

**BMBF R&D Project**

Funding No.: 02WM1355J

# **SMART-MOVE**

# **DELIVERABLES**

## **Task 6.4.2: Development of a Training Centre Concept for Sustainable Implementation of the “Research Site Fuheis“ as a Training Centre for Decentralized Wastewater Management in Jordan**

### **Deliverable 6.4- Capacity Development Measures in the Field of Wastewater Management**

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Table 1. Main Task 6.4.2 and distribution of partner's responsibilities

Task	Description	Responsible
Task 6.4.1	<b>Development of a training centre concept for sustainable implementation of the “research site Fuheis“ as a training centre for Decentralized Wastewater Management in Jordan</b>	BDZ
Task 6.4.2	Institutional anchoring and networking (website, recruitment of potential multipliers, technical and academic experts)	BAU
Task 6.4.3	<b>Development of an educational concept for technical experts (by using exemplary training materials)</b>	BDZ
Task 6.4.4	Implementation of a practical-technical course, Fuheis	BAU
Task 6.4.5	Implementation of a further training programme to promote acceptance (Fuheis and/or exemplary development region)	BAU

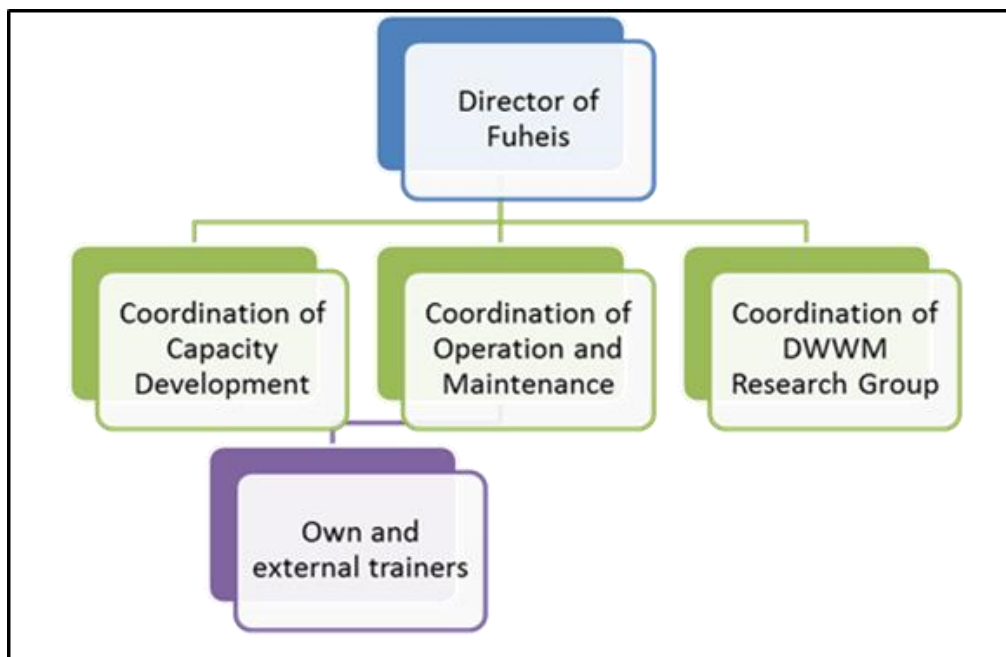
## 1 DEVELOPMENT OF A TRAINING CENTRE CONCEPT FOR SUSTAINABLE IMPLEMENTATION OF THE “RESEARCH SITE FUHEIS“ AS A TRAINING CENTRE FOR DECENTRALIZED WASTE

The key objective of SMART- MOVE project is to develop an integrated transfer of innovative technologies and management instruments to the water management practices through the generalized implementation concept in Jordan with the special attention to the development and adaptation of technologies and solutions that take into account the local conditions. This includes not only infrastructure facilities but also institutional and administrative frameworks, given the importance of achieving a long-term and sustainable operation of the system solutions developed.

The training centre concept was designed for a Competence Facility for Decentralized Wastewater Management (DWWM) Fuheis to promote its institutionalization and framework for sustainable operation. Based on SWOT analysis (strengths, weakness, opportunities and threats) of the current situation of the Fuheis site a developing strategy for sustainable functioning was established. This allowed building up the guideline for decision-making, creating new efforts and exploring future possibilities of the Competence Facility.

