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EduLink II, Energy–Agro–Food Project

# WP1 Final Report

Coordinator: Pavia University

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## Table of Contents

INTRODUCTION	2
PART I: METHODOLOGY	8
PART II: SUMMARY OF THE FEATURES OF THE SURVEYED ACTORS, EDUCATORS AND EDUCATIONAL PROGRAMS	
PART III: FIELD VISIT REPORT	



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## INTRODUCTION

The Energy-Agro-Food Nexus is likely to play an important role in the coming socio-economic development of East Africa. On the one hand, Energy, which is a key sector in sustainable growth, can greatly contribute to the improvement of rural living standards. On the other, the Agro-food value chain, which is the dominant productive and occupational sector of local economies, can greatly contribute to sustainable energy production and consumption. Moreover, the development of both sectors plays a critical role in the primary food-security question.

In spite of such importance, however, the East-African higher-education supply shows several gaps from the point of view of the Energy-Agro-Food Nexus. Indeed, a discrete number of curricula on Agriculture already exist, especially at the Master level. Nevertheless, such curricula, which have to take the pace with a rapidly evolving and relatively complex socio-economic, environmental and technological context, are of a limited, when not null, inter-disciplinary and holistic character. On the other hand, curricula on Energy are often missing and, wherever they exist, they are often based on “mono-disciplinary” approaches (e.g. “Engineering”). Consequently, they are often unable to grasp the links existing between different energy and agriculture-related disciplines, and between the latter and the food-security issue.

The Energy-Agro-Food action, which involves a network of four East-African Universities (Addis Ababa, Mekelle, Nairobi, Sokoine), three European Universities (Bologna, Pavia, Clermont) and five associates (CEFA onlus, Coopì, Pelum, CRDA, C.E.F.A. Registered Trustee), aims at contributing to the enhancement of East-African higher-education supply by including, within the M.Sc. and Ph.D. programmes already offered by the four East-African partners, innovative didactic modules integrating different energy and agriculture-related scientific disciplines and responding to the evolving needs of the socio-economic development of the region.

This document represents the final report of the activity developed within the Work Package 1 (WP1) of the EDULINK project. This activity aimed at facilitating the matching between actors’

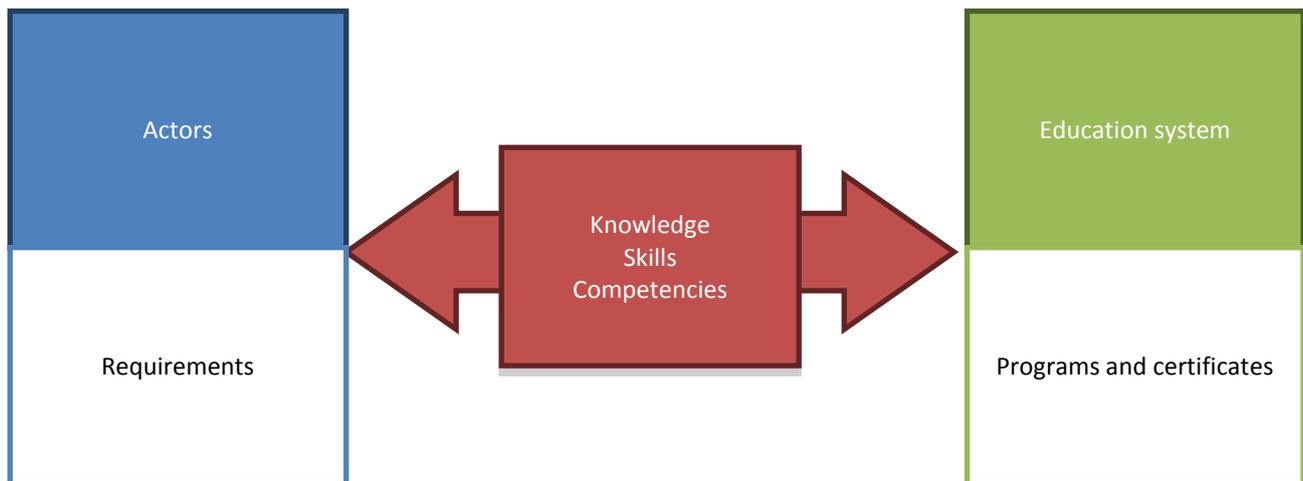


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requirements and educational supply in the design of an educational module was developed following the conceptual framework depicted in Figure 1.

**Figure 1 – Matching**



In our framework, on the one hand, there are the main actors operating in the energy and agro-food sectors with their specific professional requirements. On the other hand, there is the education system, which supply higher-education programs and certificates with the aim of forming professional figures satisfying such needs. The matching between educational demand and supply is ensured by the knowledge, skills and competences. In the relatively new educational field of bio-energy, these latter should be designed in order to satisfy the actors' requirements. On the contrary this matching can be weak with negative implications on the labour market.

Based on these considerations, the first step of the EDULINK project was the understanding of the matching between professional requirements and higher-education supply. To this purpose, the activity of WP1 was articulated into three main parts:

- (a) mapping and characterizing the relevant educators operating in the region, and the higher-education supply;
- (b) mapping and analysing the relevant actors;



(c) understanding knowledge, skills and competences of actors.

This operational phase followed the definition of a suitable investigation methodology.

This report is articulated as follows. Section 1 introduces the adopted methodology. Section two presents the main features of the mapped actors, educators, and educational needs. Section 3 illustrates the main findings concerning the understanding of knowledge, skills and competences of actors.



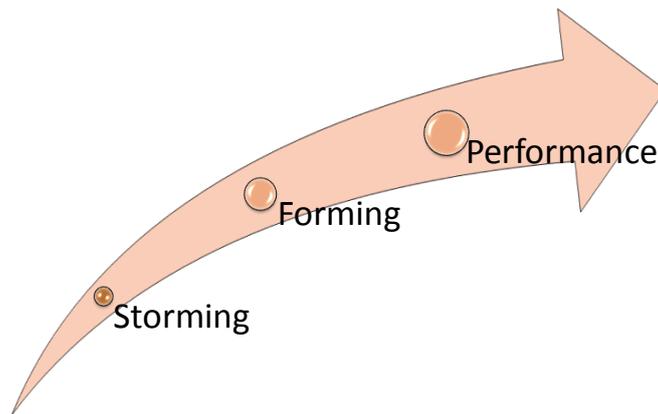
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## Part I: Methodology

### I.1. Adopted Approach and Proposed Methodology

The general approach followed in the organization and implementation of the activities of WP1 can be synthesised as in Figure I.1. In particular, the followed methodology was the result of a three-stage participatory process. The first stage was of a storming character, and aimed at generating the ideas that, during the second stage, were analysed and organized more rigorously. This allowed for the definition of the specific methodology that finally, in the last stage of the process, was followed in order to organize and implement the activities and achieve their objectives.

**Figure I.1 – Adopted Approach**



Based on this approach the above mentioned parts in which the activity of WP1 was articulated were in turn organized and implemented as follows.

#### *(a) Mapping actors, educators and the education supply*

(a.1) Preparation of a draft proposal of the tools to be used for mapping actors and educators;

(a.2) Circulation of the draft among partners for discussion and feedbacks collection;



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- (a.3) Preparation of a second draft to be sent to partners for approval;
- (a.4) Distribution of the so-defined tools to partners for compilation;
- (a.5) Processing of the collected information and, in particular, characterization of different typologies of actors and educators and of the education supply along the lines defined by partners;
- (a.6) Presentation and discussion of results at the first Kick-off Meeting.

