JoInME / JoInt Multidisciplinary training program on Entrepreneurship in the field of artificial intelligence for industry 5.0

R1/A1: Field Research Compiled Report

Deliverable doc
Created by: Atlantis Engineering SA

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Revision History

Version	Date	Author	Description	Action	Pages
0.1	15/08/2022	ATLANTIS ENGINEERING SA	Process data for the report	C	5
0.2	01/09/2022	ATLANTIS ENGINEERING SA	Compile data	I	18
0.3	15/09/2022	ATLANTIS ENGINEERING SA	Writing of introduction, conclusion	U	20

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Referenced Documents

ID	Reference		Title
1	Input data and analysis		R1/A1 Result Report_Netherlands-ATERMON
2	Input data and analysis		R1/A1 Result Report_HESO
3	Input data and analysis		R1/A1 Result Report_Nure_UA
4	Input data and analysis		R1/A1 Result Report_France_ECAM-EPMI
5	Input data and analysis		R1-A1 Result Report_Atlantis

Applicable Documents

ID	Reference	Title
1	[PARTNER ORGANIZATION]	[TITLE OF THE REFERENCED DOCUMENT]

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1. Introduction

The objective of this document is to present a compiled report of the results obtained the Field Research that was conducted in six (6) European Countries related to the Industry 4.0/5.0 emerging issues and their connection to their education. Results and conclusions based on this Field research will be used in combination with Desk Research results and outcomes to build the Case Study Book for young students across Europe.

All those actions are aligned with the project's vision to equip young individuals with resilient educational tools and knowledge, in order to be more competitive and agile to future challenges. Affected by the COVID19 crisis, this research was oriented towards pointing out effective ideas-solutions to be prepared for unexpected event of the future.

Also, one of the main goals of the preliminary research, was to identify possible gaps in technological development at industrial level, thus inspiring the students with start-up ideas. A wholistic view of the current level of technological implementation aims to be achieved, with validated information about the EU's challenges, alongside desirable future solutions for them.

The results have been organized by theme, based to the presentation of the Desk Research (R1A2) results. This approach was decided by the partners as it seemed to be more effective for comparing those documents and utilizing all the information for the next phases of the project. Also, the results have been organized by country, for the reader/researcher to be able to compare results from each country inside the report as well.

2. Main Part

The Main Part is mainly formed by the compiled results, collected by project partners throughout Europe. The report, after internal discussions with all the partners, decided to be short and specific to the point. The goal is to present the information in the most efficient way, while generalizing the data provided by each individual country report.

I. The current trends and state of Industry 4.0/5.0

In the first section, the current trends of the Industry 4.0/5.0 that have been already adopted by companies are stated. The stage of digitalization of the European companies is presented and the current maturity of the new solutions is commented. Additional comments about the applicable strategies and the tendencies are listed for all countries.

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France

For France, companies with different expertise from 12 different sectors (banks, chemicals, software, automotives, logistics and supply chain, etc) diverse sizes and levels of digitalization participated in the research. Most of them (84%) reported they have been using Industry 4.0/5.0 Technologies.

The most common technologies in French companies are **cameras** and **smart notification systems**. An important percentage seems to be using Automated software equipment in general.

According to analysis on the research results, there is a correlation between the industry sector and the use of Industry 4.0 technologies. Usually, the industrial applications of such technologies, in the domains of logistics and supply chain, are associated with information services providers tools such as software and data centers. Those correlated systems can provide with smart notifications when a camera monitoring system detects an event at industrial base, accompanied by image evidence.

Ukraine

This survey was held among Ukrainian companies which **use the Industry 4.0 technologies during production to some extent**. That's why the majority of answers were positive towards using of the cutting-edge technologies. The research revealed the fields where these technologies are applicable and described the companies' units where the technologies bring more benefit.

This companies that are the most actively engaged in implementing Industry 4.0/5.0 are:
- **food (34,4%)**
- **software (28,1%)**

The surveyed companies indicated the two most implemented technologies are:
- **smart sensors**
- **cameras**

Also, frequently used technologies are **smart maintenance** and **smart notification systems, automated software equipment, robotics** and AI techniques (**Data Science, ML and Data Mining**).

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Netherlands

Partners from Netherlands were able to select variety of responses from 8 different industries with diverse sizes, providing with representative material.

The **majority of companies (80%) are using Industry 4.0/5.0 technologies** during production of their products/services.

