DELIVERABLE T3.2.10

Summary report on pilot actions with local/transnat. SME participant groups from all PP regions

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1. Introduction

The aim of this report is to summarize all piloted trainings with lessons learnt and impact on targeted SME. This report marks the final point of the training implementation, which started almost 3 years ago with the definition of the training content and structure in the three knowledge dimensions Technology, HR and Organizational management, and Business model development (A.T2.1) as well as the definition of the didactical methodology to transport the know-how to SME and further target groups (A.T2.2).

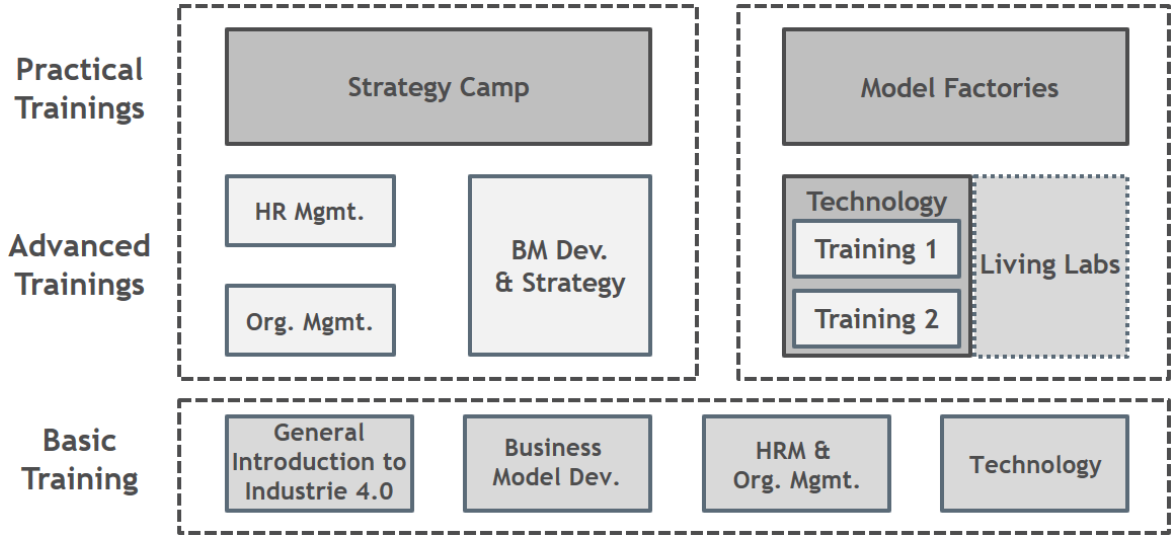


Fig. 1: Overview of the InnoPeer AVM Training Modules

The implementation of the first round of basic trainings (1st level) started in autumn 2018 in the project partners' regions Upper Austria, Veneto, Emilia Romagna and was continued in early 2019 in Bavaria, Western Hungary, and Lower Silesia.

During the development of the advanced trainings as webinars, which are hosted on the platform open.vhb.org the project partners organized a second round of basic trainings in 2019.

The participants of both basic training rounds were asked for their feedback on the training in order to improve the training content and methodology.

In winter 2019/2020 all advanced trainings became available to participants. For each of the five training courses, an online workshop was held for the elaboration of the respective advanced teaching case. Additionally, the PPs FHG and WRUT have held a living lab as intro and definition for the model factory test runs. The piloting of all trainings was accomplished in spring 2020. However, the advanced training are available on open.vhb.or beyond project end. The results of the trainings are published in the InnoPeer AVM handbook as well as on the projects' website.

This report is based on the reports from the single training levels:

- Basic Training – D.T3.2.1
- Advanced online workshops and living labs - D.T3.2.2
- Model factory test sessions - D.T3.2.3
- Strategy camps – D.T3.2.4

2. Basic Trainings

The main aim of the basic training was, to give participants an overview of the most important topics in the field of Advanced Manufacturing (AVM) = Industry 4.0. Starting with the definition of Industry 4.0 and striving the main topics of Industry 4.0 without providing too much in-depth information and applying the gained know-how in practice – solving a teaching case, the basic training is the perfect entry point for SME and further target groups into the digital production world.

As the trainings were held in each region, in native language, with a duration of 2-3 days, the participants did not need any prior knowledge in the AVM topics.

For example, an HR department leader, who attend the basic training, gets an overview of the main technologies as well as business model opportunities and share her/his experience in the HR management with other participants.

