable-specific strategy for trading

	- Popularize trade standards that govern sub-regional, regional and international trade - Develop capacity-building support program for women business operators	
Processing		
Promotion of women in processing	- Increase access for women to modern techniques in the processing sector - Build processing units managed and operated by women - Build processing capacity for women - Improve agro-processing skills	- Absence of vegetable processing strategies for youth
Distribution and consumption (infrastructure, demand creation, market information access, innovation, and storage)		
Market integration and linkages Crop diversification for food security	- Abolish airport fees on vegetable exports - Develop a free zone enclave for exports - Construct, rehabilitate, modernize market infrastructure - Reform fruits, vegetables and oilseeds sector - Develop transportation infrastructure - Promote crop diversification to ensure year-round food availability - Support private sector investment	- Private business strategy not specific to vegetables
Whole chain linkages		
Value chain approach for food diversification and production	- Expand and diversify irrigated agriculture - Develop rural sector infrastructure - Invest in processing, storage, transport and marketing infrastructure for the private sector - Improve the competitiveness of agricultural and agro-industrial products on domestic, sub-regional and international markets - Develop agricultural research and advice systems - Provide agricultural subsidies and mechanization - Develop off-season vegetable production for women - Build technical and business capacity for value chain actors	- Constrained crop diversification and processing strategies - Absence of strategies and guidance in collection and marketing functions
Youth and gender inclusion	- Apply Gender-Sensitive Planning and Budgeting - Support women in agro-processing - Set up guarantee fund to improve women's access to credit - Promote high nutritional value crops in community market gardens operated by women and youth - Improve women's and youth access to production factors	- Inconsistent guiding principles - Equity promotion but the absence of clear guidance for implementation - Gender inclusion strategies focus on production function - Women and youth capacity building limited to production

Production involves access to land, credit and production equipment, irrigation practices, and extension services. Across the clusters, the policy framework guarantees the adoption and application of gender-related policies and programs in natural resource management, especially focusing on equity between men and women. This includes equitable land and credit access. The policy framework enforces the allocation of 15% of land developed by the state or local authorities to groups and associations of women and young people. Women and youth's technical, professional, and organizational capacity will be strengthened to facilitate their integration. There is the establishment of centers for women and youth to train them and support them with equipment. Specific strategies regarding credit access for women are creating the Support Fund for the Empowerment of Women and the Development of the Child (FAFE) to finance women's entrepreneurship development activities to improve the labor output and productivity of rural women. By promoting agricultural intensification and diversification, strategies across the clusters target investment in irrigated agriculture (small and large schemes) and mechanization. In addition, the National Agricultural Support Fund supports loans and crop production subsidies for farmers.

Although the framework promotes women and youth access to production factors, applying developed land allocation is still challenged in village areas where women mostly cultivate vegetables. Instead of having access to land, they have a restricted and temporary right to land use. According to Alimata Traoré, president of the Convergence of Rural Women for Food Sovereignty of Sikasso (COFERSA), this situation is linked to social, cultural, and religious constraints (AMAP 2019). The training centers mentioned in the framework target agriculture without specifications made for vegetable production. The framework addresses storage infrastructure development mostly dedicated to other crops (e.g., cereal storage banks). This situation could lead to an absence of vegetable storage infrastructure. There is conflict in the framework between the promotion of family farms and agro-business, which is further manifested by promoting agro-business investment, widening gaps in access to land and water resources. Finally, there are no women and youth vegetable subsidy strategies. The framework targets equity by giving rights to everyone in having access to production factors. Unfortunately, there is no specific guidance for implementation to highlight how youth could be involved. Thus, the implementation might not reflect what the framework intends to accomplish.

Collection and trading require information systems, trade negotiation, and knowledge of the trade standards governing the sub-regional, regional, and international trade. The framework highlights those important aspects. It intends to improve market information systems and build the negotiation capacity of the private sector. Specifically, investment is made in a support program to build capacity for women business operators. It involves women's capacity in business plans development, technical management of trading, and organization of women's cooperatives. However, the strategies are not specific to vegetables.

Processing involves action aiming to transform and add value to agricultural products. The strategy for gender inclusion consists of improving women's access to modern techniques for the conservation, conditioning, and processing of agro-sylvo-pastoral products. There will be the adoption of a program for developing processing units and labeled agro-food products managed and operated by women and support for rural women in processing equipment. However, the strategies target general agro-food processing apart from shallots processing. In addition, the framework has no strategy for youth inclusion in the processing.

Distribution and consumption concern market development. Important measures across the clusters include reforms to reorganize the fruit, vegetable, and oilseed sectors on domestic and foreign markets. Also included will be infrastructure development (construction or rehabilitation of market and storage infrastructure). An example from the clusters is tax relief on exports and developing a 'free zone' for exports to ensure the flow of vegetables to market. The framework addresses the development of market gardens. It promotes crop diversification as part of strategies to ensure year-round foods availability for household consumption. The main characteristic of market gardening products is that they are sold as cash crops directly to consumers and restaurants.

Whole value chain development is supported by expanding and diversifying irrigated agriculture and promoting high nutritional value crops through community and market gardens for women and youth. It also involves agricultural subsidies and mechanization through equipment supply, support for the private sector, public services, and training on equipment maintenance. R&D also contributes through agricultural research and advice systems, including the selection, dissemination, and conservation of plant and animal genetic resources. Further, investments will be made at several levels of the agricultural VC. This includes investment in processing, storage, transport, and marketing infrastructure for the private sector and credit support for agricultural products' processing, conservation, storage, and packaging infrastructure, especially women and youth. There is a support fund to empower women in entrepreneurship. Finally, the framework targets capacity building along the value chain.

However, because of differences in principles used from one policy to another, there is inconsistency in framing a set of gender guiding principles. In addition, the framework promotes equity but lacks clear guidelines for its implementation. Some strategies are not specific to vegetables. These include investments for private sector infrastructure development and credit allocation for women and youth in processing infrastructure for the private sector and credit allocation for women and youth in conservation, storage, and packaging infrastructure. With inclusion, it is noticed that strategies address support for women in production rather than other functions of the VC. Also, the capacity building for women and youth in the value chain is more focused on production.

Interventions support youth and gender value chain inclusion

This section analyses the interventions initiated in the country in implementing the policies and programs (Table 3). The narrative of each cluster is developed in the following sub-sections.

General development and private sector development interventions

This cluster consisted of six projects initiated by the government and partners. The main target groups include (i) women who bear the brunt of tradition, household chores and illiteracy, limited access to credit and lack of information and training; (ii) young farmers who lack capital and basic tools; and (iii) seasoned farmers who still practice traditional farming. These projects aim to restore basic social services and socio-economic revival by:

- consolidating the irrigation facilities and improving water management,
- supporting the organizational and dynamic professionalization of agricultural actors, and
- strengthening food security and reducing poverty.

These projects support irrigation infrastructure development and management. It includes consolidating and rehabilitating agricultural facilities by strengthening the productive capacity of existing Small Village Irrigated Schemes (PPIVs), constructing new ones, and developing lowland plains (ADF-PARR 2001; AfDB-PARSEP-NM 2016). Facility management and maintenance will gradually transfer responsibility to users. It will be accompanied by public awareness and training.

The projects also focus on agricultural value chain development. Emphasis is placed on increasing the high value-added crop diversification for market gardening (ADF-PDON 2), constructing new markets (AfDB-PARSEP/NM 2016), mobilizing funds, and building capacity for the whole chain development. The fund mobilization will finance micro-projects, agricultural inputs, production, and processing equipment. This involves the acquisition of motor pumps, peelers, tillers, threshers, plows, carts, solar panels, and other equipment for agricultural development (ADF-PARR 2001; AFD-PADON 2 2018). For example, the PADON2 (AFD 2018) created the Regional Support Fund for the Development of the Agricultural Sector (FRADSA) to support innovative initiatives and promising economic development in the fields of production, processing, and marketing of agricultural products (AFD-PADON 2). The capacity building focuses on training farmers' organization management committees, producer groups, and Interest Economic Groups (GIEs) on the market garden's production, management, and marketing (PARR-ADF 2001; AfDB-PARSEP/NM 2016).

The projects also aim at improving the competitiveness and development of the private sector and inclusive development. It was planned to accompany government reforms for developing a more dynamic private sector by revising and adopting the Investment Code, developing, and adopting a Small and Medium Enterprises Development Support Program (PAD-PME; AfDB-PACE I 2017; PACE II 2018), and creating a national agency for developing SMEs. It also includes reforms in the energy sector to improve energy access for private sector development and decentralization to strengthen social inclusion. The reforms will contribute to increasing exports of goods and services, establishing an SME Support Fund, developing SMEs (including 30% owned by women and exporting SMEs including 15%

women). They will also contribute to securing land titles in Bamako and Kati in 2022 (ADF-PACEM 2018).

The projects have specific interventions targeting women's engagement along the value chain. Emphasis is placed on strengthening their technical and managerial capacity to improve production (PARSEP-NM 2016) and encouraging the organization of women into groups to support those who are a member of a well-organized cooperative. The support is to microfinance for revitalizing, diversifying, and increasing income-generating activities (IGAs) (ADF-PARR 2001).

Implementing interventions in this cluster is challenged by poor coordination between the regional and local administrative departments, NGOs, and donors operating in the agricultural sector in the Mopti region (ADF 2016). There is repetition in consecutive programs (PACE I and PACE II), especially related to the improvement of agricultural competitiveness and private sector engagement. This may be linked to the poor implementation of the private sector component of PACE I. The target for SMEs was not achieved as no SMEs were created (AfDB 2018). Therefore, a very limited number of women have benefited from SME-related interventions. The approach developed during project design encountered issues in implementation. For instance, during the PARSEP – NM (AfDB 2016), there was insecurity in the project areas in the northern region. This prevented beneficiaries from participating actively in the preparation and implementation process, which left local authorities in the project to represent the beneficiaries. As an alternative approach, it might not meet the expectation of the project's direct beneficiaries. It could prevent skills transfer to users and their organization, therefore the sustainability of implemented projects. Finally, women and youth-specific support along the VC are limited to capacity building to improve production and financial access. No interventions regarding the collection, processing, and marketing of products were applied.

Table 3. Overview of the interventions cluster analysis.

