

“Industrial Metaverse”

Il nuovo contesto tecnologico e organizzativo dei processi manifatturieri

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4 maggio 2023

DOPO IL «CO.CO.CO», DATE IL BENEVENUTO ALL'INDUSTRIAL METAVERSE

Covid, CO2 & Connectivity hanno cambiato lo scenario del manufacturing

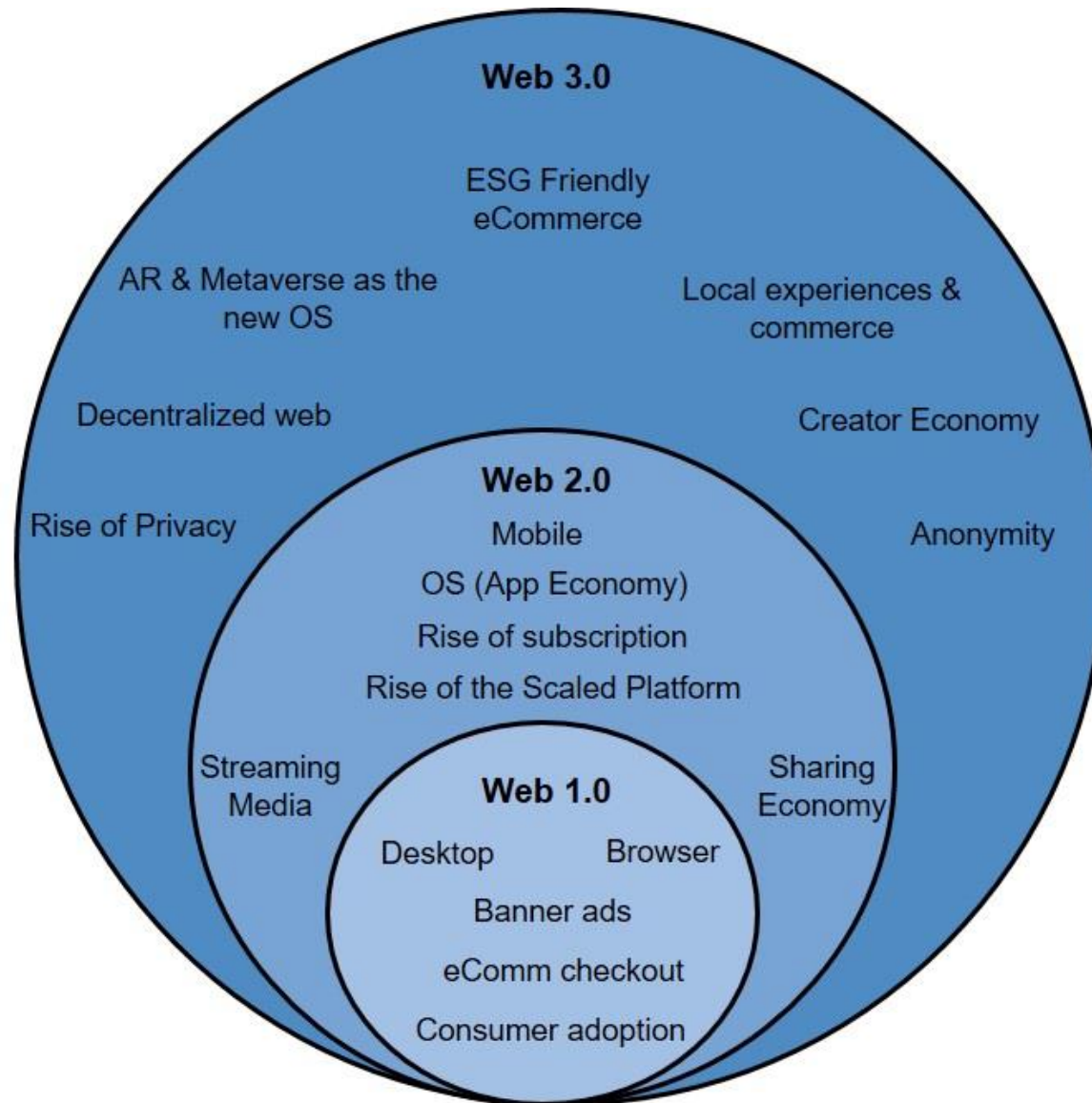


INDUSTRIAL METAVERSE

“The industrial metaverse combines physical-digital fusion and human augmentation for industrial applications and contains digital representations of physical industrial environments, systems, assets and spaces that people can control, communicate, and interact with.”

Thierry Klein, president of Bell Labs Solutions Research at Nokia

Che cos'è il Web 3.0, infrastruttura del Metaverso Industriale



WEB 3.0 / METAVERSE T.A.M.

Exhibit 21: Scenario Analysis - Potential Metaverse Market Opportunity (\$tn)

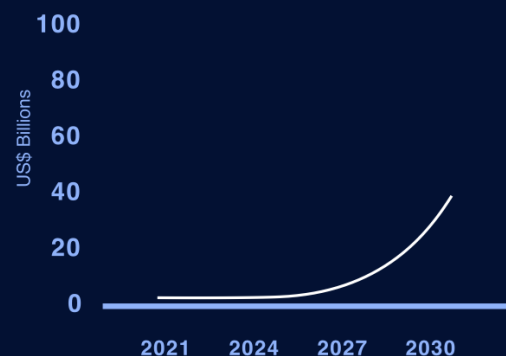
		% of Digital Economy Shifting to Metaverse													
		15.0%		17.0%		19.0%		21.0%		23.0%		25.0%		27.0%	
% of TAM Expansion	10.0%	\$	3.75	\$	4.05	\$	4.35	\$	4.66	\$	4.96	\$	5.26	\$	5.56
	15.0%	\$	4.51	\$	4.81	\$	5.11	\$	5.41	\$	5.71	\$	6.01	\$	6.31
	20.0%	\$	5.26	\$	5.56	\$	5.86	\$	6.16	\$	6.46	\$	6.76	\$	7.06
	25.0%	\$	6.01	\$	6.31	\$	6.61	\$	6.91	\$	7.21	\$	7.51	\$	7.81
	30.0%	\$	6.76	\$	7.06	\$	7.36	\$	7.66	\$	7.96	\$	8.26	\$	8.56
	35.0%	\$	7.51	\$	7.81	\$	8.11	\$	8.41	\$	8.71	\$	9.01	\$	9.31
	40.0%	\$	8.26	\$	8.56	\$	8.86	\$	9.16	\$	9.46	\$	9.76	\$	10.06
	45.0%	\$	9.01	\$	9.31	\$	9.61	\$	9.91	\$	10.21	\$	10.51	\$	10.81
	50.0%	\$	9.76	\$	10.06	\$	10.36	\$	10.66	\$	10.96	\$	11.26	\$	11.56
		\$	5.86	\$	6.16	\$	6.46	\$	6.76	\$	7.06	\$	7.36	\$	7.66
		\$	6.16	\$	6.46	\$	6.76	\$	7.06	\$	7.36	\$	7.66	\$	7.96
		\$	6.46	\$	6.76	\$	7.06	\$	7.36	\$	7.66	\$	7.96	\$	8.26
		\$	6.76	\$	7.06	\$	7.36	\$	7.66	\$	7.96	\$	8.26	\$	8.56
		\$	7.06	\$	7.36	\$	7.66	\$	7.96	\$	8.26	\$	8.56	\$	8.86
		\$	7.36	\$	7.66	\$	7.96	\$	8.26	\$	8.56	\$	8.86	\$	9.16
		\$	7.66	\$	7.96	\$	8.26	\$	8.56	\$	8.86	\$	9.16	\$	9.46
		\$	7.96	\$	8.26	\$	8.56	\$	8.86	\$	9.16	\$	9.46	\$	9.76
		\$	8.26	\$	8.56	\$	8.86	\$	9.16	\$	9.46	\$	9.76	\$	10.06
		\$	8.56	\$	8.86	\$	9.16	\$	9.46	\$	9.76	\$	10.06	\$	10.36
		\$	8.86	\$	9.16	\$	9.46	\$	9.76	\$	10.06	\$	10.36	\$	10.66
		\$	9.16	\$	9.46	\$	9.76	\$	10.06	\$	10.36	\$	10.66	\$	10.96
		\$	9.46	\$	9.76	\$	10.06	\$	10.36	\$	10.66	\$	10.96	\$	11.26
		\$	9.76	\$	10.06	\$	10.36	\$	10.66	\$	10.96	\$	11.26	\$	11.56
		\$	10.06	\$	10.36	\$	10.66	\$	10.96	\$	11.26	\$	11.56	\$	11.86
		\$	10.36	\$	10.66	\$	10.96	\$	11.26	\$	11.56	\$	11.86	\$	12.16
		\$	10.66	\$	10.96	\$	11.26	\$	11.56	\$	11.86	\$	12.16	\$	12.46

Source: Goldman Sachs Global Investment Research, World Bank, United Nations

Potential of the industrial metaverse market

Consumer Metaverse

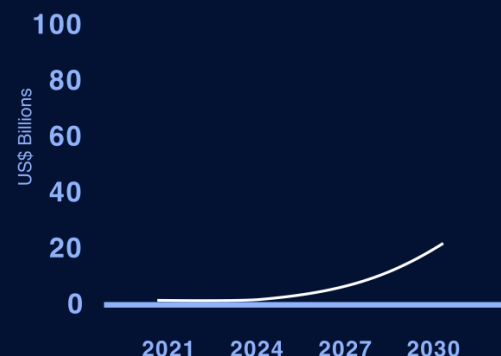
Virtual spaces revenue (global)



- Consumer appeal driven
- Reliant on trends and network effect
- Fragmented monetization, with growth from 2026

Enterprise Metaverse

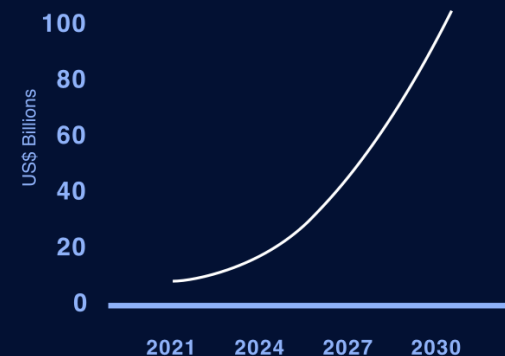
Immersive collaboration and related cloud revenue (global)



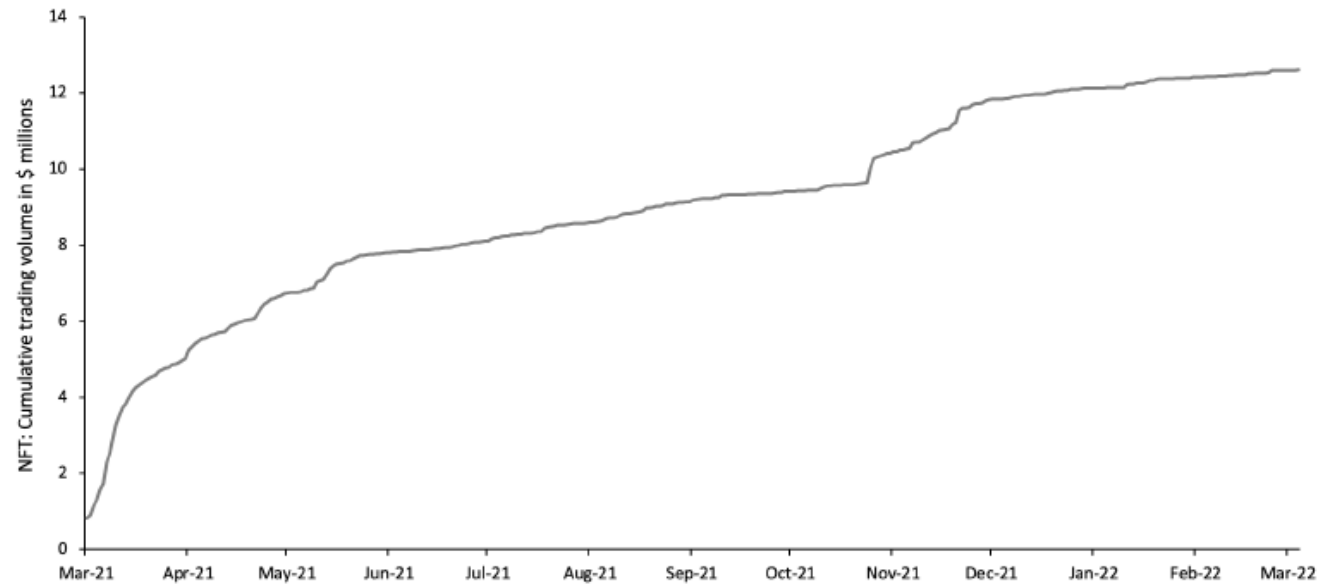
- Business value driven
- Solution and device innovation
- Good monetization potential, with growth from 2025

Industrial Metaverse

Digital twin and simulation and industrial extended reality revenue (global)



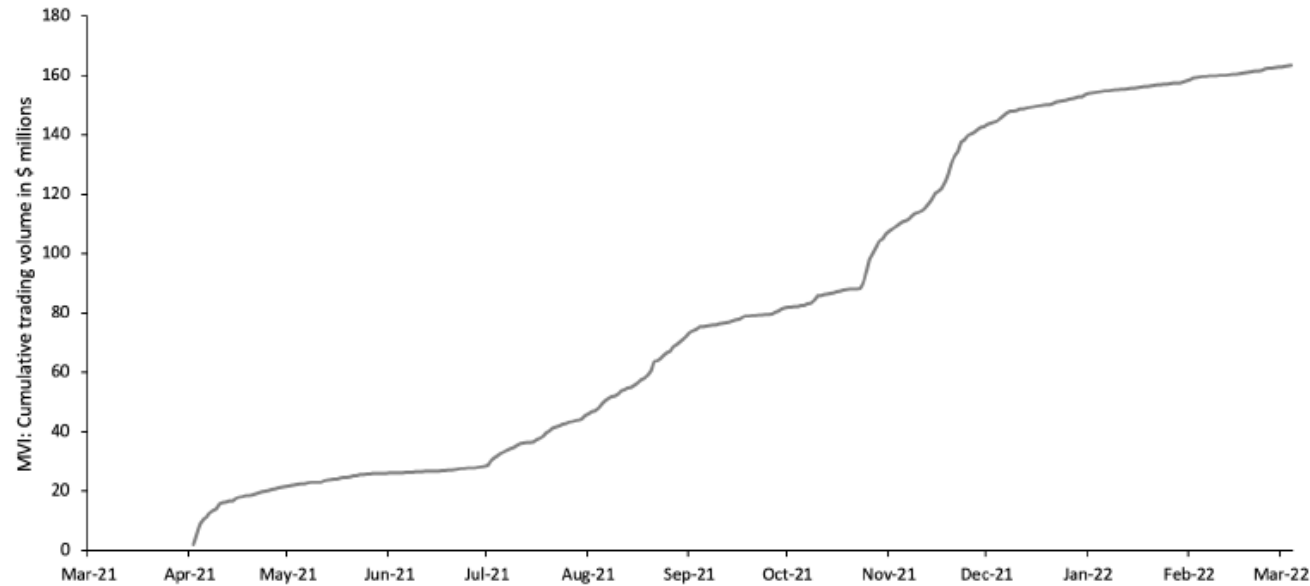
- Operational results driven
- Industrial automation focus
- High monetization potential, with early traction



Trading volumes of NFTs & Metaverse Assets

(2021-1Q22)

Panel A: The Cumulative Trading Volume of NFTs



Panel B: The Cumulative Trading Volume of Metaverse Assets

The Cointegration of NFTs and Metaverse Assets: Cumulative Trading Volume. Panel A and Panel B show the cumulative trading volume (in USD million) for NFT and dedicated Metaverse startups as categorized at <https://coinmarketcap.com/de/currencies/nft-index/> and <https://coinmarketcap.com/de/currencies/metaverse-index/>, respectively, with the trading volume data retrieved from <https://www.coingecko.com> accessed on 10 March 2022.