However, the majority of the participants had a technology background. The participants had different positions in their company, as e.g general manager, head of department, group leader, etc. in any of the three knowledge dimensions.

In total, more than 200 participants attended one of the 13 basic trainings in 6 regions.

2.1. Content and methodology

As defined in the deliverables of A.T2.1 the content and structure as well as the methodology as defined in A.T2.2, were applied in the basic trainings in all 6 partner regions.

The basic trainings were held in different methodological settings, as e.g. know-how input from the trainers, interactive phases, workshops and group works to elaborate the teaching cases (see D.T2.3.5).

The trainings started with a general overview of the field of advanced manufacturing with its opportunities and threats and continued with the three knowledge dimensions:

- Technology
- Business model development & strategy
- Human resource & organisational management

The main technologies, as Connectivity, Additive Manufacturing / 3D Printing, Simulation incl. Digital Twins and Virtual Commissioning, Robotics and Human Machine Collaboration, Data collection and analysis incl. artificial intelligence were briefly described and discussed.



Participants elaborated a teaching case on the introduction of a new MES (manufacturing execution system) by applying the connectivity protocol OPC UA. This case is based on a real business case from a German company.

In the second knowledge dimension, the purpose and benefits of business models were described as well as their development by applying the BM Canvas. Several examples of existing business models as well as possible ways to transform the existing business model to digital ones were explained as well as the opportunity of developing completely new, even disrupting business models.

Participants were encouraged to solve a teaching case on "Transforming business from contract production to technology transfer consulting service for additive manufacturing processes". This case is based on a real business case from an Italial company.

Finally, the influence on HR and organisational management by implementing new I4.0 technologies as well as the interactions between environment, organisational structure and technology were tackled. Human Resource Management and Org. Mgmt. designs were described as well as its barriers and enablers of change towards digital transformations.

Participants jointly solved either the teaching case "Digitalisation of work processes" or "Metalworking company: Building a dynamic organization". Both cases are based on real business cases from two Austrian companies.

2.2. Feedback and impact of basic trainings

As described in the deliverables of A.T3.3 the participants were encouraged to fill in a questionnaire at the end of the basic training. In a second step, selected companies were asked 3-6 months later to report on the impact of the basic training on their company.

The results of the first questionnaire show that the taught subjects of the basic trainings are seen as relevant and useful. This is reflected by participants' assessment of their newly gained knowledge (average 8.04 out of 10) and the perceived job-related usefulness of the basic trainings (8.44), reaffirming that participants' practical AVM experience prior to the training (with an average rating of 5.92 across all six partner regions) was limited.

Several months later, the participants reported, that the knowledge gained during the basic trainings was later shared with different levels of management as well as relevant colleagues (e.g. technical departments or R&D), HR and in some cases even with external project partners. The main reason why information was shared was due to its relevance in ongoing projects or new inputs that were in-cooperated with regard to customer service and product development.

