



# Studies in Educational Management

EUROKD

2019 (3) 13–25

---

## The Evidence based Learning Outcomes The Cosmet project

Javier Cárcel-Carrasco<sup>\*1</sup>, Elisa Peñalvo-López<sup>2</sup>, Manuel Valcuende-Paya<sup>2</sup>, Manuel Pascual-Guillamón<sup>1</sup>

<sup>1</sup>Ph.D., ITM, Universitat politècnica de València, Spain

<sup>2</sup>Ph.D., Universitat politècnica de València, Spain

*Received 19 May 2019      Accepted 21 June 2019*

### ABSTRACT

Learning and training are key aspects in the evolution of societies. In the case of professional activities, the 21st century must take into account those professions which require knowledge and skills upgrading to new technological advances, such as intelligent buildings measurements for construction managers and supervisors as well as other professionals who act in different building facilities. The Evidence based Learning Outcomes, is to develop smart metering learning outcomes which reflect building sector needs and which can be integrated into existing Vocational Education Training (VET) offerings for construction site managers. These evidence based learning outcomes will address the skills needs of site managers in smart metering technologies and services, delivering a European-wide comprehensive pedagogical structure. This article explains the collection and analysis of sector and VET evidence on the current and future smart metering site manager skills and training needs (covering power, gas, heat and water meters) in the six partnership countries.

*Keywords:* Construction site managers, Smart metering, Specific training, Efficient learning.

### Introduction

Training of site managers varies across the EU depending on each country's qualification framework and approach. In most countries, site managers usually get Vocational Education Training (VET) courses or in-company workplace training in the context of 2-3 year apprenticeships; building up experience in work areas such as estimating, planning, and buying; and assisting construction engineers and technicians (European Commission, 2017).

Following specific EC and national regulation (e.g. the Building Directive EPBD 2010/31/EU; the Commission Recommendation on preparation for the rollout of smart metering systems 2012/148/EU; the Energy Efficiency Directive 2012/27/EU; and the European Commission Task Force on Smart Grids Experts Group 2), a strong policy drive in most EU countries supports the timely roll-out of smart meters. This introduces a new challenge for the construction sector to employ up-skilled site managers trained in smart metering services (ESML, 2013). A 2012 CEDEFOP report (Green Skills and Environmental Awareness in Vocational Education and Training Synthesis Report) documents the smart metering skills shortages for construction site occupations as a result of the implementation of national and EU resource efficiency measures and initiatives; and insufficient modern training provision for site managers.

Beyond the installation and commission of smart meters that is being carried out in most EU countries by qualified installers, smart metering infrastructures are interconnected to other features of the building site works. Site managers need updated training in order to acquire additional knowledge to respond to modern construction site needs that involve smart metering solutions for power, gas, heat and water (EU Skills Panorama: Construction Analytical Highlight, 2014).

There is a need to address the smart metering skills gap of site managers by developing a modern VET course about general smart metering principles and technical and organisational challenges generated by the interconnection of site infrastructures (Cárcel & Peñalvo, 2016). To address modern training needs of site managers in terms of practicality, flexibility, cost-effectiveness and EU accessibility, there is a need to develop Open Educational Resources that ensure easy and free access to on-line educational material, promoting self-education and self-assessment that can be carried out in a persons own time, place and pace.

This article shows the Evidence based Learning Outcomes for the European training project (Cosmet Project, 2017), which began in 2015 (ERASMUS+ Programme agreement number 2015-1-UK01-KA202-013406), and whose objective is to analyse the training needs of building managers in relation to smart metering and design courses to provide them with updated knowledge and skills (Cárcel & Peñalvo, 2016).

### **The Cosmet Project**

According to Eurostat app. 882.000 enterprises operated in the EU-27' s construction of buildings sector (NACE Division 41) in 2010, employing 3.9 million persons, from which 260.000 represent the building construction site managers. Technicians involved in sitemanagement are responsible for running a building construction site by overseeing operations on a day-to-day basis, and ensuring that work is done safely, on time, within budget and at proper quality standards. Competition is global and workforce skills have to be continuously updated following technical, digital and environmental advances.

Training of site management technicians varies across EU depending on each country' s qualification framework and approach. In most countries, site managers usually get CVET courses or in-company workplace training in the context of 2-3 years apprenticeships, building up

experience in work areas, such as estimating, planning, buying and assisting construction engineers and technicians.

