DEFMA

"Research methodology for elaboration on training requirements & definition of learning outcomes"

(O1-A1)

PROMEA

November 2016

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1   Introduction

The first intellectual output of the project comprises of a series of activities that work towards defining the requirements and specifications for the developed VET program. The present report is the outcome of O1-A1, namely the "Instructions and tools for the collection and analysis of occupation and VET world evidence", which involves the definition of the methodological tools and guidelines required for the up-skilling of facility managers in modern environmental technologies and sustainable building services, as well as to define the learning outcomes of the DEFMA curriculum.

The methodology proposed by the present report will guide the subsequent information collection activities of the DEFMA project partners by addressing:

1. The selection of target groups and the appropriate research methods and information collection tools per target group (VET providers, field experts, sector representatives and stakeholders);
2. The methods of data processing and analysis.

Also, this document will provide a series of instructions and guidelines on the formulation of the DEFMA learning outcomes in terms of what a learner knows, understands and is able to do upon completion of the learning process, as well as the way to link learning outcomes with teaching and assessment methods & material.

Overall, the report is structured as follows: Section 1 sets the report structure and provides information about the field background. Section 2 describes the research methods to be employed for data collection and addresses key considerations for data analysis. Section 3 provides instructions for the formulation of the DEFMA learning outcomes and section 4 presents a coherent roadmap and action plan for the data collection.

1.1 Background

Facility management (FM) is a large and growing occupation across the EU, with more than 900,000 employees and an estimated volume of several hundred billion euros. Facility managers are responsible for a broad range of services including management and execution of maintenance activities, security and daily administrative tasks, and advising on energy efficiency and environmental management.

One of the major challenges from the introduction of energy efficiency measures is the shift of the wider building sector towards the increasing use of sensors and sophisticated electronic monitoring systems. Subsequently, latest environmental technologies and services have brought fundamental changes on workplace requirements. The increasing penetration of innovative environmental technologies in the building sector is expected to help cover for the existing green skills shortages for facility managers, as well as contribute to the digital upgrading of the workers. This is perhaps more evident in the case of middle-aged and approaching retirement facility managers (45+), who are less likely to take part in training compared to their younger colleagues, to up-skill themselves on key energy efficiency technologies.

In this framework, FM requires a workforce that has the ability to manage these innovative technologies to enhance maintenance management and increase energy efficiency, when at the same time it can communicate sustainability issues to the users of the built environment. Respectively, facility managers call for a combination of digital and environmental skills to maintain high performance buildings with significantly reduced energy and water consumption. The challenging aspect of the project is to match the facility managers' skills and competences with environmental/sustainability needs and relevant digital developments of the built environment, as well as to promote employability and mobility within the sector, across Europe.

1.2 Definitions of terms

Facility Managers

For the purposes of this methodology, and within the context defined in the Application Form, the term "FM" is used to describe an occupation that encompasses multiple disciplines to ensure functionality of the built environment (office blocks, shopping complexes, hospitals, etc.). In this context, "facility managers" are responsible for management and execution of maintenance activities, coordination of catering, security and daily administrative tasks, and advising on energy efficiency and environmental management. "Facility manager" may have different titles in partner countries, such as "business services manager", "support services manager" or "contracts manager", or even "estates manager".

A facility manager could work in either the public or private sector, but also work for a facilities management company, contracted to manage facilities for a number of organisations. In small companies, facilities management may be part of a general management role. In smaller buildings, the facility manager might have full responsibility for running it. On larger buildings, the facility manager may be in charge of a particular section/ task and report to a senior facility manager. The facility manager would also be the main point of contact for all people who work and/ or use the building, such as subcontractors, customers, other site professionals and the public.

The facility manager's duties would typically include:

- Managing office systems, which may include IT and technologically-advanced monitoring equipment

- Advising on energy efficiency, so as to ensure rational consumption of resources

- Communicating with the users of the building regarding maintenance issues, problems encountered when using the respective areas, such as

necessary or desirable repairs but in general developing working relationships with a wide range of people

- Making sure the building meets health and safety standards, and legal requirements

- Managing cleaning, waste disposal, catering, parking and security

- Managing large budgets and accounts

- Negotiating with contractors and suppliers

2   Data collection and research methods

The data collection of current and future sector training requirements in the DEFMA partnership countries will be a combination of field and desk research. For the implementation of field research, an online questionnaire will be developed and disseminated to relevant stakeholders in order to gather their views regarding the new digital and environmental skills requirements for facility managers. SNS will be responsible for the coordination of the activity, as well as for the compilation of collected data from all other partner countries, through the use of an online survey software platform.