The most common technologies that are being used are:
- ♦ **Cameras**
- ♦ **Smart sensors**
- ♦ **Robotics**
- ♦ **Smart notification systems**

But there is a distinction:

Heavy manufacturing (automotive, metallurgy) companies:
- ♦ Smart Factories with the above equipment

and

Clothing industries:
- ♦ Smart sensors
- ♦ **Asset management systems**
- ♦ Automated software equipment

Most of the companies were satisfied with Industry 4.0/5.0 technologies and a lot of them come from the **manufacturing sector**, are **medium to large**-sized enterprises and have an average age of 5-10 years.

Greece

Most of the companies participated in this survey on behalf of Greece were related to **Food Industry,** due to the fact that this is the **main domain of interest in Greece**. Another category of companies with important influence for the Greek market was the **Material Sector**.

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The most common technologies being used in Greece so far are:
- ♦ **Robotics** (83.3%)
- ♦ **Asset Management solutions** (66.7%)
- ♦ **Smart sensors** (66.7%)
- ♦ **Cameras** (66.7%)
- ♦ **Automated software equipment** (66.7%)

In general, companies in Greece are already using some of the latest technologies and they are very positive to the implementation of new technologies and automatization processes.

The attention is drawn on **Quality Control** and **Production Process**. Optimization of quality control is a great challenge for most industries, and the demands for **Zero Defect Procedures** is constantly growing.

Cyprus

Majority of the companies in Cyprus are already using AI and Industry 4.0/5.0 Technologies. Most of the companies who filled out the survey are relatively new founded, having the advantage of reaching a certain maturity but also the flexibility be more open to apply AI solutions and upgrade their activities to Industry 4.0.

The most popular technologies are:
- ♦ **Cameras**
- ♦ **Smart Notification Systems**
- ♦ **Automated software equipment**
- ♦ **Smart sensors**
- ♦ **Asset Management**

Overall, companies in Cyprus assumed that new technologies brought positive changes in their company life.

Lithuania

A third of the Lithuanian companies that participated in the research belong to the **software** sector, the remaining companies represent different specific areas of a wide spectrum (medicine, electronics, legal services, logistics, products for scientific research, animal health tools, various other products and services).

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More than half of the Lithuanian companies that participated in the study (56%) use Industry 4.0/5.0 technologies, of which the most popular were the following:

- **Software** (50%)
- **Cameras** (23.3%)
- **Asset management** (23.3%)
- **Smart maintenance systems** (23.3%)

The majority (70%) of the companies noted that they **see a positive impact from use of Industry 4.0/5.0 technologies.**

II.   Resilience of business processes during and after COVID19

In this section, the resilience of the already existing solutions against unpredictable circumstances was examined. The pandemic of COVID19 is being used as an example, to help extracting some useful data, like areas of improvement etc. Also, technologies that have been already implemented in European companies were evaluated and feedback from the participants was extracted during the Field Research process.

France

The French Companies which participated in the Field Research were **satisfied with the use of Industry 4.0/5.0 Technologies** in general. Most of them seem to be medium or large-sized companies, with 20-year presence in average, according to their demographic data, thus enhancing the resilience of the technologies.

Also, a general satisfaction was noticed about the Industry 4.0/5.0 use during the pandemic, and the companies declared to have **mostly automated** or **fully-automated production systems** which can be configures and controlled remotely. Companies that were already familiar with Industry 4.0 technologies were more eager to consider AI applications and all the possible benefits during COVID-19.

Participating companies stated that **all areas of business** were generally benefited from the implementation of new technologies during the COVID-19 pandemic while two fields were less affected: Asset Management (2%) and Customer relationship (2%).

