

Requirements for competence modelling in professional learning: experience from the water sector

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ABSTRACT

Competence Models are proved as critical instruments for human resources management and development, and of determined for both the labour market (employers) for the selection of the employees and training providers for the enhancement of the vocational training opportunities. The concept of competence modeling is still under development and considerable efforts are focused on the creation of new Competence Models and their application to a broad range of professional learning sectors. The scope of this inquiry is to contribute to this research field by setting the basis for the design and development of a Competence Model for the Water Sector.

1. Introduction

Nowadays, Competence Models become more and more inextricable tools for the selection of employees by the enterprises and professional employers, and for the design and delivery of up-to-date vocational education and training opportunities. Learners, employees and individuals have the chance to improve their knowledge and skills, match their qualifications with specific job requirements and become specialized in new technologies all over the world. Models for measuring and analyzing all these acquired competences (knowledge, skills and expertise) by individuals and expressing the needed competences of each profession are required.

Human resources experts have to match the employees' competences (knowledge, skills and experience) to mandatory and desired requirements of a profession or specialization. Since there are no guidelines or standardized formats, for the representations of competences, job requirements have to be performed manually in each case and each study. Juri *et al.* (2007) intended to initiate the outlines for matching competences and job profiles requirements in order to improve the description of job professions and enhance the learner achievement descriptions.

Fundamental objectives of vocational training programmes are the skills acquisition and the assessment of the employees' competences using a Competence Model to describe business and employers' needs, and requirements for skilled workers. Additionally, traditional professional trainings have been proved too

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theoretical and failed to satisfy the demands of rapidly changing post-industrial society (Lester, 1995, Wood, 1988). On the other hand, changes in learning methods, as well as increasing support of learning processes by IT science suggest that the quality and outcomes of the existent professional learning should be considered.

The gap between knowledge-oriented education and labour market needs has led to an increased attention for competence-based learning and training (Sampson and Fytros, 2009). Competence-based learning refers to the formal and informal education and training activities that individuals should meet in order to build and/or improve competences in a specific field, given some personal or employment related motives (Griffin, 1999, Aspin and Chapman, 2000, Field, 2001).

Stanley *et al* (1993) confirmed the gulf between education and practice in the continuing medical education and suggested a model of self-directed learning, connecting competences and practice and adopting experience in the professional learning process.

As a result, developing Competence Models for different job profiles and professional sectors is the key element for the reorganization of vocational education and training programmes and the company/industry search for specialized and competitive employees.

Responding to the need for developing sector specific Competence Models, WACOM (www.wacom-project.eu), Water Competence Model Transfer, is a European Project in the context of Lifelong Learning Program which intends to support employees and learners with the identification of required competences and qualifications for a specific working place. WACOM transfers the European Qualification Framework (EQF) and the German reference Model for the Competence Modeling PAS 1093 into the European Water Sector vocational education and training. First, the developing Competence Model is adapted in the field of sewage treatment plants management and secondly it will be transferred to other fields of the Water Sector and other professional sectors.

2. The Concept of Competence Modeling

2.1. Defining a Competence

McClelland (1973) was the first to introduce the term “Competences” into the human resources literature. His work “Testing for Competence Rather Than for Intelligence” was delivered to the United States Information Agency for improving their selection procedures of employees. Competences represent “the knowledge, skills, traits, attitudes, self-concepts, values or motives directly related to job performance or important life outcomes and shown to differentiate between superior and average performers” (McClelland, 1973).

In general, a competence is the capability of applying or using knowledge, skills, abilities, behaviours, and personal characteristics to successfully perform critical work tasks. Personal characteristics may be mental/intellectual, social/emotional, and physical/psychomotor/attributes necessary to perform these tasks (Dubois, 1993, Lucia and Lepsinger, 1999). Some competences are identified as more important or essential than others for a specific working place. The level of their importance may vary depending on the required tasks of the profession (Boyatzis, 1982) and should be taken in care during the design and development of Competence Models.