According to the Skills in the UK Construction Industry report (2013) of the UK based Chartered Institute of Buildings (CIOB), a worrying green and digital skills gap has become apparent in the site managers sector with regard to national and EU initiatives such as the Green Deal and the roll-out of smart meters. Following specific EC and national regulation (e.g. the Building Directive EPBD2010/31/EU, the Commission Recommendation on preparation for the rollout of smart metering systems 2012/148/EU, the Energy Efficiency Directive 2012/27/EU and the European Commission Task Force on Smart Grids Experts Group 2), a strong policy drive in most EU countries supports the timely roll-out of smart meters. This introduces a new challenge for the construction sector to employ up-skilled site managers trained in smart metering services (European Smart Metering Landscape Report, 2013). A recent CEDEFOP report (Green Skills and Environmental Awareness in Vocational Education and Training Synthesis Report, 2012) documents the smart metering skills shortages for construction site occupations as a result of a) the implementation of national and EU resource efficiency measures and initiatives and b) insufficient modern training provision for site managers.

### ***Needs Addressed by the Project***

Beyond the installation and commissioning of smart meters that is being carried out in most EU countries by qualified installers, smart metering infrastructures are interconnected to other features of the building site works. Site management technicians need updated training in order to acquire additional knowledge to respond to modern construction site requirements that involve smart metering comprehensive solutions for power, gas, heat and water smart meters (EU Skills Panorama: Construction Analytical Highlight, 2014).

There is a need to address the smart metering skills gap of site management technicians by developing a modern VET course with regards to a) general smart metering principles and b) technical and organisational challenges, generated by the interconnection of site infrastructures. To address modern training needs of site managers in terms of practicality, flexibility, cost-effectiveness and EU accessibility, there is a need to develop Open Educational Resources that ensure easy and free access to on-line educational material, promoting self-education and self-assessment in own time, place and pace.

The project creates a Strategic Partnership to tackle this challenge and modernise VET for site managers in the EU, aiming to:

OBJ-1. Develop appropriate learning outcomes and a training course to address power, gas, heat, and water smart metering skills needs, to enhance relevant VET provision for site managers.

OBJ-2. Introduce modern training methods in the form of OERs (teaching and assessment material) and Massive Open Online Course (MOOC).

OBJ-3. Facilitate mutual recognition of the developed learning outcomes across EU.

### ***Added Value of Transnational Cooperation***

The project delivers solutions applicable across the EU construction sector avoiding the duplication of effort at a national level.

This can only be achieved through transnational cooperation because: a) addressing sector needs requires EU level research, due to national specificities (such as national regulation and regional resource efficiency priorities), b) the validation and multiplication of impact appears connected to the involvement of target groups and stakeholders from different countries; the subsequent uptake of results on their part will maximise the cost-to-benefit ratio, and c) cultural and linguistic issues will be better tackled.

### ***Target Audiences***

The population of site managers with smart metering skills deficiencies due to insufficient relevant training provision in the EU are around 260.000. Via targeted dissemination activities, the project aspires to reach at least 8000 of these technicians. However, the entire population of technicians with skill deficiencies in resource efficiency technologies employed today in the construction sector is estimated at 3.9 million individuals. These construction technicians may choose to get VET provision in site management in the future. Thus, the dissemination activities of the project will also reach these professionals.

The partnership aims to reach at least 390 VET providers that offer construction site management training courses and apprenticeships in the partnership countries through structured dissemination efforts, as well as the exploitation of partners' network and contacts.

Associations, social partners and networks have the institutional capacity to provide access to 500 members of the sector. At least 20.000 building construction companies in the partner countries are expected to be reached through the project dissemination activities and project partners' network of contacts.

Policy-makers include the EU-28 Ministries of Education, National Qualifications Agencies, National Coordination Points, local/regional/national career guidance bodies, and the members EQF Advisory Group members. The project will seek to reach at least 100 individuals with key positions in the aforementioned bodies.