Desk research will be conducted by collecting additional information and evidence to enhance the quantity and quality of information gathered through field research. A desk research template will assist the documentation of national and EU environmental regulations and a second one will facilitate the identification of best practices in existing environmental training for facility managers. The data will be gathered from secondary relevant sources of information, such as EU and national pages on environmental/energy regulations and existing environmental training programs for facility managers accordingly. The input received by partners through both field and desk research will guide the definition of the DEFMA learning outcomes.

2.1   Field research

The field research methodology will employ an online structured questionnaire; this approach is time and cost-efficient, and is expected to facilitate data collection, coding and analysis. The questionnaire will ask target groups to identify, prioritise, and describe areas and tasks on which the DEFMA learning materials should mostly be focused. The online questionnaire will be distributed via a survey hosting platform (i.e. Google Forms or EUSurvey), and the recipients will receive the link by e-mail.

2.1.1 Purpose and research questions

The purpose of the proposed methodology, according to the DEFMA Application Form, is to make available up-to-date, tailor-suited to occupational needs, modern "environmental" learning outcomes, appropriate to be integrated into existing VET offerings for facility managers. The questionnaire aims to collect and demonstrate the views of DEFMA target groups (VET providers, field experts, sector representatives and stakeholders), to address the following research questions:

a) Which are the current and future digital and environmental skill needs and training requirements for facility managers arising from the dynamic penetration of innovative environmental technologies into the EU buildings market?

b) In which way the adoption of energy efficiency policies and measures at both national and EU level defines current and future training requirements for facility managers?

c) How well does the current training provision meet the needs of the modern building maintenance sector relating to advanced environmental technologies and innovative digital devices management and use?

The main aspects of the survey are defined in the DEFMA Application Form as follows:

- Thematic scope: Current and future training requirements for up-skilling facility managers in modern environmental technologies and sustainable building services.
- Target population: FM stakeholders (e.g. VET providers and trainers, field experts, sector representatives and associations).
- Geographical scope: Focus on the countries represented in the project consortium (United Kingdom, Italy, Bulgaria, Greece and Lithuania), and tentatively to other EU countries in which partners may have access through own networks.

2.1.2 Survey population

Taking into account the objectives of the survey, the population can be defined as stakeholders and experts who have an insight into the current and future skills required by professional facility managers in the field of modern environmental technologies and sustainable building services. An indicative list of target groups includes the following:

- VET providers and trainers for FM
    - o VET providers in the construction and building installation industry
    - o VET providers in the energy industry
    - o Associations of VET providers and trainers involved in the lifelong learning education of individuals that fit the profile of a facility manager
- Employers in the FM sector
    - o FM companies/ Building maintenance services companies
    - o Building installation companies
    - o Estate management companies
    - o Energy companies that offer building maintenance services
    - o Associations of employers in the FM sector
- Agencies and societies, specialised in renewable energy sources and saving
- Associations of employees in the FM sector

Possible sources to identify relevant stakeholders will be:

- ➢ National and European directories of energy efficiency measures
- ➢ National associations of FM/ building maintenance services companies
- ➢ Publications on the most used/ suggested advanced environmental technology systems for buildings
- ➢ Participants list from conferences, forums and workshops in own countries and EU

2.1.3 Sampling and performance indicators

An adequate number of data must be collected through field and desk research, to extract interesting information on sector requirements with regards to modern environmental technologies and sustainable building services skills.

The target for the collection of data has taken into consideration the degree to which FM is developed in each partner country and to a lesser extent the population proportion of the consortium countries. These estimates will be useful for tracking and monitoring the collection process in order to make sure sufficient evidence will be gathered.

