SEnDIng

D5.3.3

REPORT ABOUT THE DELIVERY AND CERTIFICATION OF INTERNET OF THINGS VOCATIONAL TRAININGS

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Document Version-Status:	SEnDINg_DLV5.3.3-final
Submission date:	M38
Dissemination level:	Public

Deliverable factsheet

Project Number:	591848-EPP-1-2017-1-EL-EPPKA2-SSA
Project Acronym:	SEnDIng
Project Title:	Sector Skills Alliance for the design and delivery of innovative VET programmes to Data Science and Internet of Things professionals

Title of Deliverable:	Report about the delivery and certification of Internet of Things vocational trainings
Work package:	WP5 "Design of e-learning platform and delivery of vocational trainings"
Task:	5.3 Provision of vocational trainings, support of learners and certification of skills provided
Document identifier:	SEnDINg_DLV5.3.3-final.docx
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Delivery Slip

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PROJECT SUMMARY

SEnDIng project aims to address the skills' gap of Data Scientists and Internet of Things engineers that has been identified at the ICT and other sectors (e.g. banking and energy) at which Data Science and Internet of Things have broad applications. To achieve this goal, SEnDIng will develop and deliver to the two aforementioned ICT-related occupational profiles two learning outcome-oriented modular VET programmes using innovative teaching and training delivery methodologies.

Each VET program will be provided to employed ICT professionals into three phases that include: (a) 100 hours of on-line asynchronous training, (b) 20 hours of face-to-face training and (c) 4 months of work-based learning. A certification mechanism will be designed and used for the certification of the skills provided to the trainees of the two vocational programs, while recommendations will be outlined for validation, certification & accreditation of provided VET programs.

Furthermore, SEnDIng will define a reference model for the vocational skills, e-competences and qualifications of the targeted occupational profiles that will be compliant with the European eCompetence Framework (eCF) and the ESCO IT occupations, ensuring transparency, comparability and transferability between European countries.

Various dissemination activities will be performed – including the organization of one workshop at Greece, Bulgaria and Cyprus and one additional conference at Greece at the last month of the project – in order to effectively disseminate project's activities and outcomes to the target groups and all stakeholders. Finally, a set of exploitation tools will be developed, giving guides to stakeholders and especially companies and VET providers, on how they can exploit project's results.

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1 Introduction

This document is a detailed report with regards to the pilot implementation of the SEnDIng IoT VET program. The IoT VET program consists of three phases:

- Phase 1: IoT online training (103 hours)
- Phase 2: Transversal skills online training (20 hours)
- Phase 3: Work based learning (320 hours)

All those who successfully completed the 3 phases of the training have passed through exams that lead to the IoT SEnDIng certification.

The participants in the pilots of both VET programs (Data Science and IoT) have been selected following an open call targeting companies which want to upskill/reskill their employees at the Data Science and IoT domains (for more information please refer to the deliverable "D5.3.1: Open call for participation of companies in the vocational trainings"). After collecting the initial interest of companies, we asked them using a google form, to provide their feedback about the details of their employees who are interested to participate in the training.

We would like also to notice that the second and third phase of the training were common for the Data Science and IoT VET programs. For this reason, at this deliverable is presented only the piloting of the first phase of the IoT VET program. For more information about the second and third phase of the IoT VET program, as well as the certification exams, please refer to the deliverable "D5.3.2: Report about the delivery and certification of Data Science vocational trainings".

2 Phase 1: IoT online training

The IoT online training started on January 2020. The participants in the training attended the following IoT online courses at http://mooc.sending-project.eu/:

- IoT-EM1: Introduction to IoT
- IoT-EM2: Architectural Design and Applications in IoT
- IoT-EM3: IoT Communication Technologies
- IoT-EM4: IoT Security and Privacy
- IoT-EM5: IoT Devices
- IoT-EM6: IoT Business Value

The number of enrolled users at each online course is depicted at the following table. Note that the same trainees (users) have been enrolled among different online courses.

