Digital Manufacturing Training System for SMEs
2017-1-UK01-KA202-036807

Deliverable 1.2:

Analysis of user needs

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Digit-T
DIGITAL MANUFACTURING TRAINING

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Introduction

This document results from the work undertaken in the **Needs analysis and definition of training requirements and specifications** activities (previously Intellectual Output 1) of the Digit-T project. The main objective of this activity was the identification of the detailed training needs in the field of digital manufacturing and the preferences on the training methodologies of the targeted market for the platform to be developed.

The information obtained from the survey was designed to indicate:

- The specific topics that should be offered within the training platform.
- The focus and technical level of the topics to be developed.
- The target audience of the developed content.
- The type of training process and average duration of the sessions.

To do so, a survey was conducted among different companies in different countries, according to the partners' network of contacts. A total of 20 interviews have been carried out in order to have a valid amount of information to be analysed. Such information has been useful to identify what is the level of digitalization in European SMEs and which are the industry needs in regard to digital manufacturing training.

Methodology

Questionnaire

The DIGIT-T questionnaire was developed based on the partners' previous experience in the Miman-t project[1]. Thus, different topics related to digital manufacturing, which were previously identified according partners' expertise, were proposed in the survey in order to detect which are the topics more in demand by the companies. Questions about the preferred methodology and format of the training material were also included.

In this regard, the survey consisted of the following sections:

1. General information about the company
2. Smart factory related training topics
3. Smart production related training topics
4. Training methodology
5. Format of the online training platform

The proposed training topics were:

Smart factory related training topics:

- Business Models
- Digitalization Strategies
- Management of I4.0
- Industrial IoT
- Business Intelligence

Smart production related training topics:

- Micro manufufacturing Technologies
- Advanced Manufacturing Systems
- Intelligent Robotics
- Production with CPS
- Advanced materials and functional printing
- Additive manufacturing
- De-manufacturing
- Big data, data mining and data visualisation

[1] https://eurecat.org/en/portfolio-items/miman-t/

Interview procedure

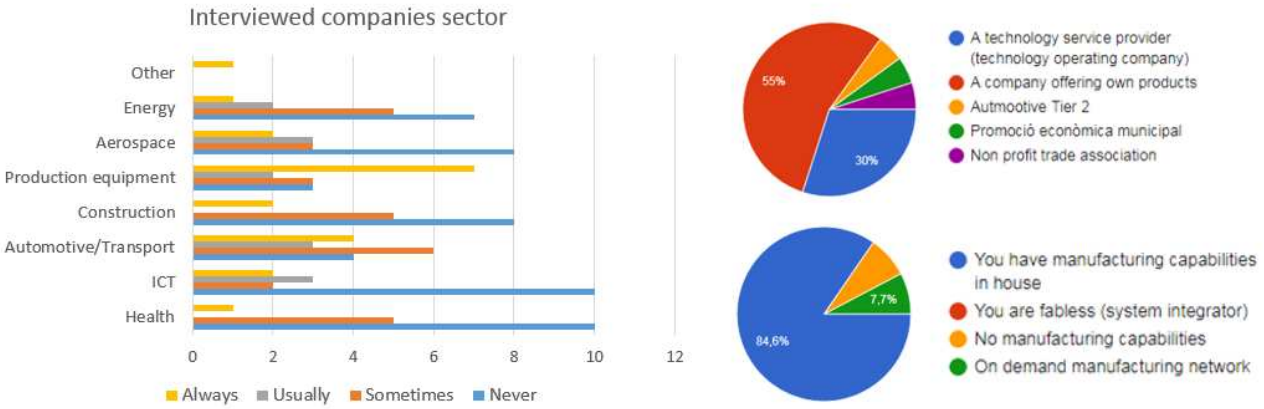
The survey was developed using an online survey tool (Google forms) in order to have a common access and store the results in an online repository, accessible to every partner. Moreover, this allows the responses of each interview to be directly entered into the database. A printed version could also be obtained if necessary. The online survey is available in the following link:

https://drive.google.com/open?id=17L9PrG_eM9O0dxHzPa8rALi5NTkj9Pjgxbv80zMVGNo

The interviews were mainly conducted face-to-face or by telephone, and directly storing the results. In some cases, the link was sent to the interviewee to allow them to answer the questionnaire on their own.