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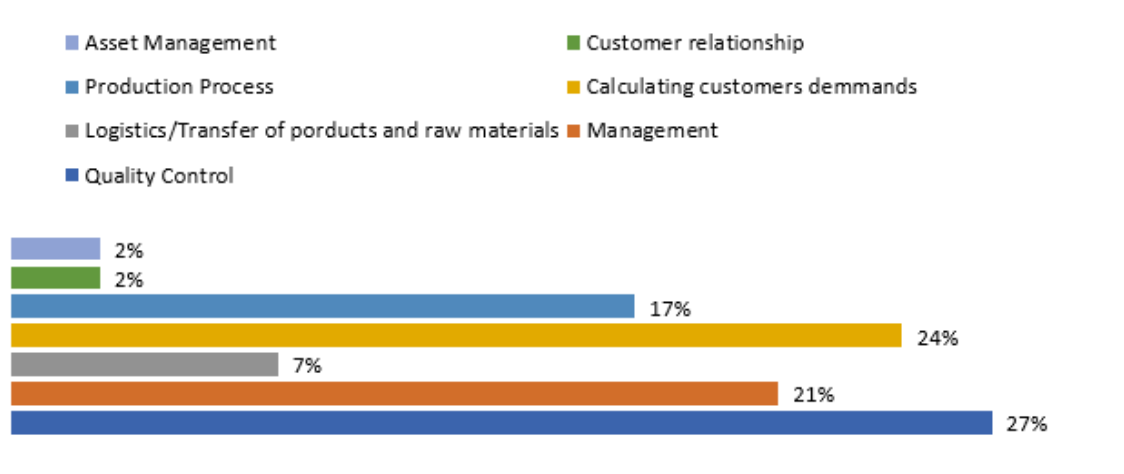| [Partner Organization]	Deliverable: [No.of deliverable]	
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Figure 1- Areas in France that were benefited from new technologies during the Covid19 pandemic

Ukraine

As it was mentioned, most of the companies participated already used some of the new technologies to their production lines, so the majority of them confirmed the **positive impact of the implemented technologies during COVID-19 pandemic**.

Also, it is worth mentioning that despite the war in Ukraine and the changes in usual business life of each company towards comply to the Martial Law and simple surviving, Kharkiv National University of Radio Electronics could manage to reach enough number of companies (33 respondents) and engaged them to respond the survey.

Although the most representative companies possessing extensive branch networks – giants of **agrarian** and **food industries** which actively implement the cutting-edge technologies **couldn't participate** because of resolving of the urgent task to keep / recover the business, the staff and production facilities which are partially occupied or destroyed by the RF. At the same time representatives of the small and medium enterprises (especially software companies) whose business has been evacuated easier or was located on safe territory could manage to participate in the survey.

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The sectors that would have been benefited more because of the implementation of AI technologies according to Ukraine companies are: **quality control, production process, general control, logistics, calculating customers' demands**.

Netherlands

A large percentage of the companies participated relied on mostly automated or fully automated production systems which can be configures and controlled remotely during the pandemic.

So, they believe that were **positively affected by the use of Industry 4.0/5.0 technologies** during the lockdowns of the COVID-19 pandemic.

Companies familiar with Industry 4.0, were keener to consider AI solutions and applications during the COVID-19 pandemic. However, more conservative industry sectors, such as **chemical** and **plastic/polymer production** do not seem to consider AI at all. Nevertheless, 70% of participated companies stated that **they would have used AI application during COVID-19.**
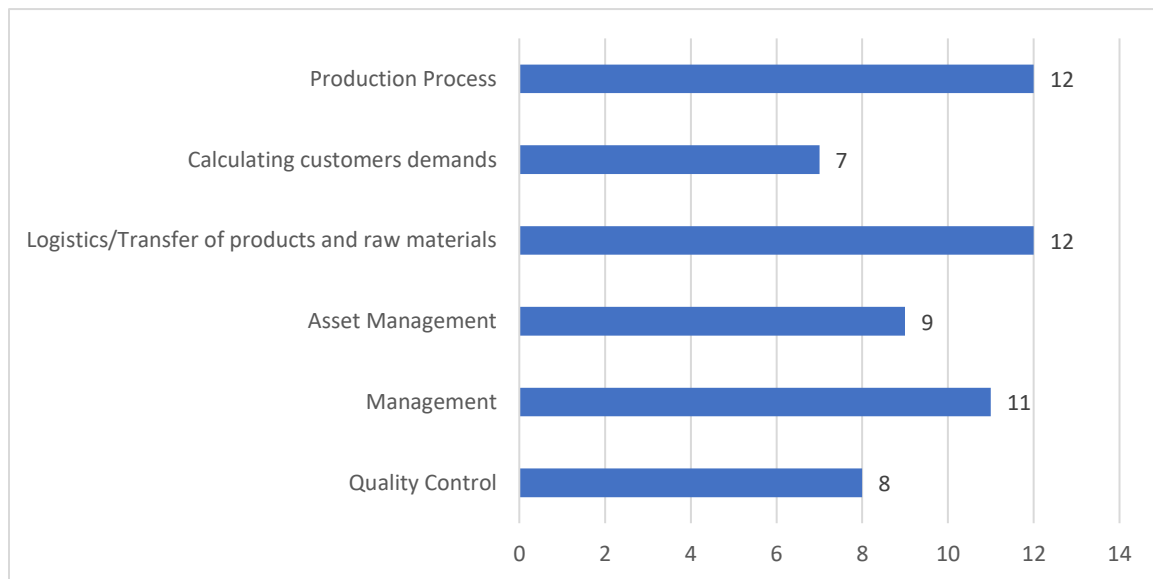