## 1.1 ORGANIZATIONAL DESIGN

Organizational design involves defining the overall direction for the Fuheis Competence Facility for DWWM. Based on the impression of the current situation of the Competence Facility for DWWM Fuheis obtained from the SWOT results and analysis, the Vision, Mission and organizational structure of the site were proposed (see Figure 1). The main suggestion was towards the support for the Director of the Competence Facility for DWWM Fuheis by creating three coordination teams.

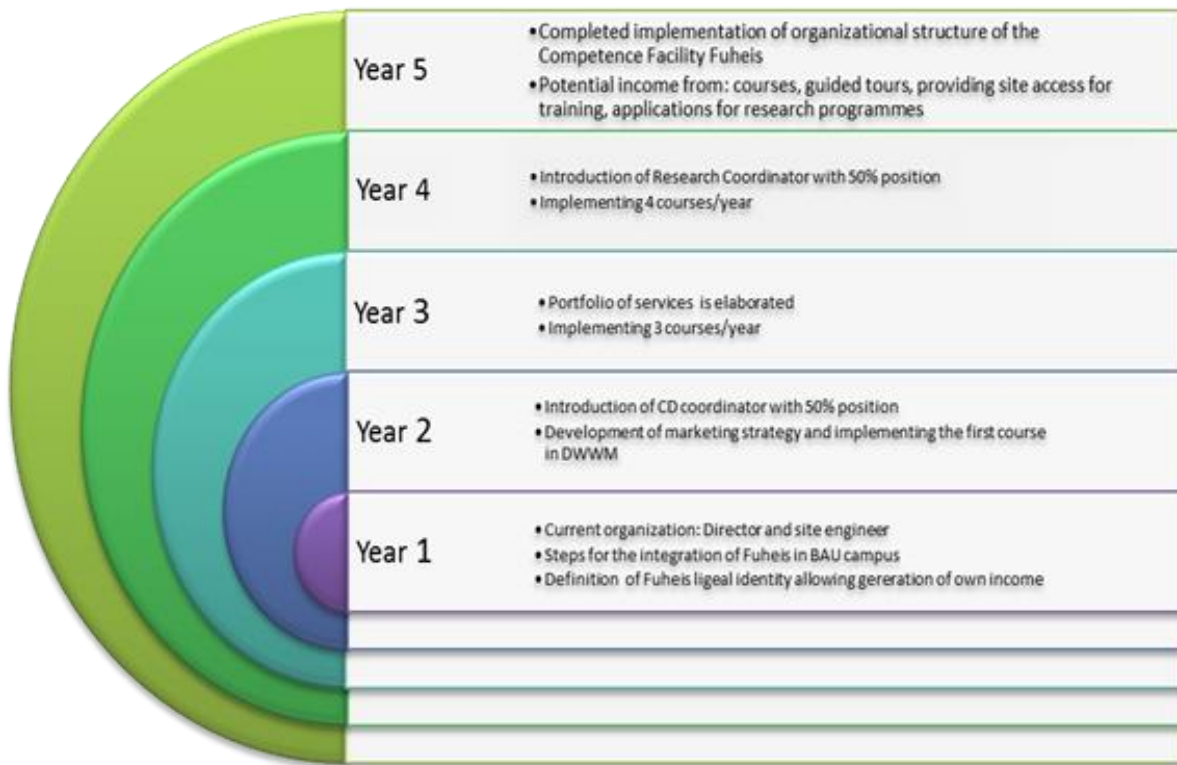


**Figure 1: Proposed organizational structure of the Competence Facility for Decentralized Wastewater Management Fuheis**

The **Director** is the legal representative of the Competence Facility for DWWM Fuheis. The main task of the Director is to coordinate the activities of Fuheis in a way that enables it to achieve its mission objectives. The approach will enable the Director to concentrate on coordination tasks, public relations, networking and searching for funding to ensure the financial sustainability of the Competence Facility for DWWM Fuheis.

The three coordination teams: **Coordination of the Research Group**, **Coordination team of Capacity Development** and **Technical coordination team for Operation and Maintenance** will coordinate activities according to their task. A group of **own and external trainers** will conduct the training modules and workshops planned for the Competence Facility for DWWM Fuheis.

Once the organization structure of the Competence Facility for DWWM Fuheis was identified, a step-by-step implementation is necessary as shown in Figure 2.



**Figure 2: Proposal of step-by-step implementation of the organizational structure of Fuheis Competence Facility**

## 1.2 FINANCIAL STRATEGY

For a financial suitability of Fuheis Competence Facility, future costs, possible sources of income and a combination of funding sources was identified.

