Les Indicateurs *de La Fabrique*

ADOPTION DES TECHNOLOGIES 4.0 PAR LES PMI & ETI EUROPÉENNES

La Fabrique de l'industrie
laboratoire d'idées

McKinsey & Company

Trois échantillons représentatifs de PMI et d'ETI, couvrant trois tissus productifs distincts

Une méthode d'enquête robuste

Enquête par **téléphone** en **juin-juillet 2025** confiés à Ipsos

PMI et ETI (50 à 5 000 salariés ; activités purement manufacturières)

1 198 décideurs en matière d'investissements (plus de la moitié sont membres de Comité de Direction) : 798 en France, 200 en Allemagne et 200 en Italie

Pondération pour assurer une **représentativité nationale** en termes de secteur, effectif et région

Des tissus économiques différents

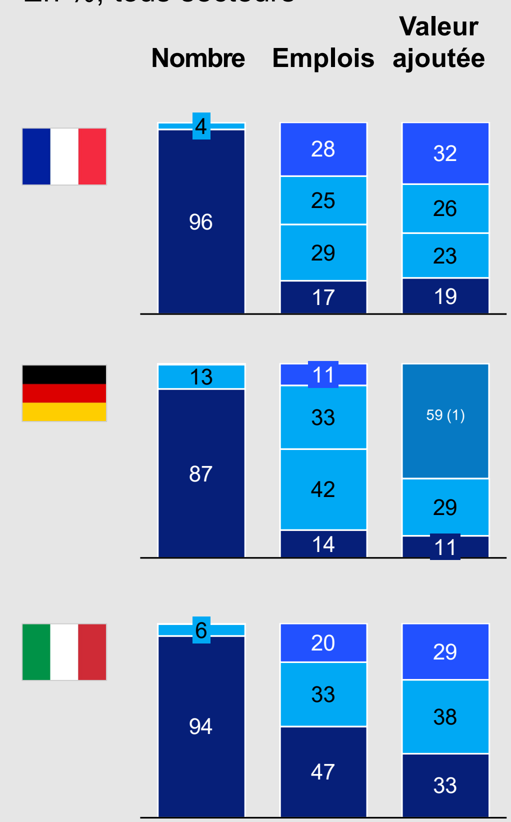
France : ~200 000 PME et ~12 500 ETI pour environ 4,9 millions d'entreprises (chiffres tous secteurs)

Allemagne : ~438 000 PME et ~17 000 ETI pour environ 3,5 millions d'entreprises

Italie : ~232 000 PME et ~6 000 ETI pour environ 5,1 millions d'entreprises

Données de cadrage

En %, tous secteurs

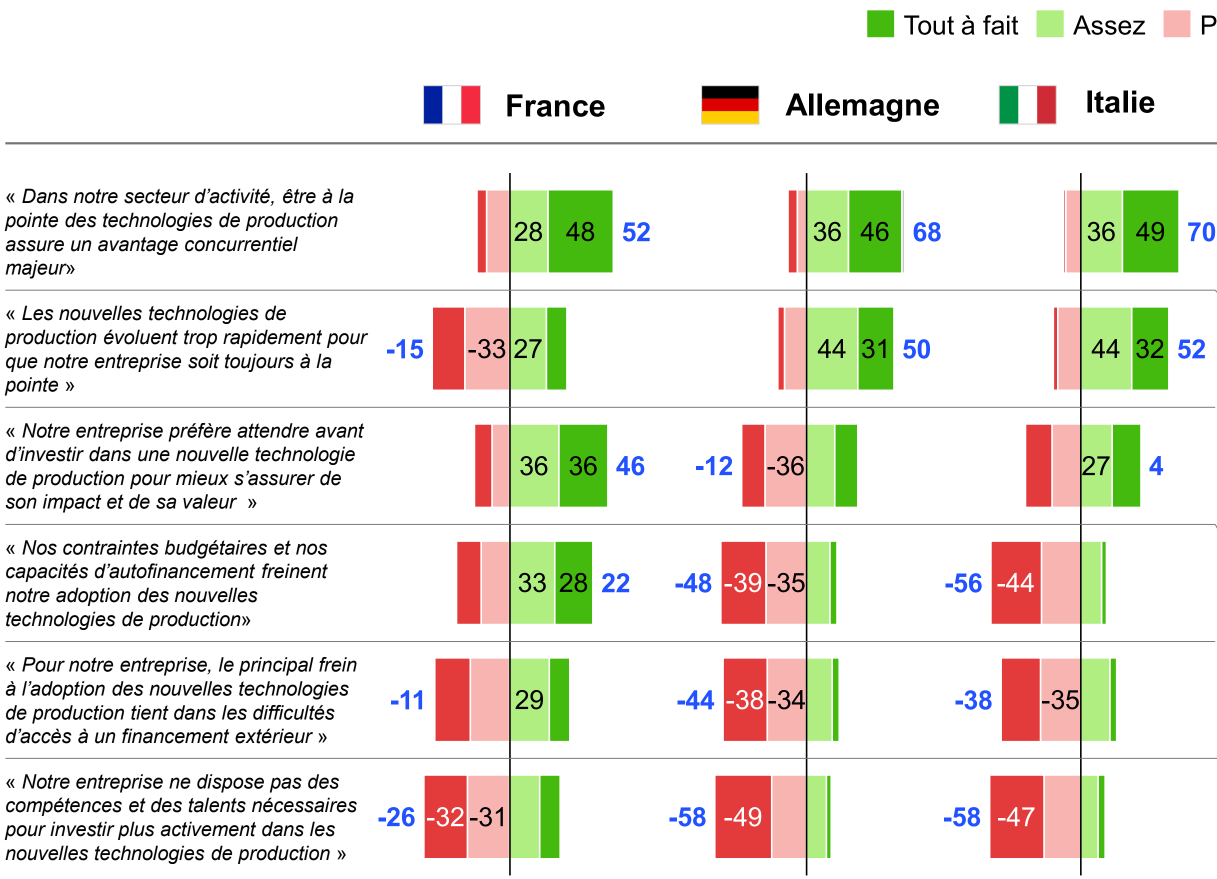


(1) : Parts détaillées des ETI et des grandes entreprises dans la valeur ajoutée non-disponibles dans les statistiques allemandes

Source : Ipsos, INSEE, IW Köln; KfW ifo business climate, Istat

En Allemagne et Italie, les entreprises ont une vision similaire des nouvelles technologies ; les françaises semblent plus prudentes ou plus contraintes

Degré d'accord à l'égard d'affirmations en %



Enseignements

Les technologies comme source de compétitivité ; la France plus nuancée

Evolution perçue plus rapide mais investissement sans attendre en Allemagne et en Italie

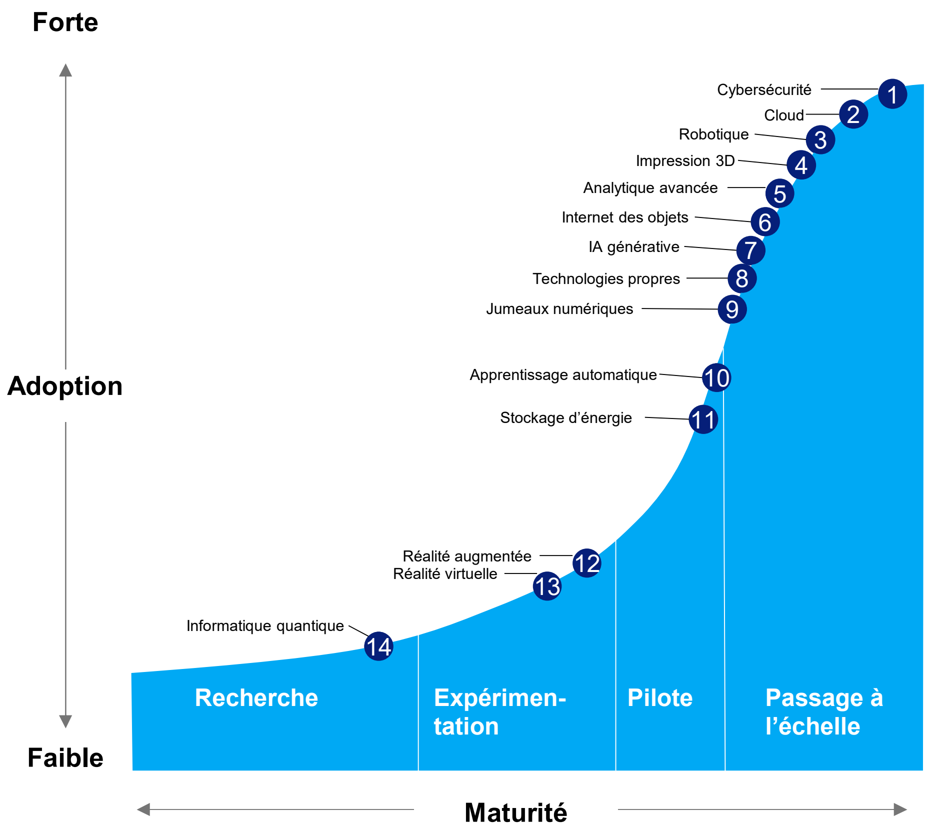
La France plus prudente (hésitante ?) Attitudes différentes selon les secteurs (e.g. prudence de l'aéronautique)

L'absence de financement n'est pas perçue comme un **frein a priori** en Allemagne et en Italie ; perception spontanée différente en France

L'absence de compétences n'est pas perçue comme un **frein a priori**, mais dans une moindre mesure en France