3. Advanced trainings and living labs

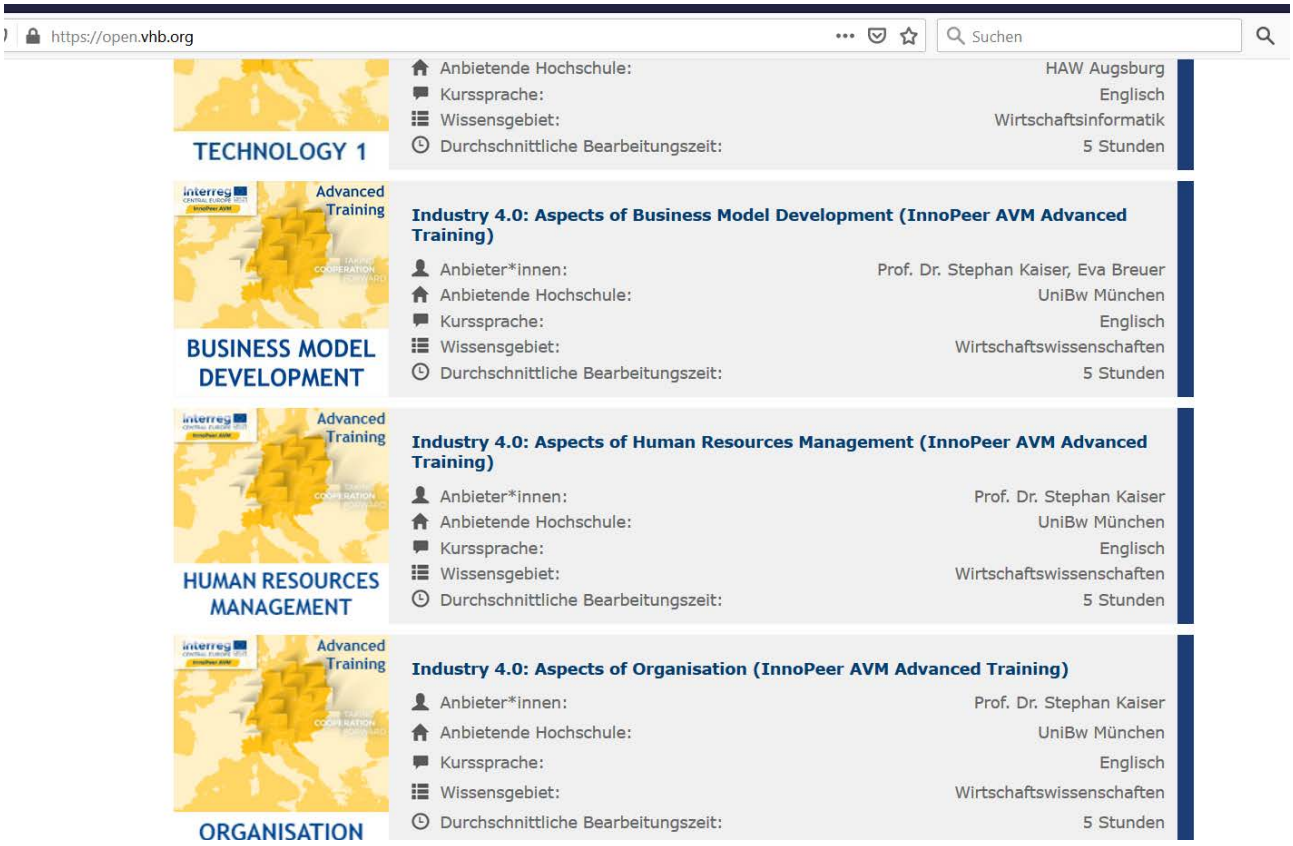
3.1. Advanced trainings hosted on the learning platform

All project partners jointly developed the structure and content of the advanced trainings. The intention of these trainings is, that particpants can choose one of the five online course (or 2, or 3, …) according to their own area of interest. The online courses offer in-depth information on the specific topics via several webinars, interviews with experts and informative texts in the following knowledge dimensions:

- Technology 1 (Connectivity, Data acquisition/analysis/security, etc.)
- Technology 2 (additive manufacturing, collaborative robotics, etc.)
- Human resource management
- Organizational management
- Business model development and strategy

All courses together are equal to 2 ECTS (university lecture) and can be completed with a certificate, if participants answer the majority of quiz questions correctly.