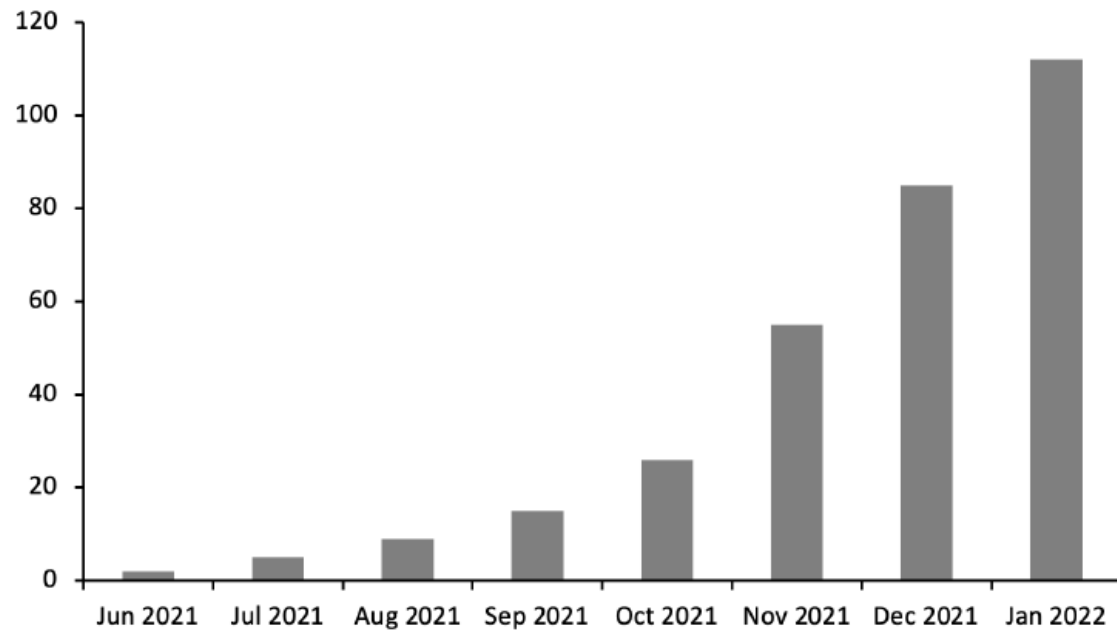


Figure 1. Apps in the Metaverse. This is the cumulative number of mobile apps that update their names to include the term “Metaverse.” The data are available from *Statista* (<https://www.statista.com/statistics/1289564/apps-adding-metaverse-name-or-description/>, accessed on 10 March 2022).

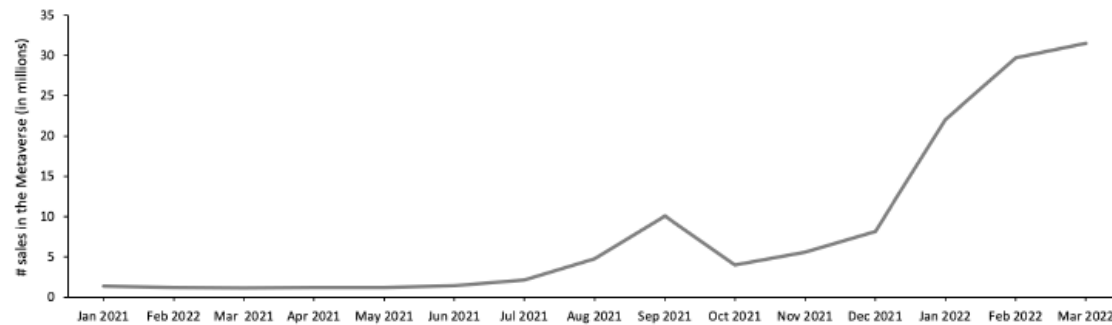


Figure 2. Sales in the Metaverse Economy. This figure shows the number of sales (in million) through Metaverse apps, which, as per the data provider’s business model, is restricted to NFT sales on the Ethereum blockchain. Therefore, the figure depicts only a subset of actual sales in the Metaverse. The data are available from <https://nonfungible.com/market-tracker> (accessed on 10 March 2022).

Volume of Apps & Total Sales in the Metaverse Economy (2021-1Q22)

AR/VR headset market size



Haptic technology¹ market size



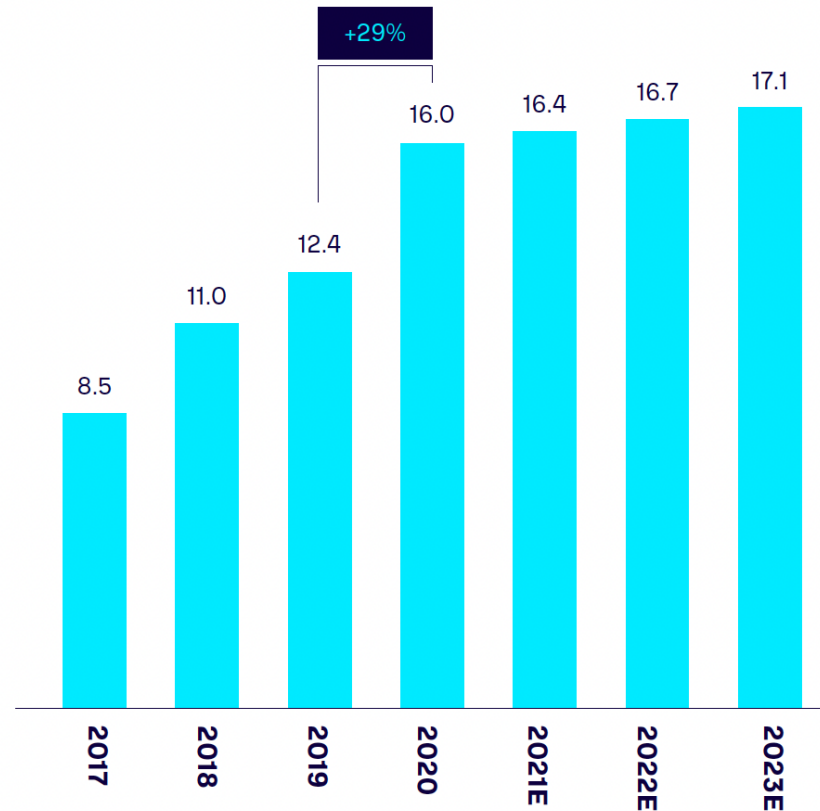
Source: Arthur D. Little, Credit Suisse, IDC, Researchandmarkets.com

La crescita del mercato per gli abilitatori del Metaverso Industriale

The growth of collaboration software has accelerated rapidly during COVID-19 pandemic¹



Global collaboration software market size (\$bn)



Source: Arthur D. Little, Statista

Note: (1) Collaboration software enables the sharing, processing, and management of files, documents, and other data types among several users or systems. Popular examples include Slack and Microsoft Teams

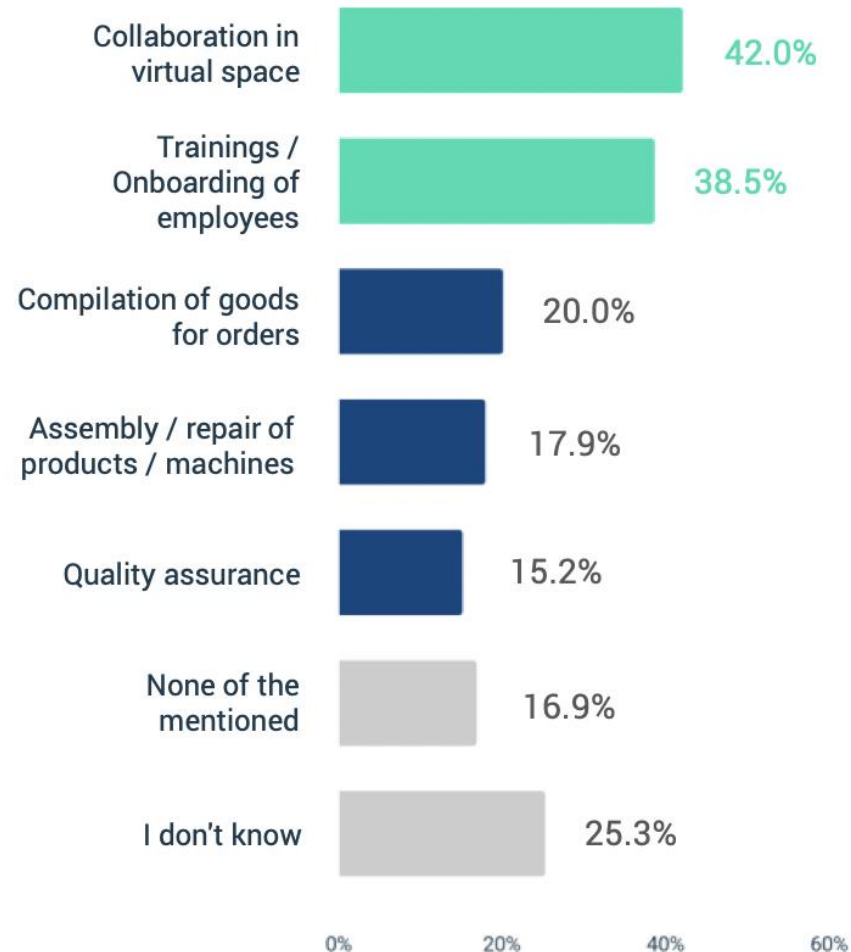
Metaverso Professionale: collaborazione digitale, training, supporto tecnico e acquisti di beni e servizi

Virtual collaboration and training conceivable

In the survey of possible areas of application in industrial settings, **collaboration in the virtual space** (42%) and use for **training and onboarding** (39%) are the most common answers. One in five can also imagine the compilation of goods for orders. In order to see more use for quality control (15%) or assembly / repair (18%), concrete practical examples are obviously needed. Already today, however, the majority of blue-collar workers and executives (over 56% each) see potential for the industry in virtual collaboration.

With 42% of mentions expressing no choice or indecision, the lack of imagination and knowledge about the Industrial Metaverse is revealed.

Possible industrial areas of use



Gli attributi tecnologici e funzionali del Metaverso Industriale

- **Scaling:** increasing the current cap of c. 100 per zone to potentially infinite.
- **Persistence:** technical limitations unlocked, actual digital persistence can improve immersion and create new experiences.
- **Interoperability:** merging of different games and new systems of interaction between them, value in one game can compound in others.
- **Economy:** trading across different games, more depth, currencies.
- **Identity:** evolution of current online identities for avatars that can represent a player in more imaginative or realistic ways.
- **Digital & physical:** spans across many aspects of life with open and closed platforms.
- **Populated by multiple contributors:** content from individuals, informal groups, organization, and commercial enterprise.

Antichi e nuovi principi nel Metaverso Industriale

1) Unicuique Suum

- Property Rights
- Self-Sovereign Identity
- Data Decentralization

2) Pacta Sunt Servanda

- Contract enforcement
- Smart Contracts
- Distributed Ledger Technologies

3) Alterum non laedere

- Proof of Stake/Work
- Conflict management vs Forking
- Remedy to market abuse

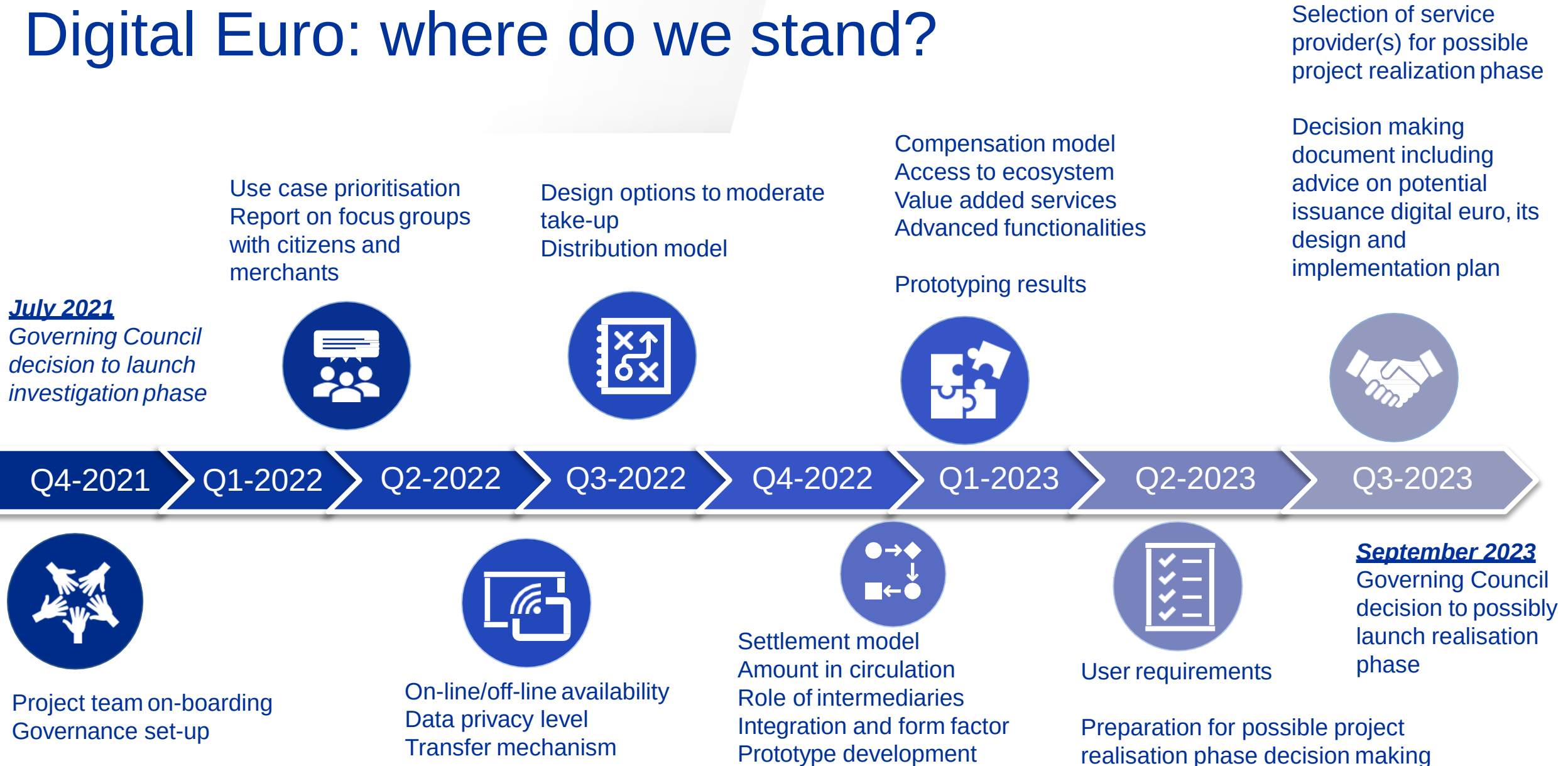


Eneo Domizio Ulpiano

SSI & Digital Euro are being introduced



Digital Euro: where do we stand?