Source : enquête Ipsos pour La Fabrique de l'Industrie et McKinsey, auprès de 1 198 PMI-ETI en Allemagne, France et Italie, en juin-juillet 2025

14 technologies de maturité différente ont été présentées aux interviewés pour mesurer leur notoriété et leur adoption

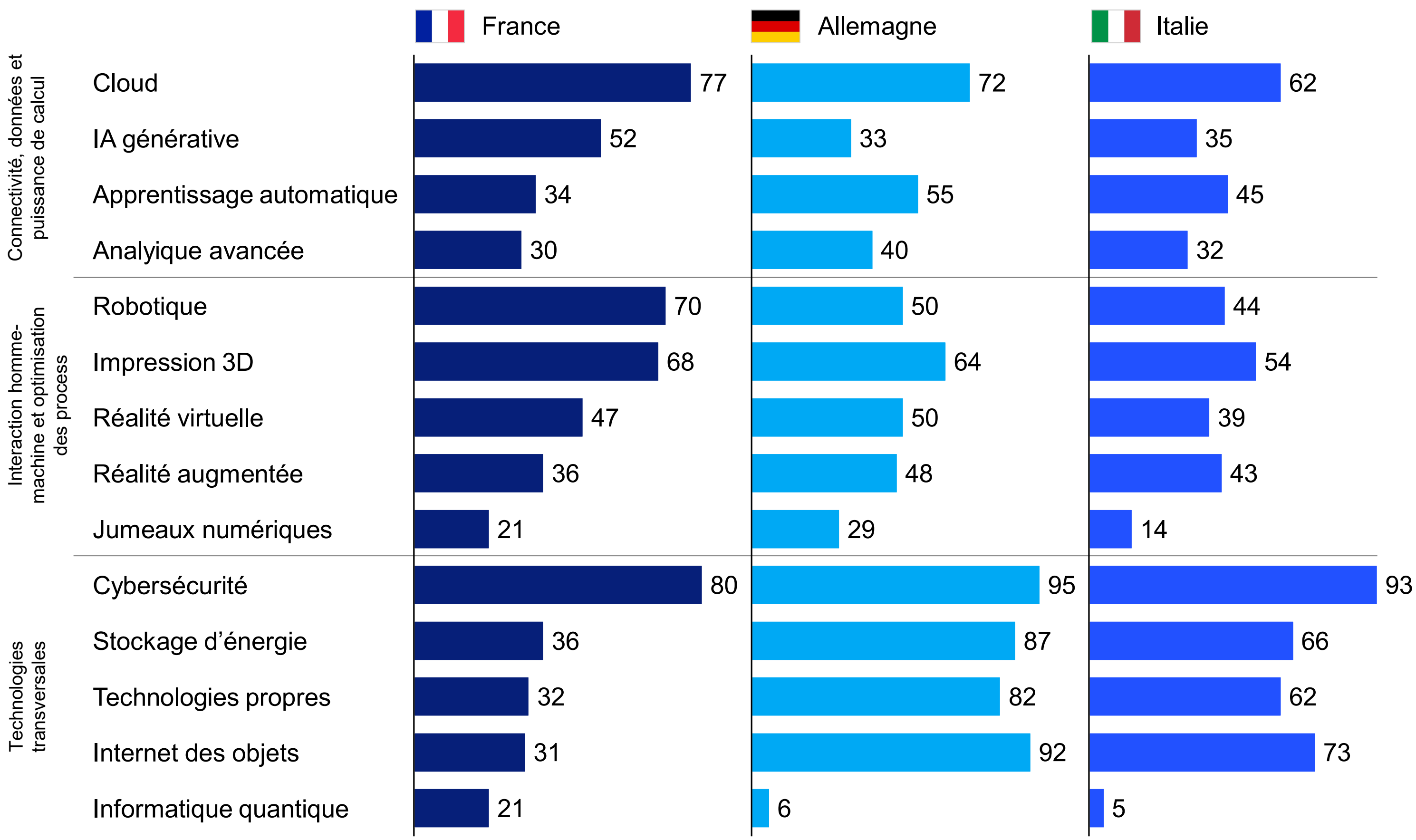


1. **Cybersécurité** « *qui protège les systèmes et les données contre les intrusions informatiques et les cyberattaques* »
2. **Cloud** « *qui permet le stockage et le traitement des données à distance et facilite l'accès et la gestion des informations* »
3. **Robotique** « *c'est-à-dire l'utilisation de robots qui permettent d'automatiser les tâches répétitives et dangereuses* »
4. **Impression 3D** « *ou additive manufacturing, qui permet la fabrication de pièces par ajout de couches successives de matériau* »
5. **Analytique avancée** « *ou advanced analytics, qui permet le traitement de grandes quantités de données pour en extraire des informations utiles et améliorer la prise de décision* »
6. **Internet des objets** « *ou Internet of things, c'est-à-dire des réseaux d'objets connectés qui sont capables de collecter et d'échanger des données, améliorant l'efficacité et la gestion des ressources* »
7. **Intelligence artificielle générative** « *qui permet d'effectuer ou d'automatiser des tâches complexes, d'analyser des données et d'améliorer des processus industriels* »
8. **Technologies propres** « *ou cleantech, qui visent à réduire l'impact environnemental, et incluent les énergies renouvelables et les systèmes de gestion des déchets, la capture et le stockage de* CO_2 »
9. **Jumeaux numériques** « *c'est-à-dire une réplique virtuelle d'un objet ou système physique qui est utilisée pour simuler, analyser et optimiser ses performances en temps réel* »
10. **Apprentissage automatique** « *ou machine learning, c'est-à-dire des algorithmes qui permettent aux systèmes de s'améliorer automatiquement à partir de l'expérience* »
11. **Stockage d'énergie** « *qui permet de stocker l'énergie de manière efficace, notamment pour les énergies renouvelables intermittentes* »
12. **Réalité augmentée** « *c'est-à-dire la superposition d'informations numériques sur le monde réel, ce qui permet d'améliorer la perception et l'interaction* »
13. **Réalité virtuelle** « *c'est-à-dire l'immersion dans des environnements simulés, ce qui facilite la formation et la conception* »
14. **Informatique quantique** « *qui autorise des calculs à une vitesse exponentiellement plus rapide, avec des applications dans la cryptographie ou la modélisation moléculaire* »

Source : McKinsey « *Technology Trends Outlook 2024* »

Une familiarité bonne à très forte avec les technologies, mais des écarts ponctuels par pays

En % de connaisseurs « *sachant précisément de quoi il s'agit* »



Source : enquête Ipsos pour La Fabrique de l'Industrie et McKinsey, auprès de 1 198 PMI-ETI en Allemagne, France et Italie, en juin-juillet 2025

Moindre connaissance des jumeaux numériques et de l'informatique quantique

Relative moindre connaissance en France de l'Internet des objets (IoT), des technologies propres (*cleantechs*) et du stockage d'énergie

Plus forte familiarité avec genAI qu'avec l'apprentissage automatique (*machine learning*) en France, à l'inverse de l'Allemagne et l'Italie

Ces scores de notoriété sont évidemment à relier avec le degré d'adoption de chaque technologie, qui demeure marqué par des particularismes sectoriels très forts (voir par ailleurs).

Le degré d'adoption est relativement homogène dans chaque pays, avec trois domaines distinctifs pour la France

En % - Base : connait précisément ou a entendu parlé de la technologie

<20% | 20-40% | 40-60% | 60-80% | >80%

	France	Allemagne	Italie
Cybersécurité	82	58	61
Cloud	66	51	52
Robotique[1]	48	20	26
3D printing	37	38	31
Analytique avancée	29	33	25
Internet des objets	33	53	48
IA générative	26	26	12
Technologies propres	27	54	55
Jumeaux numériques	19	16	9
Apprentissage automatique	17	15	8
Stockage d'énergie	20	66	51
Réalité augmentée	12	12	7
Réalité virtuelle	15	12	10
Informatique quantique	6	5	9

1. *"La robotique, c'est-à-dire l'utilisation de robots qui permettent d'automatiser les tâches répétitives et dangereuses"*

Source : enquête Ipsos pour La Fabrique de l'Industrie et McKinsey, auprès de 1 198 PMI-ETI en Allemagne, France et Italie, en juin-juillet 2025

Adoption des technologies 4.0 par secteur en France

En % - Base : connait précisément ou a entendu parlé de la technologie

<20% | 20-40% | 40-60% | 60-80% | >80%

Technologie	Ensemble France	Métallurgie	Alimentaire	Matériels de transport (dont aéro.)	Automobile	Equipement électrique et électronique	Industries de process[1]	Autres industries manufact.[2]	CA Défense > 50%
Cybersécurité	82	92	79		87	84	86	79	87
Cloud	66	86	61		57	72	70	62	52
Robotique	48	58	45		69	50	55	44	41
Impression 3D	37	44	15		62	56	42	35	66
Analytique avancée	29	28	23		10	33	29	30	41
IoT	33	11	30		20	38	39	33	31
Gen AI	26	30	22		21	38	24	22	39
Techno. propres	27	18	26		34	24	33	23	34
Jumeaux numériques	19	15	14		11	26	14	20	47
Apprentissage automatique	17	15	13		11	20	16	20	37
Stockage d'énergie	20	40	32		22	12	14	17	18
Réalité augmentée	12	12	4		9	14	8	14	31
Réalité virtuelle	15	10	12		9	19	14	14	30
Informatique quantique	6	0	7		13	4	2	9	27