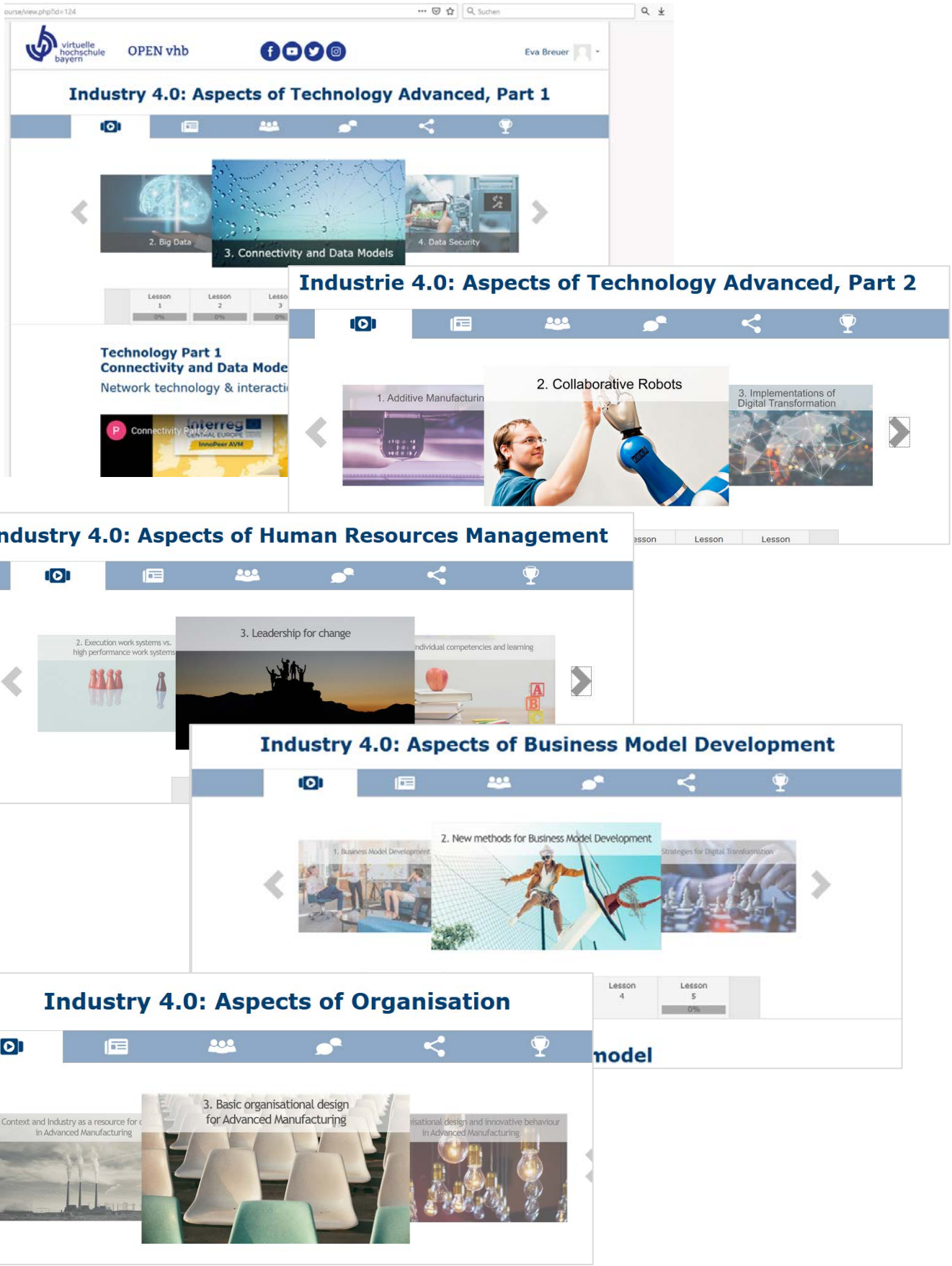
The courses are available for free on open.vhb.org – participants only have to register and agree to the terms and conditions of the VHB.



We are very proud that we were given the opportunity to host our InnoPeer AVM advanced training courses on the highly renowned digital platform of all Bavarian Universities and Highschools VHB.

This cooperation with the VHB ensures the high quality of the courses as well as their sustainability beyond project end.

Impressions of the online courses:



3.2. Feedback and impact of advanced trainings

Participants of the online courses were encouraged to fill in an online feedback questionnaire. This feedback was then used to improve the online courses.

In general, the training participants were very satisfied with the in-depth information. 85% of them plan to apply the gained knowledge in their workplace, and intend to implement changes in the fields of strategy and business models, HR & Organisation and Technology. The reasons for planning these changes are diverse and include, for example, increasing revenue and productivity, enhancing employee's well-being by reducing stress, widening the perspective and increasing AVM technology usage.

Until the end of the project, almost 1.000 participants have subscribed for one of the five advanced courses and attended several lectures and about 250 have completed one of the courses with certificate.

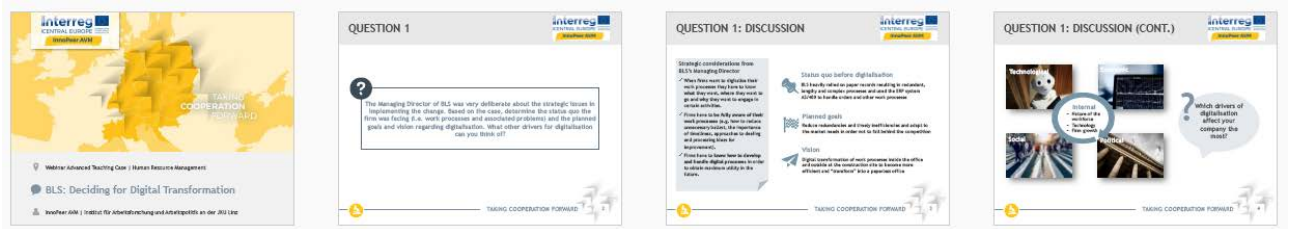
3.3. Online teaching case webinars and living labs

Participants of the online courses were encouraged to solve a teaching case per course on their own. On a fixed date the case was then discussed in a live webinar with other participants, guided by an expert from the InnoPeer AVM consortium.