The new form of policy-aware payment: a smart contract written in pseudo-code for a CBDC

```
1 function transfer(parcel, recipient, service, amount)
2   require ([...]); //initial checks: spender authorized? Amount available?
3   newPolicies[] = [];
4   foreach (policy in parcel.policies)
5     if (!policy.check(sender, recipient, service, amount))
6       return false; //if the policy forbids the transfer, terminate
7   else
8     newPolicies.append(policy.getNextPolicies(sender, recipient, service,
9       amount));
9   parcel.subtract(amount); //remove amount from old parcel
10  newParcel = Parcel(recipient, newPolicies, amount); // new parcel with new
    policies
```

Listing 1: Pseudo code of policy-aware transfer function

EU and international institutions are creating the infrastructure for decentralized self-sovereign identity



**Creating, validating and funding for
an EU interoperable SSI infrastructure**

**THE RISE OF SELF
SOVEREIGN IDENTITY IN
THE NEW ECONOMY**

Creating a free market of non-personal data



European Commission

EN English

Shaping Europe's digital future

Home Policies Activities News Library Funding Calendar Consultations

Home > Policies > Free flow of non-personal data

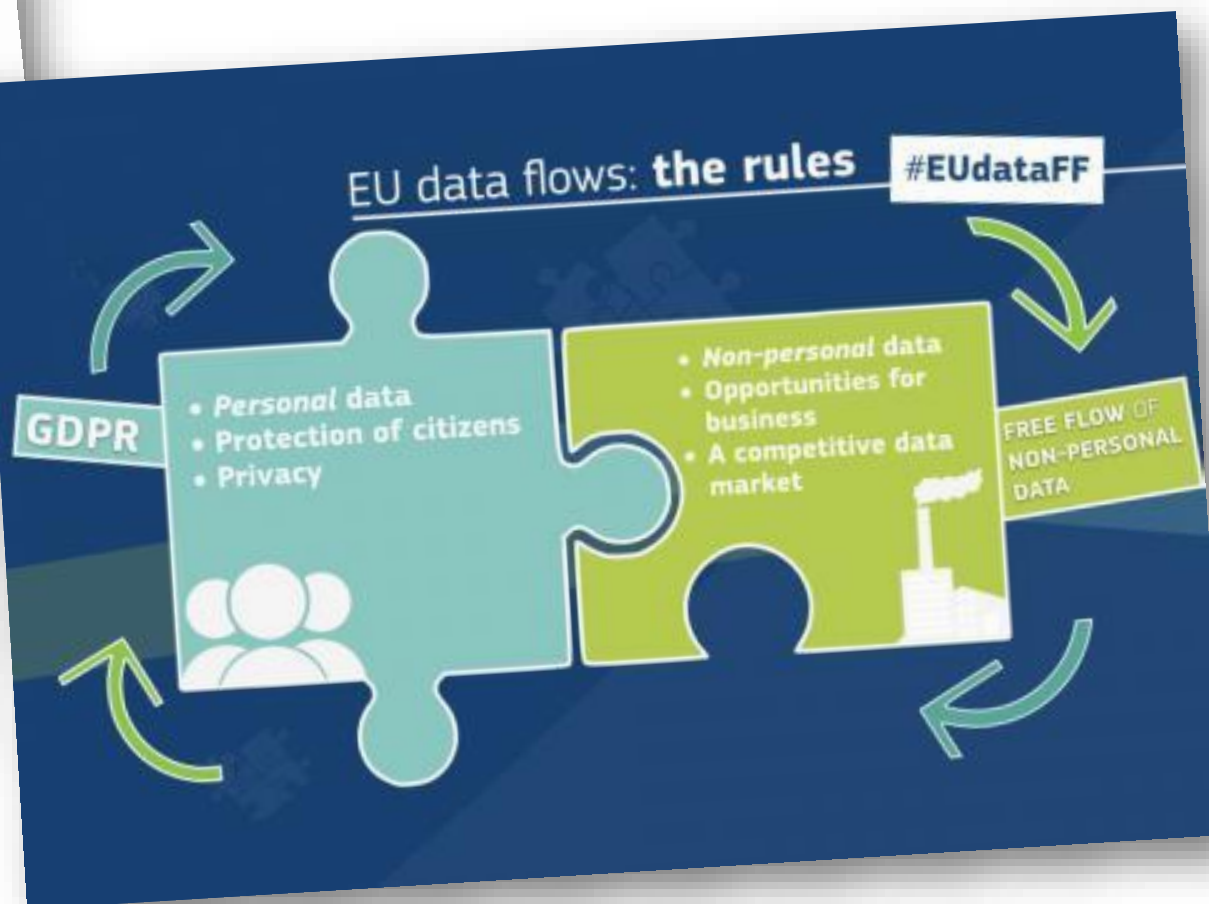
Free flow of non-personal data

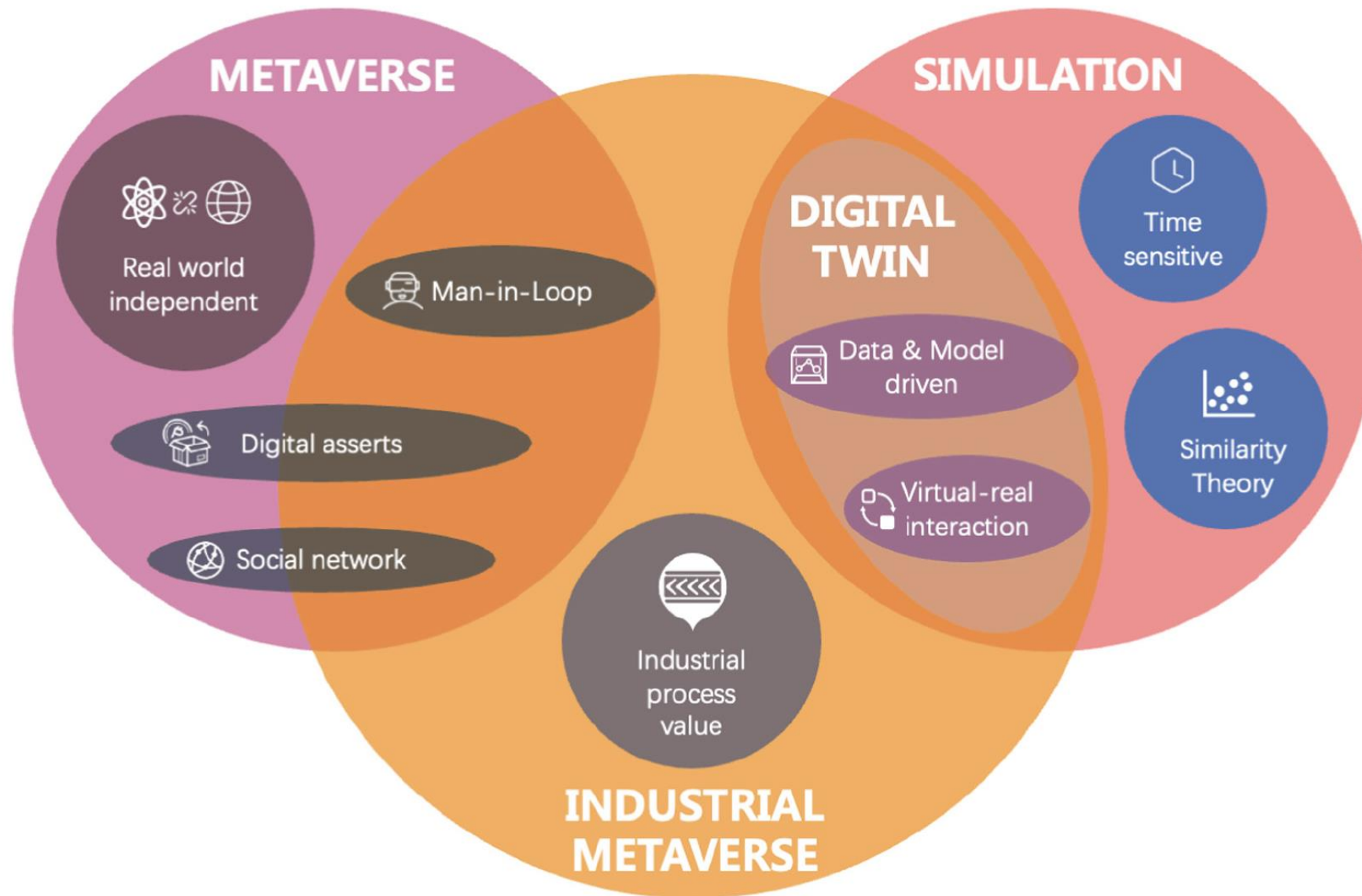
The EU wants to ensure a free flow of data in Europe, allowing companies and public administrations to store and process non-personal data wherever they choose.

Our economy depends more and more on data: data can create significantly added value to existing services and facilitate entirely new business models. To fully unleash the benefits of the data economy the Commission needs to ensure the free-flow of non-personal data.

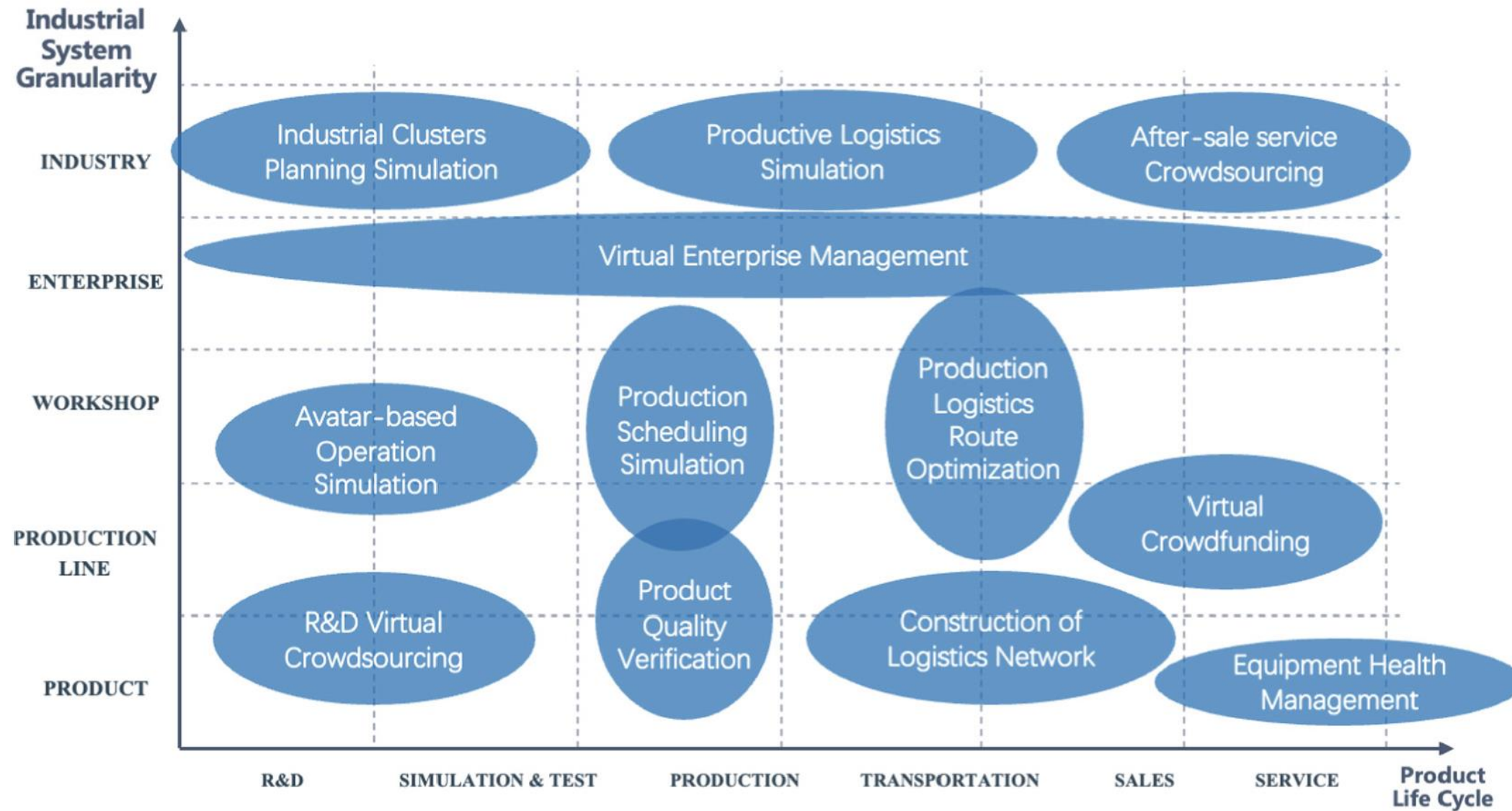
The Regulation on the free flow of non-personal data

The [Regulation on a framework for the free flow of non-personal data in the EU](#) aims at removing obstacles to the free movement of non-personal data between different EU countries and IT systems in Europe.

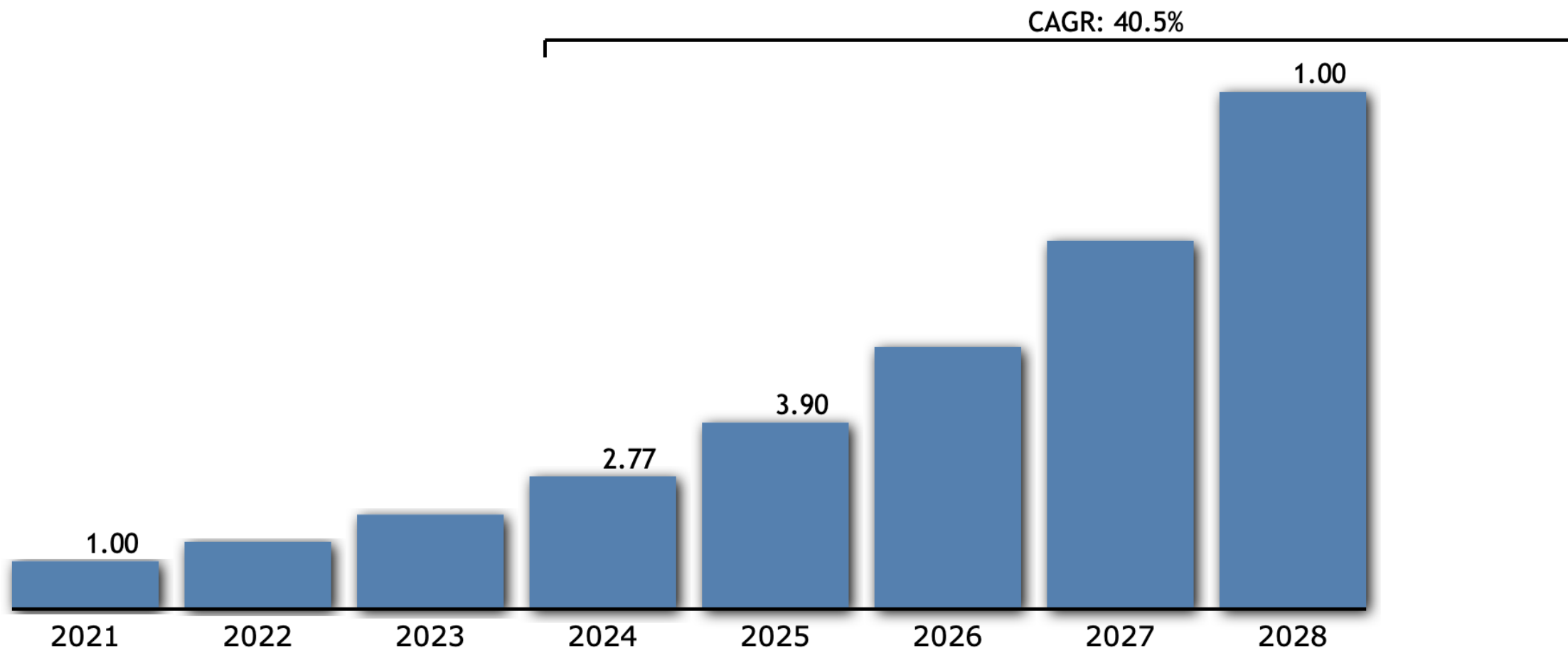




MAP OF APPLICATIONS OF INDUSTRIAL METAVERSE



METaverse IN AUTOMOTIVE MARKET SIZE 2021 TO 2028 (USD BL)



Renault lancia il primo metaverso industriale dell'automotive

Già definiti 32 casi d'uso: Digital Twin, Big Data, Supply Chain Ecosystem ridurranno del 60% i tempi di consegna e dimezzeranno la carbon footprint della produzione di veicoli

Renault Group Launches 'Industrial Metaverse' to Accelerate Its Digital Transformation

