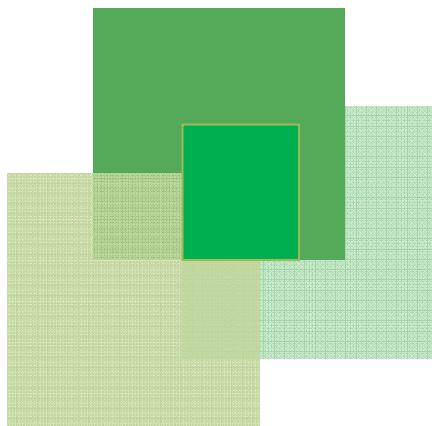




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Skills for green jobs in Mali

Unedited background country study

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Mali-Folkecenter Nyetaa

ILO Skills and
Employability
Department

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Foreword

The world finds itself in a slow recovery after the deepest recession since the Great Depression. The world is also coping with a host of environmental problems and the urgent need to reduce carbon emissions. A greener future also promises an enormous potential in a much needed employment growth. However, without suitable skills, this potential cannot be realized. Today, skills gaps are already recognized as a major bottleneck in a number of sectors, such as renewable energy, energy and resource efficiency, green building and retrofitting, environmental services and green manufacturing. Training response measures are successful where they are coherent across policy domains, systemic and systematic, and targeted at disadvantaged groups. These training measures can only be effective if based on timely identification of skills needs. Effectiveness of training measures is decisive not only for the economic recovery but also for a longer-term sustainability agenda.

This report was produced in the framework of the project, ‘Skills for green jobs’. The project was implemented in cooperation between the International Labour Organization (ILO) and the European Centre for the Development of Vocational Training (Cedefop). The project identifies skills needed for greener economies with respect to structural shifts, and new, emerging and changing occupational profiles. The ‘Skills for green jobs’ study is embedded in the Green Jobs Initiative, a joint initiative of the United Nations Environment Programme (UNEP), the ILO, the International Employers Organization (IOE) and the International Trade Union Confederation (ITUC), to assess, analyze and promote the creation of decent jobs as a consequence of the needed environmental policies. The global study was jointly funded by the Skills and Employability Department of the ILO and the Green Jobs Initiative.

The following countries have been included in the study: the ILO covered Australia, Bangladesh, Brazil, China, Costa Rica, Egypt, India, Indonesia, the Republic of Korea, Mali, the Philippines, South Africa, Thailand, Uganda and the United States. In addition, Cedefop covered six European Union (EU) member States: Denmark, Estonia, France, Germany, Spain and the United Kingdom. The ILO global synthesis report,¹ which analyzes the situation in all 21 countries involved in the study and the European synthesis report,² which covers the six EU countries, as well as all individual country reports, are available at: http://www.ilo.org/skills/what/projects/lang--en/WCMS_115959/index.htm (the ILO website) and <http://www.cedefop.europa.eu> (Cedefop website; look under *Skills Needs* theme). The unedited background country studies have been published in the electronic form in order to make them available quickly. The summaries are published as part of the synthesis reports.

The global project in the ILO was coordinated by the Skills and Employability Department and, in particular, benefited from comments and technical guidance by the team under the leadership of Olga Strietska-Ilina, Christine Hofmann, Mercedes Duran and Shinyoung Jeon. The ILO coordinating team would like to express great thanks to the authors of the report, Ibrahim Togola, Johanna Togola and Mahamadou Diarra of the Mali-Folkecenter Nyetaa, for their background country research which contributed to the global study. Special thanks also go to the ILO regional and country field offices for the project support and the ILO colleagues who assisted research at national level.

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¹ Strietska-Ilina, O.; Hofmann, C.; Duran Haro, M.; Jeon, S. (forthcoming 2010). *Skills for green jobs: A global view. Synthesis report based on 21 countries* (Geneva, ILO Skills and Employability Department).

² Cedefop. (forthcoming 2010). *Skills for green jobs: European synthesis report* (Luxembourg, Publications Office of the European Union).

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Abstract

This study was undertaken in Mali to identify major challenges and priorities related to climate change and the subsequent greening policies and strategies, and to identify major sectors with a greening potential in the country. The “greening” or “green jobs” as terms are not well known in Mali yet. There are many actions going on in Mali where greening and adaptation to climate change have not been in focus, but have been taken into account unintentionally. This is the case especially in the primary sector, which is also the government’s priority since around 80 per cent of population is engaged in the sector. There is a big potential for green jobs in Mali, both for development of new occupations and new skills for old occupations. Some of the most promising economic sectors are treated in this report. These sectors include: energy supply with renewable energy, agriculture, waste management, construction, forestry, and carbon finance.

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Executive summary

Climate challenges facing Mali are described in the National Adaptation Programme for Action (NAPA) and in the various studies assessing the impacts of climate change on the population of Mali. It appears from this analysis that droughts, floods, high winds, and strong temperature variations are the major climatic risks to which Mali is exposed. These risks will have consequences like the early drying up of water sources, reducing or irregularity of the rainy period, the decline in agricultural production and plant species, the disappearance of some plant and animal species, a higher degree of human and animal mobility to the most suitable areas, and so on. All this contributes to accelerating competition from actors for access to natural resources, often resulting in conflict. This mismatch increases the vulnerability to the impacts of climate change and may undermine the achievement of development goals that Mali has set.

The analysis of policies, strategies and key development programmes in Mali (Strategic Framework for Growth and Poverty Reduction, Programme of Economic and Social Development, Agriculture Orientation Law, etc.) shows that the impacts of climate change are not included in them as a priority, despite the high vulnerability of Mali as described in the NAPA. Also, the adaptation priority actions set out in the NAPA are not implemented even though they are urgent.

Actions on climate change are too scattered and lack a national strategic framework that defines the vision of Mali concerning the inclusion of climate change in the sectoral policies, in private initiatives and in national planning.

Like most African countries, Mali's concern under the Climate Change Convention is less on reducing emissions, but rather on the prediction and management of potential impacts due to the high vulnerability of the country. The Government has shown its political will to take into account environmental problems in development policies.

Mali has subscribed to many international agreements and conventions related to environment before and after the Rio Conference, and is implementing several programmes and environmental management plans (Desertification, Environmental Action, and National Environmental Policy Plans). Currently, Mali has undertaken to take into account the dimension of climate change into national development plans. The NAPA was developed in 2007. This plan has identified nine priority projects which are not implemented.

“Green jobs” is not a commonly used or well-known term in Mali. There are no strategies in place for greening the economy. However, there are many actions leading to the same direction, even if their original source is not greening policies, but the need for markets to adapt to the actual economical situation, and the need to develop employment markets due to youth unemployment and difficulties facing especially the primary sector due to climate change.

Until now, the main challenges in Mali have been other dimensions of development in the context of decentralization, population growth, uncontrolled urbanization and the rate of extreme poverty. For entrepreneurial development, there are so many other urgent challenges that greening is not a priority. It is quite evident that at the moment greening is not considered as an opportunity, but rather an additional burden.

However, there is a huge potential for green jobs in Mali; both for new occupation development and new skills for old occupations. Some of the most promising economic sectors are treated in this report. These sectors include energy supply with renewable energy, agriculture, waste management, construction, forestry, and carbon finance.

In an ideal situation, the Malian Government could introduce the greening aspect in all its policies and programmes, which would help the country avoid many of the mistakes made in developed and emerging countries.

The implementation of such measures requires first of all changing from project-thinking to long-term vision planning in all sectors, understanding the enormous opportunities that greening provides to the economy; well-trained human resources; sufficient financial resources and an adequate institutional framework.

Abbreviations and acronyms

AMADER	Malian Agency for the Development of Domestic Energy and Rural Electrification (Agence Malienne pour le Développement de l'Energie Domestique et l'Electrification Rurale)
ANADEB	National Agency for Development of Biofuels (Agence nationale de développement des biocarburants)
ANPE	National Agency for Employment Promotion (Agence nationale pour l'emploi)
APEJ	Agency for Promotion of Youth Employment (Agence pour la promotion de l'emploi des jeunes)
CBD	Convention on Biological Diversity
CCD	Convention to Combat Desertification
CDM	Clean Development Mechanism
CED	Centres for Education for Development
CILSS	Inter-State Committee to Fight against Drought in the Sahel (Comité permanent Inter-Etats de Lutte contre la Sécheresse)
CMDT	Malian Company for Development of Textiles (cotton) (Compagnie Malienne pour le Développement des Textiles)
CNESOLER	Malian National Centre for Solar and Renewable Energy (Centre National d'Energie Solaire et des Energies Renouvelables)
CNPM	Malian Federation of Employers (Conseil National du Patronat du Mali)
COGEVAD	Committee of Management and Waste Recovery (Comité sur la Gestion et Valorisation des Déchets Urbains)
COP	Conference of the Parties
COPIDUC	Comité de Pilotage des Déchets Urbains
CPS	Planning Committe (Cellule de planification)
CSTM	Workers' Trade Union Confederation of Mali (Confédération Syndicale des Travailleurs du Mali)
DANIDA	Danish International Development Agency
DDP	Descriptive Document of the Project
DNACPN	National Directorate for Sanitation and Pollution Control (Direction Nationale de l'Assainissement et du Contrôle des Pollutions et des Nuissances)
DNFLA	National Directorate of Functional Literacy and Applied Linguistics (Direction Nationale de l'alphanétisation fonctionnelle et de la linguistique appliquée)
DNM	National Department for Meteorology (Direction Nationale de la Météorologie)
DNSI	National Department for Statistics and IT (Direction nationale de la statistiques et de l'informatique)
DOEF	Observatory Department of Employment and Training of the ANPE (Département Observatoire de l'Emploi et de la Formation de l'ANPE)
DSUVA	Department of Urban Services, Roads and Sanitation (Direction des Services Urbains de Voirie et Assainissement)

EDV	Village schools
FAFPA	Professional Training and Learning Support Fund (Le Fonds d'Appui à la Formation Professionnelle et à l'Apprentissage)
FAO	United Nations Food and Agriculture Organization
FCFA	West African Franc
GCMI	Civil Engineering, Mining and Industry (Génie Civil, Mines et Industries)
GDP	Gross domestic product
GEF	Global Environment Facility
GIE	Economic Interest Group (Groupement d'intérêt économique)
GIS	Geographic Information System
GPRS II	Growth and Poverty Reduction Strategy II
GTPA	Multidisciplinary Working Group for Agrometeorological Assistance (Groupe de Travail Pluridisciplinaire d'Assistance Météorologique)
GTZ	German Technical Cooperation Development Agency
ha	hectares
HIMO	Employment Intensive Investment Programme (Haute intensité de main d'oeuvre)
IER	L'Institut d'Economie Rurale
ILO	International Labour Organization
INC	Initial National Communication for UNFCCC
IOE	International Organization of Employers
IT	Information Technology
ITUC	International Trade Union Confederation
LOA	Agricultural Orientation Law (Loi d'Orientation Agricole)
LPG	Liquefied petroleum gas
MDGs	Millenium Development Goals
NAPA	National Adaptation Programme for Action (Programme d'action national d'adaptation aux changements climatiques)
NC	National Communication
NDVI	Normalized Difference Vegetation Index
NGO	Non-governmental organization
ORTM	Mali's national radio station (Office de radiodiffusion et de télévision du Mali)
PASAOP	Programme of Support to Agricultural Services and Organizations (Programme d'Appui aux Services Agricoles et aux Organisations Paysannes)
PCDA	Competitive Agricultural Diversification Programme (Programme Compétitivité Diversification Agricoles)
PEJHIMO	Project for young people in working life through investments in labour-intensive work (Programme Emploi Jeunes à Haute Intensité de Main d'œuvre)
PET	High Potential Evapotranspiration

PDES	Programme of Economic and Social Development (Programme de Développement Economique et Social)
PISE	Sectoral Investment Programme on Education (Programme d'Investissement Sectoriel en Education)
PNA/ERP	National Programme of Action for Employment for Poverty Reduction (Programme national d'action pour l'emploi en vue de réduire la pauvreté)
PNE	National Employment Policy (Politique Nationale de l'Emploi)
PNAE	National Policy for the Protection of the Environment (Plan National d'Action Environnementale)
PRSP	Poverty Reduction Strategy Paper
PSI	Sector Investment Programme (Programme Sectoriel d'Investissement)
SDR	Rural Development Strategy (Stratégie de Développement Rural)
SED	Domestic Energy Strategy (Stratégie de l'Energie Domestique)
SHGW	Green Forest Foundation, Netherlands
SIE	Energy Information System (Système d'Information énergétique)
SME	Small and Medium Enterprise
SMI	Small and Medium Industry
UFAE	Unit for Training and Support for Enterprises (Unité de formation et d'appui aux Entreprises)
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention for Climate Change
VET	Vocational and Technical Education
WMO	World Meteorological Organization

1. Introduction

The challenges posed by environmental degradation and the fight against climate change will require new skills to ensure the transition of the economy towards a more environmentally friendly one. To do this, there is a strong need for training, retraining and job creation.

This study - skills for green jobs - has been initiated in several countries in the framework of the Green Jobs Initiative launched jointly by the International Labour Organization (ILO), the United Nations Environment Programme (UNEP), International Organization of Employers (IOE) and the International Trade Union Confederation (ITUC).

Mali has been chosen to participate in this research. This study is an inventory of strategies for skills development by highlighting the determinants of emerging needs and constraints to cope with environmental degradation and climate change.

Overall objective

The objective of the assignment is to identify strategic skills development responses of the country in the light of environmental degradation, climate change and the global call for greening economies.

The specific objectives are:

- identify major challenges and priorities related to climate change and the subsequent greening policies and strategies, including those in response packages to the current economic crisis;
- identify major sectors with a greening potential in the country and those ones particularly affected by green stimulus packages and programmes in the framework of crisis response;
- analyze whether and how skills response strategies are incorporated into larger ‘greening’ policies and programmes;
- analyze skills needs for new occupations, new skills for greening existing occupations and retraining needs in sectors undergoing structural changes as a result of policy implementation, and introduction of greening technologies and practices;
- identify which methods and tools, systems and institutional frameworks to skills anticipation and assessment are in use to ensure the skills provision correspondence to current and future labour market demand for green collar workers both quantitatively and qualitatively and at different levels, i.e. national, sectoral, regional, company, training provider;
- analyze how the skills response is organized to effectively meet the challenge of greening the economy, paying specific attention to planning initial and continuing training, institutional frameworks, systemic provisions, delivery channels, ad hoc versus anticipated skills responses, and skills response by different actors and providers; and
- draw conclusions and policy recommendations for skills policies and strategies, skills provision at national, sectoral, local level or enterprise level and further research needs to meet the demand of greening the economy in the country.

Methodology

The methodology used comprised a combination of literature reviews and interviews with relevant resource persons. A questionnaire was prepared to guide some of the interviews (see Annex). During the study, several different institutions were contacted, among them the different workers' unions, agencies in charge of employment, different ministries and their directorates, NGOs, private sector and research institutions.

The overall difficulty for the study was the little developed knowledge of the definition of "green jobs" in Mali in general, and the lack of statistics in most of the relevant topics to this study. Even in the case of existing statistics/information, it was difficult to obtain it due to heavy bureaucracy and little developed use of internet for information sharing purposes.

Case studies were also conducted on existing occupations that are undergoing green restructuring and emerging occupations as a result of climate change and environmental degradation.

The case studies concerned:

- disappearance of the agricultural sector (farming, cattle raising, milk production) due to climate change and desertification in the Sahel area of the country;
- disappearance of the fishing sector, especially in small rivers due to less water;
- jobs related to biofuels;
- agrometeorological assistance to farmers using remote sensing;
- new skills for farmers in the context of climate change;
- new skills for technicians working with energy production or energy equipment; and
- new skills for waste collection, separation and re-use in urban areas.

Skills requirements were also identified for the different case studies. The different skills development policies and strategies and institutions in charge of skills delivery were also analyzed as far as it was possible. The limitations in this analysis were due to very little developed understanding in Mali about the definition of green jobs. So far, this expression as well as green restructuring is not well known in Mali. Even if known as a term by some actors, it is not part of the strategies or policies developed, even if many actions lead to the same direction the underlying reasons are other than greening. Therefore, there were considerable limitations in carrying out the research.

2. Policy context

2.1 Key challenges and priorities for the green economy

According to the GPRS II, the agriculture sector is the backbone of Mali's economy: it contributes over 40 per cent of the national GDP and provides the primary means of livelihood for more than 80 per cent of the country's population. It is characterized by a wide diversity of production systems influenced by the country's various agro-climatic gradients (with herders exclusively in the Sahelian zones, and a combination of farmers, herders, and agro-herders in the Sudano-Guinean and Guinean zones).

Mali has signed the UNFCCC Convention on Climate Change in 1992 and ratified it in 1994. The country also signed the related Kyoto Protocol in 1999 and ratified it in 2002. Along with the UNFCCC, Mali has also signed more than 30 conventions related to environmental

protection. In the frame of the UNFCCC, considerable attention has been devoted to the inventory of the country's greenhouse gas (GHG) emissions during the preparation of the first National Communication (NC) of Mali submitted to the UNFCCC Secretariat in 2000. This assessment shows that Mali's emissions of GHGs mainly come from the burning of biomass in households for energy purposes and amounts from 2 to 10 million tonnes of carbon dioxide (CO₂) per year. The elaboration of the second NC started in 2007 and will provide an update of Mali's GHGs emissions.

Current changes in climatic conditions and desertification are causing degraded conditions for agricultural production and clearly represent a priority threat to the sector development, food security and economic development in Mali. As highlighted in both the Initial National Communication (INC) for the UNFCCC and in the National Adaptation Programme for Action (NAPA - Programme d'action national d'adaptation aux changements climatiques), climate forecasts for Mali indicates rising temperatures and decreased rainfall, with increased inter- and intra-annual variability. The Sudano-Sahelian zone, where rainfall varies between 200 and 800 mm, would be the area most affected by climate change, with reduced rainfall of 2.4 per cent in 2025 to 5.5 per cent in 2050. Added to this is the particularly high intra-annual variability with a reduction in rainfall of 30 per cent during the most favourable months for vegetation growth development, according to NAPA. Such alarming projections tend to be corroborated by current observations: nowadays, many rural areas of Mali already experience severe droughts, irregular rainfalls and reduction in agricultural yields. Several scientific assessments conducted by the INC and the NAPA in five representative rural areas (Bougouni, Dioila, Sélingué, Koutiala and Sikasso) concluded that climate change is likely to cause significant losses in crop production.

In the context of the above root-causes, the performance of the agricultural sector and its capacity to adapt are the key challenges in the future for the economy of Mali. How the policy will respond to these challenges, to foster a paradigm shift in agricultural development to ensure that the sector is more resilient to climate change and environmental degradation like desertification and loss of soil fertility, will be the key drivers towards a transition for greening the economy of Mali.

In terms of energy, Mali is very little developed. Access to electricity has improved, but remains still among the lowest in Africa (around 18 per cent of the population) (Rapport SIE 2007). Still most of the final energy consumption is met by primary biomass (wood and charcoal), representing about 80 per cent of total consumption and which causes severe deforestation problems, especially near larger towns. This further has impacts in the biodiversity.

When it comes to fossil fuels, the country depends entirely on imported petroleum products. However, Mali has significant hydropower potential, which are getting more and more exploited during the last 15 years and the country has potential for renewable energy (solar radiation, wind and biofuels), which could be used especially in sparsely populated rural areas where the grid is not a viable solution. To enable the development of renewable energy, Mali has developed a new energy policy, adopted in 2006, which focuses on a number of measures to reduce the vulnerability of the country.

Urbanization is causing lots of challenges, as more and more of the population from rural areas migrate temporarily or permanently to urban centres. Since the waste- and wastewater problems are not solved even for the actual population, in future these will become even bigger challenges with increased population. Lack of proper infrastructure for waste and wastewater treatment affects also in the health of people via increased hygiene problems and poisonous gases from waste burning.

The fastest growing sector in Mali is the mining sector, especially gold mining. This has some positive impact on the economy, but at the same time many negative environmental and social impacts - especially when it comes to traditional gold mining, which is often out of

control. This activity is done by youth who are often abandoning their farms and families and using chemicals for gold extraction.