- Technology 1 - Cloud-based ordering of customized powerbanks
- Technology 2 - Changing production processes with AVM technologies
- Human resource management - Deciding for Digital Transformation
- Organizational management - Dynamising Metalworking company
- Business model development and strategy - Expanding form supplier to full supply chain support in additive manufacturing

After the respective live webinars the responsible project partner uploaded the recorded webinars as movies as well as the presented slides of the teaching case introduction and the questions and answers, in chapter 5 of the respective advanced course on VHB.

Exemplary for the Orga – Teaching case:



Additionally, online living labs were implemented as preparation for the practical test runs in the model factories in Augsburg (PP FHG) and Wroclaw (PP WRUT), respectively. Based on this basic conception the living labs aimed at instructing participants and offering them knowledge to be applied in the model factors. The living lab webinars were structured according to the requirements of the practical trainings in the respective model factory.

Further details on living labs are described in D.T3.2.2

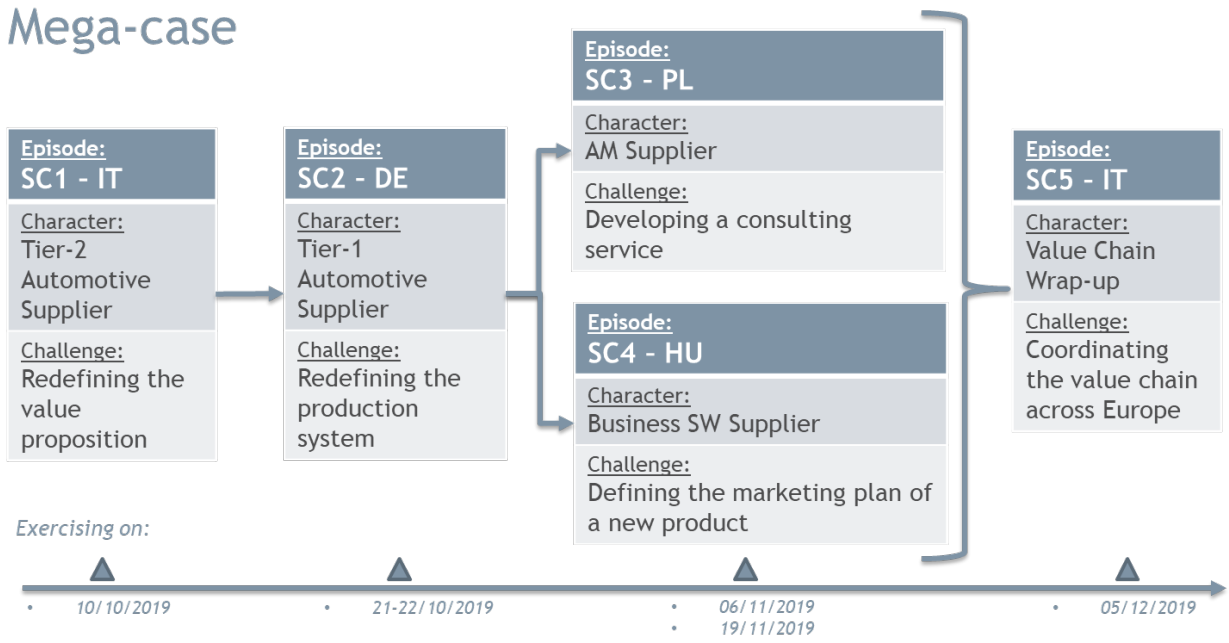
4. Practical Trainings

4.1. Strategy Camps

As described in D.T2.2.9, the goal of the strategy camps was, to teach participants to become an innovation driver in the context of Industry 4.0 related HR / organisational management and business model strategy + development within their company.

In general, the Design thinking approach was applied, with the four steps of exploration, creation, testing and implementation.

For the purpose of teaching how to drive a corporate change for competitiveness by aligning technologies, people and organization, the mega case was created – a complex teaching case with various aspects of a transnational value chain. The mega-case elaboration is organized like a Netflix series on the basis of 5 different episodes composing a single story whose plotline develops right throughout the episodes. Each Strategy Camp hosts one of the five episodes. Within the single episode there is a fictional local company as protagonist. The fictional company has a challenge to face, which puts its business into question or represents an opportunity to grow.