Table 1: Consortium partners and target numbers of questionnaires

Consortium Partner	Consortium Country	Target number of questionnaires
SWC	United Kingdom (NI)	20-25
SummitSkills	United Kingdom	20-25
SNS	Italy	20-25
BGFMA	Bulgaria	20-25
PROMEA	Greece	10-15
VSRC	Lithuania	10-15
TOTAL		100-130

2.1.4 Process

The process and timeline for implementing the questionnaire survey has been agreed by DEFMA partners as follows:

- PROMEA will deliver the first draft of the methodology report by the 8th of November 2016. Feedback regarding the deliverable is expected from all partners by the 14th of November 2016. The final draft of the methodology will be distributed to all project partners by the 15th of November;
- All partners will identify a list of relevant stakeholders by 30th of November;
- Each partner will translate the survey questionnaire into own language by the 30th of November;
- PROMEA will develop the online versions of the questionnaire and upload them on an online survey software platform (i.e. Google Forms, or EUSurvey) by the 9th of December 2016;
- Each partner will reach own target groups to communicate the nature of the survey and ask for their participation by the 15th of December 2016. Overall, the survey will be running until the mid of January 2017, along with the desk research;
- Each partner will collect, analyse and present the outcomes of the data analysis for its own country, before forwarding country-specific data and outcomes to the task leader, SNS, by the 20th of January 2017;
- SNS is responsible for the coordination of the activity, compiling the collected data from all other partners, as well as the final data analysis. The estimated end date for the consolidation of data collected from all partners is the 31st of January.

In the following chart the above planned actions and the deadlines for the implementation of the DEFMA survey are depicted.

Table 2: Survey implementation on skill requirements

Project activity/ Months (up to)	November				December			January		February	March
	08/11	14/11	15/11	30/11	09/12	15/12	30/12	15/01	31/01	28/02	31/03
O1-A1/ Develop the research methodology and EN questionnaire	■										
O1-A1/ Review of methodology, feedback and update		■	■								
O1-A1/ List of relevant stakeholders by partners		■	■	■							
O1-A1/ Translation of the questionnaire by partners				■							
O1-A2/ Develop online versions of questionnaire					■						
O1-A2/ Questionnaires forward to target groups						■					
O1-A2/ Desk research			■	■	■	■	■	■			
O1-A2 / Field research						■	■	■			
O1-A3/ Consolidation of collected data									■		
O1-A3 / Draft report on learning outcomes										■	
O1-A3/ Final report on learning outcomes											■

2.2 Desk research / Literature review

Desk research will be conducted as a complementary means of information collection on environmental technologies and sustainable building services training requirements, including evidence gathering on:

a) Relevant environmental / energy regulations at EU level – responsibility of PROMEA

b) Relevant environmental / energy regulations at national level - responsibility of SummitSkills, SNS, BGFMA, VSRC, PROMEA

c) Existing environmental training programs for facility managers – responsibility of PROMEA

Evidence on training needs and job requirements in the building installation field will be gathered as cases of reference, and will be utilised to: a) identify skills mismatches, and b) formulate the DEFMA curriculum learning outcomes, as statements of what a learner knows, understands and is able to do upon completion of the learning process.

The information gathered by desk research aims to establish a satisfactory degree of basic and comprehensive pre-analysis, to be used by SNS for the preparation of the final data analysis and synthesis report. All partners are asked to compile their research findings in the form of desk research template provided in English, which will be included and analysed by SNS in the final learning outcomes report. Possible sources of information can be the outcomes of other relevant EU projects, the context of existing national, European-level and international analyses, existing academic and commercial environmental courses, case studies and surveys conducted for business organisations, governments and training providers.