Moreover, there are also similar competences for a large scale of occupations that are characterized as “Core Competences” (Rothwell, 2002). Spencer and Spencer (1993) mark the core competences as occupational competences of individuals. Core competences could be reading, writing, computation, listening, questioning, speaking, cognitive, individual responsibility and self-esteem, management of resources (time, money, people and information), interpersonal relations, and information and technological. In a higher level, more complicated competences for personal development might include

systems of thinking, willingness to learn, mental modeling, shared visioning, team learning, self-knowledge, short-/long-term memory, subject matter knowledge, enjoyment of learning and work, flexibility, persistence and confidence, sense and urgency, honesty, giving respect to other, and initiative (McClelland, 1973, Rothwell, 2002, Ennis, 2008). Next, a combination of job-related competences and personal competences (for behaviour) follow (Delamare Le Deist and Winterton, 2005). Finally, the competences focus on the specific tasks of work, professional specialization, position or responsibility and are related more to the requirements that the industry and the labour market are setting (Ennis, 2008).

According to the European Reference Framework “Key Competences for Lifelong Learning” (2007), the competences can be grouped in 8 categories of “key-competences” for a successful profession in a knowledge society: communication in the mother language, communication in foreign languages, mathematical competence and basic competences in science and technology, digital competence, learning to learn, social and civic competences, sense of initiative and entrepreneurship and Cultural awareness and expression.

In another definition competences are defined as an integrated set of skills, knowledge, and attitudes that enables one to effectively perform the activities of a given occupation or function to the standards expected in employment (International Board of standards for Training, performance and Instruction, 2006)

A new approach based on EQF and PAS 1093 concludes the definition of a Competence as the ability to reasonably and intentionally perform a specific job and task in an unknown situation with success: Competences encompass a combination of knowledge, skills, and (intentional) behaviour and are constituted by defined activities for the observation and measurement. Competences are built and are normally demonstrated by individuals (but also by teams and whole organizations) (PAS 1093). In this paper we are following this approach as it is in line with the European policies, and required by the new knowledge and information societies as well as by the professional business, industries and enterprises.

2.2. Developing a Competence Model

A Competence Model is considered as a generic structure which is applicable beyond the built environment professions (Sampson and Fytros, 2009). It is also defined as a descriptive tool that identifies the competences needed to perform a role effectively in the organization and help the business meet its strategic objectives (Lucia and Lepsinger, 1999). Besides, industries/enterprises succeed to manage and develop the skills of their employees, recruit the most appropriate candidates and improve the quality of their offering services and products.

Competence Models depict a number of competences that are usually required for the successful accomplishment of a particular job, according to the tasks of work or professional specializations (Shippman *et al.*, 2000). These models can identify the needed skills, knowledge, behaviours and capabilities for the current and future staff selection in relation with the strategies and priorities of the industry/enterprise. They can enhance personal development by eliminating the gap between the required competences for a job profession and those that are available (Draganitis *et al.*, 2006).

It is essential, before the first steps of designing and developing a Competence Model to set a generic definition of the term “Competence”, which will satisfy all the explanations that are given throughout the literature. Sampson and Fytros (2008) expressed the aspect that a competence is comprised of three core dimensions: a) personal characteristic, b) proficiency level, and c) context. They also proposed a structure for a Competence Model, including four elements: a) name, which is the name of the competence, b) description, for a complete description of the competence, c) proficiency level in accordance to the performance of an activity, which consists of the “level” for describing different types of the proficiency level and the “scale” to represent the proficiency level, and d) context, which refers to a specific area of job, occupation or specific task that the competence is applied to.

A few years before, the initial steps in competence description had been realized through the IMS RDCEO (Reusable Definition of Competency or Educational Objective), IEEE RCD (Reusable Competency Definitions) and HR-XML Competencies (Measurable Characteristics) initiatives. The first one, IMS RDCEO specification (IMS RDEO, 2002) describes each competence with the following elements: a) identification, for the classification of a competence, b) title, as a short name of the competence, c) description of the competence, d) definition, as a detailed description of the competence, e) taxonomy, where the competence belongs, and f) personal information, as information of the individual. The second one, IEEE RCD specification provides a Competence definition in accordance with the one in the IMS RDCEO specification (IEEE P1484.20/D01, 2007). Finally, the HR-XML model (HR-XML, 2006) includes the same elements as IMS RDCEO and two extra: a) Measurable evidence, which is used to present the existence and the level of the competence, and b) Measurable weights, about the importance of the competence.

Recently, Juri *et al.* (2007) have introduced a new model for allowing advanced (semi-)automatic competence matching, since important information (like proficiency level and context) were missing from the previous schemas of IEEE RCD, IMS RDCEO and HR-XML.

A more concrete approach of the Competence Model definition emanates the PAS 1093 in combination with EQF. A Competence Model describes the competences required to successfully perform in a particular job and organization. This set of competences is then used as basis and standard for the description of specific jobs, the selection of new staff, the evaluation of the on-going performance of the whole staff, the analysis of training needs, and the classification and provision of tailor-made vocational education and training for competence development.