2.2 The response strategy

2.2.1 General environmental strategy

Attempts to consider environmental issues in general and climate change into the development plans and policies of Mali date back to 1974 after the series of drought that struck the country in 1970 through 1980. However, during that period, the formulation of strategy and policies concerning environmental protection were focused on sector policies (agriculture, forestry, water, household energy, etc.) as emergency measures to reduce the impacts of drought and related issues. Gradually, due to the persistence and intensity of drought, the government gave greater priority to the management of the environment and natural resources, integrating it into their policy for social and economic development.

Currently, the Government of Mali, with support from a number of bilateral donors, is tackling the environmental issues and constraints through the implementation of activities which include various agriculture and rural development initiatives focusing primarily on stimulating rural economies, improving agricultural productivity and promoting sustainable land management. While necessary for overall development, these interventions are not sufficient to ensure resilience of the agriculture and food production sectors to increasing climate change risks as climate change was not on the agenda when most of these programmes were elaborated.

The following discusses the key strategic policies, programmes, and the adaptation and mitigation measures in response to climate change and environmental degradation in Mali.

Programme of Economic and Social Development (PDES - Programme de Développement Economique et Social (PDES))

The PDES of the Republic of Mali aims to ensure strong and sustained growth producing opportunities and prosperity for all citizens, paving the way for the achievement of the Millennium Development Goals (MDGs). The PDES covering the period 2007-2012 derives its substance from GPRS II (Growth and Poverty Reduction Strategy) and is the programme of the President and his government for the Republic of Mali. To achieve its objectives, the PDES focuses on six priority areas:

- better organization of public action to effectively support the other programme components;
- improvement of primary production and enhancing food security;
- establishment of an environment conducive to the emergence and development of private sector;
- insertion of women and youth into the productive circuits;
- development of the social sectors; and
- implementation of the necessary reforms of society.

The axis of PDES on improving production and enhancing food security, if fully implemented, can be considered as a development with benefits for adaptation to climate change impacts.

Strategic Framework for Growth and Poverty Reduction (GPRS II)

The GPRS constitutes the reference frame for all the development policies of Mali for the period 2007-2011. The overall objective of the strategy for the period 2007-2011 is to foster a strong and sustained growth (around 7 per cent of the economy) and significantly reduce poverty. It is based on the vision contained in the National Prospective Study for Mali 2025 (ENP Mali 2025) and revolves around three main themes:

- (i) development of productive sectors,
- (ii) continuation and consolidation of structural reform, and
- (iii) strengthening of the social sector.

In view of these axes, it is clear that their objectives could be affected by the impacts of climate change. However, in the current GPRS, impacts of climate change are not included as a priority. Protection and sustainable use of natural resources, however, is mentioned as one of the 13 priority areas. Also, several activities, especially in the development of infrastructure and productive sector, can be considered as adaptation measures to climate change, if implemented.

Decentralization policy

The decentralization policy, implemented since 1999, gives local authorities the task of designing, planning and implementing actions for economic, social and cultural development at local and regional levels. The main principles are:

- (i) communities have legal personality and financial autonomy;
- (ii) they are freely administered by elected assemblies or councils; and
- (iii) they are competent in managing so far some resources such as the water, health and education sectors. Management of other sectors is in progress.

Agricultural Orientation Law (LOA)

The LOA (Loi d'Orientation Agricole), adopted in 2006, sets out policy guidelines for agricultural development in Mali. It concerns all the economic activities in the agricultural sector including: production, transformation, transport, trade, distribution, as well as other services connected to agriculture and their related social and environmental functions. The LOA aims to ensure food sovereignty and to make agriculture the engine of the national economy in order to ensure the well-being of all Malians. It builds on the implementation of the following measures among others:

- environmental protection and sustainable management of natural resources;
- increased production and productivity;
- protection of farms against agricultural risks;
- prevention and management of major hazards and disasters agriculture;
- the establishment of a rehabilitation programme of the desert areas, including investment by proactive improvement of the quality of life, integrated and sustainable management of natural resources, development and promotion of production and agricultural products in those areas; and
- the implementation of the national policy on water management is an integral part of the national policy of sustainable and integrated management of water resources.

Most of these actions of the LOA, once implemented, can help to strengthen resilience of the population to climate change impacts and can therefore be considered as options for adaptation to the impacts of climate change, as it will secure the farmers land (land reform) and will accelerate the creation of added value of the farming products.

Energy policy

To enable the development of renewable energy, Mali has developed a new energy policy (La Politique Énergétique du Mali), adopted in 2006, which focuses on a number of measures to reduce the vulnerability of the country. These measures include promotion of efficient equipment energy, promotion of new and renewable energy, promotion of hydropower, energy import electricity from neighbouring countries, recovery of residues and agricultural by-products, transportation management, forestry, etc.

The energy policy objectives set for the various sub-sectors of energy are very clear and it involves:

- increasing the country's electricity coverage from 14 per cent in 2004 to 45 per cent in 2010 and 55 per cent in 2015; to the rural electrification rate of 1 per cent in 2005 to 12 per cent in 2010 and 55 per cent in 2015;
- sustainably managing the supply of traditional energy on the community under management of 321,100 hectares (ha) - currently 1.5 million ha in 2010 and 3 million ha in 2015;
- reducing the contribution of woodfuels in total energy consumption of the country from 81 per cent in 2004 to 70 per cent in 2010 and 60 per cent in 2015;
- increasing the share of renewable energies in national production of electricity from less than 1 per cent in 2004 to 6 per cent in 2010 and 10 per cent in 2015;
- developing the biofuels industry including jatropha, for various uses (electricity generation, transport, agricultural engine etc.).

Also, the degree of increase of the country's energy independence is necessary for achieving the above objectives set in the area of renewable energy.

To achieve the objectives of this ambitious policy, the Malian Government develops projects and programmes which are actually going on or are in progress with its own financing, and/or the support of various bilateral and multilateral partners like AMADER (Malian Agency for the Development of Domestic Energy and Rural Electrification / Agence Malienne pour le Développement de l'Energie Domestique et l'Electrification Rurale).

National Policy for the Protection of the Environment (PNAE)

The first policy purposely elaborated for environmental protection is the PNAE (Plan National d'Action Environnementale) adopted by the government in 1998. The objective of the PNAE is to guarantee a clean environment and sustainable development through the consideration of the environmental aspects in the planning, implementation of the development programmes and the involvement and increased accountability of all the stakeholders. The PNAE is expected to contribute to food security, fight against desertification and harmful pollutants, and poverty alleviation.

The PNAE is made up of the following national, regional and local programmes of actions:

- land management programme;

- natural resources management;
- livelihoods improvement programme;
- development of new and renewable energy resources programme;
- programme for the management of environmental information and database;
- information, education and communication programme on environmental issues;
- monitoring programme of the implementation of the different conventions; and
- research programme for the fight against desertification and environmental protection.

If all the activities are implemented, the PNAE takes into consideration several adaptation and mitigation issues for Mali.

National actions in direction to address climate change

National Communication (NC) on Climate Change

The first NC of Mali was presented to the UNFCCC Secretariat in 2000 during the Conference of the Parties (COP) held in the Netherlands. The NC contains an assessment of Mali's GHG emissions, and presents the politics and measures designated to integrating the climate change consideration into sustainable development of the country. The document is to integrate climate change into different sectors of economy and make suggestions for measures to be taken not only inside the sectors, but in cooperation with different sectors.

The first NC has useful information but some of the data used date back to 1995. The second NC, funded by the United Nations Development Programme (UNDP), which is in progress, will enable the updating of GHG inventories in Mali and the proposal of means for the reduction and adaptation of climate change risks.

National Adaptation Programme for Action (NAPA)

In recognition of the challenges posed by climate change to the economy, Mali has elaborated the NAPA in 2007. The NAPA prioritized 19 most urgent and immediate interventions that will enhance the adaptive capacity of the country. These include, among others:

- strengthening the resilience of local grain production systems to climate change through the dissemination of seeds adapted to changing climatic conditions;
- diversifying revenue sources in rural communities as a means to enhance food security of vulnerable households;
- extending hydro-agrometeorological services to crop and livestock farmers;
- implementing multi-use water management plans (watering, irrigation, mobilization of non-conventional waters, etc.);
- restoring soil fertility through climate-resilient techniques;
- improving water retention capacities through improved run-off water catchments; and
- developing an adaptation-training package for rural communities.

Like the PNAE, the NAPA is the first of Mali's strategies which is specifically designed to mitigate the adverse effects of climate variability and change on the most vulnerable in the context of sustainable development. The NAPA features in the post Rio conventions that Mali has ratified including: the United Nations Framework Convention on Climate Change

(UNFCCC) 1994, Convention to Combat Desertification (CCD) and the Convention on Biological Diversity (CBD). The actions identified by the NAPA are also in accordance with the Strategic Framework for Growth and Poverty Reduction (GPRS) and the Rural Development Strategy (SDR - Stratégie de Développement Rural). To date, only one project (about food security) of the NAPA is being considered by Global Environment Facility (GEF) for financing and its elaboration and approval by GEF is in progress through the UNDP and FAO (United Nations Food and Agriculture Organization).

There exist a number of barriers that could hamper Mali in implementing the necessary adaptation in the NAPA. These include:

- (a) limited awareness and capacities of policy-makers to design an integrated policy response to manage the climate risks;
- (b) spatial and quality gaps in the climate information supply chain that result in under-performance of early warning systems and poor adaptation decisions;
- (c) limited capacities of farmers and herders to identify and implement adaptive measures; and
- (d) insufficient dissemination of knowledge on successful climate risks management models.

In the absence of integrated interventions aimed at lifting the above barriers to adaptation, while simultaneously addressing the current threats confronting the Malian economy, the probability of famine, climate-induced migration and food shortages, and the exacerbation of poverty remain high.

As can be seen above, it is evident from the actions taken by Mali at the national level that the country is aware that to achieve the objectives of the number of its key priorities (GPRS, PDES, LOA), there is an immediate need to address the negative impacts of climate change in a sustainable way. The key challenge today to a country like Mali is to very rapidly identify the means to have qualified men and women at national, regional and local level who could integrate climate constraint strategies in various economic and social development. Therefore, there is a need for strong and appropriate skill development in all main policy aspects of the country.

2.2.2 Green response to the current economic crisis

So far, Mali has not developed an official strategy in response to the current economic crisis.

The Malian Federation of Employers (CNPM - Conseil National du Patronat du Mali) has conducted a study about the impacts of the global financial crisis on the Malian economy, and presented the results in a seminar organized in October 2009. But in the study, the greening element was not considered as such.

2.3 The skills development strategy in response to greening

Skills development strategy of the GPRS and PDES

Creation and access to sustainable jobs, especially for youth, as well as job security, are major concerns of the GPRS and the PDES. The National Employment Policy (PNE - Politique Nationale de l'Emploi) was adopted to achieve these objectives of the GPRS and PDES. Tailored trainings to labour market needs have been identified as the best of developing the required skill and creating job. However, this skill development strategy does not actually have a green skills aspect which could be due to the fact that when most of these important policy and programme documents were elaborated, the climate change issue - especially its impacts on the developing policy - was not high on the agenda.

Education system and training structure

The education system in Mali is characterized by a classical education with an academic component for the normal cycle, and a professional which aims at the rehabilitation and capacity building of professional actors. Besides these there are also training centres and propositional learning to youth, adults, and not in school. That part of the training, qualifications and learning are carried out or funded by specialized structures such as the ANPE (National Agency for Employment Promotion), the FAFPA (Professional Training and Learning Support Fund / Le Fonds d'Appui à la Formation Professionnelle et à l'Apprentissage), the APEJ (Agency for Promotion of Youth Employment / Agence pour la promotion de l'emploi des jeunes) and UFAE (Unit for Training and Support for Enterprises / Unité de formation et d'appui aux Entreprises). In addition to the needs of capacity building and creation of new skills are also taken into account in the sectoral policies of different ministries.

Alongside the formal system, there are community schools called Centres for Education for Development (CED) or village schools (EDV) managed by people in neighborhoods or villages.

It should also be noted that adults outside the formal system can benefit the functional literacy program, managed by the National Directorate of Functional Literacy and Applied Linguistics (DNFLA - Direction Nationale de l'alphabétisation fonctionnelle et de la linguistique appliquée), an agency under the Ministry of Education. The lessons that can last up to two years are in national languages and mainly in the capital and major agricultural regions (cotton and rice zones).

One can also note, in addition to parallel training systems above, training in crafts involves mainly apprentices working in the informal sector. These trainings, which can often have a duration of two years, are not by definition a certification, and most young people can access them by social relations.

The education system and education qualification problem

Training plays a vital role in achieving the objectives of sustainable development because it provides the skills necessary to overcome the challenges associated with climate change and environmental degradation. Indeed, not only the training allows for labour supply to demand, but also because of the externalities they generate, education and training to improve the general level of knowledge and therefore productivity within the economy. The education system at this level plays a key role.

The Malian education system is still trying to find the best way to provide the skills suited to the various needs of the national economy (Forum de l'éducation 2009). Some of the challenges are the limited synergies and interaction between the professional and academic circles, the limited opportunities for continuing education on specific needs for qualified people to assure career development in the specialized sectors. The high unemployment rate is also not motivating the young people to continue qualification training for their own upgrading. The challenges of the Malian education system, therefore, are related to how to:

- produce qualified human resources necessary to meet the employment needs of public and private sector to ensure productivity and trigger a sustainable economic development;
- provide continued appropriate training for the professionalization of the primary sector;
- tailor programmes to the academic expectations of the labour market;
- revise and adapt the training with local requirements, taking into account the socio-economic and environmental development of the country;
- train the trainers from the requirements of the local and international market; and

- decentralize the training centres and schools from large cities to rural areas depending to the economic potential of each of these areas.

National Employment Policy (PNE)

To meet these challenges, Mali adopted a PNE, which aims to find answers in employment, reducing unemployment and securing jobs, adapting training to market needs, and improving working conditions. This policy is based on a number of programmes with the Sector Investment Programme (PSI) which aims for the development of a sectoral policy of training, technical education and vocational training. Several other actions have seen the day to meet the training needs and job creation. They are:

- the creation in 2002 of two national agencies respectively in employment and vocational training;
- the establishment of an Agency for the Promotion of Youth Employment (APEJ) in August 2003;
- a department dealing specifically with employment and vocational training was first created in 2004;
- the Unit for Training and Assistance to Enterprises (UFAE), previously under the Ministry of Education, has been linked to the Ministry of Employment and Professional Training to facilitate the transition from school to the professional life and link school to the enterprise;
- the National Programme of Action for Employment for Poverty Reduction (PNA/ERP) became operational in October 2005; and
- the training levy of 0.5 per cent was raised to 2 per cent in 2006.

There are also aspects of training in various policies and programmes of development. Even though the PNE has very big ambitions to contribute to the creation of job opportunities, especially for youth, by launching different interesting new initiatives, it has to be recognized that most of the programmes elaborated in the frame of PNE were initiated or launched before the issues of climate change or greening were high on the international agenda, especially for a developing country like Mali. Therefore, it is needed today for screening important programmes such as PNE to climate change. This type of initiative, screening to climate change, has been launched by some bilateral programmes like the programmes of Danida and GTZ (German Technical Cooperation Development Agency).

Youth Employment Programme

The youth employment programme is an ambitious programme for the implementation of the PNE. It consists of four components:

- enhancing the employment possibilities for youth through qualification and learning internships;
- developing entrepreneurial spirit among youth;
- developing rural employment through an approach called HIMO (Employment Intensive Investment Programme / Haute Intensité de main d'oeuvre). The HIMO approach is based on the utilization of local products and human resources to carry public or community works; and
- facilitating access to credit for youth.

The APEJ was created in 2003 for the implementation of this programme. Besides information work, the agency's mission is to assist in creating jobs for young men and women (15 to 40 years) in rural and urban areas, including facilitating access to the labour market and credit. APEJ is providing training for youth in the “*metier porteurs*” which include drivers and technicians for running and maintenance of agricultural machinery, and blue collar workers in electricity, painting, plumbing and paving jobs. The training programmes include both practical work and creation and management of micro-enterprises. The strategy of APEJ also includes the facilitation of job creation for youth in the agricultural sector by changing their perception about farming jobs, as there are enormous possibilities like agro-industry, fabrication of agricultural machinery etc. However, the skills related to greening are not taken enough into consideration in this strategy, as well as what could happen due to climate change in the productive sector on which the strategies are based on.

FAFPA (Funds for Assistance to Professional Training and Learning)

The essential task of FAFPA is to contribute to the implementation of government policy in terms of vocational skills training, and continuous learning. In this sense, it is responsible for providing technical assistance and financial structures in the realization of their plan and training projects, and also support the private vocational training project in their equipment and carrying out specific studies in the vocational training sector to optimize its interventions.

FAFPA goals

- improve the skill level of the local workforce to meet the needs of the labour market;
- strengthen and develop the human resources;
- improve the quality and capacity of the training institutions to meet the requirements of the job market;
- involve economic operators to finance the training of their employees.

Skills development strategy of the Agricultural Orientation Law (LOA)

Rural employment through the modernization and professionalization of the agricultural sector is a priority of the LOA, which is the framework for policies relating to agriculture. The overall goals mainly concern the country's food self sufficiency or the country's choice to produce the bulk of its food products on its territory by opting for sustainable methods of production, modernization of family farming, development of agro-industry, environmental protection and natural resource management for sustainable development. The promotion of rural employment and fight against youth unemployment as defined in the LOA remain common basic objectives for all agricultural and food sector policies and strategies. These objectives will be achieved in the agricultural, animal, fish breeding and forestry sub-sectors, which absorb job seekers, and fruitful points of convergence between them and all categories of job-seekers will be established.

Special emphasis is placed on vocational and technical training (VET); in the skill development strategies of the LOA and the APEJ. This is meant to reinforce informal apprenticeship and qualifying training, the development of entrepreneurship for youth and access by young business promoters to loans. Concerning employment and vocational training, the objective to be achieved through the NEP is to find solutions for job security, reduction of unemployment and under-employment, adaptation of training to the needs of the market, and improvement of employment conditions. To achieve these objectives, the strategy to be implemented in GPRS will consist of creating a legal framework conducive to the promotion of the private sector, and establishing a public service for local authorities. This strategy is planned to be accompanied by measures relating to:

- fostering SME/SMI development;
- developing local financing;
- reinforcing and improving vocational and technical training;
- developing private services market to support contractors; and
- organizing the informal sector.

Concerning the integration of (rural) women in the employment sector, the best way for this in Mali seems to be development of personal micro-projects, which create self-employment. For this, the decentralized micro-finance institutions are key, because for women it is difficult to leave the home village for employment - it is easier for them to do something at home in flexible time. Besides some non-governmental organization (NGO) projects focusing on the training of women in use of micro-credits and development of small businesses, there are no wider training programmes focused on this.

Skills development strategy of the NAPA

The development objective of the NAPA is to contribute to mitigating the adverse effects of climate change on the most vulnerable populations, from the point of view of sustainable development and poverty reduction in Mali. A number of adaptation measures have been identified in this context which comply with the guidance in the GPRS and which all fall within the rural development strategy.

There exist a number of barriers that could hamper Mali from implementing the necessary adaptation in the NAPA. These include, among others:

- (a) limited awareness and capacities of policy-makers to design integrated policy response to manage the climate risks;
- (b) limited capacities of farmers and herders to identify and implement adaptive measures; and
- (c) insufficient dissemination of knowledge on successful climate risks management models.

There is thus a huge need for capacity building and training of the different stakeholders to overcome the above barriers for successful implementation of the NAPA activities. However, the NAPA does not provide a clear strategy to ensure that the adequate skills are available for the implementation of the different activities. This is the case also when it comes to skills development strategies in general. Besides that, there is not enough cooperation and coordination between different structures responsible for skills development strategies.

There is no coherent national strategy/policy targeting to meet the skill needs for greening the economy. The main driver for the human resource development (HRD) strategies is most of all market driven. However, several institutions recognize the need for greening policy agenda in the global world, and are actually taking actions which can be considered fitting in that category even though usually arising from other needs.

Generic skills such as leadership and communication are important in Mali, especially considering the limited consideration of the opportunities that green jobs could contribute to local economy and in increasing the resilience of Mali to the impacts of climate change. Considering that the Government of Mali is now working with its different partners on improving both academic and vocational education, it is a very good occasion to include climate change-related issues in education programmes in order to create new job opportunities for millions of young people. The booming academic education sector in public and private universities and vocational technical schools could benefit from assistance in order to have suitable programmes, which could integrate green job opportunities (adaptation measures and carbon markets, etc).