2.2.1 Desk research guidelines

Regarding the collection of documentation of relevant environmental / energy regulations, a non-exhaustive list of the topics to be explored is listed below:

Relevant environmental/ energy regulations at national and EU level

The legislative / technical details / suggestions of
- *Building energy performance*
- *Green building maintenance*
- *Measures to reduce utility consumption*
- *Energy monitoring and auditing*
- *Smart energy technology adoption*
- *Prioritisation of energy saving measures*
- *Rational waste disposal*
- *Greener cleaning policies*
- *Integrated building management systems software*
- *Water reuse options*
- *Low-environmental impact materials during construction, renovation, etc.*
- *Sustainable building innovation*
- *Recycling practices*
- *Energy efficiency trends and policies*

Existing environmental training programs for facility managers in Europe

Some examples of training courses to look for, when carrying out the desk research on existing environmental training programs for facility managers, are cited below:

- Current training courses for facility managers on measures to reduce utility consumption
- Current training courses on energy efficiency technologies for facility managers
- Current training courses on energy monitoring and auditing technologies

The main components to look for when researching existing environmental training programs for facility managers could be:

- ➢ Current training modules on offer in Europe
- ➢ Main environmental / energy focus of the program
- ➢ Skills and qualifications they will lead to upon completion of such programs

3 Data processing and analysis

3.1 Field research

This section presents the steps for the aggregation and processing of the data gathered through the survey questionnaire. SNS, as the lead partner and coordinator of the activity, is responsible for validation, processing, and analysis of the data collected.

Step 1: Data validation & consolidation

Upon the completion of the survey, the data gathered will be validated and consolidated. Data validation is the process of determining the accuracy of data, to ensure compliance with project quality requirements. Information needs to be merged by compiling the large amount of data into one large worksheet, including all aspects of the data involved. A pivot table report in MS Excel is recommended to be employed.

Step 2: Identifying variables and scales

For the purposes of this specific research, and following the questionnaire structure, variables used in the questionnaire will be defined as nominal, ordinal or interval to avoid invalid results.

- *Nominal or categorical variables* are based on mutually exclusive, but not ranked or ordered, categories. Yes/ no, multiple choice or demographic questions (e.g. country, job description etc.) are examples of nominal variables.

- *Ordinal variables* are based on categories that can be ordered or ranked, and therefore questions can include a rating scale. Offering an ordered set of choices, ordinal variables allow for the evaluation of priority issues, opinions or levels of agreement.

- *Interval variables* are based on categories which are ordered, and the intervals between the values of the variable are equal (e.g. a question to be answered on a 1-10 scale).

Step 3: Mapping and coding of responses

Prior to data processing, valid responses will be reviewed and mapped into specific variables based on the type of the question. In order to investigate possible relations between variables, more than one field can be combined. In case of ordinal variables (if required), responses can be coded in numerical values to facilitate quantitative processing.

Step 4: Statistical data processing

The Microsoft Excel application can be used to process the quantitative data collected. Also, a pivot table data summarisation tool can be used to automatically sort and combine data, and provide descriptive statistics and frequencies of the predefined data fields.

Step 5: Data analysis

Basic tools of descriptive statistics (i.e. counts, means, and percentages) should be employed, where permitted by the questions, to extract trends and conclusions from target groups' replies. For rank order questions, the creation of a statistics table including the minimum and maximum ranking, mean ranking variation, standards of deviation and total responses for each skill is recommended. Moreover, graphs such as pies, columns and bars should be generated to analyse and present the results of the questionnaire; it is easier to observe a pattern emerging from a set of data when it is visually depicted.

3.2   Desk research

This section presents the steps for the aggregation and processing of the evidence gathered through desk research. Each project partner is responsible for data validation and processing, as well as the analysis of the evidence collected.

The suggested – but not necessarily the only – approach to fill in the desk research templates, when the information is fragmented, is the method of "open coding"; this method should be employed for analysing qualitative data retrieved from different sources during the stage of desk research. The rationale is that the analysis of qualitative research requires the organisation, retrieval and interpretation of large amounts of information. Open coding includes labelling concepts, defining and developing categories based on their properties and dimensions, which enables researchers (i.e. project partners) to identify and compile information from different sources.

The first step when reviewing and analysing a number of textual documents is to go through the data, identify the most relevant facts and mark them, using labels and keywords. This will make easier to compare data and identify relations, similarities and dissimilarities between different sources of information. Furthermore, keywords can be used in online search engines to retrieve additional information/data related to the industrial innovation eco-system under investigation. After collecting sufficient evidence from relevant secondary sources, project partners need to compile all data into one file and in the same form (e.g. textual document or info-graphics) to facilitate understanding and data processing.

