**Introducing Recent Electrical Engineering Developments into undErgraduate cuRriculum**

Co-funded by the Erasmus+ Programme of the European Union

# DELIVERABLE 3.1
# Development of a Capacity Building Plan

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**LIST OF CHANGES**

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## Contents

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| Index of Abbreviations | |
|---|---|
| CB | Capacity Building |
| CS | Cyber Security |
| IoT | Internet of Things |
| IREEDER | Introducing Recent Electrical Engineering Developments into undERgraduate curriculum |
| QMC | Quality Monitoring Committee |
| PCM | Project Cycle Management |
| PDM | Project Design Matrix |
| PI | Primary Investigator |
| PO | Plan of Operation |
| RE | Renewable Energy |
| StC | Steering Committee |
| SSC | Scientific and Supervising Committee |

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# 1. Introduction

The Erasmus+ Capacity Building Project for Introducing Recent Electrical Engineering Developments into undERgraduate curriculum (hereinafter called as "the IREEDER Project") is implemented from November 2019 to November 2022 (3-year project).

The main objective of the IREEDER project is to improve the capacities of high quality education in Jordan, using state of the art technology and training staff on improving the quality of the courses taught by making the best use of these technologies. Specifically, IREEDER aims at introducing the recent developments in Electrical Engineering to the undergraduate curricula, where three subjects in Renewable Energy (RE), Internet of Things (IoT) and Cyber Security (CS) will be developed. Also, three laboratories for training the students in the selected topics will be established in three different Jordanian partners (Universities).

The IREEDER Project is expected to produce three main outputs by the end of the project period, such as:

- Output 1: Teaching materials about the project topics (IoT, CS, RE) accompanied by experimental activities
- Output 2: Establishment of three labs (in three Jordanian universities) related to the project topics, accompanied by a server for a remote lab with virtual lab software at each university of the Jordanian partners
- Output 3: Training workshops in Europe and Jordan

In order to complete the outputs, IREEDER Project has endeavored to conduct various activities for its staff since November 2019. This deliverable contains the capacity building plan to be developed in the process of conducting the above-mentioned output activities. It is expected that they can be also used by those who will conduct the training courses in the long-term, after the end of the project.

# 2. Capacity Development Concept of the IREEDER Project

IREEDER capacity building plan aims at developing human resources and upgrading skills and capacities of Jordanian University professors, technical assistants and students in the fields of IoT, CS and RE.

The core capacity development concepts of the IREEDER Project are as follows:

- **Project Management**

    The Project Cycle Management (PCM) methodology is selected for the IREEDER project as the basic concept of its organizational management. The details of the PCM are discussed in paragraph 4.

- **Selection of training contents and laboratory equipment in the three topics (RE, IoT and CS) in line with the needs of the Jordanian partners**

    IREEDER project considers the needs and priorities of Jordanian partners in selecting training contents and laboratory equipment in RE, IoT and CS. In order to do so, the IREEDER Project identifies the training and teaching needs of the Jordanian partners and verifies their facilities to ensure the full implementation of training courses and the continuity after the end of the project. Moreover, the country sector policies/strategies, the mandates of the University departments and any other documentation, as well as the opinions of Primary Investigators (PIs), staff and other stakeholders are taken into account.

- **High Consideration on the linkage between individual training and organizational development**

    It is most important in the IREEDER Project that the capacity development in the three training themes (IoT, CS and RE) produces "**knowledge transfer agents**" who have good motivation and are equipped with new concepts and improved knowledge and skills. IREEDER Project supports he knowledge transfer agents with the organization of a bouquet of training workshops as conducive to playing a leading role for the capacity development in Jordanian Universities.

- **Focus on the Application of knowledge and skills to work (utilization to internalization)**

    IREEDER Project also prioritizes that the training participants (staff and students) immediately implicate the obtained knowledge and skills into practice. For this reason, theoretical knowledge is vastly supported by lab exercises. Taking into account that the three training themes are very important for students in Electrical Engineering, it is considered as vital that the future students should take the opportunity to commit substantial training after

the end of the project. For this reason, the IREEDER Project includes a sustainability plan as shown in Table 1.

**Table 1: The Capacity Development Activities of the IREEDER Project**

| 1st YEAR<br><br>**Project initialization and preparatory actions** | 2nd YEAR<br><br>**Building course material and laboratory equipment** | 3rd YEAR<br><br>**Training to utilization** |
|---|---|---|
| Identifying training and teaching needs, verifying partners' facilities<br><br>Identifying teaching objectives, materials outlines and laboratories equipment | Preparing the teaching materials<br><br>Establishment of IoT, CS, RE laboratories in Jordan | Training workshops<br><br>Students training<br><br>Dissemination activities |

Based on these concepts, the IREEDER Project provides capacity development activities across the three topics for the staff and students of Jordanian Universities. The detailed procedures are introduced in the next paragraphs.

## 3. Implementation Structure of the IREEDER Project

The capacity development activities conducted by the IREEDER are based on the implementation structure as follows and shown in Figure 1:

- General Coordinator : Al-Hussein Bin Talal University (AHU), Jordan.
- Steering Committee (StC): The StC is composed of the project general coordinator and local contact person of each partner. It will deal with the overall management and decision-making process.
- Scientific and Supervising Committee (SSC): The SSC is composed of two representatives from each partner. The IREEDER SSC will supervise scientific and technical activities, guaranteeing quality and sustainability of the project through the activities and outputs.