3. Anticipation and provision of skills

This chapter and its subsections deal with the (re)training needs which derive from major employment shifts within and across sectors and economic activities due to climate change and demands for greening the economy; and identification of skills, trades and occupation that become obsolete as a result of green structural changes on the labour market.

3.1 Green structural change and (re) training needs

This subchapter deals with employment shifts and trends due to green structural change. It identifies the sectors and economic activities with major employment growth potential and trades and related skills in declining sectors.

3.1.1 Green restructuring and its impact on the labour market

Economic activity is heavily dominated in Mali by the primary sector, which gives employment to 83 per cent of the workforce. The primary sector, with an average real level of growth of 4.06 per cent per annum has on average contributed around 40 per cent to wealth creation over the reference period (2002-05). Food crops, livestock rearing, cotton and fishing have accounted for 21 per cent, 10 per cent, 6 per cent, and 4 per cent respectively (GPRS II).

The secondary and tertiary sectors give employment to 4 per cent and 12.5 per cent respectively of the workforce. The secondary sector has contributed an average of 45.3 per cent to growth in Gross Domestic Product (GDP). The commercial subsector has recorded an average growth factor of around 2.9 per cent, with a contribution of 14.3 per cent to GDP. The industrial sector remains small. It is, however, in this sector that the highest growth rates have been recorded, with 30.1 per cent in 2001 and an average of around 9.5 per cent per annum. This rapid expansion is attributable to the gold-mining sector (GPRS II).

Table 1. Contribution of different economic activities to the workforce, wealth creation and growth rate, per cent (2002-05)

Economic activity	Workforce	Wealth creation	Average growth rate/year
Primary sector	83.4	40.4	4
- food crops		21	
- livestock		10	
- cotton		6	
- fishing		4	
Secondary sector	4.1	45.3	9.5
Tertiary sector	12.5	14.3	2.9
Total	100	100	

Climate change and primary sector (agriculture, livestock and fisheries)

Climatic changes and environmental degradation affect the primary sector (agriculture, fishing, livestock) which will still remain for some period the backbone of the economy. According to Mali NAPA, the various climatic problems in Mali are manifested by:

- a regular decrease in the amount of rain, and wide variation in time and space;

- the characteristic squall lines of the Sahel on a north-south axis over a distance of 500 to 750 km are often accompanied by strong winds and heavy, sometimes catastrophic rain;
- very strong sunshine throughout the year with little differentiation in average temperatures;
- an increase in temperatures from south-west to north-east with maximums recorded during the year reaching or exceeding 45°C, while minimum temperatures are rarely lower than 10°C;
- high potential evapotranspiration (PET) values due to high temperatures, relatively low humidities and strong winds; and
- persistence of droughts since the 1970s, leading to rainfall shortages and the moving of isohyets towards the south, which means that migration has increasingly become a strategy especially for the youth in response to these new precarious climatic and environmental conditions.

These climatic vagaries are already impacting negatively the different economic activities and sectors of Mali. These impacts are particularly visible in the agriculture sector.

The potential of soil available for agro-sylvo-pastoral activities is about 45.9 million ha, of which 25 per cent (11.47 million ha) is cultivable and 65 per cent (29.8 million ha) adapted to grazing (CILSS/CSAO, 2008). Due to poor productivity of soil and demographic pressure, the cultivated area has been doubled in the past 10-20 years, but no considerable increase in harvests. According to the National Department for Statistics and IT (DNSI), the cultivated land area increased from 1,967,000 ha in 1970/71 to 3,472,000 ha in 1994/95. This increase in area has not been accompanied by a similar increase in yields of food crops. On the other hand, many species and varieties cultivated earlier do not succeed anymore in the same area, and have been replaced by other species and varieties, sometimes spontaneously by local people (autoadaptation).

The low production has increased pressure on land suitable for agriculture. Agricultural pressure has also been reflected in regions where there is heavy demographic pressure through the cultivation of marginal or forest land. The increase of agricultural land also means very often clearing of the few remaining forests, which in turn adds to desertification.

The cotton subsector, which in the past has been one of the backbones of Malian economy, has been declining in recent years. This is due to the heavy fluctuation of the cotton price in the world market and subsidies of some rich countries to their cotton sector which put the state cotton company, CMDT (Compagnie Malienne pour le Développement des Textiles), in a situation that they could no longer have a fixed price for cotton - which in turn reduced cotton farming practiced mainly by small farmers.

Farming is the main livelihood in Mali, but is still not able to provide food sovereignty as Mali is still importing many basic foods like rice, milk, flour, etc. Also, it should be mentioned that the agricultural area of the country is very poor (low income). Therefore, in this context migration becomes the solution for young people from the rural areas, especially in the dry season for a short or long duration to cities, and to other African countries or Europe for a longer period. These migrants often send funds for the improvement of the lives of their families, assistance in the food crises, as well as investments in trade. At the same time, even if the villagers see migration as a solution to the drought and negative impacts of climate change by supporting their families from a distance, it empties the rural areas of most capable youth who could be the best ones to develop their communities.

The good news in this process is that farmers are trying to adapt to the drought and climate change impacts with their activities. Farmers are more and more diversifying the activities, and there are more and more initiatives like ecological cotton, sesame, green maize in the hot season, strawberries etc. The challenge for this new development is that the substance and the knowledge

of quality products and materials (like organic seeds, composting, storage facilities) are still limited. That will be discussed later in chapter 3.1.2.

Fruit, vegetables, oilseed crops

As mentioned above, farmers are tempted to diversify the economic activities. That has been giving a big impulse in the growing fruit, vegetable and oil seed sectors in recent years. Many fruit and vegetables which were only seasonal (rainy and cool season) are now produced almost all year round. These include banana, orange, mandarins, green beans, papayas, maize, etc. These products are produced mainly for local markets, as the production is not yet so well organized in terms of quantity and quality in order to start targeting to the western market. Considering the knowledge of Malian farmers in farming and the amount of land available, with some training and access to appropriate financing mechanisms for seed tools, this diversification of agriculture products could have a high employment impact and also increase considerably the income of Malian farmers. As regards other basic products, Mali abounds in products such as Arabic gum, shea and cashew nut. The development of those markets will contribute to increase the incomes of the rural population and will represent an interesting potential sector for employment creation. This promising subsector can contribute to strengthening and complementing the traditional crop farming and cotton farming, and make farmers more resilient to climate change.

Livestock rearing

Livestock rearing presented in 2002-05 about 10 per cent to the national economy (GPRS II). Mali is recognized in West-Africa as a big cattle country with millions of cows, sheep and goats. Cattle raising in Mali has always been extensive. There used to be two main ways: nomadism and transhumance. Today with the droughts and climate change, the nomadic-raised cattle has been reducing from year to year as the nomads can no longer trust that they will find water in the place where they are heading.³ The common way for raising cattle for big herders (50 to 2,000 cows) is the transhumance - especially in Timbuktu, Mopti, Segou, Kayes and Koulikoro regions. This means leaving home in a specific season and moving with the cattle to the place where they believe they can find food. This is mainly the activity of Fulani and Moore people. Today, with climate change, it is not so easy for the transhumance to go to find the water and food for their cattle because the local farmers have occupied most of the fallows, pastoral tracks and areas around forests. Therefore, moving around with the cattle is getting increasingly difficult and sometimes there are serious conflicts between the farmers and cattle people.

Even though Mali has a lot of cattle, its contribution to the national economy could be much more than it is today, if it were organized otherwise. Traditionally, raising cattle has been more for prestige than for profitability, and this is still mainly the case. The Government of Mali is developing initiatives and programmes in order to improve their contribution to the national economy (like the programme for valorization of raw milk, and various programmes to improve the races of cattle, etc.).

Fishing sector

The national halieutic production is estimated at 100,000 tonnes of fish annually, which makes Mali the third producer of freshwater fish in Africa (CILSS/CSAO, 2008). The fishing sector is also in full transformation in Mali. Mali has two big rivers (Niger and Senegal) and used to have several areas where fishing was very prosperous. There are few ethnic groups who are still specialized in fishing. But today, with the impacts of climate change, some of these fishing areas are in a situation that they cannot meet all year round the economic needs of those practicing fishing. Therefore, in many fishing areas like in Mopti, Segou, Massina, fishermen are

³ Source: Interview in Er Interdjef, Timbuktu 2007.

obliged to move to the south like Sikasso and Kayes where there are more water resources all year around, to be able to practice their activities. Doing that in a similar way as the transhumance, they leave their wives and children back home. The fishermen often use equipment which catches all the fish, so there is no longer need for regulation as to the size of fish taken. As the quantity of fishing has been limited, there is also more importation of sea fish from neighbouring countries to Mali, and also development of fish farming in different areas, to satisfy the needs, especially in big cities. However, fish farming is not yet very developed; the yearly production estimated at 1,300 tonnes per year (CILSS/CSAO, 2008).

Restructuring of the economy and the labour market will be driven by how policies are developed to make the primary sector more resilient. According to Mali GPRS 2007-2011, sustainable growth will be achieved in the rural sector through maximum development of agro-ecological potential and agro-pastoral skills of the country, as well as through the creation of an enabling environment from the development of a structural agricultural sector, particularly through revitalization and creation of SME/SMIs. The emphasis will be on:

- the development of dry cereals, rice, cotton, fruit and vegetables, and livestock;
- control of water and better management of natural resources (in particular, soils) to minimize the vulnerability to the vagaries of the weather;
- better availability of modern energy services for rural economic activities;
- better access to markets;
- supply and use of information on markets and technological progress.

Industrial sector

The industrial sector in Mali is characterized by the mining sector, which is dominated by gold mining, with an average growth of 9.5 per cent per year. Gold is the sector in which growth was highest in Mali over the 1994-2005 period, standing at 22 per cent (GPRS). Today, it is the first export product of Mali. Currently, there are plans for investing also in iron ore mining and with the increase of the price of the cement and the booming construction sector in Mali, there are plans for building cement factories in Mali. It should be taken account that those cement factories could consider the low carbon technologies as one of the high GHG emissions sector. It can be mentioned also that with the recent increase in the fossil fuel price, oil research is getting increasingly important. The expectations for the mining sector are as follows:

- increase in state revenue through substantial contribution of mining products to GDP;
- job creation in the production areas - particularly for youth;
- increase in the incomes of traditional exploiters; and
- development of the gold exploitation areas.

At the same time, it should be mentioned that for most of the civil society point of view and the local communities, the mining sector has still many negative social and environmental impacts which need to be addressed. The impact on forests and natural resources, the social impact (culture and tradition) and also when the mines close, all the impacts that has on the local economy which have been created around the mine.

Regarding greening, considering that the lifetime of a mine is between 10-20 years, a way could be explored how to create jobs in environmental sector and agroprocessing which could remain to maintain the jobs for young people who are working in the mines, so that the dynamics can continue in the area also after the mine is closed. This kind of approach could make easier the change for the young people who have been used to getting a regular salary.

Energy and transport

The field of traditional energy (charcoal, oil, wood) is in sharp growth in Mali. The annual consumption of fuelwood is estimated at 60 million tonnes, which represents 90 per cent of the final energy consumption. These woods are cut in the limited fragile forests that remain on the territory. Wood supply to the major centres of consumption is a standard pattern, with the villagers (farmers) the real players, where there is a network for the purchase to the village. To these must be added carriers and retailers in the markets of Bamako. Although it disturbs the environment, this network is also an important source of income for players - which is estimated to be over 200,000 people, directly or indirectly earning their income from the firewood business.

The Government has developed projects to reverse the trend by providing alternative, more efficient energy solutions, such as LPG (liquefied petroleum gas), improved stoves and fuel briquettes. According to the Malian Agency for Domestic Energy and Rural Electrification (AMADER), the use of LPG gas has increased from 834 tonnes to 6,510 tonnes between 1999 and 2007. Also according to the Government, the realization of measures will be important so that Mali reaches 75,000 tons of LPG gas in 2017, which could preserve 1.4 million ha of forest.

In addition, several types of improved stoves have been tested and traded to reduce the excessive cutting of wood. Several techniques have been successfully tested for the use of fuel briquettes from coal dust, or with invasive plants. Increasingly, this business is operated by entrepreneurs, but many have difficulty in penetrating the market.

In terms of biofuels, through agriculture and the availability of land, Mali has potential in the cultivation, production, processing of biofuel to satisfy some local energy needs. In 2008, the National Assembly of Mali has ratified the ordinance for the establishment of a National Agency for Development of Biofuels (ANADEB - Agence nationale de développement des biocarburants). Its aim is to boost biofuel pathways, regulation of pricing, ensuring consultation and dialogue between national and international partners. The use of biofuels might be of interest to areas such as transport, supply of electrical service, and cooking.

The transport sector is one of the fastest growing sectors in terms of number of motorbikes and vehicles which also contributes to creation of pollution in cities, especially in Bamako. So far, the regulation of exhaust gases has been challenging, especially when considering that many of the cars are second-hand cars from Europe. However, there is also some new development about efficient and effective means of transport, like the motorcycle taxis of the APEJ. This initiative aims to connect the suburbs to major cities, a means of transport at a lower cost to the passengers, and which consumes less fuel. These tricycles (motorcycle taxis) consume less fuel compared to second hand buses, and their price is also cheaper - hence, today a great influx of population in the suburbs to these means of transport. Hundreds of taxi-motorbikes are now at Bamako, Segou, Kayes and other towns to serve the people and also create employment for young people and reduce the use of fuel.

Building and construction sector

The building sector is one area in expansion, wherein the expression used by many people: "Mali is a country under construction". The main actors in this site are the Government with the establishment of infrastructure of public services. Houses and buildings are usually the work of contractors or individuals. The majority of construction materials are imported, which is an important motto "exit outwards". Buildings are often made without taking into account the natural ventilation for cooling and lighting. More and more architects and engineers offer their customers plans that meet the climate conditions of Mali.

Waste management

Growing urbanization partly due to the rural exodus caused by unpredictability of the rainy season is putting huge pressure on the waste and waste water management in the cities. Only in Bamako, 434 anarchic waste disposals were calculated in 2005. These are typically in the empty not yet constructed plots in the middle of neighbourhoods. A large part of useful waste (mostly metal, hard plastics etc) is collected in these places by people earning their living from waste, but from about 17,000 tonnes of plastic waste, only about 10 per cent are recycled.

The wastewater problem is at least as alarming as the waste problem. A considerable number of households do not have wastewater containers, and wastewaters are thrown outside into open wastewater collectors leading directly to the river. This is not only the case for households, but also for most of the hotels and industries.

Carbon finance

Carbon finance has become an international business in recent years. One of the mechanisms is the Clean Development Mechanism (CDM) of the Kyoto Protocol which offers opportunities to the Non Annex I countries to sustainable development, at the same time reducing the GHGs. A lot of money has been invested in the CDM in Non-Annex I countries, but Africa has benefited from this only a very little, although there is huge potential for CDM projects for example in the energy, industry, transport, forestry and waste management sectors. The reasons for this are, among others, too small projects, too high costs and weak capacity of actors for developing the CDM documents.

Other sectors

There are other growing areas such as information technology (IT) and the financial sector. In the ideal case, the financial sector could be contributing to the greening of the economy by encouraging environmentally-friendly businesses and punishing environmentally-harmful actions, but so far there is no such movement in Mali. The IT sector can have an indirect impact on the greening of the economy by providing information about possibilities of greening economy. Since it is youth who will be occupying this sector in the coming years, they are open to different sources of information and information sharing. One existing example of this is the information sharing about the rainy season to the farmers. Previously the period of the rainy season was known and controlled by farmers, due to regularity and different natural signs (birds, etc.), but now this knowledge is limited and needs to be guided by the National Directorate of Meteorology.

Identification of (re) training needs

This subchapter deals with (re)training needs based on identification of major employment shifts (current and anticipated) and the green structural change as outlined in the previous chapter. It also briefly describes the approaches and tools for identification of (re)training needs.

Agriculture sector

As described in the previous chapter, retraining needs in the agricultural sector are related to changing climate. Due to changing rain patterns and reduced rainfalls, farmers are doing their best to survive (= to adapt) to the situation with new forecasts and new farming techniques. It is clear today that the different crops they used to use 15 to 20 years ago are no longer useful anymore, due to changing of isohyets towards the south. But more than that, the climate is no longer predictable for the farmers, cattle raisers and fishermen. In most cases they are very disoriented as their life depends completely on the rainy season, which is no longer predictable.

At the same time, they are not equipped at all to face these changes, due to their own economic level and the economic level of the country to support them. Since climate change is going to make changes for a while, it is necessary to provide these communities whose life is completely dependent on natural resources with techniques and methodologies which will allow them to adapt in a better way to the changes. For that an appropriate, well designed, targeted training is needed for each of the communities depending on the field of their activities.

(Re)training is a necessity in order to fight climate change. In the field of agriculture, one of the key elements is to find appropriate water management systems for both surface and underground water. There is a need to train local farmers and develop best practices in water management for gardening, fishing and agricultural activities. Agricultural practices in Mali are not sustainable. Examples of this are extensive farming which requires clearing the areas from trees and use of chemical fertilizers, pesticides and herbicides, which contribute to making soil poorer. This situation could be in most of the areas reversed by organizing training and concrete showcases on appropriate adaptable agroforestry techniques; compost production, integration of agriculture, cattle and fishing production together, permaculture, etc.

In the sector of livestock, new ways of raising livestock are needed as nomadism and transhumance are becoming more and more difficult to practice. For the fishing sector, there is a need for training in fish farming.

On the other hand, the question is how to create added value to the agricultural production. Considering that in most places in the Malian countryside, there is very limited access to energy, development of local energy sources would be a way to add value to agricultural, fishing and cattle products. Another important aspect is how the equipment like solar dryers, mechanical farming equipment, cashew production equipment, milk pasteurization tools, etc., can be produced locally.

However, the main question remaining is how to find the capacity and skills for this kind of training? How to find facilities in the rural area? For that the training of trainers, identification of local leaders and identification of communes with some facilities, which can bring other communes together, is required. The Malian Government, through its different projects and programmes, has a key role to play in this. Civil society and the private sector have also an important role to play.

Some work has already been done on that and some strategies elaborated by the government, including different initiatives like APEJ, ANPE with different training initiatives targeted to rural areas and the programme of HIMO (Haute Intensité de main d'oeuvre), which assists in hiring especially the young people during the dry season. Civil society has also several different initiatives for training of farmers in the sector of environmental businesses, training centres like CampBio for youth in cooperation with MFC Nyetaa and Ministry of Environment, solar training schools in rural areas etc. Considering that more than half of the population of Mali is under 30 years old, there is still a lot of (re)training need in order to adapt the Malian economy to the negative impacts of climate change.

Industrial sector

Today, the industrial sector is mainly characterized by gold mining today, which is a vital economic sector in Mali. In the situation of climate change, drought, and unpredictability of the rainy season, many farmers see the mines as positive as they provide work to their youth. But the problems start when production ends and the mines close and the youth lose their jobs. This contributes to increase the number of people who already have problems in the primary sector. The key is how the mining sector could provide other opportunities around the mines so that when they get closed, the other activities could stay which would alleviate the shock.

Energy and transport

The energy sector in Mali, as mentioned before, is characterized by the use of traditional biomass, which represents about 90 per cent of the final energy consumption, and which causes deforestation. The Government of Mali has taken many different initiatives in order to find sustainable solutions to that. Different civil society organizations have also had various initiatives in order to develop the energy and transport sector in a more sustainable way. Even considering all these efforts, when it comes to access to modern energy and transport services in the rural area, most of the technology still uses the fossil fuels (diesel, kerosene, petrol, LPG etc). However, Mali has very rich potential in renewable energy, which could satisfy a lot of energy and transport needs and create more jobs. The challenge is that there is very limited capacity on designing appropriate technologies, which can satisfy the modern energy needs of the communities and also put in place an appropriate financial mechanism, which could allow communities and municipalities to have access to these types of services.

Also, if there is such technical capacity, it is usually concentrated in the capital. Considering the continued growth of the Malian population and that a big majority is youth, the development and promotion of renewable energy technologies for promotion of modern energy services and transport can play a very important role in job creation and in the creation of wealth. Since the Malian population is mainly rural and the settlements are distributed and villages distant from each other, the grid connection would be very costly. As the main activity is farming, a lot of agriculture residues could be valorized in energy production, and access to modern services could add a lot of value to the different farming products. If this is done, the communities can be more resilient to climate change because even if the yield is fluctuating due to an unpredictable rainy season, farmers can always add value to their production with the modern energy services, and get better prices.