At a later stage, partners need to review the evidence gathered, to identify similar data and create categories of information based on their common properties. Finally, all categories emerging from the data should be codified for easier reference during the research and for making easier the synthesis of desk research findings.

4 Instructions on how to formulate the learning outcomes, according to the EQF

4.1 Description of the European Qualification System (EQF)

The diversity of educational and training systems in Europe is challenging transparency, the comparability of national qualifications, as well as the need to set explicit standards for educational and training procedures. This has prompted the EU to adopt a pan-European educational framework that will bond national qualification systems within one context. The European Qualification Framework (EQF) constitutes the common European reference framework, which connects countries' qualifications systems increasing their transparency throughout Europe. The framework acts as a translation device to make national qualifications more readable and comparable across Europe, aiming to promote workers' and learners' mobility between countries and facilitate their lifelong learning.

EQF comprises eight reference levels based on "learning outcomes" (defined in terms of knowledge, skills and competences). This approach shifts the emphasis from input (type and duration of learning experience) to actual learning, i.e. to what a person is able to do upon the completion of a learning process. By shifting the focus to learning outcomes, the EQF manages to:

● Match the needs of the labour market with education and training offerings;
● Facilitate the transfer and use of qualifications across different countries and educational and/or training systems;
● Enable the validation of non-formal and informal education;
● Transfer units of learning outcome based on a credit system (ECVET).

4.2 The Learning Outcomes approach

The development of national qualifications frameworks with descriptors based on learning outcomes is a step towards making qualifications and levels of learning explicit. According to the EQF, a "*learning outcome*" is defined as a statement of what a learner knows, understands and is able to do upon the completion of a learning process. Moreover, learning outcomes are used as a basis for credit

transfer and accumulation (ECVET) and are specified in three categories dimensions (descriptors) - as knowledge, skills and competence, which can be described as follows:

Knowledge: The outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices related to a field of work or study. According to the EQF, knowledge is described as theoretical and/or factual.

Skills: The ability to apply knowledge and use know-how to complete tasks and solve problems. According to the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical skills (involving manual dexterity and the use of methods, material tools and instruments).

Competence: The proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work in study situations and in professional and personal development. According to the EQF, competence is described in terms of responsibility and autonomy.

In the context of the DEFMA project, the development of a VET curriculum for facility managers requires the acquired knowledge, skills and competences that will be recognised through an independent process based on accepted European standards. To this end, the DEFMA project aims to relate the developed VET program for modern environmental technologies and sustainable building services with the European Qualification Framework to facilitate mutual recognition and transfer of learning outcomes across EU. This subsection frames the data gathered with the EQF, ECVET and ESCO standards providing specific guidelines and instructions on how to formulate the learning outcomes in terms of statements of what a learner knows, understands and is able to do upon completion of the learning process and how to link them to the EQF levels.

4.3 EQF Levels and Learning Outcomes

Each one of the eight EQF reference levels represents a different set of requirements, defining the associated level of knowledge, skills, and competences. To ensure compatibility with EQF standards, the DEFMA learning outcomes need to be placed at one of the EQF reference levels, which range from basic (Level 1) to advanced (Level 8). Partners responsible for the classification of data gathered should link the learning outcomes to appropriate EQF levels by indicating the level of difficulty, and demonstrating what the learner will know, understand and be able to do upon the completion of learning processes in the context of DEFMA.

Table 3 depicts the European Qualification Framework for lifelong learning, whereas each of the eight levels comprises a distinct set of knowledge, skills, and competences. Most national qualifications frameworks complying with EQF usually place non-higher post-secondary training at level 4, or in some cases 5. After the completion of the research, the DEFMA learning outcomes are expected to correspond to levels 4 and 5 of the EQF (see table 3 below).

