

Edited by



DIH
Digital Innovation Hub



CONFINDUSTRIA
Verona



Report

LOGI-Know to accelerate the CPS knowledge in the logistics and transportation sector

LOGI Know



This Digital Innovation Hub Activities has received financial support as third party from the European Union's Horizon 2020 research and innovation programme, through an Open Call issued and executed under the project DIH4CPS (Grant Agreement N° 872548).





Speedhub

Digital Innovation Hub set up by Confindustria Verona in August 2017, as part of the planning of the Government's National Industry 4.0 Plan, dedicated to companies that see innovation as the way to improve their competitiveness.



Goal:

Stimulate and promote the demand for innovation of the local production system, strengthen the level of knowledge and awareness with respect to the opportunities offered by digitization and represent the "gateway" of local companies to the world of Industry 4.0.



A European-wide Digital Innovation Hub

Speedhub is part of the network of Digital Innovation Hubs included in the European Commission's catalog in the "fully operational" category. The catalog aims to map the ecosystems and specializations present in the various European regions at EU level and become an easy access point for companies to the best available technologies.



The DIH4CPS network and the project



Speedhub, with its LOGI-Know project, was one of the winners of the 2nd Open Call of the DIH4CPS network, a program funded by the European Union under Horizon 2020, the funding program created by the European Commission to support and promote research.



This is an initiative that aims to create an interdisciplinary network of DIHs and solution providers related to cyber-physical systems (CPS), i.e., computer systems that are able to interact seamlessly with the physical system in which they operate, and where therefore physical objects are joined by their own representation in the digital world.



The goal of DIH4CPS, literally Digital Innovation Hub for Cyber Physical System, is to promote in European companies the knowledge and adoption of Cyber Physical Systems (CPS).

Project's QR Code



Speedhub, given the attention it has always chosen to devote to the world of logistics due also and especially to the strategic location of Verona, has chosen to focus its work on the adoption of CPS technologies in logistics and transportation processes.



Logistics 4.0

Logistics 4.0 is a concept introduced and shaped by development from ICT and IIOT.

By Logistics 4.0 we refer to the application to the world of logistics and supply chain of the paradigms and concepts inherent in Industry 4.0, and it translates, for example, into new storage systems, handling systems, and transportation modes, which are developed along three main axes:

- process automation
- interconnection of assets
- integration of supply chain actors

Companies that embrace Logistics 4.0 will have a competitive advantage by being able to build a flexible, sustainable and highly responsive supply chain.

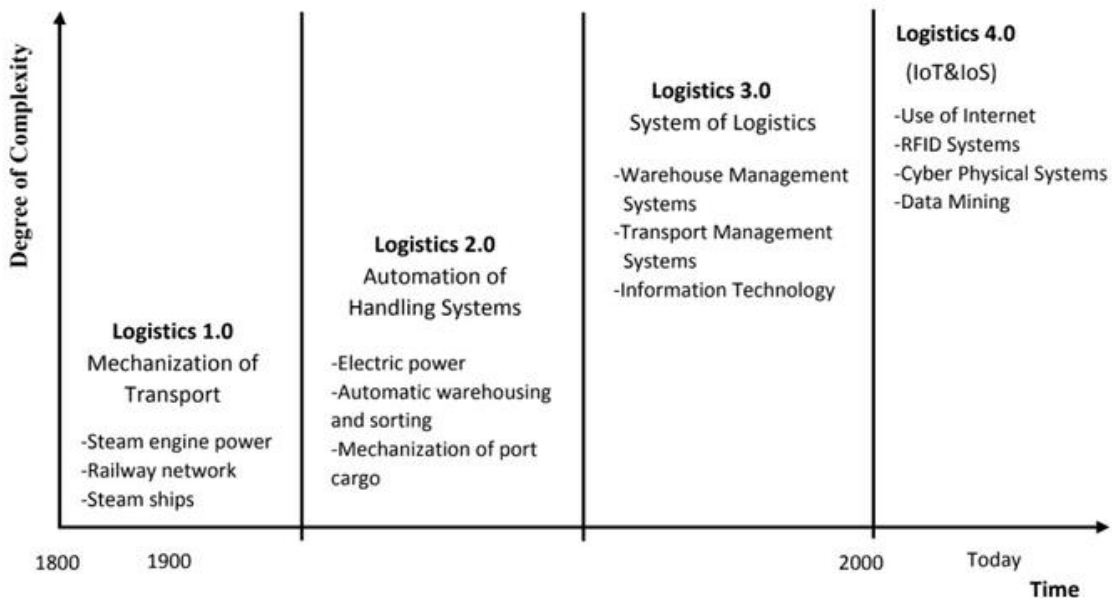


Figure 1: Evolution of Logistics over time and in degree of complexity. ¹

Cyber Physical Systems (CPS)

Cyber Physical Systems (CPS) are considered one of the core innovations of the Fourth Industrial Revolution.