Analysis of the results

The set of interviews is composed by 20 different companies from 3 different countries: 8 interviews from Spain, 8 from Italy and 4 from UK.



As presented in **Error! Reference source not found.**, most of the interviewed companies offers own products and have manufacturing capabilities in house, which is common in most European countries. Few SMEs have experience on digitalization, and while the majority of the companies are aware of the new processes and the digital revolution they do not have the resources or the required knowledge to start with the digitization of the company.

Position	No specific knowledge	Theoretical knowledge	Practical experience	Theoretical knowledge and practical experience
Worker	11	2	5	0
Technician	6	5	4	5
Middle Manager	4	10	1	4
Top Manager	7	8	1	3
Other	4	1	0	0

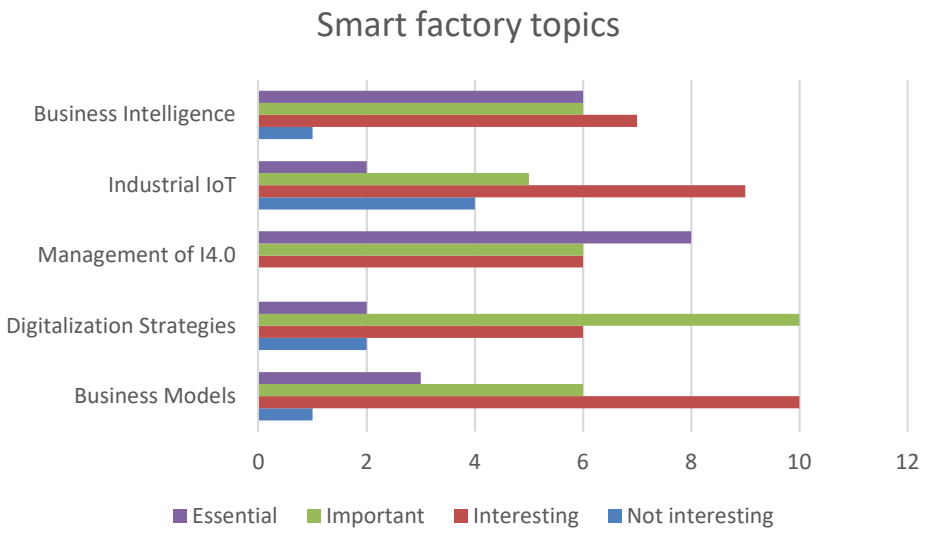
All the responses regarding training topics and course format have been analysed as a whole set of data. To do so, the responses of the survey were weighted in order to obtain an aggregated result and be compared between different categories. Thus the “not interesting”, “never”, “unlikely”, etc. responds were weighted by 0, increasing this factor by 1 for each category. The results obtained are presented in the following subsections.

Smart factory training topics

The following table presents the responses from the survey. It is evident from the results that companies, and in particular its managers, are interested in more detailed information regarding Management procedures of the new digital era, also known as I4.0 or connected industry, depending on the region.

Topic	Not interesting	Interesting	Important	Essential	Score
Business Models	1	10	6	3	31
Digitalization Strategies	2	6	10	2	32
Management of I4.0	0	6	6	8	42
Industrial IoT	4	9	5	2	25
Business Intelligence	1	7	6	6	37

Other concepts, like Business Intelligence, Digitalization Strategies or new Business Models that can appear in the digital era, are considered interesting for the most of the companies.



Smart Production training topics

The following table presents the responses from the survey regarding the proposed technologies to be included in the training system. According to the survey results, intelligent robotics is perceived as an essential technology that will produce a dramatic change on how things are done in today's manufacturing companies. Advanced manufacturing systems are also considered an important technology to take into account.

Topic	Not interesting	Interesting	Important	Essential	Score
Micro manuf. Technologies	5	9	1	4	23
Adv. Manuf. Systems	1	5	11	3	36
Intelligent Robotics	2	5	4	9	40
Production with CPS	2	8	6	3	29
Advanced materials and functional printing	2	8	7	3	31
Additive manufacturing	5	6	6	3	27
De-manufacturing	5	9	4	2	23
Big data, data mining and data visualisation	5	9	3	2	21

In this section of the survey, each technology was broken down into different sub-topics, in order to obtain a detailed overview of the needs of the companies.