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- Quality Monitoring Committee (QMC): The quality WP leader will form a quality monitoring committee, which contains two members from each partner, in the framework of this Quality Assurance Plan in charge of conducting an internal evaluation of the project. The QMC will organize the mechanisms to review all deliverables and reports from all other WPs from a quality point of view. QMC will also monitor the role of each partner and ensure its commitment to the project activities. The quality WP leader will deliver a total of three monitoring reports during the project eligibility period and submit them for approval to the QMC and the Steering Committee.
- Coordinator of each WP: For each WP there is a coordinating institution, which provides reports to the Steering Committee for approval.
- Peer reviewing team: Evaluates and review each item linked to the project teaching deliverables (including syllabus, curriculum, program, contents, labs, …).
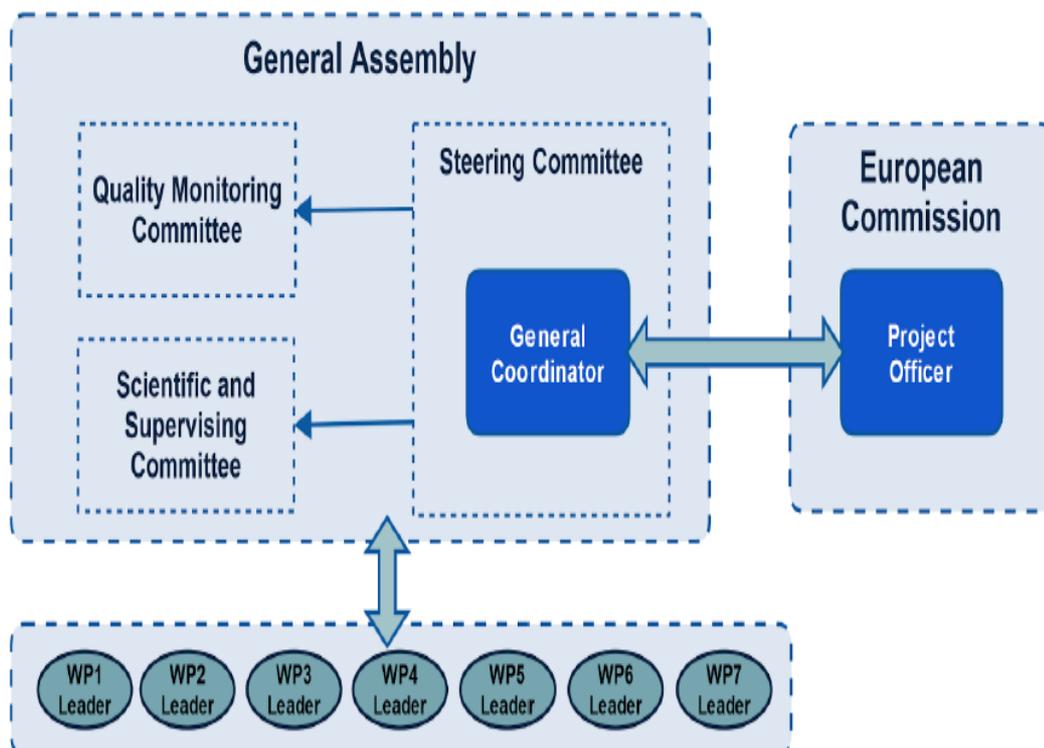


**Figure 1: Implementation Structure of the IREEDER project**

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# 4. Project Cycle Management (PCM)

Project Cycle Management (PCM) is the method of management proposed for IREEDER. It can be applied to all proposed courses of the three training themes or other project activities and aims at achieving specific goal(s) or objective(s) within a specific timeframe, as a summary of PSM tasks ins shown in Figure 2.
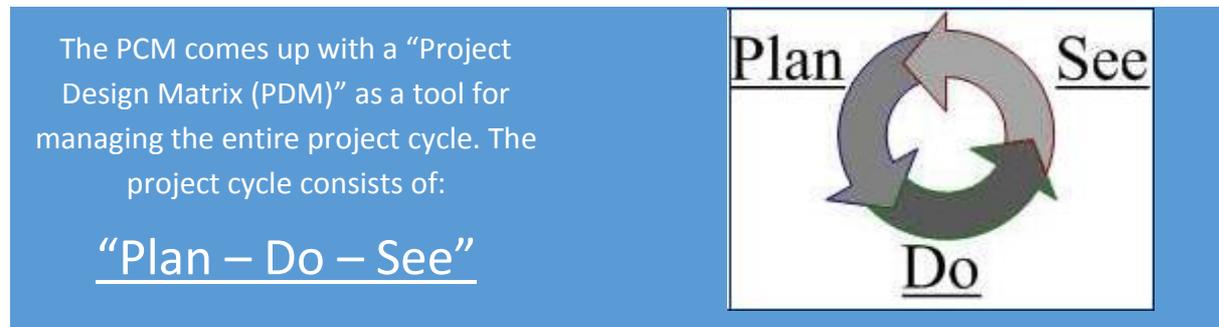
The PCM comes up with a "Project Design Matrix (PDM)" as a tool for managing the entire project cycle. The project cycle consists of:

## "Plan – Do – See"

**Figure 2: PCM tasks for IREEDER project**

The PCM cycle is explained as follows:

- Plan: A written account of a future training course or other project activity aimed at achieving specific goal(s) and objective(s) within a specific timeframe. It explains in detail what needs to be done, when, how and by whom.
- Do: To implement, to direct and to monitor all steps in their proper sequence.
- See: To review the steps (process), to evaluate to what extent the objectives are accomplished, to extract any lessons learned from the process and results, and to come up with recommendations and short-/long-term actions.

The PCM, proposed for the IREEDER project, has some advantages:

- Participatory Approach: Participants are able to be engaged in the analysis equitably, thus nurturing a sense of ownership.
- Logic: Due to the nature of the IREEDER project, it has to be formulated logically, based on problem analysis and the Project Design Matrix (PDM).
- Consistency: The project cycle is managed consistently.