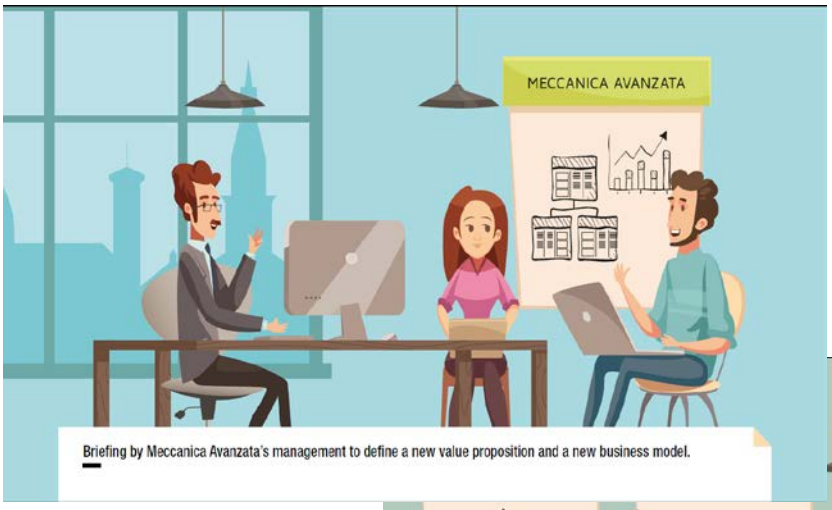


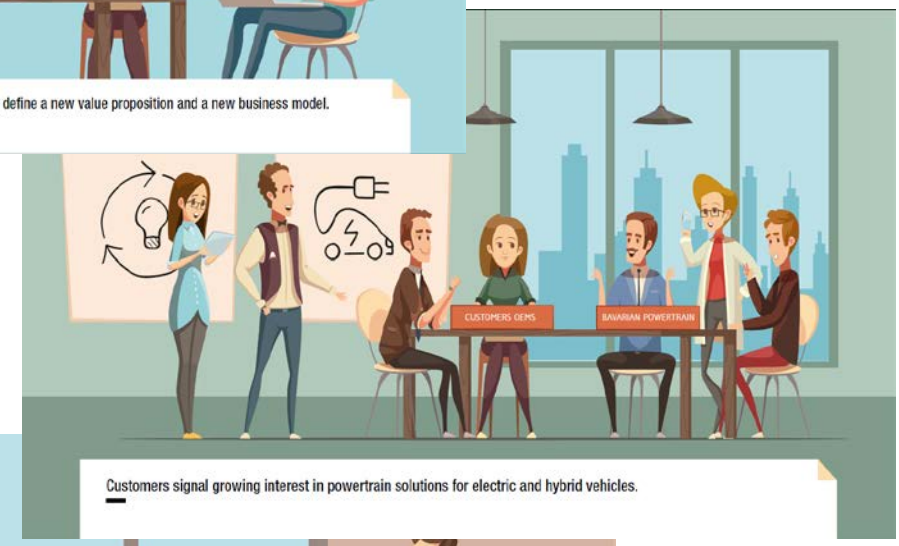
The fictional value chain consisted of an Italia mechanics producer, a Bavarian powertrain producer, a Lower Silesian additive manufacturer, and a Western Transdanubian software (ERP) specialist, who finally met in Italy to discuss the updated value chain with all its changes.

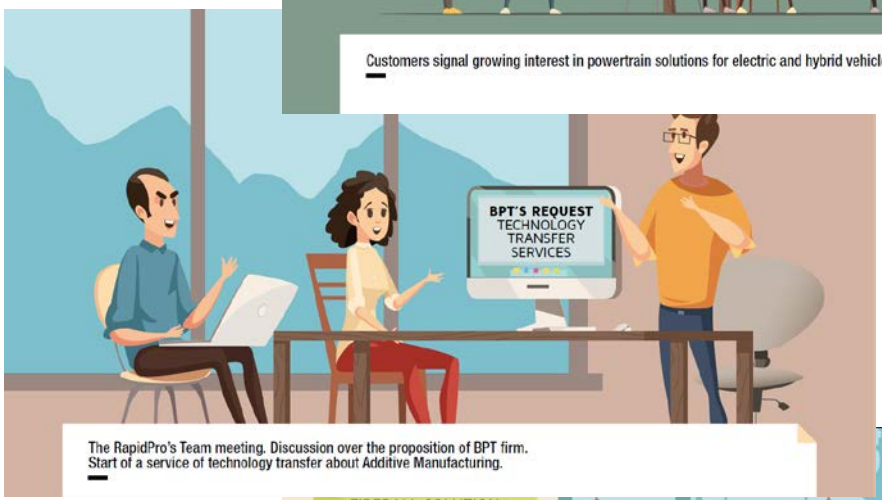
The participants of each of the strategy camps commonly elaborated solutions for the given challenges, which is described in detail in D.T3.2.4.