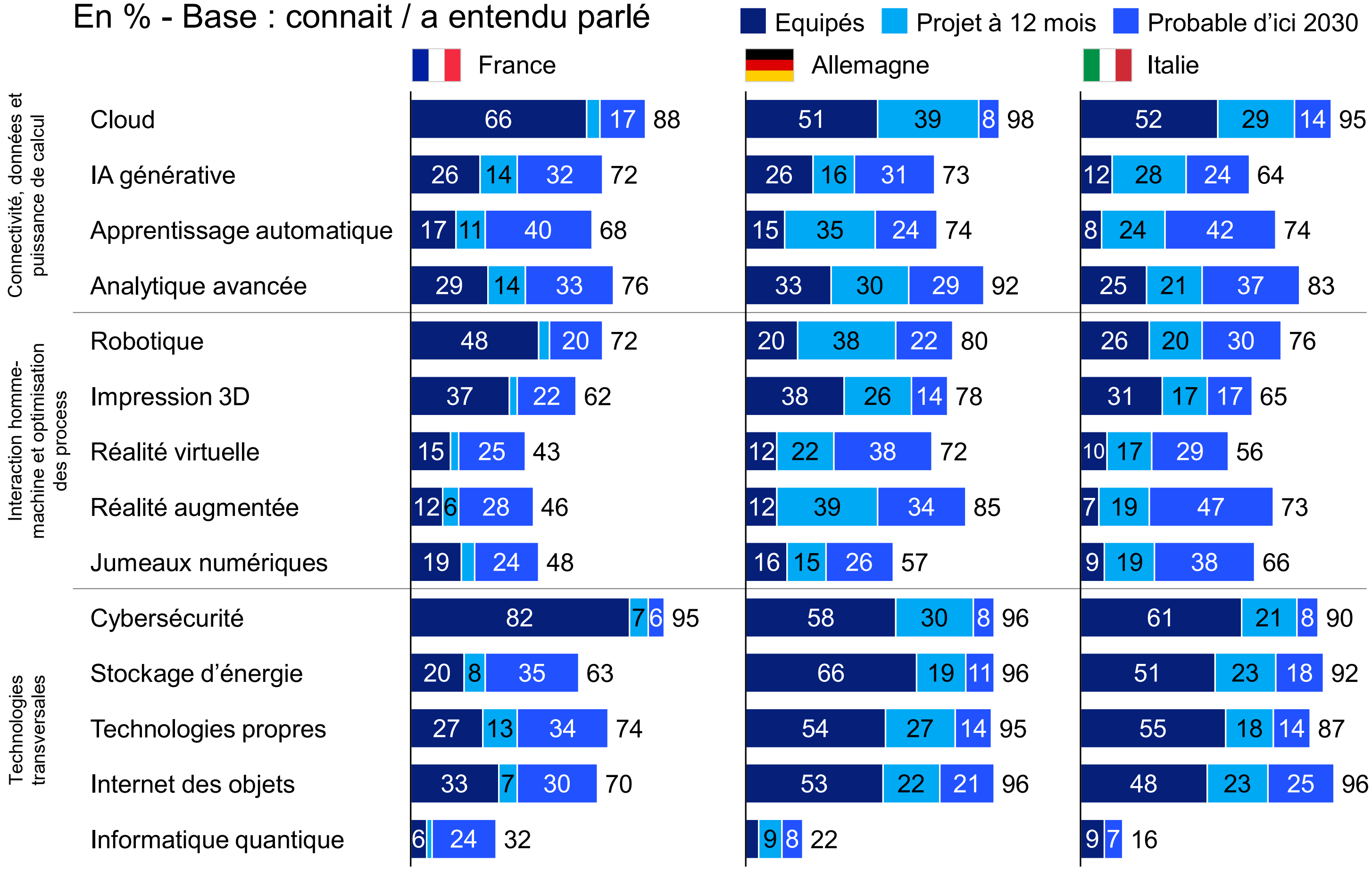
1. Cokéfaction et raffinage (C19), Industrie chimique (C20), Fabrication de produits en caoutchouc et en plastique (C22), Fabrication d'autres produits minéraux non métalliques (C23)
2. Textiles (C13), Habillement (C14), Cuir et chaussure (C15), Bois (C16), Papier et carton (C17), Imprimerie (C18), Produits métalliques hors machines et équipements (C25), Meubles (C31), Autres (C32 et C33)

Note: bases trop faibles pour l'industrie pharmaceutique et l'énergie

Source : enquête Ipsos pour La Fabrique de l'Industrie et McKinsey, auprès de 1 198 PMI-ETI en Allemagne, France et Italie, en juin-juillet 2025

La France gèlerait ses investissements sur les 12 prochains mois et perdrait ainsi de son avance

En % - Base : connait / a entendu parlé



1. *"La robotique, c'est-à-dire l'utilisation de robots qui permettent d'automatiser les tâches répétitives et dangereuses"*

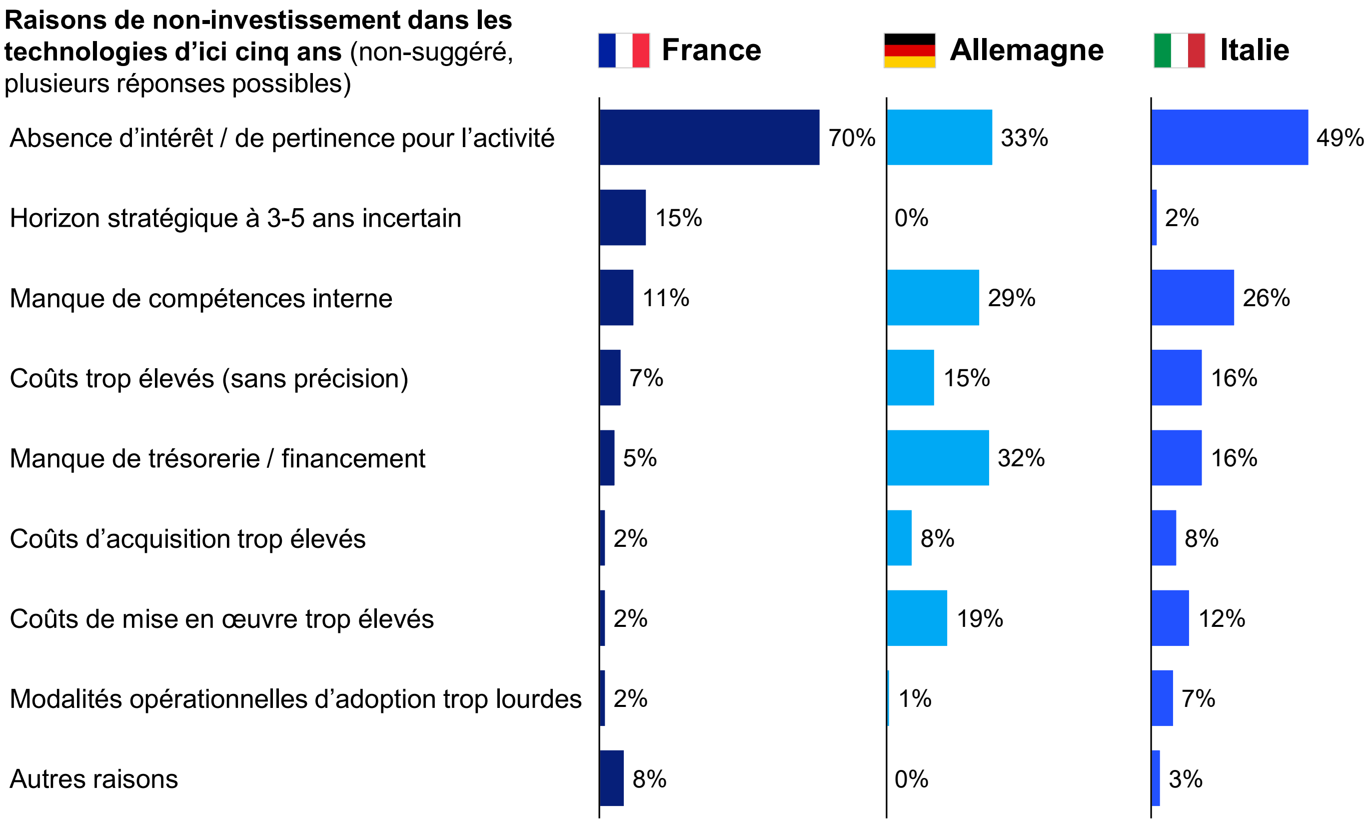
Source : enquête Ipsos pour La Fabrique de l'Industrie et McKinsey, auprès de 1 198 PMI-ETI en Allemagne, France et Italie, en juin-juillet 2025

Des taux d'équipement relativement homogènes malgré quelques différences :

- Avance de la France en IT (rattrapage allemand et italien à venir) ;
- 48% des PMI-ETI françaises équipées de robots[1] ; mais Allemagne et Italie devraient reprendre la tête d'ici 2030 ;
- L'Allemagne N°1 d'ici à 2030 sur toutes les technologies, hors informatique quantique (France) dont le degré d'adoption resterait encore modéré, suggérant un intérêt focalisé sur quelques secteurs seulement (défense, aéronautique, pharmacie…).

Des PMI & ETI françaises plus réticentes (conjoncture mais aussi ouverture ?)

En %, toutes technologies (base : non-équipés et ne l'envisageant pas d'ici 2030)



Source : enquête Ipsos pour La Fabrique de l'Industrie et McKinsey, auprès de 1 198 PMI-ETI en Allemagne, France et Italie, en juin-juillet 2025

Les dirigeants des PMI & ETI françaises qui n'envisagent pas d'investir dans une des 14 technologies 4,0 d'ici à cinq ans avancent très largement un manque d'intérêt ou de pertinence pour leur activité. L'écart majeur observé avec l'Allemagne et l'Italie pour ce même argument interroge évidemment leur appétence ou culture technologique en tant que telle.