The PCM has mainly six (6) components, as shown in Figure 3, to make a plan. The project monitors the activities based on the Plan of Operation (PO, implementation schedule and responsible persons), and evaluates the progress of the project along with the indicators on the PDM.
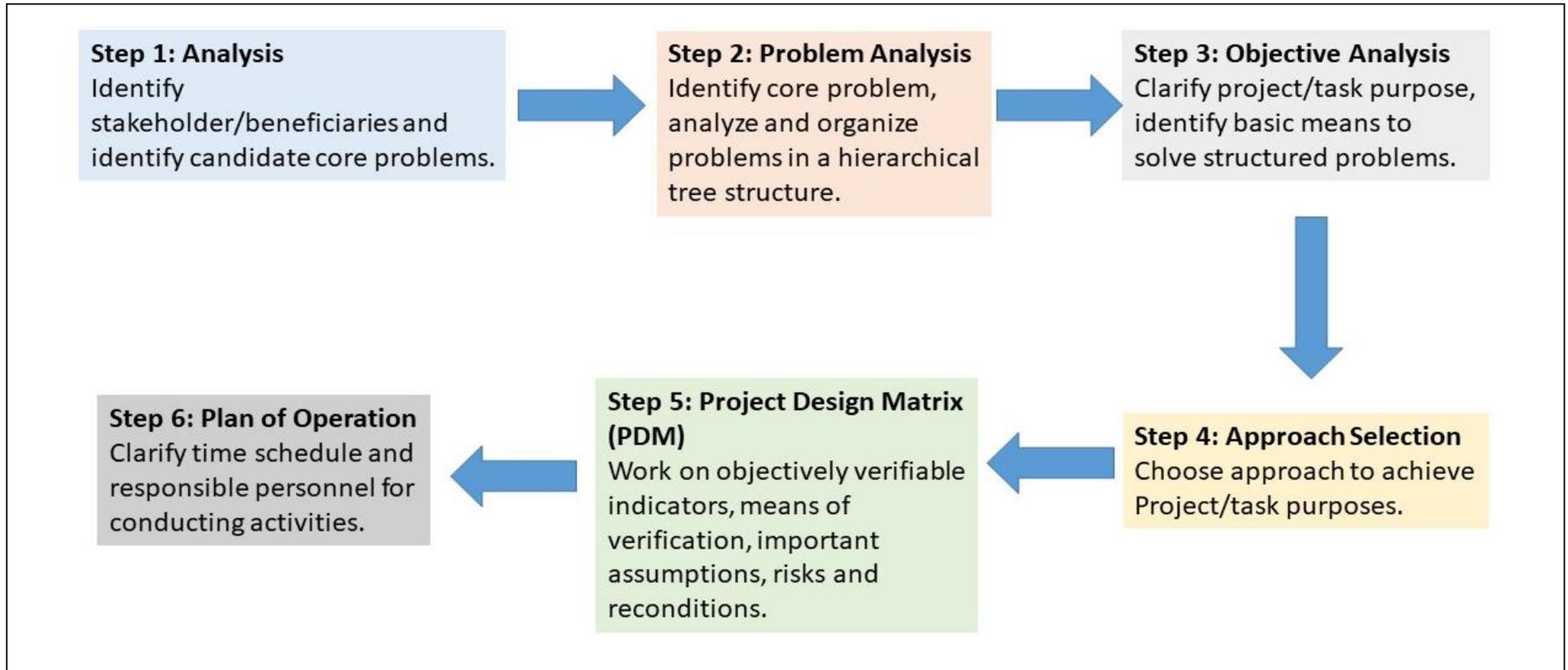
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**Figure 3: The Procedure of PCM**

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A template of the PDM is presented in Figure 4. The PDM does not have a time schedule, a person in charge, an implementer, input or any other remarks. Thus, the Plan of Operation (PO) is made besides the PDM. The members of the IREEDER project implement their activities. The General Coordinator and the Steering Committee monitor the progress of the project based on the PO. Whenever there is a delay, they investigate the causes and take appropriate action. At the same time, they check to what extent the indicators of output and project purpose on the PDM have come to the expected levels. If they do not, they have to reconsider the means of approach (activities).

| Narrative Summary | Objectively Verifiable Indicators | Means of Verification | Important assumptions/risks |
|---|---|---|---|
| Overall Goal: What is expected after the project's purpose is achieved? | Standards for measuring project achievements | Data sources from which indicators are derived | Important but uncontrollable factors of the project |
| Project Purpose: What should the project achieve within the project period | | | |
| Outputs: How should the project achieve the project's purpose? | | | |
| Activities: What should be done to achieve the output? | Input: Personnel, material, equipment, facilities and funds required for the project | | Pre-conditions: Preliminary actions before the beginning of activities |

**Figure 4 Project Design Matrix (PDM)**

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The proposed PDM for the IREEDER project is presented below:

| Overall Goal | Standards of measuring project achievements | Data sources from which indicators are derived | Important but uncontrollable factors of the project |
|---|---|---|---|
| IREEDER project is to improve the capacities of higher education, using state of the art technology and training staff on improving the quality of the materials taught by making best use of these technologies. The developed materials will be oriented to the recent technologies in electrical engineering including RE, IoT and CS, in addition to their different applications. | Producing the new teaching materials. The availability of the teaching materials for all stakeholders. Holding the training workshops at Europe and later in Jordan. Holding the dissemination workshops in Jordan. | Number of academic departments in the Jordanian partners that adopt the materials in their curricula. Number of staff and technicians trained in Europe. Number of students enrolled in the developed subjects. | |
| **Project Purpose** Develop, integrate, accredit and evaluate subjects with appropriate laboratories' components in the fields of RE, IoT and CS taught by universities in Jordan. These subjects will be developed and taught by English language. Engage faculty in the development of interactive instruction techniques for lectures, laboratory subjects, and sharing experiences with EU artner universities. Develop and implement subject content using Virtual Learning Environment (VLE) delivery and remote labs. Extend services and training in collaboration with the industry firms | | Number of academic departments in the Jordanian partners that adopt the materials in their curricula. Size of the attendance at the training workshops. Size of the attendance at the dissemination workshops A satisfaction survey among all stakeholders. | The continuation of the authorities to support the project Commitment from all partners to all project activities. All the Jordanian partners will adopt the developed subjects into their curricula. Jordanian partners do not accredit the developed subjects in their programmes. |