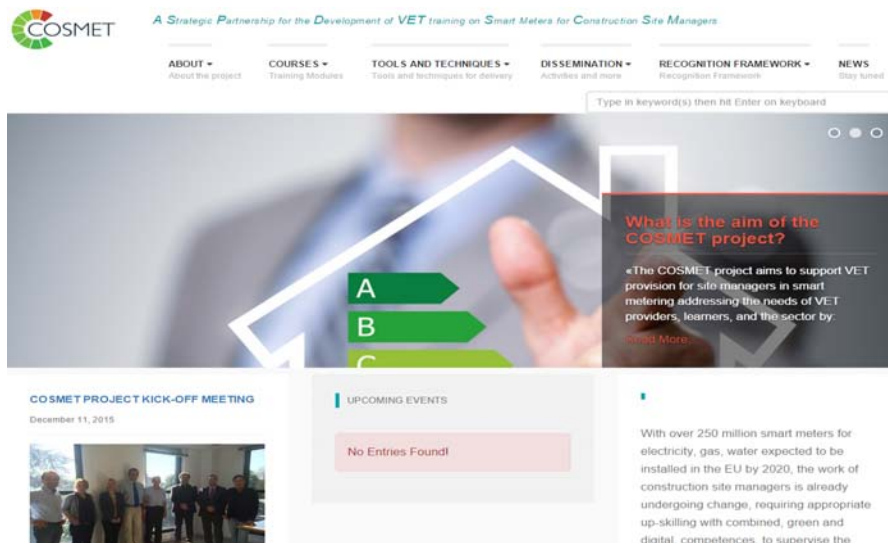


Figure 1: Web made for the Cosmet project.

Source: Web 1

There are six partners that are part of this education project. Five centres formed by Professionals or Training Associations and a European University.

The partnership will develop and offer a novel course on smart metering aiming to empower site managers with a new set of combined skills and competences, with regards to principles, technologies and services related to electricity, gas, heat and water smart meters. It will develop and offer learning resources on smart metering specifically addressing the supervision and management skills needs of the construction site sector, beyond the existing installation and commissioning skills focus (e.g. technical, digital, environmental, regulative aspects and customer consultation).

The project consortium will produce OERs and make the curriculum available in the format of a MOOC to support informal learning and personal learning pathways, as a means to reach individuals reluctant to participate in continuing training opportunities.

### Project Objectives & Target Groups

The project objectives are to:

- Develop appropriate learning outcomes and a training course to address power, gas, heat, and water smart metering skills needs, to enhance relevant VET provision for site managers;
- Introduce modern training methods in the form of OERs (teaching and assessment material) and Massive Open Online Course (MOOC); and
- Facilitate mutual recognition of the developed learning outcomes across EU.

The main target groups of the project are:

- VET students intending to work as site managers;
- Site managers working in the construction sector in Europe;
- VET providers for construction site managers;

- Stakeholders and associations in the construction sector.

The objective of Output O1: Evidence based Learning Outcomes, is to develop smart metering learning outcomes which reflect sector needs and which can be integrated into existing VET offerings for construction site managers. These evidence based learning outcomes will address the skills needs of site managers in smart metering technologies and services, delivering a European-wide comprehensive pedagogical structure.

This article explains the collection and analysis of sector and VET evidence on the current and future smart metering site manager skills and training needs (covering power, gas, heat and water meters) in the six partnership countries; and presents the findings from that research. It is based on national and European desk and field research activities that involve the project target groups and relevant stakeholders, namely VET providers, smart metering field experts, sector representatives and associations.

### Methodology

Data collection consisted of two on-line surveys which were conducted in November and December 2015. Each survey was addressed to different groups of stakeholders in each of the six partnership countries (United Kingdom, Greece, Spain, Germany, Lithuania and Poland). Desk-based research was also carried out to identify specific qualifications and courses with smart metering content in each country (Cosmet Project, 2017).

The survey for sector representatives, identifying the training needs of site managers in smart metering, consisted of 17 questions. It was sent to companies operating in civil engineering, building, construction, building installation, building Services engineering, and estate Management as well as associations of employers and employees.

The survey for VET providers, identifying smart metering training issues was composed of 6 questions. It was sent to VET providers and trainers for the construction industry; and associations of trainers and VET providers involved in the lifelong learning education of individuals that fit the profile of a construction site manager.

The target for participation across both surveys was a minimum of 100. Each country partner agreed to provide at least 9 participants in each survey. The actual participation numbers by country are in table 1.