This cannot be done without designing an appropriate training programme targeted to youth in rural areas in designing, developing and maintaining appropriate energy and transport technologies which can meet their needs, based on the economic potential in their locality. For example, for a community with cattle potential and access to water resources (underground or surface) the option could be biogas, for good farming areas with some forest resources, the option could be biogas and/or biomass gasifier technologies, for areas with good wind potential, small windmills, and electric cars could be an option, and solar thermo for drying and PV for lighting could be an option almost everywhere in the country. The biofuels from biodiesel or bioethanol based on the sustainable principles such as respect of traditional land ownership, local production, local transformation and local use can contribute a lot in a local economy.

In order to successfully do that, capacity has to be created to increase the energy supply and improve transformation for the agricultural production. There is need for an integrated model. Considering that energy is a catalyst for the economy, it should be based on local resources. This training is needed for local people but also the people who are in charge of rural development programmes. A lot can be done in training of trainers. But the fact today is in most of the developing countries like Mali, access to modern energy is still not included as an integrated part in the development of the agricultural sector or in general in the rural development programme. So there is a need for better synergy, which will result in a much higher impact and in the increased resilience of the communities to climate change.

Building and construction

The construction sector is very active in Mali at the moment - even booming in Bamako and the regional capitals. At the same time, most of the construction in Mali now is based on concrete construction, not in energy efficient techniques. Mali is a country of a very long history and tradition, and there is a traditional type of clay construction architecture called Sudanese architecture (Timbuktu, Djenné, etc.), which is even internationally recognized. In colonial times,

the French became interested in this architecture and promoted it in the colonial buildings. But the fact today is that modern architecture in Mali does not promote these techniques. New concrete buildings are very energy inefficient, with electric air conditioning, water heaters, etc.

Restructuring this situation towards more ecological and energy efficiency represents a huge opportunity to job creation and the reduction of GHG emissions. There is very limited expertise, knowledge and capacities, in the level of architects, construction engineers, technicians and masons. Very important and ambitious programmes could be designed to cover all sectors of building and construction for greening, which can comprise the identification of appropriate sites for the provision of local construction materials, identification of local masons who still have some knowledge of this type of construction, and designing programmes on how to improve their knowledge to become trainers of trainers. The same can also apply to architects, technicians, and engineers. Trainers are needed to create those capacities. Another important thing is training programmes for marketing experts to promote traditional building (local material construction) among the Malian people for them to rediscover the benefit of the techniques in order to create demand. There is also a need that the banking sector could recognize this construction in the same way that they recognize concrete construction. This could also be a great advantage to the government as energy consumption could be reduced.

Carbon finance

Like most of the less-developed countries, especially African countries, Mali benefits very little from the opportunities of carbon finance, even though there is a huge potential. One of the main reasons for this is that there is very limited capacity to identify, develop and promote carbon finance projects. Most of the elements in this new market are missing. Many project developers do not even know that their projects could benefit from such a mechanism. For those who know, they cannot find expertise at the national level to assist them. And if they find expertise, they cannot find financing, as there are no financing institutions at the national level to finance it. So far, this makes it difficult for carbon finance activities to take off in Mali. There have been some initiatives and training programmes and few projects benefiting from carbon financing, but they are all relatively big, like hydropower, a big afforestation programme, etc. Even though something has been done, there is still a lot to be done. Training needs to be focused on project developers, national consulting companies and specialized NGOs, as well as financial and government institutions in charge of rural development sectors.

3.1.2 Skills response

This subchapter analyzes effectiveness and organization of skills response to meet the challenge of green economic restructuring, paying specific attention to active labour market policy measures, planning of initial and continuing training, institutional frameworks, systemic provisions, delivery channels, ad hoc versus anticipated skills responses, and skills response by different actors and providers.

In Mali, training is offered in several ways: traditional academic training, vocational training, and workshops and seminars for capacity building. Academic training has been done according to a well-defined plan, which is validated at the level of ministries, directorates and teaching academies. Vocational training and employability training are made through specialization based on specific themes, but of short duration. There are also training workshops and seminars, which usually attract the attention of policy makers or actors in relation to specific topics.

The Government, in collaboration with its partners, have set up development and learning centres for professionals. The purpose of these centres is to strengthen the capacity of the public and private sectors. The centres have at their disposal tools for the benefit of a well-defined target. With the development of data on the labour market, there is a mismatch between labour

demand of companies and educational qualifications of job applicants. These degrees are generally more suited to the needs of the public service. With changes in the environmental context, the state and private structures must also follow this trend by adapting more to the training needs of the market, which leads to market driven educational programmes.

Professional training is crucial in promoting green skills among the population. Technical and vocational education and training is being promoted by the Sectoral Investment Programme on Education (PISE - Programme d'Investissement Sectoriel en Education) to supply young professionals required in different promising sectors which include agro-business, construction, hydraulic, mining, crafts and tourism and ICT. Accordingly to this objective, several professional training centres and employment counselling agencies were created. The government has been implementing programmes and projects that enhance human resource capacities, to facilitate the reintegration or conversion, with new trends and opportunities in the job market.

The Government also sets up funding facilities to target the (re)training needs of the Malian economy for job creation. These initiatives include the Professional Training and Learning Support Fund (FAFPA - Fonds d'Appui à la Formation Professionnelle et l'Apprentissage).

Skills response of National Agency for Employment Promotion (ANPE)

The ANPE is a public administrative institution. Its mission is to contribute to the implementation of national employment policy. It is responsible for the collection, centralization, analysis, and dissemination of data relating to employment, promotion of self-employment, studies on employment and vocational training. To carry out its missions, ANPE has administrative, technical and operational structures. ANPE has been active in creation of jobs in the sectors of the economy which can have some direct or indirect impacts on greening the economy. These include, among others: jatropha plantation for the creation of jobs for rural youth, moto-taxies and new taxis for young drivers etc.

The DOEF (Observatory Department of Employment and Training / (Département Observatoire de l'Emploi et de la Formation) of the ANPE has a mission to develop, implement and monitor programmes on the labour market. In this capacity, it is responsible, for example, for collecting, processing, analyzing and disseminating information on the labour market; making available to the public and policymakers knowledge and guidance in creating employment and improving the adequacy of training opportunities for present and future labour markets; identifying promising sectors with potential for job creation; and creating and regular updating of a data bank on employment and training.

It would also be important to develop specific impacts of climate change in relation to each of the profession and training adaptations in this direction, and make public and training institutions aware of all the opportunities which exist in the sector of greening economy on one hand, and the limited human capacity for these sectors on the other hand.

According to an interview with the Director of the ANPE, agriculture is a priority for the Mali Government, as well as for the ANPE. The ANPE is working in cooperation with all the ministries, and through its interventions tries to reduce rural exodus by supporting youth in rural areas. Activities supported in this direction are, for example: poultry, fisheries (with the reforestation of river benches) and cattle raising (artificial insemination). For these and other activities, they are providing special kits, with all the necessary tools and the appropriate training included.

In 2009, 3,000 kits have been shared with youth, including 1,000 agricultural kits, 500 livestock kits, 30 baler kits, 100 tiller kits and 210 kits for photographers. Of these, 82 per cent were given to men, 14 per cent to women and 4 per cent to groups. Agricultural kits include:

plow, seeder, donkey cart and donkey, two cows, and small animals (sheep, chicken etc). The livestock kits include: feeders, drinkers, wheelbarrows, buckets, rakes and five cows.

Skills response of APEJ

At the APEJ, several projects have been implemented to enable young people to adapt to the labour market reality. The labour market in Mali has difficulties in absorbing graduates because of their lack of experience, and therefore APEJ develops projects, which serve for the vocational training practice for the disadvantaged. There is a project for young people in working life through investments in labour-intensive work (PEJHIMO - Programme Emploi Jeunes à Haute Intensité de Main d'œuvre). This project takes into account the focus of capacity building and training for SMEs, GIE, the engineering construction sector, community groups, municipal officials and technical staff of the state. For the first time, the APEJ has organized around 5,200 trainee days of training; 40 per cent of which for women.

Especially in its rural youth programme, APEJ has several activities that can be considered green, even though not resulting from green economic restructuring: the hydro-agricultural aménagement, reforestation of watersheds, operation and management of forest supply basins and the work of erosion control, strengthening local capacity (municipalities rural SMEs, consultants, farmers' associations and youth groups) in the design, planning, implementation, monitoring and control, management of rural infrastructure projects and environmental protection, through a wider approach to high intensity of labour. It contributes to the development of entrepreneurship among rural youth in developing training modules in entrepreneurship to meet their specific requirements. The APEJ also put into place funding bodies mechanisms for rural youth to access credit for the purchase of tools for production and marketing.

The APEJ programme of rural employment and labour-intensive work has recently begun a project for digging a river. In fact, the rivers are blocked due to the cutting of trees that are along the banks and which are the protectors of the rivers against silting. The project was not justified because of environmental reasons, but for economic and employment reasons. There are many other similar cases with different actors in Mali.

UFAE (Unit for Training and Support for Enterprises)

This is a public scientific and technological facility, which was created by the Government of Mali with the French support, because of the reform of the national system of technical and vocational training. For achieving their training, audit and consultancy missions, these units are using trainers and experts from the training units for the productive sector of Mali, sub-regional or international. Created by law in 1997, the first three UFAEs are based in Bamako. The networking of their human and material resources is particularly suited to the diversity of situations encountered.

The UFAE/GCMI "Civil Engineering, Mining and Industry" (located at the Ecole Nationale d'Ingénieurs de Bamako) is specified on actions in the direction of staff management and technical managers in the productive sectors. Being able to mobilize the resources of higher technical education, the UFAE/GCMI also maintains close ties with experts (from the world of business) that may be requested. Accompanying projects, audits and sectoral technical expertise - much appreciated - are examples of the work done.

The UFAE/MB "Construction and Maintenance" (based at the Central School for Industry, Commerce and Administration Bamako) specializes in the development of skills of qualified and skilled workers and supervisors, in the traditional and modern sectors of the economy. This UFAE actively contributes to the establishment of training by alternating direction of apprentices and craft patterns.

The UFAE/GO "Management and Organization" (located at the Graduate Institute of Management) mobilizes a variety of skills to meet the needs of business in accounting, IT and marketing. Its multiple capacities for intervention (market research, audits and training in the tertiary sector) have already provided answers to numerous requests from professionals.

These units have no strategies for meeting the challenges of greening the economy, but execute the demands coming from the various clients, which may also include greening components. UFAE generates much interest from companies and trade associations. The structure has responded to the need for training of more than 40 companies, which represents approximately 30,000 training hours of continued education, actions taken have mobilized in different areas, with the support of more than 70 expert trainers.

All these above-mentioned structures have the potential for capacity building and rehabilitation of human resources. Sometimes they are taking partly unintentionally into account certain acts relating to climate change, even though there are no programmes or strategies for it yet.

In addition, other structures exist through specific programmes, for example, for literacy. The CED (Centres for Education for Development) has served for the literacy of more than 4,000 young men in the Bamana language, and about 837 people received training in various fields such as agriculture/gardening, and tree planting, beekeeping, poultry etc.

These various development projects for capacity building of human resources and rehabilitation are in the majority government programmes with funding from bilateral or multilateral donors. The intervention by these partners reduces the costs of services of trainers / experts. However, some specialized centres also try to make modular training fees to the private companies or government agencies.

Skills response in the agricultural sector

For the diversification of the technical and agricultural sectors, the Government has undertaken policy in order to organize the agriculture sector, and also integrate agriculture and natural resource management; the LOA. To implement the LOA, different decisions have been adopted, and from that, different projects and programmes initiated according to the objectives of the LOA. Even though it was not written with greening and climate change in mind, many of the elements of LOA are going in the direction of greening economy.

The LOA recognizes that agriculture and sustainable management of natural resources are interlinked, which is already in a way an anticipation of recognizing that agricultural development of Mali is linked to climate change. The LOA gives also an important role to the professionalization of the agricultural sector and added value to the production locally which could become one of the key contributors to the creation of work - especially to rural youth.

Among the programmes initiated before the creation of the LOA, can be mentioned:

- The PCDA (Competitive Agricultural Diversification Programme): The project aimed to promote agricultural supply chains and to develop growth and economic opportunities in rural areas, from production to marketing of agricultural products. It also allowed the creation of chains of production and supply of local and international markets in agricultural, livestock and fisheries, in which Mali has comparative advantages. As a result, the company's structures and peasants technology demonstrations for water control system (drip, micro spray), storage and preservation of agricultural products. According to the report of the PCDA, the system of micro-jet on citrus fruits permits a water saving of 35 per cent, a time saving of 75 per cent and a gain of manpower by 60 per cent and a yield of 15 per cent increase and better water management. In the same launch, the system of

drip irrigation in intensive production of potatoes had resulted in water savings of 53 per cent, saving time of 75 per cent, an increase of labour of 56 per cent and a yield of 47 per cent increases.

- The PASAOP (Programme of Support to Agricultural Services and Organizations) was a major programme of the Government of Mali, with the support of the World Bank, for the growth of rural development. It sought to enhance the sustainable volume of agricultural production, enhancing food security, and improved incomes and living conditions of rural populations. In addition, it sought to protect the environment and make a significant contribution to better management of natural resources.

These projects have shown their relevance to improving crop yields and diversification of agricultural techniques that will allow farmers to promote future sustainable development of rural areas. Today the market of the agricultural sector requires a number of factors to stimulate its growth and performance. In the image of its demonstration projects, the state needs to support and guide, bringing more attention to climate change and the temporal evolution of these jobs. In the development of the next phase of PCDA and PASAOP, these occupations can be hopefully even better integrated, due to the existence of the LOA and the attention of the negative impacts of climate change to the Malian primary sector.

3.1.3 Case studies

Case study 1. Disappearance of the agricultural sector in the Sahel: Climate change and desertification

Mali is an agro-pastoral country. In 2006, agriculture accounted for 36.9 per cent of GDP. It is practiced by 80 per cent of the population living in rural areas (GPRS II). Farmers are subsistence farmers, sometimes in combination with cash crops. The Malian economy is therefore heavily dependent on the performance of the agricultural sector, which is particularly sensitive to climate variations, long periods of drought and a continuous process of desertification in the south that has been in progress for several decades.

The area of Mali is estimated at 1.2 million km², of which the land suitable for agriculture is about 14 per cent (NAPA). The rest is occupied mostly by desert. The cultivable part faces the problem of advancement of the desert in the Sahelian zones bordering the desert.

Agriculture is dependent on the rainy season. The weather conditions have considerable influence on the harvest. From north to south, rainfall varies between 100 to 1,200 mm. In the center of the country (the Segou, Koulikoro, and part of the Kayes regions) the instability of the rainfalls affect many local conditions. In the northern part of the country many farmers have been already obliged to abandon their farming and cattle raising activities or to migrate to the south.

According to the DNSI, already between 1970 and 1995, the cultivated land area in the country increased from 1,967,000 ha to 3,472,000 ha, which represents an increase of 15 per cent in forest clearance. This increase in area under cultivation has not been accompanied by an increase in yields of food crops, which have remained low with an average of 750 kg/ha, taking all crops together, according to NAPA. Similar development has continued also during the past decade.

Soils in general impose several constraints from the agronomic point of view, which further limit the potential for cultivation. The 3 to 3.5 million ha of land (PNAE, 1998) cultivated annually show a moderate to low level of fertility, with deficiencies of phosphorus, potassium and sulphur and a strong tendency to wind and/or water erosion.

Especially in the regions of high demographic pressure, agricultural pressure is reflected in the cultivation of marginal and/or forest land and in a decrease in the period of time during which land is left fallow.

The degradation is generally not uniform throughout the territory. In the north, the process of desertification is progressing alarmingly over a vast sparsely populated area, with a major risk of sand encroachment in valleys and ponds.

The phenomenon of sand encroachment is a process in which grains of sand are transported by the wind or by water from a place of supply to a place where it is deposited. It is the most spectacular manifestation of desertification. Sand encroachment is a complex process, which involves two different mechanisms, the movement of masses of sand at particle scale and global movements.

According to NAPA, the costs of soil degradation to the Malian economy range between 20.9 and 26.5 per cent of GDP, or twice Mali's external debt.

Past and present practices relating to adaptation to climate change

According to NAPA, substantial migration of populations from the north to the south of the country and substantial emigration to coastal countries and the West have been noted in response to drought. This mobility is part of the autonomous adaptation which populations have spontaneously developed. During this period, the 'strong arms' (*bras valides*) emigrated to more prosperous locations and countries with the aim of working there in order to come back and pay for food for their family who had stayed where they were. The means of subsistence for populations that could not emigrate and were forced to stay where they were was often linked to resources such as: legumes and food plants, collected products which have become rare, mushrooms and tubers of wild plants, hunting and fishing products, wild or domesticated fruits and wild grasses.

The persistence of drought and shortage of rainfall have also led to rural populations practicing rain-fed agriculture in inland valley swamps and in the floodplains of rivers and creeks, particularly for rice cultivation. However, when exceptional rainfall occurs, the dry cultivation undertaken in these areas is endangered, often leading to food shortages. To mitigate this situation, peasants have adopted new forms of land occupation. There has been a massive increase in agriculture on land at altitude.

Field study

As part of this study, a socio-economic survey was conducted about the change in agriculture and animal husbandry. It was conducted among a representative sample of the population, in three villages in the district of Didieni (North-West part of Mali, 165 km from Bamako to the North-West). Those surveyed were notables, young people (men and women), and community leaders. The age of respondents was between 27 and 84 years.

Didieni is located in the Koulikoro region in North-West Mali, in Sahel area. The population is estimated at about 10,000 inhabitants. The main activities of the commune are agriculture, livestock and trade.

According to the findings of the investigation about the changes that have occurred in the locality during the past 10 to 20 years, the reduction in the level of rainfall, the disappearance of forests, and the instability of the start-up period of the rainy season were regularly mentioned. Previously farmers mastered the start-up period of the rainy season, and the end, and could therefore plan the period of ploughing, seeding, the type of seed, and the time of harvest.

Climate change, together with desertification, has already had big impacts in the life and farming practices in the area. These can be summarized as following:

- Due to poor productivity of soil and demographic pressure, the cultivated area has been doubled in the past 10-20 years, with limited increase in the yield. According to Dagalan Diarra, a notable from Kokaïra (village located about 18 km from Didièni) their cropland used to be 4 to 5 ha, but is now gone to 10 to 12 ha, with a similar performance. The increase in agricultural land means very often clearance of the few still existing forests, which in turn adds to desertification.
- Many species and varieties cultivated earlier no longer succeed, and have been replaced by other species and short-time varieties. Popular culture in the area was pearl millet. This culture requires a long period for the seed and risks related to rainfall. Currently farmers have access to an early variety of sorghum, which is better suited to current conditions. Crops like pearl millet tend to disappear in favour of sorghum, peanuts and watermelon. The development of the culture of groundnut and watermelon is partly due to the sandy soil.
- Farming as the main livelihood does not give enough food and income to families, and therefore many have been obliged to adapt to the situation with different means, most important of which is migration. The migration of young people happens into the country during the dry season for a short or long duration, and to Europe or Africa for a long time. These migrants often send funds for the improvement of the lives of their families, assistance in the food crises, as well as investments in trade.

As for cattle raising, most livestock is to meet the needs of labour for farming, but often also for the sale of meat. During the dry season, animal herds need to migrate to pasture areas in the south, because in Didieni there is not enough fodder for animals. This (transhumance) is a common phenomenon all over in Mali, and is naturally creating a lot of pressure in the pasture land of the south. Indeed, conflicts are steadily increasing between local southern people and people coming with their herds from the north.

The above-mentioned results are from the central part of Mali, which is in Sahel area. As mentioned, agriculture can still be practiced, but it is no longer providing livelihood to everyone. The need for additional farm land is putting pressure on the remaining forests, and it can be seen that the population is living in a vicious circle. Adaptation measures are not always sustainable: migration and increased transhumance to the southern part of the country are examples of this.

The skills response in this case is mostly self-organized and ad-hoc. In the agriculture sector, efforts are made by the government and NGOs to provide information to farmers about the new varieties of seed and new species to grow. Migration is self-organized by individuals and families.