Table 3: Levels of the EQF defining learning outcomes

Level	Knowledge	Skills	Competence
Level 1	Basic general knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured context
Level 2	Basic factual knowledge of a field of work or study	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools	Work or study under supervision with some autonomy
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	Take responsibility for completion of tasks in work or study; adapt own behaviour to circumstances in solving problems
Level 4	**Factual and theoretical knowledge in broad contexts within a field of work or study**	**A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study**	**Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities**
Level 5	**Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge**	**A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems**	**Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others**
Level 6	Advanced knowledge of a field of work or study, involving a critical	Advanced skills, demonstrating mastery and innovation, required to solve	Manage complex technical or professional activities or projects, taking

	understanding of theories and principles	*complex and unpredictable problems in a specialised field of work or study*	*responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups*
Level 7	*1.Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research 2.Critical awareness of knowledge issues in a field and at the interface between different fields*	*Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields*	*Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams*
Level 8	*Knowledge at the most advanced frontier of a field of work or study and at the interface between fields*	*The most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice*	*Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research*

4.4 Application of the EQF system for the DEFMA learning outcomes

The following instructions are intended to support project partners to apply the learning outcomes-oriented EQF - ECVET approach in the development of the DEFMA curriculum.

What are the key characteristics of learning outcomes?

1. Learning outcomes should refer to qualifications, not to individual learners' specific development of skills and competences. This is because learning achievements may vary from learner to learner considering the different levels of progress and skill development. Consequently, when learning outcomes are to be described, they should refer on the learning achievements of an average learner.

2. Learning outcomes should be student-centred. Learning outcomes need to be described in such a way that their focus is on the learner and not on the teacher or the objectives that the curriculum needs to achieve.

3. All learning outcomes should be externally verifiable and measurable. They should be formulated in such a way that an evaluation process can be employed to determine whether the learner has actually achieved the learning outcomes. Moreover, orienting learning outcomes towards occupational activities and tasks makes it easier to determine assessment criteria.

4. Learning outcomes should refer to what the student knows and is able to do at the end of the learning process. In other words, learning outcomes should not describe the learning path or activity but the outcome following the completion of a learning process.

5. The type of learning methods and processes used to accomplish specific learning outcomes are not relevant with the description of learning outcomes.

6. There should be as many learning outcomes as needed to clearly reflect what students will learn from the course.

7. Each learning outcome statement should have a single primary purpose rather than a dual or compound purpose. A dual outcome may be problematic if a student demonstrates achievement in one area but not in another. In such a case, it is better to formulate two distinct learning outcomes.

How are good learning outcomes formulated?

Use active, clearly comprehensible verbs: It should be ensured that active verbs (e.g. "explain", "develop", "select", "analyse") will be used in the formulation of learning outcomes. Such verbs should describe measurable and observable actions and tasks and can be supplemented and combined with sector specific verbs. Ambiguous verbs such as "to be familiar with" should be avoided. Box 1 provides a list of active verbs that can be used for the descriptors of knowledge, skills and competence.

Specify and contextualise the active verb: Learning outcomes should be specified and contextualised in terms of what the knowledge and ability refer to. The formulation of learning outcomes should consist of a verb and the related object as well as an additional sentence describing the context. Example: He is able to analyse the *function* of cloud computing.

Avoid vague and indefinite formulation: Learning outcomes should be neither too general that they become indistinct nor too concrete so that modules becoming inflexible. Simple and unambiguous terminology that is easily comprehensible to learners should be used. Academic jargon should be avoided. Last, learning outcomes should not contain evaluating words such as "good", "simple", "efficient", "successful" etc.

Set minimum requirements for achieving learning outcomes: Learning outcomes should comprehensibly describe the minimum demands for achieving/validating a unit of learning outcomes, i.e. all learning outcomes which are necessary for fulfilling the tasks in the sense of a complete vocational activity should be listed.