| | | | The weak contributions from a partner or more. Weak interest in the project from the stakeholders especially the industrial firms in Jordan |
|---|---|---|---|
| and local communities. Improve the human capacity of Jordanian<br><br>universities by providing training and upgrading opportunities in the EU for aspiring young and women academic staff | | | Political and security issues hinder the mobility of the trainees to Europe.<br>Involvement of faculty staff project activities.<br>Weak interest of the students in the developed subjects. |
| **Outputs:**<br>WP1<br>1.1 Kick-off meeting<br>1.2 Identifying training and teaching needs<br>1.3 Verifying partners' facilities.<br>WP2<br>2.1 Setting teaching objectives and materials' outline | WP1:<br>1.1 holding the Kick off meeting at AHU and forming the committees<br>1.2 Distributing the questionnaire and preparing the report based on it. | WP1:<br>1.1 The number of partners attending the Kick off meeting, and finalizing the committees' lists.<br>1.2 Delivering the report on time. | All partners can easily travel and attend all meetings without problems related to travel and visas.<br>All partners will commit to the project activities |

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|---|---|---|---|
| 2.2 **Teaching** materials | 1.3 Distributing the survey among partners and preparing the report based on it. | 1.3: Delivering the report on time. | and deliverables' deadlines. |
| WP3 | | | Political stability of |
| 3.1 Development of capacity building plan | WP2: | WP2: | Jordan (or Middle East) |
| 3.2 Identification of general equipment of laboratories | 2.1 collecting the contributions from partners and examining them to prepare the report. | 2.1 Delivering thereport on time. | and measures for COVID19 will not affect |
| 3.3 Training reports | 2.2 Collecting the contributions from all partners and merging them in the final materials. | 2.2 Delivering the teaching materials on time. | the mobility of the project partners and the |
| 3.4 Training reposrts in Jordan | | | implementation of the |
| WP4 | | WP3: | project. |
| 4.1 The first annual quality assurance report | | 3.1 Delivering the capacity building plan on time. | The allocated budget for equipment will cover |
| 4.2 The second annual quality assurance report | WP3: | 3.2 Delivering the report on time. | them. |
| 4.3 The third annual quality assurance report | 3.1 Receiving the contributions from partners. | 3.3 The number of trainees attending and delivering the training reports on time. | Jordanian partners can adopt the developed |
| 4.4 The mid-term evaluation report | 3.2 Receiving the contributions from partners. | | teaching materials. |
| 4.5 The final evaluation report | 3.3 Holding training workshops in the EU partners | 3.4 The number of trainees attending, and the number of the held workshops. | All Jordanian partners will allocate the space |
| WP5 | | | (rooms) to establish the |
| 5.1 Elaboration of the sustainability plan | 3.4 Holding the training workshops in Jordan. | WP4 : Delivering all reports on their scheduled time. | labs. |
| 5.2 Student training | WP4: | WP5: | Jordanian faculty |
| 5.3 Setting up e-learning module | Receiving the contributions from partners | 5.1Delevering the sustainability plan on time. | members will have the |
| 5.4 Final-year graduation projects | WP5: | | interest to learn and |
| WP6 | | | |
| 6.1 Development of dissemination plan | | | |
| 6.2 Communication plan and promotion materials | | | |

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| | | | |
|---|---|---|---|
| 6.3 The first dissemination workshop 6.4 The second dissemination workshop<br>WP7<br>7.1 IREEDER plenary meetings<br>7.2 IREEDER website and communication platform<br>7.3 Financial auditing report | 5.1 Receiving the contributions from partners.<br>5.2 Holding training workshops for the students in the Jordanian universities.<br>5.3 Lunching the e-learning module in the project website.<br>5.4 Enrolling final-year students in graduation project related to RE, IoT and CS.<br>WP6:<br>6.1 Receiving the contributions from all partners.<br>6.2 Preparing the communication plan the promotion materials.<br><br>6.3, 6.4 Holding the first and second dissemination workshop in Jordan.<br>WP7:<br>7.1 Coordinating plenary meetings<br>7.2 Lunching the IREEDER website. | 5.2 The number of the training workshops and the number of the attending students.<br>5.3 Feedback from the users of the e-learning module.<br>5.4 Number of graduation project accomplished and number of students.<br>WP6:<br>6.1 Delivering the dissemination plan on time.<br>6.2 Feedback about the communication plan, and the number of promotion materials.<br>6.3 Number of the stakeholders attending the dissemination workshop.<br>6.4 Number of the stakeholders attending the dissemination workshop.<br>WP7:<br>7.1 The meetings minutes. | teach the new materials.<br>A partner or more cannot attend the project meetings and workshops.<br>Insufficient contribution to a deliverable or more.<br>The allocated budget is not enough to purchase the lab equipment.<br>A delay in the accreditation process of the developed subjects.<br>A delay in the procedure of establishing the labs and establishing the equipment |