Online course	Number of enrolled users
IoT-EM1: Introduction to IoT	155
IoT-EM2: Architectural Design and Applications in IoT	101
IoT-EM3: IoT Communication Technologies	91
IoT-EM4: IoT Security and Privacy	82
IoT-EM5: IoT Devices	93
IoT-EM6: IoT Business Value	76

Table 1: Number of enrolled users at each Data Science online course

The estimated effort for each online course was 10 hours per week (unless the IoT-EM1 whose estimated effort was 3 hours). We provided an indicative timeline for the completion of each course however we have given also to the trainees the possibility to complete the online courses till the end of the third phase of the training (work-based learning). This has been done taking into account the philosophy of MOOCs giving to the trainees the possibility to adapt the training to their own schedule. The trainees had to successfully complete the 6 IoT online courses by achieving at least 70% score at the self-evaluation quizzes of each course. The success rate for each course is depicted at the following table.

Online course	Success rate
IoT-EM1: Introduction to IoT	50%
IoT-EM2: Architectural Design and Applications in IoT	54%
IoT-EM3: IoT Communication Technologies	53%
IoT-EM4: IoT Security and Privacy	49%
IoT-EM5: IoT Devices	53%
IoT-EM6: IoT Business Value	45%

Table 2: Success rate at each Data Science online course

2.1 Evaluation of IoT online courses

For each online course, the trainees have been asked through a survey embedded at the end of each course (and using it as a feedback loop) to evaluate various aspects using a scale from "Strongly Disagree" up to "Strongly Agree". The aspects evaluated for each online course are the following:

1. I have enjoyed the course.
2. This course was challenging.
3. The course met my expectations.
4. he quality of the training material was high.

5. The content was well organized and easy to follow.
6. The course will be useful in my work.
7. The objectives of the course were clearly defined.
8. The time allocated for the course was reasonable.
9. The course enhanced my knowledge of the subject matter.
10. In this course, I have been challenged to learn more than I expected.

Totally, 207 responses have been collected for the 6 IoT online courses. The distribution of responses per online course is depicted at the following table.

Online course	Number of responses
IoT-EM1: Introduction to IoT	62
IoT-EM2: Architectural Design and Applications in IoT	35
IoT-EM3: IoT Communication Technologies	31
IoT-EM4: IoT Security and Privacy	23
IoT-EM5: IoT Devices	32
IoT-EM6: IoT Business Value	24
Total number of responses	**207**

Table 3: Number of responses collected for the evaluation of Data Science online courses

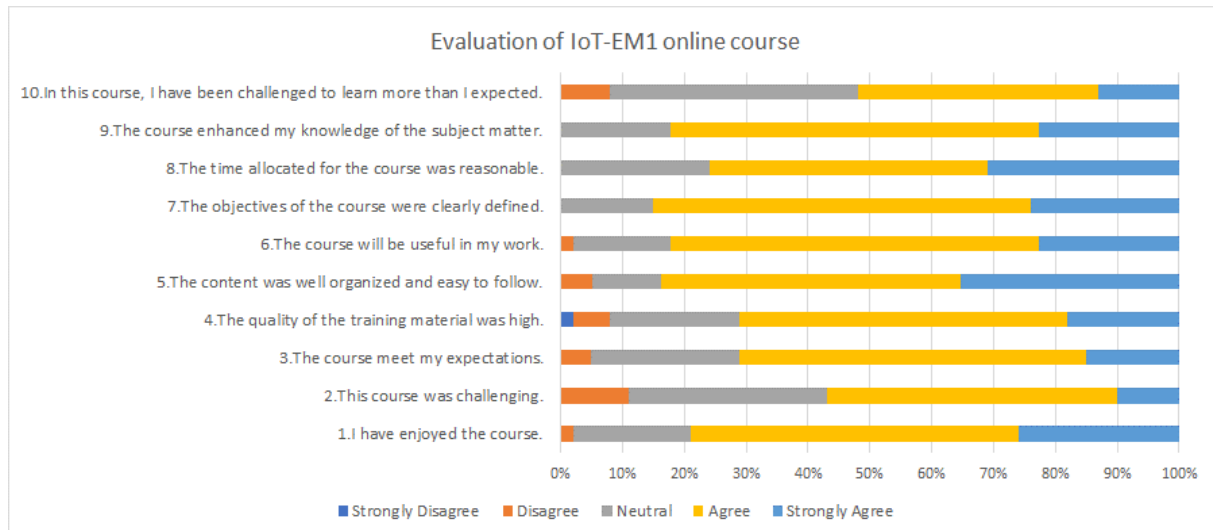The following diagrams depict the evaluation of each course.