*(b) Understanding actors' professional needs*

- (b.1) Discussion during the first Kick-off Meeting of the structure of the questionnaire to be used to collect information on actors' professional needs;
- (b.2) Organization of comments and design of the questionnaire;
- (b.3) Submission of the questionnaire by local partners to actors;
- (b.4) Organization of local conferences by pairs of African and European partners with the aim of:
  - sharing the information collected with questionnaires
  - collecting additional feedback
  - establishing the network;

*(c) Field Visit Report*

- (c.1) Collection of the questionnaires;
- (c.2) Data elaboration and preliminary characterization of the regional situation;
- (c.3) Circulation of preliminary results among partners;
- (c.4) Presentation and discussion of preliminary results at the regional conference.

The tools that were finally proposed and used for the two rounds of data collection were:

- two excel spread sheets, one for mapping actors, the other for mapping educators and higher education supply;
- a semi-structured questionnaire for understanding professional needs.



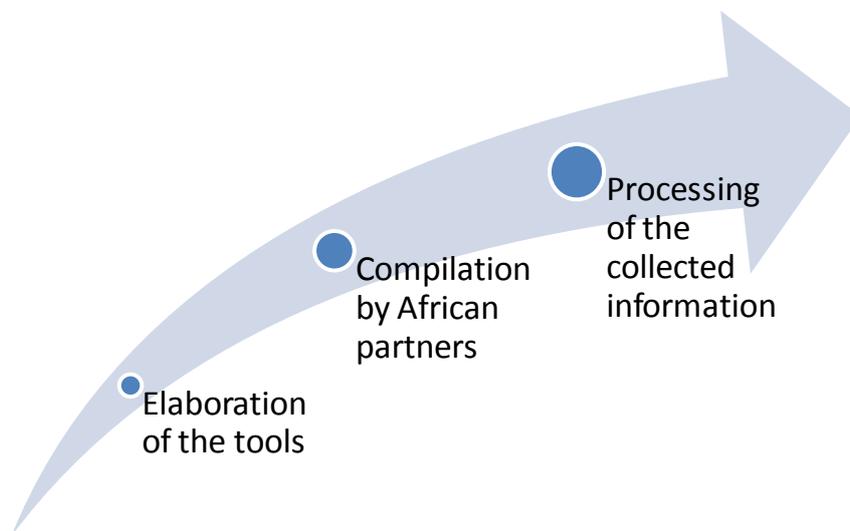
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## I.2. Mapping Actors, Educators, and the Higher-education Supply

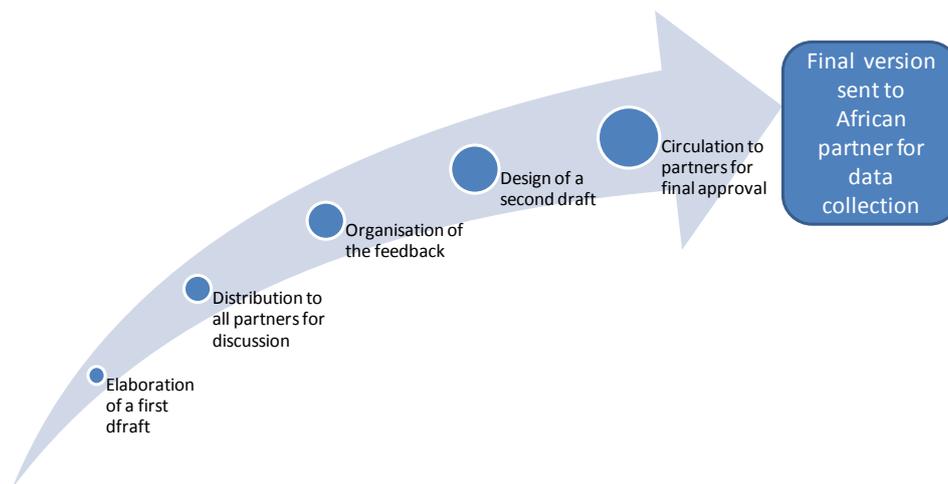
The subgroup of activities aimed at mapping actors, educators and the higher-education supply was in turn articulated into three main steps. The overall followed process is the one illustrated in Figure I.2. The first step consisted in the elaboration of the tools used for data collection. Once prepared, such tools were compiled by African partners. Finally, the collected information was processed by the coordinator in order to finally achieve the desired mapping.

**Figure I.2 – Steps followed in mapping actors and educators**



The first step of the mapping process – the elaboration of the tools to be used for data collection – was of a participatory character and was developed according to the steps illustrated in Figure I.3. Initially, a first draft of the tools was elaborated by the coordinator. Then, such a draft was distributed among partners for discussion and feedbacks. Finally, after the organization of the latter, a second draft was prepared and let circulate once more among partners for final approval.

**Figure I.3 – The participatory process followed in the elaboration of the tools**



The detailed timeline followed in the implementation of the overall mapping process is the one reported in Table I.1.

**Table I.1 – Timeline followed in mapping actors, educators and educational supply**

Date	Activity
October 11-19, 2013	Circulation of the first draft of the tools among partners
October 21, 2013	Delivery of the tools to African partners for performance



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9 December, 2013	Deadline for data transmission to the UNIPV
December 10, 2013 – January 10, 2013	Data processing
January 13-17, 2014	Results presentation at the first kick-off meeting

The tools finally elaborated through the participatory process represented in Figure 4 consisted in two excel spread sheets, the one used for mapping actors, the other for mapping educators and their education supply. The entries of such excel spread sheets are the following.

*(i) Excel spread sheet for mapping actors*

- Name of the actor
- Country registration
- Organisation type (public, private, etc.)
- Other African country/ies of intervention
- Sectoral focus (primary producer, processor, trader, R&D, policy, etc.) – Keep the mapping broad to start and refine later
- Major national partners in the agro-energy only or energy market (company name and website )
- Major international partners in the agro-energy only or energy market (company name and website)
- Activity level (National, Regional, District, Community, etc.)
- Web address
- Contact details (name, position in the organisation, and address).

*(ii) Excel spread sheet for mapping educators and their education supply*

- Name of education provider (English and local language)
- Country of registration



- Program title (one for each program)
- Type of program (Phd, master, lifelong learning)
- Focus of content (International, National, local)
- Main subject areas (technological, environmental, social, economical, policy, etc.)
- Length of course
- Number of students
- Main source of students (University, NGOs, Private, etc.)
- Type of actors involved in the program (actors are those of the agro-energy chain or energy chain)
- Type of participation of actors in the program (design, teaching, internship, research etc.)
- Web site
- Contact details
- Syllabus in attachment.

## **I.2. Understanding Actors' Professional Needs**

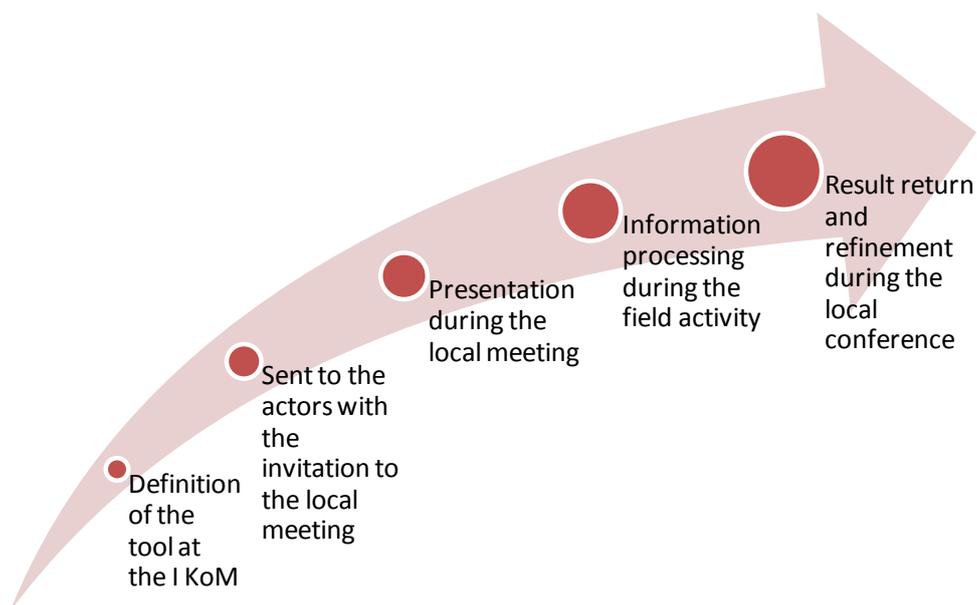
The process followed to understand actors' professional needs was articulated into the five main steps illustrated in Figure I.4.