Micro manuf. Technologies	
EDM	2
Extrusion	1
Injection moulding	6
Handling and assembly of micro components	5
Adv. Manuf. Systems	
Flexible assembly systems	9
Reconfigurable manufacturing systems	6
Agent based control	1
System integration	6
Sensing & metrology	8
RFID tracking	8
Intelligent Robotics	
Micro robotics	4
Industrial and collaborative robots	12
Sensors, actuators, control systems	11
Programming languages	5
Mobile robots	5
Production with CPS	
Manufacturing systems modelling and simulation	8
Inspection assisted manufacturing and assembly	3
Adaptive and autonomous manufacturing and assembly systems	7
Context-aware equipment and systems	2
Self-adaptive and uncertainty-aware fixturing	1
Advanced materials an functional printing	
Smart materials (shape memory alloys, etc.)	7
Materials with improved performances (composites, etc.)	6
Thin film printed devices	2
Hybrid printed electronics	3
Functional coating deposition	2
Sensor and electronics integration	7
Additive manufacturing	
Fused deposition modelling	6
Stereolithography	5
Other 3D printing technologies	8
New design strategies for additive manufacturing	8
De-manufacturing	
Disassembly, shredding, cleaning, sorting, testing, reconditioning	7
Image Recognition and classification technologies	5
Simulation models	6
Big data, data mining and data visualisation	
Statistics fundamentals	1
Programming	4
Data visualisation	6
Predictive models	9
Data simulation	5
Data storage and management	6

In accordance with previous results, industrial and collaborative robots, sensors actuators and control systems, and flexible assembly systems were the most demanded technologies. Moreover, predictive models for data mining and data visualisation was also identified as important.

Course structure

This part of the survey was used to determine the characteristics of the courses to be developed: target audience, type of information or duration among others.

Type of information	Score	End user	Score
General overview	34	Worker	18
Collection of use cases	35	Technician	27
Theoretical background	21	Middle manager	27
Methods and guidelines	34	Top manager	23

It can be observed that companies expect training material composed by general overview of the topics, with some methods and guidelines, and with a collection of use cases in order to see the practical applications and how can this impact on their business.

The material should target technicians and middle manager, which means that courses should also include some technical aspects in order to make it useful and challenging for the audience.

Duration of training modules	
1 - 5 h per module	14
5 - 10 h per module	5
> 10 h module	1
Number of sessions	
2 - 5 sessions	16
5 - 10 sessions	3
Only one large session	1
Average duration of each session	
5 - 8 min (capsules)	2
10 - 15 min	4
30 min	8
60 min	6
Language preferences	
The whole material in my own language	11
The whole material in English would be useful to learn the international technical terminology	6
Texts in English, but media in my own language	3
Texts in English, but text in my own language	0
Weight of use cases	
10 - 30%	6
30 - 50%	10
50 - 70%	4
Lectures - Exercises ratio	
50 - 50%	8
80 - 20%	12
100 - 0%	0

The preferences regarding course structure are:

- Modules with an average duration of 1 to 5 hours. Each one of the modules should be composed by 2 to 5 sessions, with an average duration of 30-60 minutes per session.
- Regarding the contents, the course should be structured as a mix between theoretical content and collection of use cases with a weight of 30 to 50% of the course. The course should also present an 80-20% ratio between lectures and practical exercises.
- The training material will be developed in English, and then translated into Spanish and Italian.