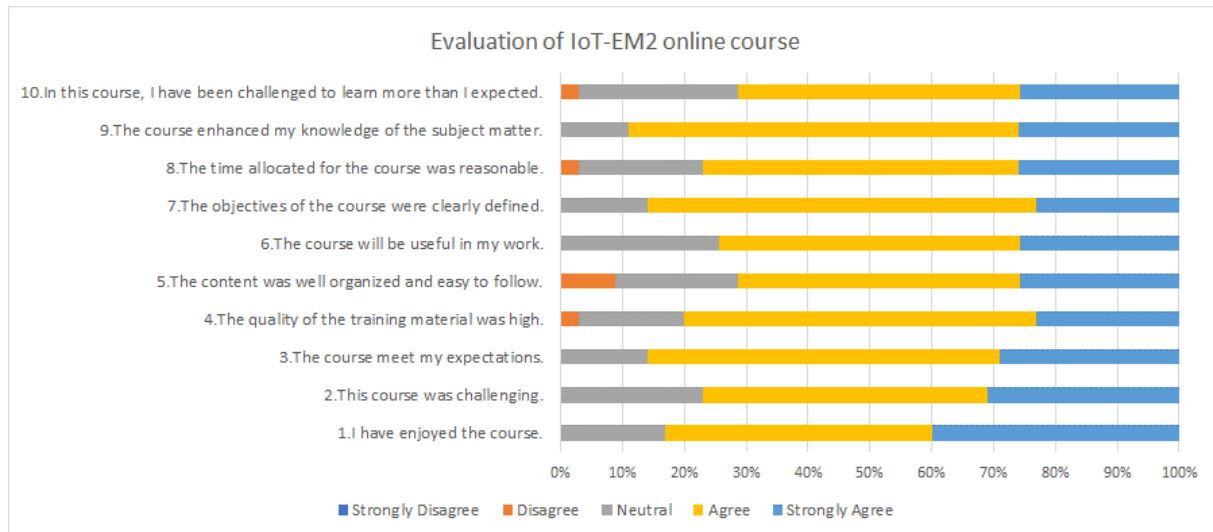**Figure 1: Evaluation of IoT-EM1 online course**
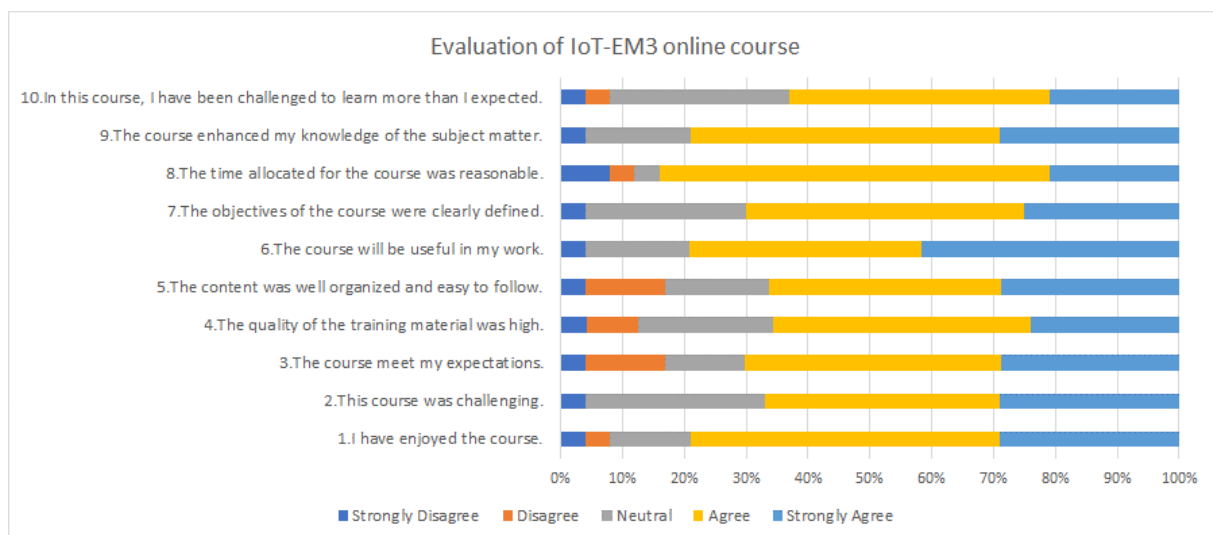
Figure 2: Evaluation of IoT-EM2 online course

