EXAM 4.0

THE EXCELLENT ADVANCED MANUFACTURING 4.0

AM 4.0 labs running I4.0 technologies

Technology 12: Digital workplace

12/15

Piloting the Advanced Manufacturing workshop 4.0

03

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Introduction

Following the piloting process of Advanced Manufacturing Labs for HVET/VET through the Collaborative Learning Factory (hereafter CLF), the EXAM4.0 partners we have piloted 16 technologies embedded in Industry 4.0

The following image shows the overall structure of the piloting process.

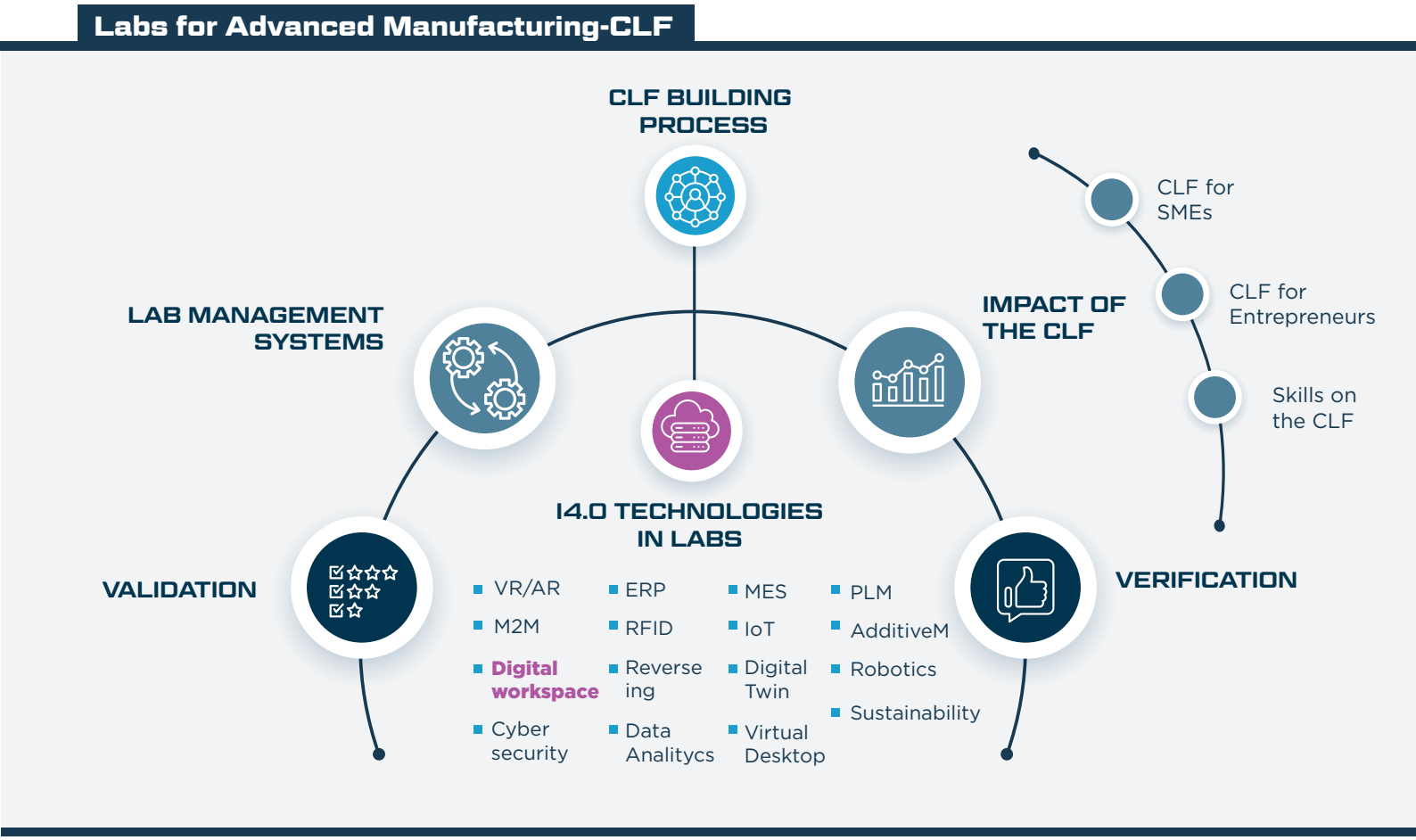

Figure 1: Overall structure of the EXAM4.0 labs piloting process.
Source: EXAM4.0