Figure 2 - Sectors that would have been positively affected by the Industry 4.0 during Covid19 pandemic

We can see the sectors that would have been affected more positively from innovation technologies during the COVID19 pandemic.

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Below some of the new technology companies experimented with, and new processes established during the COVID-19 era are presented:

♦ Automatization of **production processes** (40%)
♦ Automatization decision-making on **management level** (40%)
♦ Implementation of high-end **logistics solutions** (40%)

Greece

Greek companies that implement Industry 4.0/5.0 technologies seem to already have **positive impact during the Covid-19 pandemic**, and they are interested in expanding their use and move towards automatization. The companies in question, were mostly **large companies**, employing at least 50 employees (most over 200) and they stated that the use of AI helped them during the pandemic.

A majority of the companies stated that AI technologies could have helped the following sectors during the pandemic, and thus providing with more resilience are:

♦ **Quality Control** (83.3%)
♦ **Production Process** (83.3%)
♦ **Asset Management** (50%)
♦ **Management** (33.3%)

All of the above areas could function with very little or zero human activity, so they could have been more resilient during a time of social distancing.

Cyprus

Use of Industry 4.0/5.0 Technologies and AI applications affected positive the companies during the COVID19 pandemic, and according to estimations, extreme circumstances increased productivity and innovation.

For Cyprus, all companies **operating with human workforce**, stated they would benefit from new technologies in order to speed up specific processes and change their production according to rapidly changed demands. Those sectors are:

♦ **Management** (56%)
♦ **Quality Control** (37%)

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- **Asset Management** (37%)
- **Production Process** (33.3%)

Lithuania

The majority (90%) of the Lithuanian companies that participated in the study believe that **the use of Industry 4.0/5.0 technologies during the COVID-19 pandemic had a positive effect on the companies' production in general.**

A third of the companies were not sure whether the application of AI would have had a positive effect on their company's operations during the COVID-19 pandemic, however, half of the respondents tended to answer positively. The companies identified areas that could have been positively impacted by using new technologies during the pandemic:

- **Management** (50%)
- **Production process** (36.7%)
- **Quality control** (30%)
- **Calculating customer demands** (30%)

III.   Implementing AI solutions at national companies - foreseen challenges

In section 3, all the challenges during the implementation of new technologies are presented. This section will act as inspirational material because it lists all the factors that are putting obstacles in the way of automatizations and adopting innovative techniques.

France

Although the majority of companies in France are implementing new technology solutions to their production some of them faced challenges.
The main problems for France companies were:

- **Training of the Personnel** (30%)
- **Software Readiness** (24%)
- **Investment Budget** (20%)

Ukraine

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Ukrainian companies were not so positive towards the implementation of AI applications, although they were positive in general about the use of new technologies. Such uncertainty regarding implementation of the advanced technologies strengthened with AI caused mostly by the **expensiveness of AI solutions**.

Moreover, for most participants **there was availability** of **experts working on implementing the new technologies** or **AI solutions**. Those results apply mainly for the representatives of **software companies** which is the 2nd biggest group of represented business (28,1% of the surveyed). The second part of the positively answered companies is represented **by agriculture and food manufacturers** (34,4% of the surveyed).

Ukrainian companies stated that in order to adopt cutting- edge technologies they need to revise the following:
- Increase of the **investment budget**
- Change **hardware** (63,6%)
- Change **software** (60,6%)
- Changes in the **production line** (for Manufacturing companies - 24,2% of respondents)

Besides the above, small part of the companies in question were **ready** to implement new technologies without any changes, and **software companies** were interested in updating only for modernization reasons.