Cluster / Reference	Objectives	Location	Intervention	IVVC related solutions	Gaps
General and private sector development intervention cluster 1. The rural development support project in the Mopti region—2001–2011 2. Project to support the socio-economic reintegration of the populations of northern MALI (PARSEP – NM)—2016–2021 3. Economic Growth Support Programme - Phase I (PACE - I) Appraisal report 2017–2018 4. Project to support the development of the Office du Niger area (PADON 2)—2006–2017 5. Economic Growth Support Programme - Phase II (PACE - II) Appraisal report 2018–2019 6. Project to Support the Competitiveness of the Malian Economy (PACEM) 2018–2022	- Strengthen basic social services and socio-economic activities - Consolidate hydro-agricultural facilities and improve water management - Enhance food security and reduce poverty	- Timbuktu, Taoudéni, Kidal, Gao and Ménaka, Ségou and Mopti - Ségou region - Mopti	- Irrigation development - Capacity building and support	- Water and irrigation infrastructure development - Operation and maintenance of system facilities - Capacity building for women in production - Fund mobilization to support activities along the value chain	- Limited interventions for youth IVVC involvement - Inclusion limited to production capacity building and financial support - Insecurity preventing implementation participation - Weak coordination and poor performance in implementation
Climate change and environment intervention cluster **Government initiatives** 1. Support program for adaptation to climate change in the most vulnerable municipalities in the regions of Mopti and Timbuktu, 2015–2018 2. Integral development and climate resilience project in the plains of Delta 2—2017–2021 3. Strengthen climate change adaptive capacity and resilience of the municipalities of Sandare, Massantola, Cinzana and M'pessoba, 2014–2016 4. Enhancing Adaptive Capacity and Resilience to Climate Change in Mali's Agriculture Sector, 2010–2019 **Country partners' initiatives** 5. Programme Support for Climate Change Adaptation in the vulnerable regions of Mopti and Timbuktu—2016–2019 6. Integrated development and climate change adaptation program in the Niger basin (PIDACC), 2019–2025 7. Enhancing climate change adaptation of the vulnerable agriculture communities in Ségou region, 2010–2016	- Improve the resilience of the population and ecosystems - Promote sustainable socio-economic development - Enhance adaptive capacities of vulnerable rural populations to climate change	- Mopti - Timbuktu - Ségou	- Capacity building - Irrigation - Infrastructure - Research and studies	- Irrigation infrastructure development and rehabilitation - Use of climate-resilient techniques in water mobilization and application - Financial support - Capacity building for women - Support for women in production, processing and marketing	- Storage is developed for cereals only - Youth inclusion is limited to processing while women are supported in production, processing and marketing - Weak coordination of activities

Agricultural development intervention cluster **Government initiatives** 1. Project for Increasing Agricultural Productivity in Mali (PAPAM), 2010–2019 2. Improve Agricultural Productivity in Mali-Funding from the Adaptation of Smallholder Agriculture Programme (PAPAM/ASAP), 2013–2018 3. Governmental 103,000ha development program: implementation, 2007–2012 4. Governmental 100,000 ha development program: provisional consolidation 2014–2018 5. Rural development support project of the Daye, Hamadja and Korioume plains (PADR-PDHK), 2002–2015 6. Project for the Development of Productivity and Agricultural Diversification in the Semi-Arid Zones of Mali (PDAZAM): Integrated Pest and Pest Management Plan (PGIPP). 7. Mali-Fostering Agricultural Productivity Project, 2010–2018. 8. Agro-pastoral sector Support program (PAFA). Intermediate evaluation of the PAFA support program for the agro-pastoral sectors of SIKASSO, 2009–2015 9. National Programme of Rural Infrastructure (PNIR). 10. Integrated Rural Development Programme, Kidal Region report, 2007–2017 **Country partners' initiatives** 11. Seed Sector Support Project (PAFS), 2002–2009 12. Project for the economic empowerment of women in the Shea butter subsector (PAEFFK, 2004–2016 13. Ansongo District Rural Development Project (PRODECA, 2001–2015 14 Decentralizing investments in public goods to support agriculture and livestock-based economies and to build resilience for rural women, 2018 15. Development Programme of the Special Agro-Industrial Transformation Zone of the Koulikoro and Peri-Urban Regions of Bamako (PDZSTA-KB), 2020–2025 16. NGO Mali Rural Development (MDR), 2012–2014 17. NGO Association KAFINI, 2016 18. NGO Association of village women's groups, 1999–2012 19. NGO Association for Active and Participatory Development, 2016–2017 20. NGO Council Association for Grassroots Development Initiatives, 2000–2019	- Increase the productivity of smallholder agricultural producers - Improve the resilience of small rural producers and the ecosystems to climate change, and strengthen the adaptive capacities of poor rural populations - Alleviate poverty and improve welfare, productivity and strengthen the resilience to climate shocks - Increase women's income and sustainably ensure their economic empowerment - Reduce food insecurity in communities	- Nationwide - Koulikoro region, Gao region - Dogon and Bamako Districts - Regions of Kayes, Ségou, Sikasso, Mopti, Tombouctou	- Hydro-agricultural and infrastructure development - Capacity building - Financing climate change mitigation systems	- Prioritize women and youth access to production factors and processing units - Develop agro-business incubators and local business for youth	- Lack of gender analysis and strategy in project implementation - Limited achievement in irrigation infrastructure development - Low ownership of irrigation schemes by cooperatives - Limited financial ability for local NGOs to support vegetable production development
Food security intervention cluster **Government initiatives** 1. Food Security Enhancement Project through the Development of Irrigated Crops (PRESA / DCI), 2013–2019	- Help improve food security and reduce poverty	- Nationwide and Koulikoro Region	- Infrastructure development - Capacity building,	- Training in mechanization	- Limited support to youth access to inputs, equipment and infrastructure

Country partners' initiatives 2. Food and Nutritional Security Enhancement Project in Koulikoro Region (PReSAN-KL), 2014–2021 3. Program to build resilience to food and nutrition insecurity in the Sahel (P2RS), 2014–2021	- Increase on a sustainable basis agro-sylvo-pastoral and fishery productivity and production		training and support	- Women's access to inputs, equipment and infrastructure - Support for women and youth in business development and access to financial institutions	- Ineffective infrastructure construction-related interventions - Off-season vegetable production focus
Finance and agriculture intervention cluster **Country partners' initiatives** 1. Inclusive Finance in Agricultural Value Chain Project (INCLUSIF) 2018–2024 2. IGREENFIN Greening Agricultural Banks & financial sector to Foster Climate Resilient and Low Emission Smallholder, approved in 2020 3. Rural Microfinance Programme (PMR) 2010–2018	- Rural poor's sustainable financial access - Increase inclusive financing for smallholder producers and their organizations - Rural communities' resilience and adaptive capacity	- Koulikoro - San, Tominian and Ségou - Timbuktu and Circles or municipalities	- Facilitating access to financial services - Capacity building and support	- Financial services and microfinance	- Interventions are ongoing
Water resources development intervention cluster **Government initiatives** 1. Program for the Integrated Management of Water Resources in Mali—2010–2015 2. Contract-Plan 2019–2023 State-Office of Niger-Farmers. 2nd Semester 2020 performance report **Country partners' initiatives** 3. Project to support the implementation of the integrated water resource management action plan. Project completion report—2015–2019	- Improve country's socio-economic situation and to reduce poverty - Contribute to creating sustainable development	- Niafunké Circle - Tonka Circle - Diré Circle - Goundam Circle - Niafunké Circle	- Knowledge, management and monitoring of water resources - Development of irrigation technologies - Capacity building	- Develop water mobilization and irrigation infrastructure - Allocate 10% of irrigated land to women and youth - Build institutional capacity for decentralized system - Support rural financial development - Support farmer organizations	- Insufficient women engagement in IWRM strategy - Limited youth inclusion intervention - Priority rice production other than market gardens - Allocate only 10% of irrigated land
Irrigation development intervention cluster **Government initiatives** 1. Lowland development project in the Yélimané Circle (LDP/YC), 2006–2015 2.Priority development program in local irrigation (PAP), 2010–2012	- Contribute to increasing sustainable	- Populations in the regions of Mopti, Kayes,	- Irrigation infrastructure development	- Allocate 10% irrigated land to women	- Youth empowerment is limited at capacity building

3.PASSIP: Proximity Irrigation Subsector Support Programme, 2008–2023 4.Project for developing commercial irrigated agriculture in the Office du Niger zone (PDAIC-ZON) MALI **Country partners' initiatives** 5.Irrigation Development Programme in the Bani and Sélingué Basin (PDI-BS) Phase I, 2010–2015 6.**Supporting the national program for sustainable small-scale irrigation, 2019–2021**	agricultural production and income - Reduce food insecurity - Promote sustainable socio-economic development, preservation of natural resources	Koulikoro, Sikasso, Ségou, Baguinéda	- Support advice - Capacity building and training	- Financial support for irrigation infrastructure development and rehabilitation - Build managerial capacity of schemes, agricultural water users associations, provide technical assistance to farmers for optimal on-farm irrigation system design and cost-benefit analysis, access to financing, irrigation training and extension services	- Support for women is limited to production - Poor access to microfinance - Weak coordination, communication, information sharing, monitoring and partnership development - 10% irrigated land targeted to women is lower than the one set in law

Climate change interventions

This cluster explores six interventions initiated mostly by international organizations or partners. The target groups of this cluster include women and youth. For example, women of the PIDACC account for 51% of the total beneficiaries (GOM 2017). Its objectives focus on:

- improving the resilience of the populations and ecosystems of the Niger River basin through sustainable management of natural resources,
- promoting sustainable socio-economic development through developing water resources, and
- increasing the resilience of vulnerable communities and their capacity to adapt to climate change.

This cluster contributes to youth and gender VC inclusion in several aspects. Promotion of irrigated vegetable production emphasizes irrigation construction or rehabilitation, small-scale dams, community market gardening, wells, rainwater storage, collection facilities, and ponds (AEDD/GOM 2015; AfDB-PIDACC 2018). It also includes improving market gardening by supplying watering cans, spades, and shovels (AEDD/GOM 2015). It also promotes climate-resilient techniques using drip irrigation and Californian system, pumping with solar energy systems, complementary irrigation, and techniques for restoring and improving soil quality for agricultural production (BOAD 2018). Further, it supports local grain seed production and dissemination, grain storage expansion, and crop diversification incentives to adapt to climate change (Adaptation Fund 2016). The cluster also addresses youth and women empowerment in production and marketing. It consists of constructing processing units for agricultural and horticultural products (GOM 2017). There is also a provision of training for women on market gardening techniques for various crops, product handling and marketing.

However, crop storage construction addressed in the cluster only focuses on cereals banks. Vegetable storage is not addressed. Youth are included in only the processing segment of the value chain, while women are supported in the production, marketing, processing, and equipment access. Further, there is weak involvement of decentralized structures at the regional level (regional directorate of agriculture, regional directorate of water and forest, etc.) and the district level. Finally, the PDIR/PD2 (ORS 2017) project promotes gender and youth inclusion, but it is not vegetable-specific. This is because this project is the intervention program of the Priority Investment Plan, where vegetables were not included.

Food security interventions

The intervention documents explored under this cluster are initiated by international organizations (Table 3). The interventions target women in market gardening and women and youth in Economic and Interest Groups (GIEs) as stated in P2RS with 50% women beneficiaries out of 53,000 rural people (ADF 2014). This cluster seeks to:

- improve food security and reduce poverty, and
- increase, on a sustainable basis, agricultural productivity and production.

This cluster intends to strengthen the capacities of public, private, and community institutions in the agricultural sector to ensure efficient management of infrastructure and production chains (AfDB-PReSAN-KL 2014). This is by training producer organizations in technical and financial management as well as water management and maintenance of irrigation networks. It also involves information on land tenure and logistical support in mineral and organic fertilization producers through local agricultural advisers and office staff

(ADF-PRESA/DCI 2013; ADF-P2RS 2014). It supports farmers to modernize and better link to markets and invest in agricultural machinery and mechanization. Particular emphasis is placed on developing the private sector through institutional support and the support for national agro-ecological zones. It also involves the promotion of Economic and Interest Groups (EIG) and the facilitation of government employment mechanisms for youth.

This cluster also contributes to developing the crop subsector by promoting resilient crop techniques, access to agricultural land, and improved inputs such as mineral fertilizers and compost by developing composting units. It also involves providing preservation equipment, processing, and market infrastructure (ADF-PRESA/DCI 2013; AfDB-PReSAN-KLB 2014; ADF-P2RS 2014). Further, it emphasizes the development of irrigated schemes, lowlands sites, micro-dams, flood spreading sills and water collection basins and promotion of food diversification through market gardens and the exploitation of 50% of local irrigation (irrigation de proximité) in the off-season for market gardening (AfDB-PReSAN/KLB 2014).