Table 4: List of active verbs corresponding to formulation of learning outcomes

Qualification	List of active verbs
Knowledge	*Arrange, define, describe, duplicate, identify, label, list, name, match, memorise, outline, order, select, determine, present, have knowledge of, gather, classify, explain, write, recognise, measure, emphasise, repeat, report, know, state, reproduce, recall, relate, recognize, etc.*
Skills	*Draft, infer, analyse, alter, apply, argue, assemble, itemise, split, demonstrate, express, choose, influence, substantiate, provide examples, name, report, describe, designate, judge, assess, present, diagnose, discuss, illustrate by example, conduct, classify, categorise, assign, discover, design, develop, elucidate, recognise, explain, calculate, compile, expand, tell, manufacture, evaluate, produce, find, conclude, formulate, contrast, devise, generate, question, indicate, identify, illustrate, integrate, interpret, clarify, criticise, teach, praise, solve, modify, rearrange, recreate, rewrite, use, arrange, organise, plan, practice, justify, regulate, represent, collect, create, appreciate, deduce, write, refer to, structure, synthesise, divide, separate, test, translate, shape, rephrase, outline, paraphrase, differentiate, investigate, subdivide, transform, visualise, connect, compare, verify, defend, utilise, predict, prepare, display, project, suggest, select, appraise, show, summarise, etc.*
Competence	*Lead a team, instruct trainees, act independently, monitor work processes, assume responsibility, etc.*

4.5   Organisation of Learning Outcomes into Units

What is a unit of learning outcomes?

A unit is a component of a qualification, consisting of a detailed set of knowledge, skills and competences that can be evaluated, validated and certified. Units enable progressive achievement through transfer and accumulation of learning outcomes. Units of learning outcomes can be specific to a single qualification or common to several qualifications, and may also describe so-called 'additional' qualifications, which are not part of a formal qualification or curriculum. Learning units are subject to assessment and validation which verify whether the learner has achieved the learning outcomes expected. Furthermore, ECVET requires the use

of units to facilitate the transfer, recognition and accumulation of assessed learning outcomes of individuals who are aiming to develop an occupational profile.

How are units of learning outcomes determined?

A unit of learning outcomes should provide a comprehensive and consistent learning process. The criteria that need to be taken into consideration are the following:

- Units of learning outcomes should be developed as independently as possible of each other.
- Units of learning outcomes should be structured in such a way that the relevant learning outcomes can be achieved in a specific time interval. Units of learning outcomes should include all necessary learning outcomes.
- Units of learning outcomes should be assessable.

How should the learning outcomes and units be described in DEFMA?

To ensure compatibility with EQF standards, the DEFMA learning outcomes should be comprehensively described in the context of a coherent description as a matrix, subdivided into individual elements of knowledge, skills and competence. This description mode is clearly structured regarding the subsequent assessment of learning outcomes and enables the comparison with the respective national curricula. The title of the unit of learning outcomes should be clear and comprehensible, and reflect the content of the unit. Tables 5.1 and 5.2 below provide examples of possible DEFMA learning outcomes description following the above EQF system.

Table 5.1: Example of DEFMA Learning Outcome - Mode of Description

Learning Unit 1	**Cost-effective ways to reduce energy bills**		
Learning outcomes corresponding to **EQF Level 4**	*Understand the central role a facility manager plays in implementing sustainable solutions to achieve better performing buildings.*		
	Knowledge	*Skills*	*Competence*
	Knows/Aware of: *Distinguish between no-cost and low-cost measures for buildings.*	*Able to:* *Judge the specific measures a FM can implement towards energy reduction in utility bills.*	*Able to:* *Communicate the benefits and business opportunities from the good practices in the management of energy consumption.*
	Be aware of energy policies.	*Learn how to introduce an energy efficiency campaign.*	*Monitor work processes in buildings' energy performance.*

Table 5.2: Example of DEFMA Learning Outcome - Mode of Description

Learning Unit 2	**Smart building controls to minimize the consumption of resources, e.g. heating (thermal efficiency).**		
Learning outcomes corresponding to **EQF Level 5**	*Understand the need for a facility manager to shift from a reactive (i.e. fix things by reacting and responding to a call) attitude towards a proactive (i.e. use business tools to see issues before they become problems) attitude.*		
	Knowledge	Skills	Competence
	<u>Knows/Aware of:</u> Analyse the influence of the use of low-environmental impact materials to enable clean building, both for residents and for professionals. Be aware on where and how information control systems and monitoring/diagnostic systems can be implemented in the overall project.	<u>Able to:</u> Judge the needs and business opportunities from a system perspective that a heat-insulated green house in future must have. Understand the different methods and materials with which a building can be efficiently insulated.	<u>Able to:</u> Describe the benefits and business opportunities that an efficiently-insulated building may offer. Describe the innovation process of eco-insulating an existing building.