Case study 2. Water and fish resources and climate change – The case of Mali

The country of Mali is crossed by the two largest rivers in West Africa, the Niger (4,200 km, of which 1,700 km are in Mali) and the Senegal (1,700 km). These two great rivers and their tributaries form an immense hydrographic network located in gigantic catchment areas (300,000 km² for the Niger and 155,000 km² for the Senegal), which Mali shares with 12 other countries. The total potential supply from these two hydrographic networks is estimated at 46 billion m³ per year, or approximately a flow of 1,776 m³/s. In these basins, nearly 400 wet zones have been identified (flood plains, lakes, ponds, wadis, etc.), of which some, such as Lake Walado-Debo, Lake Horo and the Seri Plain, are classified Ramsar sites, with more recently the entire Inner Niger Delta, which makes this the second largest wet zone in the whole of Africa (NAPA).

The rivers, whose basins are home to virtually the entire population of Mali, play an essential role in the national economy. They are the basis of every sort of economic development (supply of drinking water, agriculture, animal husbandry, fishing, industry, transport, trades, etc.). Other equally important activities such as tourism and mining also benefit from the rivers and their tributaries.

Although plentiful in theory, the surface and underground water resources are seriously threatened. The causes include:

- wastefulness and/or thoughtless management of the irrigation networks (particularly by the big irrigation systems such as the Niger Office);
- deforestation of the river banks;
- sedimentation and/or silting up of the rivers, lakes and ponds;
- various forms of pollution;
- deposit of 13 million tonnes of silt per year by the great rivers;
- invasive aquatic plants.

These various phenomena cause:

- annual losses estimated at 30,000 billion m³ of water in the inner Niger delta;
- pollution of the surface water and the deep water tables near areas of population concentration, mainly due to the discharge of used domestic water and household waste into the streams and rivers and to industrial waste, which often has a very high content of toxic elements (derived, for example, from the tanneries or the gold mines) and presenting a direct threat to surface water and, by infiltration, to the underground water supply; and
- changes in the natural system of flooding, leading to a major transformation of the traditional systems of production based on flood recession crops. This has also reduced the natural grazing areas, often causing conflicts over property rights between growers and cattle owners.

Despite the existence of a considerable potential in terms of underground water, actually exploiting it is problematic due to very irregular geographical distribution, mobilization difficulties and constraints in actually reaching the water (depth of water table).

Case study - Fishing

Fishing in Mali is an age-old tradition originating in the delta area of the River Niger. The Malian technique of inland fishing is very well known in the sub region of West Africa. Malian fishing is done only by hand and is carried out wherever there is water: in the rivers, the lakes, the ponds, the hydro-electric dams and irrigation dams, the flood plains, etc.

Hitherto fishing has mainly been the activity of traditional tribes such as the Bozo, Somono and Sorko, but now it is becoming increasingly attractive to other ethnic groups. Today it is also practiced by people who formerly had only farming activities, due to the fall in crops and their inability to support themselves with their former activities. This has led to an intensification of fishing following the growth in needs; the people have designed more sophisticated fishing apparatus and are making use of toxic substances and explosives. The fish population has a low rate of regrowth compared to the quantities of fish that are being removed.

On another level, fishing in the small streams has decreased considerably due to a fall in the water level engendered by lower rainfall. Formerly, people fished in the little rivers near their

villages, using this as an extra source of income. But today most of these streams have become sporadic or have dried up completely.

The fishing sector was formerly one of the pillars of the national economy, representing around 4.2 per cent of GDP. Practiced by nearly 500,000 persons (7.2 per cent of the active population), it contributed essentially towards the State income and local revenue (around 90 billion FCFA per annum). Malian fishing is done only by hand and is carried out wherever there is water: in the rivers, the lakes, the ponds, the hydro-electric dams and irrigation dams, the flood plains, etc. Mali was a major producer of freshwater fish (carp, mudskipper, etc.) - the country exported an average 5,600 tonnes per year of traditional smoked and dried fish to neighbouring countries. It was possible for annual production in the Inner Niger Delta alone to reach 100,000 tonnes. This completely satisfied internal demand, estimated at 10.5 kg per annum per capita (compared to 7.8 kg per annum per capita for meat). At 300 tonnes per annum, imports of frozen or dried foods remained marginal.

Today the rivers are suffering from the phenomena of climate change and have lost their capacity for renewal, both in relation to the quantity of water in the streams and their capacity to retain water and in relation to the various activities carried out there (fishing).

To illustrate these changes, a survey was carried out amongst elderly village inhabitants and their leaders (male and female) which clearly showed the effects of climate change on these surface water areas. The survey was carried out in five villages which have streams or rivers amongst a population aged between 42 and 88 years. The results obtained are very enlightening and show well enough to what degree water points have been affected by the phenomenon of climate change.

1. Changes in water courses in the last 10-20 years

All the persons questioned in the survey confirmed that the backwaters, rivers and temporary pools had undergone changes over the last 10-20 years. The chief evidence of the phenomenon is the silting up of streambeds and riverbeds. In fact, excessive wood-cutting along the water line, the death of certain types of trees (due to insufficient water) and plantations along the river banks or at the water sources (because of insufficient rainfall) have all resulted in erosion of the river banks. The earth carried along in the current fills the backwaters, temporary pools and riverbeds, making it difficult for rainwater to be retained. Today, 80 to 90 per cent of these water points have become temporary rainwater points or temporary water sources (not capable of holding water for more than 3-4 months compared to 8-10 months 10 or 20 years ago).

2. Reduction/disappearance of aquatic fauna

In the past, the water courses had a very high potential of fauna, but today the picture is very different. The people questioned in the survey confirmed that in the past the following animal species were very abundant in the water sources: toads, fish (catfish, mudskipper), crabs, turtles, monitor lizards, crocodiles and snakes. Other non-aquatic species sheltered on the river banks: birds, monkeys, lizards, etc.

Today over half of this aquatic population has disappeared. The water courses can no longer be fished and yet this was a very important activity for the populations concerned. The products derived from fishing (principally the fish themselves) contributed greatly to raising the level of nutrition of the inhabitants (fish used in sauces). Others used the fish as a source of income (sales).

3. Deterioration of nutritional quality and reduction in sources of income

The scarcity of fish and other aquatic animals has resulted in a deterioration of people's diet. The fish formerly used as a source of protein have become increasingly hard to find. Fishermen for whom fish was a source of income are faced with increasing financial hardship due to the lack of fish.

New emerging activities

Given all the disasters brought about by climate change in the water reserves, the human population has adopted other behaviour to make up for the deficit (adaptive activity).

- **Farming and market gardening.** Where the waterside vegetation has already disappeared (or nearly), a significant portion of the population who lived from water sources have converted to market gardening activities. The vegetables they grow are destined either for sale (to generate an income to replace fish products) or for their own consumption. However, this activity has further contributed to the silting up of the water points, as the gardening soil is constantly washed away in the rain and fills up the streambeds and ponds.
- **Small trade.** Where fishing no longer provides an income, some fishermen who used to sell some of their catch have turned to fish trading - they go and obtain their supply in the major areas of exploitation (the big rivers) and then take the produce to market.
- **Development of fish farming.** Given the importance of fish products in the diet and as a source of income, other people have taken up the activity of fish farming. Their idea was to dig little fish ponds for raising fish. However, they only have limited means to carry out this activity and their techniques are often inept.

Most of these adaptive practices are ad-hoc, born of ideas that arise in general discussion or possibly under the guidance of various development projects. As a result, fish farming, for example, is not as profitable as it could be because the people do not have knowledge of the proper techniques.

To further illustrate the effects of climate change on the water courses, other interviews were conducted at Bamako with the river fishermen established on the banks of the River Niger. Below are some excerpts.

Fisherman, 67

I am of the Bozo tribe and I have been fishing since I was very young (4 years old).

I was born in Konou (Dioro district) and I came to Bamako to make big money from fishing.

Talking about the amount of water in the river, there is a big difference between the present time and past time (that is to say 30-40 years ago). In the old days the river stayed high for at least 3 months because we had a lot of rain. In this high water period the fish could multiply in the spawning areas. Towards October the river began to go down. The fish were carried down into the river bed and filled it up.

Now it is exactly the opposite. It does not rain enough. This means that the amount of water in the river is going down. The river does not rise (or very rarely) so that the fish cannot reproduce (these days the river is only up for about 15 days at the most). It is even not unusual to find some parts of the river that have dried up completely, something that would have been unthinkable 30-40 years ago.

When there is plenty of rain and the rivers rise, the fish can reproduce. In the old days, fishermen could feed themselves and their families from what they caught. This time seems to have gone; there are very few fishermen who manage to survive without going into other activities (farming, for example: 80 to 90 per cent of Bozos and Somonos now have some kind of farming activity). There are no more fish (or hardly any) in the river. The scarcity of fish is due not only to the shortage of rain but also to an increase in the number of people who now practice this activity. Fishing used to be the preserve of the Bozos and Somonos; now people are going into it who used to be just farmers, because crops are going down and they cannot survive off their own activities.

All these events are due to climate change and pollution of the river waters (from pesticides used by out-of-season market gardeners along the banks of the river; and also by dyers' chemicals).

If you are asking for solutions for change, my suggestion would be that certain activities should become more widespread or should be encouraged:

- improve methods of fish farming;
- inform and encourage the rural population to return to the land; and
- increase the efforts to stop pollution of the waters by the market gardeners and dyers.

Fisherman, 55

I am from Foni (Tamani). I came to Bamako to make money. I have been fishing since I was 18 years old.

Thirty years ago you could not compare the level of the river to what it is now. The river used to flood in every rainy season and it took a long time before it went down again. This is not the case now. This is due to the fact that these days we no longer have abundant rainfall, as has already been said.

With regard to the fish, the fact that the pattern of water movements is disturbed and there are growing numbers of fishermen has enormously upset fish reproduction (fall in the reproductive rate). Now there are very few fish and most of the fishermen have been forced to turn to agriculture in order to meet their own needs (the activity of fishing having become inadequate). Similarly, a lot of farmers have turned to fishing because of a fall in crops, also due to lack of rain. All these disturbances are due to climate change. To this you have to add the increase in population, construction (there is more and more building in the river bed, hindering fish reproduction) and various forms of pollution (use of pesticides, waters dirtied by the dying industry).

As a solution in response to climate change, my suggestion would be:

- develop fish farming;
- inform and encourage the population to reduce pollution of the river waters; and
- teach the fishermen more appropriate skills with regard to the nets they use (dimensions, quality).

3.2 New and changing skills needs

This chapter and its subsections deal with skills needs for newly-emerging green collar occupations, and with new and changing skills requirement for existing occupations (skill gaps) in the context of greening the economy.

Mali, like other developing countries, faces the problem of the globalization of the economy. The self-sufficiency is no longer a solution to growth. Changes in world prices of raw materials have direct impacts on the global and local economy. Besides that, the awareness of western consumers is increasingly having an impact also in the production systems of the south. For that, Mali must find local solutions in order to adapt to the international climate. However, the biggest challenge in Mali in the coming years will be adaptation to climate change and mitigation of its effects. Therefore, new occupations and new skills for existing occupations are very important elements for facing the new situations.

3.2.1 New green collar occupations

This subchapter deals with green collar occupations, which emerge newly as a result of adaptation to climate change and mitigation of its negative impacts.

The fight against climate change creates new activities that constitute an important source of job creation. In Mali, the greatest opportunities to create new green jobs are in the areas of energy: rural electrification, energy production from agricultural residues, energy efficiency and various applications of solar energy. Another important sector with new emerging green collar occupations is the meteorological sector, including agricultural meteorologists, and data collectors in the field, new occupations in the waste management sector, carbon finance-related occupations and research.

In the energy sector, demand for new occupations stems from the fact that the energy production of Mali is over 80 per cent from firewood and charcoal. In future, this is not sustainable for several reasons: the growing population and changing habits demand more energy, and the existing forests cannot support all these needs in the long run. Energy is the cross-cutting theme in development, which should be integrated in all policies and programmes. As Mali has no petrol reserves (in use) of its own, and hydropower potential is declining due to climate change, other possibilities have to be explored. The fact that the countryside is very sparsely populated does not favour establishment of grid all over the country. Therefore, small-scale local energy production is most suitable for Mali.

Some examples of new green jobs that emerge in the energy sector are described below.

Biofuel for rural electrification

National Strategy for the Development of Biofuels in Mali

For three decades, taking into account the changing situation in international energy, Mali joined the search for durable solutions to satisfy their basic energy needs. It is in this context that experiments were carried out with biofuels based on jatropha oil for biodiesel and alcohol from sugar cane for ethanol, which are good substitutes for diesel and gasoline.

Also, to ensure lasting satisfaction of energy needs, in 2006, the Government adopted the National Energy Policy and Strategy Development of Renewable Energies and, in June 2008, the National Strategy for the Development of Biofuels. The National Strategy for the Development of Biofuels is to increase local production of energy through the development of biofuels to meet the socio-economic needs of the country. The creation of the National Agency for Development of Biofuels is an institutional mechanism provided for the implementation of that strategy. With

the status of a public administrative nature, the National Agency for Development of Biofuels has the mission to promote biofuels, including:

- having a centralized structure, coordination and harmonization of activities in the field of biofuels;
- having more professional players in the field of biofuels;
- issuing technical standards and quality of biofuels;
- establishing a framework for consultation among key actors (public, semi-private);
- providing and maintaining a continuous flow of exchanges between national and international partners in the field of biofuels.

Biofuel from jatropha curcas

Traditionally, jatropha oil has been used in Mali for soap production. However, the combined fluctuation of the price of fossil fuels and increasing global awareness about climate change has boosted interest in jatropha oil production as a substitute to diesel fuel in Mali to reducing fossil fuel consumption and creating an additional market for local production.

Being a landlocked country without any petrol reserves (in use) of its own, the fossil fuel import costs in Mali are huge. As a developing economy, there is a lot of potential for increasing fuel use in both the transport and energy sectors of Mali. On the other hand, Mali has a big potential for production of biofuels.

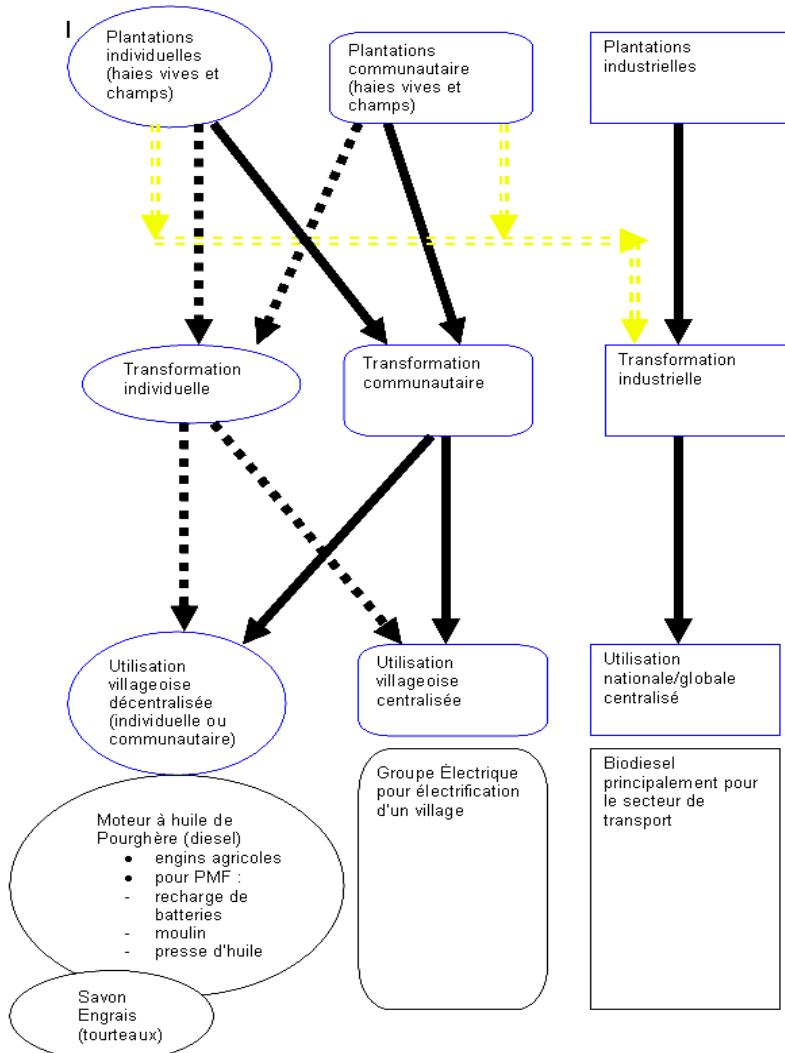
There are many pilot experiences emerging in some villages of Mali where women's groups, cooperatives, communities, and other stakeholders collaborate to produce jatropha for local use. This includes many activities for the plantation through seed collection and processing as well as oil utilization as a substitute for diesel. Besides biofuel production, jatropha can also be used in other areas such as:

- soil protection (fences, cake as fertilizer, etc.);
- secondary products such as soap ingredient and organic fertilizer; and
- burning fuel which gives a net emission of CO₂ from zero.

The jatropha oil application as fuel also requires technical competences for engine conversion to enable oil combustion. All these activities could create many new green jobs. Some of these new jobs are also new occupations, namely technicians working on different jatropha equipment (pressing and filtering systems).

At least three types of models with economic, social and cultural implications are tested in Mali: decentralized village community model, centralized village community model and model of development of large plantations, largely funded and controlled by outside capital, possibly in association with Malian capital. Each model may contain variants and should be analyzed in terms of creating new types of rural employment in the specific contexts of the villages concerned.

Figure 1: Three different models



Wood and agriculture residues valorization for bioenergy production

Forests comprise a major natural resource in Mali. Due to deforestation and degradation, this resource is under severe pressure. Actions are underway in Mali to use fuelwood, household wastes, agricultural residues, and animal waste in a more sustainable way. Cleaner cooking fuels using sustainable biomass offer the opportunity to create employment in rural communities, raise incomes, and improve health. Combining this initiative with clean-burning, locally-produced stoves offers even more benefits. The already existing new green jobs in this sector in Mali include:

- The manufacture of charcoal briquettes from the residues of carbonized cotton stalks and stalks of millet, maize and tiph (a wild herb). The company which realizes biomass production in Mali currently employs approximately 16 people and works with a network of 13 women's associations on carbonization of cotton stalks, which is the main raw material. The company also has over 40 dealers for the distribution of briquettes.

- Production of improved stoves from metal or clay. A good example of this is the stoves "SEWA" by the company Katene Kadji which is also a new business source of green jobs creation.
- **Green jobs in solar energy applications:** The renewable energy sector of Mali is promising in terms of green job creation as the country is endowed with huge renewable energy resources - particularly solar. The country has almost 4,000 hours of solar sunshine per year. Currently this energy is underexploited and could contribute to provide access to modern energy services in rural areas. Solar thermal energy could be tapped for cooking, thereby reducing the consumption of wood. Solar photovoltaic energy is another application that is currently developed on a small scale to provide electricity for lighting in school and health centres as well as for medicine refrigeration. Solar photovoltaic is also used to provide power for telephone relays in non-electrified zones. All these applications generate new jobs for installation and repair.

The country also has a National Centre for Solar and Renewable Energy (CNESOLER - Centre National d'Energie Solaire & des Energies Renouvelables) equipped with workshops for solar thermal equipment production. The production of this equipment represents an interesting opportunity for green jobs creation or upscaling.

Other opportunities in the field of energy are the small-scale hydropower stations, wind mills and energy efficiency.

Meteorology

Since the early 1970s, Mali, like other countries in the Sahel region, has suffered from recurrent droughts and severe consequences of climate change that have contributed to the deterioration of ecosystems with heavy losses for both populations and for livestock. The Agrhytmet Programme was launched in 1975, following a resolution of Ministers of the member countries of the Inter-State Committee to Fight against Drought in the Sahel (CILSS - Comité permanent Inter-Etats de Lutte contre la Sécheresse) and a joint mission of the World Meteorological Organization (WMO) and the United Nations Food and Agriculture Organization (FAO). The mission recommended, inter alia, strengthening the capacity of meteorological and hydrological services of the countries concerned to enable them to diagnose early because, in similar situations as noted by the mission, if drought had been announced in advance, their consequences could have been mitigated.

In Mali, an Agrometeorological Division was created within the National Weather Service, and agents were trained in the Regional Agrhytmet Centre in Niamey (Niger) and equipment was acquired to strengthen observational networks and data transmission and to increase storage capacity and data processing.