Specific interventions promote gender and youth inclusion in the value chain. Emphasis is placed on training, monitoring, and supporting youth in agricultural machinery, farming diverse crops, including vegetables (ADF-PRESA/DCI 2013) and facilitating women's access to land, inputs, equipment, and infrastructure. Women leadership in community resource management (AfDB-PReSAN/KLB 2014) is also promoted. As evidence, there is the development of market gardens for women. Finally, there is support for both youth and women in developing business plans and access to financial institutions.

However, interventions are not effective. A study conducted by Goîta (2014) shows that many infrastructure projects were not completed, resulting in a lack of infrastructure to meet the expressed needs of producers. Crop diversification that allows market garden development is promoted in the on-season while the season is not as favorable for vegetable production. On-season vegetable production represents less than 20% of total annual cultivated areas and less than 50% of vegetable areas during a year. The reason is that the schemes are more devoted to rice growing, maize cultivation, or even peanuts (Adant et al.,2019). Finally, the cluster promotes no interventions supporting youth access to inputs, equipment, and infrastructure.

Agricultural development interventions

Interventions explored under the cluster of agricultural development are initiated by the government of Mali, partners, and national Non-Government Organizations (NGOs). The target groups of this cluster are family farms using small-scale irrigation and mostly women and youth. Examples from the interventions show that women account for 27% of the PADR-PDHK project and 45% of the PRODECA, with over 50% of women as the workforce directly involved in vegetable production. This cluster seeks to:

- increase food production and reduce food insecurity,
- increase women's income and sustainably ensure economic empowerment, and
- reduce poverty in communities.

This cluster supports many aspects of irrigated vegetable production. Irrigation development facilitates productivity increases by crop diversification and developing large- and small-scale irrigation systems, managed land, lowlands, ponds, wadis, and consolidation and extension of the Middle Bani Plains and Maninkoura development projects (ADF-ADRD 1999; PADR-PDHK 2010; PAPAM/ASAP 2013; PGA 2007 2014; PAPAM 2018). The water will be applied under partial or total control for market gardening and horticulture. This cluster also supports infrastructure construction for the production, processing, preservation, and

packaging of improved seeds. This includes certification laboratories, cold chambers, warehouses, packing lines to produce and process certified seeds (PAFS), and agro-industrial development zones for the private sector (ANICT 2018). Further, the cluster develops financial services and provides national banks (BNDA) with funds for crop development and income-generating initiatives (ADF-PRODECA 1999; PAPAM 2018). The cluster strengthens value chain actors' capacity, especially producers' organizations, service providers (PAFS 2009; PAPAM 2018), and rural communities in market gardens and agroforestry.

Specific interventions for gender and youth inclusion along the value chain are highlighted. Women and youth are prioritized in accessing irrigation schemes and market gardens and provided with financial and technical support for their small- and medium-scale processing enterprises (ADF-ADRD 1999; PNIR 2001; IFAD-NRIRDP 2005; PAFS 2009). Interventions also promote economic initiatives of rural youth in agricultural value chains and related economic activities. This will enable them to gain sustainable access to vocational employment and reduce risks in their economic initiatives. Agro-industrial zones development promotes rural youth participation in entrepreneurship and market access through business incubators (AFAWA), agricultural digitization, and local business promotion in agro-industrial parks (GOM-PDZSTA/KB 2019). Financial support will also be provided for innovation development and commercialization in rural areas (IFAD-FIER 2014).

However, there is a lack of gender analysis and guidance, limited attention to gender participation throughout the implementation process, and a lack of gender experts and women in the project team (PAPAM 2018). Adoption of irrigation technologies is not achieved due to partial disbursement of funding. This results in planned irrigation schemes remaining incomplete which leads to decreasing crop production and productivity in the target location. Another gap is the low ownership of the irrigation scheme management by cooperatives. This situation can lead to inappropriate and ineffective scheme management. Finally, some interventions from NGOs on market gardening development for rural communities, especially women, have limited impacts due to financial constraints.

Finance and agriculture intervention

This cluster explores three interventions initiated by the government and partners. The main targets of this cluster include promoters of economic initiatives, with special attention to women and youth. For example, in the INCLUSIF project (GOM 2017), women and youth represent 50% of the affected workforce. It aims at:

- contributing to the sustainable access of the rural poor to financial services and meeting their socio-economic development needs,
- increasing the financial inclusion of small producers, their organizations, and small and medium agribusiness enterprises, and
- supporting the building and scaling up of rural communities' resilience and adaptive capacity and farmers' organizations.

The cluster contributes to agricultural development in facilitating access to financial and technical services and ensuring institutional viability. This is by improving technical and financial support for agricultural SMEs and economic operators, including processors, traders, suppliers, warehouse managers, and market aggregators. Enhanced access of producer organizations, vulnerable groups, and rural youth to micro-financial institutions and sources of finance adapted to their needs will also be provided. It emphasizes the engagement of the private sector in mobilizing more financial resources for developing agricultural sectors (GOM-INCLUSIF 2017). In addition, there is the digitization of financial services and the creation of an Innovative Financing Facility. The latter will help provide

concessional loans for adaptation practices and renewable energy use to support farmers, women, youth organizations, cooperatives, SMEs, and photovoltaic (PV) operators along agricultural value chains. This will favor the use of irrigation techniques for both rainy and dry seasons, Ecosystem-based Adaptation, and mitigation measures for agriculture (IFAD-IGREENFIN 2020).

This cluster undertakes capacity building of actors and rural financial institutions to ensure institutional viability to improve business development skills and facilitate eligibility for finance under the credit line. This includes the readiness and ability of farmer organizations, cooperatives, and SMEs to understand climate threats and identify and develop business plans (IFAD-IGREENFIN 2020).

The cluster develops specific interventions promoting gender and youth inclusion in agricultural production, especially in capacity building and production techniques and technologies. The capacity building emphasizes financial literacy, natural resources management, and participation in decision-making. Techniques include using cost-competitive technologies for developing vegetable gardens, agroforestry, and techniques to face adverse climate change effects (IFAD-IGREENFIN 2020).

The cluster is very ambitious as the interventions target financial and technical support for the actors along the agricultural value chain, including women and youth. However, implementing the interventions in this cluster is still ongoing except for the PMR completed in 2018, but we could not access the project completion report. Therefore, we cannot analyze its performance or effectiveness.

Water resources management interventions

The water resources management interventions cluster explores initiatives to exploit water resources for economical use better. The target beneficiaries of the cluster are the general population. Specifically, it involves farmers, breeders, fishers, women, youth, and the nomadic population. The objectives of this cluster are to:

- improve the socio-economic situation and reduce poverty through better knowledge of the resources and their integrated management,
- create sustainable development at the regional and farm level, and
- increase food security and incomes of small farmers.

This cluster contributes to developing the agricultural VC. First, it promotes production diversification by developing irrigation schemes in the Office du Niger[10] (GOM/MEAP 2020). It also involves promoting efficient water use and lands for agriculture (MEE-PCA/IWRM 2016). In addition, the cluster promotes private sector investment. It intends to create attractive conditions for processing, conservation, private investment in irrigation development, and agricultural equipment manufacturing infrastructure. As a measure, the agricultural equipment intended for agricultural use benefits from a tax exemption for 15 years from registration (GOM/MAEP 2020).

Second, the cluster develops institutional capacity building for coordination at the decentralized level. This is strengthened by decentralizing technical services to the municipalities, the local consultation structures, and professional organizations in terms of

[10] Contract-Plan 2019–2023 State-Office of Niger-Farmers. The overall objective of this new Contract-Plan is in line with the directives of the Agricultural Orientation Law (LOA) of 2006 and the Agricultural Development Policy of 2013. We have not been able to access the project document. Only the 2020 performance report has been used to collect information about the project.

participatory planning and at the technical level. It supports the resilience of users in the irrigation sector by adopting more efficient water-saving technologies (GOM 2017; AfDB 2017), farmers' organizations' capacity, and creating mutual savings and credit unions (GOM 2017).

The cluster promotes gender and youth inclusion, with 10% of the developed irrigated land in the Office du Niger area being allocated to them. Also, at least 10% of the women are involved in the decision-making process of developing the schemes (GOM/MAEP 2020). However, the Contract Plan (2019–2023) being implemented in the Office du Niger prioritizes rice production. Vegetables are promoted as a diversification product. In addition, it targets 10% of developed land to be allocated to women and youth. This target is lower than the 15% set by the Agricultural Land Policy (GOM-LFA 2017). Gender inclusion in the PCA/IWRM is found modest, according to WER (2016). This means that despite the will to integrate the gender aspect in Integrated Water Resources Management, the strategy for engagement is insufficient. The transversal aspect of the IWRM, including gender and climate change, is weak (GOM 2018).

Irrigation development interventions

The irrigation development interventions cluster explores government and partners' initiatives to develop the irrigation subsector. Beneficiaries include family farmers (EAFs), rice farmers, market gardeners, and micro-entrepreneurs working in logistics and marketing. The objectives of this cluster seek to:

- contribute to the reduction of food insecurity, and
- promote socio-economic development through developing irrigable land and plains by preserving natural resources.

This cluster contributes to irrigated vegetable production and enables gender and youth inclusion along the value chain. Through the provision of finances for developing irrigation infrastructures such as small village irrigated schemes (PPIV), women's market gardens (PPM), and small irrigated schemes (PPI). It also involves constructing or expanding the irrigated area, open-air canals, intake structure, and pumping stations. Acquisition and installation of pipes, meters, and related facilities to provide water irrigation are also included (AfDB-PDI/BS 2009; GOM-PAP 2010; PDAIC-ZON 2017).

There is advisory support to actors along the value chain to improve production and market flows. This includes supporting farmers and their organizations (PPIV and PPM management committees, producer groups, women's groups, and Agricultural Water User Association (AUEA) to become more professional, sustainable, and financially autonomous. IPRO/IRRIGAR-Pays Dogon, for example, has supported the establishment and capacity building for cooperatives by endowing them with a fund for potato production. The advice emphasizes efficient water management at the scheme level, private or collective investment in processing, storage, and equipment management (e.g., cost calculation, depreciation, and profit margin). It also involves marketing support (e.g., market research, price negotiations, and maintenance of management documents), control of accounts and allocation of profits (GOM-LDP/YC 2005; PASSIP 2012; GIZ 2019; PDAIC-ZON 2017). The capacity development is given to ministry staff to develop legal frameworks, coordinate small-scale irrigation programs, and improve adherence to construction and operation standards of irrigation infrastructure (GIZ 2019).

Finally, the cluster promotes women and youth engagement in the IVVC, developing their technical and managerial capacity to enable them to take up agriculture as a profession

(AfDB-PDI/BS 2009; PDAIC-ZON 2017). Specific emphasis is placed on developing market gardens and transferring the management responsibility to women (GOM-LDP/YC 2005). The IPRO projects (REAGIR and IRRIGAR) in Koulikoro, Delta Interior, Pays Dogon and Sikasso (GOM 2019) developed irrigation schemes (AHAs) with a specific target of 10% minimum to women for vegetable production. Women also benefit from capacity building in the conservation and commercialization of shallots through training and storage infrastructure construction. In these projects, 30% of the decision-making staff is women. Access to financial services involves adapting financial facilities to the needs of women through support to the networks of existing and future savings and credit banks (GOM-LDP/YC 2005; AfDB-PDI/BS 2009). The PDI-BS (AfDB 2009) targeted 10,000 women and youth as beneficiaries of specific activities.

However, youth inclusion is very modest, mainly found in capacity-building activities. Gender inclusion focused on production, credit access, and capacity building in commercialization and storage. Products processing is addressed but targets fish products. The 10% target of developed lands or schemes allocated to women is lower than the target mentioned in the Agricultural Land Law (LFA 2017). Besides those specific shortcomings, some issues encountered during project implementation are observed and may harm the effectiveness of the interventions.