**Figure I.4 – Steps followed in understanding actors' professional needs**



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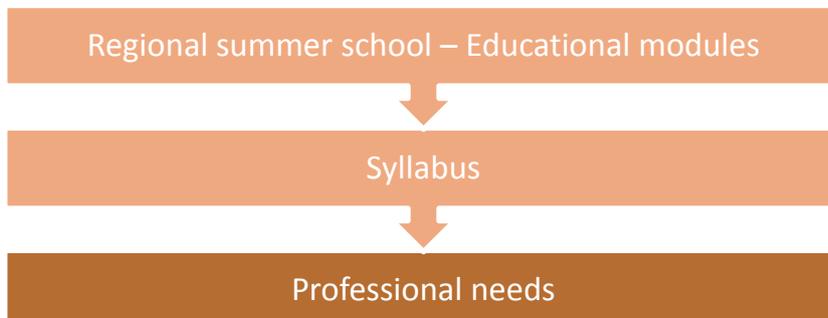
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The first step consisted in the definition, during the first kick-off meeting, of the tool to be used later for data collection. After its preparation, the tool was then sent by African partners to actors to be filled. Along with the tool, actors also received the invitation to the local meeting whose main purpose was the one of presenting the tool and its aim. The collected information then, after processing, was finally presented and discussed by actors during the local conference, allowing for refinements and additional feedbacks. Some partners decided to distribute the tools during the local conference and actors' meeting in order to better clarify the objective and content.

In turn, the presentation of the tool to actors during the local meeting had two main purposes. The first one was explaining what was the aim of collecting data on actors' professional needs in view of the overall Energy-Agro-Food action. Such an aim can be illustrated as in Figure I.5. The purpose of collecting information on actors' professional needs is ultimately the one of designing innovative educational modules somehow embodying the requirements of the labor market. Such modules, during the last activities of the action, will be first tested with a regional summer school, and then will be finally incorporated in higher-education syllabus of African partners.

**Figure I.5 – Aim of understanding professional needs**



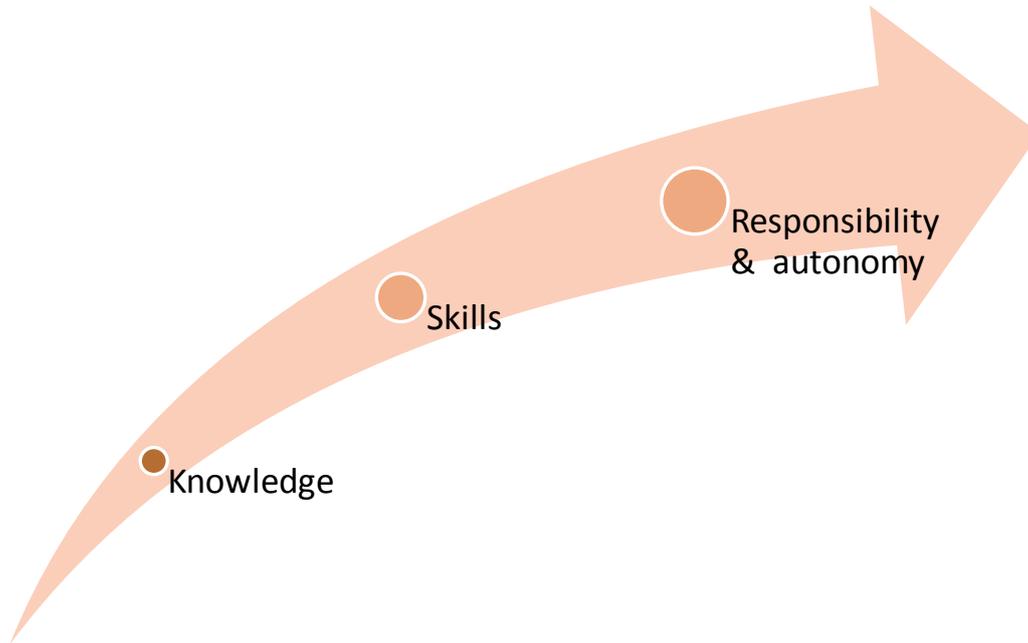
The second purpose of the local meeting, instead, was the one of clarifying the specific contents of the tool distributed to actors for compilation. In particular, the information asked through the tool gravitates around the three major topics illustrated in Figure I.6. Knowledge and skills are the instruments in the student toolbox that are necessary to address specific issues. In particular, knowledge is what is known, the outcome of the assimilation of information through learning in terms of body of facts, principles, theories and practices that are related to food and agro-energy. On the other hand, skills is what can be done, the ability to apply knowledge and use know-how to complete tasks and solve problems, both of a cognitive and practical character. Finally, responsibility and autonomy inform on when to use knowledge and skills. They consist of professional conduct and wider competences displayed in terms of attitudes, behaviour and initiative necessary for operating professionally.

**Figure I.6 - Major topics faced by the tool**



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The tool distributed to actors' in order to understand their professional needs consisted in a semi-structured questionnaire. The open structure of the questions asked was suggested by the necessity of encouraging actors' genuine answers and comments. To the same aim, the compilation of such a questionnaire took place during the meeting after a general discussion on the contents. The structure of the questionnaire is the following:

- First, the tool asks to inform on the Organization and the professional level to which the reported comments apply.
- Concerning knowledge, it asks to describe relevant requirement in terms of body of facts, principles, theories and practices
- Concerning skills, it asks to describe the major tasks and problems to be solved
- Concerning responsibility and autonomy, it asks to describe the professional conduct, features and wider competences requested in terms of attitudes, behaviour and initiative.



Finally, each pair of African and European partners organised the local conference aimed at sharing the results of the questionnaire, discussing them further and collecting additional feedback. Furthermore, the conference also aimed at establishing the network.



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## **PART II: SUMMARY OF THE FEATURES OF THE SURVEYED ACTORS, EDUCATORS AND EDUCATIONAL PROGRAMS**

### **II.1. Introduction**

This part of the report summarises the data collected during the mapping process. In particular, data are organized in tables comparing the three East-African countries targeted by the Energy-Agro-Food action. These tables are conveniently divided into two groups, the surveyed relevant actors operating in the Energy and Agro-Food sectors with a potential interest in the project and the educational programmes offered by African Partners and other Universities with a possible interest in promoting educational modules in the field of bioenergy.

### **II.2. Mapped Actors**

Table II.1 reports the number of national and international actors surveyed in the three countries. The numbers of actors mapped in Ethiopia and Kenya are similar and significantly greater than the number of actors mapped in Tanzania. Moreover, the greatest bulk of those mapped in Ethiopia and Kenya is of a national type, while in Tanzania the international type is more relevant in the analysed sample.

**Table II.1 - Number of actors surveyed on the total and by country of registration**

	National	International	n.a.	Total
Ethiopia	20	2		22
Kenya	24	2		26
Tanzania	4	7		11

In Table II.2 these actors are grouped according to the type of organization. While in Kenya and especially in Tanzania the majority of mapped actors are private organizations, in Ethiopia the



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majority is of public character. Indeed, this difference is in line with the more general observation that the public sector plays an important active role in Ethiopian economic development. Moreover, in all countries NGOs represent a small minority of mapped actors.