The present report is the one out of 16 I4.0 technology described within the "Industry 4.0 technologies in labs" section, specifically #12 Digital Workplace

1 Definition and application of digital workplace in industry

"The digital workplace strategically unifies an organization's employees and the technologies they use in an ecosystem that strives to facilitate agile ways of working, improve employee engagement and deliver an exceptional experience for its users"
Simon Dance – CEO, Interact Software.

When we unpick it, we can see it comprises of three core elements (Interactsoftware, 2021):

- **People:** The employees, their digital needs and the impact that has on key indicators such as engagement, productivity and innovation – but also the resulting impact on the customers/consumers, suppliers and stakeholders.

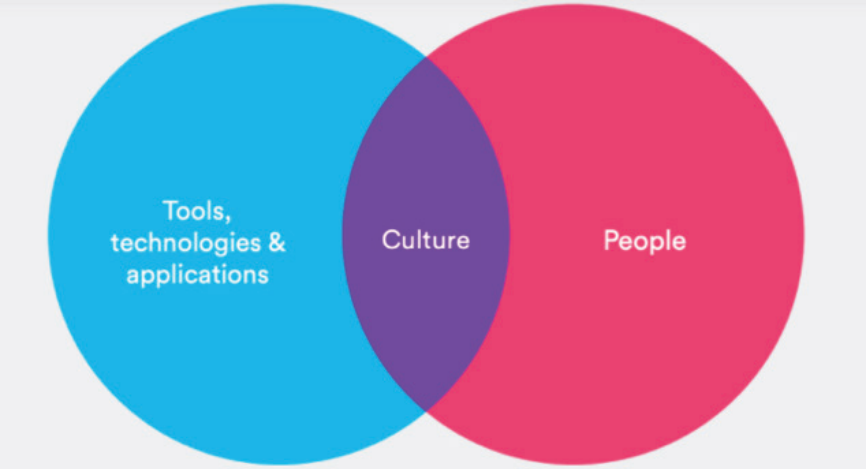

Figure 2: The 3 elements of a digital workplace. Source: https://www.interactsoftware.com/blog/what-is-a-digital-workplace/

- **Tools:** The technologies and applications that make up the 'digital' element of how they communicate, collaborate and work day-to-day.

- **Culture:** When these two elements – people, and tools – come together in a strategic and considered way, they collectively shape the employee experience. Aligning this with the business mission, values and overall direction, it becomes the foundation of the corporate culture and drives employee engagement.

Creating a digital workplace strategy does not have to be an overwhelming task. By asking the right questions and taking stock, their own digital transformation objectives can be figured out. **As part of the process, this has to be considered:**

- Who are our employees and what do they need to do their job well?
- What technologies already make up our digital workplace?
- What gaps are there between employee needs and available tools?
- Can every employee connect to the information and tools they need, regardless of their device or location?
- Do our employees understand our organization, its direction and purpose, and how they contribute to the achievement of the goals?
- Do our systems integrate or work effectively together?
- Are we leveraging an effective digital workplace platform or intranet solution to give our employees a central access point to our digital workplace?
- How is the employee experience of our current digital workplace?
- What do we envision for the future of our digital workplace?
- How does our digital workplace align with, or contribute to, our organization's mission, objectives and overall culture?

Understanding the people of the company and picking the right tools for the digital toolbox is just the start. Strategy considers the experience created as a result. There is a huge difference between simply having a collection of tools and technologies, labelling those as the 'digital workplace' – and taking a strategic, holistic approach to designing and nurturing an effective digital work experience.