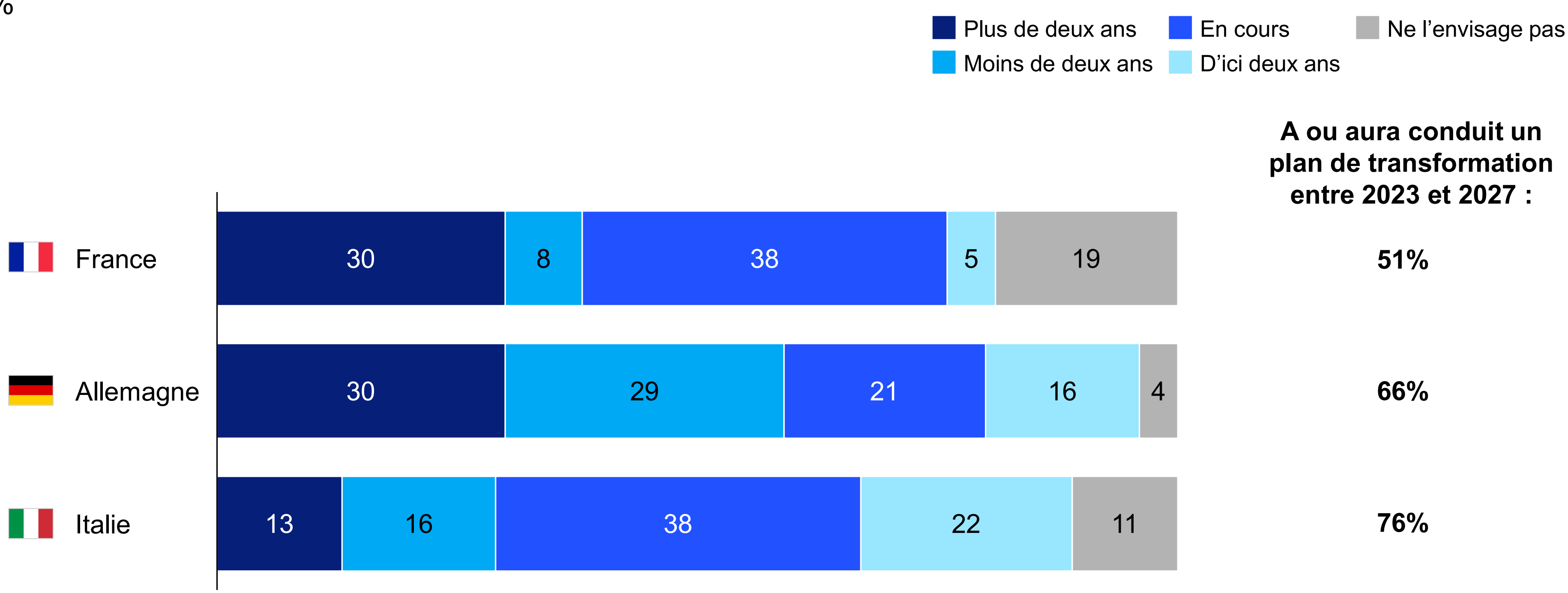
La France se caractérise aussi par le poids d'un contexte économique bien plus incertain qu'ailleurs.

Inversement, en Allemagne et en Italie, le manque de compétences internes apparait dans le top-3 des raisons pour ne pas investir (i.e., écart entre l'attitude générale décrite plus haut et la réalité concrète).

Le manque de trésorerie ou les besoins de financement sont aussi mis en avant par les dirigeants allemands et italiens, mais avec plus de vigueur en Allemagne (idem : écart avec l'attitude générale déclarée plus haut)..

Les PMI & ETI allemandes s'engagent plus souvent dans des transformations pour améliorer leurs performances de production, tandis que les Italiennes pourraient accélérer d'ici deux ans

En %



Les PMI & ETI qui conduisent ou ont conduit un plan de transformation se montrent plus ouvertes aux nouvelles technologies, affichent une meilleure connaissance des technologies 4,0, sont plus équipées, et sont plus équilibrées dans leurs réponses (panoplie d'arguments plus large) en cas de non-adoption d'une des 14 technologies.

Source : enquête Ipsos pour La Fabrique de l'Industrie et McKinsey, auprès de 1 198 PMI-ETI en Allemagne, France et Italie, en juin-juillet 2025

En résumé

Attitudes vs. technologies

Avantage compétitif reconnu des nouvelles technologies

Evolution perçue rapide en Allemagne et en Italie

Volonté d'attendre un retour d'expérience en France

Relative absence a priori de freins liés au financement ou aux compétences

Equipement

Taux d'adoption relativement homogènes et plutôt à l'avantage actuel de la France…

…Y compris en pénétration[1] de la robotique

Allemagne et Italie pourraient rattraper la France d'ici 2030 (hors quantique)

Freins à l'adoption

Climat d'incertitude en France qui y conduit au gel des investissements

Pertinence des technologies variable selon les secteurs (mais désintérêt plus fort en France)

Manque de compétences (surtout en Italie) ou de financement (Allemagne voire Italie)

Impact segmentant des plans de transformation

1. Le questionnaire mis en œuvre avec Ipsos apporte une information déclarative, et mesure une pénétration d'équipement (au moins un robot), mais non une densité (taille du parc de robots).

Source : enquête Ipsos pour La Fabrique de l'Industrie et McKinsey, auprès de 1 198 PMI-ETI en Allemagne, France et Italie, en juin-juillet 2025

Résultats d’enquête auprès de 1 200 PMI-ETI européennes

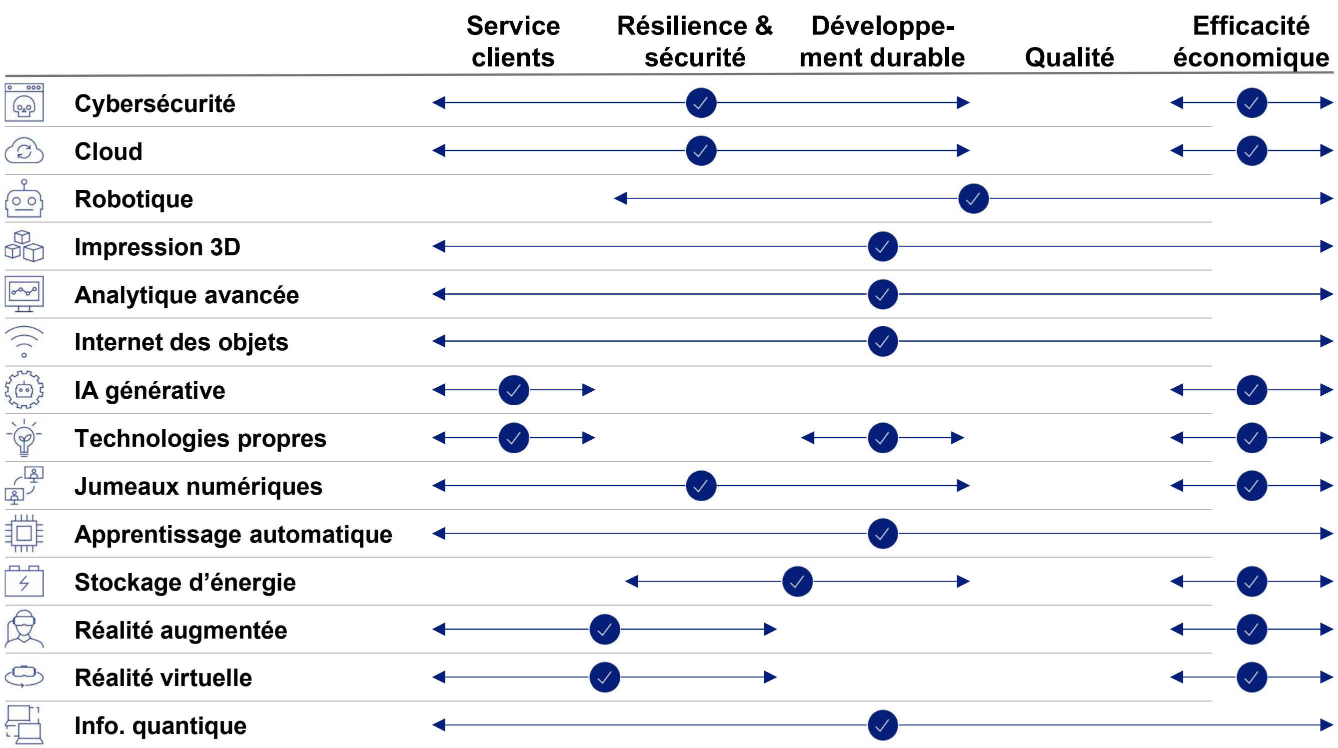
Comment renforcer l’investissement dans les technologies 4.0 ?