**Table II.2 - Number of actors by organisation type**

	Public	Private	NGO	n.a.
Ethiopia	14	5	3	
Kenya	10	16		
Tanzania	1	8	2	

Table II.3 shows the number of actors surveyed by sectoral focus. In general, this table highlights a certain variety within countries. However, it is worth noticing that in Kenya and especially Tanzania the majority of mapped actors are either producers or processors. In Kenya there are also a significant number of actors active in R&D or trade. In Ethiopia, instead, the majority of the surveyed actors is active in more than one sector simultaneously and, in particular, also in extension or policy. Moreover, also in Ethiopia there are a good number of producers and processors.

**Table II.3 - Number of actors by sectoral focus**

	Ethiopia	Kenya	Tanzania
Producer			3
Processor		11	2
R&D		7	
Extension	1		
Financing			
Training	1		
Trader	3	4	
User	1		



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Producer, processor		2	5
Producer, processor, supplier	1		
Producer, processor, user	1		
Producer, processor, trader, R&D, policy	1		
Producer, processor, policy, extension	5		
R&D, extension	1		
R&D, policy, training	4		1
Renting, leasing, training	1		
Policy, training			
n.a.	1		

In Table II.4 actors mapped are grouped according to their level of activity. In all countries, and especially in Ethiopia, the majority of considered actors operate at the country level. In Kenya and Tanzania, however, there is a more balanced number of actors operating at the regional and national level. The actors operating at a district or project level are a small minority.

**Table II.4 - Number of actors by activity level**

	District	National	Regional*	Project	n.a
Ethiopia		17	3	2	
Kenya	1	15	10		
Tanzania	1	2	8		

\*Note: in the case of Kenya the term “regional“ means “East-African“. For the other countries, it represents the sub-national level.

Table II.5 shows the actors mapped according to a national, international or regional main partner. In Ethiopia and Tanzania the information is mostly not available (one national company in Tanzania has 14 main national partners). In Kenya, instead, the majority of the surveyed actors has a national



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public partner, the latter being in 18 out of 26 cases the same public company, and in 6 the same regional institution.

**Table II.5 - Number of actors with a national, international or regional main partner**

	National	International	Regional*	n.a.
Ethiopia	22			
Kenya	18		8	
Tanzania	3			8

\*Note: in the case of Kenya the term “regional“ means “East-African“. For the other countries, it represents the sub-national level.

### II.3. Mapped Educators and Education Supply

The 30 educators surveyed by country is shown in Table II.6. Almost half of the total educators surveyed are in Ethiopia followed by Kenya and finally Tanzania.

**Table II.6 - Number of educational programmes by country**

	Number
Ethiopia	14
Kenya	11
Tanzania	5
Total	30

Table II.7 reports the number of educational programmes mapped in the three countries with a potential interest in adopting an educational initiative in the field of bioenergy. They are grouped by typology. Especially in Ethiopia, but also in Kenya, the majority of such programmes are of a post-graduate type (either M.Sc. or Ph.D.), while there are no mapped lifelong learning programmes. In



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Kenya more than one third are undergraduate programmes. Instead, in Tanzania, with the only exception of one M.Sc., programmes are only of a lifelong learning type.

**Table II.7 - Number of educational programmes by type**

	Ethiopia	Kenya	Tanzania
Diploma	1		
B.Sc.	1	4	
M.Sc.	6	4	1
Ph.D.	6	3	
Lifelong Learning			4

We also noted some common grounds, specific features and divergences in the programs length across countries as reported in the following:

- Diploma: 1-4 years in Ethiopia;
- B.Sc.: 4 years in Ethiopia; 4-5 years in Kenya;
- M.Sc.: 2 years in Ethiopia, Kenya and Tanzania;
- Ph.D.: 4 years in Ethiopia; 3 years in Kenya;
- Lifelong Learning: 2-3 weeks in Tanzania.

The number of educational programmes in each country by type and kind of specialization is illustrated in Table II.8. The data highlight both the relative variety of these specializations and their mono-disciplinary character, the only exceptions being the M.Sc. and Ph.D. in Agriculture and Energy supplied in Ethiopia.

**Table II.8 - Number of educational programmes by type and kind of specialization**

Country	Educational title	Diploma	B.Sc.	M.Sc.	Ph.D	Lifelong
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						learning
Ethiopia	Technical subjects	1				
	Agriculture		1	2	2	
	Energy Technology			2		
	Agriculture and Energy			1	1	
Kenya	Environmental and Biosystems Engineering		1	1	1	
	Food Science and Nutrition		2	2	1	
	Agricultural Engineering		1		1	
	Soil and Water Engineering			1		
Tanzania	Crop Science			1		
	Biogas making					1
	Biofuel, renewable energy					1
	Sustainable bioenergy					1

In Table II.9 the educational programmes are organised by the main subject areas. In Ethiopia the main subject areas are either technical, agricultural, or both. In Kenya all mapped programmes fall within the technical, environmental and policy area. In Tanzania, where lifelong learning programmes prevail, the technical component is dominant.

**Table II.9 - Number of educational programmes by main subject area**

	Ethiopia	Kenya	Tanzania
Technical	5		3
Agricultural	5		
Technical, agricultural	4		
Technical, economic			1



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Technical, environmental, policy		11	
Technical, environmental, social, economic			1

Table II.10 shows the university programmes by main source of their students. In Ethiopia and Kenya, the main sources of students are the university and industry. In Tanzania instead the main source of students are either industry or NGOs. This feature was expected considering the fact that majority of mapped programmes is of a lifelong-learning type

**Table II.10 - Number of educational programmes by main source of students**

	Ethiopia	Kenya	Tanzania
University	6	5	1
University, industry		6	
NGOs, industry			3
Public institutions			1
Private colleges	2		

Tables II.11 and II.12 illustrate the number of educational programmes by type of actors involved and the typology of their involvement. In Ethiopia and Tanzania, the actors involved in the surveyed educational programmes operate either in the energy or agro-energy chain, while in Kenya they belong the industry sector. In general, these actors participate to programmes in different ways, but only in Ethiopia they have been reported as providers of internship opportunities.

**Table II.11 - Number of educational programmes by type of actors involved**

	Ethiopia	Kenya	Tanzania
Energy Chain	4		5
Agro-energy Chain	4		



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University and industries		11	
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**Table II.12 - Number of educational programmes by type of actors' involvement**

	Ethiopia	Kenya	Tanzania
Research		6	1
Design, teaching			1
Design, teaching, research			3
Design, teaching, internship, research etc.	8		
Teaching, research		4	



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## PART III: FIELD VISITS REPORT

### III.1. Introduction

This section of the report deals with the main results achieved during the field visits in the ACP Countries foreseen by the project's WP1 and organised by the African Partner Universities. The main achievements are presented for each University and ordered according to the visit period (Table III.1).

Table III.1 - Timeline of the field visits

African University	Linked European University	Date
University of Nairobi	University of Pavia	23 February – 6 March, 2014
Addis Ababa Institute of Technology; University of Mekelle	University of Bologna	2-9 March, 2014
Sokoine University of Agriculture	University of Auvergne – Clermont Ferrand I	6-17 April, 2014

All reports on the field visits of European Partners to the coupled African University include an introduction on the local background followed by some paragraphs dedicated to the main issues of the project. Among them, particular attention has been paid to the professional profiles requested by the labour market as suggested by the involved actors, to the challenge for the local Universities to answer these needs, to the possible educational initiatives to be designed and implemented, to the potential innovative actions, and to the internship/attachment features.