The fact is that, the digital workplace is an ongoing process. It has existed, in one guise or another, for decades. It will continue to grow, reshape and redefine itself indefinitely.

We cannot expect to undertake a single digital transformation program – buy some new software, ask our staff what they need – and tick it off the to-do list. We have to keep revisiting it. It is critical to be flexible enough to respond to this new reality, to embrace and adapt to the new waves of change that will continue to disrupt the way we work.

A digital workplace is a conscious and ongoing commitment. It needs to combine a long-term vision, governing principles, a process of measurement and continual evaluation points. We cannot stop this evolution but we can steer and choose its direction to our convenience.

The digitalization of workplaces brings many opportunities to facilitate work tasks. The following is a non-exclusive list of functionalities of Digital Workplaces (Deloitte, 2021).

- Real-time tracking of manufacturing processes, operation times per step and progress
- Digital documentation, drawings, troubleshooting guides and checklists
- Digital work orders with detailed description of tasks and their sequence
- Automatic OEE calculation
- Digital process optimisation based on machine and quality data (data analysis)
- Digitalized Quality guidelines
- Automatic raw material/product in process management
- Predictive Maintenance instructions
- Digital assistance for corrective maintenance tasks. Remote support's option
- AR assistance tools
- Training on the flow of work
- Safety/ergonomics' instructions and guidelines

From an education perspective, digital workplaces offer a number of extra alternatives, which are discussed in the following section.

2 Digital workplace in HVET/VET labs

In the previous section we have analyzed the features of a digital workplace in a Smart Factory. If we come to an educational environment, it is possible to take the best of the digital workplace and also to enhance the learning experience of the students. Not only the features related to production aspects of a LF are easy to implement but also features related to the pedagogical process would be available in the labs.

Taking into account the students or the user, the following functions could be implemented:

- Make accessible the necessary information for the project or work such as: plans, process sheets, quality criteria, measurement processes, delays, tool states ...
- Provide content to carry out the work (video tutorials, documents, AR / VR ...)
- Facilitate maintenance instructions
- Show the degree of development of the work (% of work done, % of work to be done, delays, status of work ...)
- Show expected learning results
- Show OEE, stoppages and their reasons

Taking into account the teachers, the following functions could be implemented:

- Report on student performance: machining times, measurements, material used ...
- Report on the status of students: arrears, work done ...
- Allow to insert necessary information to aid in training
- Allow a predictive maintenance
- Allow training on the flow of the work
- Improve the quality of teaching
- Ensure safety
- Control the stock of material and tool

2.1. Integration of digital workplace in Miguel Altuna's lab

The Miguel Altuna HVET centre mainly offers training in different disciplines of machining, in addition to automation and robotics or administration and finance. That is why it has a 2000m2 machining lab, in which you can find different machines (milling machines, lathes, CNC, grinding, EDM, mechatronics, stamping and welding) divided in 8 different cells, where students from 6 study programs practice.

Figure 3: Miguel Altunas's Machining lab. Source: Miguel Altuna

The strategy of the centre is to implement Industry 4.0 technology in the Mechanical Manufacturing lab, with the aim of accustoming students and teachers to work in a digitized environment.

The laboratory, which is in evolution, has the following characteristics:

- Connected machines
- Smart warehouse
- HMI

The first step was to connect the machines. For this, each machine has been coupled with an RFID reader, an HMI and a signalling beacon; and that, together with the machine, is connected to a PLC that through a WI-FI receiver is connected to the specific network of the lab (used to work on cybersecurity) that is connected to the server where the data is stored.

Figure 4: Student booking the machine. Source: Migeul Altuna

The RFID reader is used to reserve the machine. Each student has their own RFID card that they will have to use to reserve the machine. This reservation can only be done at the machines and at the assigned time. This way, you avoid students starting up machines without supervision, reducing the number of accidents.