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| | 7.3 Selecting the auditing office and the availability of all required documents. | 7.2 Number of the visitors and their feedback.<br>7.3 Delivering the financial auditing report on time. | |
|---|---|---|---|
| Activities:<br>WP1<br>Holding the kick off meeting at AHU and forming the committees.<br>Preparing the questionnaire and distributing it among stakeholders.<br>Preparing the survey about the partner facilities and distributing it among partners.<br>Preparing the two deliverables.<br>WP2<br>Preparing the teaching objectives and the materials' outline for each topic RE, IoT and CS.<br>Preparing the three teaching materials for RE, IoT and CS.<br>WP3<br>Preparing the capacity building plan<br>Establishing IoT, Re and CS labs at AHU, MU and TTU respectively<br>Holding IoT, RE and CS workshops at UCLAN, UPAt and UVigo respectively | Inputs<br>WP1:<br>Mobility of at least 2 representatives from each partner to AHU.<br>Adequate staff days for all partners<br>WP2 and WP3:<br>Adequate staff days for al partners<br>IoT, RE and CS education platforms.<br>Remote server and virtual lab software at each Jordanian partner<br>Mobility for 15 trainees from Jordan to UCLAN, UPAT and UVigo<br>Mobility for 15 trainees to AHU, MU and TTU<br>Adequate staff days for all partners<br>WP5 and 6:<br>Adequate staff days for all partners<br>WP7:<br>Mobility for at least 2 representatives from all partners to project meetings | | Preconditions<br>Political stability in Jordan.<br>The presence of the willing to start the project among all partners.<br>The previous experience of EU partners in similar projects<br>The previous experience of partners in capacity building programs in Re, IoT and CS.<br>The ability of all trainees to attend the training workshops in Europe. |

**Figure 5 The proposed Project Design Matrix (PDM) for the IREEDER project**

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The proposed template of the Plan of Operation (PO), on a year basis, for the IREEDER project is presented below:

| Work Package | Task | Deliverable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Responsible Person | Working Group | Output | Cost | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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**Figure 6 Plan of Operation (PO) for the IREEDER project**

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## 5. Monitoring and Evaluation Framework

For the monitoring and evaluation of the IREEDER project, the following frameworks are proposed.

**Monitoring Framework**

| Activities | Monitoring targets | Monitoring tools | Venue | Monitoring body |
|---|---|---|---|---|
| Training Courses | Contents of training courses<br><br>Attitude and responses of the lecturer to trainees<br><br>Appropriate and plain explanation of the lecturer<br><br>Good atmosphere to activate free discussion and question<br><br>Time management | Training Plan (Training targets, curriculum, time schedule, etc.)<br><br>Monitoring Sheet | Classroom | SSC, WP Coordinators |
| Post-Training Activity (Action Plan) | Appropriateness of identifying core problem and problem analysis<br><br>Appropriate usage of PCM tools<br><br>Commitment of all members<br><br>Appropriateness of technical assistance/ advice and timing | Presentation Reports<br><br>The ppt slides and/or documents | Classroom | SSC, QMC |

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| | | | | |
|---|---|---|---|---|
| | from lecture to trainees<br><br>Time management | | | |
| Task Team Activities<br><br>(Implementation of Action Plan) | Implementation of planned activities in schedule or not<br><br>Team building<br><br>Commitment of all members to the Task Team activity<br><br>Identification of impeding factors and counter measures | Observation of daily works<br><br>Plan of Operation<br><br>Technical report<br><br>Interview and discussion to member and concerned people | Scheduled meeting with Task Teams Scheduledl<br><br>Meeting with SSC | WP Coordinator |
| SSC | Progress of capacity development activities in each WP<br><br>Progress of Task Team activities | Report from WP Coordinator at scheduled meetings | Scheduled meetings | General Coordinator |
| StC | Overall management and decision-making process | Reports from SSC | Scheduled meetings | General Coordinator |
| QMC | Internal evaluation of the project | Project deliverables | Scheduled meetings | StC |

**Figure 7 The proposed Monitoring Framework for the IREEDER project**

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### Evaluation Framework

| Activities | Main Evaluation Targets | Indicators | Verified Resources | Evaluator |
|---|---|---|---|---|
| Training course | Trainees' attendance<br><br>Satisfaction rate<br><br>Training contents match needs<br><br>Utilization of trained skills and knowledge | More than 70% attendance rate<br><br>More than 80% satisfaction rate<br><br>More than 80% of training the contents match the needs<br><br>More than 60% of utilization of the trained kills and knowledge | Feedback sheet filled by the trainees after completion of the training course<br><br>Final reports of lecturers | SSC |
| Task team activities | Achievement of project purpose and planned activities<br><br>Incidents (experiences/lessons learnt) in implementation process | To what extend the project purpose is accomplished<br><br>To what extend the students understood how to use the obtained knowledge and skills<br><br>Lessons learned and good experiences of the task team | PDM presentation | SSC |

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| Organizational capacity development | To what extend the task teams have improved the organizational capacity development | Criteria defined by the Organization (Jordanian Universities) | Capacity assessment sheet | According to the internal procedures of the Organization |
|---|---|---|---|---|

**Figure 8 The proposed Evaluation Framework for the IREEDER project**

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# 6. Implementation Process

The Implementation Process has four (4) steps, as shown below, across the project duration. This section explains how to take these steps one by one.

| Step 1: Capacity Assessment | Identify/define the target level based on strategy, policies, mandates, etc.<br><br>Assess the current capacity which targets group (human resources, equipment) has.<br><br>Identify training needs |
|---|---|
| Step 2: Design of Training Program | Draft the framework of the training program.<br><br>Employ a facilitator to conduct the training.<br><br>Conduct a pre-training study for a detailed design of the training.<br><br>Set up a detailed schedule and contents of training.<br><br>Notify the details of the training to the participants |
| Step 3: Implementation and Monitoring | Arrange the venue and needed equipment.<br><br>Prepare an attendance sheet, feedback sheet (reflection sheet/questionnaire).<br><br>Implement the training.<br><br>Monitor the training participants and facilitator(s).<br><br>Let the participants fill in the feedback sheet.<br><br>Analyze the process of the training and the results of the feedback sheet |
| Step 4: Evaluation | Present the results to the project participants and the external evaluator and get any feedback.<br><br>Present the results to GC and senior staff in the Erasmus+ directorate. |

**Figure 9 Implementation Process of the IREEDER project**

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### STEP 1: Training Needs Analysis and Capacity Assessment

### 1.1 The Framework of Capacity Development Activities

Firstly, the IREEDER Project identifies (1) the capacity development needs of the target groups in RE, IoT and CS and (2) the level of existing capacity of the participants through survey and capacity assessments.