Impact des investissements technologiques sur la productivité

Annexes (apport et perspectives pour chaque technologie)

Investir dans les technologies 4.0 renforce la compétitivité des entreprises dans tous les domaines de leur chaine de valeur

Domaines d'application des technologies



Source : (1) McKinsey Global Institute (MGI), "Economic potential of generative AI", 2023 ; (2) McKinsey, interviews d'experts, McKinsey "2020 IT cost benchmarking", MGI, Omnicom Group ; (3) McKinsey, étude de cas "Gestion des stocks", 08/2023 ; (4) McKinsey, Lighthouse, étude McKinsey "Capturing value in machinery & industrial automation", 2019

23%

Gain de productivité additionnel issus d'une **automatisation avec l'IA générative** (vs. sans) en France, 2022-2040, TCAM[1]

30%

Réduction moyenne des dépenses annuelles en SI permise par le déploiement du **Cloud**[2]

-60%

Réduction de l'empreinte carbone des batteries automobiles, réalisable avec une **technologie propre** (batteries lithium-soufre pour véhicules électriques)

30-90%

Réduction moyenne des délais grâce à la **robotique**, renforçant les capacités d'adaptation aux ruptures

11%

Amélioration du niveau de service (associé à une réduction des stocks de 21%) pour un fabricant de moteurs d'avions grâce à **l'apprentissage automatique** et aux **jumeaux numériques**[3]

Comment inverser la trajectoire ?

Non-exhaustif - Pour discussion

Prioriser les cas d'usage les plus contributifs à la compétitivité de la France

S'appuyer sur les atouts et succès passés de la France en matière d'innovation industrielle :

- Les solutions robotiques, pour conforter une base industrielle déjà solide
- Les solutions de projection numérique (jumeaux numériques, réalité virtuelle), pour renforcer l'avantage européen en matière de conception
- Certains cas d'usage de l'IA, pour tirer parti d'un large accès à des jeux de données en Europe

Encourager la coopération sectorielle pour partager des technologies renforçant la compétitivité, particulièrement entre grands groupes et PME

- **Développer un véritable « partenariat de compétitivité » entre grands entreprises et PME-ETI** (e.g., le déploiement de l'IA dans les grandes entreprises est deux fois supérieur à ce qu'il est dans les PME en France ; encourager des plans de transformation « partagés »)
- **Partager la R&D entre acteurs, au travers de programme de recherche communs ou d'initiatives d'achats / investissement communes** (e.g., investissement de 300 MEUR dans le laboratoire de recherche en IA Kyutai par Iliad, CMA CGM et Schmidt Futures)

Promouvoir une culture d'innovation et **investir dans le développement de compétences** des collaborateurs

- **Impliquer les dirigeants dans la promotion de l'innovation** , investir dans la formation aux nouvelles technologies (en coopération avec les grands groupes) et définir des stratégies technologiques à long terme
- **Promouvoir la culture et engager des plans de transformation** autour des technologies 4,0
- Favoriser, encourager et récompenser en tant qu'organisation l'innovation et la génération d'idées

Réduire les barrières financières en tirant parti de leviers internes et externes

- **Saisir l'augmentation des investissements de capitaux privés dans les PME européennes**, tout en rester vigilant face aux stratégies d'investissement à court terme
- **Mobiliser les financements publics dédiés** (e.g. plan France 2030)

Source : analyses et études McKinsey « Grandes et petites entreprises : plus de complémentarité pour plus de compétitivité » (07/2025), « *Accelerating Europe: Competitiveness for a new era* » (01/2024) et « Redéfinir les stratégies industrielles à l'aune des grandes mutations récentes » (06/2023)

Impact des technologies sur la productivité

- On attribue à Solow, en 1987, le début des recherches en économie sur le décalage paradoxal entre l’ampleur des investissements dans les TIC et le ralentissement des gains de productivité, au niveau dans les données macroéconomiques.

- Quelques années plus tard, Brynjolfsson & Hitt (1993, 1996) apportent les premières preuves empiriques d’un effet positif des TIC sur la productivité au niveau microéconomique. Ce point a depuis fait l’objet de nombreuses confirmations convaincantes, que l’on peut résumer ainsi :
  - Par rapport aux grandes GPT précédentes (vapeur et électricité), les gains imputables aux TIC ont été plus importants et plus rapides. Il n’était pas anormal qu’ils mettent du temps à se propager.
  - Si les bénéfices microéconomiques des TIC sur la productivité ne font plus de doute, ils n’en découlent pas de manière nécessaire. La rentabilité de l’investissement est en effet largement conditionnée à deux autres dimensions : la qualité de l’organisation –en pratique de la réorganisation – de l’entreprise et l’élévation des compétences des salariés.
  - Alors que ces technologies sont connues et théoriquement libres d’accès, divers effets cumulatifs aboutissent au fait que l’amélioration de la productivité imputable aux TIC se concentre à l’extrémité déjà favorisée de la distribution, creusant l’écart avec les entreprises retardataires, parmi lesquelles les PME sont surreprésentées.

- La vague récente des technologies « 4.0 », et aujourd’hui l’intelligence artificielle, prolongent ces questionnements.
  - Elles apportent de nouvelles opportunités de gains de productivité mais requièrent des investissements coordonnés en technologies, compétences et organisation.
  - L’hétérogénéité des entreprises demeure un facteur clé pour expliquer pourquoi les investissements en TIC génèrent des résultats variables selon les contextes organisationnels et sectoriels.
  - En outre, il serait logique que, cette fois encore, les effets microéconomiques détectables sur la productivité surviennent plusieurs années après l’engouement qui entoure leur essor. C’est encore plus vrai pour les effets mesurables à l’échelle macroéconomique.

Source : La Fabrique de l’Industrie, novembre 2025

Nous avons retenu 14 technologies de production du futur qui ont un impact sur l'ensemble de la chaine de valeur des entreprises

		Description (telle que formulée aux interviewés)	**Design/ R&D**	**Planifi-cation**	**Supply mgt**	**Produc-tion**	**Mainte-nance**	**Stock mgt**	**Trans-port**	**Relation client**	**Logistique inverse/ Recyclage**
Connectivité, données et puissance de calcul	**Cloud**	Permet le stockage et le traitement des données à distance et facilite l'accès et la gestion des informations	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Analytique avancée	Ou *advanced analytics* - Permet le traitement de grandes quantités de données pour en extraire des informations utiles et améliorer la prise de décision	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Apprentissage automatique	Ou *machine learning* - Algorithmes qui permettent aux systèmes de s'améliorer automatiquement à partir de l'expérience	✓	✓	✓	✓	✓	✓	✓	✓	✓
	IA générative	Permet d'effectuer ou d'automatiser des tâches complexes, d'analyser des données et d'améliorer des processus industriels	✓	✓	✓	✓	✓			✓	
Interaction homme-machine et optimisation des process	**Réalité virtuelle**	L'immersion dans des environnements simulés, ce qui facilite la formation et la conception	✓			✓	✓	✓			
	Réalité augmentée	La superposition d'informations numériques sur le monde réel, ce qui permet d'améliorer la perception et l'interaction	✓			✓	✓	✓			
	Robotique	L'utilisation de robots qui permettent d'automatiser les tâches répétitives et dangereuses				✓	✓	✓	✓		
	Impression 3D	Ou *additive manufacturing* - Permet la fabrication de pièces par ajout de couches successives de matériau	✓			✓	✓				
	Jumeaux numériques	Une réplique virtuelle d'un objet ou système physique qui est utilisée pour simuler, analyser et optimiser ses performances en temps réel	✓	✓		✓		✓	✓		
Technologies transversales	**Informatique quantique**	Autorise des calculs à une vitesse exponentiellement plus rapide, avec des applications dans la cryptographie ou la modélisation moléculaire	✓			✓					
	Technologies propres	Ou *cleantech* - Visent à réduire l'impact environnemental, et incluent les énergies renouvelables et les systèmes de gestion des déchets, la capture et le stockage de CO_2				✓		✓	✓		✓
	Internet des objets	Ou *Internet of things* - Réseaux d'objets connectés qui sont capables de collecter et d'échanger des données, améliorant l'efficacité et la gestion des ressources				✓	✓	✓	✓	✓	✓
	Stockage d'énergie	Permet de stocker l'énergie de manière efficace, notamment pour les énergies renouvelables intermittentes				✓		✓	✓		
	Cybersécurité	Protège les systèmes et les données contre les intrusions informatiques et les cyberattaques	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source : McKinsey & Company, La Fabrique de l'Industrie

Connectivity, data, and computing power

Cloud | Driver of flexibility, competitiveness and security

xx Sample size (N=)

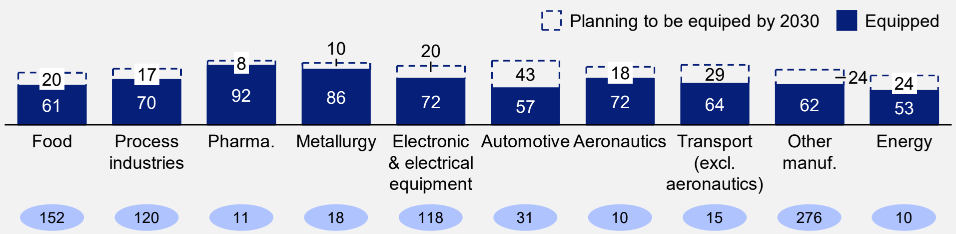
Definition

Remote storage and processing of data, facilitating access and information management

Usage

Cost saving & Business Agility – paying only for what's used, faster response/scale resources up or down with demand
Collaboration & Remote Work – securing access for distributed teams and partners
Security & Compliance – harnessing security, backups, and tools to meet regulatory standards (important in EU)
Operational Efficiency – allowing reliable storage, automatic updates
Innovation & Growth – enabling adoption of IoT, AI, and data analytics

Deployment[1], %



In most sectors, cloud will already equip >~70% of companies in the coming year and is planned to cover over 80% of companies by 2030 except in Automotive

Key elements to consider

Data sovereignty and compliance (especially for defense): vendor choice, GDPR rules, CLOUD Act exposure (US), where data is stored
Security & Encryption – Data protection, access control, backups.
Integration & Skills – Ability to connect with existing systems and staff digital readiness.