There was no communication with the beneficiaries during the Middle Bani Plain (PMB) design (GOM 2009), resulting in conflict and project suspension until the conflicts were resolved. Further, there was insufficient involvement of the agricultural division of the Ministry of Agriculture in the planning and use of small-scale irrigation systems in the "*supporting the national programme for sustainable small-scale irrigation" project* (GIZ 2019). Thus, the prerequisites for efficient and environmental-friendly use of the systems were not sufficiently considered. This situation led to inadequate maintenance of the irrigation infrastructure, inefficient water use, and poorly adapted irrigation methods by the water users' organization. The processing was not appropriate and led to losses (GIZ 2019). Finally, there was a reduction of AHA and advisory support activities, weak coordination, and ineffective monitoring of the PNIP (GOM 2012) because of insufficient state participation in financing local irrigation development and the insecurity crisis.

Overall assessment of interventions

Input provision focuses on seed promotion and diversification by producing and disseminating seeds adapted to the effects of climate change. It also includes providing skills and logistical support to produce mineral and organic fertilizers and supporting the expansion of seed storage infrastructure. Interventions supporting the seed value chain emphasize the development of infrastructure. These include certification laboratories, cold chambers, warehouses, and packing lines to produce and process certified seeds. One woman and youth-specific intervention focused on facilitating women's access to inputs and equipment and promoting youth in agricultural machinery and farming of diverse crops, including vegetables (Table 4).

Table 4. An overview of interventions for gender and youth IVVC inclusion.

Category	Interventions	Shortcomings
Input provision (seed, fertilizers, chemicals, tractors and harvesting machines)		
Climate-resilient seed and diversification	- Production and dissemination of local grain seed production adapted to climate change - Incentives for crop diversification	- Interventions related to women and youth are general, not specific to vegetables
Seed value chain development	- Construct infrastructure to support the seed VC - Facilitate women's access to inputs and equipment - Train, monitor and support youth in agricultural machinery and farming diverse crops .	
Irrigation supply (equipment, schemes, supply chain and private sector investment)		
Women and youth engagement promotion	- Allocate 10% of the irrigated land to women and youth - Promote at least 10% women in the scheme development's decision-making process - Finance for developing irrigation infrastructures - Developing market gardens and transferring the management responsibility to women	- Infectiveness of project implementation resulting in no progress on irrigation infrastructure construction - Modest gender inclusion - 10% target is lower than the 15% set by policy - Modest integration of women in IWRM
Production (land policy, ILM, equipment, extension, credit access and collective economy action)		
Productivity, production, and diversification of crops	- Develop irrigation infrastructure, gradually transfer responsibility to users - Construct or rehabilitate irrigation schemes (small- and large-scale), water mobilization structures and climate-resilient irrigation techniques	- Absence of gender strategies during project design - Limited influence of NGOs to expand market gardens due to lack of funding - Infectiveness of project implementation resulting in limited construction of irrigation infrastructure - Schemes allocated in the Office du Niger give priority to rice production. Vegetables are promoted off-season - The 10% target of developed lands and schemes allocated to women is lower than the target mentioned in the Agricultural Land Law - Low ownership of the irrigation scheme management by cooperatives.
Youth and gender inclusion	- Develop technical and business skills - Technical and financial support for women and youth - Build capacity for women and youth in financial literacy, natural resources management, and participation in decision-making	

Collection and trading		
Support for women and youth in collection and trading	- Technical and financial support for aggregators - Build capacity for women and youth in storage and conservation infrastructure construction - Women training on product marketing - Financial support for innovation and commercialization for rural women and youth	- Insufficient interventions supporting women and youth in collecting and trading of agricultural products - Capacity building for conservation limited to shallots
Processing		
Women and youth promotion Support for the private sector in processing	- Construct processing units for agricultural and horticultural products for women and youth - Improve technical and financial support for agricultural SMEs, processors, traders, suppliers, warehouse managers and market aggregators	- Only capacity building actions have targeted youth in the IPRO projects
Distribution and consumption (infrastructure, demand creation, market information access, innovation, and storage)		
Market development	- Develop agro-industrial zones - Develop women's product marketing and commercialization skills	- There is limited storage infrastructure for vegetables
Development of agricultural value chains	- Facilitate access to improved inputs such as mineral fertilizers and compost production by developing composting units - Promote crop diversification and off-season production, provide preservation, processing and market infrastructure - Develop irrigated schemes, water mobilization infrastructure and irrigation technologies	- Limited production of vegetables in the off-season - Weak coordination of activities - Insufficient coordination and weak involvement of key actors - Insecurity problem preventing beneficiaries from attending preparation and implementation workshops - Ineffectiveness of interventions in infrastructure development - Absence in the VC of specific support for women and youth to access inputs
Development of financial systems and mechanisms	- Mobilize funds to finance micro-projects, agricultural inputs, production and processing equipment - Create an Innovative Financing Facility to provide concessional loans - Support existing networks of savings and credit banks	
Promotion of the private sector	- Create incentives for private sector investment - Support the creation and training of cooperatives and provide them with production funds	
Gender and youth inclusion	- Promote gender and youth inclusion in the production - Provide financial and technical support within the VC - Build capacity for actors within the whole VC	

Irrigation supply has been addressed by the consolidation, rehabilitation, construction, and maintenance of irrigation facilities. The approaches used to promote irrigation schemes create opportunities for women and youth to access irrigation by encouraging crop diversification interventions under the National Local Irrigation Development Program (PNIP), including IPRO-REAGIR and IPRO-IRRIGAR allocation of at least 10% of the irrigated land to women. The Contract-Plan in the Office du Niger allocates 10% of the irrigated land to women and youth. These interventions also promote gender inclusion in the decision-making process for irrigation scheme development. Other interventions develop market gardens managed under women's responsibility and promote community market gardening, which gives access to both women and youth. However, the interventions under the PNIP pay more attention to women's inclusion than youth.Further, the 10% of irrigated land allocated is lower than the 15% set by law (GOM-LFA 2017). Finally, besides market gardening, priority is given to rice production on developed land. Vegetables are considered a diversification crop and are sometimes produced in the off-season.

Production function emphasizes increased productivity and crop diversification, the efficiency of infrastructure management, production chains, and promoting women and youth engagement. Inclusive development of irrigated land increases women and youth access to agricultural land. Water infrastructure schemes included small-scale dams, rainwater storage, collection facilities, ponds, and large- and small-scale irrigation systems. There is also the consolidation and extension of the Middle Bani and Maninkoura plains. Water is applied under partial or full control by promoting climate-resilient techniques and water-saving methods like drip irrigation and California system, solar-powered pumps, complementary irrigation, and restoring and improving soil quality. There is also financial support by developing adapted financial services collaboration with the National Agricultural Development Bank (BNDA) for financing agricultural campaigns and various income-generating initiatives. Training in business management, financial literacy, and credit societies is provided to financial service providers and farmers, including women and young people.

Although interventions supported women and youth in accessing production, there is a lack of clear gender integration and inclusion strategies. The rate of land allocated to women and youth is under the target set in the law, and vegetable production is not given priority. Usually, vegetables are promoted in the off-season. Project implementation was hampered by financial issues leading to modest achievement in some locations. Local NGOs involved in market garden development to support rural women have limited capacity to design and implement bankable agricultural projects and limited access to finance to expand their activities.

Collection and trade are organized into two categories. Part of the production is short circuit, sales where the products are collected and sold in the nearest market. The products are mostly delivered directly by producers to retailers, which lowers the number of intermediaries. Long circuit marketing is only possible for less perishable products such as shallots and onions (Haggblade et al., 2014). This phase involves wholesalers of the aggregation markets and the wholesalers of the consumer markets who finance the collection, transport, and distribution of horticultural products. Fewer interventions (only one) targeted this category of actors with technical and financial support. Young people and women benefited from training in constructing storage infrastructure for product conservation.

Processing focuses on promoting women and youth investment in processing to increase the value of agricultural products. This includes the construction of processing units for agricultural and horticultural products for women and youth and improving technical and financial access for agricultural SMEs and economic operators, including processors.

Distribution and consumption reflect food availability and accessibility in domestic and global markets. Most clusters aimed to improve food security and reduce poverty. This is the motivation for crop diversification. A study carried out among producers in five country regions showed an average of 89% of horticultural products marketed against 11% for own consumption (Haggblade et al. 2014; Diakité et al. 2014). However, in rural areas, the production is mainly self-consumed, and surpluses are traded depending on the local market. Over 80% of the horticultural products marketed are carried out by women in both rural and urban areas (Diakité 2014; USAID and Cross boundary 2018). They work directly with those aged 15 to 24. Agricultural workers aged 25 to 59 become more autonomous and take care of marketing their own production (Diakité 2014). The market linkage emphasizes agro-industrial zone development, creating opportunities for domestic and local business for women and youth in agro-industrial parks along with entrepreneurship and market access through business incubators. It also involves skills development for women in product marketing.

The whole value chain targets most of the functions of the agricultural value chain. Whole chain interventions promote crop diversification through access to improved inputs such as mineral fertilizers, compost, and the development of irrigated schemes, water infrastructure, and irrigation technologies such as lowlands sites, micro-dams, flood-spreading sills, and water collection basins. The interventions also promote market gardens, small-scale irrigation for vegetables, and resilient crop techniques in the off-season. Interventions ensured the provision of infrastructures such as conservation equipment, processing, and market infrastructure. Funds are provided for financing micro-projects, agricultural inputs, production, and processing equipment. This includes establishing the Innovative Financing Facility to provide concessional loans for adaptation practices and renewable energy use to support farmers, women and youth organizations, cooperatives, SMEs, and photovoltaic (PV) operators. Other finance-related interventions improve existing and future micro-financial institutions, including savings and credit banks.

Along the value chain, interventions promoting private sector investment include implementing the SME Support Program to facilitate their investment in irrigation, processing, conservation, and improving agricultural equipment manufacture. There is also a tax exemption for 15 years from registration by private investors. Support to private sector investment also includes energy sector reforms, financial services, private or collective investment in processing, storage, and collective equipment, and advisory services to management tools (e.g., marketing, control of accounts, and allocation of profits). Regarding inclusion, women and youth are given priority in accessing irrigation schemes. They are also financially and technically supported in their SME processing units. This promotes economic initiatives for rural youth in agricultural value chains and related economic activities.

Despite developing inclusive irrigation schemes, vegetable production is not a priority. Vegetables are mostly produced in the off-season, with 90% production. This is justified by the fact that cereals and other crops are not sown, resulting in more land available and favorable temperatures for vegetable production (Haggblade 2014). The interventions focus more on the agricultural value chain with no specific interventions targeting the whole IVVC. Finally, difficulties faced in project implementation reduced their effectiveness. These

include weak coordination, limited achievement in infrastructure development, limited gender analysis and integration over the interventions.

Synthesis analysis on youth and gender value chain inclusion

Actors and stakeholder landscape in the IVVC policy and interventions

Different stakeholders involved in the policy process with their respective key roles are presented in Table 5. Some public, private, and civil society institutions are involved in agricultural water and irrigation development projects. They collaborate to promote development initiatives at local, regional, and national levels and provide support for the creation of agricultural and agro-industrial enterprises and the creation of peri-agricultural enterprises.

Table 5. Key actors and their roles in water resources, irrigation, and agriculture development.