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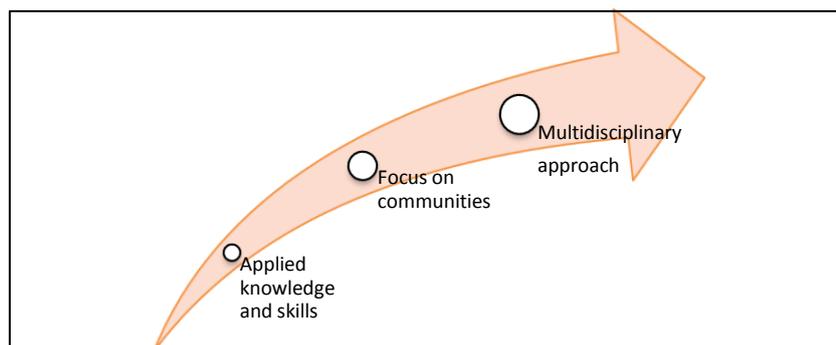
On the basis of the gathered information, the final paragraph focuses on the common and critical aspects, and points out the elements to be discussed at the Regional Conference in order to draw the next steps of the project.

## III.2. University of Nairobi

### III.2.1. Background suggestions

During the local conference with stakeholders held at the University of Nairobi and through the field visits to the local bio-energy plants, three major background suggestions concerning professional requirements emerged (Figure III.1).

Figure III.1 – Background suggestions emerged during the field visit in Nairobi



Participants recognised the importance of a sound theoretical background, but they also underlined the need to integrate this background with *applied knowledge and skills*. This aspect was unanimously recognized as a priority. The major observations received on this issue are the following:

- “Students should be able to solve operative problems at the end of their education”
- “Practical skills are relevant due to business needs, i.e. students with adequate professional competences at the end of their education and ready to work”



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- “Post-graduate students often apply for extensions (i.e. additional study periods), however the organization of additional study periods do not ensure that students obtain the requested knowledge”

- “What is required is a stronger “problem solving” attitude, and the capacity to move from theory to practice”

As a consequence, participants to the meetings organised during the field visit suggested three major directions in the design of an educational course:

- First the need to include into the programme practical problems and case studies presented by professionals.

- Second, all participants recognised that the attachment programme is an essential part of education and that its implementation is crucial. Attachment programmes should be long enough to develop adequate basic knowledge and skills. Students should perform their internship under the supervision of a professional tutor. This initiative requires financial resources and the availability of a professional tutor because the students involved in the internship program do not have previous working experiences.

- Third, networking with actors is important for attachments and for the identification of supervisors.

The second background suggestion received during the field visit emphasized that educational programmes on bioenergy should have a focus on community level solutions. For instance in Kenya the bio-energy sector is expanding at the household and smallholder farmers level in the form of use of human and animal waste for bio-energy generation. Practitioners underlined the need of experts with the capacity to interact with the community identifying the problems and proposing potential solutions in terms of: food security, additional income generation opportunities; energy production. The community-based approach finds justification in the recent development of bio-energy from human and animal waste at the household, smallholder farmers, and community level. Also the local government is supporting research and extension activities in this sector.

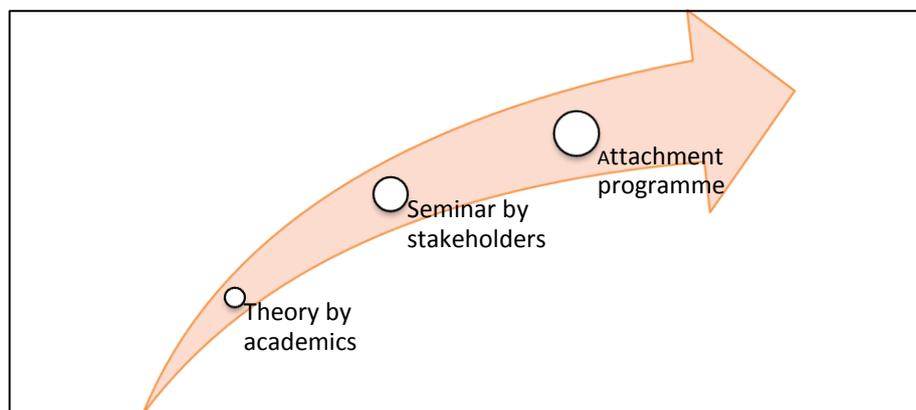


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Finally, all participants agreed on the need to design an educational programme based on a *multidisciplinary approach*. Four major topics were identified as priorities: food security, income generation opportunities, environmental sustainability, and energy production. The capacity to evaluate the socio-economic impact of projects was also indicated as an important additional asset. At the local conference, a possible framework of the educational module suitable for passing from theoretical to applied skills and knowledge was designed along the lines illustrated in Figure III.2.

Figure III.2 - Possible framework of the educational module



Among the possible topics to be developed during the educational initiative it was strongly suggested a focus on Project cycle management for the development of bioenergy and agro-food synergies. Project identification, design and implementation were indicated as important skills still lacking in the professional environment of Kenya.

Local conference participants also indicated the need for an educational initiative at the master programme level with a specific attention to professional accountability that can be considered as an important aspect for the success of an educational module.

### III.2.2. Educational initiative as a result of the ENERGY\_AGRO-FOOD project



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A suggested potential educational initiative at the end of the ENERGY\_AGRO-FOOD project was the organisation of a module within the Continuous Professional Development, which is compulsory for teachers at the University of Nairobi. It lengths approximately 40 hours per year and the attachment should be organized returning to the respective profession asking the identification of needs.

The need to formally recognise the designed educational modules in a different curricula was also addressed. It was recalled that the University of Nairobi has already an internal process for the revision of curricula with the contribution of the actors during specifically organised workshops every five years. Involved actors are those who offer employment to students. Result of the workshops is a five-year strategic plan that leads to the revision of the curricula. The educational modules designed within the Energy Agro Food project should be recognised during this process of revision of the curricula.

### III.2.3. Specific knowledge, skills and responsibility and autonomy

During the field visit the specific knowledge suggested are listed in Table III.2.

Table III.2 – Summary of the relevant knowledge

I. Concepts and contexts	V. Project design
II. Conflict areas between agro-food and energy	VI. Planning, programming and implementation
III. Technology policy	VII. Strategic assessment (Outlook)
IV. Chain management	VIII. Impact assessment with specific reference to food security, environmental sustainability and land

On the side of skills, the major feedbacks are related to the capacities illustrated in Table III.3.

Table III.3 - Summary of the relevant skills



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I. Understand real problems	V. Data analysis and collection
II. Identify the target population	VI. Project design
III. Problem solving	VII. Reports writing
IV. Farm planning and recordkeeping	

Team leadership capacity and responsible people were suggested as specific professional and autonomy features.

### III.2.4. Innovation

During the field visit the discussion also addressed the topic of innovation that was interpreted into four main directions: a) the need to stimulate students to start their own business; b) the opportunity to enlarge the FABLAB, the already existing scientific park; c) the establishment of job creation centre (to foster entrepreneurial and economic development) and a placement office to support the attachment program; d) the development of training of trainers programmes.

### III.2.5. Networking activity

All the participants recognised that networking activity is crucial for the project because it allows to point out deficiencies and makes the educational programme dynamic and up-to-dated with respect to the professional requirements. It was also recognised the importance to establish a network based on the participation of different typologies of stakeholders and able to survive after the end of the project.

## III.3. Addis Ababa Institute of Technology

### III.3.1. Background suggestions



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During the field visit at the Addis Ababa Institute of Technology a clear indication was that the energy sector labour market has currently not yet found appropriate professionals and is not covered by adequate skills despite the growing **needs of adequate professional skills**.

Individuals working in the energy sector are normally not trained as energy specialists. In particular their academic background is based on the following fields:

- Engineering (mostly Mechanical and Electrical);
- Environmental sciences;
- Environmental engineering;
- Physical sciences (mostly Chemistry and also Physics) and agricultural disciplines.