Firstly, core funding will be needed for running Operation and Maintenance (O&M) costs and for the site's current personnel. It was proposed that the Competence Facility for DWWM Fuheis would be integrated into the Al- Balqa University campus and the site's O&M and personnel costs would be financed by BAU.

Secondly, complementary sources of income can be found in international research funding and funding derived from capacity development activities for which fees can be charged: training courses, guided tours, providing access to the site for training activities.

The Analysis of personnel and operating costs led to total annual costs (including personnel and operating costs) for the Competence Facility of 44,400 JDS, equivalent to 55,500 € a year. With the proposed organizational structure, the total annual personnel and operating costs would increase to 52,800 JDS, equivalent to 66,000 €. In addition to these personnel and operating costs, it was recommended to equip the site with the facilities required to conduct training courses on site in order to secure initial investments. Table 2 lists and quantifies the costs and potential income sources projected over the next five years.

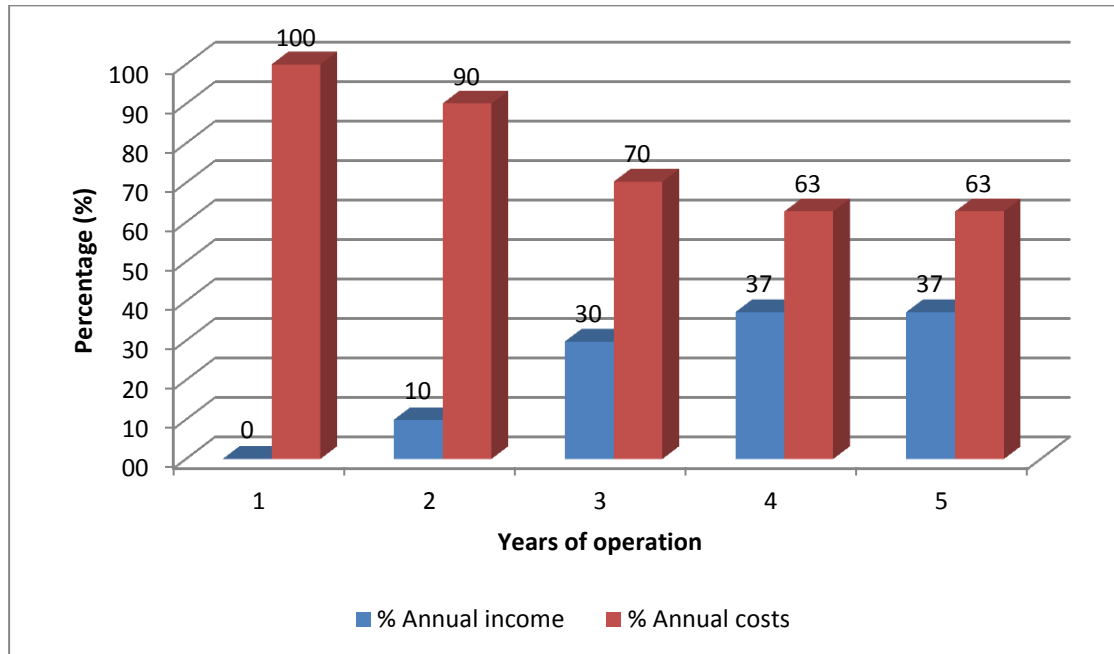
Table 2: Annual cost estimation for five- year operation of Competence Facility for DWWM Fuheis