Renault Metaverse Aims to Save \$330 Million by 2025

Renault claims first 'Industrial Metaverse'

Renault claims a new milestone in its digital transformation by launching 'Industrial Metaverse'

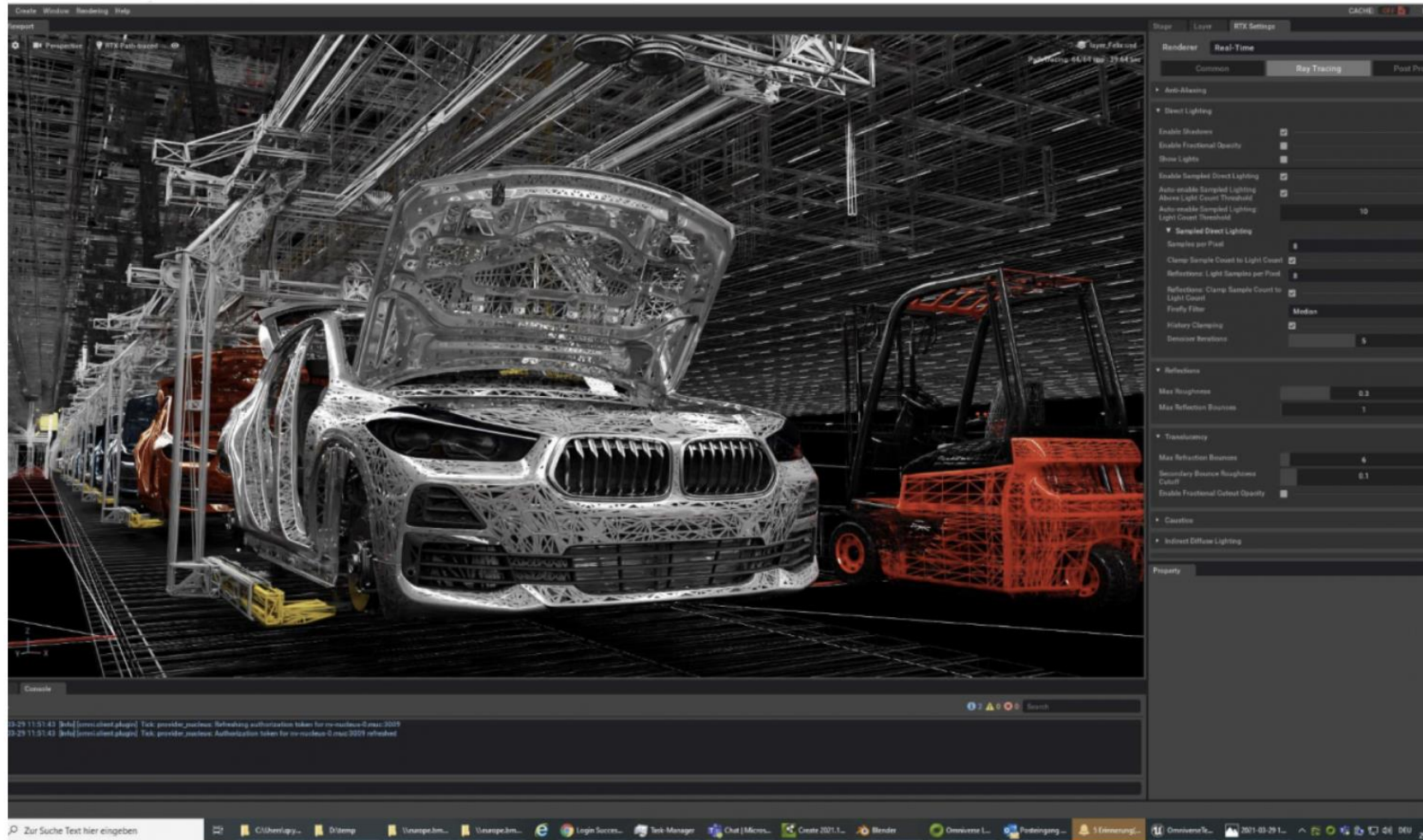
By David Leggett



Renault lancia il suo metaverso Più efficienza e sostenibilità

Il gruppo Renault lancia il primo metaverso industriale, che si basa su quattro dimensioni, di cui il primo è la raccolta massiccia di dati. In secondo luogo, i Digital Twin, per consentire ad ogni stabilimento di essere provvisto di una replica nel mondo virtuale; segue la connessione dell'ecosistema Supply Chain e infine l'utilizzo di una serie di tecnologie avanzate, per esempio Cloud, 3D e big data. Entro il 2025, il metaverso permetterà di risparmiare 320 milioni di euro, a cui si aggiungeranno 260 milioni di euro negli stock, una riduzione del 60 per cento dei tempi di consegna dei veicoli e del 50 per cento della carbon footprint della produzione dei veicoli.

BMW & NVIDIA OMNIVERSE



The BMW Group and NVIDIA are generating a completely new approach to planning highly complex manufacturing systems with the Omniverse platform

<https://youtu.be/6-DaWgg4zF8>



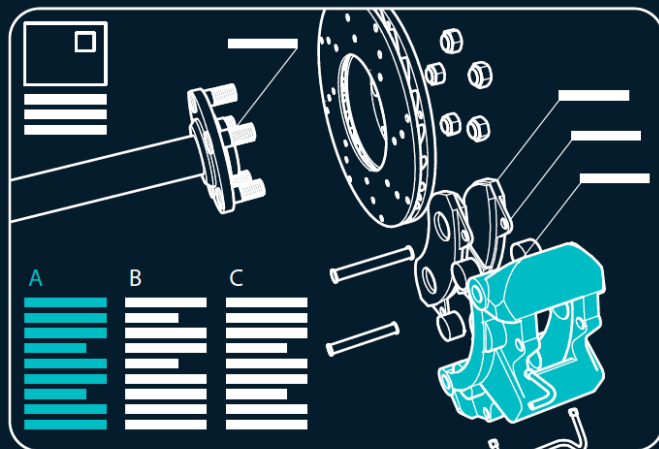
INDUSTRY NEWS

Microsoft Introduces Solutions from Assembly Line to Metaverse

The company's technology powers General Motors' latest vehicle software platform, Mercedes-Benz factories and Fiat's new virtual showroom.

Microsoft executive Judson Althoff (left) discusses MO360 Data Platform with Mercedes-Benz leaders Jan Brecht (center) and Jörg Burzer.

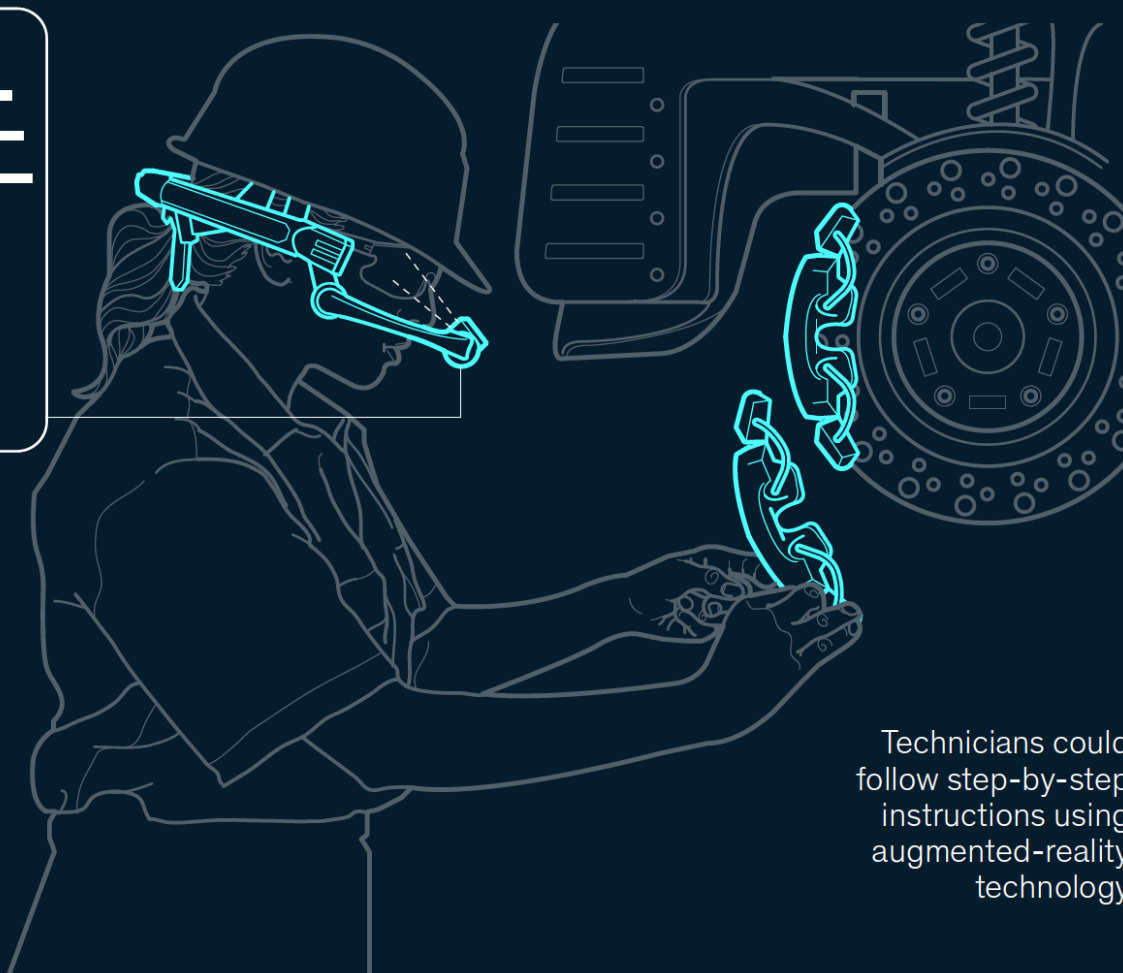
Wearable extended-reality devices could improve the service process of vehicles and assist with employee training.



Service technicians, including those at third parties, could receive training and guidance through extended-reality devices

Technicians could inspect onboard vehicle data and connect online with OEM experts for joint diagnosis and to order parts

Technicians may be able to connect with customers at their homes to conduct virtual inspections and an initial diagnosis



Technicians could follow step-by-step instructions using augmented-reality technology

WayRay unveiled the world's first Metaverse on Wheels

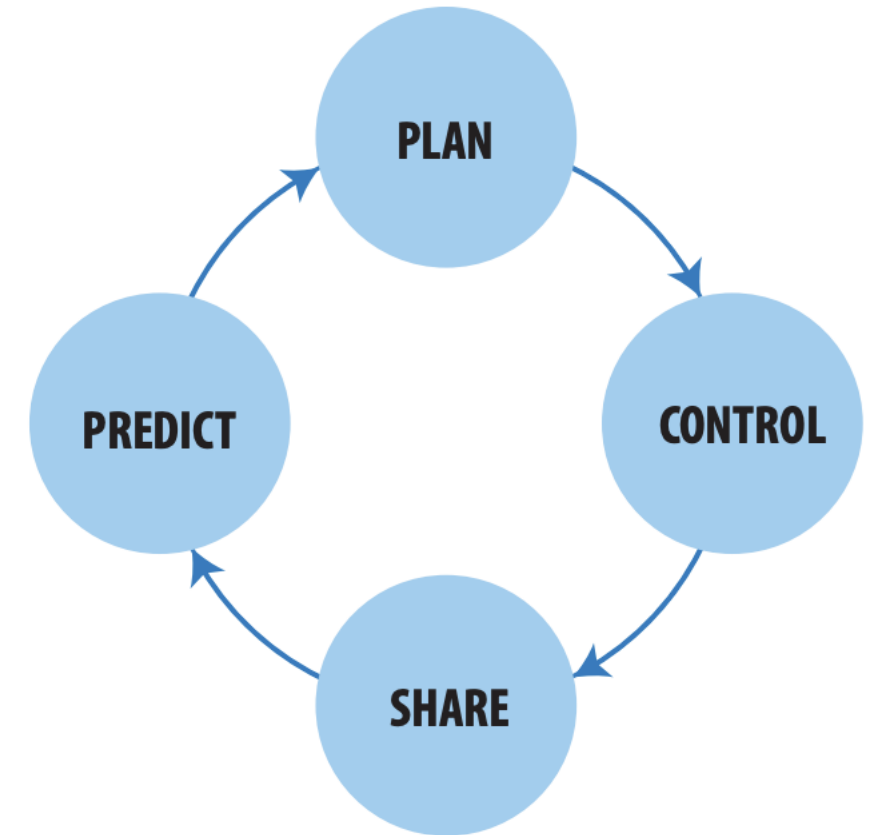


Metaverse changes the way we engage with each other—learning, growing, working, and playing together in a shared virtual reality. This is a completely new way of traveling.