In a CPS system, physical objects are flanked by a digital representation of them. The virtual object image, also called the Digital Twin, provides a set of data directly connected to the network.

Key foundational technologies:

- ✓ **Artificial Intelligence**
- ✓ **Augmented e Virtual Reality**
- ✓ **Digital Twin**

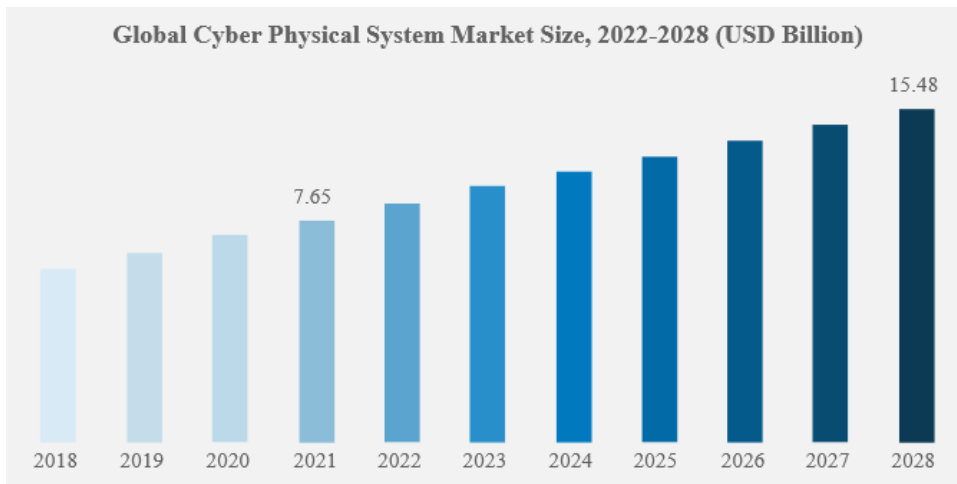
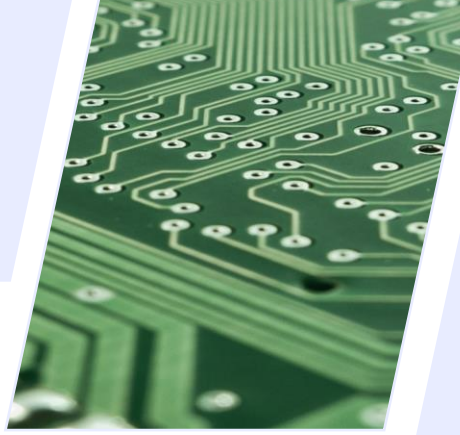


Figure 2: Expected growth in market size at the global level of CPS. ²





CPS –

Main founding technologies: AI

Artificial Intelligence represents the ability of a technological system to solve problems or perform tasks and activities typical of the human mind and ability.

- AI is expected to increase productivity in companies by more than 40 percent by 2035 ³
- AI is expected to grow from 12% to 60% within warehouses from 2022 to 2026 ⁴
- Where used, AI has brought a 15 percent saving in logistics costs ⁵



Some applications of AI in logistics and transportation:

- Big data for predictive analysis of market trends and the entire supply chain
- Optimization of automated warehouses
- Coordination between warehouses and transportation companies
- Handling robots in warehouse logistics (warehouse robotics market worth 4.7 billion USD in 2021 Expected CAGR of 14% from 2021 to 2026) ⁶
- Inspection of products using cameras that can interpret images
- Route optimization
- Self-driving transportation vehicles