Category and key institutions	Key roles
Government agencies at the central level—water, agriculture, climate, and environment	
- Water and agricultural sectors: National Water Council, Superior Council of Agriculture, National Executive Committee for Agriculture - Under the ministries responsible for water and the environment (MEE): National Directorate of Hydraulics (DNH), National Directorate of Sanitation and Pollution and Nuisance Control (DNACPN), National Directorate of Industry (DNI), National Directorate of Water and Forest (DNEF). - Under the Ministry of Agriculture : Directorates of Agriculture (DNA) and Rural Engineering (DNGR), the Institute of Rural Economy (IER), Planning and Statistics Unit of the Rural Development Sector (CPS/SDR), National Food Safety Agency (ANSSA) and the Agricultural Technology Laboratory (LTA), Regional Directorate of Trade and Competition (DRCC), Agricultural Markets Observatory (OMA) and Private Market Information Systems (MIS)	- Define and follow up agricultural policy, resource mobilization, implementation reports, monitor the implementation of the Agricultural Orientation Law - Evaluate national and regional water master plans and water distribution projects - Contribute to the M&E design and support the implementation of the Environmental and Social Impact Assessment[11] (ESIA) - Monitor the strategies, programs and investment implementation in AHA[12] areas - Participate in quality standards and training plan development and carry out applied research for technical solutions and market information systems - Ensure coordination and technical consistency of investment plans, financial programming and resources
Government technical services	
- Water sector: National Directorate of Hydraulics and its divisions: **Regional Directorate of Water and Forests (DREF), Regional Directorate of Sanitation and Pollution and Nuisance Control (DRACPN), Regional Directorate of Hydraulics (DRH)** - Agricultural sector: National Directorate of Rural Engineering[13] (DNGR) and its division: Hydro-agricultural Development, Agricultural Mechanization, Rural Spatial Planning, and Training), National Directorate of Agriculture (DNA), Regional Directorate of Agriculture (DRA), Regional Agronomic Research Center (CRRA), State Technical Services (SET), Regional Plant Protection Service (SRPV), Regional Assembly (AR), Regional Chamber of Agriculture (CRA)	- Develop the National Water Policy and coordinate and control its implementation - Develop policies in hydro-agricultural, equipment and rural land - Monitor and coordinate policy implementation - Develop the elements of the national agricultural policy and ensure the coordination and control of its implementation
Basin and regional agencies	

[11] Environmental and Social Impact Assessment

[12] AHA: Hydro-Agricultural Development (Aménagement Hydro-Agricole in French)

[13] Law N ° 05-013 – AN of February 11, 2005 and according to the provisions of Decrees N ° 09-187/P-RM and N ° 09-203/P-RM of May 4, 2009, relating respectively to the organization and the operating methods of the DNGR and the creation of regional directorates and sub-regional services.

- Basin or Sub-Basin Committees - DRGR—Regional Directorate of Rural Engineering (DRGR-Kayes, DRGR-Sikasso, DRGR-Ségou, DRGR-Mopti, DRGR-Tambouctou, DRGR-Gao, DRGR-Kidal, YRES, DRGR-Bamako, DRGR-Koulikoro)	- Ensure intelligent management of resources - Establish, develop, support, control and coordinate national programs, policies and strategies on agricultural management and value chain development
Local governments	
- Local Rural Engineering Service (SLGR) - Agricultural Sector/Agricultural SubSector (SA/SSA), Plant Protection Service (SPV), Cantonment of Water and Forests, Local Hydraulic Service (SLH), Local Water Committee (CLE), Circle Council (CC), Communal Council (CoC)	- Establish, develop, support, control and coordinate regional programs on agricultural management and development - Popularize good practices within the VC, water conservation techniques and soils in watershed - Contribute to recommendations for ESIA implementation - Organize the implementation of the training plan - Ensure and support infrastructure for conservation, processing, and market access - Launch DCE/DAO, select the company and control office for executing the work of the AHA
Private sector	
- Family Farms (EAF) and Agricultural Enterprises (EA) are an integral part of the private sector[14] - Input suppliers, equipment sellers, contractors, transporters, aggregators, traders, importers, exporters - Network of Agricultural Input Operators in Mali, Malian Association of Vegetable and Fruit, Exporters, the Federation of Exporters of Livestock and Meat of Mali, the Group for Professional, Agro-Food Product - Transformation and the Malian Association of Exporters of Picked Products	- Contribute to the agricultural policy process and debate - Support and coordinate interventions on production, development of value chains and financing - Develop AHA management manuals and training - Provide agricultural credit assistance to target communities - Supervise takeover bids, provide opinions on issues related to the agricultural inputs sector, share information with the Agricultural Market Observatory
NGOs, INGOs, partners and civil society	
- Technical and Financial Partners (PTF) - Professional Agricultural Organizations (OPA) and cooperatives, associations, unions, federations, confederations and foundations - INGOs: GIZ, World Vision International, CARE Mali, Oxfam, SNV - NGOs: Mali Rural Development, Association KAFINI, Association of Village Women's Groups, Association for Active and Participatory Development, Council Association for Grassroots Development Initiatives and Actions	- Contribute to the financing of agriculture and provide technical expertise in implementing agricultural development programs and projects - Civil society represents the population in policy design and follows up the implementation - Initiate projects, mobilize resources and implement agriculture and irrigation projects
Research institutions	
- National : Institute of Rural Economy (IER), Central Veterinary Laboratory, and the Polytechnic Rural Training and Applied Research Institute of Katibougou - International : World Vegetable Center	- Carry out agricultural and animal production research, post-harvest technology, food technology and socio-economic research - Develop improved vegetable varieties with higher yields

The analysis shows that different stakeholders' participation and influence in policy processes vary depending on their engagement. As evidence, national government agencies and agricultural sector donors participate more fully and frequently than other stakeholder groups, including the private sector, in agricultural policy debates (Traoré et al., 2019). Mali's private sector appears to have the least influence in shaping policy decisions. Their involvement is limited to validation workshops. Further, governance and management are characterized by weaknesses in communication, monitoring, evaluation, and capitalization of achievements. Challenges are often found with organizational and operational capacity and coordination, insufficiently strengthened partnerships, and funding to meet growing needs (Sogoba et al., 2014). Research findings in the governance and management of Mali's

[14] Agricultural Development Policy (PDA, 2013).

Extension and Advisory Services (EAS), for example, showed poor linkages or gaps between extension workers' work plans, activities, and results (Kouriba 2015). There is also an imbalance in the distribution of resources between state services. For example, the resources mobilized for the PNIP are concentrated at the National Directorate of Rural Engineering and its branches and not to the National Directorate of Agriculture and the Planning and the Statistics Unit of the Rural Development Sector. This can result in poor performance under the PNIP. All these issues can hamper the effectiveness of policies and interventions and therefore negatively influence the promotion of youth and gender inclusion in the agricultural VC and, specifically, IVVC.

Figure 3 shows the IVVC functions (in green) and the effects of the policies and programs (in orange) in enabling youth and gender inclusion (in blue). As indicated in the key actors' table, several institutions are involved in the VC. These actors, including the central government and its technical institutions, INGOs, national NGOs, and civil society, interact in diverse ways (e.g., partnership, consultation, and collaboration) to define and implement policies and interventions. Through this interaction, they enable the environment for gender and youth inclusion at the different levels of the VC.

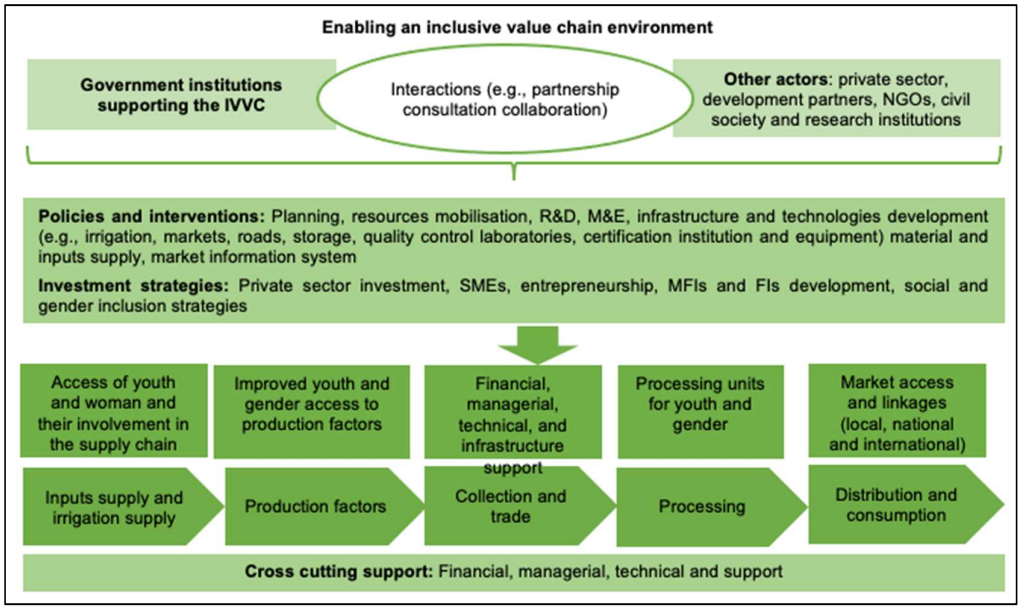


Figure 3. Actor and stakeholder interactions in facilitating IVVC youth and gender inclusion.

Barriers and opportunities for youth and gender IVVC inclusion in Mali

This section discusses barriers and opportunities in the policy framework and the interventions for youth and gender IVVC inclusion (Table 6).

Barriers hindering women and youth IVVC inclusion

Covid-19 and consequences of the August 2020 coup d'état. The restrictive measures were taken after the emergence of Covid-19, and government sanctions following the 2020 coup in Mali negatively impacted the economy, particularly household income resulting from difficulties in accessing seeds and other agricultural inputs. Consequently, there was a reduction in cultivated areas and a drop in household production. In addition, the lack of

product storage capacity led to a partial loss of agricultural production. A drop in income was observed among 79% of households selling food crops (FAO 2021a). This shows the vulnerability of the value chain, especially in terms of logistics and infrastructure.

Table 6. Barriers and opportunities for youth and gender IVVC inclusion.

Category	Barriers	Opportunities
New drivers	- Covid-19 and consequences of the August 2020 coup d'état	- Covid-19 as intervention opportunities
Policy and governance	- Limited number of agricultural diversification strategies - Weak policy support to vegetable and horticultural subsector - Conflicting strategies in family farm promotion and agro-business development - Modest integration of women in IWRM - Ineffective multi-sectoral approach - Decentralization challenged by the resource allocation process due to local authority's capacity - Unbalanced participation of stakeholders in shaping policy decisions	- Promotion of crop diversification, climate-resilient inputs and infrastructure - The framework promotes favorable conditions for self-sufficient food production and market linkages - Holistic approach for water resources management in the policy framework - Agriculture entrepreneurship promotion - Recognition of family farms - Private sector and agro-industrial zones development - Expanded research institutions - Regionalization as a new approach to decentralization
Interventions and implementation	- Inefficient implementation of interventions in irrigation infrastructure development - Weak and insufficient coordination of intervention activities and unsuccessful partnerships between key actors - Absence of vegetable-specific irrigation development - weak ownership of irrigation schemes - Financial challenges during interventions implementation	- Implementation of interventions promoting climate-resilient seeds, seed storage, rehabilitation of irrigation - Facilities, training on fertilizers - Interventions based on the PNIP approaches - Providing additional funds - Sensitive evolvement of gender inclusion in the decision-making process
IVVC-related inclusive development and implementation	- Absence of women and youth-specific strategies in the IVVC - Women and youth-specific strategies and interventions concentrated in production - The percent of irrigated land allocated to women and youth is less than the law requires - Unclear water access guidance for gender and youth inclusion in irrigation development	- Sensitive evolvement of gender inclusion in the decision-making process - Priority integration for women and youth in agricultural professions - Intervention support youth and gender engagement capacity along the value chain

Limited agricultural crop diversification strategies. The policy framework promotes diversification by targeting most crops, including vegetables. However, the lack of specific strategies on vegetable development prevents this sector from benefiting from full support along the value chain. Agricultural sector policies from 2007 to 2017 focused on increasing domestic rice production, reforming the cotton sector, and maintaining input subsidy

programs (FAO 2017). Consequently, vegetable seeds are expensive for farmers as they are imported and may not adapt to local conditions. There are formal seed companies (local, foreign, and farmer cooperative) in the country with vegetables in their portfolio. However, breeding programs are mostly non-existent (Schreinemachers 2020). The high cost of vegetable seeds can constitute a limiting factor for vegetable development as seed cost harms vegetable enterprise performance (Dembele et al., 2018).