According to the PAS 1093, Competence Modeling is defined as a process for the planning, development, realization, and evaluation of methods and guidelines for the observation, measurement and evaluation of competences (that are not observable and not measurable) with the help of activities (that are observable and measurable) in human resource development.

2.3. Competence Modeling in the Water Sector

The established aspects of the shortage of precious water resources and the consequences of climate change have been the spark of a numerous European policies that have been developed and adopted for the protection and sustainable utilisation of water resources, creating a huge demand particularly in vocational education and training. Economic factors like privatisation and increasing cost pressure in water management are sharpening these educational needs leading to the demand for VET opportunities and products as short targeted.

The move to more friendly and environmental policies has led to the development of new technologies in the water industries as well as in the whole industry. This reveals the need for acquisition of higher level and specialised skills. Within the next years, the demand for up-skilled highly qualified employees is estimated to raise and especially for managers and professional occupations. In contrast, the decline of the labour market for unskilled plant and machine operative workers or workers with elementary knowledge is a concrete feature since the turn of the millennium.

The water industry is in close correlation to the safeguard of public health and commercial and industrial wellbeing of the economy. The continuous need for automatization of the industry services and the sophistication of the functional operation of the whole plant have increased the demands for a more accurate and competences-based training of employees and the supporting organizations.

Searching for already existing or applicable Competence Models in the Water Industries, reveals the absence of such models or other models are in the process of formation with the defining the needed competence for each group of employees at the first phase.

The Water Research Foundation in USA is going also to complete a relevant Competence Model at the end of 2012 (<http://www.waterresearchfoundation.org>).

Employment and Training Administration (ETA) has developed a complete Competence Model, which is applicable to the Water Sector and is depicted as a pyramid with 9 tiers, in accordance with the nature of the competences. Lower tiers (1-3) correspond to basic competences, which are fundamental in a large scale of job professions. Moving to the upper tiers, competences become more and specialized for satisfying the specifications of each working place and requirements of industry (technical competences). At the top of the pyramid (tiers 6-9), a number of occupational-competences are depicted. This model, which graphically represents the competences, is available in the web portal of US Department of Labor (<http://www.careeronestop.org/competencymodel/pyramid.aspx?WS=Y>).

The 9-tiers pyramid is comprised of competences for all the required elements for the competent function of the Water Industries and analyzed as follows:

- Tier One (basis of the pyramid) - Personnel Effectiveness Competences
- Tier Two - Academic Competences
- Tier Three - Workplace Competences
- Tier Four - Industry-Wide Technical Competences
- Tier Five - Water Sector Technical Competences
- Tier Six - Occupation-Specific Knowledge Areas
- Tier Seven - Occupation-Specific Technical Competences
- Tier Eight (top of pyramid) - Occupation-Specific Requirements
- Tier Nine (top of pyramid) - Management Competences

Consequently, this paper introduces the tools and instruments for the requirements elicitation of the Water Sector that will set the lines of the designing and developing Competence Model. First of all, a concrete definition of the terms “Competence” and “Competence Model” has arranged in accordance to EQF and PAS 1093 (as described previous in this chapter). The next step is the organization and execution procedures for defining these specific needs, which are describing in the next chapter. Type of competences (simple or complex), minimum number of competences that is required for the description a job profile, determination of the needed competences of each job profile, occupation or specific task, and existence of professional programs for the acquisition of these competences are just few queries that should be considered and analysed explicitly through these processes.

3. The Concept of Competence Modeling

In this section, the identification of the specific demands and needs of the water management and existing practice concerning Competence Models in the water sector is analyzed and the fundamental elements that underpin the successful application of a Competence Model for the job-related in the Water Sector are described.

The analysis was based on two dimensions:

- Elaborated inquiry of experts’ requirements from the water sector and Vocational Education and Training via workshops
- Identification of Water sector needs through an online survey

Concerning the first dimension, workshops at a national level in 4 different European countries scheduled and accomplished at the beginning of 2010. Presentations, working in small groups, and brainstorming sessions were the main sections of the workshops. The intended outcomes of these events were focused on the implementation of a Competence Model in a specific field of Water Sector, management of sewage treatment plants.

The Online Survey is based on an online questionnaire and except for the English language it is available in four additionally languages: German, Greek, Hungarian and Romanian. The Survey aims to collect the preferences and needs of experts from all the Water Sector eras for the better developments and adjustment of the Competence Model in this Sector in general.