COPYRIGHT © 2021 WAYRAY

The cognitive supply chain

**How companies are using AI to create
“next-generation” supply chains**

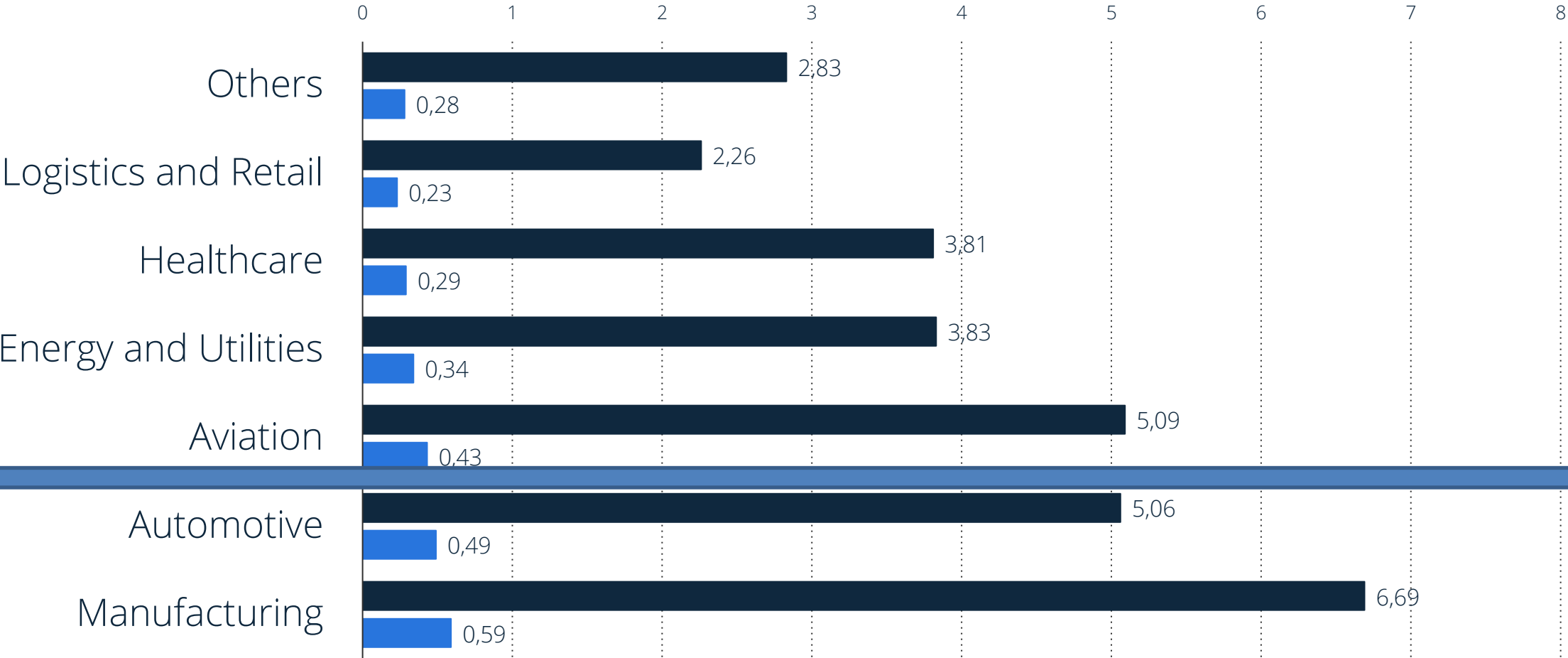


Source: Infosys

Il mercato mondiale dei Digital Twin: 8x dal 2020 al 2025

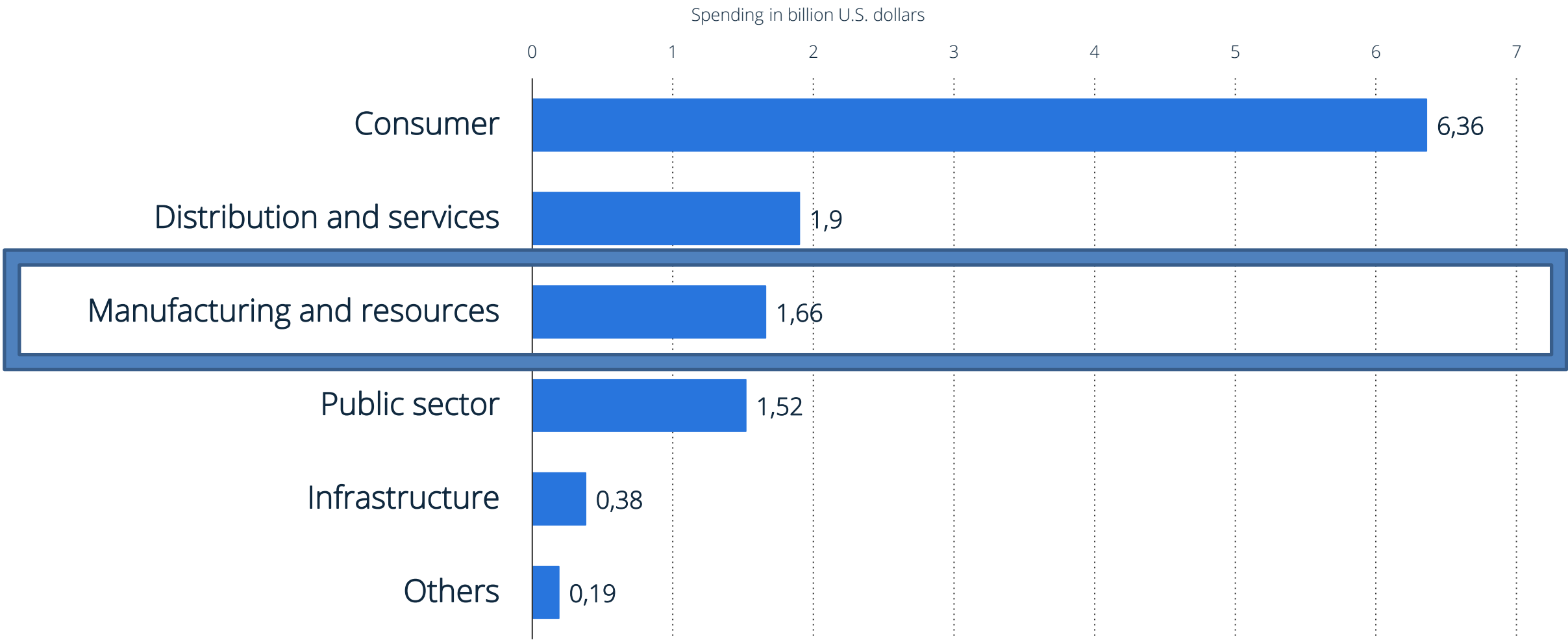
Market value in billion U.S. dollars, by industry

■ 2025 ■ 2020



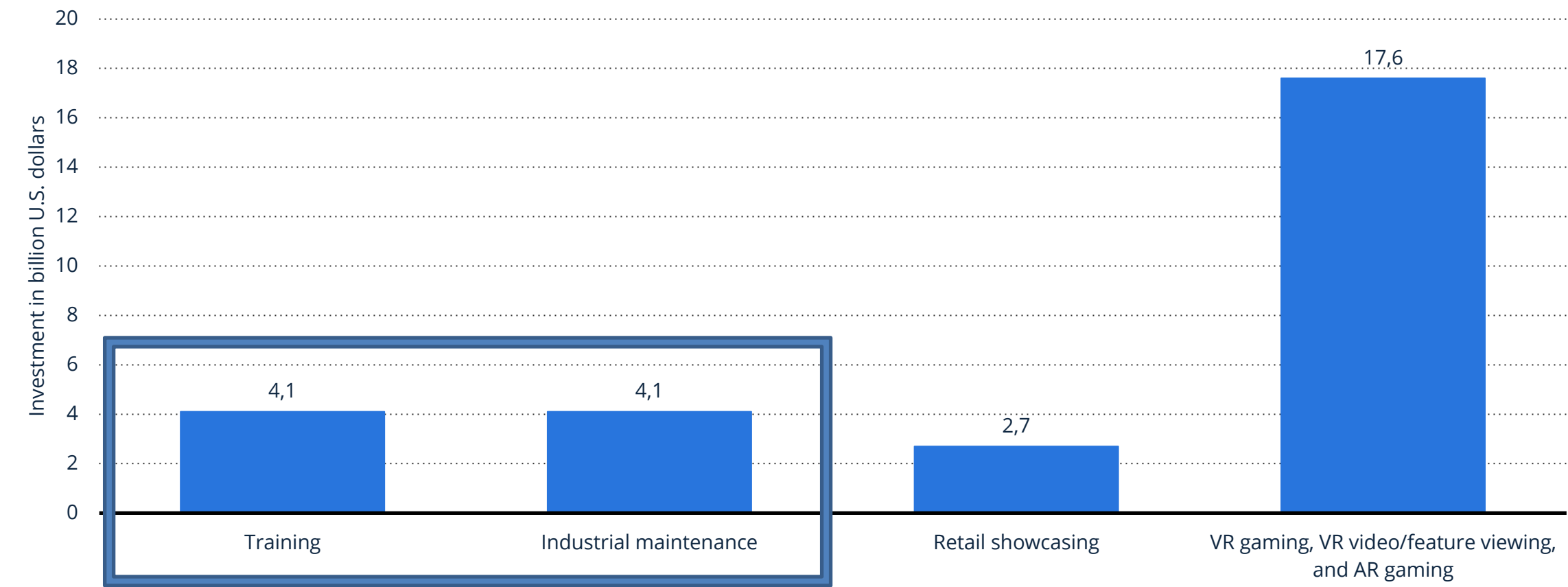
Note(s): Worldwide; Expert interviews and BIS Research analysis
Source(s): BIS Research; [ID 1296187](#)

Investimenti in Augmented/Virtual Reality per segmento



Investimenti in AR/VR per ambito applicativo

Investment in AR/VR technology worldwide in 2024, by use case



Description: The commercial use cases for augmented and virtual reality (AR/VR) that are expected to receive the largest investment in 2024 are training and industrial maintenance with 4.1 billion U.S. dollars forecast to be invested in both fields. VR gaming, VR video/feature viewing, and AR gaming make up the three largest consumer use cases for augmented and virtual reality (AR/VR), with 17.6 billion U.S. dollars expected to be spent in 2024. [Read more](#)
Note(s): Worldwide; 2020
Source(s): IDC

Il 52% è disposto a usare tecnologie immersive per meeting o attività di teamwork

The metaverse is coming to work

We also asked respondents about emerging technologies at work.

- 52% of employees are open to using digital immersive spaces in the metaverse for meetings or team activities in the next year.
 - 47% of employees are open to representing themselves as an avatar in meetings in the next year.
 - 51% of Gen Z and 48% of Millennials envision doing some of their work in the metaverse in the next two years.
 - 16% of employees say they never expect to do any work in the metaverse.
 - 13% of employees say they don't know what the term 'metaverse' means.
- "Avatars and the metaverse bring us one step closer to making people feel like they're together even when they are physically apart," says Mar Gonzalez Franco, principal researcher at Microsoft Research. "Our early research shows that when compared to an audio-only call, people feel more engaged, more present, and even more comfortable

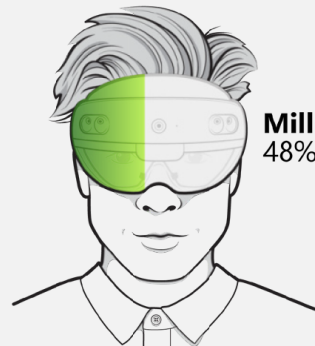
when using an avatar in a meeting. The people you are speaking with are better able to see your body language, and back-and-forth conversations feel more natural."

Leaders need to consider how emerging technologies like the metaverse and AI can augment collaboration and facilitate co-creation and creativity in a distributed work world.

Millennials and Gen Z are more likely to envision doing some of their work in the metaverse in the next two years.



Gen Z
51%



Millennials
48%



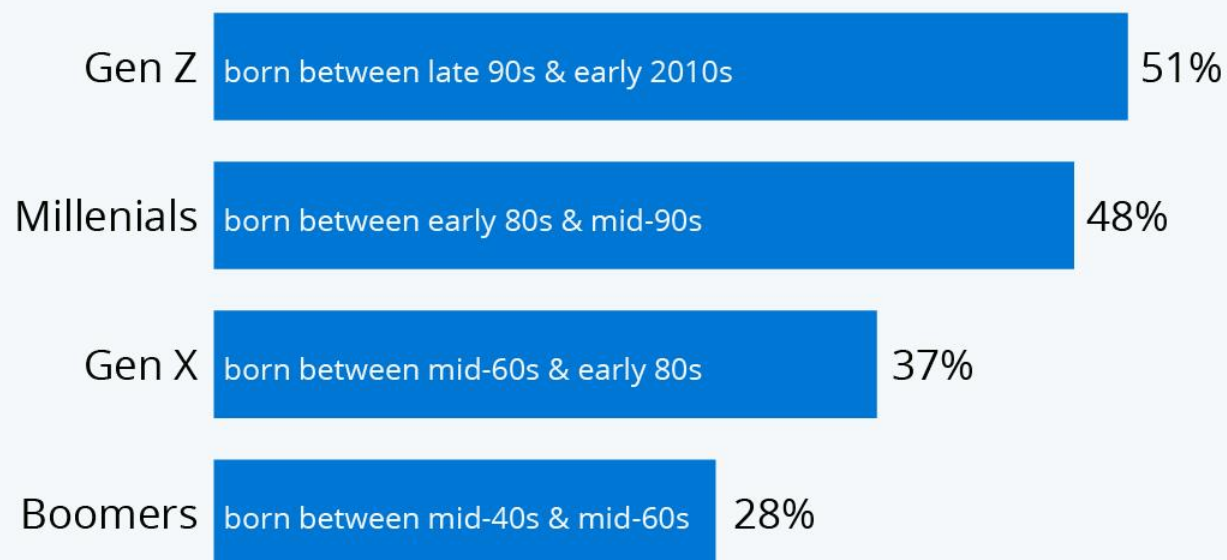
Gen X
37%



Boomers
28%

Will the Metaverse Lead to Metawork?

Share of respondents envisioning partly working in the metaverse in the near future by generation



Overall respondents not expecting metaverse work at all 16%

Based on surveys of 31,102 full-time employed or self-employed workers in 31 countries; Jan-Feb 2022

Source: Microsoft 2022 Work Trend Index

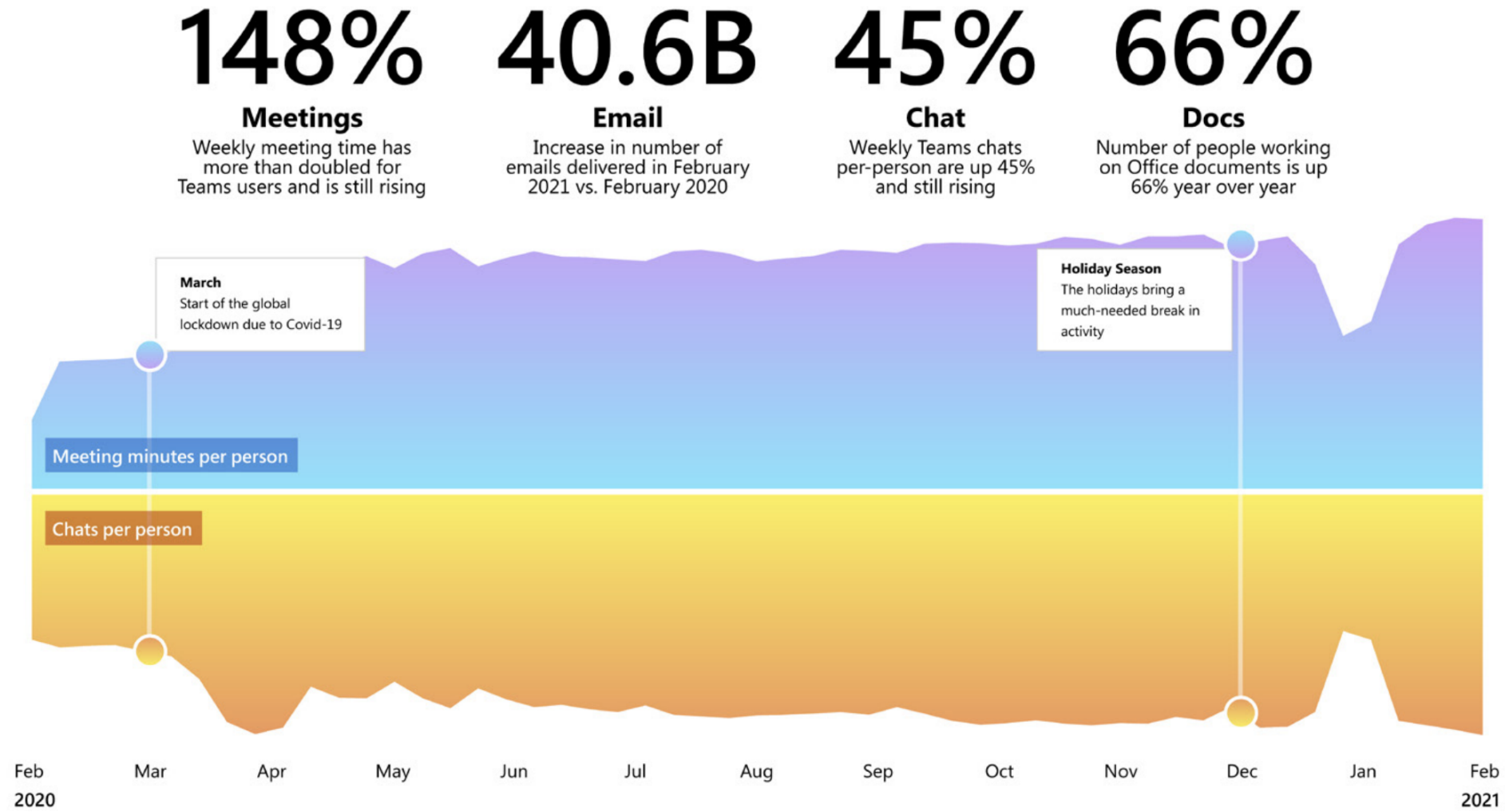


Macché «Smart Working».

Arriva il Metaworking ...