Netherlands

The majority of the companies participated are already using Industry 4.0/5.0 technologies during production of their products/services.
Although, actions and measures to enhance the use of Industry 4.0/5.0 tools are changes regarding:
- **Hardware** (50%),
- **Investment budget** (46%)
- **Training of personnel** (46%)
- **Software** (43%)
- **Operational activities** and **production lines** (for manufacturing companies)

Greece

All of the companies in question stated that they need to proceed with some alterations in order to adopt Industry 4.0/5.0 Technologies.

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The main changes that the participants foreseen are necessary are listed below:

- **Training of the personnel** (85%)
- **Hardware** (71.4%)
- **Software** (57.1%)
- **Operational Services** (57.1%)
- **Employees activities** (42.9%)
- **Investment costs** (28.6%)

It is worth mentioning that even **most recently founded companies** seemed to experience the same challenges as the more established ones.

Cyprus

Companies in Cyprus depend on the human workforce, so most of them stated that they had to proceed with some alterations in order to achieve a certain level of Industry 4.0/5.0 technologies used.

Areas that require for updates are:

- **Training of the personnel** (40%)
- **Operational services** (50%)
- **Employees' activities** (50%)
- **Investment budget** (37%)
- **Production Line** (33.3%)

All the above factors are related and connected with each other. Also, they are in close relation with the previous results, putting "Management" as an important factor. Management defines when a change needs to be implemented in all operational activities in order to apply new technologies.

In Cyprus the majority of the companies declared that they do not have a team of experts working on AI solutions and applications.

Lithuania

The main obstacles to digital transformation in Lithuanian manufacturing companies are related to **the lack of internal financial resources and external funding opportunities**

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for digital technologies, and the cost of implementing such technologies is perceived as the biggest obstacle. Another important barrier to digital transformation and the use of AI is the lack of skilled workers, as it is recognized that **existing workers lack the necessary skills and there is a shortage of competent people in the labor market**.

Below are the most important aspects identified by the interviewed companies that should be changed in order to implement or use more Industry 4.0/5.0 technologies, and which are related to the mentioned obstacles:

♦ **staff training** (53.3%)
♦ **software** (50%)
♦ **investment budget** (40%)

IV.   Common unsolved Problems

The final section, presents the most common problems that companies are facing and could be potentially benefited from the use of AI and Industry 4.0/5.0 technologies in general.

France

The most common problems for French Industries are connected with the human interaction and located more at:

♦ **human factor** 37 %
♦ **poor management of equipment** 18%
♦ **quality control** 13%

Most of the companies agreed that implementation of technology solutions **can potentially assist with eliminating problems during production/manufacturing**. Although, some companies with many years of presence (over 20), in the sectors of Telecommunications/Microelectronics-Radiofrequency and Software provided with negative answers.

For the majority of the responders **a team of experts** was available **for working on the implementation of new technologies/AI solutions**, with the additional comment regarding French companies, that usually **they are not interested in investing money and resources on a large scale**.

Implementation of new technologies could benefit more the sectors of:

♦ **Quality control** (41%)

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♦ **Logistics /transfer of products** (19%)

Ukraine

The most problematic fields in the companies and simultaneously could benefit more due to implementing AI are:

♦ **Quality Control (**87,9%)
♦ **Production Process** (60,6%)
♦ **Management** (48,5%)
♦ **Logistics** (39,4%)
♦ **Miscalculating customers' demands** (15,2%).

Therefore, these areas can be suggested for developing the smart AI applications solving the determined shortages caused by employee mistakes and mishandling equipment that can become a core for startup products.

Netherlands

The most problematic areas for companies in Netherlands are:

♦ **Human factor** (50% of the responses)
♦ **Mishandling of equipment** (40% of the responses)
♦ **Quality control** (40% of the responses)

The above responses are related to the **human factor**, and results showed that humans were **responsible for 50% of the mistakes during production** for the companies in question. However, these numbers should be compared with other KPIs in order to establish more concrete results.

For Netherlands, companies with **over 20 years** of existence seemed **not keen on using new technologies** to solve problems on the shop floor or at management level. These companies in particular operate in **clothing production**, **food/edible products** and **medicine/cosmetics**.

An important percentage of the respondents stated that **there is a team of experts** working on innovative technologies, affected by parameters such as company's size etc. A general tendency was indicated: companies were not very keen on investing great amounts of money and effort on new projects.