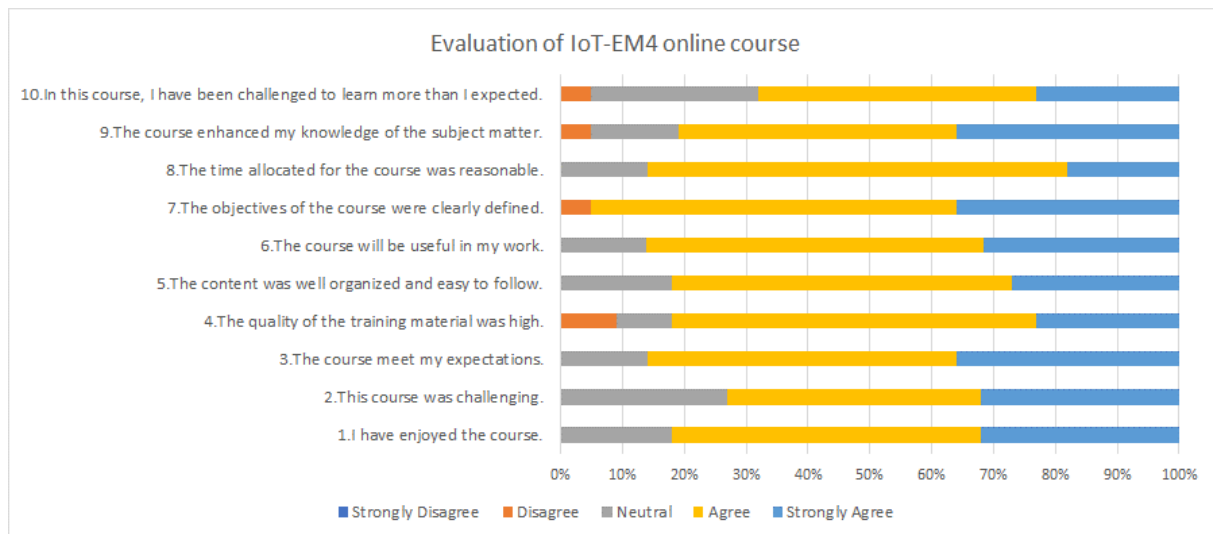

Figure 3: Evaluation of IoT-EM3 online course

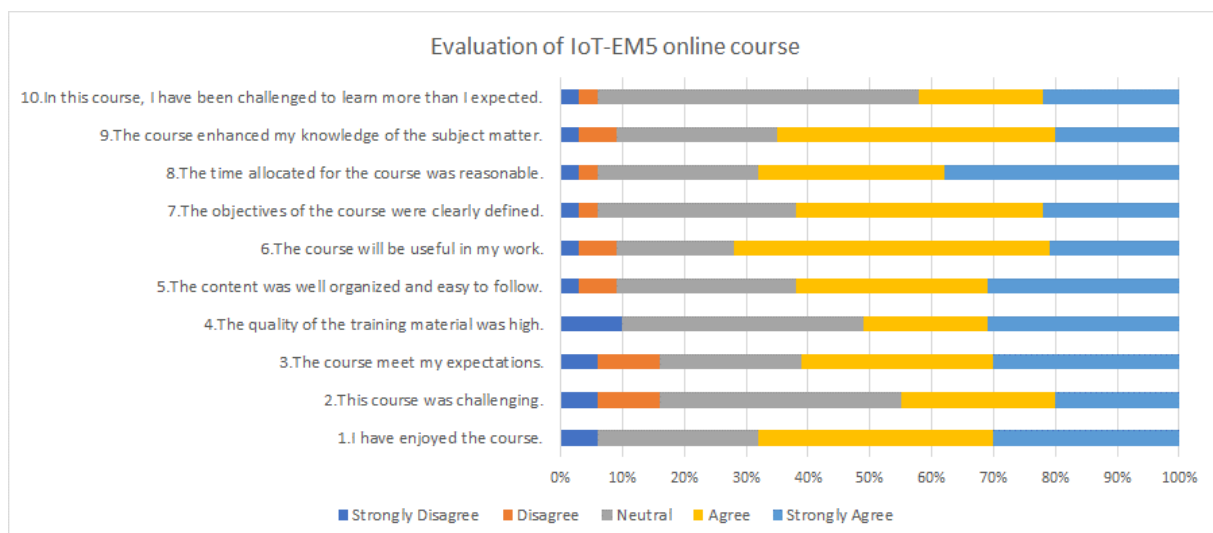**Figure 4: Evaluation of IoT-EM4 online course**