Table 1: Participation numbers by country

| Country        | Industry responses | VET responses | Total |
|----------------|--------------------|---------------|-------|
| Germany        | 11                 | 18            | 29    |
| Greece         | 9                  | 9             | 18    |
| Lithuania      | 11                 | 10            | 21    |
| Poland         | 15                 | 10            | 25    |
| Spain          | 32                 | 14            | 46    |
| United Kingdom | 9                  | 16            | 25    |
| Total          | 87                 | 77            | 164   |

Source: Cosmet Project

The purpose of the programme provision research was to identify any training programmes in each country which deliver training in smart meters.

### **Data Validation, Consolidation and Analysis**

Upon receipt of the completed surveys, the gathered data was produced in the form of Microsoft Excel spreadsheets in partner native languages. Partners translated data into English and data was then validated (to confirm the accuracy of data) and consolidated (by merging into one spreadsheet).

Statistical computations and analyses assume that the variables have a specific level of measurement and are appropriately defined during the construction of the questionnaire. Consequently, variables can be defined as nominal, ordinal or interval to avoid nonsensical results. - Nominal or categorical variables are based on mutually exclusive responses but not ranked or ordered categories. Yes / no, multiple choice or demographic questions (e.g. country, job description etc.).

- Ordinal variables are based on categories that can be ordered or ranked and therefore questions could include a rating scale. Offering an ordered set of choices, ordinal variables are more flexible than nominal variables and 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 interval variable are equally spaced.

Prior to data processing, valid responses were reviewed and mapped into specific variables based on the type of the question. In the case of ordinal variables, responses were recorded in numerical values to facilitate quantitative processing.

Basic tools of descriptive statistics like counts, means, and percentages were employed (where questions allowed this) to extract useful information.

### **Research Sample**

A total of 89 individuals responded to the survey. The numbers by company/organization type for each nation are in table 2. The question asked:

“What type of organization do you represent?” and could select more than one answer. They could also choose to not answer the question):

Table 2: Numbers by company/organization type for each nation

|                        | Germany | Greece | Lithuania | Poland | Spain | United Kingdom | Total |
|------------------------|---------|--------|-----------|--------|-------|----------------|-------|
| Civil engineering      | 0       | 1      | 0         | 0      | 1     | 0              | 2     |
| Building               | 0       | 1      | 3         | 4      | 2     | 0              | 10    |
| Construction           | 3       | 4      | 1         | 0      | 7     | 0              | 15    |
| Building installation  | 0       | 1      | 1         | 6      | 1     | 0              | 9     |
| Building services eng. | 0       | 0      | 4         | 0      | 6     | 5              | 15    |
| Estate management      | 0       | 0      | 1         | 1      | 1     | 0              | 3     |
| Employers association  | 0       | 0      | 0         | 4      | 1     | 1              | 6     |
| Employees association  | 0       | 0      | 0         | 0      | 0     | 0              | 0     |
| Other*                 | 7       | 2      | 0         | 2      | 13    | 3              | 27    |
| Total                  | 10      | 9      | 10        | 17     | 32    | 9              | 87    |
| Actual responses       | 11      | 9      | 11        | 17     | 32    | 9              | 89    |

Source: Cosmet Project

### Research Results (Industry/Stakeholder research)

Respondents were asked to identify “to what extent construction site managers need to possess the following smart metering technologies knowledge, skills and competences.” (Options in terms of relevance were: Very Low, Low, Average, High, Very High).

1. Knowledge of a wide range of gas, heat, water, and electricity smart metering technologies and systems.
2. Knowledge of the environmental impact of gas, heat, water, electricity smart metering systems.
3. Knowledge of the IT infrastructure related to the recoding and storage of transmitted data.
4. Knowledge of the network infrastructure and the Internet of Things systems that cover the wide range of “smart” devices (sensors, actuators, meters etc).
5. Knowledge of the device interconnectivity among smart devices and smart metering systems.
6. Knowledge of technical issues related to the installation of smart metering technologies in new buildings (e.g. topics such as where to place antennas etc).
7. Knowledge of technical issues related to the retrofitting of smart metering technologies in existing buildings.
8. Construction site management and supervision skills regarding smart metering systems (e.g. checking processes, time planning and prioritization of site works).
9. Coordination of site staff, employed in works that include smart metering.
10. Preparing designs, drawings and reports on site works that include smart metering.
11. Digital skills on incorporating smart metering technologies in automated home infrastructures.
12. Technical skills on incorporating smart metering technologies in automated home infrastructures.
13. Customer consultation skills on the selection of the most suitable smart metering solutions.
14. Customer consultation skills on the use and impact (environmental, economic) of smart metering systems.