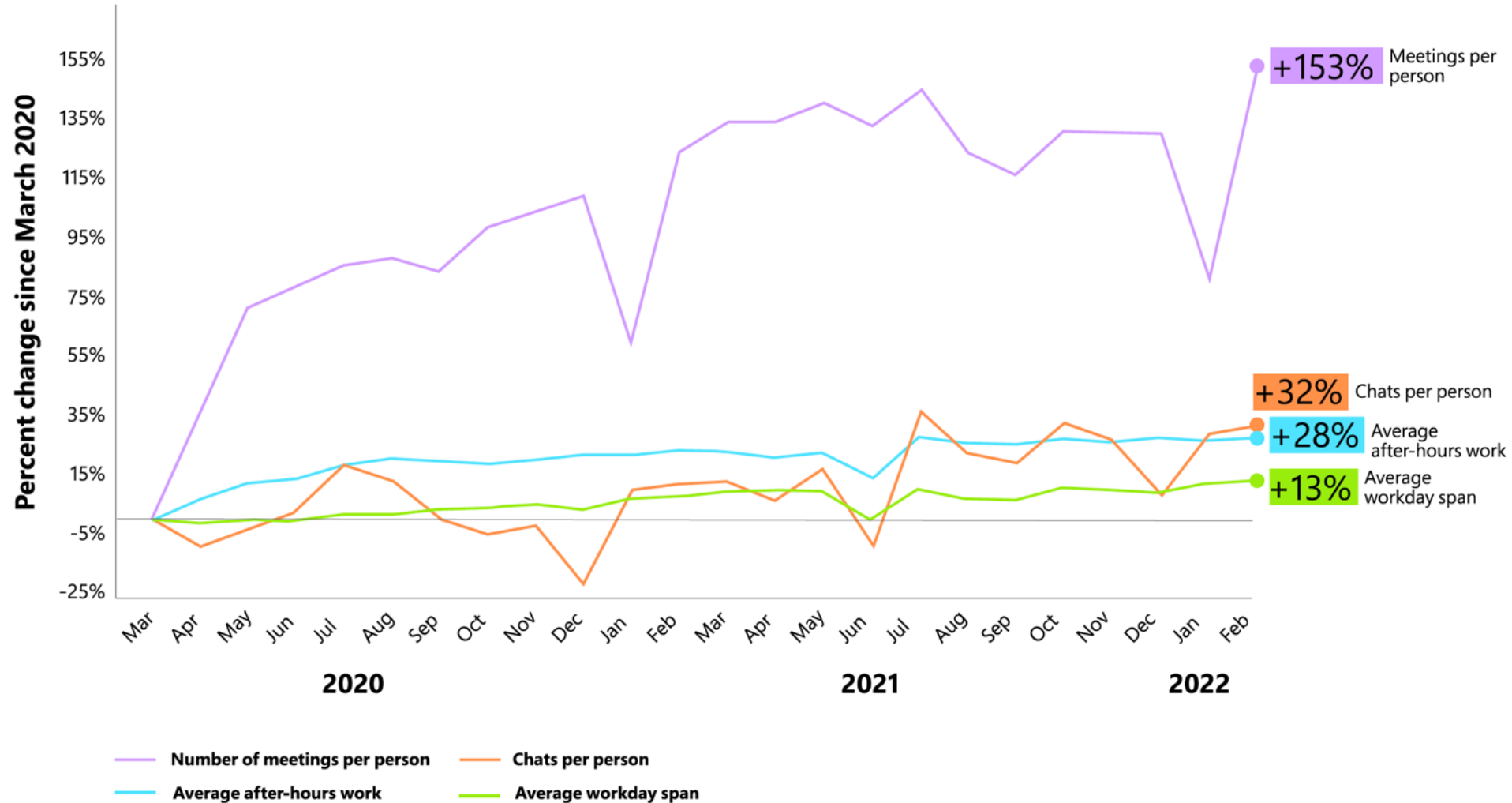
Digital overload is real and climbing

One year in, time spent in meetings and chats sent per person each week continues to climb.



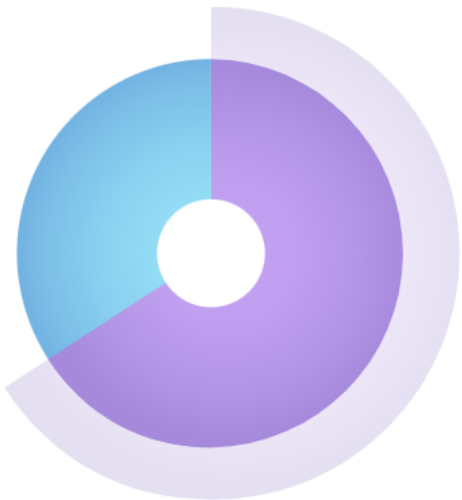
Analysis reflects the change in collaboration activity across Microsoft 365 tools from February 2020 to February 2021. This visualization is based on aggregated data, without personal or organization-identifying information. [Learn more about our approach.](#)

The new way of working, after the pandemic



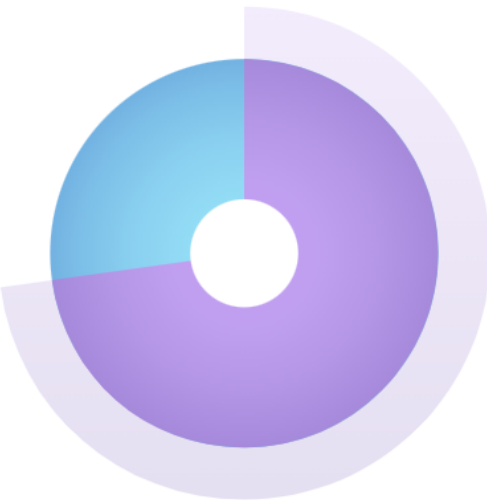
Hybrid work is inevitable

Business leaders are on the brink of major updates to accommodate what employees want: the best of both worlds.



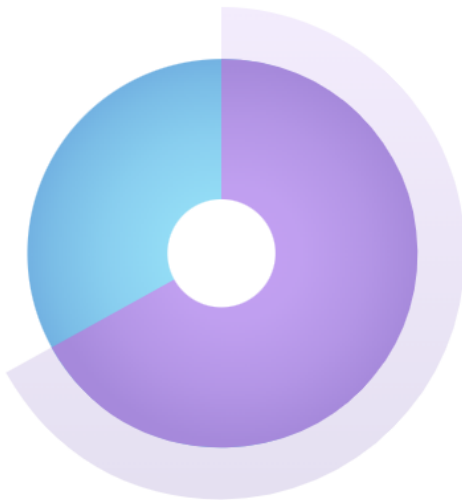
66%

of leaders say their company is considering redesigning office space for hybrid work



73%

of employees want flexible remote work options to stay

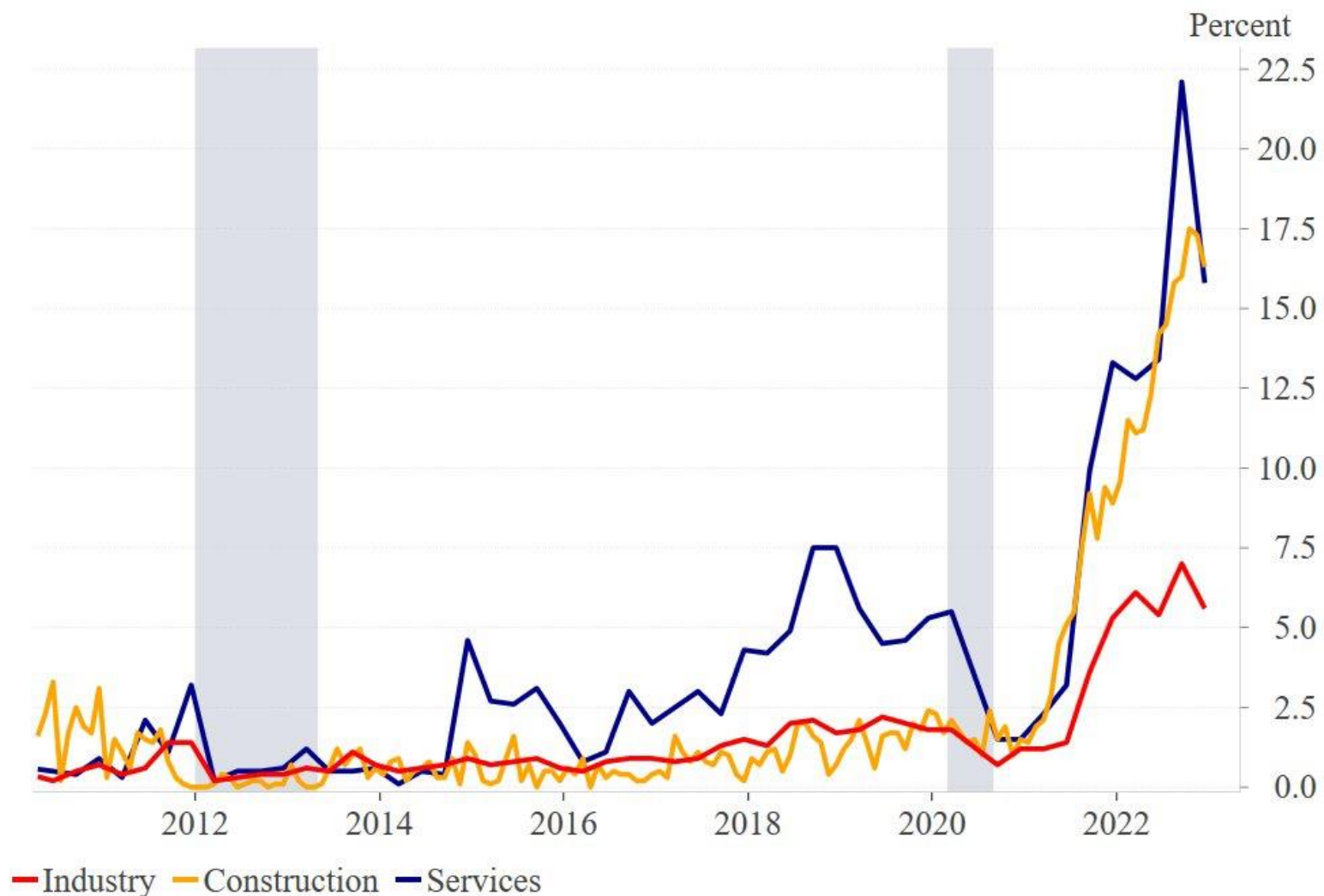


67%

of employees want more in-person work or collaboration post-pandemic

The Work Trend Index survey was conducted by an independent research firm, Edelman Data x Intelligence, among 31,092 full-time employed or self-employed workers across 31 markets between January 12, 2021 to January 25, 2021.

Italian firms are signalling lack of workforce



% di imprese italiane che lamentano la scarsità di manodopera come fattore limitante della produzione (Fonte: R. Trezzi, Gennaio 2023)



IMPRESE CHE ASSUMONO

DICEMBRE

11%



GIOVANI

DICEMBRE

32%



DIFF. REPERIMENTO

DICEMBRE

45%

OPPORTUNITÀ DI LAVORO NEL MESE DI DICEMBRE

Entrate previste

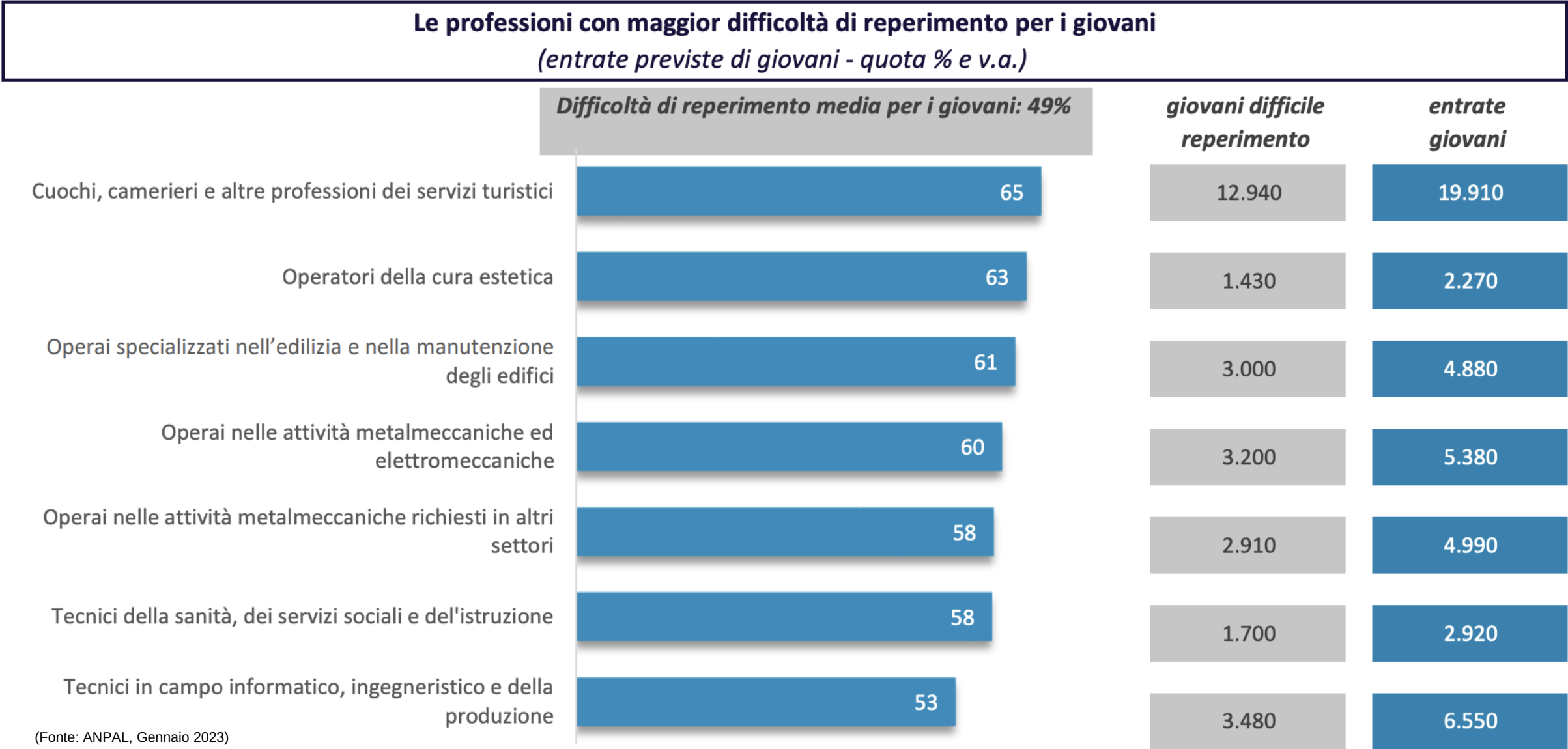
diff. rep. %

Operai specializzati	47.450	56,6
Professioni tecniche	43.400	50,3
Dirigenti e professioni intellettuali, scientifiche e con elevata specializ.	21.890	49,8
Conduttori di impianti e operai di macchinari fissi e mobili	41.720	46,7
Professioni qualificate nelle attività commerciali e nei servizi	99.680	46,3
Professioni non qualificate	47.760	31,9
Impiegati	27.440	31,6

(Fonte: ANPAL, Gennaio 2023)

**In 2022, in Italy, 45% of
job offers have not found
appropriate candidates**

In positions for young candidates, the mismatch reaches 49%



Manufacturing industry has the highest shortage

I principali settori...