Moreover, they do not have the relevant knowledge to bring a technological and economic change.

Thus, technicians with a **practical knowledge** are lacking.

Further aspects that emerged from the involved actors were the lack of data and information on the bioenergy sector (demand, policies,...), and the strategic relevance of the **energy and agro-food nexus** (food security and supply of biomass from agro-food chain by-products and residues; bioenergy for irrigation and water use, for agricultural machineries and rural hunger contrast, and for food transport; fertilizers from bioenergy residues; increasing dependence of agro-food value chain competitiveness on energy efficiency).

### III.3.2. Educational requirements

The actors involved in the field visit underlined the need of professionals who works directly with farmers or the industry sector and also suggested the creation of a **multidisciplinary expert in bio-energy profile** with the capacity to:

- Organize surveys and databases;
- Design and manage projects;
- Plan rural and energy-integrated development;
- Adopt problem-solving approaches;
- Communicate research developments and bridge answers and needs;



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- Integrate agro-food and energy opportunities;
- Assess technologies for bio-residues recycling;
- Eco-design for the agro-food and bio-energy supply chains;
- Improve the economic sustainability of bio-energy solutions (energy economics);
- Identify and delivery adequate policy measures (e.g. subsidies).



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### III.3.3. Role of the University

During the field visit, it emerged that Ethiopian Universities recognise the need of an investment in educational programmes on bio-energy. To this purpose the following four main critical aspects should be addressed:

- At Bachelor, and at technical and vocational level there are **no individuals specifically trained** for the bio-energy sector. Curricula at these levels are essentially covering energy in general;
- Graduates at MSc and PhD level find placement mostly within **research and teaching institutions**, highly involved in theoretical works and without a specific training for technology and innovation transfer and for local need analysis. Such professionals should be able to identify and offer solutions in response to local needs;
- **Internship program** is not well developed to bridge theory and practice;
- **Extension services** need to be strengthened in order to improve their effectiveness in communicating research solutions and disseminating technological innovations.

### III.3.4. Coordination as a form of innovation

A further problem pointed out during the field visit was the lack of synergy between different organizations/disciplines working in this area. In general they pursue the objective of a single organization/ministry.

The networking activity promoted by the project could contribute to lead to a better coordination between different organizations/ministries.

## III.4. University of Mekelle

### 4.1. Background suggestions

The field visit at the University of Mekelle focused on three levels of the bio-energy chain: a) business (fame and industrial); b) household; c) governmental.



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The lack of **technical education** was a common weakness. Moreover, there was a convergence on the importance to initiate a curriculum in the area of **sustainable energy** with a specific focus on biogas.

#### 4.2. Context at business level and educational requirements

According to the actors participating to the project's meetings, at business (farm, industry) level local workers are not specifically trained for the sector. The unavailability of specific knowledge is reinforcing the dependence from foreign equipment producers countries, such as India, for the import not only of technology but also of qualified labour, particularly in the management and technical problem solving areas.

Knowledge and skills were indicated as particularly weak in the following disciplines:

- Agronomy;
- Management;
- Energy;
- Economy;
- Technology;
- Political economy.

Thus, the importance of a **multidisciplinary approach** in educational initiatives was emphasized.

#### 4.3. High educational initiatives to be developed

Bioenergy related high educational initiatives to be undertaken can be articulated into two levels: graduate and post-graduate.

At graduate level, interviewed actors suggested the creation of an **energy specialist** profile with specific knowledge into two main fields:

- Bio-energy projects design and management;
- Bio-material (for bio-gas generation) technical innovation design.



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Concerning the post-graduate level, lifelong or short training programmes were recommended suggesting as areas of interest: plants technical maintenance, bio-energy chain organization and management, and workplace safety.

#### **4.4. Domestic producers and consumers of bio-energy and governmental level**

The field visit pointed out bio-gas production - through recycling wastes (from manures and agro-food chain residues) by households and smallholder farmers - as an emerging sector. At this level, it was underlined the importance of the information and technical services commonly provided during the construction of the plant. However, interviewed actors also suggested the relevance of extending these practices at the community level since biogas is primarily spread at domestic level. Currently there is a limited number of community based bio-gas facilities (e.g. remote areas, rural communities and villages).

Finally, concerning the public sector the interviewed actors advocated the need of experts in the area of energy (i.e. experts on energy policies and energy project management).

### **5. Sokoine University of Agriculture**

#### **5.1. Background suggestions**

The local conference confirmed the interest of stakeholders in agro-energy, even though it is still an embryonic sector. Other renewable sources of energy are more common, such as solar and wind energy. Given the need for energy biomass production in Tanzania, agro-energy projects in the country are rather small-scale. Production of agro-energy emerges mainly from small actors (NGOs, individuals).

The profitability issue was also raised. Even though some agro-energy sources are economically valuable in the medium and long run, initial investment costs have a strong incidence. Therefore,



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some actors may find low incentive in the short run to invest in such systems. The stake is now to provide energy to the whole population, which means mass production.

Awareness appeared as an important vector of diffusion of agro-energy. Generally, it seems that (I) motivation and (II) training are two key elements to understand the adoption of agro-energy sources by households and small farmers.

For medium size farmers and groupings of farmers, it seems that the potential lack of profitability is crucial. For instance, it seems to be profitable for clean energy from sugarcane waste and not for sisal.

## 5.2. Skills requested by the organizations

The actors during the field visit at the Sokoine University of Agriculture underlined the importance of **technical knowledge** and **well-trained students**.

Actors pointed out that students' knowledge is sufficient at theoretical level but extremely limited in terms of practical skills. It seems that they do not have enough field experiences during their studies.

Concerning skills, it was noted the lack of **management and marketing skills**. Even though they have a good know-how, they are not always aware of the stakes of marketing products. Moreover, human resources and management skills are missing. Students should be familiar with the everyday life in an organization such as: how to communicate with colleagues, with hierarchy; how to manage a group of collaborators; how to negotiate a salary; labor regulations; business ethics and CSR; etc.

Students should have more practice on CV/cover letter writing, as well as funding proposals, etc.

Actors also suggested that courses should focus more on project analysis management (including monitoring and evaluation).

Problem formulation and analysis appears very important during the discussions of the local conference. Indeed, it seems that there is a trade-off between food and energy. Students should be prepared to these stakes (economic analysis, land use issues and policy issues).

### 5.3. Matching between the actors' needs and university curricula

At the University of Sokoine there are some lectures related to agri-business (e.g. AB603 Agribusiness environment, elective course; AB607 Strategic agribusiness management; AB608 Agribusiness management in practice, etc.), but it results that there are no lectures on energy issues neither on agro-food-energy.

The curricula should integrate a better knowledge of the energy sector, which calls for a survey to better know this sector: for instance, to have a better idea on practices, to understand why individuals adopt/or do not adopt certain types of energy (such as, cost and awareness).

During the local conference external stakeholder support the idea of courses taught by professionals (minimum 10% of lectures). Having more practical activities in the curricula is essential.

This reinforces the relevance of designing a new teaching module on agro-food-energy.