Obstacle for implementation[2], % (87)

For those who are not planning to invest in the technology within the next 5 years (11% vs. ~3% in Germany or Italy where adoption is currently lower), main obstacles are:

74% a lack of interest / relevance

6% a lack of internal skills

18% other not detailed reasons

ROI factors

Main cost drivers: (1) number of **licenses**, (2) **computation** power, (3) **storage** capacity, (4) **data transfer** bandwidth, (5) **security** level, (6) **support and integration** services

Savings are coming from **IT costs** (infrastructure, maintenance, energy), **operational efficiency** (enabling innovation, faster collaboration etc.)

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Connectivity, data, and computing power

Advanced analytics | Project based algorithms for operational excellence

xx Sample size (N=)

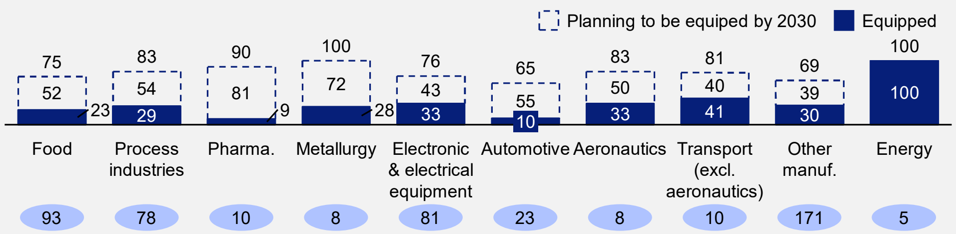
Definition

Processing of large quantities of data to extract useful information and improve decision-making

Usage (description + key figures)

Production Optimization – analyzing production data to improve efficiency, reduce waste, and increase output quality
Predictive Maintenance – using sensor data to predict machine failures, reduce downtime, and cut repair costs
Supply Chain & Inventory – forecasting demand, optimizing stock levels, and improving delivery reliability
Customer & Market Insights – understanding customer needs, segmenting markets, and guiding product development
Financial & Risk Management – identifying cost drivers, improving pricing strategies, and detecting anomalies/fraud.

Deployment[1], %



French SMEs plan to keep investing to reach 76% deployment by 2030, but lower than Germany with over 90% and Italy with 83%

Deployment is lagging in Food, Pharma and Automotive sectors

Key elements to consider

Data quality & availability – reliable, clean, and accessible (e.g., leveraging cloud)

Skills & talent – in-house expertise or external partners for analytics.

Clear use cases – involving business and IT in "test and learn" developments

Obstacle for implementation[2], % (103)

For those who are not planning to invest in the technology within the next 5 years (21%, ~2x more vs. Germany or Italy), main obstacles are:

76% a lack of interest / relevance

11% quoted an "uncertain strategic horizon"

10% a lack of internal skills

8% a lack of cashflow and/or financing

ROI factors

Cost reduction (maintenance, waste, energy)

Productivity gains (process efficiency, automation)

Revenue growth (better forecasting, new offers)

Risk reduction (quality control, compliance)

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Connectivity, data, and computing power

Machine learning | Large transformative impact across industries

xx Sample size (N=)

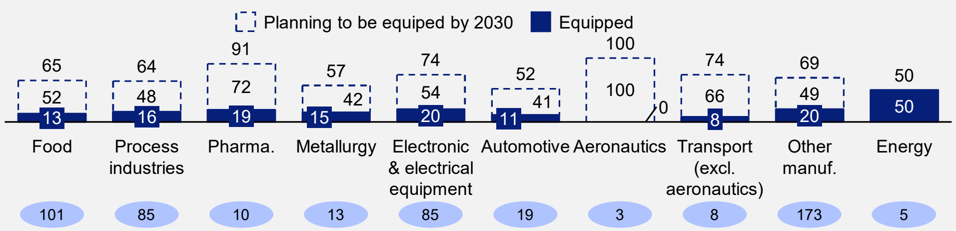
Definition

Algorithms that allow systems to automatically improve from experience

Usage (description + key figures)

Processes Automation – automating repetitive, time-consuming tasks, reducing manual effort and increasing efficiency
Data-driven Decision Making – collecting and processing structured or unstructured data to recognize patterns and enable industries to make informed decisions
Predictive Maintenance – predicting equipment failures to reduce downtime and maintenance costs
Customer Experience Enhancement – analyzing customer behavior, personalizing marketing and recommendations

Deployment[1], %



Most French SMEs plan to invest in machine learning by 2030 (68%) but the step is high as only 28% will be equipped within the coming year.
Only the Aeronautics and Pharma sectors have a high current deployment rate

Key elements to consider

ML tools are **rapidly evolving**, improving in both functionality and interoperability

2 important success factors: (1) establish a **data management strategy** that standardizes data accumulation and (2) have the right **skills and collaborations** between key stakeholders (**business experts, data scientists, and IT**) to ensure continuous improvement of AI models

Obstacle for implementation[2], % (146)

For those who are not planning to invest in the technology within the next 5 years (29%), main obstacles are:

70% a lack of interest / relevance – lowest level of disinterest ex aequo with cleantechs among all 14 technologies

13% a lack of internal skills

10% an uncertain strategic horizon

6% a lack of cashflow and/or financing and **6%** because costs are too high broadly speaking

ROI factors

Cost reduction (maintenance, waste, energy)

Productivity gains (process efficiency, automation)

Revenue growth (better forecasting, new offers)

Risk reduction (quality control, compliance)

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Connectivity, data, and computing power

Gen AI | Highly publicized technology with tangible impact

xx Sample size (N=)

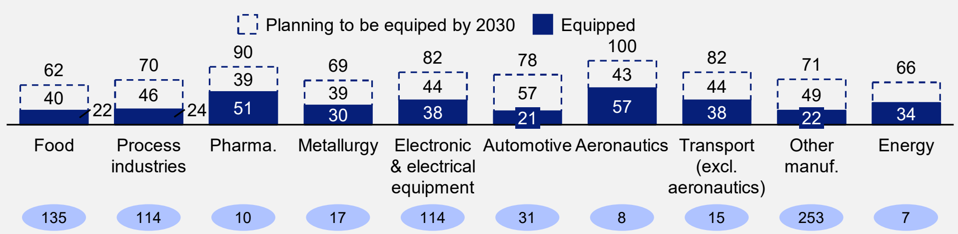
Definition

Creation of new content (text, images, code) to execute or automate complex tasks, analyze data, and improve industrial processes

Usage (description + key figures)

Insight extraction - rapidly searching large corpora of text, visuals, etc. and identify relevant patterns (e.g., ~14% productivity increase for customer support agents utilizing tools such as call summarization)
Content generation - developing complex data tailored to specific context (text, visual, sound, etc.), >10x efficiency improvements in document creation (contracts, NDAs, etc.)
User interaction - 'out-of-the-box' humanlike conversational ability incl. context memory (e.g., >60% increase in customer interaction / service volume driven by AI automation over next 5-10 years)

Deployment[1], %



72% of French SMEs plan to invest in Gen AI by 2030, near identical to German (73%) and greater than Italian SMEs (64%).

Only the food and energy industries are less eager for this technology.

Key elements to consider

Integrate GenAI risks : data privacy and security, equity, copyright protections, inaccuracies all affect the Gen AI value chain
High growth market : exponential increase in number and variety of use cases, but also fast evolution in cost of model creation, monetization, open / closed source to be aware of
Regulation & compliance : might affect research into Gen AI and its potential applications

Obstacle for implementation[2], % 183

For those who are not planning to invest in the technology within the next 5 years (26%), main obstacles are:

78% a lack of interest / relevance

9% a lack of internal skills, **7%** an uncertain strategic horizon, **5%** a lack of cashflow and/or financing and **8%** other reasons (not detailed)

ROI factors

Automation - of human tasks

Augmentation – or enhancement of human productivity

Acceleration – to extract knowledge and shorten innovation cycles

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Human-machine interaction and process optimization

Virtual Reality | Immersive simulations

xx Sample size (N=)

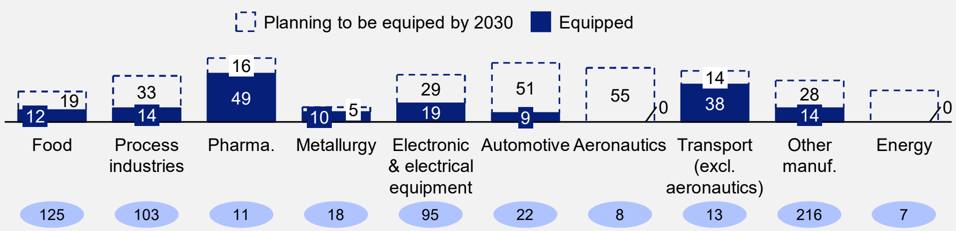
Definition

Immersion in simulated environments, facilitating training and design

Usage (description + key figures)

Plant design & development – enabling engineers and designers to immerse themselves in 3D models, identify design flaws early, and accelerate development cycle
Workforce training & safety – providing immersive training environments for complex and hazardous environments, improving safety, skill development and retention rates
Maintenance & operations - reducing downtime, minimizing errors, and enhancing operational efficiency by allowing workers to work in simulated 3D environments that simulate actual machinery

Deployment[1], %



French SMEs are much less keen on deploying VR (43% target by 20230) than their German (72% target) and