CPS –

Main founding technologies: AR and VR

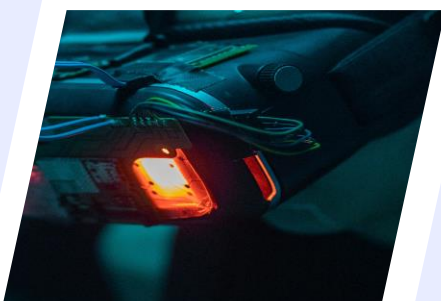
Augmented Reality: is based on the real world and completes it with virtual images that improve or increase the experience without affecting the possibilities of interaction

Virtual Reality: three-dimensional surrounding environment, not real but simulated, in which the user is able to interact thanks to the combination of hardware and software devices that offer a totally immersive experience



Some applications of AR and VR in the field of logistics and transport:

- 1) Staff training, for a more effective and safer training
- 2) Rationalization of warehouse management operations
→ the use of wearable technologies can increase warehouse productivity by 15% and reduce errors by 39% globally ⁷
- 3) Optimization of transport and related operations:
 - ✓ In the loading means
 - ✓ In the management of transport documentation, in particular in the context of import and export
 - ✓ As a driving aid
 - ✓ As a support in delivery in the last mile delivery





CPS –

Main founding technologies: Digital Twin

Virtual model that replicates a physical consideration.

The global digital twin market was valued at \$ 6.5 billion in 2021 and is set to exceed \$ 53.5 billion by 2028, exhibiting a CAGR of 42.1% during the forecast period 2022-2028 ⁸



Some applications of digital twins in the field of logistics and transport:

- Warehouse design: space optimization and handling simulation of products, people and handling equipment
- Complete planning and coordination of the entire logistics network
- Analysis of the efficiency of logistics processes
- Verification of stability and safety of the structure of a warehouse
- Container fleet management
- Monitoring of particularly sensitive shipments (for example in the medical or electronic field)



The survey

In this scenario that demonstrates the importance and value of CPS for the most important business processes, including logistics and transport, Speedhub has developed an online survey in order to collect the point of view of local companies on the subject and knowledge and adoption of the same, trying to answer the following research questions:

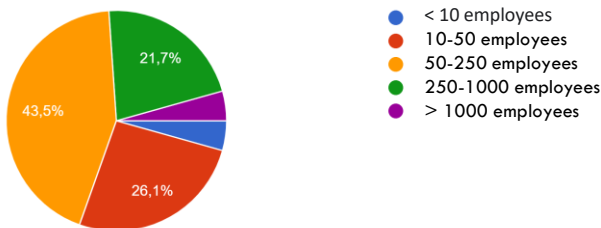
1. What is the level of general digital innovation
2. What is the level of digital innovation in logistics and transport processes
3. How do companies position themselves with respect to the adoption of CPS systems

The sample

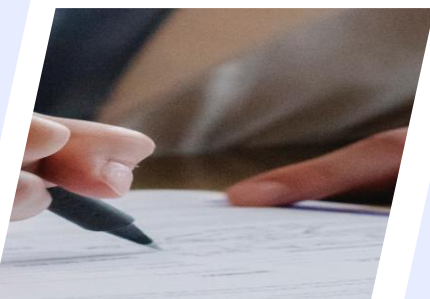
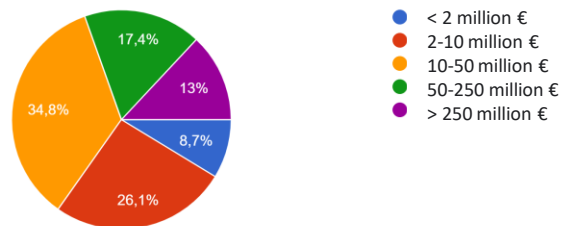
The spectrum of the sample is wide, allowing to have solid data:

- 74% of the enterprises are SMEs
- The remaining 26% are large companies

Number of employees of the company



Company turnover in the last financial year available





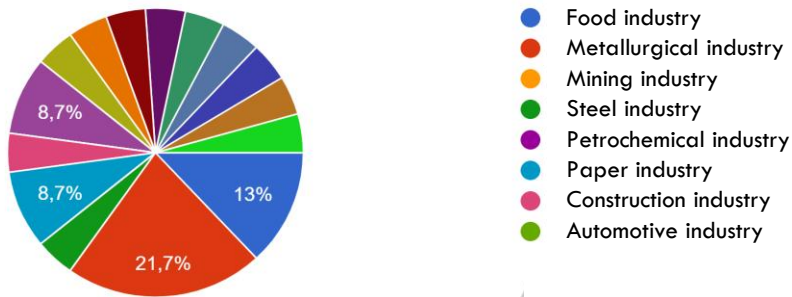
The sample

In terms of the sectors of companies, we can also see very good heterogeneity. The two most represented sectors:

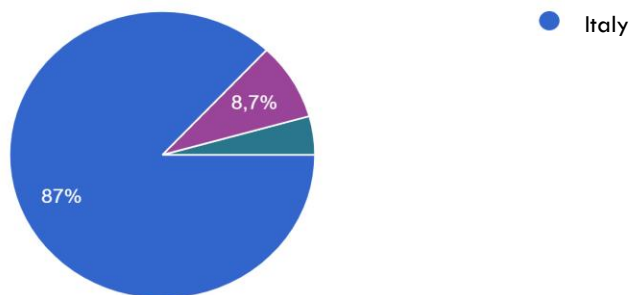
- Metal industry
- Food industry

Finally, 87% of the sample is represented by companies with HQs located in Italy.

Industrial sector to which the company belongs

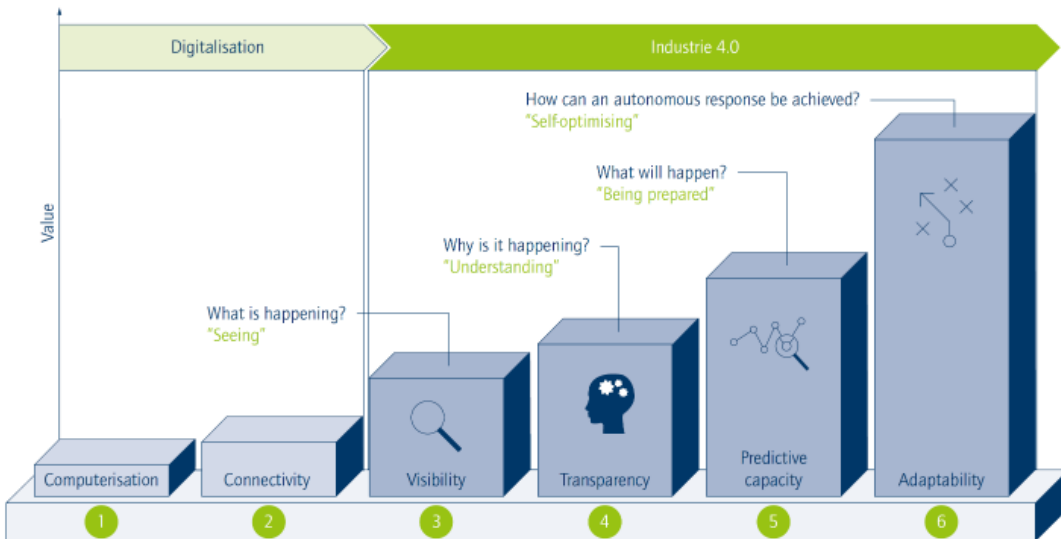


Headquarters location

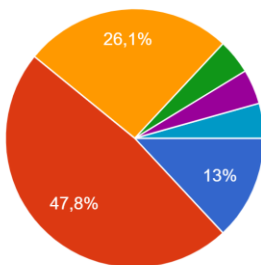


As anticipated, before focusing on logistics and transportation processes, we wanted to frame the level of cross-firm digital innovation.

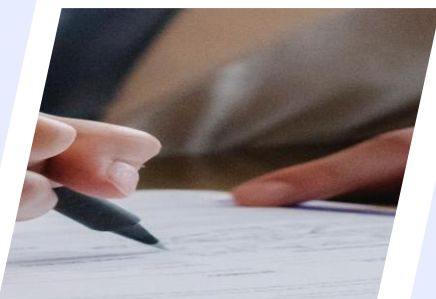
On the Acatech model [Schun et al., 2017] ⁹ that allows for the assessment of digital maturity according to a 6-level spectrum, the analysis brings out how half of the participating companies self-position themselves at the second level, that of Connectivity, where IT systems are connected, thus the starting point for Industry 4.0.



At what stage of development towards the Industry 4.0 paradigm do you think your company is currently?