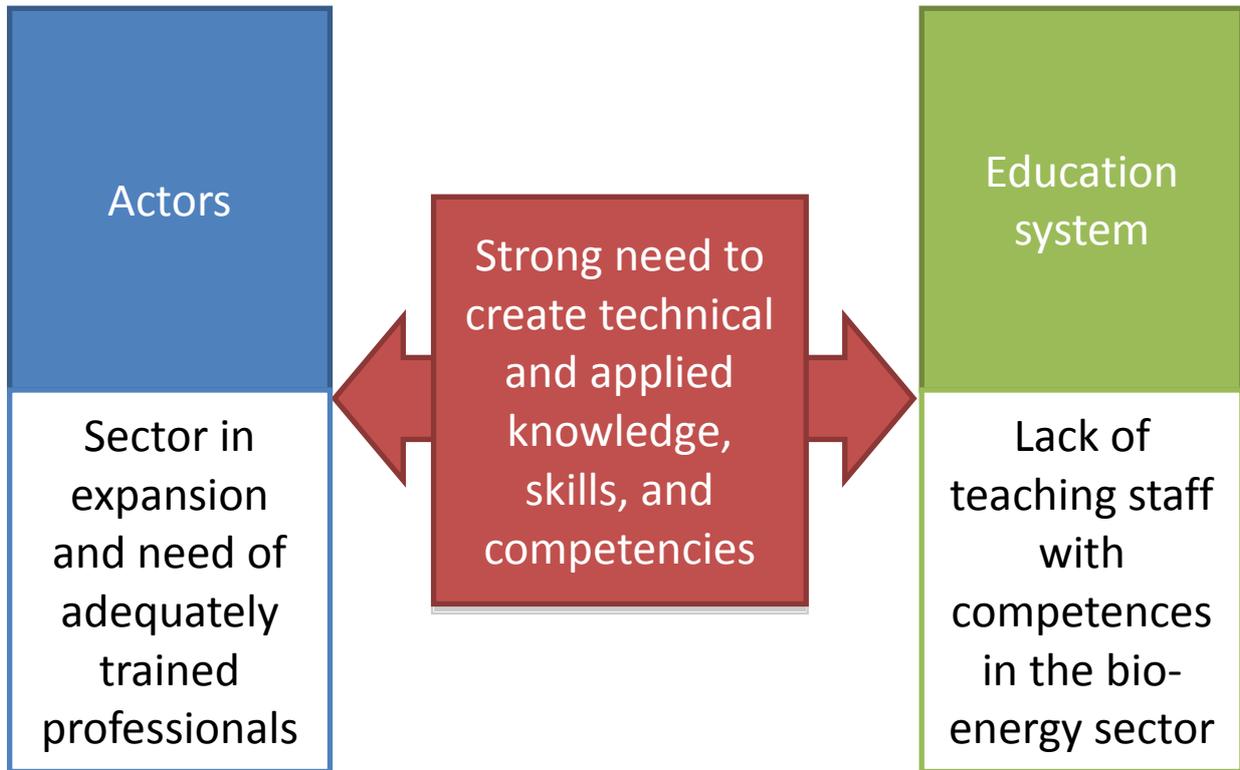
## 6. Common and critical aspects

The field visits have clearly indicated the importance of the project and its potential contribution to the matching between the labour market requirements and the educational supply (Figure III.3).

Figure III.3 - Common background indications



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The observations collected during the meetings with actors and through local conferences have pointed out some common elements, summarized by the word cloud in Figure III.4 that shows some focal/critical aspects to be discussed at the Regional Conference.

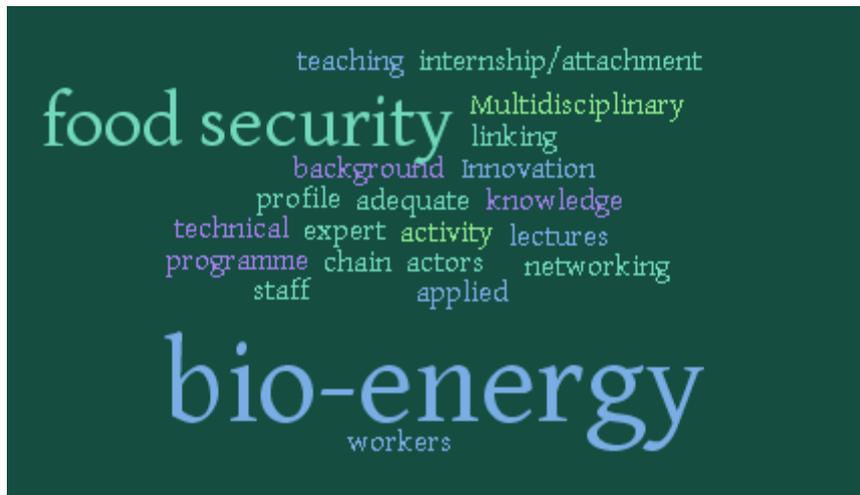
Figure III.4 – Word cloud



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The emerged issues have clear effects on the:

- definition of responding learning objectives;
- identification of the target university level courses;
- design and development of the teaching modules to be integrated with the educational offer;
- creation of functional didactic materials, and
- implementation of internship experiences.

They are organized in Table III.4 in order to facilitate analysis and discussion.



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Table III.4 – Common elements and crucial aspects

Common elements	Crucial aspects to be discussed
<p>Need to focus on the bio-energy chain and more precisely on:</p> <ul style="list-style-type: none"> <li>- bio-energy sources (biomass production) from crop by-products / residues, and animal wastes;</li> <li>- bio-energy sources from industry by-products / residues and urban waste;</li> <li>- biomass transformation and bio-energy production;</li> <li>- bio-energy consumption at household, small farm, community, and industry level;</li> <li>- bioenergy residues as fertilizers;</li> <li>- public sector / Government role.</li> </ul>	<p>Should the teaching module consider the chain as a whole or just a part of it?</p>
<p>Importance of linking bio-energy, food security and income generating /saving activities</p>	<p>How teaching module can implement this connection ?</p>
<p>Multidisciplinary bio-energy expert profile</p>	<p>What scientific disciplines should be considered?</p>
<p>Level of the educational initiative: graduate and / or post-graduate level; lifelong learning</p>	<p>At which level the teaching module should be incorporated (BA, MA, PhD, LLP) ?</p>
<p>Lack of workers with applied and technical background. Thus the need for lectures given by actors</p>	<p>What role and modalities that depict actors involvement ?</p>
<p>Importance of internship/attachment program</p>	<p>Length and organization of internship / attachment</p>
<p>Innovation - Several possibilities were suggested:</p> <ul style="list-style-type: none"> <li>- to stimulate students to start their own business;</li> <li>- possibility to enlarge an already existing scientific park, or incubator;</li> <li>- establishment of an Institution for jobs creation and of a placement office to support the attachment program;</li> <li>- development of the capacity of the academic staff through a mutual joint research activity;</li> <li>- networking activity as a means to promote coordination among stakeholders.</li> </ul>	<p>Direction to be taken</p>



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The aforementioned issues were discussed during the regional conference held in Nairobi. The observations emerged are summarized in alphabetic order by country in Box 1, 2 and 3.

#### Box1: Ethiopia

1. The first question is to select the chain of bio-energy to be designed in the program, where someone suggested the whole package of bio-energy to be considered for the energy-Agro-Food module design, while someone else suggested a single or few packages of bio-energy to be considered.

**Answer:** the group had thoroughly discussed on this and reach to the point not to select or decide at first because when the process of designing the module started, that is when in-depth evaluation for customer demand, identification and selection of the program level, and their like, the answer will eventually asserted.

2. The second question deals with how teaching modules can be designed in order to support and connect bio-energy, food security and income generation

**Answer:** it is considered that the linkage could be set and strengthen in relation to the development of the modules of the program and in parallel the module should facilitate active learning process. Furthermore, internships incorporated into the program could be used as useful platform to students to work on projects that link the stated elements.

3. The third question, which deals with the demand of incorporating multidisciplinary bio-energy profile into existing programs, in turn raises a question of which scientific discipline has to be selected.

**Answer:** the group refers that the program should have the broad scientific views of Engineering and Economics, besides it is expected to let emerge merits of Environmental and Food Systems.