Subject/item	Year 1		Year 2*		Year 3**		Year 4***		Year 5***	
	JDs	Euro	JDs	Euro	JDs	Euro	JDs	Euro	JDs	Euro
<b>PERSONNEL COSTS</b>										
Director (50% University staff)	9600	12,000	9600	12,000	9600	12,000	9600	12,000	9600	12,000
Coordinator of Capacity Development (50%)	0	0	4200	5,250	4200	5250	4200	5250	4200	5250
Coordinator of Research Group (50%)	0	0	0	0	0	0	4200	5250	4200	5250
Engineer 1	8400	10,500	8400	10,500	8400	10,500	8400	10,500	8400	10,500
Engineer 2	8400	10,500	8400	10,500	8400	10,500	8400	10,500	8400	10,500
Accountant	1200	1500	1200	1,500	1200	1500	1200	1500	1200	1500
Driver	3000	3750	3000	3,750	3000	3750	3000	3750	3000	3750
<b>SUBTOTAL</b>	<b>30,600</b>	<b>38,250</b>	<b>34,800</b>	<b>43,500</b>	<b>34,800</b>	<b>43,500</b>	<b>39,000</b>	<b>48,750</b>	<b>39,000</b>	<b>48,750</b>
<b>OPERATING COSTS</b>										
Electricity	3600	4500	3600	4,500	3600	4500	3600	4500	3600	4500
Treatment plants maintenance and spare parts	3600	4500	3600	4,500	3600	4500	3600	4500	3600	4500
Fuel and oil for car	3600	4500	3600	4,500	3600	4500	3600	4500	3600	4500
Office supplies	1200	1500	1200	1,500	1200	1500	1200	1500	1200	1500
Cleaning	1800	2250	1800	2,250	1800	2250	1800	2250	1800	2250
<b>SUBTOTAL</b>	<b>13,800</b>	<b>17,250</b>	<b>13,800</b>	<b>17,250</b>	<b>13,800</b>	<b>17,250</b>	<b>13,800</b>	<b>17,250</b>	<b>13,800</b>	<b>17,250</b>
Total annual costs	<b>44,400</b>	<b>55,500 €</b>	<b>48,600</b>	<b>60,750 €</b>	<b>48,600</b>	<b>60,750 €</b>	<b>52,800</b>	<b>66,000 €</b>	<b>52,800</b>	<b>66,000 €</b>
Potential income from courses	<b>0</b>	<b>0</b>	<b>4818</b>	<b>6023</b>	<b>14,454</b>	<b>18,068</b>	<b>19,272</b>	<b>24,090</b>	<b>19,272</b>	<b>24,090</b>
Potential income from guided tours and providing access to the site							<b>400.00</b>	<b>500.00</b>	<b>400.00</b>	<b>500.00</b>
<b>SUBTOTAL POTENTIAL INCOME</b>	<b>0</b>	<b>0</b>	<b>4818</b>	<b>6023</b>	<b>14,454</b>	<b>18,068</b>	<b>19,672</b>	<b>24,590</b>	<b>19,672</b>	<b>24,590</b>
<b>TOTAL ANNUAL COSTS</b>	<b>44,400</b>	<b>55,500</b>	<b>43,782</b>	<b>54,728</b>	<b>34,146</b>	<b>42,683</b>	<b>33,128</b>	<b>41,410</b>	<b>33,128</b>	<b>41,410</b>

\*1 year together with Director preparing a marketing strategy and running the first course

\*\* Portfolio of services ready and 3 courses being implemented.      \*\*\* 4 courses being implemented

According to the projection of income compared to costs over five years, shown in figure 3, the income derived from these activities will enable the Competence Facility to cover the personnel costs plus some additional costs.



**Figure 3: Five-years projection of annual income of Competence Facility for DWWM Fuheis by implementing capacity development activities, compared with costs**

### 1.3 EDUCATIONAL STRATEGY

Special attention was paid to promote a specific educational training strategy for the Competence Facility for DWWM Fuheis. An educational strategy will constitute the core purpose of the Fuheis site and means to develop capacities to contribute towards the implementation of an integral decentralized wastewater management and its acceptance in Jordan.

The Institutional Framework of the Competence Facility for DWWM Fuheis defines the training needs while Jordanian Government set up the goals in the wastewater management sector to increase the population's connection to sewer networks to 80% by the year 2025 (DWWM Policy, 2016). Moreover, the Ministry of Water and Irrigation MWI of Jordan pointed out the necessity to increase capacities in the public and private sector in terms of planning, implementation and operation (DWWM Policy, 2016). According to DWWM Policy, several topics are selected of great importance, such as economic feasibility, scenario development and comparison, analysis of costs, GIS (Geographic Information System) based decision-support tool, urban planning, participatory planning, selection of technologies, operation and maintenance and monitoring of technologies which define regulatory, managerial and technical aspects for decision-makers to use as leading points for implementing DWWM projects in Jordan.