Weak policy support to vegetable and horticultural subsector. The vegetable value chain is not as supported as cotton and cereals. This includes the lack of specific subsidy programs, weak processing development strategy, and unorganized collection and trading systems still vulnerable to the informal sector. There is a lack of collection infrastructure and organization. The existing warehouses are limited to a handful of cooperatives. Trading is by short circuit sale through informal trading with exchanges between traders exclusively settled in cash, immediate sale after harvest on local markets or to wholesalers through the intermediary of collectors and traditional storage techniques, usually in huts with high loss rates (USAID and Cross boundary 2018). This can also affect the prices with intermediates who engage in rent-seeking behavior. Wholesalers engaged in long-distance coverage with fresh produce face challenges with infrastructure. Therefore, they only target producers reachable from cities to avoid spoilage.

The resource allocation process and local authority capacity challenge the multi-sectoral approach and decentralization. Several ministries and departments are involved in designing, developing, and implementing policies. The policy framework shows a will to promote a multi-sectoral approach. However, it is challenged by weak coordination among the involved actors and leads to overlapping interventions. The decentralization policy implementation is characterized by the weak financial capacity of the decentralized communities, linked to a low level of resource transfers from the state. It is also characterized by the insufficient mobilization of the local authorities' resources and their dependence on external financial resources (Ousmane 2020). This constitutes a bottleneck for rural development and agriculture. It also influences policy implementation capacity, especially policies that rely on decentralization.

Limited stakeholder participation in policy decision-making. Although the policy framework tries to ensure participation, the inclusiveness of actors at the design stage is weak. Private sector involvement in the policy development is modest due to limited application of consultation frameworks, the predominance of the informal sector (linked to low human resource capacity), and insufficient application of regulations and legislative direction. This negatively influences agricultural policy implementation (Samaké et al. 2019), hindering private sector participation in the IVVC development.

Conflicting strategies in family farming promotion, agro-business development, and gender integration in IWRM. The policy framework promotes both family farming and agricultural entrepreneurship. However, public interventions tend to reduce the participation of family producers in agricultural resource management. This has many consequences for women and youth for managing agricultural land in general and irrigated vegetable production in particular. When state-owned land is sold, a large amount is bought by foreign companies, limiting chances for local smallholders and youth (Muiderman et al., 2016). Further, interventions initiated by the Mali National Youth Employment Agency (APEJ) for youth to benefit from land have negligible impact. The IWRM principles recognize the role of women in water resources management. However, gender integration in

resource mobilization and management does not meet expectations. Consequently, women will still be marginalized in the decision-making process and water resource management.

Unclear water access guidance for women's and youth's investment in irrigation. Generally, the policy framework promotes equitable access to water for all. However, there are no strategies for gender and youth investment in irrigation. Ineffective coordination among ministries results in the neglect of youth and gender inclusion in water management planning. For example, the National Gender Action Plan developed detailed actions for gender inclusion in different sectors. However, it lacks support for women's activities in water management, especially in irrigation. Some programs integrate the gender aspect in terms of participation, but there is no clear strategy guiding women's participation and economic empowerment (FAO 2017b).

Inefficient implementation of interventions in vegetable-specific irrigation and infrastructure development. Many projects have undertaken irrigation infrastructure development to increase crop diversification. Unfortunately, some interventions have been unsuccessful because of poor coordination, ineffective partnerships, and difficulty in receiving the expected funds from the government. When resources are not mobilized to implement interventions, it results in a lack of infrastructure to meet the expressed needs of producers. This can negatively influence youth and gender inclusion. The irrigation interventions are always generalized for crop diversification except for specific and prioritized crops like cotton and rice. Only market gardens are dedicated entirely to vegetable production among the irrigation schemes developed. This results in weak irrigation infrastructure and limited use of pumps in vegetable irrigation (USAID and Cross boundary 2018). Sometimes, vegetables are promoted in the off-season. Consequently, intensive production of vegetables is limited.

Weak ownership to irrigation schemes. The irrigation systems developed require maintenance and an appropriate management structure. They are sometimes handed over to water user associations or cooperatives. In some interventions, weak ownership is noticed, resulting in ineffective management of the schemes. Weak ownership is one of the factors that can prevent the full operationalization of irrigation schemes (Amede 2015). It can lead to water shortages for farmers and affect women and youth.

Absence of women and youth-specific strategies to participate along the IVVC. The government undertook the rice initiative[15] in 2008, later extended to maize, wheat, millet, and sorghum to increase production mainly through fertilizer subsidies. Thereafter, 95% of chemical fertilizer consumption focused on cereal and cotton production (Diakité 2014; USAID and Cross boundary 2018), resulting in poor access to inputs for vegetable production, especially for women and youth. The vegetable sector suffers from the lack of comprehensive policies on fertilizer subsidies (USAID and Cross boundary 2018). In such a situation, women and youth do not consider agricultural activity to be marketable. Agriculture does not attract rural youth because they cannot see the opportunity to make a profit (CTA 2019). Women and youth-specific strategies and interventions are concentrated in production rather than other functions in the VC; however, they promote women's access to market gardens. As market gardens are mainly cash crops and providers to restaurants, their influence on the international market may be negligible. FAO (2017a) characterized this as consumer-oriented policies.

[15] National Development Strategy of Rice (NRDS – Stratégie nationale de développement de la riziculture, 2009–2018)

Limited allocation of irrigated land to women and youth. The policy framework calls for the allocation of 15% of developed irrigated land to women and youth. However, the level reached by most interventions trying to implement this strategy is 10%. Some interventions focus more on women than youth. This is the case for some projects developed under the PNIP. The consequence emerging from these barriers is the insufficient coverage of women and youth in accessing irrigation infrastructure.

Financial challenges during intervention implementation. Development partners support most interventions. The financial investment from the government is low. Unfortunately, in some interventions, the government fails to provide its contribution. This is a limiting factor that hampers the achievement of the interventions.

Weak coordination of intervention activities and unsuccessful partnerships between key actors. Insufficient involvement of the Ministry of Rural Development in the planning and use of small-scale irrigation systems leads to developing irrigation systems that may not be environmentally friendly. Additionally, it can lead to inadequate maintenance of irrigation infrastructure, inefficient water use, and poorly adapted methods by end-users. Weak coordination and unsuccessful partnerships among actors in implementing interventions hamper the development of infrastructure and its access to the target population, including women and youth.

Opportunities for Women and Youth IVVC Inclusion

Covid-19 response. Response to the Covid-19 pandemic prompted a series of interventions that supported farmers, including providing cereal kit distribution of seeds, fertilizers, and pesticides. As a result, 5,000 market gardeners benefited from market gardening and seed kits, including 3,000 women. Additionally, 150 fruit and vegetable preservation and processing kits were distributed. Producers in dry areas benefited from the distribution of supplemental irrigation kits (e.g., watering cans, water pipes, and pumping equipment). Good resilience practices such as using certified seeds, using adapted varieties, supplemental watering, and improving soil fertility through sustainable land and water management practices have been disseminated to farmers (FAO 2021b).

The policy framework promotes crop diversification, climate-resilient inputs, and favorable conditions for food production and market linkage. This can be an opportunity for the domestic production of quality vegetable seeds, increasing seed availability, reducing seed prices, and improving access. It also promotes crop diversification to ensure year-round food availability for household consumption. The consumption market is growing due to rising urbanization and dietary changes. According to USAID and Crossboundary (2018), 8% of total food expense in Mali is vegetables (fresh and processed). This rate is higher in Bamako (13.8%) compared to rural areas (7%). These represent opportunities for women and youth to invest more in horticultural production and sell in the short circuit. Further, the framework promotes reforms in the fruit, vegetable, and oilseed sectors oriented toward domestic and foreign market development. This includes market infrastructure development (road and rail) linking to neighboring countries and abolishing airport fees for vegetable exports.

Holistic water resources management and regionalization-based decentralization approach in the policy framework. Mali has adopted the IWRM approach, emphasizing holistic water resources management and planning tools and developing master plans. IWRM principles recognize women's role in water resource development and management.

To fill the gaps observed in the decentralization process, there is a reform that led to the adoption of the regionalization as a new approach to strengthen the state's legitimacy and credibility in the economic development mission and wealth and job creation. Its success will be an opportunity for regional development and of the rural areas.

Promotion of agriculture entrepreneurship in large areas and family farms. Family farms are promoted officially in the policy framework. An advantage of being registered as a family farm is the access to subsidy support. This is an opportunity to increase the production of vegetables. Also, farmers are the main beneficiaries of the new Small-Scale Irrigation Promotion Program. Interventions developed under this program promote gender inclusion and vegetable production as a diversification product. The policy framework also targets agricultural development in large-scale irrigation areas. This creates an opportunity for women and youth engagement as a productive workforce. Regarding irrigated vegetables, large-scale irrigation development contributes to promoting off-season vegetable production. For instance, there is an allocation of irrigated land in the Office du Niger to women and youth for agricultural production.

Private sector and agro-industrial zone development. The policy framework provides strategies for importing raw materials for input production. Women farmers have limited access to fertilizers, seeds, pesticides, agricultural equipment, and machinery (Njobe and Kaaria 2015). Facilitating the importation of the inputs will assist them to increase their vegetable production. The framework also promotes technical and financial support to SME development and agro-industrial zone establishment. There is an opportunity to develop more processing units to produce value-added vegetable products. Employment opportunities and enterprise development for women and youth groups are also promoted. Finally, the framework mobilizes private sector investment by extending its role to constructing hydraulic infrastructure, market garden wells, and the supply of motor pumps, micro-irrigation equipment and the like.

Recognition of women and youth integration in agricultural professions. There is a legal framework for gender and youth inclusion in agriculture. The Agricultural Land Law—LFA (Loi Foncière Agricole) says that 15% of developed land by state or local authorities is to be allocated to groups and associations of women and youth (GOM-LFA 2017). This is an opportunity to develop and support vegetable production. Further, the framework targets women as beneficiaries of market gardens. Increasing market garden development will improve women and youth access within the interventions. The framework also promotes modern conservation and processing techniques for women. There will be formalization and upgrading of women's small-and-medium processing businesses into labeled agro-food products. As vegetable processing is still predominated by traditional transformation, the promotion will create opportunities for women to develop their processing capacity further.

Gender-sensitive decision-making in the implementation process. Gender inclusion in the decision-making process is considered under the PNIP. In the IPRO-IRRIGAR and IPRO-REAGIR projects, women represent 30% of the members of the AHA management and maintenance committees (Hertzog 2019). In the Contract-Plan Office du Niger implementation, there is a 15% involvement of women in the decision-making process (GOM, 2019). The market gardening schemes are dedicated to women; however, the exploitation of lowlands is dedicated to rice cultivation. Effective involvement in the decision-making process can be an opportunity to ensure women and youth have access to land, water, and infrastructure (e.g., storage, processing, conservation, and marketing) for vegetable production.