...con maggiori **DIFFICOLTA' DI REPERIMENTO** e i motivi (%)

...che più richiedono **ESPERIENZA** lavorativa specifica (%)

Industrie metallurgiche e dei prodotti in metallo

17

38

3

Industrie del legno e del mobile

21

29

4

Costruzioni

18

31

4

Servizi informatici e delle telecomunicazioni

18

29

4

Industrie meccaniche ed elettroniche

18

26

3

■ Preparazione inadeguata

■ Mancanza di candidati

■ Altri motivi

Costruzioni

24

59

Servizi alle persone

43

35

Servizi informatici e delle telecomunicazioni

45

30

Servizi di trasporto, logistica e magazzinaggio

22

52

Servizi avanzati di supporto alle imprese

36

37

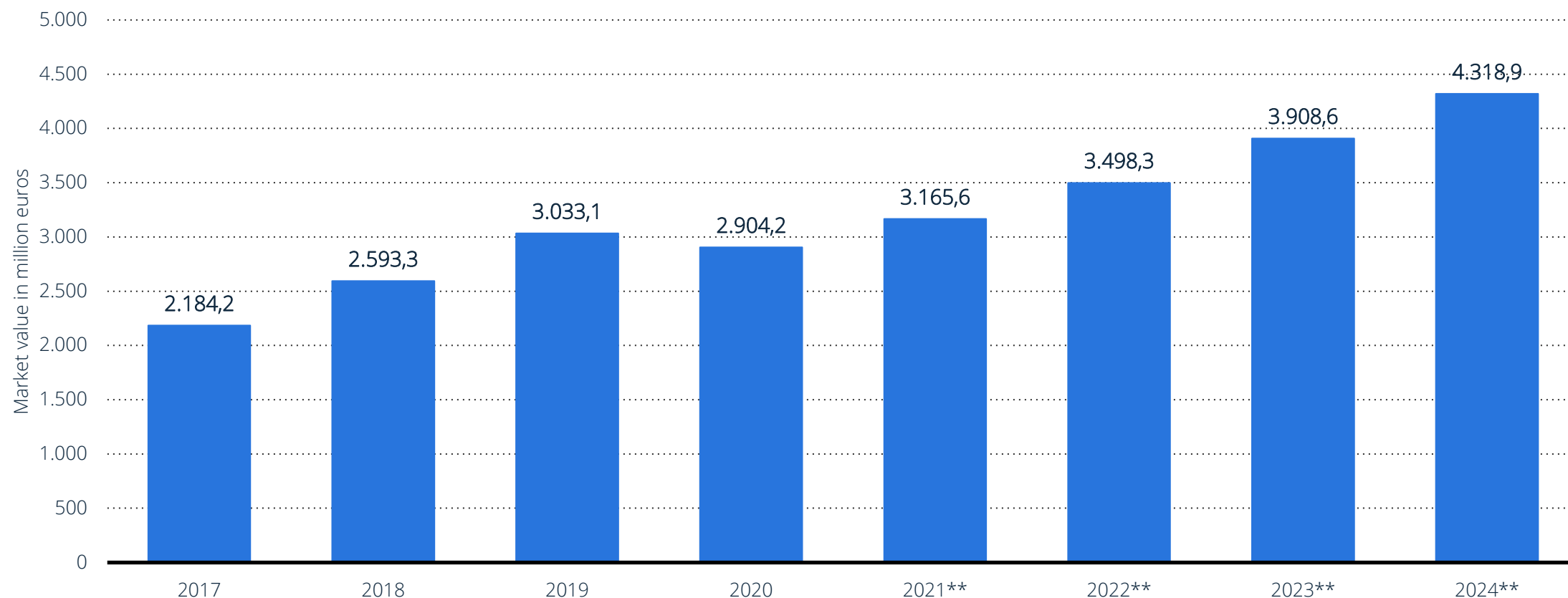
■ Esperienza nella professione

■ Esperienza nel settore

Quota % delle entrate difficili da reperire sulle entrate totali di ogni settore.

Come cresce il settore delle applicazioni Industry 4.0 in Italia

Il valore del mercato Industry 4.0 è previsto raddoppiare nel 2024 rispetto al 2017

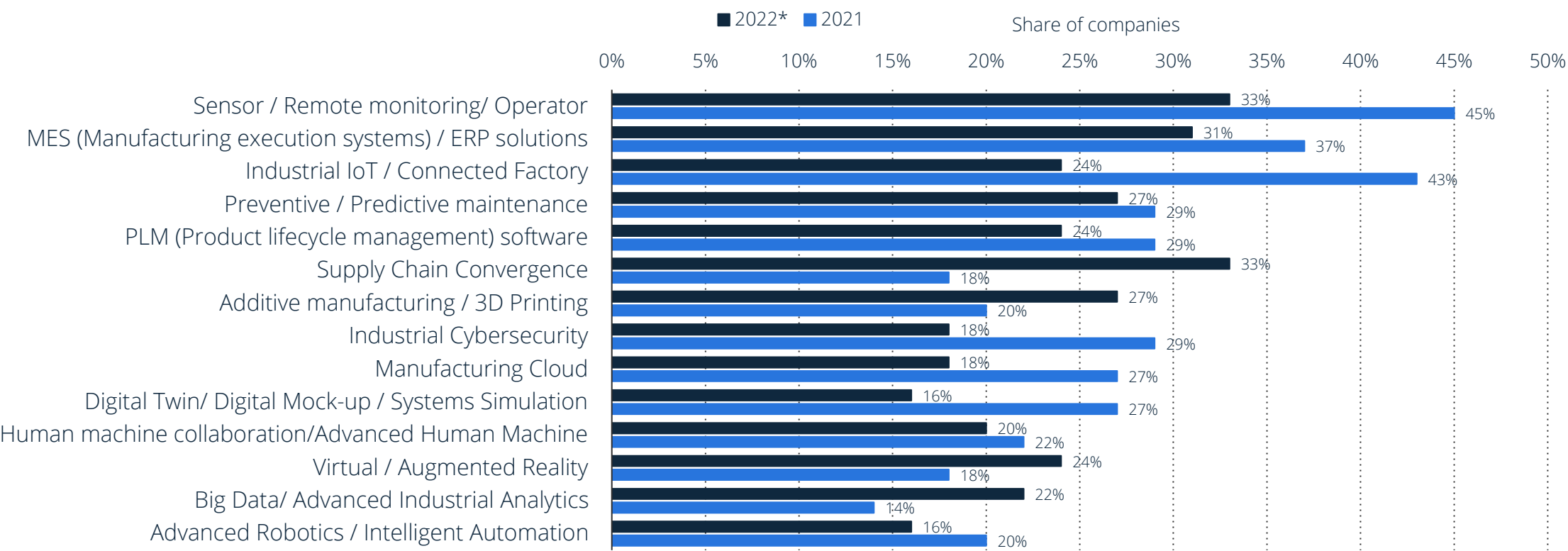


Note(s):2020

Source(s): Associazione Nazionale Industrie Informatica, Telecomunicazioni ed Elettronica di Consumo; Associazione italiana per l'Information Technology; [ID 1057237](#)

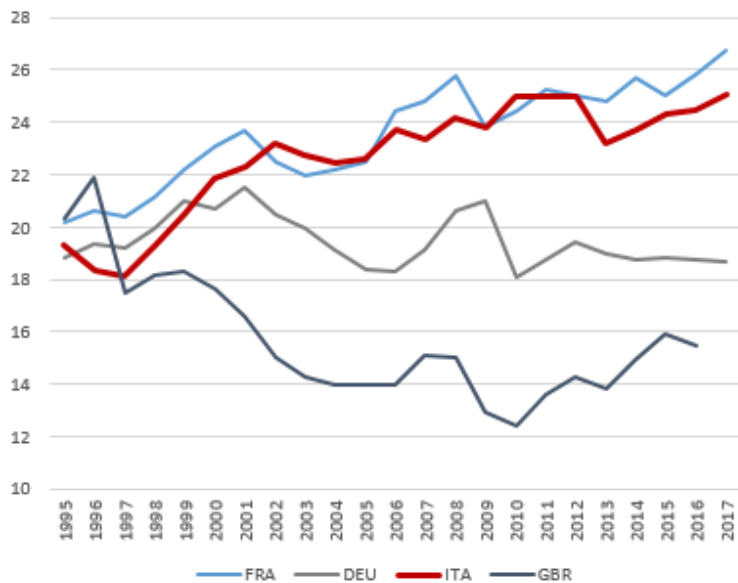
In quali applicazioni 4.0 investono le imprese industriali italiane

Share of companies investing in 4.0 industry in Italy 2021-2022, by sector

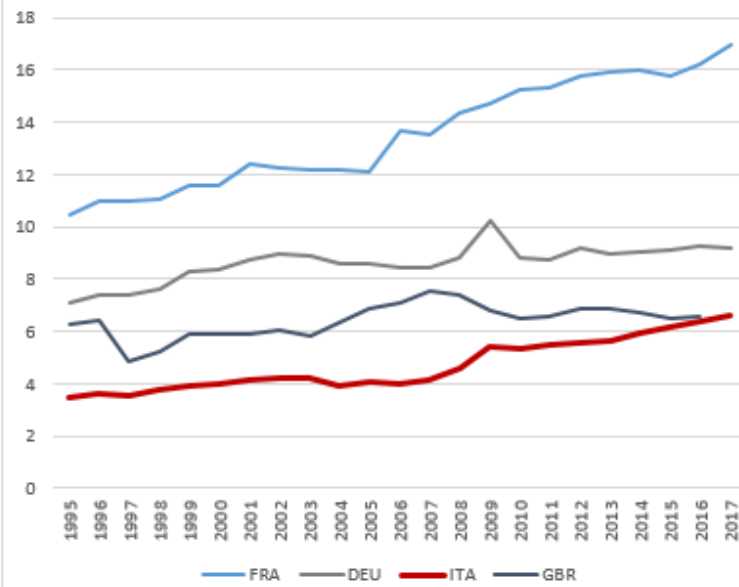


Note(s): Italy; February to March, 2022; 55 respondents; Italian companies
Source(s): The Innovation Group; [ID 1313576](#)

Gross fixed capital formation as a % of value added

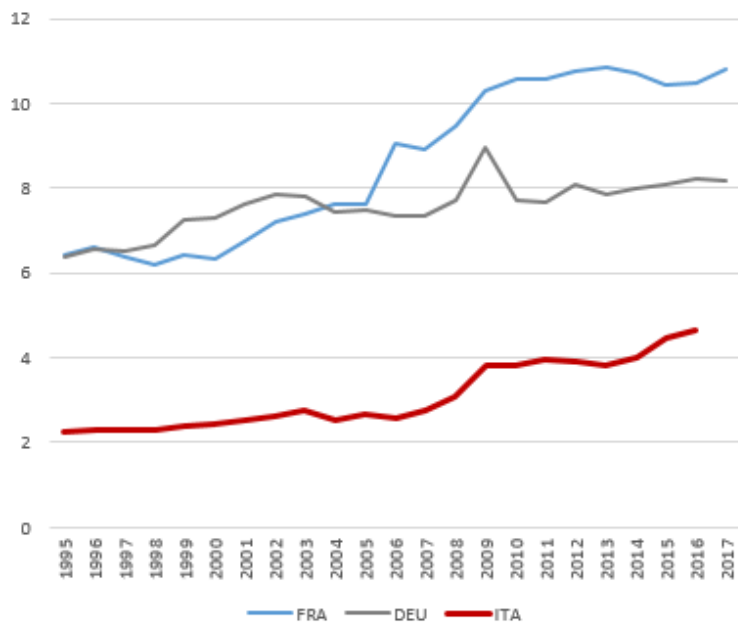


Intellectual property product as a % of value added

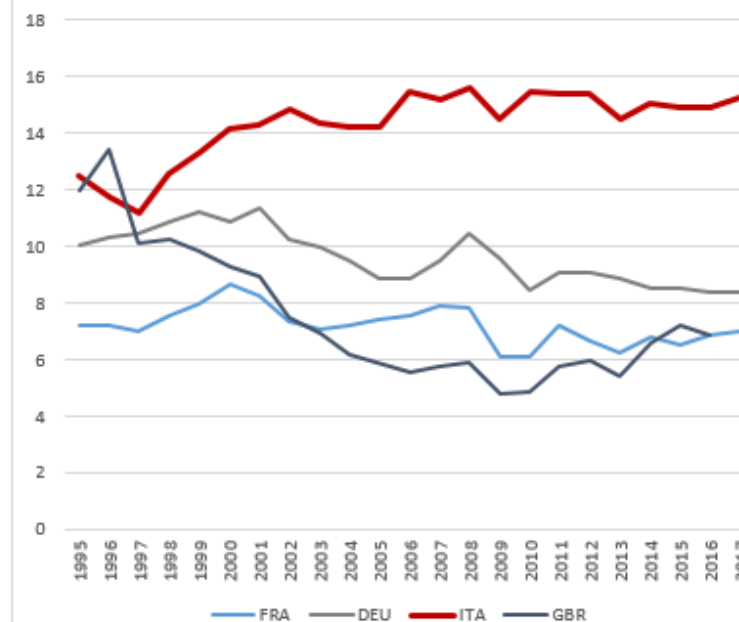


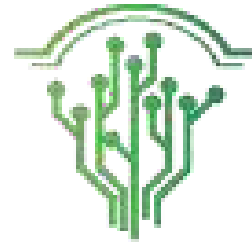
L'Italia investe più di tutti gli altri in macchinari, e meno di tutti gli altri in ricerca e proprietà intellettuale