## 2 DEVELOPMENT OF AN EDUCATIONAL CONCEPT FOR TECHNICAL EXPERTS (BY USING EXAMPLARY TRAINING MATERIALS)

The institutional framework of the Competence Facility for DWWM Fuheis is based on educational training strategy which constitutes to develop capacities and contributes towards the implementation of integrated DWWM in Jordan. To address this issue, BDZ e.V. designed and developed a separate educational concept for implementing technical training course integrating the special challenges Jordan is facing. Educational concept contains the material for two specific training modules on:

- I. Operation of DWWT technologies
- II. Maintenance and Monitoring of DWWT technologies

The content of the modules is listed in this chapter and the concept, including the two example sets of teaching materials, was presented in a separate document as part of the products of the project to be delivered by BDZ to Al- Balqa Applied University.

### 2.1 METHODOLOGICAL APPROACH

The main objective of the training unit is to support the capacities of trainees by providing technical knowledge of DWWM, operation, maintenance of decentralized wastewater treatment and reuse technologies. Awareness levels related to water situation, managerial and regulatory tools of DWWM as well as technical aspects constituted the content of the knowledge transfer. By mean of this, analytical, critical, behaviour, and real –technical problem solutions skills were be developed during the training process.

The model “Training the Trainers” was applied as a possibility to preliminary deliver the knowledge to the trainers who will recall learned information teaching other personnel.

Additionally, didactic- methodological principles were expanded to technical and decision- making skills through vocational and practical education with the focus on the development of participants’ skills and capabilities, as shown in figure 4.

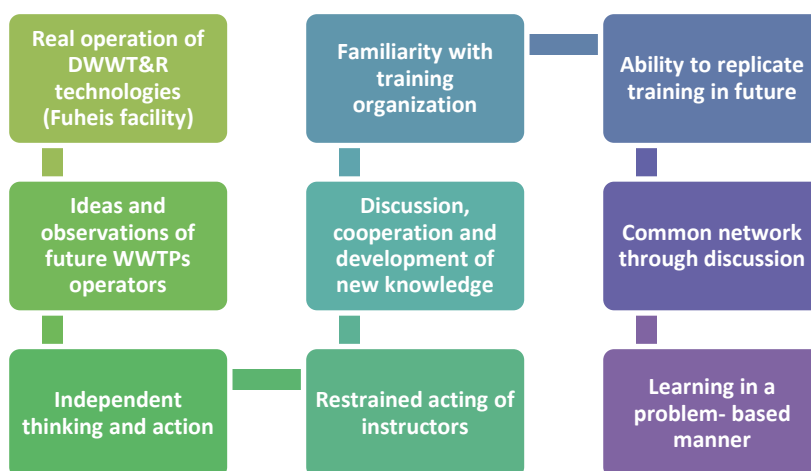


Figure 4: Methodological characteristics of training modules

## 2.2 TRAINING COURSE ON OPERATION OF DECENTRALIZED WASTEWATER TREATMENT TECHNOLOGIES

Accurate operation of decentralized wastewater treatment technologies is a clear need to ensure long-term sustainable treatment processes. Thus, within the framework of educational strategy of the Competence Facility for DWWM Fuheis, a training course on operation of decentralized wastewater treatment was developed.

As a part of this activity, educational training materials were designed in 4 main components and 13 teaching modules as shown in figure 5.