All strategy camps were held in autumn 2019, organized by PPs DEMO in Modena (IT), PP UniBwM in Munich (DE) , PP WRUT in Wroclaw (PL), and PP UniSo in Sopron (HU).

All solutions were also illustrated as storyboards. Some impressions are shown here:







Concluding, the strategy camps were very helpful for the participants, in order to understand the need and also tools to implement changes in various aspect of the companies position in digital transformation.

However, it showed that participants opted for a gradual transformation path and only one group considered a radical renovation of corporate organization and its business activities.

Additionally, the strategy camps offered the participants the possibility to discuss own challenges that they were facing in their digital transformation process. The analysis of these challenges and possible solutions were discussed in smaller groups. Participants intended to use this as basis for solving their own challenges and issues of their change process.

4.2. Model factory test runs

The project partners DEMO, FHG and WRUT have organized model factory test runs in various topics.

In autumn 2019, the **first** event was organized by **DEMO**, together with Bosch TEC, a company of the Bosch Group providing services focused on training and competence development. The collaboration led to implement the Model Factory within the factory of Bosch VHIT – another company of the Bosch Group, which produced vacuum and hydraulic pumps and is located in Offanengo (Crema, Italy).

The participants to the Model Factory had the possibility to study the solutions adopted by Bosch VHIT and to see them in operation along with the production line. Such solutions are powered by Internet of Things (IoT) and generate a complex array of data that are exploited to manage production and logistics.

Thus, thanks to the Model Factory, the participants had the possibility of deepening how to put into practice I4.0 solutions useful for make production and logistics more efficient and effective. This is the most urgent concern of many Italian SMEs and it usually represents the issue from which the firms start to think about Industry 4.0.

Apart from the technical issues (RFID systems in logistics, monitoring of warehouse stocks, lean production, etc.), the most important insight the participants received regarding the role of data themselves – how data is collected and used for e.g. failure prediction.

The **second model factory** was organized by PP **WRUT** close to Wroclaw, in cooperation with the company Materialise, in early 2020. It was designed as a direct follow-up of the implemented living lab, dealing with additive manufacturing.

Materialise is on of the biggest 3D manufacturing companies in Europe with huge know-how and experience in this kind of production.

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During this model factory, the following activities were carried out:

- Study visit to several production types, as e.g.:
    - Selective laser sintering
    - Multi Jet Fusion
- Case studies presentations realized by Materialise
- Open Q&A round between participants and company representatives
- Living Lab results practical verification

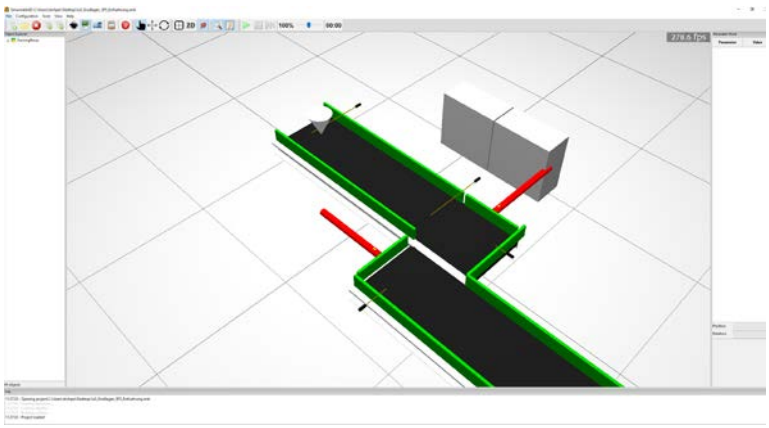
Especially the last activity was very much appreciated by the participants and had a high learning effect.

The CAD models that were prepared by the participants after the living lab were earlier sent to the organizers and manufactured with the individual properties given by LL participants. Based on the achieved printed models the authors could verify if all aims were reached, and why some were impossible to realize or just didn't look well.