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The problematic areas **that could benefit** from new technologies are:

- **Production processes (50%)**
- **Asset management (50%)**
- **Management (50%)**
- **Quality control (50%)**
- **Logistics /transfer of goods (43%)**
- **Miscalculated customer demands (30%)**

Figure 3 - Areas that could be benefited from the use of Industry 4.0/5.0 technologies in general

Greece

According to the research for Greek companies, the most problems occur during the following processes:

- **Quality Control** (57.1%)
- **Employee mistakes** (71.4%)
- **Mishandling equipment** (42.9%)
- **Packaging** (14.3%)

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Basically, quality control and packaging could be connected, indicating **problems in the production line**. Also, mishandling equipment could be one of the employees' mistakes, putting **human factor** involvement in the center of attention.

The fields that could benefit from the implementation of new technologies, according to Greek participants, are:

- ♦ **Production Process** (85.7%)
- ♦ **Quality control** (71.4%)
- ♦ **Calculating customers demands** (57.1%)
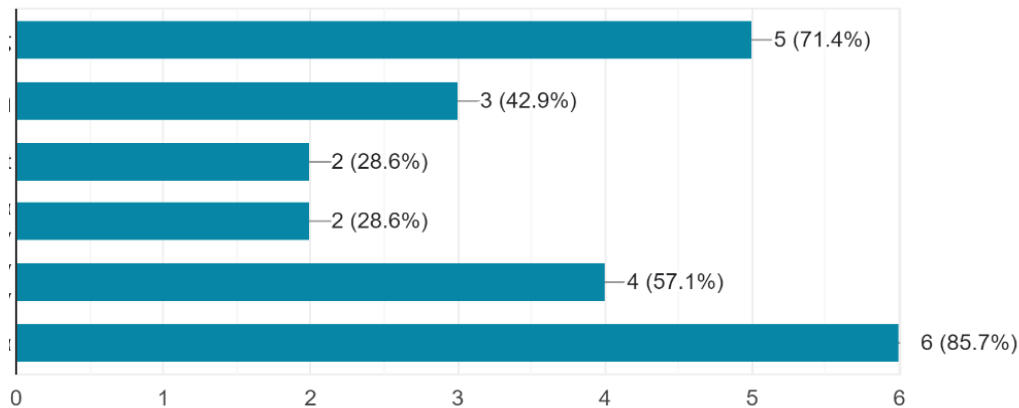- ♦ **Management** (42.9%)

Figure 4 - Problematic areas that could benefit from new technologies in Greece

Cyprus

The most common problems companies in Cyprus are facing, are the following:

- ♦ **Logistics/Transfer** (57%)
- ♦ **Quality Control** (37%)
- ♦ **Employee mistakes** (47%)

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Human factor was considered important for an amount of the mistakes that take place. Majority of companies are convinced that **most of the problems can be solved by implementing new technologies,** especially when it comes to speeding up the production and transfer of products.

More specific, the fields in companies that could benefit more from the implementation of new solutions are:

- ♦ **Logistics/ Transfer of products** (50%)
- ♦ **Asset Management** (40%)
- ♦ **Quality Control** (40%)
- ♦ **Management** (43%)

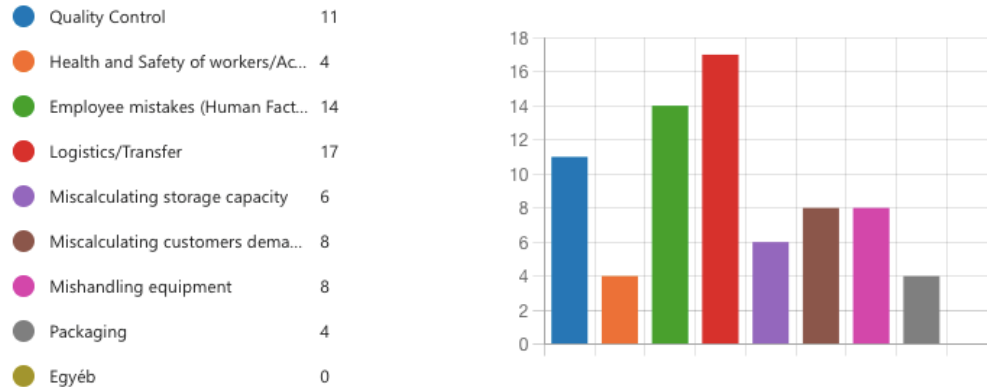|	
● Quality Control	11
● Health and Safety of workers/Ac...	4
● Employee mistakes (Human Fact...	14
● Logistics/Transfer	17
● Miscalculating storage capacity	6
● Miscalculating customers dema...	8
● Mishandling equipment	8
● Packaging	4
● Egyéb	0