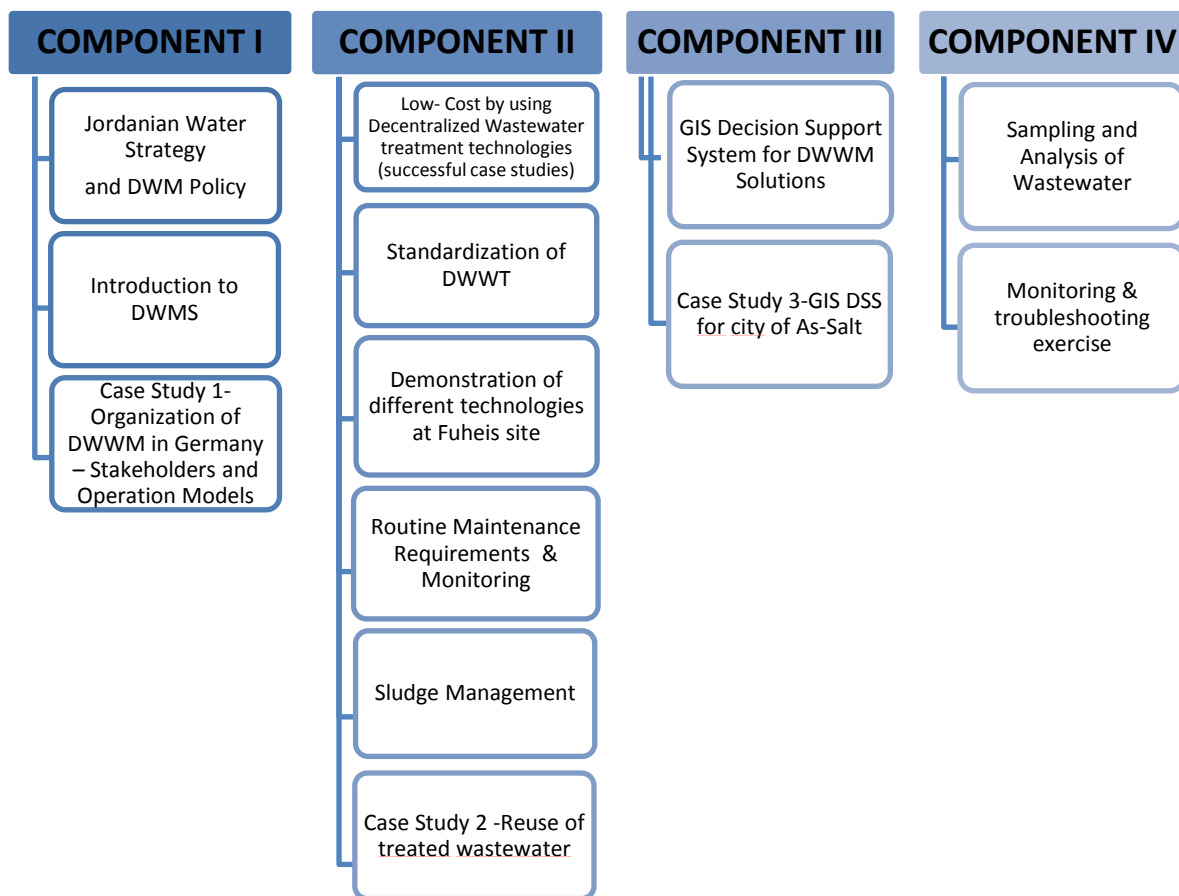


Figure 5: Teaching components and modules of training course on DWWTs

## 2.3 TRAINING COURSE ON MAINTENANCE AND MONITORING OF DECENTRALIZED WASTEWATER TREATMENT TECHNOLOGIES

Teaching materials for training course on maintenance and monitoring of DWWT technologies were developed to introduce routine maintenance requirements of decentralized technologies, maintenance of wastewater collection system and primary treatment (e.g. septic tank), and other treatment technologies installed at the Competence Facility for DWWM Fuheis. The materials were also focusing on checklist of parameters (operation of pumps, distribution system and sludge level),



emergency operating and response programme, troubleshooting, sampling and wastewater analytics as well as protocols and remote monitoring.

The description of modules is presented in table 3.

**Table 3: Description of modules for training course on maintenance and monitoring of DWWT technologies**

Module	Main aspects
Routine maintenance requirements	<ul style="list-style-type: none"> <li>• Periodic inspections and performed tests of DWWT</li> <li>• Scheduled maintenance</li> <li>• Operation and Maintenance manual</li> </ul>
Performance inspection of indicators	<ul style="list-style-type: none"> <li>• Qualitative O&amp;M (visual observations, operability and reliability)</li> <li>• Quantitative O&amp;M (time demand, residuals, chemical use, power consumption)</li> </ul>
Collection system	<ul style="list-style-type: none"> <li>• Inventory systems</li> <li>• Condition assessment</li> <li>• Corrective maintenance to specific elements, equipment, situations</li> <li>• Risk of system failure</li> <li>• Preventive maintenance</li> <li>• Emergencies</li> </ul>
Primary treatment	<ul style="list-style-type: none"> <li>• Septic tank Modified septic tank – aerated system suspended growth</li> <li>• Modified septic tank - attached growth</li> </ul>
Sequencing batch reactor	<ul style="list-style-type: none"> <li>• Regular maintenance of SBR</li> <li>• Operating the SBR</li> </ul>
UV lamp as a part of modified sequencing batch reactor	<ul style="list-style-type: none"> <li>• How does UV lamp work?</li> <li>• Regular maintenance of UV lamp</li> <li>• Important information</li> <li>• Operating UV lamp</li> <li>• Cleaning procedure</li> <li>• Replacement of UV Lamps</li> <li>• Sampling of wastewater after UV disinfection</li> </ul>
SBR Puroo	<ul style="list-style-type: none"> <li>• How does SBR Puroo work?</li> <li>• Regular maintenance of SBR Puroo</li> <li>• Important information</li> <li>• Operating the SBR Puroo</li> <li>• Operating of SBR Puroo control system</li> <li>• General information of operation SBR Puroo control unit</li> </ul>
Eco- technologies	<ul style="list-style-type: none"> <li>• Regular maintenance of eco-technologies</li> <li>• Important information</li> <li>• Operating the eco-technologies</li> </ul>