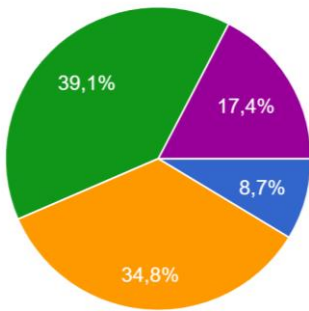
- **Computerization:** presence of isolated information technologies to make repetitive actions efficient and increase the accuracy of products
- **Connectivity:** partially connected machinery and plants, complete integration is missing
- **Visibility:** presence of sensors for data acquisition from processes. We start talking about the company's digital shadow
- **Transparency:** use of technologies for data analysis aimed at understanding the interactions between the elements of the digital shadow
- **Predictive ability:** adoption of technologies to identify and simulate the most probable future scenarios in order to anticipate events and implement suitable measures in good time
- **Adaptability:** decision-making processes are automated. The goal is that the company knows how to use the data coming from the digital shadow to make decisions that give the best possible result in the shortest possible time by implementing the necessary measure automatically, without human assistance.





From the perspective of planning innovative projects at the strategic level, we can see a good ability to plan in a coordinated manner and with a long-term vision.

How does your company plan innovative projects at a strategic level?



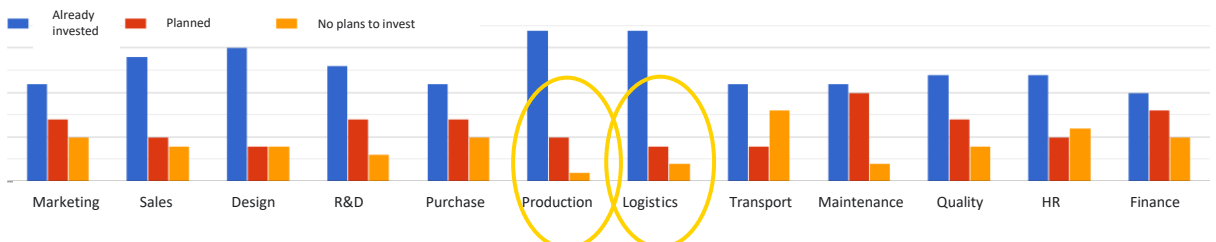
- **Spot design** - Single, uncoordinated actions by some company units using their own budget and without any integration strategy
- **Soft coordinated planning** - Actions of the single units of the company, with use of their own budget, but with minimum coordination by the management
- **Coordinated planning** - Although the actions derive from the individual units of the company (with use of its own budget), the management has a great interest in these initiatives and follows their development and trends
- **Design based on strategic analysis** - Projects based on a structured strategic analysis, aimed at being aligned with the corporate mission and vision, with analytical management of time and resources and use of a single budget
- **Design based on long-term planning** - In addition to the strategic analysis, a clear timed plan of the transformation programs to be implemented in the company was defined, with careful coordination of the existing initiatives and the definition of a specific working group for management

As many as 91% of the companies report the presence of coordinated actions across departments in the company, with 56% stating the presence of a structured strategic plan instead.

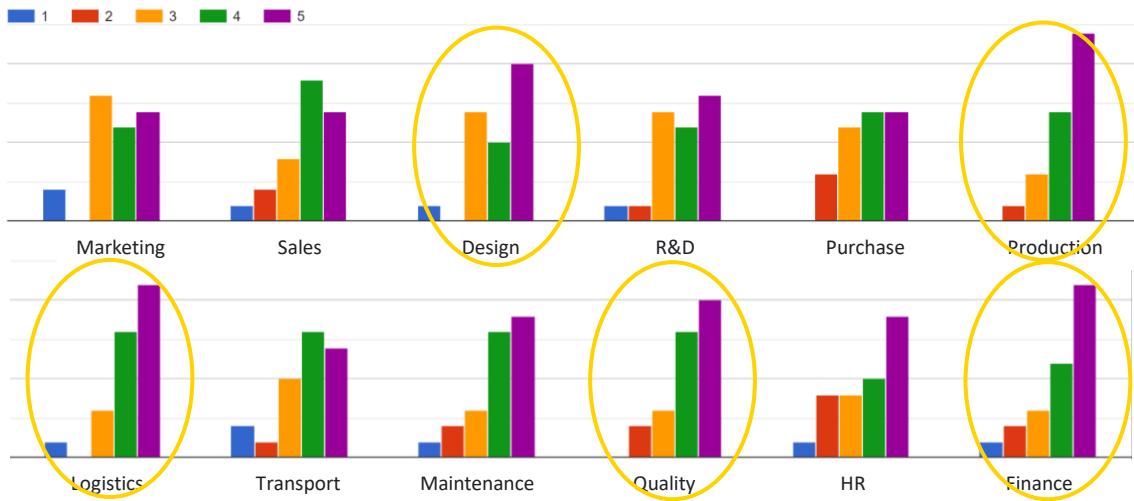
The questionnaire then dwells on the company departments where investing in innovation and digitization is considered most important.