Opportunity for an inclusive IVVC development from interventions using the PNIP approaches. The PNIP emphasizes the multi-use of water resources and inclusivity of interventions. There is also a launch of socio-technical studies to avoid conflicts over the future cultivable space and facilitate land redistribution processes. The inclusive character of the interventions and the land tenure security are opportunities for smallholder farmers, especially the vulnerable groups (women and youth), to engage more in production.

Interventions support youth and gender capacity and engagement along the value chain. Technical and managerial capacity building for women and youth are found across the clusters. It involves training on market gardening techniques for various crops and product marketing. Women also get support in market gardening equipment and in organizing into cooperatives or groups, creating opportunities for access to credit from financial institutions to invest in agricultural activities. Youth benefit from training and support in agricultural machinery and farming diverse crops. Both women and youth are supported in building financial literacy and natural resources management skills. Finally, they are trained on cost-competitive technologies for developing vegetable gardens and techniques to mitigate the effects of climate change.

Existence of research institutions. Several research institutions at the national level (Table 5), including the Institute of Rural Economic—IER (Institut de l'Economie Rurale). This is an opportunity for research into locally produced vegetables.

Existence of funds targeting women's empowerment. These include the Support Fund for the Empowerment of Women and the Development of the Child (FAFE). Through this fund, women are supported in entrepreneurship and income-generating activities (IGAs). The fund also is used to strengthen their technical and managerial capacities. The National Agriculture Support Fund (FNAA) supports subsidies for agricultural development. It guarantees loans, finances seed production, and provides crop subsidies.

Recommendations

The findings show a strong political will to develop the agricultural sector through strategies and projects. Although the framework contains several opportunities, developing the horticulture sector and IVVC is not given a strong focus compared to other crops such as cotton, cereals, and rice. This results in the limited availability of quality vegetable seeds. The framework lacks guidance and mechanisms that enhance youth and gender inclusion. Further, the intervention implementation is challenged by poor participation, coordination, partnership, monitoring and evaluation, communication among actors, and insufficient financial resources from the state's contribution. The IVVC is not well-structured compared to other crops such as mangoes, cashews, and gum Arabic. IVVC development is not a priority of the policy and intervention frameworks. Women and youth are the main workforces for vegetable production, yet they are facing several challenges to engage with and to benefit from the IVVC. As a result, there is limited impact found in irrigation development, food security, youth, and gender IVVC inclusion.

The analysis of barriers and opportunities influencing youth and gender IVVC inclusion provides a framework to define a medium to long-term development vision of enhancing social inclusion and equality in the irrigated agricultural subsector. To achieve the vision of improving incomes, nutrition, health, knowledge, representation, and voices of women and youth farmers and disadvantaged groups through sustainable and inclusive IVVC development, these objectives are essential:

- Enable a supportive policy and institutional environment and governance mechanisms for youth and gender IVVC inclusion and public and private investment,
- Enable private sector investments in irrigation supply chains, irrigated vegetable value chains, and horticultural subsectors,
- Enhance inclusive interventions to support youth and gender IVVC inclusion and economic empowerment, and
- Transform youth and gender inclusion and economic empowerment at the system level.

Enable a supportive policy and institutional environment and governance mechanisms

The focus needs to be on enabling a supportive policy with technical, financial, and institutional aspects to facilitate youth and gender engagement in IVVC. This should be done in a sustainably and equitably to mobilize public and private investment into IVVC and horticultural subsectors. These recommendations are suggested as action strategies to achieve this objective.

- **Strengthen agricultural policies and programs to address emerging challenges in youth and gender inclusion effectively.** Policy support should emphasize crop diversification, climate-resilient input production, facilities and supply, good resilience practices, sustainable land, and water management practices, holistic approaches for water resources management, agriculture entrepreneurship, and private sector and agro-industrial zones development. These will help build the resilience capacity of agricultural sectors and food systems to adapt to emerging challenges. Further, clear strategies, guidance, and mechanisms to support youth and gender inclusion in rural economic development and the agricultural value chain should be developed and strengthened.

- **Provide policy support to the IVVC and horticultural subsector development toward enabling youth and gender inclusion and benefits.** The IVVC seems dispersed in agricultural policy and difficult to define through strategies. It is necessary to undertake reforms to reorganize the irrigated vegetable subsector. Policy support will need to strengthen the infrastructure for collecting, transporting, storing, and processing irrigated vegetables. There have been programs that supported individual and private irrigation through various. irrigation systems. Similar programs focusing on the development of irrigated vegetables for youth and women can be initiated. This will not only promote the increased production of horticultural products but also make the horticultural sector attractive to young people and women. Further, clear and specific strategies, guidance, and activities for youth and gender engagement need to be developed to enable these groups to benefit from investment in water management and irrigation development.

- **Support policy interventions on family farming development to ensure that investment policies protect the rights of local populations.** Harmonizing the promotion of family farming and agro-business development should be formalized in policies and strategies that bring together and encourage small producers and investors to work within a well-organized, state-mediated partnership framework. Such policy implementation guidance and responsibility may be transferred to decentralized state services through regionalization.

- **Support an in-depth review of existing policies, standards, programs, and a revision of the agricultural input policies.** The private sector should have a role in producing, importing, and distributing fertilizers, seeds, irrigation equipment and developing a sustainable business model for in-country production and supply of inputs. Develop a list of the actors involved in the agricultural input value chain and IVVC and identify their needs. Stakeholders in the irrigated vegetable subsector must be identified in all functions of the agricultural value chain, e.g., inputs, irrigation, production, collection, storage, processing, and distribution. This identification phase must be coupled with a diagnosis or survey to understand the technical, material, organizational and financial needs to define programs.

- **Develop youth-and-gender-sensitive input subsidy policies and programs for youth and gender benefits.** It is essential to assess the effectiveness of existing subsidy policies and governance mechanisms in the agriculture sector. Studies to understand women and youth's financial management, capacity, and investment potentials should be undertaken. These will help to better design an effective program of grants and innovative financing mechanisms to benefit the most vulnerable, including women and youth. This will also assist access to climate-resilient irrigation equipment, inputs, and services, including information financial and market services by smallholders, women, tenants, and marginalized groups. As the market gardening sector and family farming are crucial for IVVC, strategies to provide budget support to these subsectors should be on sector concerns rather than overall political and funding priorities. Since government support for agriculture has not benefited vegetable farmers, this would help distinguish subsidies for vegetables from those for other crops.

- **Create, strengthen, or revitalize policy consultation framework and process at two organizational levels.** Improving consultation framework and processes will help strengthen coordination and interactions between stakeholders and actors across sectors while avoiding overlaps, duplication of actions, and respecting norms and standards for irrigation system development and environmental sustainability. For the multi-sectoral approach to succeed, create or revitalize consultation framework and processes where the actors can develop key projects and programs portfolios. The consultation framework and process used by different ministerial departments need to bring together and stimulate diverse interests of the private sector in the irrigated agricultural value chain development by designing project portfolios at the department level. A detailed and comprehensive M&E system in project portfolios will effectively assess a project's impact on targets. Across different ministries, consultation frameworks and processes will balance the role (in terms of participation) of the actors and stimulate the interest and participation of the private sector, which enhances the effective implementation of policies and interventions.

- **Strengthen coordination, communication, and M&E of policy and program implementation**. This will ensure that implementing institutions have access to resources according to their level of involvement to fulfill their mission.

Enable private sector investments into the irrigation supply chain, irrigated vegetable value chain, and horticultural subsector

Engagement and investment from private sector service providers are critical for IVVC and horticultural subsector development. This is because the private sector brings skills, innovation, knowledge, and support for the advancement of irrigation and input supply, creating output market linkages for horticultural products, and establishing financial and logistics service systems. Enabling private sector investment into IVVC and horticultural subsector should consider:

- **Create an enabling environment for more domestic manufacturers, irrigation and input businesses, and processing SMEs to grow.** This should begin with revising taxes and import regulations for raw materials required for irrigation equipment, climate-smart inputs, processing, and logistics. Further, it is essential to engage with the private sector to capitalize upon private sector investment in irrigation equipment, input supply chains, processing, and market infrastructure.

- **Accelerate sustainable financing models to help de-risk private sector investments in irrigation markets, especially products and services that support youth and gender inclusion.** More collaborations and partnerships between public and civil society organizations and the private sector are needed to address essential infrastructure, including seed production and storage, local fertilizer manufacturing, rehabilitation of irrigation facilities, agro-industrial zone development, collection centers for horticultural products, and market facilities targeting high-end markets and domestic transportation.

- **Foster partnerships between entrepreneurs, farmer groups, cooperatives, private and public sector actors.** Fostering partnerships will establish direct demand and supply linkages to ensure youth and gender benefit from markets created for IVVC and horticultural subsectors. It is critical to consider the micro-scale agribusiness subsector as a key economic area to attract youth to participate in agriculture. Support to agricultural SMEs, business operators, and processor start-ups can be provided by tailoring a business incubation program.

Enhance inclusive interventions to support youth and gender IVVC inclusion and economic empowerment

Special attention should be paid to empowering women and youth through interventions. It is difficult to define the program impact for which only one objective or sub-objective addresses the youth and gender inclusion. It would be more impactful to develop specific programs focusing on youth and women, ensuring they include comprehensive monitoring and evaluation systems. Hence, it should consider:

- **Enable youth and gender access to resources and requirements for IVVC investment.** Efforts should be made to develop comprehensive interventions to improve youth and women's access to land and water resources, inputs, credit, processing equipment, storage, and market linkages for irrigated vegetable products. This requires youth and gender segmentation to tailor targeted interventions and bundle different interventions, innovations, and services to best-fit youth and gender investment within the IVVC. One example is irrigation equipment bundled with pay-as-you-go financing services.

- **Strengthen the readiness and capacity of youth and women to engage in IVVC.** Designing and implementing comprehensive interventions for youth and gender IVVC inclusion are necessary conditions but strengthening youth and gender readiness and capacity to engage with these interventions will determine the success of their IVVC investment. Readiness and capacity studies will understand their interests, needs, and available capital to engage with the interventions. Capacity building should leverage existing practices, including SME start-up incubation, job creation, financial and business capacity building, and agricultural machinery and processing.

- **Improve the financial, information services, and collective action.** This includes effective mobilization and consolidation of funds created at the sector level (e.g., National Agricultural Support Fund, Fund for Women's Empowerment and Child Development, Water Fund, Climate Fund), and the decentralized financial system to strengthen mechanisms to access financing for women and youth within the IVVC. Others include strengthening seed and irrigation research, enhancing extension services, developing market information systems by providing technical information on the conservation, processing, and marketing of vegetables by women and youth. Additionally, promote youth and women organizations with collective action as they still encounter difficulties in accessing credit. Organization and collective action will provide advantages including mutual savings, collective access to credit, collective purchase of inputs, use of extension services, and collective marketing, which helps to reduce transport costs.

Transform youth and gender inclusion by economic empowerment at the system level

To achieve this objective, barriers that hinder transformative changes in irrigated agriculture should be addressed. Suggested recommendations are:

- **Support policy and institutional capacity development.** An evidence-based policy dialogue on youth and gender inclusion is critical to achieving systemic capacity development. Capacity development includes strengthening local governments and authorities, community-based organizations, farmer associations, and cooperatives. Women and young farmers must actively participate in decentralization processes to ensure needed changes in policies through a multi-sectoral approach promoting gender and socially inclusive innovations in irrigation technologies and supportive of sustainable water use in irrigated agricultural value chains, horticulture, and agribusiness.