Agrometeorological assistance has been tested in Mali in order to guide farmers in adapting to changes and climate change. This assistance consists of:

- The collection of satellite images from METEOSAT satellites and remote sensing images including vegetation indices (NDVI - Normalized Difference Vegetation Index) from the Regional Agrhytmet Centre for monitoring the evolution of rainfall (new occupational profile).
- The development and dissemination of a newsletter "Agro-hydro-weather" during the season, May to October, every ten days by a multidisciplinary working group, Agrometeorological Assistance (GTPA - Groupe de Travail Pluridisciplinaire d'Assistance Météorologique), composed of representatives of the departments of agriculture, meteorology, hydrology and communication (new skills to existing occupations).

- For the ten days, the report outlines the weather and time of rainfall, the crops, waterways, pastures, pests, and makes projections for the next ten days and gives advice to rural areas (new occupational profile).
- The officials of meteorological observation stations, officers of the structures on the ground and literate farmers are responsible for the collection of field data (new occupation profile).

The strategy of using weather information requires:

- strengthening the network of data collection. In the context of decentralization, each rural community must have a reference weather station (the building) which costs about 150 million FCFA or in some cases an automatic station (50 million FCFA). This would facilitate the decentralization of the same assistance to the rural world weather and the participation of people and organizations in data collection,
- improving climate forecasts;
- transferring of authority and communication of climate information; and
- training of farmers in the use of equipment for data collection

Waste management

Malian cities are rapidly urbanizing, yet few have sanitary landfills. Rather, most cities use managed dump-sites to dispose waste. Using the carbon revenues from composting waste at such sites could help solve the growing solid waste management challenges, while managing GHG emissions.

Sustainable waste management is a major challenge for the urban cities in Mali. The situation is hardly different in other African cities. As cities grow, the goods consumption in these cities also grows, resulting in ever-increasing quantities of waste produced by urban residents and industries. Waste collection, separation and re-use offer a huge potential for creating employment. But there are constraints to tap the full potential for organized job creation in this sector.

Current development presents interesting opportunities for job creation for recycling, transformation and re-use of waste. These occupations are mostly new occupations, but some are also existing greening occupations. In this chapter, the new occupations are presented.

- There is an increased involvement of women and children in the sorting of plastic bags, bottles and other valuable components of the waste. The driving force for this new occupation is the increased demand for recycled plastic bags by plastic manufacturing industries in Mali as well as in Côte d'Ivoire as an alternative to the short supply of the principal raw materials in the plastics industry.
- There are also some SMEs who have been specialized in the recycling of electronic waste.
- Some SMEs have been created to manufacture road pavement from compacted plastic bags and soil.
- Women's associations are also created for recycling plastic bags which are then sold or reused as fibre to weave diverse objects like baskets, bags, suitcases, etc.

Carbon financing

In the final seminar of Green Facility Mali, one of the biggest barriers identified for Mali's participation in one of the carbon financing mechanisms, the Clean Development Mechanism

(CDM), was the absence of national experts for developing and accompanying CDM projects. For this, the solution would be the establishment of a permanent mechanism of training, information and follow up for the actors and establishment of a network of national experts for development and elaboration of PINs (Project information note) and DDPs (Descriptive Document of the Project).

These actions would create new occupations both in training and supervision, and also result in concrete projects qualified for CDM.

Research

In the field of research in Mali, climate change has not been a focus for a very long time, but now there are certain activities which are creating new profiles and occupations. Among these is the previous soil-water laboratory in the Institute of Rural Economy which has been converted into an Agroclimatological laboratory. The driving force to this has been the need to diversify the research due to climatic variability. In general, the research has become more pluridisciplinary which necessitates new competencies and research profiles.

As well, the application of research results creates new occupational profiles in the field of technology and techniques. Among these are: the meteorological information as mentioned above, local production of improved seeds, and techniques of pre-soaking (*pré trempage*) for resistance to drought. Youth could also be trained, for example, in techniques of protection of fields and plantations in the changing climate, moving from village to village like nurses making interventions and training for local people.

3.2.2 Greening existing occupations

This chapter deals with new types of skills, competences and skill gaps, which need to be incorporated into existing occupational profiles.

In Mali, new skills will be needed to address the challenges created by climate change on the former socio-economic activities in the primary sector comprising agriculture, livestock and fishing, which are the biggest job-providing sectors in Mali. In addition, there are also new skills needed in the energy and construction sectors. Urbanization is a growing problem with waste management, requiring new skills and creating new jobs. Some examples of new green jobs that are emerging and the needs of capacity building for old occupations are described below.

New skills for the agricultural sector

In the agricultural sector, the new skills include a better understanding of climate change and its impacts in Mali, and the adaptation and mitigation mechanisms to existing agronomes. As they are the ones in charge of different development programmes and projects, it is important that they can provide advisory services and training about the issues related to climate change.

Farmers need new skills and competences related to new farming techniques and varieties/species more appropriate in the changing climate conditions. At the same time, even with new techniques and species, agriculture may not provide enough profit to earn a living, different additional income sources are crucial to reduce rural exodus.

These additional income sources include vegetable and fruit gardening, adding value to production by processing of local raw materials or by focusing in fulfilling the standards of ecological farming (cotton), or fair trade (shea butter, cashew nuts, mangos etc.) small commerce, and animal husbandry (especially chicken, sheep and goats), integrated farming and tree nurseries and planting. Other new skills for farmers can be completely new part-time occupations related to local production and/or maintenance of equipment, ecotourism, etc.

New skills in bioenergy, including biofuel production

For bioenergy markets to develop in Mali, capacity building is required in all areas of project and programme design, development, implementation, and operation. This entails a long-term commitment, with activities focusing on individuals, institutions, and systems, and aimed at public, private, and non-government organizations (NGOs).

Capacity-building activities include:

- training policymakers on policies and programmes for accelerating adoption of bioenergy by small landholders;
- integrating bioenergy into national development strategies in agriculture, forest conservation and sustainable use, poverty alleviation, energy, and rural electrification;
- strengthening enterprises to source, integrate, install, operate, maintain, and service bioenergy systems; provide business training and incubation support;
- training the finance and banking sectors (senior management/loan officers) on the risks/rewards of financing bioenergy projects, through pilot projects and programmes that minimize initial investment risks;
- providing training and technical assistance on standards for bioenergy development;
- making an effort to organize grassroots organizations for collecting, grading, and oil processing;
- improving yields per ha of jatropha plant which is promising for increasing oil production; and
- conducting communications and outreach on bioenergy benefits/challenges, including consumer awareness campaigns.

The bioenergy sector has a number of training needs including:

- **nursery growers:** the technical implementation of nurseries, as plantation operations are very sensitive (recovery of plants relatively difficult, increasing of the growth potential).
- **producers:** planting techniques necessary for successful plantations, the result of good production.
- **users of jatropha oil:** the use of jatropha oil often requires some modifications of the engines (KIT operation) and some maintenance due to the effects of pure vegetable oil. For use at local level, it is important to train operators of platforms or other engines (agricultural, transport etc) in adaptation and equipment maintenance.

New skills for waste collection and separation

In the district of Bamako, composting of organic waste is done on a small scale, mainly for gardening purposes. In 2001, there was only one small composting enterprise - Dakan Compost. This activity is gaining momentum in the use of organic waste in agricultural farms in the surrounding area of Bamako. In the peri-urban zone of Bamako, farmers sort out the inorganic objects and spread the remainder over their field, as organic wastes are very useful in the restoration of soil fertility in highly degraded soils. The reasons given for promoting recycling are to improve food security and create income-generating activities. Use of organic waste is not a new occupation, but demands new skills for people working in waste collection and separation. In the best case, the organic waste could be separated from the rest already at the source. However, this would require new skills from the GIEs working in waste collection: namely,

information, communication and training skills in order to teach people how to separate the waste. On the other hand, this could be a completely new occupation as well: “waste advisor”.

There are interesting opportunities to provide know-how and build capacity of the different actors to perform safer and sustainable management of solid waste. The skill needs could include:

- informing and sensitizing the population for pre-separation in the household level of organic waste from other products. This could be done by the government institutions in charge of waste management in collaboration with the NGOs, GIEs (small enterprises called “Groupement d’intérêt économique” / Economic Interest Group) and cooperatives involved in waste collection;
- providing adequate equipment to the GIEs and cooperatives. Simple guide on how to separate organic matter from other products could be developed for this purpose. These actions will help reduce unpleasant gas emission and ease the composting;
- sensitizing the people working on the dumping site concerning the health risks related to their occupation and also providing training in composting techniques, safer sorting techniques and to provide them with adequate equipments such as gas masks;
- in order for the small-scale entrepreneurs to stay competitive in the market, providing them organizational capacity, so that they can set up companies to meet the minimal requirements to be eligible for tendering; and
- building capacity at all levels - local, regional and national - on approaches to waste management and governance.

New skills for construction and building

In the construction sector, there is a need for new skills for architects, construction engineers and masons in planning and building more energy-efficient houses and adding value to the local materials used in construction. The most appreciated material for construction is concrete, even though it is not the most appropriate. In the hot climate, concrete houses are very hot as concrete stores the heat. There are good clay construction techniques, relevant for higher living standard houses as well, but these are not well known. Therefore, architects and construction engineers could play a central role in information sharing about the benefits of local construction materials.

3.2.3 Identification of skill needs

This subchapter deals with methods, approaches, systems and institutional responsibilities in the identification of current and future skill needs for the green jobs labour market.

In Mali, the greening of the labour market has not yet been an issue, as such. Therefore, the skills needs have not been directly identified by any agency or programme. The identification of the needs has been done via this study, by interviewing experts from different fields. There are, however, some actors who could add to the identification of skills needs for a green jobs labour market, like, for example, the Observatory Department of Employment and Training of the ANPE, and the strategic planning units of different ministries.

3.2.4 Skills response

This subchapter analyzes effectiveness and organization of the skills response in relation to the challenge of greening the economy, with specific attention to planning of initial and continuing training, institutional frameworks, systemic provisions, delivery channels, ad hoc versus anticipated skills responses, and skills response by different actors and providers.

Since the skills needs for the green jobs labour market has not been identified in Mali prior to this study, there has not yet been intentional skills response either.

3.2.5 Case studies on new green collar occupations

Case study 3. New green jobs in Mali's emerging biofuel sector

Today, Mali, as a non-oil producing country, is confronted with the soaring price of oil, which always impacts on the economy of a developing country; particularly a country like Mali. As a result, we are now witnessing a considerable and growing interest on the part of commercial investors and users for biofuels, in both the public and private sectors throughout the world. There is particular interest in the jatropha plant⁴ because it is easy to grow and requires very little water; this interest is not only in Mali but several other African countries and in Asia.

At the present time in Mali, approximately 55 per cent of the urban areas have an electrical power supply; and less than 10 per cent of the rural zones (SIE, 2007), although more than 70 per cent of the population of Mali live in the countryside. These figures show how difficult it is for the rural population to get access to modern sources of energy.

Modern techniques for higher agricultural production often make use of petroleum fuels, but the cost of this is already excessive for most of the population. The rising price of oil has made it even more difficult for the rural population to acquire modern techniques and production technologies.

In 2007, Mali imported 700 million litres of petroleum products at a cost of over 252 billion FCFA. At the same time, traditional forms of agriculture are being increasingly destabilized due to climate change. With the rains becoming scarcer, farmers are looking around for new strategies and investigating other plant varieties that are better suited to the new difficult conditions.

In this situation there is an option of growing jatropha, which produces an oil that can be used as a substitute for petroleum fuel. This would:

- provide access to modern farming techniques and technologies;
- provide access to a multifunctional platform in rural areas;
- supply the fuel for electricity in rural areas using “green” technology; and
- enable activities that generate a source of income.

These combined advantages will help the population to adapt to the negative effects of climate change by increasing their revenue and their opportunities and by introducing added value at the local level. Furthermore, the use of biofuels locally could reduce CO₂ emissions and also reduce the consumption of petroleum products.

The use of biofuels instead of petroleum products could have [positive] effects on the local economy, by creating jobs in the rural areas and providing a new source of income where the feedstock is actually a cash crop. At national level there could be macroeconomic benefits in terms of a reduction in the cost of importing petroleum products and general stimulation of the entire economy. The general aim is to enable the Mali Government to diversify its sources of energy in order to develop good policies of adaptation to the effects of climate change.

⁴ Translator’s note: The jatropha plant: *jatropha curcas*, also known as Pourghère, Barbados nut or Physic nut.

The production and use of jatropha oil could have a dramatic impact on improving the socioeconomic situation in rural areas of Mali; it could also have a positive effect on the environment in general and contribute to a reduction in foreign exchange expenditure by creating other forms of employment, different from traditional agriculture.

The negative effects of climate change are affecting all sectors in Mali, starting with agriculture, but very few of these sectors are giving any thought to the consequences of these changes. This is adding to the already severe pressures being felt by the people of Mali, with widespread poverty and very poor living conditions.

Case study - Technician operating a multifunctional platform

Abdul⁵ is an artisan in the village of Tiecourabougou, situated in the commune of Didieni, Koulikoro Region, in the Sahelian zone. Trained as a blacksmith, this adolescent became convinced of the positive impact of growing jatropha in his commune and he quickly decided to train as a technician and producer of jatropha.

Didieni has a population of 29,349 inhabitants, mainly Bambara people. There are also Fula and Moorish minorities – wandering herders. The main language spoken is Bamanan.

Before Abdul discovered the jatropha plant, he used to sell wood to provide for the needs of the people in his commune. His village is one of the first in the commune to grow jatropha and use the oil in a multifunctional platform set up for the benefit of the inhabitants.

Abdul became more and more interested in the jatropha plant and the technology for converting it into oil and he quickly realized that investing in this branch could bring him significant returns. So he undertook the works and today a lot of jobs have been created around him, thanks to this plant. There are small-scale plantations providing work and income for women and youth and there is a transformation plant for converting jatropha nuts into oil, cake and residue. The transformed products are used to fuel mills and charge batteries, or as primary matter in the form of soap or fertilizer. Having familiarized himself with the growing techniques, Abdul is now a technical advisor for other producers in the area.

In this instance the farmers are now learning how to produce jatropha, and the mill operators can learn how to use the oil in their motors or what to do to buy their own press and produce jatropha oil themselves for sale or for engine lubrication. As this economic sector is still very young, there are not many means available to inform the Malian population or to provide them with training. A few people in the pioneer villages have the chance of being trained by an NGO or some other development project, but there is no regional or national programme to train all those who are interested - the cost of such a programme would be prohibitive. Nevertheless, rural colleges and polytechnics can begin to teach the production of jatropha seeds. It will only be future generations who are able to benefit.

Case study - Rural electrification project based on jatropha fuel for 10,000 inhabitants in the commune of Garalo – A new paradigm of energy supply for sustainable development

In the context of climate change, rising prices and uncertain access to petroleum fuels the NGO MFC Nyetaa has been working for the last seven years to develop pilot projects to show that pure jatropha oil can meet the future energy needs of Mali and provide benefits to the local population. These projects focus on the use of pure jatropha oil as a substitute for diesel in

⁵ Name changed

multipurpose platforms, transport and rural electrification, and constitute models for future electrification projects in Mali, West Africa and the world.

The electrification project for the village of Garalo is a key component in this effort. The objective is to reduce the poverty of village populations, achieve environmental advantages and keep the planet green while supplying electricity from generators sufficient for 10,000 persons in the Commune of Garalo. The project was designed by MFC with ACCESS, an innovative Malian company specializing in energy supply services.

ACCESS was supported by MFC Nyetaa and the FACT Foundation in the installation and start-up of a 300kW plant which can run both on diesel and jatropha oil to supply energy services to the population, with a multitude of domestic and productive uses. The industrial benefits reach the commune as a whole and are beneficial for the development of the local economy. The energy input is financed by AMADER (*Agence Malienne pour l'Energie Domestique et l'Electrification Rurale*) and SHGW (Green Forest Foundation, Netherlands).

MFC was responsible for setting up the sustainable production of jatropha oil for local use. The people of the Commune of Garalo are to realize the plantation of 1,000 ha of jatropha (of which 600 ha have already been planted) to supply the oil required for the plant to generate clean electricity. The total surface area of the plantations is made up of small plantations of 0.5 to 5 ha, belonging to and managed by the local farmers, who do the necessary growing according to the techniques of sustainable agriculture. This production constitutes a new source of income for the local population.

This very ambitious project arises at the insistent request of the local population to have access to modern energy services. This innovative project will supply electricity and other modern energy services to more than 10,000 persons in the commune of Garalo. The project will stimulate the local economy through the productive use of electricity in small and medium size businesses, job creation and the supply of electricity for social uses in schools, maternity hospitals and community establishments, as well as for domestic uses. At the same time, the local environment is protected and the integrity of the local community and the social structure of the commune is guaranteed. The project is being conducted in close cooperation with the local population and the local authority.



Three generators at Garalo



Night-time generator producing electricity for the village

Direct impact on employment

It has been estimated that the use of biofuel for the electrification of Garalo has created around 50 jobs for biofuel technicians, machine maintenance technicians and jatropha nursery workers.

Indirect impact on employment

The owner of a very popular restaurant on the main Garalo street explains that with the arrival of electricity now she can continue to serve late at night and her takings have gone up. She uses the electricity for lighting and for charging mobile telephones. She is now thinking of buying a refrigerator so that she can sell iced water and drinks. There are several other cases like hers in the village. It has been estimated that at least 200 indirect jobs have been created since electrification of the village.

Training needs

The production of jatropha implies a certain number of training needs:

1. Nursery growers

Ignorance of the techniques for establishing a jatropha nursery means that the plantation operations have become very delicate (difficulties recovering the plants, percentage of weak plants removed and poor development of plants).

2. Producers

As with the nursery growers, the planters are ignorant of or do not understand the plantation techniques that are essential for a plantation to flourish, the basis of good production.

3. Jatropha oil motor operators

The use of jatropha oil entails certain modifications to a motor (running kit) or particular maintenance operations due to the effects of pure vegetable oil.

For local users, it is important to train operators on platforms or other motors (farming, transport, etc.) in how to adapt and maintain their machines.

4. Users of the residue following extraction of jatropha oil

Training in the use of the residue following extraction of the oil would be an inestimable advantage for the people (fertilizer, biogas, animal feed, soap manufacture, etc.).

In the first two cases, financial support, training and information are essential if this enterprise is to be sustainable. Associations and individuals who would like to enter this field cannot afford the means of production or transformation. For the moment, the only tools they have are technically informal. Technicians and landowners alike are in need of sound training on the jatropha plant and its many virtues.

Case study 4. Agrometeorological assistance and job creation opportunities in Mali

1. Impact of climate change in Mali

Since the creation in 1895 of the first meteorological stations in Mali up to the present time there have been many periods of drought. However, since the year 1972 the frequency of drought has increased (1972-1973, 1977-1979, 1982-1983, 1985-1987 and 2004-2005), evidenced by an overall trend towards a decrease of useful rainfall of 20 per cent between 1951-1970 (a wet period) and the latest reference period 1971-2000 during which the isohyetal contours have moved 200 km further south. The 1,200 mm isohyetal line has virtually disappeared from the Mali chart and the monthly rainfall analysis also shows an irregular occurrence of rainfall at the beginning and end of the rainy season, with frequent significant pockets of deficit in the middle of the season. In other words, the rainfall pattern in Mali is being severely affected by climate variations and change.

The following climate characteristics have been observed in Mali:

- regular decrease in the amount of rainfall and wide variations in time and location;
- squall lines running north-south for a distance of 500 to 750 km often accompanied by very high winds and abundant or even catastrophic precipitation;
- strong sunshine throughout the year with very little variation in average temperature;
- increase in temperatures from the south-west to the north-east with maximum temperatures during one year reaching or exceeding 45°C and minimum temperatures rarely falling below 10°C. For the period 1961-1990, 50 per cent of maximum temperatures remained above the average value of 30.5°C;
- high values for potential evapotranspiration due to high temperatures, relatively low humidity and strong winds; and
- persistent drought since the 1970s causing significant pluviometric deficit and isohyetal movement towards the south. As a result, the population has increasingly adopted a migration strategy in the face of these new unstable climate and environmental conditions.

Anything which causes variation or a reduction in the length of the growing season is bound to destabilize farming production, degrade the soil and the vegetation, diminish water resources and proliferate cultivation pests.