*15. Knowledge of the European legislation framework for the installation of smart metering technologies in buildings.*

*16. Knowledge of the national legislation framework for the installation of smart metering technologies in buildings.*

*17. Knowledge of the health and safety issues associated with site works that include smart metering technologies and services.*

The overall rankings for the smart metering knowledge, skills and competences needed by site managers are shown in table 3. These are ranked in order of importance based on the combined numbers of respondents who marked each one as High or Very High, expressed as a percentage. Where there are equal rankings, the number of respondents who marked each one as Average have been used as a 'positive'. Where rankings are equal with others, these are shown with the = sign. Full details of each country's percentage responses can be found in Appendix A.

Those marked High/Very High with a percentage of over 50% are the most important (shaded green); those with a percentage between 30% & 49% are important (shaded amber); and those with 29% or less are least important (shaded red).

Table 3: Skills and competences needed by site managers

|  | High/Very High | Average | Low/Very Low | Ranking |
|--|----------------|---------|--------------|---------|
| 8. Construction site management and supervision skills regarding smart metering systems (e.g. checking processes, time planning and prioritization of site works). | 57%            | 32%     | 11%          | 1       |
| 17. Knowledge of the health and safety issues associated with site works that include smart metering technologies and services.                                    | 55%            | 25%     | 20%          | 2       |
| 9. Coordination of site staff, employed in works that include smart metering.  | 54%            | 27%     | 19%          | 3       |
| 13. Customer consultation skills on the selection of the most suitable smart metering solutions.   | 49%            | 27%     | 24%          | 4       |
| 6. Knowledge of technical issues related to the installation of smart metering technologies in new buildings (e.g. topics such as where to place antennas etc).    | 47%            | 32%     | 21%          | 5       |
| 10. Preparing designs, drawings and reports on site works that include smart metering.   | 46%            | 31%     | 23%          | 6       |
| 7. Knowledge of technical issues related to the retrofitting of smart metering technologies in existing buildings.   | 45%            | 35%     | 20%          | 7       |
| 5. Knowledge of the device interconnectivity among smart devices and smart metering systems.   | 42%            | 32%     | 26%          | 8       |
| 1. Knowledge of a wide range of gas, heat, water, and electricity smart metering technologies and systems.   | 40%            | 40%     | 20%          | 9       |
| 16. Knowledge of the national legislation framework for the installation of smart metering technologies in buildings.  | 39%            | 30%     | 31%          | 10      |
| 11. Digital skills on incorporating smart metering technologies in automated home infrastructures.   | 36%            | 33%     | 31%          | 11      |
| 12. Technical skills on incorporating smart metering technologies in automated home infrastructures.   | 35%            | 38%     | 27%          | 12      |
| 15. Knowledge of the European legislation framework for the installation of smart metering technologies in buildings.  | 35%            | 29%     | 36%          | 13      |
| 4. Knowledge of the network infrastructure and the Internet of Things systems that cover the wide range of “smart” devices (sensors, actuators, meters etc).       | 33%            | 38%     | 29%          | 14      |
| 14. Customer consultation skills on the use and impact (environmental, economic) of smart metering systems.  | 33%            | 34%     | 33%          | 15      |
| 2. Knowledge of the environmental impact of gas, heat, water, electricity smart metering systems.  | 32%            | 41%     | 27%          | 16      |
| 3. Knowledge of the IT infrastructure related to the recoding and storage of transmitted data.   | 29%            | 43%     | 28%          | 17      |

## Research results (VET Provider research)

### Research Sample

A total of 77 individuals responded to the survey. (The question asked: “What is your area of expertise regarding vocational education and training (VET) provision for the construction sector?” and could select more than one answer. They could also choose to not answer the question):

It can be seen that 66% of respondents had expertise in VET provision for construction; 40% had expertise in building installation; and 39% had expertise in the energy and water sectors.