The training courses and other capacity development activities have to be designed to satisfy the needs of the Jordanian partners. However, the available resources (financial, physical and human) can limit the framework of the activities. It is important that the training planners have to seek the for best solutions considering the available resources.

In this section, the methodology of training needing analysis and capacity assessment is introduced.

### 1.2    The Procedure of Capacity Assessment

The IREEDER Project has a Work Package (WP1) dedicated to this scope that has two objectives:

•       To initialize the project by forming the different committees, assigning tasks, and elaborating agreements during the kick-off meeting.

•       To define the current knowledge and further needs of engineering students in the skills of the fields (IoT, CS, RE) with an emphasis on using these technologies in Jordan.

For the latter objective, the purpose is to find out the level of technical knowledge of the engineering students and to map possible competence gaps, and determine their interest and needs. This will help in the determination of the student potentials and profile for the IREEDER project, as well as highlighting the important issues to be included in the training and the best training methods. The teaching and training needs for IoT, CS and RE, are identified from a questionnaire distributed among all IREEDER partners and other stakeholders (universities, students, trainees, private companies, public administration).

Based on the results, the needs for the courses proposed by IREEDER are underlined and suggestions on the topics to be covered in the courses and the teaching material to be used are suggested.

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This input will be provided to WP2 and WP3 of the project to be analyzed and filtered by the experts within the IREEDER Consortium in order to define the contents of the courses and their implementation.

The most important findings of this survey will be used as guidelines when forming the teaching materials in WP2 and the selection of the laboratory equipment in WP3. The results are presented in detail in IREEDER Deliverable 1.2, entitled: "Identifying training and teaching needs".

Moreover, the facilities of all partners are reported in a survey to ensure continuity to the IREEDER project. The survey gathers information about the number of departments and students, laboratories, libraries, existing subjects for the project topics and their contents, number of academic staff members and their previous experiences, international relations, and many other facilities like the video conference instruments and halls. As a result, the differences in the facilities of the IREEDER project partner are reported as well as the availability of expertise in the three European partners who will be in-charge of the training workshops and courses in IoT, CS and RE. The results are presented in details in IREEDER Deliverable 1.3, entitled: "Verifying Partners' Facilities".

**STEP 2: Design of Contents for the three Training Themes**

**2.1 Selection of Contents of the Training Themes**

This step is to design the training program. The three training themes (IoT, CS and RE) have been selected in the proposal phase. During the implementation of the IREEDER project, the most appropriate contents of the training themes should be selected.

For the selection of the contents, three factors are considered: necessity, priority and appropriateness.

**(1)    Necessity**

The "Necessity" of the training is considered as a fundamental condition for a capacity building program and includes the necessity of:

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**Individuals:** In the IREEDER project, the target groups (expected trainees and students) have been identified. With the use of individual capacity assessment surveys and discussions among the project partners, the possible contents are analyzed as well as their urgency and/or importance for each training theme.

**Organizations:** The capacity development program is linked with the necessity of concerned organizations (Jordanian Universities). For this reason, fruitful discussions about the necessity are taking place with the project managers of the three training themes.

### (2)    Priority in the country policies and mandates

The "Priority" condition is to assess whether the contents of the three training themes are matched with and prioritized in country policies/plans and the mandates of each Jordanian University (as described in their course program).

It is also expected to take into account the available technical/knowledge transfer from the European partners and the budget restrictions of the IREEDER project.

### (3)    Appropriateness

Lastly, it has to be considered whether the selected training themes are appropriate areas as a means to develop the capacity development of the target organizations and groups. This process was fulfilled during the preparation of the IREEDER proposal and the selection of the appropriate Jordanian Universities/Departments and Primary Investigators (PIs).

### 2.2 Establishment of Training Framework

For the three training themes (IoT, CS and RE) of the IREEDER project, the training framework has to be established. The training framework means the main contents (purpose/outcome, outputs, activities and overall goal), trainees and venue.

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In order to establish the training framework, the PCM methodology can be used. Based on the results of individual capacity development sheets, the capacity gap and the development needs are identified.

### (1) To break down the factors which consist of training themes

For example, the concept of "Photovoltaic System Performance" may include many meanings and definitions, as presented in the following table.

**Typical meanings/definitions of "Photovoltaic System Performance"**

| Capacity | Typical definitions of the Capacity |
|---|---|
| Photovoltaic System Performance | Working in a useful way, accurate performance, efficient performance, fast execution, goal-oriented performance |

The **"goal-oriented performance"** is considered as the most effective definition for "Photovoltaic System Performance" in the IREEDER project. The "goal-oriented performance" requires many basic skills beforehand, e.g. the training planners/facilitators should have knowledge on how to establish a "goal" and how to plan a training method. In IREEDER, the training planners (University Professors) are capable to assess the existing level (intermediate or advance) of trainees, and design the training course to be matched with the speed of trainees' comprehensions. The details are in the next section (Annual Plan of Capacity Development).

### (2) Annual Plan of Capacity Development

Based on the previous knowledge of the IREEDER partners in the teaching of the three training themes, the extent of the capacity gap of trainees is assessed (including the laboratory equipment and exercises). In general, a teaching class is consisted of having students with different strong and weak points.