Figure 5 - Problematic areas that could benefit from new technologies in Cyprus

Lithuania

As stated by the Lithuanian companies that participated in the study, the most common problems in the production process are related to the following areas:
- ♦ **Employee errors (human factor)** (60%)
- ♦ **Quality control** (30%)
- ♦ **Calculating customer demands** (30%)

Among other problems, the lack of employees and the lack of personnel with specific knowledge or skills were also mentioned. On the other hand, more than half (60%) of the

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companies stated that they **have a team of experts working with innovative technologies.**

30% companies stated that **70% and more of the total number of errors during production is due to human intervention in the process**.

According to the companies, areas such as **quality control, production process and management** could be positively affected by the introduction of new technologies.
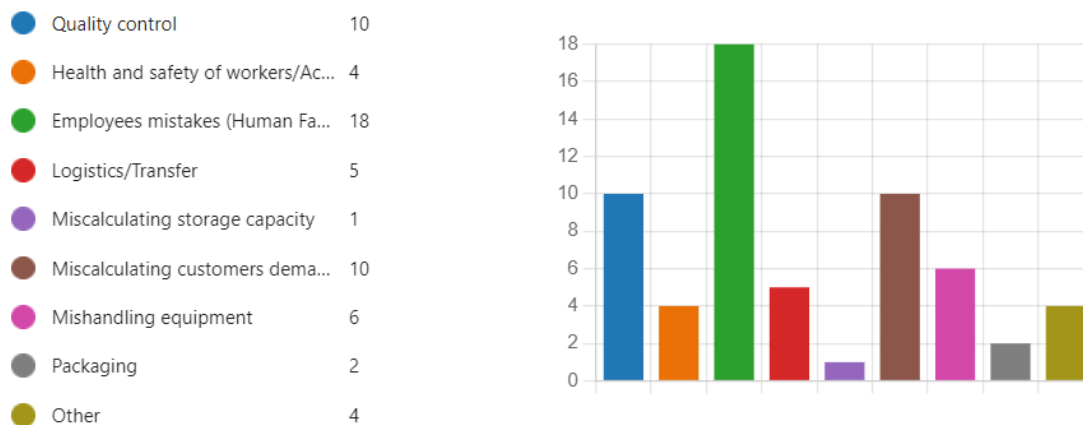

Figure 6 - Problematic areas that could benefit from new technologies in Lithuania

3. Conclusions

Conclusions of the report will be presented with bullets, in an attempt of being as clear as possible, and serve the purpose of building the **Case Study Workbook,** one of the project's future steps. Additional information is available in the separate sections of this report, and in each partner's individual country report. All the documents have been referenced.

I.   *The most common technology trends in Europe are:*

♦ **Cameras**
♦ **Smart notifications systems**
♦ **Smart sensors**

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Also important: Robotics, Asset Management, Automated software solution

II.   Resilience of companies during COVID19

European companies **were positive towards the use of new technologies**, especially during challenging circumstances, such as COVID19 pandemic. Companies that were already using advanced applications, stated their satisfaction with them.
Possible areas that could have been affected positively are:

- **Quality Control**
- **Production Process**
- **Management**
- **Logistics/Transfer of goods**
- **Asset Managements**
- **Calculating customers' demands**

III.   Challenges of implementing AI solutions, current implementation status

The challenges the companies in Europe are facing when it comes to adopt new technologies and innovative solutions related to Industry 4.0/5.0 are:

- **Training of the personnel**
- **Investment budget**
- **Hardware/Software**
- **Operational activities/ Production Line (mostly for Manufacturing companies)**

IV.   Common problems (Inspiration for students)

The most common problems European industries are facing are presented below:

- **Quality Control**
- **Mistakes due to the human factor**
- **Logistics/ Transfer of goods/ Supply chain management**
- **Mishandling equipment/ Asset Management**
- **Production Process**

The field research was conducted in six European countries and the results are considered as indicative of all the latest technological trends, developments, challenges,

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and market tendencies for the EU. This report is reflecting the main issues and will be used to direct partners towards building quality educational material, aligned with the European needs.

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