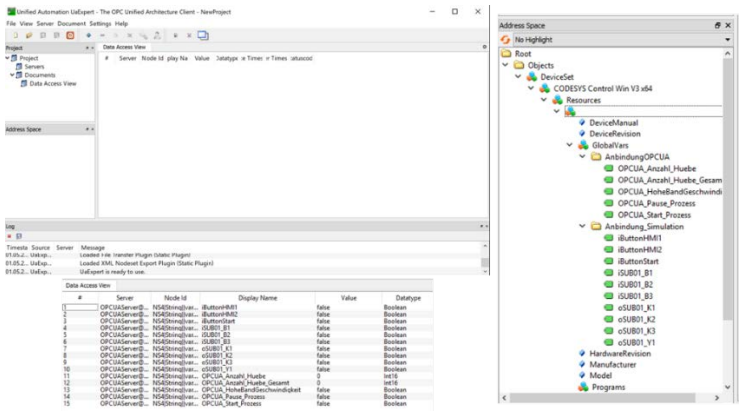
The **third model factory** was implemented by PP **Fraunhofer IGCV** in spring 2020. Initially, it was planned to be held at the Fraunhofer site in Augsburg as well as at the University Augsburg. Due to the shut-down caused by COVID-19 pandemy, the concept had to be changed and adapted for the online presentation of the model factory, which was done in a two-days event.

On the first day the topics of Digital Twin (session 1) and Connecitvity (session 2) were covered. On the second day the questions of the first day were answered and the topic of rapid prototype development (session 3) was covered.

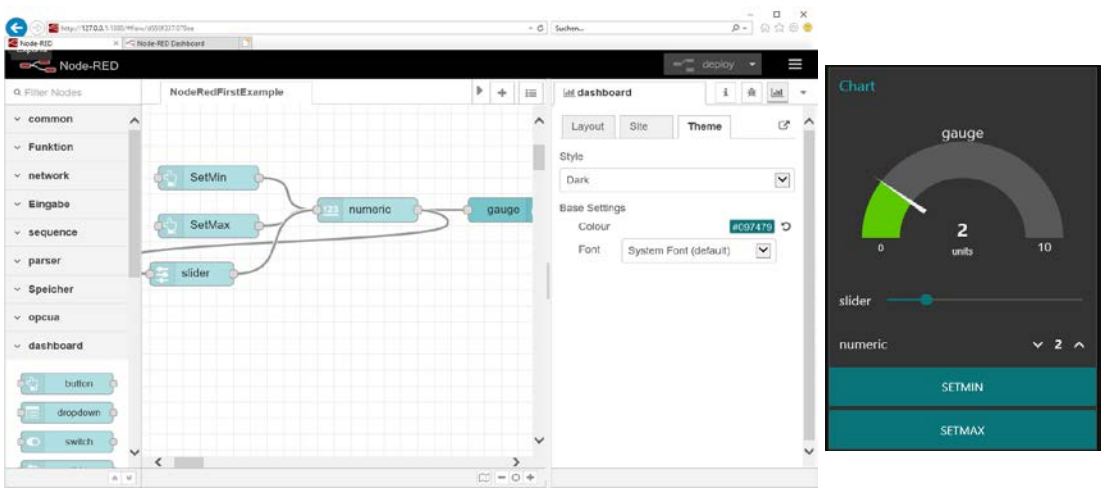
For the first session with the topic of virtual commissioning, the participants used *Simumatik3D* (see Figure below) for simulating actors and sensors as well as the *Codesys Engineering Suite* (Figure 3) for simulating the PLC Code.



Both programs were connected over OPC UA with each other to exchange their control variables, which is very common for many different simulation tools. Even though the first session was not yet about OPC UA, the free OPC UA Client *UA Expert* by Unified Automation was introduced, to test the OPC UA connectivity to the PLC Simulation (Codesys). In the second session the UA Expert was one of the main tools used to see the set-up OPC UA connection in the PLC.



For the last session, the programming tool *Node-RED* was used to rapidly develop high quality human machine interfaces with OPC UA connection by using a simple programming interface.



Concluding, the model factory has been implemented successfully, with very positive feedback from the participants. Several of them have even started with follow-up activities.

Despite the fact, that participants were not able to see everything in real, the learnings of the participants were of high value.

Shifting the model factory to a virtual event even offered the opportunity for more persons to attend the event.

The virtual Model Factory was recorded and is therefore a good addition to a physical on site training.

5. Conclusion

The internally consistent, but at the same time thematically diverse training programme, that was created and implemented in the project InnoPeer AVM can be considered as great success.

It was implemented with high quality in face-to-face settings as well as in blended learning formats. Far more than 200 participants attended at least on of the trainings and were mostly satisfied with the provided information content as well as with the applied training methodologies.

Piloting and permanently improving the single training modules is not only beneficial for the participants but also for the project partners. All of them intend to apply selected formats in their future work – as educational institution for students as well as business support organization for their target companies.