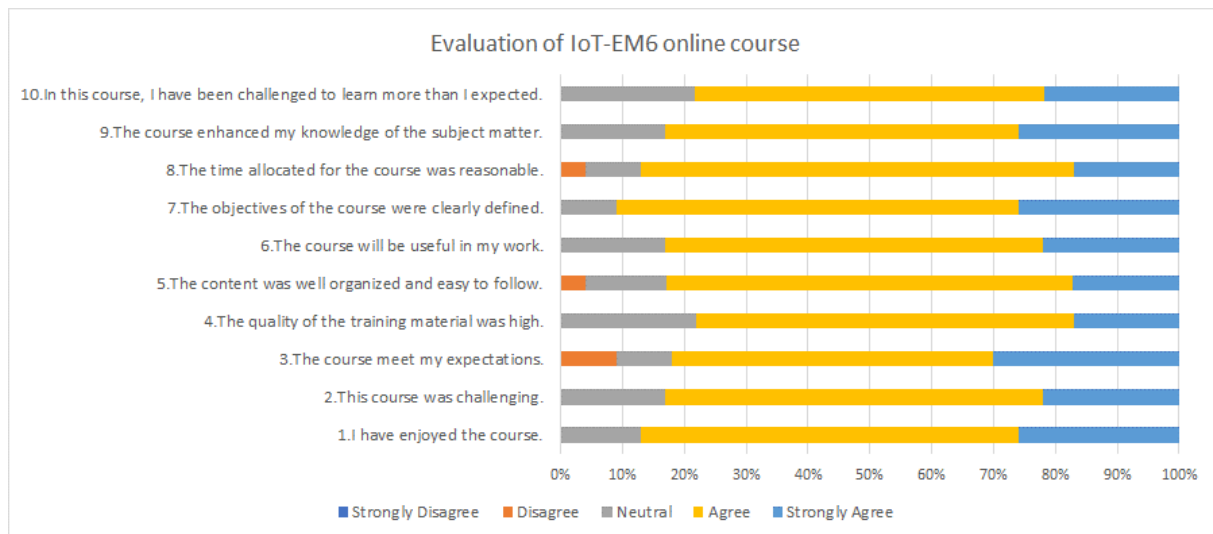**Figure 5: Evaluation of IoT-EM5 online course**

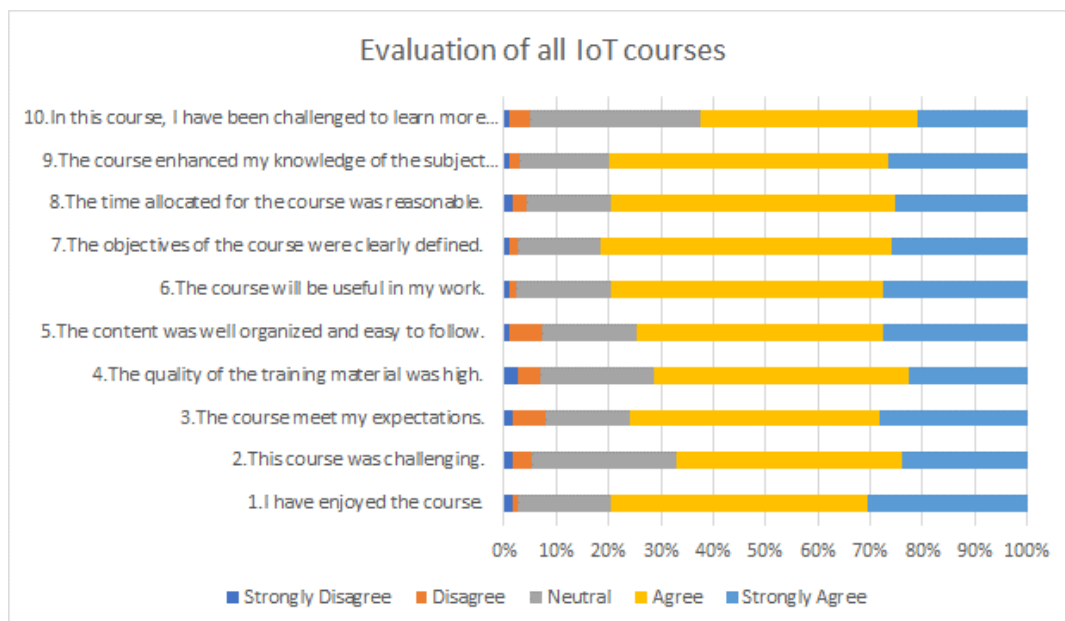**Figure 6: Evaluation of IoT-EM6 online course**