### Research Results

Respondents were asked the following questions:

1. *How relevant to the role of site managers is training in smart metering technologies in your country? (Select one answer)*

2. What are the most needed skills/knowledge site managers need to acquire via training? (Select 3 most important)
3. What skill sets would site managers need for managing smart metering technologies? (Select all that apply)
4. Who should have the biggest role in providing training to site managers on smart metering technologies and services? (Select one answer).
5. How much training time do site management trainees need in order to improve their knowledge/skills in smart metering? (Select one answer)
6. What is the best way to improve the site manager's knowledge and skills in smart metering? (Select one answer)

The results for each question are shown, expressed as a percentage, in the tables below (Key: DE = Germany; GR = Greece; LT = Lithuania; PL = Poland; ES = Spain; UK = United Kingdom.) Where rankings are equal with others, these are shown with the = sign.

The results for question 1: “How relevant to the role of site managers is training in smart metering technologies in your country?” are shown in table 5.

Table 4: Relevant to the role of site managers is training in smart metering technologies

|                     | DE  | GR  | LT  | PL  | ES  | UK  | Overall |
|---------------------|-----|-----|-----|-----|-----|-----|---------|
| Very relevant       | 44% | 33% | 70% | 60% | 43% | 50% | 49%     |
| Moderately relevant | 17% | 33% | 0%  | 30% | 36% | 38% | 26%     |
| Not very relevant   | 39% | 22% | 30% | 0%  | 14% | 13% | 21%     |
| Not at all relevant | 0%  | 11% | 0%  | 0%  | 7%  | 0%  | 3%      |

Source: Cosmet Project

A summary of the results for question 2: “What are the most needed skills/knowledge site managers need to acquire via training?” is shown in table 6.

Table 5: Most needed skills/knowledge site managers need

|  | Percentage | Ranking |
|--|------------|---------|
| Technical skills (e.g. incorporating smart metering technologies in automated home infrastructures)                          | 71%        | 1       |
| Managerial skills (e.g. site supervision skills such as checking processes, prioritization of site works)                    | 68%        | 2       |
| Digital knowledge and skills (e.g. IT infrastructure interconnectivity, programming skills)                                  | 52%        | 3       |
| Environmental knowledge (e.g. knowledge of the environmental impact of gas, heat, water, electricity smart metering systems) | 42%        | 4       |
| Public and customer consultation skills on the use and impact of smart metering systems                                      | 21%        | 5       |

Source: Cosmet Project

The percentage results for question 3: “What skill sets would site managers need for managing smart metering technologies?” are shown on a country by country basis and overall in table 7. Those with an overall percentage of over 50% are the most important (shaded green); those with a percentage between 30% & 49% are important (shaded amber); and those with 29% or less are least important (shaded red).

Table 6: Percentage results for question 3

|               | DE  | GR  | LT   | PL  | ES  | UK  | All |
|---------------|-----|-----|------|-----|-----|-----|-----|
| Installation  | 56% | 33% | 100% | 60% | 64% | 44% | 58% |
| Managing      | 22% | 56% | 60%  | 70% | 50% | 69% | 52% |
| Maintenance   | 72% | 33% | 80%  | 40% | 29% | 50% | 52% |
| Inspecting    | 50% | 89% | 50%  | 40% | 31% | 50% | 48% |
| Reporting     | 50% | 67% | 30%  | 30% | 43% | 31% | 42% |
| Commissioning | 72% | 22% | 0%   | 10% | 36% | 56% | 39% |
| Consulting    | 44% | 44% | 20%  | 20% | 29% | 38% | 34% |
| Design        | 0%  | 33% | 0%   | 40% | 79% | 19% | 27% |

Source: Cosmet Project

The results for question 4: “Who should have the biggest role in providing training to site managers on smart metering technologies and services?” are shown in table 8.

Table 8: Percentage results for question 4

|   | DE  | GR  | LT   | PL  | ES  | UK  | All |
|---|-----|-----|------|-----|-----|-----|-----|
| VET providers for the construction industry | 61% | 33% | 100% | 60% | 64% | 44% | 60% |
| VET providers for the energy/water industry | 22% | 33% | 0%   | 10% | 7%  | 44% | 21% |
| Construction industry associations          | 17% | 22% | 0%   | 20% | 29% | 6%  | 16% |
| Environmental agencies                      | 0%  | 11% | 0%   | 0%  | 0%  | 0%  | 1%  |

Source: Cosmet Project

The results for question 5: “How much training time do site management trainees need in order to improve their knowledge/skills in smart metering?” are shown in table 9.