Design, Production, Logistics, Quality and Administration are considered the core areas for investments of this kind, and confirming this in the same areas, particularly Production and Logistics, companies say they have already invested.

In which of the following business areas has your company already invested in digitalization and in which do you plan to do in the future?



How does your company plan innovative projects at a strategic level?



The analysis then sought to understand how companies seek to upskill and reskill the competencies in order to foster digitization, a crucial point for the company to benefit from the innovations introduced.

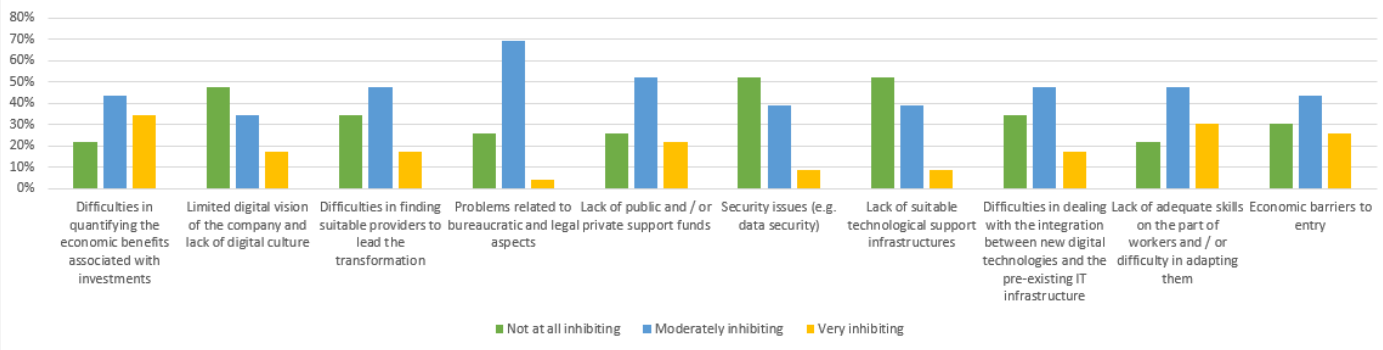
What is your company doing to retrain and upgrade the skills of its staff to facilitate digitization?





Finally, to frame the major difficulties and obstacles in achieving the 4.0 paradigm, the difficulties related to quantifying the economic benefits associated with investments in digitization and the lack of appropriate skills on the part of employees and the difficulty in adapting them.

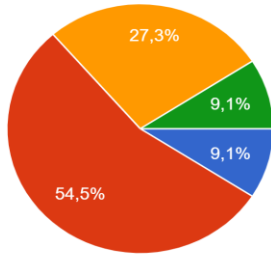
Which do you think are the main obstacles to the implementation of technological innovations in the company?



Digitization of the logistics area and transportation

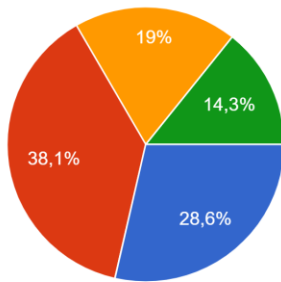
Let us now turn to the business area at the center of the research, logistics and transportation. First of all, the survey wanted to investigate companies' satisfaction with the degree of digitization and innovation in this area: most of the respondents show a good level of satisfaction but also a willingness to invest further in the near future, especially in the logistics area as opposed to the transportation-related area.

Do you think the current level of innovation and digitalization of the company's logistics area is sufficient?