3.1. Organisation of the National Workshops

Water Sector experts as well as adult and vocational training entities were invited to introduce their vision on professional skills and abilities that are needed for working in the field of water management. Job profiles, workplace descriptions and related vocational education and training opportunities in the field of water management and especially in sewage treatment plants.

The national level Workshops were realized in four European countries: Germany, Greece, Hungary, and Romania. They were a half-day or full-day event with durations between 5 up to 8 hours. The agenda topics were defined the same for all the workshops and adjusted to the preferences and the occupational specializations of the participants of each country.

Workshops intended to record the identification of the needed competences, professional skills, and abilities for all groups of employees in the sewage treatment plants. The job profiles of the involved professions and specialisations in the operation of sewage treatment plants were explicitly analysed. Participants were also asked to record the available and existing occupational training programmes in the water sector and especially in the field of wastewater management and management and operation of sewage treatment plants.

The attending potential participants of the workshops were comprised of designers, developers, providers and end users of Competence Models in the water sector. A first invitation with a very short description of workshop agenda and objectives was sent to all interested people in each country 6-10 weeks prior the event. A second reminder with detailed information on the agenda, registration form and details of the location of the event was sent 2-4 weeks before the workshop. Additionally, several phone calls were made or extra emails were sent for any extra information that was needed and especially at the last week before the workshop.

Invited experts came from: a) users of professional training in the water sector (sewage utilities, wastewater units, water operators, private consulting enterprises and engineering companies, b) providers of professional training in the water sector (academics in the water sector, private and public training centres, universities, technical universities, technical colleges and research institutes), c) decision makers for professional training in the water sector in general (politicians, water associations, ministries of education and professional training, responsible ministry for water resources affairs, regional public administrations and organisation for standardisation), and finally d) human resources development entities.

The whole event divided in 2 main sections, one information sharing section and a second interactive section.

The goal of the first Information Sharing Section was the introduction on the concept of competences, competence models, competence modeling for the water sector, European Qualification Framework (EQF) and the National Qualification Framework (NQF). Additionally, presentations for the categorization of the main domains of the water sector, procedures of management of a wastewater and/or sewage treatment plant were included, in order to illustrate the objectives of the workshop, get known the wide meaning of the related terms, underline the lack of such a model for the water sector and facilitate the participation of the guests in the second Group Collaborative Section.

The Group Collaborative Section consists of 3 sessions, one brainstorming session for the identification of the main involved professions and specializations for the management and operation

wastewater and sewage treatment plants as well as the existence of vocational education and training opportunities in this field, one session for filling out a predefined questionnaire with the required competences of the employees in the management of sewage treatment units and a third one in order to wrap-up all the results.

For the Brainstorming Session, a number of questions were posted by the organizers and a progressive discussion started among all the participants. Through this, the job profiles and professional specializations in the sewage treatment plants and wastewater units were described. Besides, notes were taken for the occupational skills, qualifications, level of specialization, and the percentage of well-skilled employees (workers) in correlation with the available vocational training programs for the field of wastewater and sewage management.

In the Second Session, a questionnaire with a list of competences for all the categories of employees and all the operative procedures of the sewage treatment plants was discussed. All the employees were divided in three groups - categories (workers / operators, technicians / engineers and management directors).

The total number of the questioned competences (knowledge, skills, activities, expertise) is categorized in groups in accordance with the operative function of the sewage treatment plants (Table 1).

Table 1. Categories of competences for the sewage treatment plants

Categories of competences			
1	General activities	7	Biological section - biological filter
2	General knowledge	8	Biological section - aeration tank
3	General skills	9	Biological setting - secondary setting
4	Measurements and investigation	10	Biological setting – general
5	Maintenance and operation	11	Sludge digestion
6	Primary treatment	12	Mechanical section

The following were investigation for each competence and directed to each one of the three groups of employees categories:

- Is this competence needed?
- The answer could be: Yes, the competence is needed or No, it is not needed
- (If the competence is needed)
- How important is this competence for the group of employees?
- The answer refers to the selection one of the 6th scale: 0, 1, 2, 3, 4, 5, and 6 (0= not important, 1= less important, 2= a bit important, 3= quite important, 4= important and 5= very important)
- Which level of this competence is needed for this group of employees according the 8th scale of EQF standard?