- **Create and operate multi-stakeholder platforms and dialogue (MSD) at multiple levels.** The MSD aims to connect private sector actors, government, community-based organizations, and cooperatives to discuss barriers and opportunities for youth and gender inclusion in IVVC and broader social inclusion in economic development. The MSD will be an institutional mechanism to promote demand-driven entrepreneurship, agribusiness, and market system development for IVVC. MSD will foster cross-sectoral cooperation and collaboration, win-win partnerships, and inclusive youth and gender-specific policy strategies and interventions.

- **Invest in research for development.** Research investments should target the commercialization of domestic seed and fertilizer production, nature-based solutions for land and water resource management, and irrigation development. These are essential for developing domestic agribusiness capacity. Inter-disciplinary research is needed to understand youth and gender inclusion concerning challenges and resilience capacity from Covid-19 restrictions and climate change, specifically, how these affect current agro-ecologies, water availability, gaps in public and private sector investment in the irrigated agricultural value chain, and horticultural subsector.

References

1. Adant, V.; Coulibaly, D.; Fofana, B. 2019. *Etude sur les potentialités de productions maraîchères en saison d'hivernage et définition des conditionnalités de réussite (E3). Rapport final*. Programme d'Appui au Sous-Secteur de l'Irrigation de Proximité.
2. Adétonah, S.; Coulibaly, O.; Ahoyo, R.; Sessou, E.; Dembélé, U.; Huat, J.; Houssou, G.; Vodouhe, G.; Loko, J. 2015. Analysis of Gender and Governance of Value Chain-Based Systems on Rice and Vegetable Crops in Southern Benin and Mali. *Open Journal of Social Sciences* 3: 134–141. http://dx.doi.org/10.4236/jss.2015.36020
3. AMAP (Associations pour le Maintien d'une Agriculture Paysanne). 2019. *Femmes rurales: Difficile équation de l'accès à la terre (Rural women: Difficult equation of access to land).* https://malijet.com/la_societe_malienne_aujourdhui/232597-femmes-rurales-difficile-%C3%A9quation-de-l%E2%80%99acc%C3%A8s-%C3%A0-la-terre.html (Accessed on May 2021).
4. Amede, T. 2015. Technical and institutional attributes constraining the performance of small-scale irrigation in Ethiopia, *Water Resources and Rural Development* 6: 78–91, ISSN 2212–608. https://doi.org/10.1016/j.wrr.2014.10.005
5. CTA (Technical Centre on Agricultural and Rural Development); FARA (The Forum for Agricultural Research in Africa). 2011. *Agricultural Innovations for Sustainable Development. Contributions from the Finalists of the 2009/2010 Africa-wide Women and Young Professionals in Science Competitions.* Volume 3 Issue 2. September 2011. Accra, Ghana.
6. CTA. 2019. Attirer les jeunes dans le secteur de l'agriculture (Attract young people to the agricultural sector). *CTA Technical Brief.*
7. Das, M.B; Fisiy, C.F.; Kyte, R. 2013. *Inclusion matters: The foundation for shared prosperity* (*81478*) 1–301. Washington DC: The World Bank.
8. Dembele, K.D.; Mshenga, P.M.; Owuor, G.; Felix, Badolo F.; Tignegre, J.B. 2018. Economic Analysis and Determinants of Selected Women-Led Vegetable Enterprises Performance in Koutiala and Bougouni Districts, Mali. *Journal of Economics and Sustainable Development* Vol. 9(14). ISSN 2222–1700 (Paper) ISSN 2222–2855 (Online).
9. FAO (Food and Agriculture Organization of the United Nations); ECOWAS Commission (Economic Community of West African States). 2018. *Profil national genre des secteurs de l'agriculture et du développement rural.* Série des Evaluations Genre des Pays-MALI. https://www.fao.org/3/i8706fr/I8706FR.pdf
10. FAO. 2017a. *Développer des chaînes de valeur sensibles au genre – Cadre d'orientation*. Rome: Food and Agriculture Organization of the United Nations. https://www.fao.org/3/a-i6462f.pdf
11. FAO. 2017b. *Country fact sheet on food and agriculture policy trends.* Rome: Food and Agriculture Organization of the United Nations. https://www.fao.org/documents/card/en/c/6ad88fc2-1803-4cba-a055-43495c2099ce/
12. FAO. 2021a. Mali | *Moyens d'existence agricoles et sécurité alimentaire dans le cadre de la covid-19: rapport de suivi,* Mai 2021. Rome: Food and Agriculture Organization of the United Nations. https://doi.org/10.4060/cb4458fr
13. FAO. 2021b. *Systèmes agroalimentaires nationaux et la covid-19 au Mali. Effets, réponses politiques et implications à long terme*. Rome: Food and Agriculture Organization of the United Nations. https://doi.org/10.4060/cb3622fr
14. Haggblade, S.; Traoré, A.; Diakité, L.; Dramé, Z.; Sidibé, M. 2014. *Promotion of an inclusive value chain: Perspectives and potential of horticultural products in Mali*. FIDA

15. Hertzog, T.; Sangare A.; Coulibaly, T. 2019. *Mid-term evaluation of the National Proximity Irrigation Program and updating of its monitoring-evaluation system*. Bamako, Mali: Ministry of Agriculture.
16. Kouriba, I. 2015. *Definir les Besoins de la Mise en Place d'un Forum National des Services de Conseil Agricole et Rural Performants Pour Une Agriculture Intensive au Mali*. Bamako, Republic of Mali. Forum des Services de Conseil Agricole et Rural du Mali.
17. Krippendorff, K. 2004. *Content Analysis: An Introduction to its Methodology*. London, UK: Sage.
18. Diakité, L.; Zéinabou, D.; Sidibé, M. 2014. *Analyse de la chaîne de valeur des produits horticoles: tomates fraîches, échalotes fraiches, Gombos et Choux au Mali.* Bamako: Chambre d'Agriculture du Mali, IER et MSU.
19. Lefore, N.; Giordano, M.; Ringler, C.; Barron, J. 2019. Sustainable and equitable growth in farmer-led irrigation in sub-Saharan Africa: What will it take? *Water Alternatives* 12(1): 156–168
20. Mamadou, C.; Guillaume, S. 2020. *Le pôle de croissance agricole du territoire de l'office du Niger au Mali: actions publiques et changements de gouvernance*. Montpellier, France: Centre de coopération internationale en recherche, 80p.
21. Merrey, D.; Lefore, N. 2018. *Improving the availability and effectiveness of rural and "micro" finance for small-scale irrigation in sub-Saharan Africa: A review of lessons learned*. IWMI Working Paper No. 185. Colombo, Sri Lanka: International Water Management Institute.
22. Minh, T.T.; Osei-Amponsah, C. 2021. Towards poor-centered value chain for sustainable development: A conceptual framework. *Sustainable Development*. 18 June 2021. http://doi.org/10.1002/sd.2220 (accessed on December 2, 2021).
23. Minh, T.T.; Zwart, S.; Richard, A.; Schmitter, P. 2021. *Analyzing the enabling environment to enhance the scaling of irrigation and water management technologies: A tool for implementers*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 18p. (IWMI Working Paper 197. [doi: https://doi.org/10.5337/2021.201 (accessed on December 2, 2021).
24. Muiderman, K.; Goris, Y.; Ates, B. 2016. Youth inclusiveness in agricultural transformation: A quick scan study. https://knowledge4food.net/wp-content/uploads/2016/12/161130_youth-inclusiveness-agri_quick-scan-final.pdf (accessed on December 2, 2021).
25. Nakawuka, P.; Langan, S.; Schmitter, P.; Barron, J. 2018. A review of trends, constraints and opportunities of smallholder irrigation in East Africa. *Global food security* 17: pp. 196–212.
26. Nientao, M. 2017. Integrated water resources management in Mali: The view of international law. International Peace and Security. *Journal of International Law and International Relations* (05): 147–180.
27. Njobe, B.; Kaaria, S. 2015. *Les femmes et l'agriculture: le potentiel inexploité dans la vague de transformation.* https://www.afdb.org/fileadmin/uploads/afdb/Documents/Events/DakAgri2015/Les_femmes_dans_l_agriculture.pdf (accessed on December 2, 2021).
28. Ousmane, S.Y. 2020. *Le Mali, de la décentralisation à la régionalisation, quelles perspectives?* http://www.lmi-macoter.net/wp-content/uploads/2020/11/Cahiers-de-MaCoTer_1-2_papier_Ousmane-Sy.pdf (accessed on December 2, 2021).
29. Sajuyigbe, A.S. 2017. Influence of financial inclusion and social inclusion on the performance of women-owned businesses in Lagos State, Nigeria. *International Journal of Management and Development* 4(3): 18–27.

30. Samaké, A.; Sanogo, O.; Traoré, A. 2019. *Rapport de synthèse des ateliers de restitution des résultats de l'évaluation du processus d'élaboration des politiques agricoles et de sécurité alimentaire par les intervenants au Mali* (No. 1879-2020-429). Department of Agricultural, Food, and Resource Economics, Michigan State University, Michigan, USA.
31. Schreinemachers, P. 2020. *Tapping into the potential for vegetable seed production in Mali*. Tainan, Taiwan: World Vegetable Center–Innovation Lab for Small-Scale Irrigation. https://ilssi.tamu.edu/2020/09/16/tapping-into-the-potential-for-vegetable-seed-production-in-mali/ (accessed on December 2, 2021).
32. Shah, T.; Namara, R.; Rajan, A.; 2020. *Accelerating irrigation expansion in sub-Saharan Africa: Policy lessons from the global revolution in farmer-led smallholder irrigation*. Washington, DC: World Bank.
33. Sogoba B.; Ba A.; Zougmoré R.; Samaké O.B. 2014. *Comment instaurer un dialogue entre chercheurs et décideurs pour l'adaptation aux changements climatiques au Mali: Analyse des défis, contraintes et opportunités.* Document de Travail No. 84. Programme de recherche du CGIAR sur le Changement Climatique, l'Agriculture et la Sécurité Alimentaire. Disponible en ligne sur: www.ccafs.cgiar.org
34. Theriault, V.; Smale, M.; Assima, A. 2018. The Malian fertilizer value chain post-subsidy: An analysis of its structure and performance. *Development in Practice* 28(2): 242–256, DOI: 10.1080/09614524.2018.1421145.
35. Togola, C.O. 2018. After CREDD 2016–2018: *What social perspectives?* Friedrich Ebert Stiftung.
36. Traoré, A.; Samaké, A.; Sanogo, O.; Haggblade, S.; Koné, Y. 2019. Improving Agricultural Policy System Performance in Mali: Stakeholder Diagnostics and Prescriptions (No. 1879-2020-442). Feed the Future Innovation Lab for Food Security Policy; Department of Agricultural, Food, and Resource Economics, Michigan State University, Michigan, USA.
37. USAID (United States Agency for International Development) and Crossboundary. 2018. On the functioning of agricultural markets in Mali strategies for development. https://cdn.ymaws.com/www.andeglobal.org/resource/resmgr/research_library/2018-11_MIFP_Study_on_Agricu.pdf (accessed date: April 12, 2021).
38. Zamudio, A.N. 2016. *Review of current and planned adaptation action in Mali*. CARIAA Working Paper No. 11. International Development Research Centre, Ottawa, Canada and UK Aid, London, United Kingdom.: www.idrc.ca/cariaa (accessed on December 2, 2021).