Conclusions

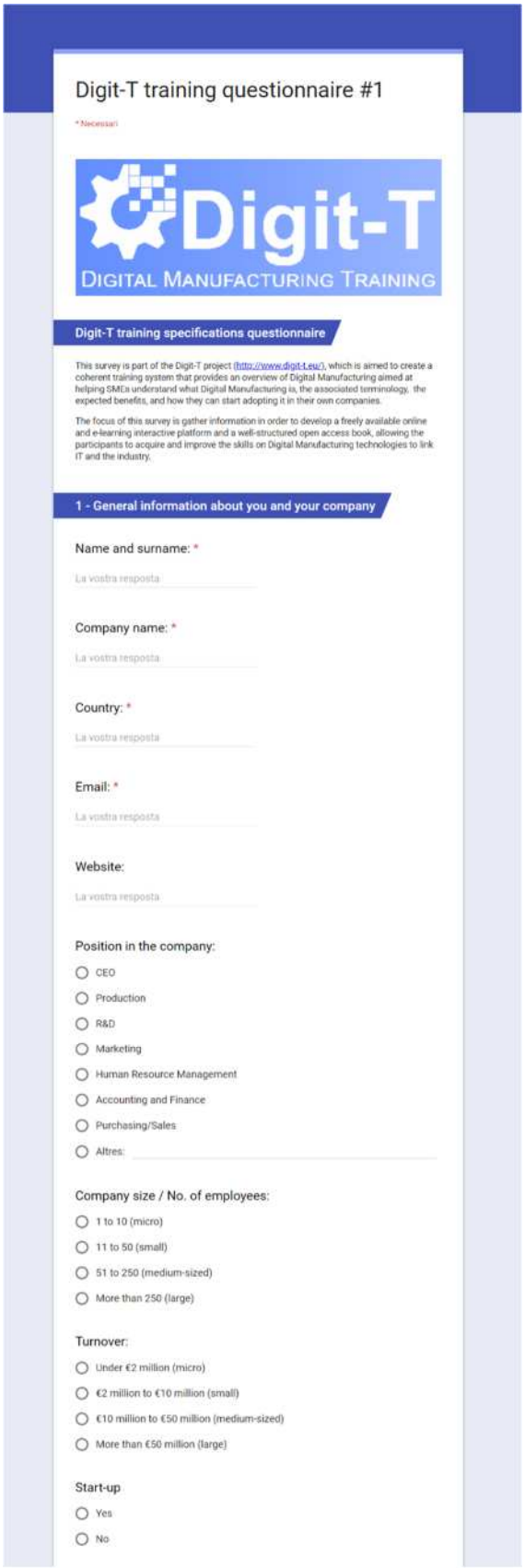
According to the survey results, the topics of the course and its structure have been defined. The training system will be divided into three different main Topics: Management in I4.0, Advanced Manufacturing Systems and Intelligent Robotics. Each of them will be composed by different modules and each module into different sessions. The sessions will have an average duration of 30-60 minutes, in order to match with the courses preferences.

Document revisions

Name	Date	Version	Change	
			Subject of change	Page
Jordi Grabalosa Saubí	26/06/2018	0.1	Initial draft for review	
Santi Fort	13/08/2018	0.2	Draft incorporating comments from Claudia Pagano and Helena Arrand	All
Helena Arrand	10/10/2018	1.0	Formal Issue following Management Meeting	

Table 1 Record of changes to this document

Annex 1: Screenshot of the online survey (initial part excerpt)



Digit-T training questionnaire #1

* Necessari

Digit-T training specifications questionnaire

This survey is part of the Digit-T project (http://www.digit-t.eu/), which is aimed to create a coherent training system that provides an overview of Digital Manufacturing aimed at helping SMEs understand what Digital Manufacturing is, the associated terminology, the expected benefits, and how they can start adopting it in their own companies.

The focus of this survey is gather information in order to develop a freely available online and e-learning interactive platform and a well-structured open access book, allowing the participants to acquire and improve the skills on Digital Manufacturing technologies to link IT and the industry.

1 - General information about you and your company

Name and surname: *

La vostra resposta

Company name: *

La vostra resposta

Country: *

La vostra resposta

Email: *

La vostra resposta

Website:

La vostra resposta

Position in the company:

- CEO
- Production
- R&D
- Marketing
- Human Resource Management
- Accounting and Finance
- Purchasing/Sales
- Altres:

Company size / No. of employees:

- 1 to 10 (micro)
- 11 to 50 (small)
- 51 to 250 (medium-sized)
- More than 250 (large)

Turnover:

- Under €2 million (micro)
- €2 million to €10 million (small)
- €10 million to €50 million (medium-sized)
- More than €50 million (large)

Start-up

- Yes
- No