Concerning the training planners, it was revealed from the kick-off meeting that all Jordanian Universities are considered as strong organizations that have a vision and a concrete capacity development plan and conduct related activities strategically. As the result, all Jordanian partners can utilize their human resource efficiently and effectively.

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Therefore, it is proposed to establish a long-term capacity development goal (7-10 years) and a mid-term capacity development goal (3-5 years). The long-term and mid-term goals should be closely linked with the capacity development priorities of the Jordanian Universities. However, the approach to the goals can be yearly reviewed, and revised in the annual plan.

The annual plan includes;

- Expected outputs from training themes and training courses
- Learning outcomes and objectives
- Literature/reference updates
- Time schedule
- Target group (number of students, qualification, etc.)
- Planned venue
- Budget (cost) for teaching materials, training planners/lecturers, visual aids, reports, etc.

The annual plan should be submitted to the concerned administration by the due date of the next academic year's plan and budget.

### (3)    Selection of an external facilitator (lecturer)

Apart from the experienced permanent staff of the Jordanian Universities, there is always possible to add external facilitators for specific seminars on the three selected training themes, laboratory assistance etc. During the establishment of the annual plan of capacity development, these training facilitators could be assigned. The appropriateness can be assessed by criteria such as: educational background, experiences as a facilitator/lecturer, expertise on training theme, quality of the proposal, reputation etc. A typical scheme of the selection process is proposed. For each Jordanian University, the scheme should also adapt the institutional regulations.

**Actual Schedule for the selection of facilitators**

| 1 | Decide the procedure of selection |
|---|---|
| 2 | Prepare terms of reference of facilitators of the 3 training themes to be announced in public |
| 3 | Classification of terms of reference in public |
| 4 | Review proposal papers (1st Selection) |
| 5 | Make 1st selection and list for interview |
| 6 | Interview with candidate facilitators |

| 7 | Final Selection |
|---|---|

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## 2.3 Design of a Training Course

### (1)    Draft design of training curriculum and type of training

As discussed above, the results of the surveys can help the project team to identify the most important topics that need to be included in each of the course. Based on these, a full teaching outline of each course (IoT, CS and RE) is prepared. The draft design of training curriculum and type of training forms a useful tool for project partners in order to prepare the teaching material. In this case, a clear idea about the teaching objectives in the phase of preparing the teaching slides is provided. Moreover, the trainers know exactly what teaching materials they will use and how to reach the intended aims.

In general, for all three training themes the following contents are proposed for the design of the training curriculum:

- Generation Course Details (Title, ECTS, Prerequisites, Academic Level)

- Course Aims and Learning Outcomes

- Weekly Schedule and Teaching outline for each Week

- Teaching, Learning and Assessment Strategy Description

- Assessment Methods and Pass requirements

- Scheduled Activity durations

- Bibliography

*Course Aims and Learning Outcomes*

For the definition of the aims and learning outcomes of each course, the Blooms Taxonomy terminology is proposed.

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**Active Verbs in Bloom's Taxonomy**

## Active verbs developed based on Bloom's Taxonomy

| Knowledge | Understand | Apply | Analyze | Evaluate | Create |
|---|---|---|---|---|---|
| define | explain | solve | analyze | reframe | design |
| identify | describe | apply | compare | criticize | compose |
| describe | interpret | illustrate | classify | evaluate | create |
| label | paraphrase | modify | contrast | order | plan |
| list | summarize | use | distinguish | appraise | combine |
| name | classify | calculate | infer | judge | formulate |
| state | compare | change | separate | support | invent |
| match | differentiate | choose | explain | compare | hypothesize |
| recognize | discuss | demonstrate | select | decide | substitute |
| select | distinguish | discover | categorize | discriminate | write |
| examine | extend | experiment | connect | recommend | compile |
| locate | predict | relate | differentiate | summarize | construct |
| memorize | associate | show | discriminate | assess | develop |
| quote | contrast | sketch | divide | choose | generalize |
| recall | convert | complete | order | convince | integrate |
| reproduce | demonstrate | construct | point out | defend | modify |
| tabulate | estimate | dramatize | prioritize | estimate | organize |
| tell | express | interpret | subdivide | find errors | prepare |
| copy | Identify | Manipulate | survey | grade | produce |
| discover | indicate | Paint | advertise | measure | rearrange |
| duplicate | Infer | Prepare | appraise | predict | rewrite |
| enumerate | relate | produce | Break down | rank | role-play |

_Weekly Schedule and Teaching outline for each Week_

The definition of weekly schedule and teaching outline should take into account the proposed number of weeks and hours for lectures and laboratory exercises by the Jordanian Universities. Moreover, the percentage of theoretical and practical sessions (as part of the full semester duration time) should be defined.

*Teaching, Learning and Assessment Strategy Description*

A strategy is needed to define how teaching should be carried out to facilitate learning as well as how the course will be assessed. A typical teaching scheme for all three training themes is proposed including at the beginning the fundamental aspects, followed by deeper knowledge, while current trends/future aspects in each theme are presented at the end of the semester. The practical courses should support the lectures allowing a discovery/engineering/problem-solving approach to learning. The assessment is designed to assess both the students' comprehension of theoretical topics through the written exam (interim and final), their practical and investigative/research skills through a coursework assignment which will include a practical project based on the work carried out in the lab and an investigative/research question.