3.2. Online Survey Design

The online survey, for defining the needs of the water sector in general concerning the competence modeling, is launched and available to all interested Water Experts. The survey was based on a

comprehensive questionnaire of 15 issues-questions and available in 5 different languages: English, German, Greek, Hungarian and Romanian. The survey was active for 2 months and accessible in the link <http://survey.agroknow.gr/index.php?sid=38344&newtest=Y&lang=en> (for English language). Main objectives of the whole initiative is to direct to as many water experts from the whole Europe (at least) and collect their aspects and visions on the development and adjustment of a Competence Model in the Water Sector.

First, an invitation letter was sent to all interested experts from all the domains of water sector and occupational and adult training and an announcement circulated to all related publically means (newspapers, scientific journals, online platforms and web sites, and water associations and organisations). Several reminder announcements and e-mails letters released during the running period of the Survey.

The covering topics of the online questionnaire are the a) Current Awareness of Competence Standards, b) Perceived Need of the Implementation of Competence Model in the Water Sector, c) Vocational Education and Training in the Water Sector, and d) Demographic Data of the participants. The list of domains of the Water Sector that is appeared in the online questionnaire and gives its main divisions is presented in the table 2.

Table 2. Suggested Domains of Water Sector as they are presented in the Online Questionnaire

Suggested Domains of Water Sector	
1	Irrigation Water
2	Water Use in Animal Husbandry
3	Hydrology (e.g. surface and ground water, water resources studies)
4	Hydraulic Engineering (e.g. physical modeling, numerical modeling, seepage studies)
5	Environmental Protection (e.g. Environmental research, protection of water resources from pollution, ecotoxicology)
6	Legislation
7	Hydroelectricity
8	Geothermal power
9	Wastewater management
10	Sewage Treatment Plants
11	Desalinization Plants
12	Water Supply (potable Water)
13	Domestic Water use (indoor and outdoor household purposes)
14	Transportation on water (rivers and lakes navigation)
15	Water Sports / Athletic Activities
16	Recreational Uses of Water Resources (e.g. baths, spas, ...)

For the first section (Awareness of Competence Standards), a number of questions are raised in order to investigate the understanding of the terms “competence”, “competence standards”, and “Competence Models”, the aspect of the importance of Competence Models to explicitly describe the frame of job profiles and further specializations, and the involvement or prospective application of Competence Models in the description of job professions/specializations in a specific field (Figure 1).

1. Current Awareness / Understanding of Competence Standards.

* Have you ever heard of the term “competences”?

Yes
 No

* Have you ever heard of the term “competence standards”?

Yes
 No

* Please rate your current understanding of how Competence Models/Standards can be used to describe Job profiles.

1
 2
 3
 4
 5

? Possible answers 1= minimum, ... 5= maximum.

* Have you ever used competences to describe a job profession/specialization in your field?

Yes
 No

Figure 1. Part of the Online Questionnaire for the requirements exploration of the Water Sector in competence modeling

Next section “Perceived Need of the Implementation of Competence Model in the Water Sector” is divided in two parts with one corresponding question for each part. The level of importance of the Competence Model in the water sector in general is to draw the related job profiles. In the second part, the significant reasons of the necessity of the Competence Model in describing the framework of job professions and specializations in the water sector and the level of their importance are listed.

The “Vocational Education and Training in the Water Sector” comprises of two parts, one for the exploration on how the employees are well-skilled and competent enough in a list of domains of the Water Sector and the second one for defining the degree/level of the existence of specialised training opportunities for job professions of each domain of the Water Sector.

At the end, a section with demographic questions is included for specifying the gender, age, level of higher education, country of origin, sector of work or research, and the relevance of their field of work/interest with the listed domains of Water Sector.

4. Results from Requirements Analysis

4.1. National Workshops Results

The main outcome of all the National Workshops is the general consensus of the absolute necessity for the development of a Competence Model in the specific field of sewage treatment plants as a pilot testing of the instrument and the adjustment in all the domains of the Water Sector in a later phase. This will help

on the better description and analysis of all the related job profiles, define the required competences and match each profession with all the important competences. In case of sewage treatment plants, the developing Competence Model should consider several parameters, such as the size of the unit (small or big), offered services (e.g. reuse of wastewater), level of rehabilitation and sludge utilisation, the state of development, application of new technologies and the level of automatisisation.

It is also important the differentiation of employees' categories among the four national workshops, based on the education/training needed to occupy that specific job or specialization. Thus, a short description and explanation should be given for each one group of employees. The feedback from the workshops raised important suggestions on changing the categorization of employees of sewage treatment plants.