Once you make the reservation, the signalling beacon will change colour indicating that the machine is busy. In the event of a breakdown, the beacon will indicate a breakdown so that no one reserves the machine and the maintenance staff notices.

Before starting the machine, students will have to confirm that they are wearing the PPEs (Personal Protective Equipment). It is a way of creating awareness in order to reduce accidents.

Figure 5: Student confirming the individual safety equipment. Source: Miguel Altuna

The last function of the HMI is that each student has their personalized documentation. Through their own server, each student will have access to the documentation necessary for the manufacturing of the parts. The objective is to have 0 paper in the lab.

Figure 6: Documentation of a student for manufacturing. Source: Miguel Altuna

The second step is to have a smart warehouse. Thus, the location of each tool in the warehouse is controlled by means of RFID to speed up searches. By means of RFID detection arches, it is also possible to know who has taken them and consequently where the student is using them.

Figure 7: RFID reader arch for tools and users. Source: Miguel Altuna

2.2. Role of the digital workplace in the EXAM4.0 CLF

The CLF that is going to be launched has divided its production process into 4 stages (product design, process engineering, production and assembly) as can be seen in the following image. Within these stages, the digital workplace is going to be incorporated in all of those stages.

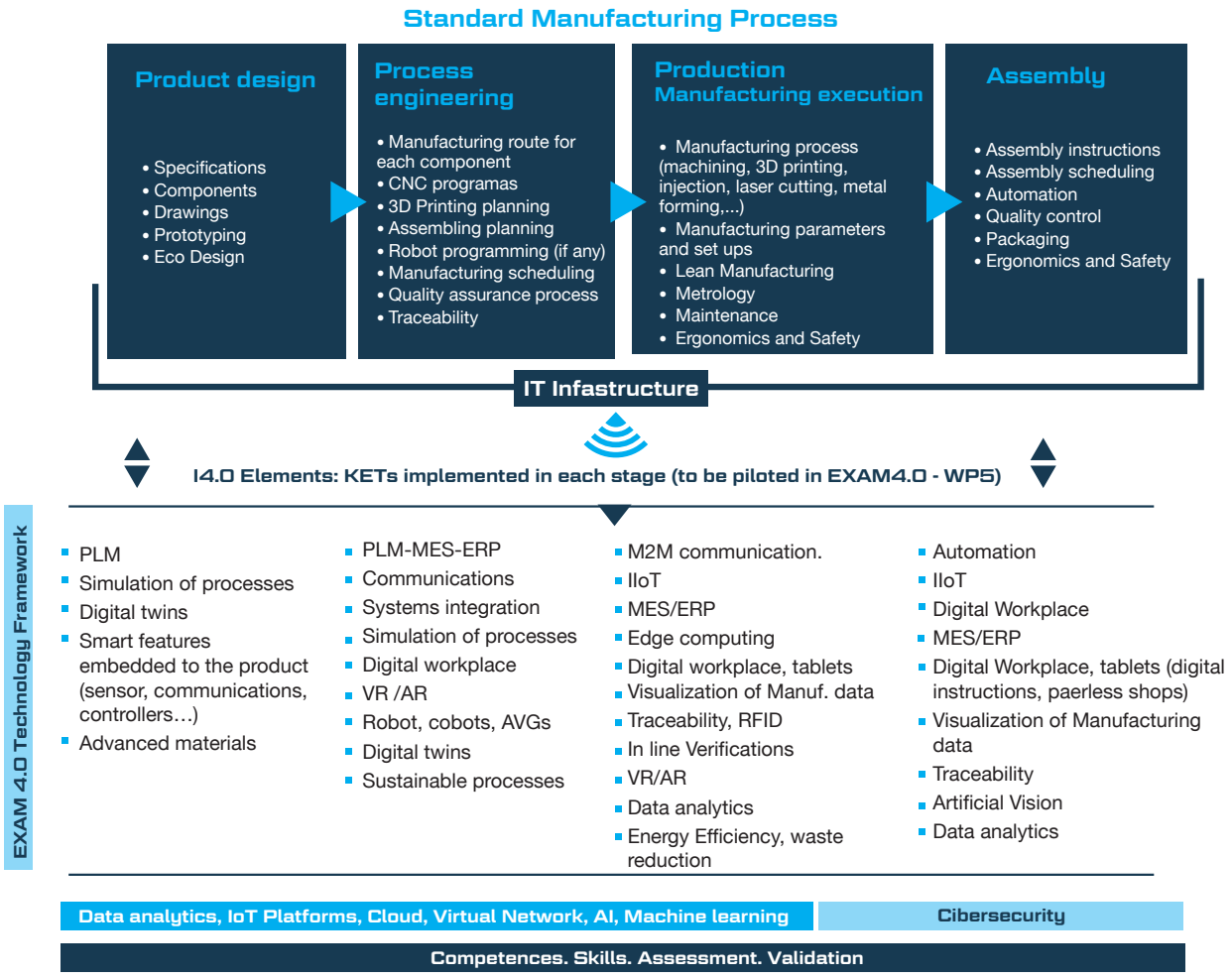

Figure 8: EXAM4.0 CLF value chain Source: Author's creation

The fact that it is a Collaborative Learning Factory (CLF) makes it essential to create a digitized working environment. For the robot's production to be done in an optimal way, it is necessary that certain data be collected and sent in real time. This can be achieved through the digitization of the machines and processes that will dump the data to apps such as MES, ERP ... that allow us to work in a collaborative and coordinated way.

Taking into account that the objective is to work with advanced manufacturing, it is impossible to achieve this without incorporating the technologies of Industry 4.0. One of the characteristics of this technology is that it is connected and that it improves the process by obtaining and analyzing the data obtained.

2.3. Benefits of to the use of digital workplace in EXAM4.0's CLF

The application of a digital workplace in the CLF helps in the proper functioning of the process. That is to say, you can make sure that students from different HVET are able to work with optimum productivity. Among other points it improves:

- Collaborate with team members
- Manage projects and tasks with full visibility
- Resolve issues, tickets, defects, and service requests
- Automate standard and repetitive business processes that require approvals
- Integrate third-party applications
- Auto-generate reports to make better data-driven decisions

2.4 Competences addressed with digital workplace

The competencies acquired with a digital workplace can be classified into two groups: Technical and soft competences.

The technical competences are the ones that are most closely related to the technical content to be acquired in the learning process of the students, in this case Machining Technicians, Mechanical Production Scheduling Staff and Industrial Design. **Among other technical competences the main ones are:**

- Greater awareness of the production process, from raw materials to part verification
- Calculation of costs and time
- Production scheduling
- Stock management (raw material, tools, etc.)
- Relationship with different suppliers
- Data analysis
- Improvements to be made in the production process

Secondly, as for the soft competences developed with ERP are:

- **Teamwork**: being a collaborative tool, team members can plan their tasks and all have access to the production sheets, the control sheets....
- **Digital awareness:** they get used to virtual working environments, understanding the data obtained, managing it and drawing conclusions.
- **Personal:** autonomy, initiative, critical spirit, to be aware of the importance of good planning and to see how the decisions taken in the process affect them.
- **Communication:** between different students, the one who plans the production with the one who executes it, being aware of the importance of the different explanations (verbal and written) that are given within the production process and that can help achieve a better result

3 Collaboration opportunities opened by digital workplace

On the one hand, when it comes to digitizing workstations, a lot of data is obtained about production, assembly and distribution processes. The accessibility to this data makes it easier for HVET that do not have such an infrastructure to work with real data. In this way, we bring the teaching-learning processes of other centers with less infrastructure closer to reality.

On the other hand, the fact that everything flows over a digitized environment makes the process scalable. With the fulfillment of certain requirements and licenses, any HVET will be able to enter and participate if they want.

4 References

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