*Assessment Methods and Pass requirements*

The following table includes a list of the proposed assessment elements linked with their weighting, size and the learning outcomes, as well as the pass requirements.

| Number of Assessments | Form of Assessments (e.g. Mid-term/final exams, practical coursework) | Weighting % | Size of Assessment /Duration/Wordcount | Learning Outcomes being assessed |
|---|---|---|---|---|
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| **Pass Requirements**. |  |  |  |  |

*Scheduled Activity durations*

The following table is proposed for the scheduled activity duration. It includes the expected number of hours that should be spent in class, the time that the student should spend for guided independent study and the total number of ECTS.

| *Scheduled Teaching* | Hours |
|---|---|
| Lectures |  |
| Practical sessions |  |
| Project Work in the lab |  |

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| | |
|---|---|
| Exams | |
| **Total Scheduled hours** | |
| **Guided Independent Study** | |
| Directed Reading and Investigations | |
| Preparation for practical sessions | |
| Work on Coursework | |
| Preparation for Exams | |
| **Total Guided Independent Study** | |
| **TOTAL SCHEDULED ACTIVITY** (25hours per 1ECTS) | |

*Bibliography*

The proposed bibliography could include recent, possibly free online, books or references in the literature. It is proposed that the bibliography may be separated to "Required" and "Additional".

### *Aspects of Capacity Development in Designing Training Courses*

The capacity development of the IREEDER project has three different aspects. One is to increase and widen the knowledge about theory, methods and systems. The second aspect is to develop skills, i.e. the adoption of new knowledge into practice and technical skills. The last aspect is to change (improve) trainee's attitude.
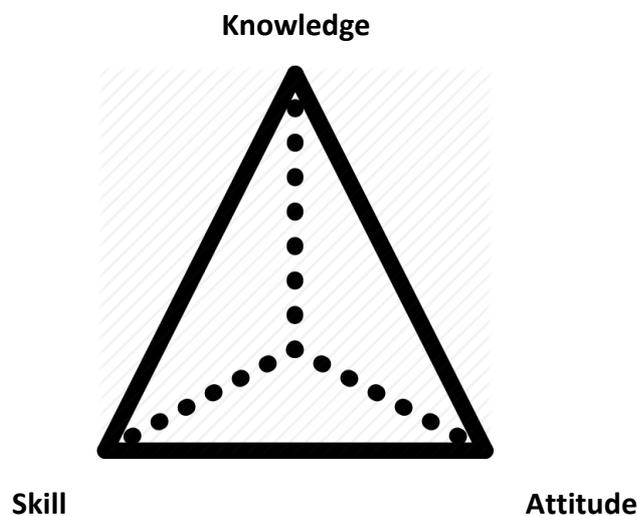
**Knowledge**



**Skill**　　　　　　　　　　　　　**Attitude**

**Figure 10 Three Aspects of Capacity Development for the IREEDER project**

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The IREEDER Project has prioritized that the trainees utilize the obtained knowledge and skills, rather than that they just participate in the training programs. Thus, in the IREEDER training courses, the trainees are required to follow practical sessions and prepare project works at the lab.

Moreover, apart from increasing the knowledge of the trainees with in-class training or skill training at the lab, attitude training is necessary to be conducted. A typical sample of considerations taken into account to design the IREEDER training courses is presented in the next table.

**Suitable considerations to design an IREEDER training course (Sample)**

| Aspect | Required Activities (in a case of "Renewable Energy") | Training Type |
|---|---|---|
| **Knowledge** | Photovoltaic system performance | In-class training about the concept<br><br>Outline of methodology<br><br>Comprehension about the system<br><br>Case studies |
| **Skill** | Motivate people<br><br>Make decisions at the right time<br><br>Delegate responsibilities<br><br>Have good communication skills | In-class training about the concept<br><br>Lab course |
| **Attitude** | Learning from mistakes | In-class training about the concept<br><br>Lab course |

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**STEP 3: Implementation and Monitoring (Supervision)**

In the previous steps for the capacity building plan for the three training themes (IoT, CS and RE) of the IREDER project, the training themes and content have been decided. The next step refers to the implementation stage.

### 3.1 Preparation

Before starting a training course, the following preparation steps are proposed:

**(1)   Venue**

It has to be confirmed that the training venue is the appropriate size and has the available teaching facilities.

**(2)   Schedule (time table) and agenda**

The training schedule (time table) in cooperation with the facilitator(s) should be set.

**(3)   Notification to Participants**

An invitation/notification email/announcement and the details of the training to the participants is sent.

**(4)   Printed handouts**

Handouts are useful for trainees to understand the main points of the lecture and/or to review them. It is recommended for facilitator(s) to prepare any handouts for training beforehand.

**(5)   Required equipment**

It is recommended that visual aids are in working order before the training begins. Any feedback sheet to assess the reaction of the trainees after the training, and to reflect on the comments for the next training should be present.

### 3.2 Implementation

**(1)   Opening Session**

Suitable person(s) (e.g. IREEDER General Coordinator) may be asked to have opening remarks if necessary.

The facilitator(s) should be introduced to trainees.

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An orientation (briefing) about the training is given to the trainees about:

The purpose of training

Curriculum and time schedule

Usage of venue and laboratory

Strong commitment to the course work

Any other business

### (2)    Supervision

The facilitator performs the lecture/lab course but also monitors the progress of trainees since he understands their background (educational level, daily work, usage of technical terms, etc.). If any problems or difficulties of the trainees are noticed during the explanation from the lecturer, further explanations are needed.

"Time management" is also one of the important responsibilities of the facilitator.

Finally, in order to improve the quality of training, "recording" is crucial. The facilitator is expected to record comments and/or requests from the trainees and explain/discuss with them.

### (3)    Closing

The facilitator reviews and summarizes every session, and comment on the work/effort of the trainees during the training. Also, all participants are reminded about the necessity and importance to utilize knowledge and skill acquired in the laboratory courses.

At the end of the course, suitable person(s) (e.g. IREEDER General Coordinator) may be asked to offer the closing remarks

### 3.3 Reporting

A report is expected by the facilitator at the end of the training. The report has to mention, for example:

Overview of the training course

Actual curriculum and time table

Results of monitoring process for theoretical and lab courses

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Results of feedback sheet

Comments on the training

Lessons learnt from the training

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