The initial categorisations of employees were:

“workers, technicians/engineers, and management directors”

The new groups of employees are:

“semi-skilled workers, skilled workers, technicians, biological engineers, chemical engineers, mechanical engineers, automation engineers and management directors”

An idea for recording the most important jobs related to the sewage treatment and match each one with the proposed or any missing (no listed) competences came up. The suggested jobs and specializations are listed in the table 3.

Additionally, the competences could be grouped differently in order to cover both water treatment as well as the sludge treatment. Competences for the work in the laboratory, measurement and controlling the whole function of the unit should be included.

Another dimension of categorizing the proposed competences could be according the basic processes of a sewage treatment plant.

- Planning/Construction
- Operation/Maintenance
- Control/Regulation
- Development/Research

Table 3. Involved Jobs and professional specialisations as they were described at the national level Workshops

Jobs and Specializations for the Sewage Treatment Plants		
Water pipe worker / technician	Senior laboratory worker	Head of the operational department
Sewer pipe cleaner	Senior sewage maintainer	Water supply and sewage technician
Sewer inspector	Senior sewer cleaner	Engineer
Sewer maintainer	Senior sewer inspector	Senior engineer
Sludge dryer maintainer	Senior sludge cleaner	Head of the engineering department
Laboratory worker	Pipe and pipe system controller	Head of the conducting department
Sampler	Leader of the sewage section	Managing director

Following the outcomes and the interested results from a so wide range inquiry (experts from four European countries), the keystones of a fully applicable and functional Competence Model have been determined for the Water Sector. All the measurable and remarkable elements have been evaluated for the implementation in the case of management of sewage treatment plants and the adjustment in other domains of Water sector.

4.2. Results of the Online Survey

On the contrast with the strengthen focus of the National Workshops on describing the outlines of the development a Competence Model for the management of sewage treatment plants, the outcomes of the online survey are more general and aim to define the requirements of all the domains of the Water Sector concerning the development and application of a Competence Model.

Concerning the results of the online questionnaire, a summary of the responses is presented since the survey just ends and the analysis of the results is in progress. The first replies revealed interesting results which are helpful for the further design and development of the Competence Model.

All the experts answered that they are familiar with the concept of the term “Competence” and the majority of them (76.6%) have the same opinion for the term “Competence Model”. As for the level of understanding the pathways that the Competence Models can be proved useful for describing the framework of job profiles, the majority of experts select the middle-level 3 (quite understanding) in a percentage of 42,53% or level 4 (understanding) in a percentage 22.99% from the scale 1 (= less understanding), 2, 3, 4, and 5 (= enough understanding). Besides, most of the participants (57,47%) replied that except from knowing the concept of “Competences”, they have already used them in order to describe job professions and specializations in their working or researching field.

Measuring the usefulness of the Competence Model in the water Sector, a great percentage of replies mention the importance of such a model in this specific sector. A portion of 44,83% answer the level 4 (important) and another 31,93% select the level 5 (very important) in the scale 1 (= less important), 2, 3, 4, and 5 (= very important) (Figure 2).