- We are satisfied with this and we have no plans for investments in this area in the next 2 years
- We are satisfied but we plan to invest in this area over the next 2 years
- We are not satisfied and we are investing in this area
- We are not satisfied but we have no intention of investing in this area

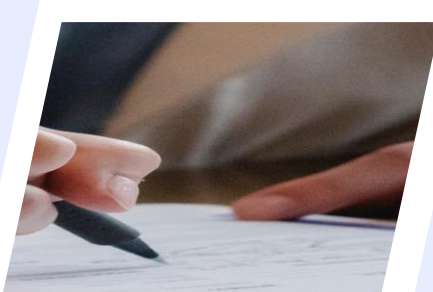
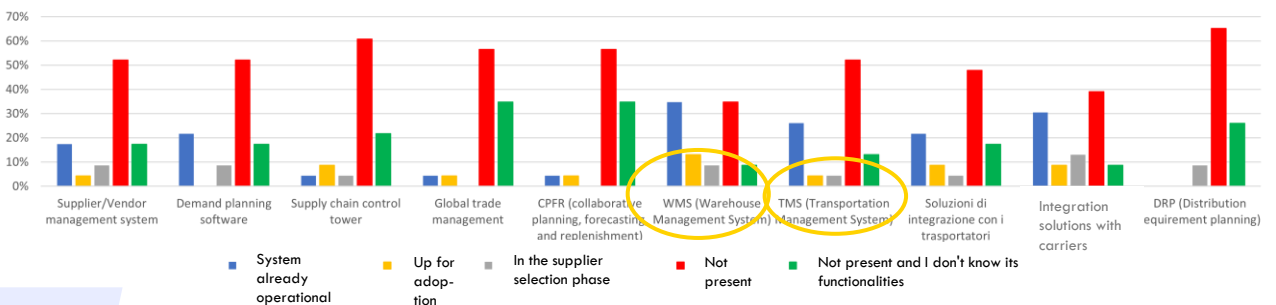
Do you think the current level of innovation and digitalization of the company's transport area is sufficient?



- We are satisfied with this and we have no plans for investments in this area in the next 2 years
- We are satisfied but we plan to invest in this area over the next 2 years
- We are not satisfied and we are investing in this area
- We are not satisfied but we have no intention of investing in this area

Analyzing instead the ICT systems in the company serving the improvement and coordination of area processes, the most prevalent systems are WMS, TMS and track&trace. Others such as carrier integration solutions and supply chain control tower, which are of definite value to the company, have yet to find diffusion in the corporate fabric.

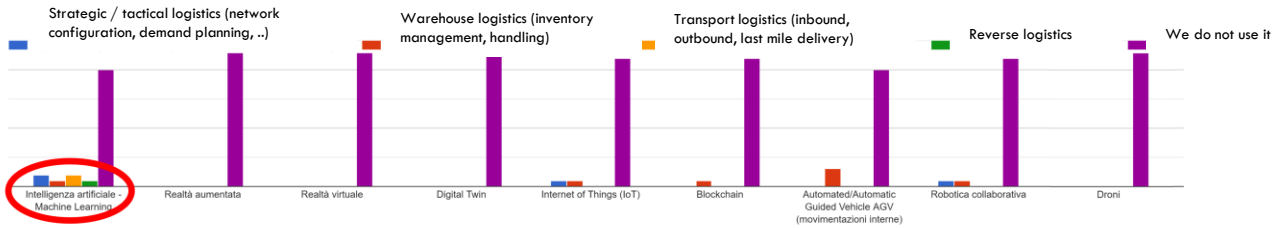
Which of the following systems dedicated to logistics and transport among those listed are present in the company?





Moving on to the most innovative technologies, the questionnaire still showed some distance from their use in the core areas of logistics and transportation. Only AI, IoT, AGVs and collaborative robotics are beginning to spread.

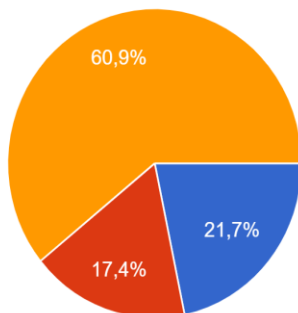
In which areas of logistics and transport do you use the following technologies?



CPS in logistics and transportation

Turning then to the awareness and adoption of cyber physical systems, it is evident from the survey that the possible benefits in general of CPS are still widely unknown today, even more so in the logistics and transportation area alone.