	<ul style="list-style-type: none"> <li>• Influent distribution systems</li> <li>• Flow-splitting device the RVF</li> <li>• Aerating system</li> </ul>
Sludge drying bed for eco-technological sludge mineralization	<ul style="list-style-type: none"> <li>• How does sludge drying bed work?</li> <li>• Unplanted/ planted sludge drying bed</li> <li>• Regular maintenance of sludge drying bed</li> <li>• Operating the sludge drying bed</li> </ul>
Emergency operating and response programme	<ul style="list-style-type: none"> <li>• Emergency Response Programme (ERP)</li> <li>• Example of emergency response plan, actions lists templates</li> </ul>
Troubleshooting	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Cause</li> <li>• Check</li> <li>• Solution</li> </ul>
Safety with work of wastewater treatment facility	<ul style="list-style-type: none"> <li>• Safety regulations</li> <li>• Confined-space entry</li> <li>• Lockout</li> <li>• Personal protective equipment (PPE)</li> </ul>
Sampling and analytics of wastewater	<ul style="list-style-type: none"> <li>• Quality assurance</li> <li>• Types of analysis</li> <li>• Physical characteristics</li> <li>• Chemical parameters</li> </ul>
Records, reporting, protocol and remote monitoring	<ul style="list-style-type: none"> <li>• Checklists</li> <li>• Contractor data</li> <li>• Maintenance log</li> <li>• O&amp;M protocol and report</li> <li>• DiWa 5 Software</li> </ul>

### 3 CONCLUSION AND RECOMMENDATIONS

The newly proposed organization strategy will alter the current status of operation and personnel costs. Therefore, the main focus of the financial strategy was towards estimation of revenues and expenditures (including personnel costs for coordinators of CD O&M and research group, two site engineers, a director, an accountant and a driver), required infrastructure, O&M, and possible sources of income. Capacity development activities (e.g. technical training courses, general guided tours and renting of the site for other training organizations) will contribute to the revenue generation of the Competence Facility for DWWM Fuheis. Additionally, a proposed coordinator of Research and Development will allow Al- Balqa Applied University to apply for grants to conduct research projects. International research funding and funding derived from capacity development activities will be able to secure the financial resources and support with laboratory and technical equipment at the Competence Facility for DWWM Fuheis. However, the integration of the Competence Facility for DWWM Fuheis into Al- Balqa Applied University campus will be crucial. Therefore, the property of the land where Competence Facility for DWWM Fuheis is located has to be clarified with Water Authority of Jordan (WAJ) since it is the current owner of the land.

The recommended educational training strategy for the Competence Facility for DWWM Fuheis is a part of its institutional framework and presents the core purpose of the Competence Facility Fuheis to develop capacities and contribute towards the implementation of integrated decentralized wastewater management and its acceptance in Jordan. Therefore an educational concept for technical experts was elaborated and technical training course on decentralized wastewater treatment solutions was conducted with participation of water engineers from Water Authority of Jordan (WAJ), master students and Laboratory Technicians at Al- Balqa Applied University and engineers from Royal Scientific Centre. The educational concept included specific modules on Operation, Maintenance and Monitoring of DWWT technologies, and can be adapted for selected target groups (e.g. decision- makers, planners of DWWT, technical experts and operators of WWTPs as well as students (Bachelor, Master, PhD, users of WWTS, private sector, International Centre for Technical and Vocational Training in Amman, international cooperation institutions).

The formulated capacity development initiative requires a strategic approach that responds to the particular characteristics of the educational concept and fills the gaps in the theoretical and practical vocational education expands knowledge on DWWM and relevant water policies such as the current Jordanian Water Strategy and Decentralized Wastewater Policy. Consequently, the proposed approach to develop an educational concept for technical experts on operation, maintenance and monitoring allowed applying CD instruments that include workshops, hands-on experience and technical training measures targeting at enhancing the technical and academic viability of decentralized wastewater treatment and reuse solutions in Jordan.