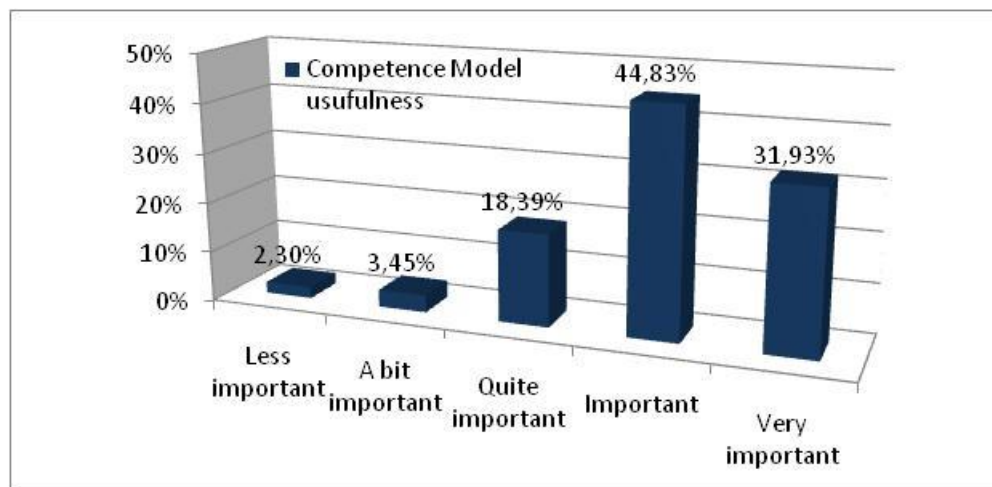


Figure 2. Usefulness of a Competence Model into the Water Sector

In addition, there is a consensus of the experts for the reasons which underline the importance of the Competence Model. Equal percentages (40%) believe firmly that acquisition of qualifications, as well as measurement of training needs and gap analysis establish the importance of the application of such a model. A percentage of 28% have the same opinion for the description of job profiles and the

comparability of training opportunities. Smaller, but not negligible (22%), find the explanation of the organizational requirements a good reason for the development of this model.

As for the estimation of the level of employees' training in all the domains of the Water Sector, the answers reveal that people are well-skilled and enough competent mainly for the field of water supply (63%), wastewater management (54%), sewage management (60%) and finally hydrology-research on ground and surface water resources (45). Besides, enough skilled are also the employees in the fields of hydraulic engineering - numerical modeling etc (35.83%), environmental protection (39%), irrigation water use (29%) and operation of units for hydroelectricity (24%).

Based on the inquiry of the level of the existence of training opportunities for each one of the domain of the Water Sector, the first results are notable. Wastewater management in general and sewage management, and water supply seem to be the domains with a lot of training opportunities for the learners and employees (further training) and this is a good explanation of why the employees are enough skilled (as previous showed) and a reason that confirm the imperativeness of the pilot testing of the Competence Model in one of these fields, where a large number of competence have been described and analyzed.

A large number of the answers find the absence of training programmes for the agricultural use of water resources (irrigation water use and water use in animal husbandry). The level of vocational training for the fields of hydrology science, hydraulic engineering and environmental protection are significant, but new programmes are needed. Concerning the operation of hydroelectric plants and units for the utilization of Geothermal power the results are not so easy to be explained. Finally, there is plenty of offering training programs for the legislative issues in accordance of the water use (Figure 3).