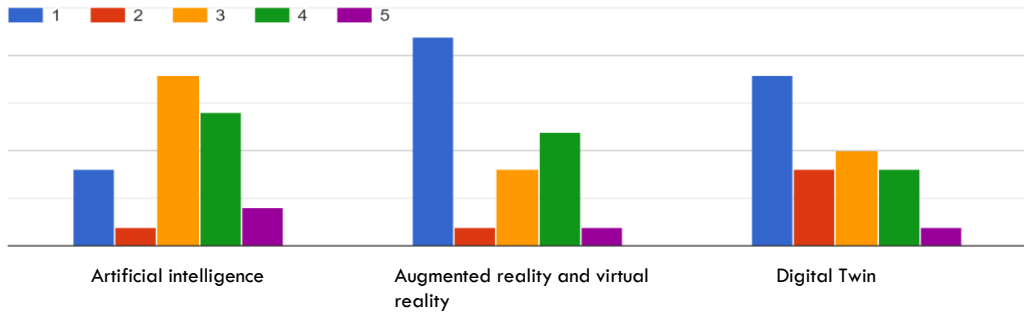
Have you ever heard of Cyber Physical Systems (CPS)? If so, do you think it could have a strong impact on logistics and transport processes?



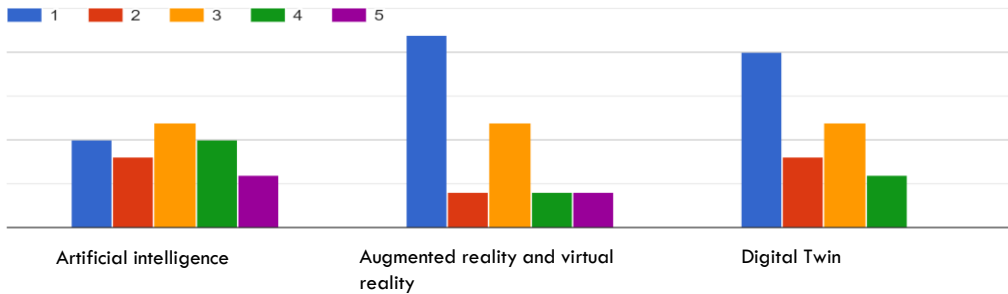
- Yes, I have heard of them and I consider them important to improve logistics and transport processes
- Yes, I have heard of them but I consider them very important for other business areas such as design and maintenance and not for logistics and transport
- No, I've never heard of it

By specifically analyzing the foundational, and best-known, technologies behind CPS, namely AI, AR and VR, and Digital Twin, the goal was to understand the perceptions of businesses with respect to the improving potential of these individually for logistics and transportation efficiency.

Regardless of your use, how much important do you think the following technologies are for improving the efficiency of warehouse logistics processes? (1 = no impact, 5 = very strong)



Regardless of your use, how much important do you think the following technologies are for improving the efficiency of transport management? (1 = no impact, 5 = very strong)



At this point, the research sought to explore the views regarding the adoption of CPSs in logistics and transportation, but about 80% of respondents having not yet experienced these technologies in logistics and transportation admit that they cannot assess their actual benefits and applications.



Bibliografia e Sitografia

1. **Turan Paksoy, Cigdem Gonul Kochan, Sadia Samar Ali** - Logistics 4.0: Digital Transformation of Supply Chain Management
2. **Business Research Insight**
3. **Accenture** - Artificial Intelligence
4. **MHI** - The 2022 MHI Annual Industry Report
5. **McKinsey&Company** - Succeeding in the AI supply-chain revolution
6. **MarketsAndMarkets** – Warehouse Robotics Market
7. **Zebra** - Studio
8. **Vantage Market Research** - Digital Twin Market Size, Share & Trends Analysis Report by Enterprise (Large Enterprises, Small & Medium Enterprises), by Application (Product Design & Development, Predictive Maintenance, Business Optimization, Performance Monitoring), by Industry (Automotive & Transportation, Energy & Utilities, Infrastructure, Healthcare), by Region (North America, Europe, Asia Pacific, Latin America) - Global Industry Assessment (2016 - 2021) & Forecast (2022 - 2028)
9. **Günther Schuh, Reiner Anderl, Roman Dumitrescu, Antonio Krüger, Michael ten Hompel** - Industrie 4.0 Maturity Index. Managing the Digital Transformation of Companies – UPDATE 2020



Edited by



DIH
Digital Innovation Hub



CONFINDUSTRIA
Verona



LOGI Know



This Digital Innovation Hub Activities has received financial support as third party from the European Union's Horizon 2020 research and innovation programme, through an Open Call issued and executed under the project DIH4CPS (Grant Agreement N° 872548).