Figure 7: Evaluation of all IoT online courses

From the evaluation, it is concluded that the trainees were satisfied with the overall IoT online courses given the following average scores received:

- 80% declared that they enjoyed the courses
- 67% declared that the courses were challenging
- 76% declared that the courses met their expectations
- 71% declared that the quality of the courses was high

- 75% declared that the content was well organized and easy to follow
- 80% declared that the courses will be useful in their work
- 82% declared that the objectives of the courses were clearly defined
- 80% declared that the time allocated for the courses was reasonable
- 80% declared that the courses enhanced their knowledge of the subject matter
- 73% declared that they have been challenged to learn more than they expected

3 Phases 2&3 and certification exams

As the transversal skills training and the work-based learning were common for the 2 VET programs (Data Science and IoT), please refer to the deliverable "D5.3.2: Report about the delivery and certification of Data Science vocational trainings" for details about the second and third phase of the IoT VET program, as well as the certification exams.

4 Conclusions from the pilot delivery of IoT VET program

The overall implementation of the piloting of the IoT VET program can be considered satisfactory given the profile of the trainees (employed professionals with work commitments) and the completion rates achieved through each phase of the training:

- 35 out of 95 trainees (36%) have successfully completed 103 hours of IoT online training and received a certification of completion. The completion rate of the online courses at SEnDIng MOOC is much higher than the average completion rates (20%) observed at MOOCs provided by big brands like Harvard, MIT and Stanford.

- 42 out of 136 trainees (30%) -common among the Data Science and IoT VET programs- have successfully completed the 20 hours of transversal skills online training.

- 23 out of 23 trainees (100%) -common among the Data Science and IoT VET programs- have successfully completed the 320 hours work based learning, passed the certification exams and received the (Data Science or IoT) SEnDIng certification.

Generally speaking, the difficulties that the trainees faced due to the COVID-19 situation (e.g. due to the pandemic and to the long period employees stopped working or worked remotely, companies have gone through a phase where they had other priorities other than providing work-based training for their employees and this in many cases resulted in employees not being able to allocate enough hours to SEnDIng-related projects during the

work-based learning phase) has affected their participation in the program and for this reason a drop rate is observed through the 3 phases of the Data Science VET program.

Moreover, we faced two main challenges during piloting:

- Deliver online the transversal skills training. Although the initial plan was to deliver the transversal skills training through face-to-face sessions, the COVID-19 restrictions forced us to reschedule this training and move to online sessions. The main challenge was to keep the motivation of the trainees and promote collaborative learning and the continuous interaction between the trainer and the trainees through the online sessions using various training techniques (e.g., role play, working in teams, teambuilding).

- Running work-based learning. Running the work-based learning was a key challenge faced at this phase due to the different expertise of the participating companies and moreover, due to their different culture as a consequence of different national contexts. For this reason, we run an online training for the in-company mentors who had the responsibility for guiding their trainees, while we have also provided a handbook describing all the details and methods for monitoring the work-based learning and assessing their trainees. An additional challenge has been raised due to COVID-19 given that work-based learning was adapted at the internal policies of each company with regards to the remote or on-site work of their employees.