Furthermore, the results of climate change models (MAGICC and SCHENGEN) indicate that the average temperature will increase from 30.5⁰C in the period 1961-1990 to 32.5⁰C in 2050 and 34.5⁰C in 2100 (or an increase of 2-4°C) and that rainfall will continue to decrease progressively from east to west by 2100. For example, for the location of Sikasso, the average annual variation in rainfall will be -7.5 per cent and -15 per cent in 2050 and 2100 respectively in relation to the average for the period 1961-1990.

The consequences of these variations and climate changes are:

- uncertain food supply and famine
- 30-60 per cent fall in farming production
- reduction in crops
- 50 per cent loss in animal breeding
- lack of food; malnutrition
- increase in the surface areas used for crop growing

- loss of means of production
- deforestation, bush fires and the disappearance of protected forest areas
- proliferation of certain pests and the disappearance of others
- soil erosion (loss of arable soil)
- migration of 20-30 per cent of the population and their herds into areas that are more likely to meet their food needs. This high rate of migration concerns principally the regions of the north, i.e. more than 30 per cent of the population
- disappearance of villages and destruction of social cohesion.

2. Possible solutions to cope with climate change

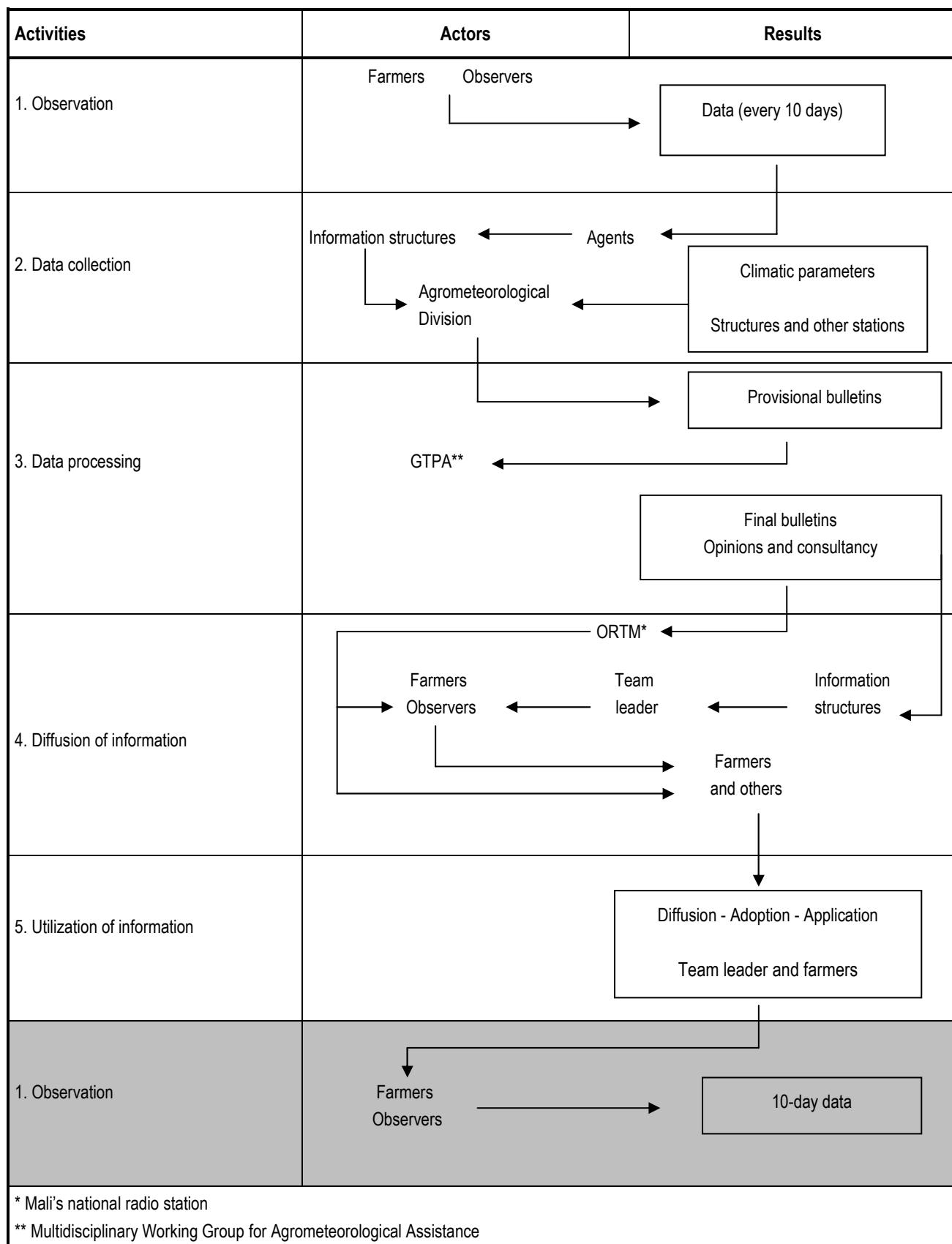
The Malian Meteorological Office has an observation network consisting of 19 synoptic stations, 20 main agro-climatological stations, 35 auxiliary agro-climatological stations and 214 pluviometric stations. There are four (4) meteorological radars installed at Bamako, Gao, Manantali and Mopti, each giving readings on cloud cover within a radius of around 250 km. Satellite images are collected from METEOSAT satellites and remote detection images in particular on vegetation indices (NDVI) are collected by the Regional Agrhytmet Centre.

A system of countryside monitoring (see figure 2 below) has been set up by the Meteorological Office in order to minimize impact of the above. As part of a rural campaign entitled *May to October*, an information bulletin on farming and rainfall is produced and distributed every ten days by a multi-disciplinary Working Party for Agrometeorological Assistance, composed of representatives of the Agricultural Department and the Meteorological Office and experts on hydrology and communications.

The bulletin describes the previous ten days in terms of the weather and rainfall situation, the crop situation, the rivers, pastureland and pests; makes forecasts for the next ten days and gives advice to the rural population as shown in the figure below.

Local data is collected by officials at the weather stations, officers in the local information centres and literate farmers.

Figure 2: Circulation of agrometeorological information



3. Opportunity for job creation: Meteorological assistants

The strategy for using meteorological information requires, in turn, reinforcement of the data collection network, improvements in weather forecasting, transfer of skills and communication of weather and climate information.

- The data collection network is inadequate, given the vastness of the country. In the context of decentralization, each rural commune should have its own reference weather station (+ the building) which costs around 150 million FCFA or in certain cases an automatic station (50 million FCFA). This would make it easier to decentralize meteorological services in the countryside amongst the rural communes and would ensure that local people and organizations shared fully in the data collection process.



Meteorological station

- Daily weather forecasting adapted to the needs of the users should be improved by using the Geographic Information System (GIS). It should also be more local in order to allow farmers and team leaders to plan their activities and make alternative choices (for example, a different variety of seed in the event of a dry period) with the overall aim of saving the countryside.
- The quality of seasonal observations is negatively affected by lack of data due to the inadequate collection network; also by out-of-date equipment and poor means of communication. Satellite data which is promptly received and processed would make up for this lack. For example, by gauging rainfall from the frequency of occurrence of cold top cloud structures it is possible to:
 - determine the zones likely to have received the rainfall
 - detect intermediate periods of drought
 - estimate the quantity of rainfall in the zones for which there is no directly obtained data because there are no rain gauges or adequate means of communication
 - provide more informed opinions and agrometeorological advice, given a better appreciation of the rainfall and campaign progress.
- In addition, automating the use of the crop forecast calendar with the GIS would be very useful for assembling agrometeorological advice.

- A fundamental condition to ensure proper application of the information is training of the men and women in the countryside and also of team leaders in matters of agrometeorology (rainfall readings, verbal observations, use of products). This training could be done in cascade format followed by skills recycling, making strong use of the existing rural training structures.
- The plan for the diffusion of meteorological information should make use of the rural organizations, the local agricultural training structures (for the dissemination of information) and NGOs, as weather information forms part of the “technological package” which these structures are supposed to transfer to the farmers. This would also facilitate the transfer of skills. Greater use should therefore be made of state radio and private radios for broadcasting information, with specific times and programmes aimed at the rural population, as part of the spread of information and to support the setting up of meteorological assistance activities in the countryside.
- Furthermore, it should be noted that agrometeorological assistance has encouraged the development of the SIMPLAST factory in Mali for the manufacture of the local pluviometer called the “farmers’ rain gauge” at a cost of 3,000 FCFA compared to an import price of 150,000 FCFA. There are now sale points in certain communes, providing a source of employment for young people and associations. It remains a priority to increase the number of these sales points in order to make it easier for all the rural population to acquire this valuable working tool.

Conclusion

The staff of the Meteorological Office consists of 52 officers: 25 engineers, 12 technicians and 15 contracted employees, all of advancing age (in ten years, more than 56 per cent of the engineers and 100 per cent of the technicians will have retired). Certain weather stations are manned by volunteers.

We also note an inadequate observation network, scant collection of meteorological data and the fact that the latter are stored at national level but not diffused due to outdated equipment.

This means that there are major needs in terms of training, skills recycling and recruitment of qualified personnel, as well as in the creation of new weather stations and the purchase of state of the art equipment, particularly for remote detection and processing satellite images. There is also an opportunity to create or improve local radio stations to broadcast relevant information.

Case study 5. New skills for farmers in the context of climate change

Almost 80 per cent of population of Mali is getting its income from farming. The government has also fixed development of agriculture as its priority area due to food crises. However, with changing climate the old farming practices and varieties grown are no longer profitable.

There is a need for training in adaptation to climate change in the farming sector, and also training in other livelihoods to support or replace income from farming. This concerns both men and women as most of the population in rural areas lives from farming.

Farmers - Male

Traditionally, men are responsible for bringing the grain to the family. This is usually millet, maize and rice. Often the whole family works in the same family field; sometimes it can be shared also between the brothers. The size of family fields varies between 1 and 10 ha, naturally depending on the size of the family and other factors. Most of the work is done by men, the ox are used usually only for labour. Due to the changing climate and desertification, farming is not

as productive as it used to be. The income from the farming is not enough for nourishing the whole family, and therefore young men are often sent out to cities of other countries for searching income.

Men harvesting millet



Often life is harder and income insufficient in new places, but going back is not easy either, at least not with some seed corn. Therefore, the best strategy in reduction of rural exodus is creating new opportunities of employment or new strategies and techniques for farming.

Possibilities in farming itself include, among others, integrated farming, new ways of farming using less water, increasing the productivity of land by ecological methods (composting), and selection of seeds, organic cotton or other organic products like vegetables. Diversification of income sources and adding value to the production are also opportunities. Adding value to production often requires energy, which is not a foregone conclusion in Mali, where only about 10 per cent of the rural population have access to electricity.

Farmers - Female

The roles of women and men in Malian society differ from each other in many ways. In the farming season, women usually grow ground nuts and rice in their own small parcels, in addition to assisting the men in the family fields. Besides income from these products, women also gather and transform different forest products like shea nuts, fruits and herbs. Due to climate change, both of these activities are becoming more difficult and unpredictable.

Women harvesting groundnuts



Due to poverty, people are often obliged to find adaptation mechanisms, which are not sustainable in the long run. One example of this is wood commerce and charcoal production. In the cities, the demand for firewood and charcoal is huge, and it is a relatively secured income source, as it does not depend on rain, like for farming.

Box 1: A woman from the village of Karako

Five years ago, she used to go searching for firewood several days a week. She sold it to the wood buyers coming from Bamako with their big lorry. She had started this business as farming and shea nuts Moreno longer provided sufficient income for her needs due to changes in the climate (reduced rainfall). But then she got an opportunity to participate in a development project where women are helped in starting new income-generating activities instead of wood commerce. Now she is growing chili and vegetables in her parcel in a women's collective garden, and in addition, selling soap in the local markets, for herself and for the cooperative in which she is a founding member. She has been able to completely abandon wood commerce, and now earns more money than with the wood. But even more importantly, she says that she has learned to read, write and do calculations in the literacy courses organized by the development project. That has been the most important thing for her, as now she can count the investments and profits from her businesses. The micro-credit and savings scheme organized by the project has assisted her and many other women in establishing new micro-businesses which are more sustainable than wood commerce.

Besides the new techniques and skills, farmers need to get better organized around the transformation of their production, as well as in marketing aspects. Cooperatives and associations need to have a legal status to be recognized officially. However, most of the time, farmers do not know enough about the importance of legalization of their groups and do not have enough organizational skills. Therefore, capacity building in these aspects is very important for the development of the local economy.

Selling and marketing are other domains where farmers need a lot of capacity building. At the moment, it is the buyers coming from the cities who define the prices, which can be very low as farmers are selling the products individually, not in groups.

There are lot of efforts put into the provision of new skills to the farmers and reinforcing their capacities. This is the main focus of many government programmes as well as of NGOs and other actors. One of the main drivers for this is climate change, even though it is not stated in

many project documents. Climate change has come to the focus quite recently, and therefore it is not included in the policies and programmes developed some years ago.

In the rural areas, the fact that there are different actors who have different projects and programmes which are not coordinated together causes confusion. There can be villages with several different development projects, which all aim for the same goals with the same people, but all are using different methods and approaches. Therefore, a coordination mechanism should be developed for the actions of NGOs as well as other actors in the same area.

It is good to bring the training and information to the village level instead of organizing centralized trainings only in the cities. In this way more people can access training and information. However, it might be useful to centralize the capacity building somewhere, like in specialized rural training centres, bringing together people from a defined area and providing training in the proximity. In the absence of a training centre, local municipalities could capitalize on the different information and organize training in cooperation with different actors, like NGOs. Microcredit schemes are very useful to rural people as well, and it might be a good idea for the microcredit institutions not only to provide financing, but also to assist the applicants in development of business plans.

At the higher educational level, there is need for training for trainers, gender considerations, communication, innovative market approaches, and networking and cooperation. Also, the challenge remains as to how to give up short-term project approaches and adopt longer-term strategies, in all levels of the activities and among all the actors.

Case Study 6. Greening the existing occupations of technicians working with energy for production or energy equipment

This case study will consider the greening of the new skills required by technicians working in the field of renewable energy such as solar, wind or biofuels. These technicians would typically be involved in installation, repairs, operation and maintenance of decentralized rural renewable energy equipment, although there is also demand in poorly served (in terms of electricity) parts of towns and peri-urban areas. The energy sector is now one of the fast growing sectors in Mali. Less than 20 per cent of population has access to modern energy services, and in rural areas it is less than 10 per cent. Access to energy has recently been reprioritized as a key prerequisite for economic development in the updating of Mali's Poverty Reduction Strategy Paper (PRSP), and the profile of energy, particularly renewable energy, has increased significantly internationally and in Mali.

Due to Mali's vast size (1.2 million km²) and low population of around 12 million, the population density is very low, and grid extension will therefore never be a realistic option for much of the population. Therefore a decentralized approach is required to respond to the decentralized population. The Malian Ministry responsible for energy created the Rural Electrification Agency, AMADER (Agence Malienne pour le Développement de l'Energie Domestique et l'Electrification Rurale). It is responsible for providing concessions for rural energy service companies and for providing subsidies to allow those companies to operate. Thus it can be seen that there is political will and action to support decentralized energy supply. However, although a limited number of solar and biofuel projects have been supported, most of them use diesel mini grids. The handful of pioneering small-scale biofuel projects (e.g. the Garalo Bagani Yelen Project carried out by Access and MFC Nyetaa in a village of 10,000 people in the south of Mali) needs to start from zero when training technicians in these new technologies, as it is creating a completely new energy sub-sector.

In addition, AMADER has limited funds and operators prefer to work in larger villages with more potential clients, so a large number of Mali's 11,000 villages have to still find a way of providing their own energy. And for small-scale applications like lighting, TV, radio,

refrigeration of vaccines and also water pumping, solar PV provides a cost-effective solution. Thus there is a steady and increasing demand for solar hardware, installations, operation and maintenance. Sometimes in windy parts of the country, small wind turbines can offer similar amounts of electricity.

Access to renewable energy sources has a very positive impact on populations, in terms of services available, adding value to local agricultural produce, improving living conditions, reducing the vulnerability of the local population to the effects of climate change, as well as mitigating emissions which would have been pumped out had a fossil fuel source been used. So the advantages are multiple. Considering the large number of villages in Mali and the large number of people living off-grid, there is a significant potential to reduce greenhouse gas emissions, and if the small-scale sustainable biofuel model becomes widely adopted, perhaps even reduce fossil fuel combustion by providing locally-produced biofuel to diesel burning power stations.

The economic impacts of solar energy are somewhat problematic due to the relatively high investment costs (although they are falling all the time) and the need to import hardware from abroad. But the solar panel lifetime is 10-30 years depending on the technology used, and so effects continue over a long period. However, the potential market is very large, and certainly well-structured solar businesses in Mali are prospering, and prices are coming down, not least due to recent increased quality and reduced prices of hardware produced in China. Employment in the sector is growing in a similar way, as a corresponding increase in the number of installers, repairers, and operators is required.

In the case of Lenga⁶ (see Box 1 below), technological development has certainly played a significant role in the greening of his job. The latest renewable technologies are more advanced, lower cost, and hence becoming more widespread. Some technologies did not exist in the same way as they do today, so educational or vocational training was not available to previous generations. Thus there is a need for educational and vocational training facilities to stay on the cutting edge of technological development in order to be able to produce the green workers of tomorrow.

Box 1. Lenga, renewable energy technician in a Bamako solar energy company

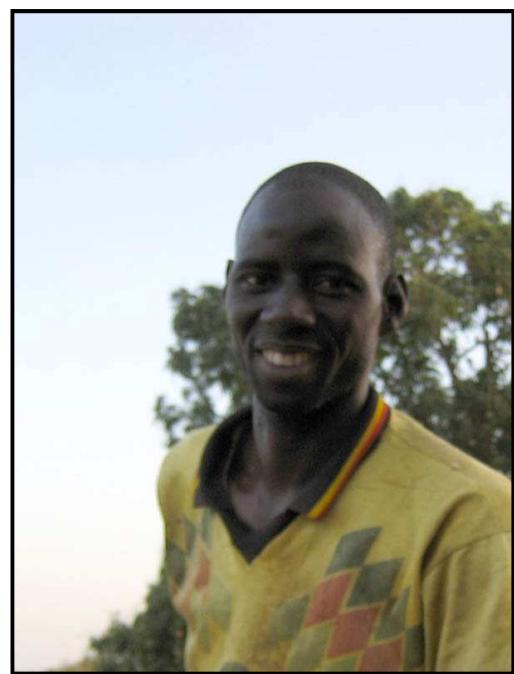
Lenga has been trained as an electrician to install 22V AC domestic electricity systems in the construction industry. He worked in the field before getting the chance to upgrade his existing skills as an electrician when he was taken on as a trainee in a solar energy company. He added DC solar systems for lighting and refrigeration to his knowledge, as well as solar water pumping systems of around 1kW. Solar water systems are more complicated, having larger power outputs, and requiring additional knowledge of pumps, inverters, and some basic plumbing. After his traineeship, he then got a job in an NGO doing solar installations full time all over the south of Mali, and is now able to work alone or lead an installation team. He had no formal training in renewable energy technologies, but rather learnt on the job and in traineeship posts, which is very common in Mali.

This kind of greening of technicians jobs is not yet a widespread phenomenon in Mali, but seems to be limited to certain sectors, particularly those in which significant new advances have been made which have been able to provide more efficient or lower cost solutions, which are to make the sector attractive to the relatively poor Malian population. In the solar sector in Mali, there are a number of relatively large solar companies in Bamako. Some of these have regional representation. There are also smaller companies, NGOs and associations which need solar technicians. Many rural clinics have solar powered lighting and communication radios funded by

⁶ Name changed

the government or by donor programmes, or by the local populations themselves. In order to maximize efficiency and for the best results to be obtained, well-trained solar technicians are required not only in the installation of the equipment, but in order to assure also the maintenance of the solar systems.

Box 2. A true rural solar energy technician from Zambala village



He was a practical-minded person in his village of Zambala (population 2,500), off the grid and 280 km from Bamako. He taught himself how to repair bicycles and radios for his neighbours. As a result he became the village “fix-it” man and was able to supplement his farming with extra income. When a solar project started to provide lighting in the school, clinic and public square, he volunteered to be one of the members of the village solar maintenance committee, and received training in maintenance and operation, and assisted in installation of lighting systems. After the project was over, he continued to look after the systems and even became Zambala’s leading solar energy specialist, and has installed a system for his neighbour (above left).