Key elements to consider

Important setup time: creating virtual environment and updating it regularly to match real plan or situation. Matching the core use cases specifically for the industry / company

Availability of skills: ensure resources to setup VR environment + maintain it after deployment

Obstacle for implementation[2], % 342

For those who are not planning to invest in the technology within the next 5 years (55% vs. 25% in Germany and 43% in Italy), main obstacles are:

89% a lack of interest / relevance

8% an uncertain strategic horizon

ROI factors

Workforce training & retention: reduced time of training / upskilling and retention rate increase
Operational efficiency: reduced downtime, improved plant layout and optimized workflows through optimized design
Faster development cycles: reduced time to design and identify flaws before physical production

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Human-machine interaction and process optimization

Augmented reality | Technology where digital meets real world

xx Sample size (N=)

Definition

Overlay of digital information on the real world, improving perception and interaction

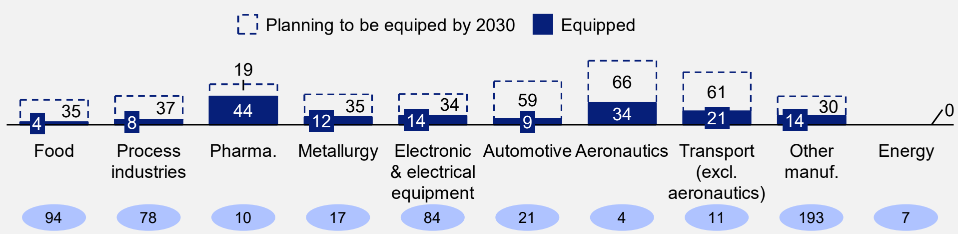
Usage (description + key figures)

Maintenance and production efficiency – providing real-time data and schematics overlaid on machinery to simplify maintenance, reduce errors, enable experts to guide on-site workers, provide instructions to assemble complex components

Quality control – assisting quality checks in real-time to ensure accuracy and reduce the number of defects

Training workforce & safety – providing immersive training environments for complex and hazardous environments, improving safety, skill development and retention rates

Deployment[1], %



Less than half of French SMEs intend to delay AR by 2030 (46%). The number is particularly low for companies with less than 100 employees (36%) and in the energy and food industries

Key elements to consider

Physical constraints: advancements in improving battery size, optical field, display brightness for outdoor usage, etc, could enable the next level of adoption and make AR headsets more compatible for workers in industrial use cases

Large setup phase: integration with existing machinery is required to ensure success and precision of solution

Obstacle for implementation[2], % 270

For those who are not planning to invest in the technology within the next 5 years (52% vs. 15% in Germany and 26% in Italy), main obstacles are:

91% a lack of interest / relevance – highest level of disinterest among all 14 technologies

6% an uncertain strategic horizon and **4%** because costs are too high broadly speaking

ROI factors

Cost efficiency: reduced cost of training and prototyping. Need for more consumer-friendly and scalable applications first

Operational efficiency: reduced downtime, improved production efficiency

Main cost drivers are (1) hardware, (2) integration with legacy systems, (3) software, and (4) training and change management

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Human-machine interaction and process optimization

Robotics | Proven technology continuously improving

xx Sample size (N=)

Definition

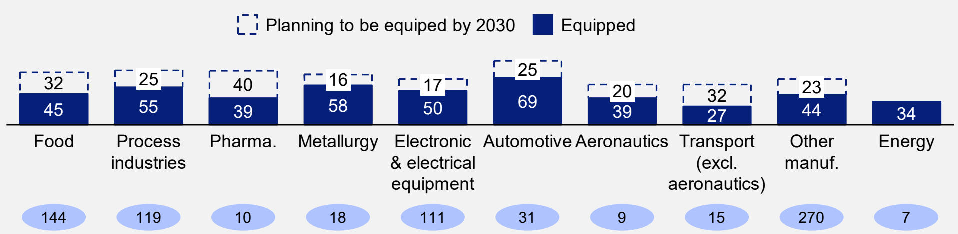
Use of robots to automate industrial tasks, allowing to improve execution speed, precision and/or security

Usage (description + key figures)

In production: fixed or mobile robots allowing to replace or collaborate with operators (development of cobots and machine-to-machine technology), allowing to manage more complexes tack leveraging more advanced sensors and artificial intelligence (e.g., machine vision)

In logistics: solutions are now highly effective in optimizing the transport (e.g., AGVs) and storage of parts (e.g., stacker crane), managing value-added operations such as picking or packaging

Deployment[1], %



Robotics is already **largely deployed** in most industries, led by **automotive and process industry**

Key elements to consider

Robotics is one of the **most widely deployed technologies in industry**[3]. **New generations** of robots are more **flexible, more adaptable, and easier to set up**, can be implemented in companies with lower production rates (e.g., versus automotive industry) and with **less investment capacity**

Obstacle for implementation[2], % 205

For those who are not planning to invest in the technology within the next 5 years (28%), main obstacles are:

86% a lack of interest / relevance

5% a lack of internal skills, **5%** because costs are too high broadly speaking and **4%** an uncertain strategic horizon

ROI factors

Gains calculation is linked to several factors:

- Improvement in **operational efficiency** or productivity, increase in production rate
- **Reduction in non-quality**
- Working conditions, **employee safety** improvement

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology
3. Considering on the presence of a least one robot in the companies (the size or age of the installed fleet is not considered here)

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

La Fabrique de l'Industrie et McKinsey & Company, « *Adoption des technologies 4,0 par les PMI-ETI européennes* », novembre 2025

Human-machine interaction and process optimization

3D printing | In-house, on-demand production of parts

xx Sample size (N=)

Definition

Production of parts by adding successive layers of material

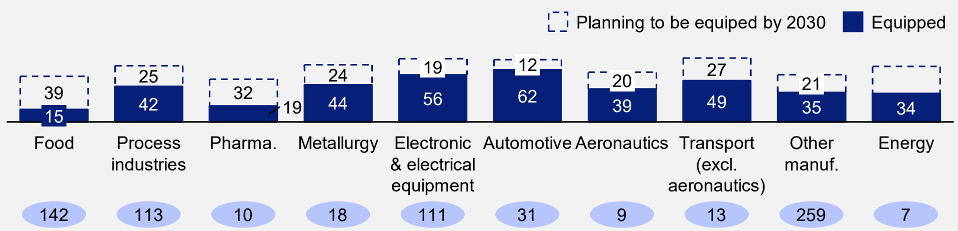
Usage (description + key figures)

Rapid Prototyping and Product Development – creating and testing prototypes, reducing time and cost associated

Production of Complex and Customized Components - producing complex geometries and highly customized parts that are difficult or impossible to create using traditional manufacturing techniques

Maintenance, Repair & Operations – producing spare parts (especially for obsolete machinery), reducing lead time and dependance on suppliers, enabling flexible inventory management with on-demand production of parts

Deployment[1], %



The target of French SMEs to adopt 3D printing (62% by 2030) is similar to Italy (64%) but lower than Germany (78%).

This is due to Germany having an already very high rate of implementation (64%)

Key elements to consider

Material & process standards : maintain properties, structural integrity, and consistent quality with 3D-printed components

Obstacle for implementation[2], % 264

For those who are not planning to invest in the technology within the next 5 years (37% vs. 22% in Germany and 34% in Italy), main obstacles are:

89% a lack of interest / relevance

5% an uncertain strategic horizon and **4%** because costs are too high broadly speaking

ROI factors

Upfront costs of 3D printing : printers, software, training

Operational & maintenance efficiency gains : reduced downtime, reduced inventory of spare parts, reduced supplier dependance and lead time

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Human-machine interaction and process optimization

Digital twin | Virtual copy for powerful simulations

xx Sample size (N=)

Definition

Virtual replica of a physical object or system, used to simulate, analyze, and optimize performance in real time

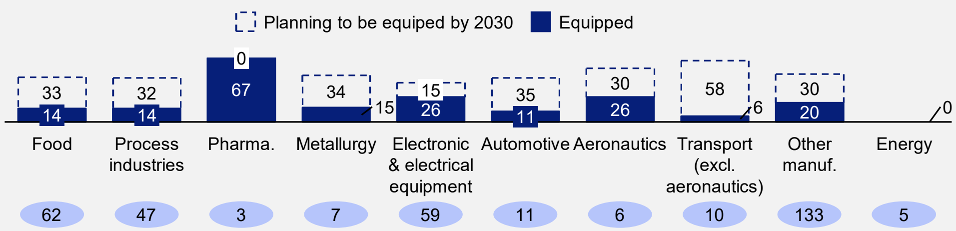
Usage (description + key figures)

Predictive Modeling and Maintenance – analyzing IoT data to predict maintenance needs, reducing unexpected downtime, increasing resilience by simulating "what-if" scenarios

Performance tracking – simulating real-time bottlenecks, optimizing product line sequencing

Design optimization – enabling immersive design reviews using AR/VR, optimizing layouts, machine placements and flows, facilitating collaboration during design phase

Deployment[1], %



Only 2 industries seem keen on deploying digital twins : Pharma and Aeronautics. Company in the Defense sector also have high equipment rates (47%).

Current and planned deployment levels are similar between French, German and Italian SMEs.