R&D investment as a % of value added



Machinery excluding ICT as a % of value added





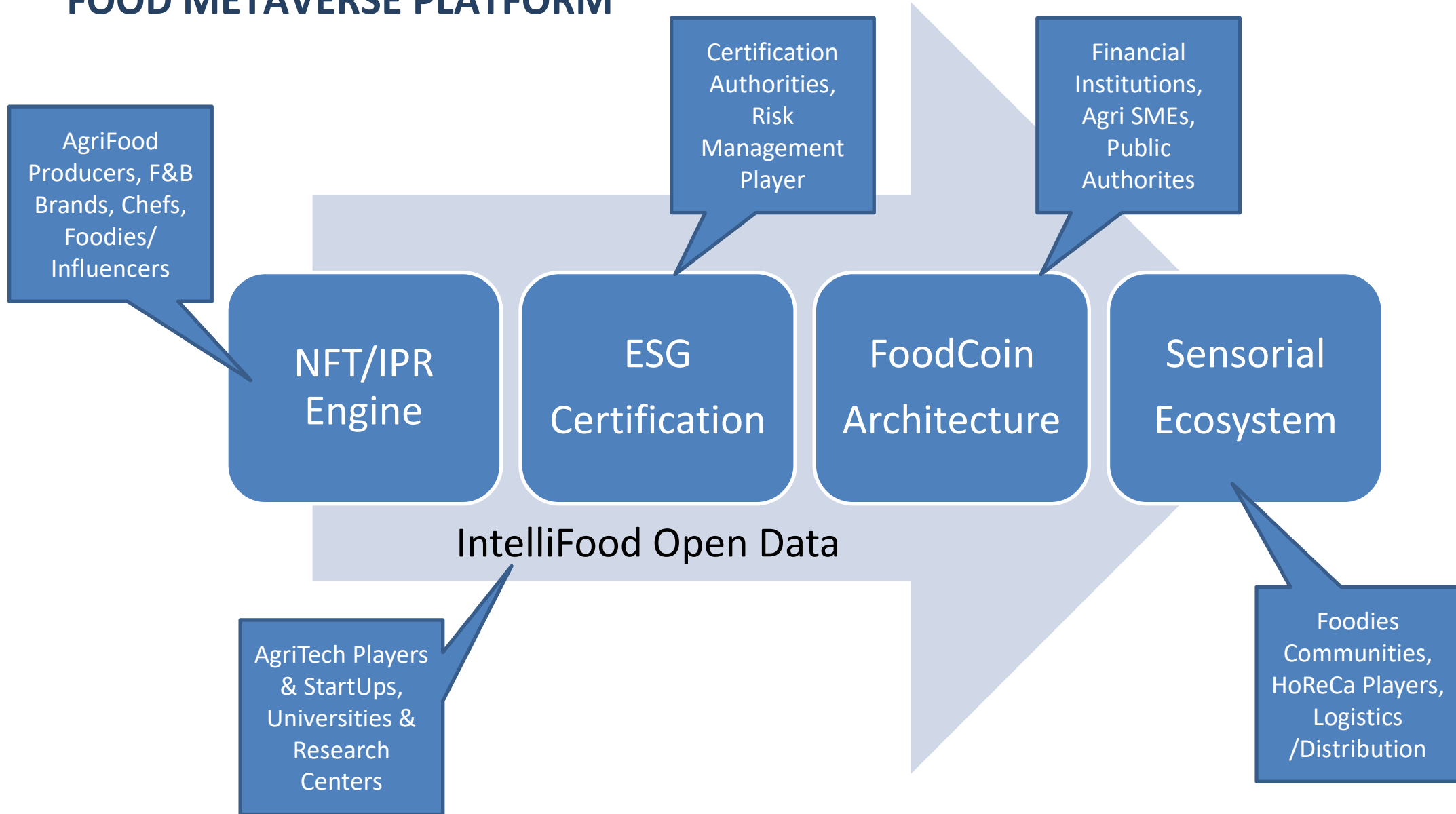
FONDAZIONE
RICCAGIOIA

FOOD METAVERSE PLATFORM

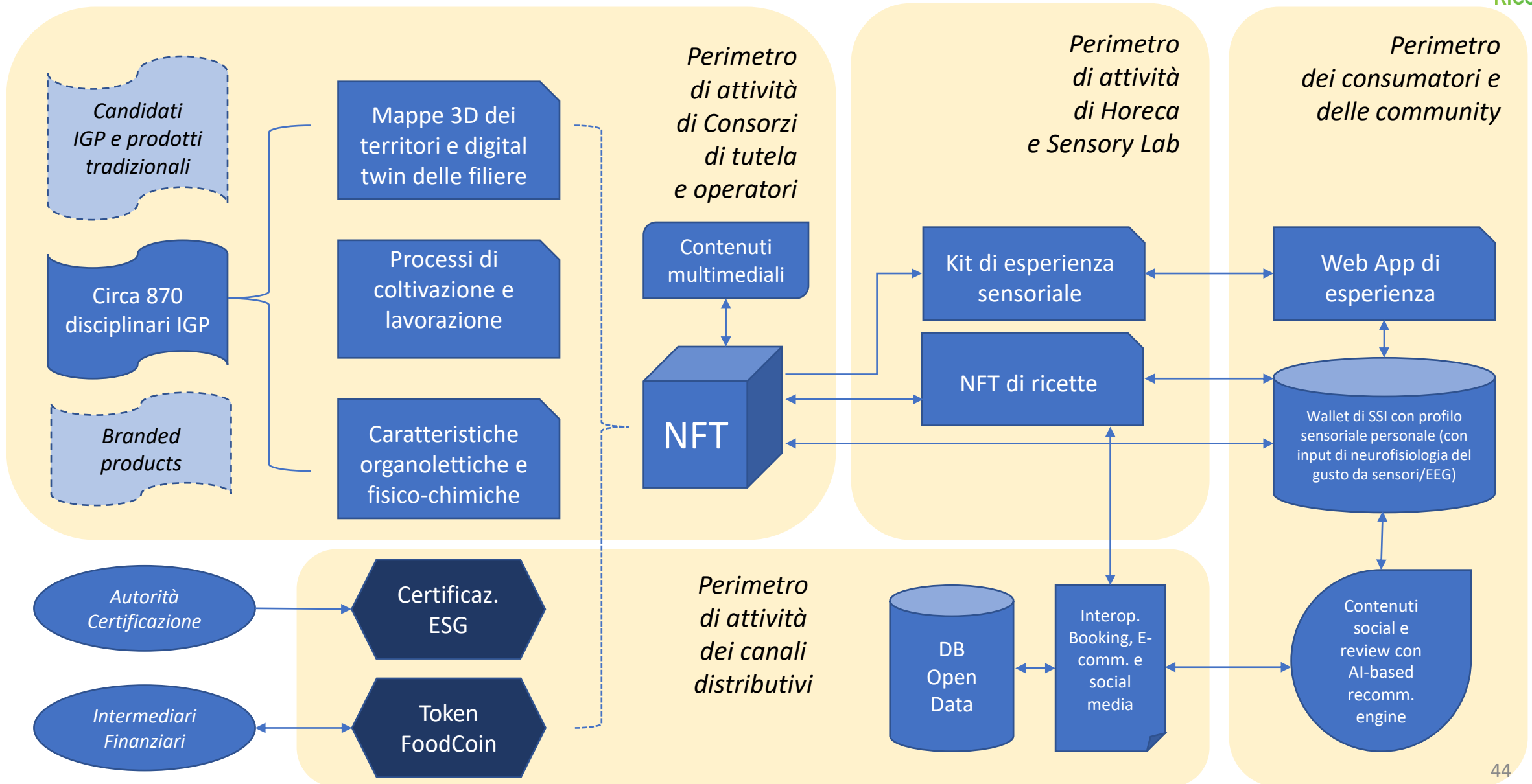


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FOOD METAVERSE PLATFORM



Schema di funzionamento della FMP

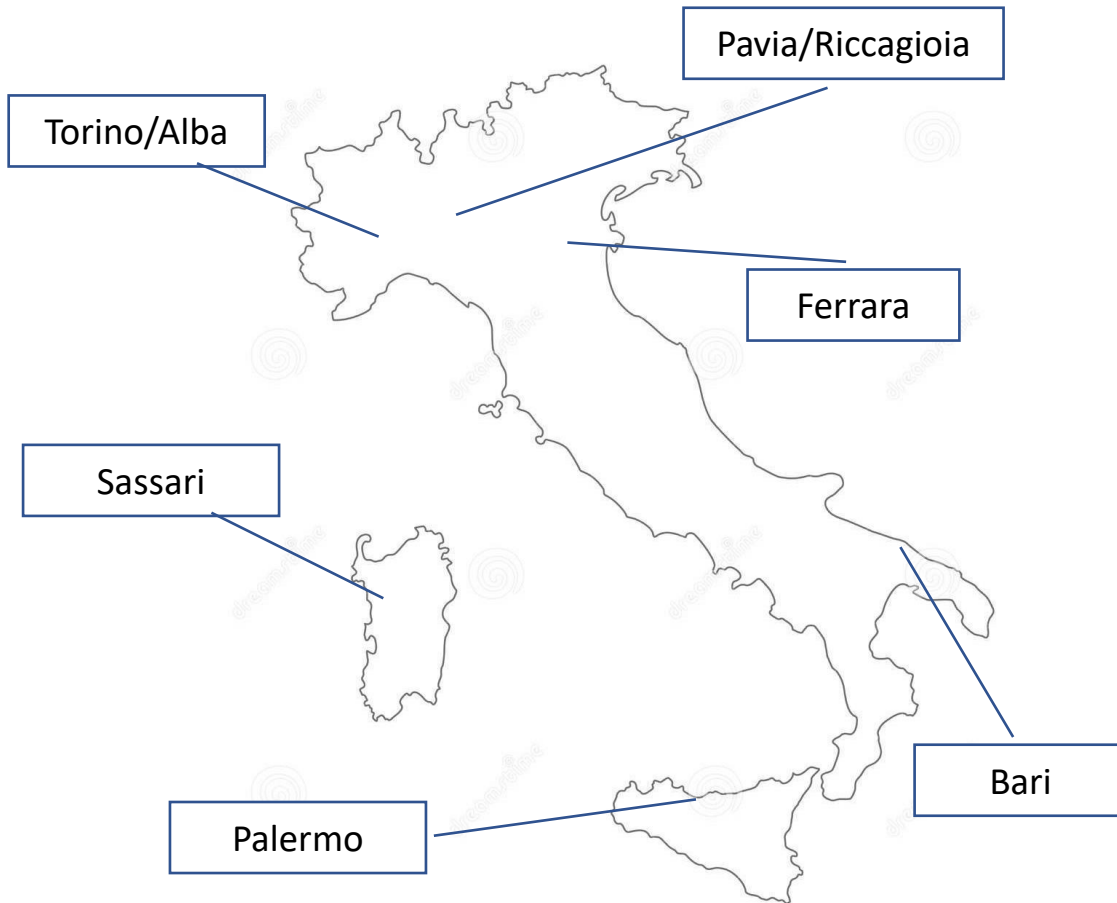




The figure illustrates the concept of a wine NFT. On the left, a bottle of wine is shown with a white label that reads 'NFT' in bold black letters. To the right of the bottle are two smartphones. The first smartphone displays a home screen with a grid of icons: a bunch of grapes for 'Grapes A-Z', a heart for 'Liked & Tested', a speech bubble for 'New & Interesting', a wine glass for 'Wine & Food', a location pin for 'By Country', and a wine bottle for 'Wine Styles'. At the bottom are icons for 'My Top Rated' and 'Settings'. The second smartphone displays a detailed view of the 'Grapes A-Z' section, showing a grid of grape varieties with their respective colors and names: Pinot Noir, Riesling, Pinot Gris, Sauvignon Blanc, Semillon, Syrah, Torrontes, Traminer, Verdejo, Viognier, Vitis, Zinfandel, Aglianico, Barbera, Bonarda, Cabernet Sauvignon, Carmenero, Chardonnay, Corvina, Dornfelder, Gamay, Grenache, Merlot, Pinotage, Pinot Noir, and Pinot Rouge.



Infrastruttura tecnologica sul territorio

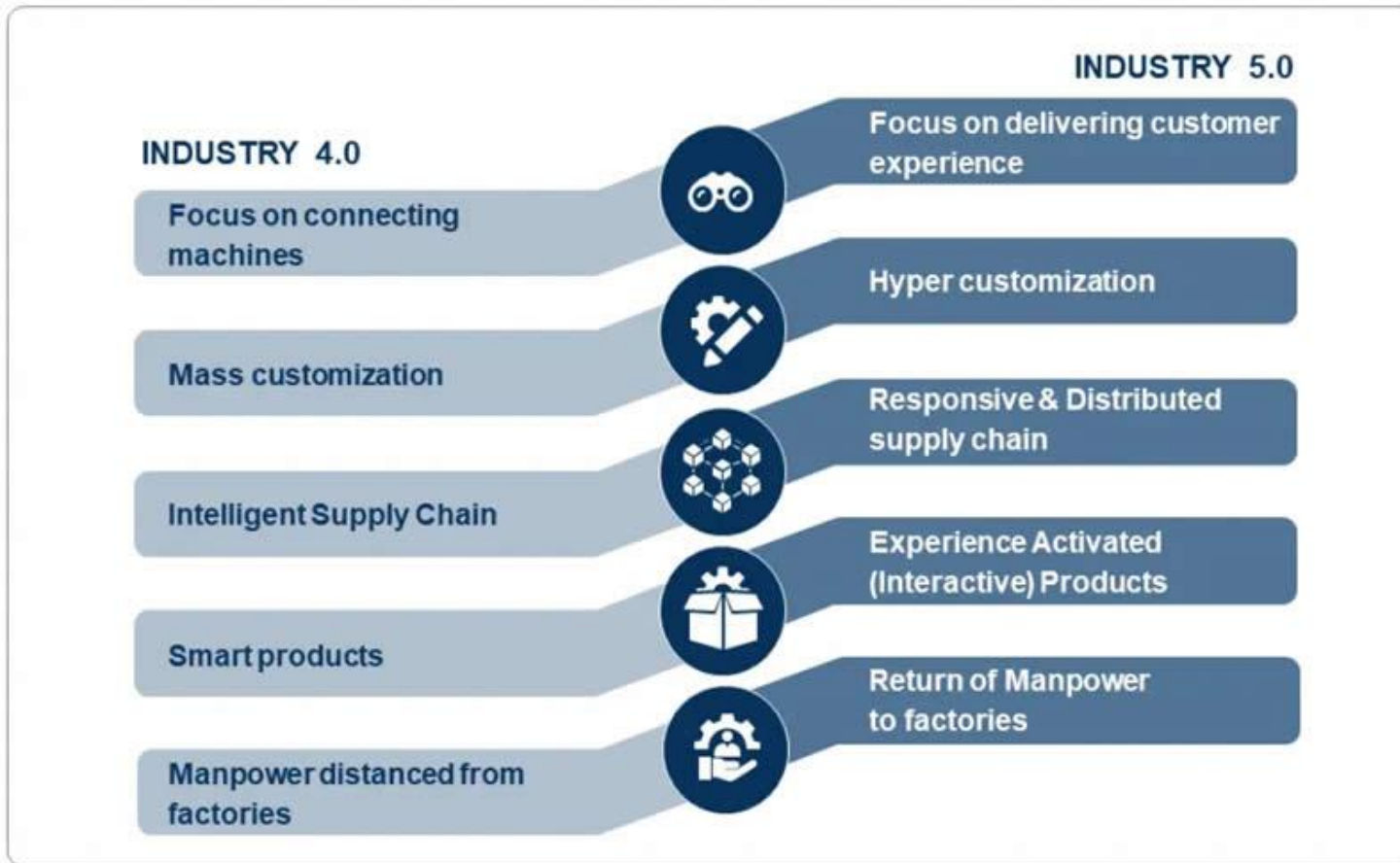


In termini tecnologici, la Piattaforma conterrà i seguenti elementi:

- 1) **Infrastruttura cloud** centralizzata e ridondata, su data center di classe A, supportata dal partner AWS
- 2) Infrastrutture di **edge computing** presso le sedi operative di Torino/Alba, Pavia, Ferrara, Bari, Palermo, Sassari
- 3) **Soluzioni applicative** in modalità **SaaS**
- 4) **Applicazioni** per utilizzatori intermedi e finali in modalità WebApp
- 5) **Device di VR/AR** per didattica ed esperienza immersiva
- 6) Strumentazione per **l'analisi sensoriale**

Verso Industry 5.0: la digitalizzazione end-to-end dei processi manifatturieri diventa sostenibile, inclusiva e resiliente

Highlights of Industry 5.0 compared to Industry 4.0



INDUSTRY 5.0



Human-centric



Sustainable



Resilient

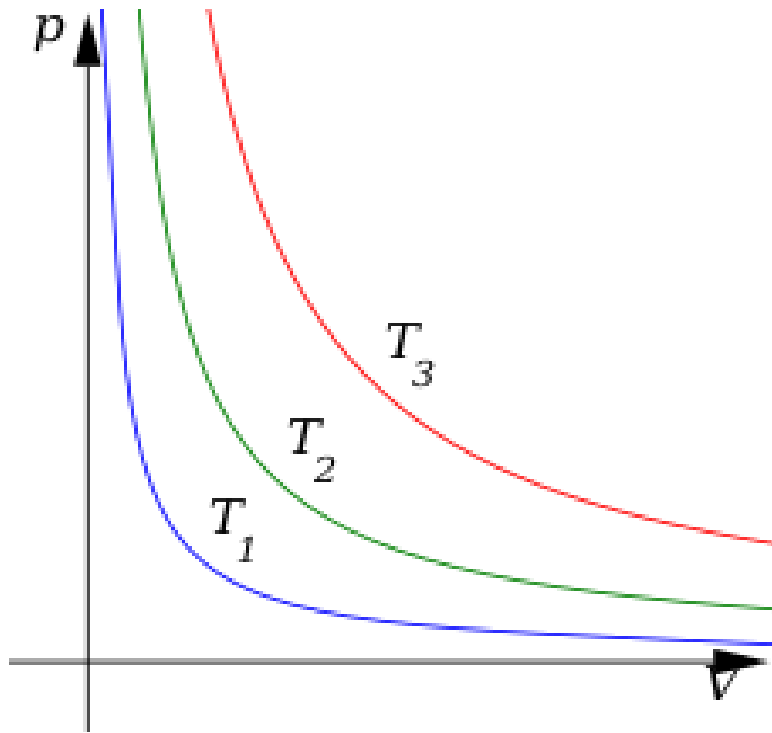
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Industry 5.0: From theory to practice

Le tre «trasformazioni» epocali (e urgenti) dell'industria italiana



- **La trasformazione ambientale**, da battaglia di minoranze ideologiche a priorità di riferimento della società civile. Anche energia e materiali si trasformano: da utility tecnica a sistema valoriale dominante, sia politico/sociale, sia finanziario.
- **La trasformazione istituzionale**, da nazionale a regionale/globale. Il dialogo con regolatori e istituzioni che stanno facendo da “market maker” diventa centrale, perché le regole determinanti si scrivono a Bruxelles e negli organismi internazionali, non più a Roma..
- **La trasformazione organizzativa**, da aziendale a ecosistemica. Serve a progettare “gli *intangibles* per i *tangibili*”, a sviluppare il capitale umano e digitale per costruire il capitale infrastrutturale.

Thanks!

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