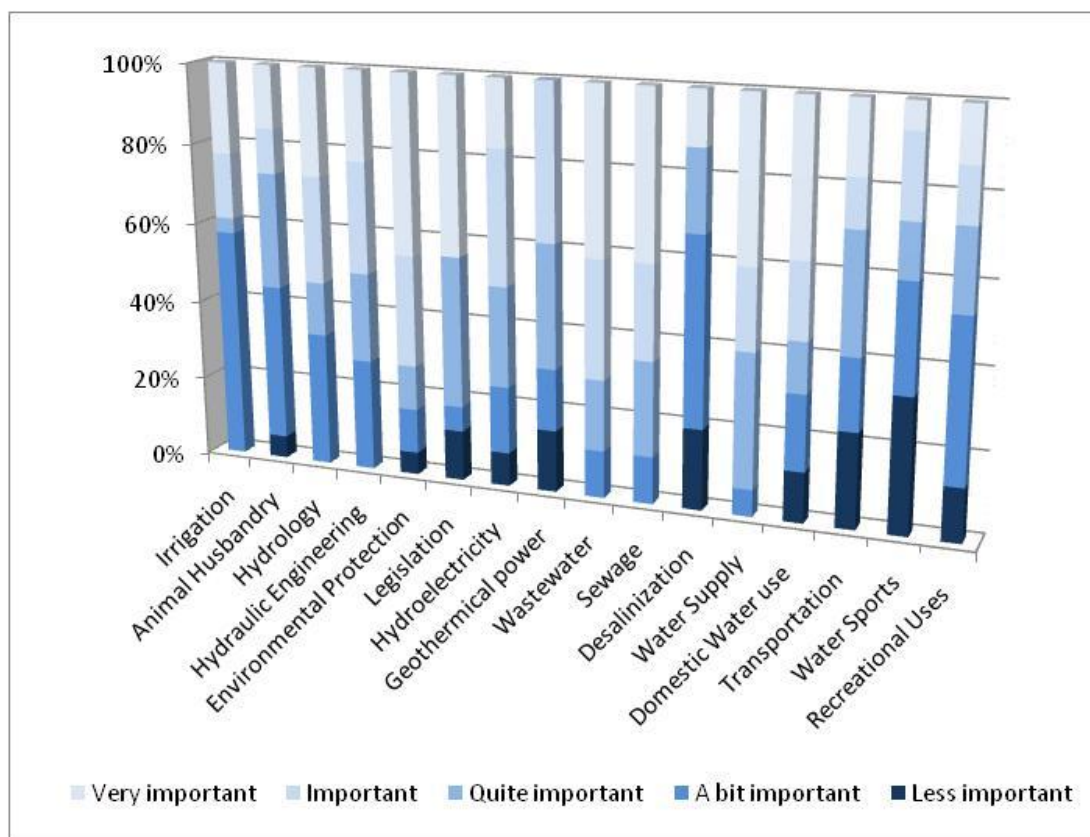


Figure 3. Existence of specialised training opportunities for each Water Sector area professions

Finally, these first results of this survey underline the importance of the competences and competence modeling in the describing the job profiles and improving the opportunities of the professional training. Besides, determination of the domains of Water Sector with a lot of vocational and training programmes and enough competent employees, define the first fields for the implementation of the Competence Model in the Water Sector.

4.3. Implications for Competence Model in the Water Sector

A Competence Model describes the actions of an employee in order to achieve or exceed the strategic goals of the organization-industry (Delamare Le Deist and Winterton, 2005, Teodorescu, 2006).

From the results of the National Workshops and the Online Survey, it seems that there is a great differentiation of the professional training and the level of well-skilled employees in the domains of the water Sector. Apart from excellent understanding of the deep meaning and the importance of a Competence Model in the specific professional learning sector, the experts believe competence modeling will improve the transparency and the comparability of the training opportunities, and specify and develop new required competences for each one specific job profession.

A useful outcome from the online survey is the determination of specific fields (Water supply, Wastewater management, Sewage management) as the domains of the Water Sector with a lot of existent training programs and enough competent employees. Consequently, these professional learning fields should be used for the first pilot testing of such a model, since a large number of competences, that should be defined, and descriptions of job profiles are included.

In case of the specific domain of sewage management, the Competence Model should include Competences, which are expressed in four dimensions:

- Job description, for a detailed description of all the involved Job professions, occupations, positions or tasks that are involved in all the operational processes of the industry
- Recording the Competences, for creating a detailed list with all the current or future required competences of each job profession
- Categorisation of the competences in an easy and understanding way
- Parameters of the industry, concerning the size and the services of the industry

5. Conclusions

Competences are becoming more and more important for business, life-long learning and the whole European society. In particular for professional training, a shift from learning input towards learning outcome orientation can be identified in combination with the increase of technology-enhanced learning: Information and communication technologies' support for learning, education, and training as well as for competence and skill development is crucial to achieve the overall objective of the European i2010 strategy for information society and media (COM 2005) to become the leading information society and region worldwide and of the new European Digital Agenda 2020 (COM 2010). The ongoing focus and inclusion of technology-enhanced learning within the 7th Framework Programme is reflecting its impact and support for business and competence development both by enterprises and individual employees.

The European Commission states in its publication on "The use of ICT to support innovation and lifelong learning for all-A report on progress" of 9 October 2008 (SEC 2008) the growing success of technology-enhanced learning ("A decade of experience in Europe has proven its value as an innovative tool for education and training") and "reflects the growing complexity of e-learning and its role as a basic tool for education and training as well as it concludes that e-learning should be seen as an important part of learning in general". That is supported by the decision of the European Commission that technology-enhanced learning has become one of the four transversal lines of the Lifelong Learning Programme

(2007) and a general priority in the four vertical programmes (COM 2008). Thus it can be summarized that competence orientation and competence models can be seen as one of the main drivers and facilitators of the new knowledge and information society and that technology-enhanced learning is a key instrument with growing usage and importance.

The worth of Competence Models is proved by the increase of competition, innovation and raising consumer demands which have led the labour market and the industries to search for well-skilled and competent employees. On the other hand learners, employees and individuals look for educational and training programmes that will supply them with the important knowledges, skills and other elements of the concept “competences” and set themselves competitive and essential in their workplace.

The design and development of Competence Models should be drawn according to the preferences, requirements, and innovations of each professional learning sector in which they will be implemented. The water Sector is a wide range sector with a lot of working and researching fields and a plenty of job professions and specializations. European policies have been developed and adopted for the protection and sustainable utilisation of water creating a huge demand in particular in the vocational training. This work provides the main lines and the tools for recording the specific requirements and needs of the domains of the water Sector in order to develop a successful and applicable Competence Model for this Professional Learning Sector.

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