Table 8: Percentage results for question 5

|                             | DE  | GR  | LT   | PL  | ES  | UK  | All |
|-----------------------------|-----|-----|------|-----|-----|-----|-----|
| Less than 20 hours per year | 22% | 44% | 0%   | 50% | 43% | 69% | 39% |
| More than 20 hours per year | 61% | 56% | 100% | 40% | 57% | 31% | 56% |

Source: Cosmet Project

The results for question 6: “What is the best way to improve the site manager’s knowledge and skills in smart metering?” are shown in table 12.

Table 9: Percentage results for question 6

|   | DE  | GR  | LT  | PL  | ES  | UK  | All |
|---|-----|-----|-----|-----|-----|-----|-----|
| In-house training within construction companies | 50% | 11% | 10% | 60% | 50% | 31% | 38% |
| VET provision for the construction industry     | 33% | 44% | 50% | 20% | 36% | 50% | 39% |
| Apprenticeships for site managers               | 11% | 44% | 40% | 10% | 14% | 6%  | 18% |

Source: Cosmet Project

## Conclusions

The 17 smart metering technologies knowledge, skills and competences from the industry/stakeholder survey can be grouped into the 5 headings used in the VET Provider survey as follows: 1) Digital knowledge and skills (knowledge 3, 4, 5 and 11); 2) Managerial skills (8, 9

and 17); 3) Technical skills (6, 7, 10 and 12); 4) Environmental knowledge (1, 2, 15 and 16); 5) Public and customer consultation skills (13 and 14).

By using these groupings and taking the Average, High and Very High scores from the industry/stakeholder survey, the ranking in table 13 can be seen. This shows that industry and VET Providers broadly agree on the importance of each group of knowledge, skills and competences.

Table 10: Importance of each group of knowledge, skills and competences

|   | Average/High/<br>Very High | Percentage of total | Ranking Industry | Ranking VET |
|---|----------------------------|---------------------|------------------|-------------|
| Managerial skills                       | 221                        | 83%                 | 1                | 2           |
| Technical skills                        | 278                        | 77%                 | 2                | 1           |
| Digital knowledge and skills            | 253                        | 72%                 | 3                | 3           |
| Environmental knowledge                 | 254                        | 71%                 | 4=               | 4           |
| Public and customer consultation skills | 125                        | 71%                 | 4=               | 5           |

Source: Cosmet Project

All COSMET outputs are designed to be sustainably useful to EU-28 VET providers, construction site workforce and learners, sectoralstakeholders, and public authorities involved in policy-making for: a) training purposes, and b) the promotion of mobility andtransparency in qualifications.

### Acknowledgment

This work has been conducted within the framework of the research project COSMET "Training in Smart Meters for Construction Site Managers" funded by the European Commission within the Key Action 2: Strategic Partnerships in VET, reference number 2015-1-UK01- KA202-013406.

### References

- CARCEL-CARRASCO, J. & PEÑALVO-LOPEZ, E. (2016) "Training in smart metering technologies for construction site managers ". *Congreso INNODOCT 2016 (Valencia)*. Editorial UPV. 223-256
- CEDEFOP report (2012). "Green Skills and Environmental Awareness in Vocational Education and Training Synthesis Report". <http://www.cedefop.europa.eu/en/about-cedefop/what-we-do/annual-reports>.
- COSMET PROJECT. *The web of Cosmet project*. <<http://www.etaew.net/cosmet/>>. [Consulta: 10 de Mayo de 2017]
- ESML. SMART REGIONS. (2013). "European Smart Metering Landscape Report". [https://ec.europa.eu/energy/intelligent/projects/sites/iee-projects/files/projects/documents/smartregions\\_landscape\\_report\\_2012\\_update\\_may\\_2013.pdf](https://ec.europa.eu/energy/intelligent/projects/sites/iee-projects/files/projects/documents/smartregions_landscape_report_2012_update_may_2013.pdf)
- EUROPEAN COMMISSION. *The EU programme for education, training, youth and sport*. <[http://ec.europa.eu/programmes/erasmus-plus/index\\_es.htm](http://ec.europa.eu/programmes/erasmus-plus/index_es.htm)>. [Consulta: 10 de Mayo de 2017]
- Web 1. The web of Cosmet project. <http://www.etaew.net/cosmet/>.