The case in Box 2 above gives a good example of the benefits of providing practical training at the proximity to rural populations. Often rural technicians trained in Bamako or other cities get a taste for city life, are reluctant to return to rural areas, and end up staying. But providing training in a rural setting can create genuine rural technicians who can play a vital role in operation and maintenance of decentralized solar systems. It is often only the existing local population who can provide real follow up and maintenance for installations in small or remote villages – of which there are many in Mali.

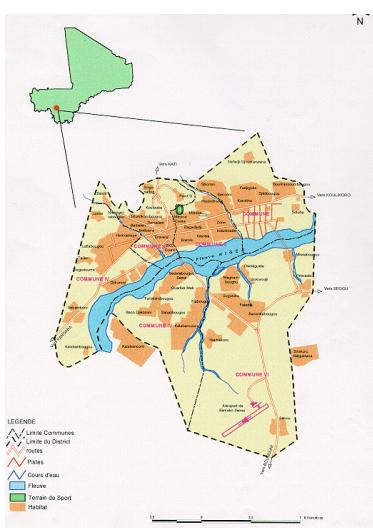
However, there is also a need for better quality technical training in schools, universities and vocational facilities in order to provide higher-qualified human resources as well. Combining theory and practice is the key in the success of these trainings. When technology moves so fast, training bodies have to be sufficiently dynamic to keep up with the latest developments, and identify the ever evolving skills gaps.

Case study 7. New skills for waste collection, separation and re-use in urban areas

Sustainable waste management is a major challenge for the urban cities in Mali. The situation is hardly different in other African cities. As cities grow, the goods consumption in these cities also grows, resulting in ever-increasing quantities of waste produced by urban residents and industries. Waste collection, separation and re-use offer huge potential for creating employment. But there are constraints to tap the full potential for organized job creation in this sector. This subsection discussed waste management practices in the district of Bamako and the skills needs to better organize the sector. The case study is concentrated on solid waste collection, separation and re-use, in Bamako, the capital of Mali.

The district of Bamako is divided into six urban municipalities. The population of Bamako is growing very fast. According to the official census data of the DNSI, the district of Bamako had 1.4 million inhabitants in 2001. This population has grown rapidly to over 2 million inhabitants, according to unofficial sources. The city has also expanded drastically and is now spread on an area of a radius of over 15 km. This rapid extension of the city and growth of the population is mostly due to a strong rural-urban migration. In fact, the deterioration of the productive resources and decreasing performance of agriculture sector, consecutive to long years of a decreasing trend of rainfall, have increased rural exodus. Young people, feeling that opportunities to improve their livelihoods are lacking in the villages, move to the urban cities to find work with the hope of coming back. They end up settling in the urban cities or surrounding areas.

Map of the district of Bamako



As population grows, consumption of goods also grows, which results in an increased generation of solid waste. It is estimated that between 0.6–0.7 kg of waste are produced per person per day in Bamako. However, there are wide variations according to season and household income. The organic fraction of this waste accounts for about one-third of the total waste produced.

Solid waste collection in the district of Bamako

In the years following Independence, the municipal authorities assumed responsibility for collecting waste, backed by investments in lorries and depots. By the 1990s, the growth of the cities, combined with a lack of ongoing investment and administrative difficulties, led the government to accept the participation of waste management enterprises and non-profit organizations, whose emergence was often supported by NGOs. Small enterprises known as

“Groupement d’Intérêt Economique” (GIE) began to complement the municipal collection system in specific neighborhoods by establishing a clientele of households who pay monthly fees for waste collection. These fees vary between 1,500 and 2,000 FCFA (2€ - 3€) for households. It is estimated that about 60 per cent of the waste is collected by the GIEs or cooperatives. This waste is first deposited in the temporary dump station (primary collection). The GIEs generally work with simple donkey-pulled carts and limit themselves to transporting waste to temporary depots or on farming fields around the edge of the town. From the temporary depots, the Department of Urban Services, Roads and Sanitation - DSUVA (Direction des Services Urbains de Voirie et Assainissement) removes the waste, which is dumped to final disposal in open areas. Actually there is only one modern landfill for waste disposal, (décharge de Noumoubougou), which is located some 15 km from Bamako.

In the district of Bamako, platforms have also been created to bring together the various actors involved in urban waste management. These include the Steering Committee of Urban Waste in Commune IV (Comité de Pilotage des Déchets Urbains - COPIDUC IV) and the Committee of Management and Waste Recovery (Comité sur la Gestion et Valorisation des Déchets Urbains) in Commune VI (COGEVAD). Both COPIDUC and COGEVAD bring together the local council, GIEs, community associations of women and youth, local leaders and farmers. These platforms have tried to regulate the disposal of waste by lorry drivers (setting prices and improving access), in consultation with the DSUVA.

Job opportunities in solid waste recuperation and reuse in the district of Bamako

Current development presents interesting opportunities for job creation for information work, recycling, transformation and re-use of waste. The respective occupations are: information worker, waste recycler and waste artisan.

- Today in the district of Bamako, composting of organic waste is done at a small scale for mainly gardening purposes. In 2001, there was only one composting small enterprise, Dakan Compost. This activity is getting a momentum use of organic waste in agriculture farm in the surrounding area of Bamako. In the peri-urban zone of Bamako, farmers sort out the inorganic objects and spread the remainder over their field, as organic wastes are very useful in the restoration of soil fertility in highly degraded soils. The reasons given for promoting recycling are to improve food security and create income-generating activities.
- There is also an increased involvement of women and children in the sorting of plastic bags, bottles and others valuable components of the waste. The driving force for this new occupation is the increased demand for recycled plastic bags by plastic manufacturing industries in the country and also in Côte d’Ivoire as an alternative to the short supply of raw materials in the plastics industry.
- Some SMEs have been created who are manufacturing road pavement from compacted plastic bags and soil.
- Women’s associations are also created for recycling plastic bags which are then sold or reused as fibre to weave diverse objects like baskets, bags, suitcases, etc



• *Women sorting valuable objects of waste dump*

- There are also some SMEs which have been specialized in the recycling of electronic waste.



Sorted electronic appliances

Waste management policy and adequacy

The National Directorate for Sanitation and Pollution Control (DNACPN - Direction Nationale de l'Assainissement et du Contrôle des Pollutions et des Nuisances) was created in 1998 and is responsible for the elaboration of the sanitation and pollutant management policies in the country. Consultations have been organized to collect the opinions of the different stakeholders regarding sanitation and pollutant management, however this has not yet resulted in a clear policy document for the sector.

With the decentralization, which became effective in Mali in 1994, municipalities have become responsible for waste management and all now have waste management plans, often developed with support from donors, but most have not started implementation. The political will does exist to tackle the problem of waste management in order to improve the local health situation. For better management of the waste, initiatives are underway by the municipal authorities to construct controlled solid waste dump and wastewater treatment unit. However, there are insufficient financial resources available to the municipal authorities to ensure the collection and disposal of urban wastes, and landfills are reaching capacity. Privatization of waste management is thus seen as an option.

In order to modernize the governance around waste management, there is need to review the waste management plans to shift them from a technically oriented “top-down” affair, where the users are merely objects, to a more mature, participatory, urban service with providers in communication and partnership with users in a transparent relationship. It is hoped that the stakeholder platforms that are being created have the value of ensuring this modernization of the governance issue in the waste management sector.

Skills gap and training needs for the different actors

As described above, the waste management sector is not well developed in the district of Bamako. The waste collection component is more organized than the recuperation and reuse, which is done in an informal manner by actors who have no technical knowledge in recycling methods. They work with dangerous products without safety measures, which causes many health problems. There is also lack of affordable equipment to process the organic waste in compost. Another problem is organic waste mixed with other waste, which could be composted if separated.

There are thus interesting opportunities to provide know-how and build the capacity of the different actors to perform safer and sustainable management of solid waste in the district of Bamako. The specific new occupations include:

- **Waste information worker:** Responsible for sharing information and sensitization of the population for pre-separation in the household level of organic waste from other products. These positions could be created by the government institutions in charge of waste management in collaboration with the NGOs, GIEs and cooperatives already involved in waste collection. Simple guides on how to separate organic matter from other products could be developed for this purpose. Similarly, there is need to sensitize the people working on the dumping site concerning the health risks related to their occupation and also to provide training in composting techniques, safer sorting techniques and to provide them with adequate equipments such as gas masks.
- **Recycler:** Responsible for separating all the useful materials from the waste. These include: plastic bottles, tins, cans and other small metals, plastic bags etc. This recycling would be much easier if the organic matter would have been separated beforehand. There are already a lot of people working informally in this sector. It would be important to use

these same people and provide them training so that they could do the work more effectively and safely.

- **Waste artisan:** Responsible for making new objects from the waste: like toys and tools from waste metal, baskets etc from plastic bags. Some people are already working in this sector, but mostly informally. It would be important to provide some training for them, in the preparation of new objects, but also in the marketing of their products.

4. Conclusion

4.1 Main ‘greening’ shifts in economies and labour markets

Like all less developed countries, Mali is very vulnerable to climate change. One of the main reasons for that is that the Malian economy is based on sectors, which depend mostly on the variation of the climate, namely the primary sector: agriculture, livestock and fishing. At the same time, the majority of the Malian population living mainly in rural areas are also illiterate. This makes the training for these communities to address the negative aspects of climate change very challenging, as most of the tools developed in these sectors are in foreign languages, not spoken by the rural communities (English or French).

With the fact of the impact of climate change, the shift in economies and labour market towards “more green” becomes necessary. Little by little it is happening in different parts of the country. For example, there are more and more agrobusiness initiatives for adding more value to agriculture, dairy and livestock products at the local level. These include solar dryers for fruit and vegetables, small agriculture processing units running on LPG gas instead of petroleum products, cashew processing units etc. There are different small initiatives on compost production (from agricultural waste and solid rubbish dump) and selling it also in cities for gardening.

In the energy sector, the Government of Mali has provided tax exemptions for all renewable energy equipment used in Mali, which contributes to the development of solar businesses. Since Mali has available land, there are more and more initiatives to develop biofuels (biodiesel and bioethanol) from jatropha, cassava and sugar cane. For example, the livestock people are becoming interested in the multiplication of small milk production units which need heat for pasteurization and there is more and more interest to develop biogas from dung to get modern energy for pasteurization and running the refrigerator for storing the milk products.

Even though this economic shift towards “more green” is not recognized as such in different policies since it is a very new concept, it can be seen that some local and national initiatives from both private and public actors in Mali are already towards greening.

4.2 Skills implications and development

Skills are the basis of any human development, especially when it comes to the economy in the context of climate change when everything about the weather is unpredictable. In that context, only countries with appropriate skills can see the economy resisting in this type of environment. Mali is not an exemption.

4.2.1 Anticipation and identification of skill needs

Today, the Government of Mali is engaged in a programmatic approach in order to achieve its priorities. The advantage of this kind of approach, if well planned, is that it allows anticipation of some type of risks as well. When it comes to the impacts of climate change, there are possibilities to make climate screening as tested by Danida in its development programme in Mali. In order to do that, the Government of Mali already took the first step by fixing clear

priorities - which are to make agriculture an engine of the socioeconomic development of the country. It is also this agriculture which is among the most vulnerable sector to the impacts of climate change. Therefore, Mali will need a lot of capacity building at all levels (public, private, civil society, etc.).

There are many mechanisms existing already in Mali, which could allow the identification of the existing skills, like, for example, the different ministries have the CPS (*Cellule de planification*) which is in charge of preparation of different ministries' programmes. If these different CPS could be trained and aware of the impacts of climate change, and the benefits that greening of the economy can bring them, they could take measures to rectify the ongoing programmes according to the impacts of climate change and the new programmes in preparation can anticipate the negative impacts of climate change. By knowing that, they can also identify the skills they need.

When it comes to the civil society in Mali, it is organized in different networks like *Réseau climat of Mali*. This network is already managing the first adaptation funds from SIDA for NGOs with a capacity building and skills development component, in order to make the most vulnerable communities more resilient to climate change. These kind of different initiatives are contributing to skills development - especially the rural communities need to understand that climate change is here to stay for the long term, and there is urgent need to adapt in a more sustainable way. It is also important to combine traditional and modern knowledge.

4.2.2 Response policies and programmes

Today, climate change endangers all Mali Government's development efforts, as well as its partners. Therefore, according to Malian policy, as regards agriculture, the objective is not only to produce, but to create the value-adding changes, and how to professionalize agriculture in rural areas by creating more permanent jobs in order to reduce rural exodus. For that, among its other initiatives, the Mali Government has created AMADER - the Agency for Domestic Energy and Development of Rural Electrification, to provide rural areas with modern energy services, in order to diversify the activities.

4.2.3 Effective delivery mechanisms

- **For the public sector** - the CPS of the different ministries should be provided the tools and capacity in order to anticipate or reorganize the programmes which are vulnerable to climate change.
- **For civil society** - appropriate NGO networks like *Réseau climat Mali* could play a role in strengthening the skills of the NGOs.
- **For the private sector** - FAFPA is providing financial resources to private sector to undertake training and skills development in areas which will allow the activities to be run in a more sustainable way. There should be a possibility for a company to request resources for skills development, which will allow it to "climate screen" its activities (anticipation, reorganization). But in order to do that, the company has to be aware of the possible options it has; awareness has to exist first.

5. Recommendations

5.1 Policy recommendations

The objective of this assignment was to identify strategic skills development responses of the country in the light of environmental degradation, climate change and the global call for greening economies. The findings of the study show that there are no strategies as such in place for greening economies. However, climate change is affecting Mali and other countries in the region and several measures have been taken in the direction of greening economies - even unintentionally.

Incorporating greening aspect to the different policies and strategies of the country might be very useful in the actual environment of globalization. Besides it being useful for the sustainable development of the rural as well as urban areas, it could bring added value to Mali as a developing country which is placing emphasis on environmental issues.

In the agricultural sector, for reducing rural exodus and motivating the youth to stay in rural areas and in the farming sector, the recommendations are around three axes: natural resources, land tenure and equipment. For youth to feel ownership, land tenure is a central issue. If the young farmers had a possibility to concretely own the land where they are farming, having a legal paper, for example, 3-5 ha of land, this would assist in reducing the rural exodus and motivate them to grow their own land and take better care of it (in terms of fertility and protection by hedges). Microcredit schemes facilitating access to equipment and locally organized training are other recommendations.

There is already some cooperation between the energy and the agriculture sectors, through the multi-stakeholder committee on energy. This is an example to congratulate. Also, when it comes to contacts between operators and bankers, facilitating this and development of expertise in the field of carbon finance, would create green jobs.

Concerning fisheries; the following actions can be suggested to mitigate the effects of climate change at the water points:

- develop fish farming in rural and urban areas;
- organize training sessions over the dangers of water pollution from households, industries and gardeners;
- develop ecological agriculture (market gardening) around water points;
- organize meetings for capacity building for the preservation of farming land; and
- develop other income-generating activities at village level with the available local resources.

5.2 Recommendations for education and training

The different training centres and programmes (APEJ, ANPE, etc.) should also be supported in identifying training needs in terms of climate change through training of trainers (TOT). Strategy requires the development of training modules for trainers. These modules could include among others the fundamentals of climate change, the relationship between climate change and employment, and the relationship between climate change and training. There would be core modules common to all sectors, but also specialized modules for specific sectors. As was noted

above, the sectors of agriculture, energy, and construction of buildings are affected by climate change. But modules could be developed for all the sectors of greening economies.

Decentralization of training is the key to sustainable results and reduction of rural exodus. Training centres should be in all regions so that participants in the training do not need to go all the way to the Capital.

Capacity building is also needed in the level of administration and policy-makers, as well as in higher education. Integrating environmental issues, especially climate change, as a part of the curriculum - as is already done in some schools and universities in developed countries.

In several activities, such as jobs in high demand on the labour market, in addition to the mechanical work of digging the river, training of the population in relation to environmental protection and reforestation is needed, for example through job creation for the tree nurseries. Capacity building about environmental issues could be incorporated in all the training programmes.

Considering gender aspects in the elaboration of training programmes, for rural women, it is even more difficult than for men, to participate in the training programmes outside their village. Therefore, there should be mechanisms which can reach women where they are. Microcredit schemes are good, but they alone are not enough. Training is needed in the development of business plans.

In the field of agriculture, development of skills on agroprocessing and added value to agricultural production is necessary. Mali is a big producer of products like mangos, cashew nuts, shea nuts, but these are usually sold as raw materials without any added value to the local or foreign markets. However, value adding would be very important in the local economy, especially in the situation of climate change.

In the field of meteorology, it is recommended to extend the agrometeorological coverage to all regions by training local people, and designating one structure as being responsible for reinforcement of capacities in the meteorological field.

5.3 Recommendations for further research and data collection

The list of recommendations for further research and data collection is challenging. Data collection is not easy as there is not much quantitative data available. For qualitative data collection, establishment of a working group or network for green jobs might be useful. This could facilitate the data collection and planning of further research.

Further research could be done in all the different sectors mentioned in this report and even in other sectors. For new employment potential, the most relevant fields are energy and waste. For greening shift inside the sectors, agriculture and other primary sector activities are important.

It has also to be kept in mind that there is a lot of traditional and local knowledge available about the adaptation mechanisms to climate change. Collection and testing of this knowledge would be very important - and after that, disseminated.

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Web sites

ANPE: Agence Nationale pour l'Emploi / National Agency for Employment Promotion:
<http://www.anpe-mali.org/>

APEJ: Agence pour la Promotion de l'Emploi des Jeunes / Agency for Promotion of Youth Employment: <http://apej.org.ml/>

CNPM: Conseil National du Patronat du Mali / Malian Federation of Employers:
<http://www.cnpmali.org/>

DOEF: Département Observatoire de l'Emploi et de la Formation de l'ANPE: <http://oef-mali.org>

FAFPA: Fonds d'Appui à la Formation Professionnelle et à l'Apprentissage / Professional Training and Learning Support Fund: <http://fafpamali.org/>

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Annex: Questionnaire on structures: Employment, unions, consultants to the Ministries of Labour, Energy, Agriculture, etc.

Technological changes, globalization, aging populations and climate change will all considerably change the pattern of the labour market and the demand for skills, as well as creating new kinds of jobs. The growing importance of sustainable development and the passage to a low carbon economy will also require new skills and qualifications, offering great potential in terms of the creation of green jobs but also implying structural change and the transformation of existing employment.

The initiative for Green Jobs was launched by the United Nations Environment Programme (UNEP), the International Labour Organization (ILO), the International Employers Organization (IOE) and the International Trade Union Confederation (ITUC) in order to evaluate, analyze and promote the creation of decent work as a natural consequence of environmental policies. It supports a concerted effort on the part of governments, employers and unions to promote sustainable jobs and development in a debatable global climate.

Questions

1. Is the expression "green employment" used in Mali?

If yes, in which domain?

1. Agriculture
2. Education
3. Health

2. Is there cooperation between the different ministries on the question of employment in general and on questions of climate change in particular?

3. Is there a relationship between "green jobs" and job creation; if so, in which potential sector?

If the person being interviewed does not understand the term "green employment" the interviewer should attempt to explain point by point for each of the different sectors:

1. Agriculture: soil conservation, water efficiency, farming methods
2. Forestry: replanting, reforestation, agroforestry, sustainable management of forests with a system of certification
3. Energy production: renewable energy, gasification, cogeneration
4. Trade: promotion of environment-friendly products, use of ecolabels, reduction of transport distances
5. Industry: population control, production techniques, use of efficient materials, etc
6. Transport: fuel-saving vehicles, non motorized transport (bicycle, foot)
7. Construction and land use: solar energy systems, ecological buildings, zero emission buildings

4. Is there a coherent national political plan to meet the need for skills in a greener economy?

5. In the context of a greener economy, are there coordinated political skills and development strategies linked to policies on trade and industry, technology, the macro economy and the environment?

If yes, please explain: What type of coordination mechanisms are already in place (for example, inter-ministerial coordination, the labour market information systems, mechanisms for feedback between employers and the training system, value chains, groups and industrial networks)? How do they operate?

6. What are the main institutional obstacles that impede skills development in the transition to a green economy?

- i. information
- ii. training
- iii. other