4. The fourth question is at which level the teaching module should be incorporated (BA, MA, PhD, LLP)?

**Answer:** taking into consideration stakeholders' need and demand, and the general objective of the action, a priority for Master of Science is selected and with long-term target on Life Long Program is recommended.

5. The fifth question risen, which is linked to the observation that employees and workers lack applied and technical background, asks whether the designed program



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should offer lectures given by actors with excellent profile.

**Answer:** considering that market lacks high profiled or well experienced personnel from industry, the group recommend the program to incorporate internship, seminar work, field visits, and to invite expatriates from partner universities from Europe or the region.

6. The sixth question regards the recommend length and organization of internship/ attachment.

**Answer:** a two-month period of internship after the students finish one-year course is recommended. The organization of internships should be done by both sides, i.e. either the office of University-industry, or the student independent search.

7. The seventh question is related with the approach of the program to be followed in view of Innovation.

**Answer:** the group declines the point that the program should be a good platform for the possibility to enlarge an already existing scientific park, or incubator so that students could increase their entrepreneurial skills and find real-life problem solutions.

## Box 2: Kenya

1. Should the teaching module consider the chain as a whole or just a part of it?

Response:

The UoN Team considers a whole chain approach

2. How teaching module can implement this connection?

Response:

- Identify gaps in current practices, then develop teaching modules that address the gaps
- Develop very clear objectives for attachment through MOUs and checklists
- Develop innovative ways of developing potentials for marketing
- Include engineering innovation



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### 3. What scientific disciplines should be considered?

Response:

- Agricultural experts
- Economists
- Engineers
- Food Scientists
- Nutritionists
- Environmental experts

### 4. At which level the teaching module should be incorporated (BA, MA, PhD, LLP)?

Response:

Bachelors, Long-life learning programs/Continuous Professional Development, Masters, PhD

### 5. What role and modalities that depict actors involvement?

Response:

Innovation:

- Through training on entrepreneurial skills

Incubation concept (also known as Ideation process) to nurture young entrepreneurs

### 6. Length and organization of internship / attachment

Response:

Capacity development of the academic staff through joint research activities

- Strengthening universities and private sector relationships through the MoUs and modules targeted at certain gaps so as to help industry address challenges and develop new products for innovation
- Synergy with industry will give students a chance to be in touch with current level of technology
- Academic research projects after attachment should reflect innovation that benefits industry (Case of synergy between ICRAF and EBE, UoN)



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## 7. Innovation: direction to be taken

Response:

Come up with:

- an Award system for best innovations
- -Stakeholders consultative Forum
- Dialogue days between industry and universities
- Establish an institution for jobs and placement office to support attachment process
- Tap into our University Alumni

### Box 3: Tanzania

The common elements that were agreed during the bilateral discussion emphasized on the need to focus on the bio-energy chain and more precisely on: bio-energy sources (biomass production) from crop by-products / residues, and animal wastes; bio-energy sources from industry by-products / residues and urban waste; biomass transformation and bio-energy production; bio-energy consumption at household, small farm, community, and industry level; bio-energy residues as fertilizers; public sector / Government role. Moreover, **it was noted that Policy and economics of energy-agro-food (i.e. economic theory on bio-/alternative energy) should be given due consideration.**

It was agreed that the teaching module should consider the **whole value chain** from production to consumption, given the existing relationship between actors in the sector. The importance of linking bio-energy, food security and income generating /saving activities was also noted by emphasizing the need to align the module in a manner that captures the synergies between the three aspects. In essence, remains from food crops and animals can be used as bio-energy source which can then impact on both food security and income generation by enhancing value addition through increased processing activities.

To achieve the above, multidisciplinary bio-energy expert profile is needed with priority given to Engineering, Socio-Economics, Food Science and Environmental Science disciplines. The module developed should be incorporated first and foremost at the MSC/MA mainstream academic levels and, in the second stage, into lifelong learning programs. Given the rudimental stage of the Energy Agro food nexus in



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Tanzania, there should be an intentional move to ensure that a similar course is taught at the BS/BA level for creating more awareness that will then stimulate its uptake at the post-graduate level. The module should thus be flexible enough for down scaling to match the needs of the undergraduate level teaching.

It was noted that due to lack of workers with applied and technical background, there is need for professional lectures/seminars to be given by relevant actors/stakeholders. The modality will be that external stakeholder to be given 20% involvement in the overall training of students on the energy-agro-food nexus. This will help in imparting hands-on skills and exposing students to actual happenings on the ground before even going for their **internships** (currently taking 6 months soon after the first year of MSC/MA course work).

In order to increase networking and communication among all stakeholders, it was suggested that a data base platform of all stakeholders should be established at the SUA University for enforcing and formalizing constant communication with the external world. This can also take a form of a website created specifically for Energy Agro Food issues.

## 7. ?????

In order to further develop scientific knowledge on synergies between bio-energies and agro-food fields, and boost the cooperation between Partners, WP2 will aim at extending the capacity of the academic staff also through collaborative research activities on the basis of which the planned study visits at the EU university Partners will be focused (project activities 2.1 and 2.2).

Preliminary indications on research fields are illustrated in Table III.5.

Table III.5 – Research fields

African University	Linked European University	Topics
University of Nairobi	University of Pavia	Bio-energy and food security (economic perspective)
Sokoine University of	University of Auvergne -	Bio-energy value chain analysis; business management;



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Agriculture	Clermont Ferrand I	behavioural and experimental economics; public and development finance
Addis Ababa Institute of Technology	University of Bologna	Technological innovation; biomass use and bio-energy generation: small plants efficiency; family farm economics; bioenergy and cost-benefit analysis
University of Mekelle	University of Bologna	Technological innovation; biomass use and bio-energy generation: small plants efficiency; bio-energy economics and policy; social impact assessment

## Annex 1: TABLE OF COMMON ASPECTS EMERGED DURING THE PROJECT FIELDWORKS

<b>Common Aspects:</b>
-lack of <b>practical skills</b> - need for <b>technical education</b>



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<p><b>-attachment</b> is essential</p> <ul style="list-style-type: none"> <li>- <b>Internship</b> programme must be strengthened</li> <li>- opportunities and challenges to <b>foresee stakeholders' lectures and seminars</b></li> <li>- importance of <b>stakeholders</b> but <b>low involvement in the design of curricula</b></li> <li>- idea of <b>courses taught by professionals</b> (minimum 10% of lectures)</li> </ul>
<ul style="list-style-type: none"> <li>- importance of <b>networking</b> with actors</li> <li>- need to improve the <b>networking</b> capacity among involved Organizations/Stakeholders</li> <li>- Stakeholders interest to improve cooperation with the University</li> <li>- idea of <b>courses taught by professionals</b> (minimum 10% of lectures)</li> </ul>
<ul style="list-style-type: none"> <li>- <b>multidisciplinary</b> approach (food security, income generation opportunities, environmental sustainability, and energy generation)</li> </ul>
<ul style="list-style-type: none"> <li>- focus on <b>project cycle management</b> in the field of bioenergy and agro-food synergies</li> <li>- need to increase <b>managerial competences</b></li> <li>- lack of <b>management skills</b></li> </ul>

**Further comments expressed by the Stakeholders in the Local Conference evaluation questionnaires:**



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Question	Comments
Do you think that the University has the possibility to <b>better link higher education</b> to the needs of the labour market?	Dissemination of innovation; Is better to work with Universities with better experience in agriculture/ linking research action to market
Did you get new ideas on <b>possible cooperation</b> between the University and your Organization?	Technology Dissemination and Transfer; Capacity Building opportunity; Employment opportunity: Energy Food Chain Knowledge;
Any other comment:	Time for discussion should be increased; Need to have regular workshops on the same and other topics; The problems to be addressed remain vague; The discussion time is very short and the number of involved stakeholders is narrow; It was very good but you need to organize similar conferences to evaluate your achievements;