Key elements to consider

Synergy with other technologies (AR, VR, IoT, advanced analytics) to maximize value creation. Requires scalable connectivity and be vendor independent

Large setup phase : important time and skills needed to create and regularly update digital twin

Data quality : robust infrastructure with legacy systems is essential to collect real-time data

Obstacle for implementation[2], % 166

For those who are not planning to invest in the technology within the next 5 years (48%), main obstacles are:

88% a lack of interest / relevance

6% an uncertain strategic horizon and **4%** a lack of internal skills

ROI factors

Gains calculation is linked to several factors:

- Improvement in **operational efficiency** due to performance tracking and optimized design
- **Reduction in unplanned downtime** due to predictive maintenance

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Cross-cutting technologies

Quantum computing | From qubits to breakthroughs

xx Sample size (N=)

Definition

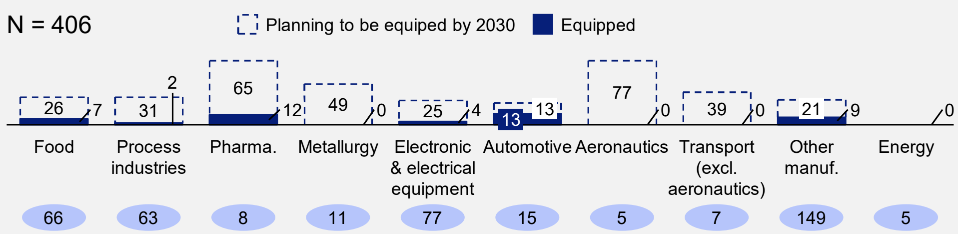
Next generation of computers, to calculate at an exponentially faster speed, with applications in cryptography and molecular modeling

Usage (description + key figures)

Quantum computing is being tested mainly in **medicine, materials, optimization, finance, cybersecurity, manufacturing, AI, and sensing**.

Most projects are still in **pilot or research stage**, but they promise **faster discoveries, smarter logistics, better security, faster development of AI applications, enhanced simulations and new materials** in the coming decade.

Deployment[1], %



Actual quantum advantage for useful applications is still outstanding, with promising research and experimentation in pioneering enterprises (e.g., Rolls-Royce/Riverlane tool to accelerate complex material discovery for jet engines in hostile environments)

Key elements to consider

Quantum computing not only will provide a speedup computing power but also enable:

- **Quantum communication**: which will be critical for secure communication in the era of quantum computers
- **Quantum sensing**: which provides higher sensi-tivity in more modalities than conventional sensors

Obstacle for implementation[2], % 256

For those who are not planning to invest in the technology within the next 5 years (63% vs. 75% in Germany and Italy), main obstacles are:

81% a lack of interest / relevance

8% because costs are too high broadly speaking, **6%** a lack of internal skills and **5%** an uncertain strategic horizon

ROI factors

Cost-effectiveness may take time. Traditional supercomputers can perform most calculations that businesses require reasonably well and at a much lower cost; this is expected to change once quantum advantage is achieved and general-purpose quantum computers take center stage

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Cross-cutting technologies

Cleantech | Promoting sustainability and resource efficiency

xx Sample size (N=)

Definition

Technologies aimed at reducing environmental impact, including renewable energy, waste management systems, CO_2 capture and storage

Usage (description + key figures)

Renewable Energy : integrating renewable energy sources (ex : solar, wind) and building hybrid power models to optimize power costs and meet decarbonation targets for industries

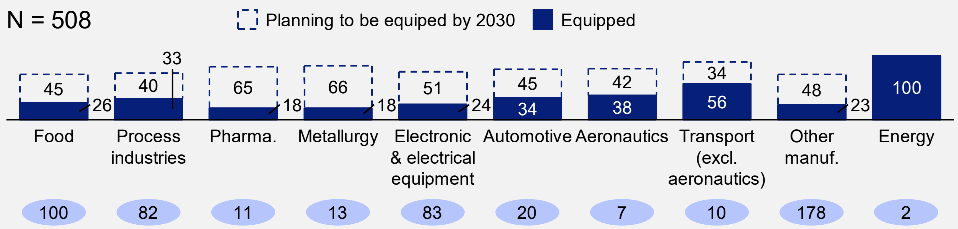
Energy Optimization : improving energy distribution with smart grids analytics, AI-driven analytics to identify savings in procurement and processes

Waste Management and Recycling : using waste products for other processes, treating industrial wastewater

Carbon Emission Reduction : CO_2 capture and storage technologies

Deployment[1], %

N = 508



Deployment rates in France (40%) of cleantech are much lower than in Germany (81%) and Italy (73%).

Companies with <100 employees also have a very low adoption rate of cleantech (32%) and are an important target for improvement.

Key elements to consider

Climate technologies beyond electrification and renewables are diverse, each having unique development timelines and use cases

For example: circular technologies scaling require collaboration across the supply chain to administer collection, recycling, and reintroduction into the value chain

Obstacle for implementation[2], % (115)

For those who are not planning to invest in the technology within the next 5 years (23% vs. 5% in Germany and 8% in Italy), main obstacles are:

70% a lack of interest / relevance – lowest level of disinterest ex aequo with machine learning among all 14 technologies

11% an uncertain strategic horizon

7% a lack of financing, **6%** because costs are too high broadly speaking and **8%** other reasons (not detailed)

ROI factors

Public sector incentives such as potential policies and regulations could be pivotal in shaping investment decisions, business case viability

OPEX efficiency : improved energy efficiency, reduced cost of waste treatment through recycling

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Cross-cutting technologies

IoT | Connected assets for data-driven automation and insights

xx Sample size (N=)

Definition

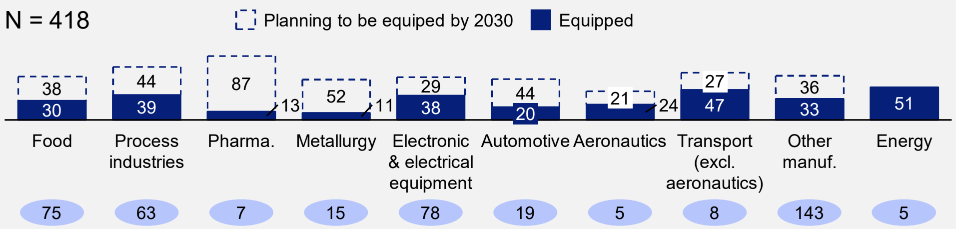
Networks of connected objects that can collect and exchange data, improving efficiency and resource management

Usage (description + key figures)

Predictive Maintenance – using sensors to monitor equipment health in real-time, anticipating and addressing potential failures
Energy & Utility Management – energy optimization, applications in smart grids, real-time water and heat consumption
Production process Optimization – productivity increase with ral-time monitoring of production downtime, failures, and yield
Environmental monitoring & Hazard Management – real time alerts, monitoring air quality, emissions, equipment overheat..
Asset Tracking & Inventory Management – tracking warehousing and inventory to better control resources and reduce inefficiencies

Deployment[1], %

N = 418



Most sectors are keen on deploying IoT, with **70% on average targeting deployment by 2030**. Only the Aeronautics and Energy sectors respondents are not planning further IoT investments beyond the next 12 months.

Key elements to consider

Cybersecurity : biggest obstacle to IoT adoption (according to IoT suppliers and buyers) with increasing number of connected endpoints and vulnerabilities
Scalability to achieve full potential with other digital offerings (advanced analytics, digital twin, etc) requires strong planning beyond pilot phase
Interoperability between IoT on site, to avoid fragmented and varying protocols hindering the potential

Obstacle for implementation[2], % (111)

For those who are not planning to invest in the technology within the next 5 years (27% vs. 4% in Germany and in Italy), main obstacles are:

79% a lack of interest / relevance

9% a lack of internal skills, **4%** because costs are too high broadly speaking and **5%** other reasons (not detailed)

ROI factors

Operational efficiency : reduced downtime with predictive maintenance, production optimization, and reduced hazards and accidents increase the overall yield rate of industries
Reduction of variable industrial costs : better use of energy and utility resources through real-time monitoring and optimization, reduced inventory costs, optimization of supply levels for raw materials

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Cross-cutting technologies

Energy storage | Efficient storage of intermittent energy

xx Sample size (N=)

Definition

Efficient storage of energy, particularly for intermittent renewable energies

Usage (description + key figures)

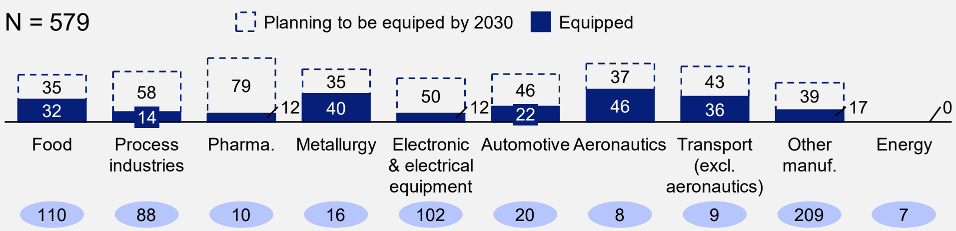
Reduce peak demand charges – storing electricity during off-peak hours and using it during peak demand hours to reduce electricity costs

Backup Power - providing power during temporary grid disruptions to reduce unplanned downtime

Renewable Energy Integration - storing excess renewable energy, reducing reliance on grid and support sustainability goals of lowering CO2 emissions

Deployment[1], %

N = 579



Only 28% of French SMEs are equipped or planning to equip in the next year, far less than in Germany (88%) or Italy (74%).

The aeronautics industry stands out with a high adoption rate of 70%.

Key elements to consider

Integration & scalability : prioritizing modular and scalable systems that allow incremental capacity additions as operations grow

Flexibility : choose systems that can adapt to changing energy demands (eg : with advanced software for dispatch intelligence and performance optimization)

Compliance & incentives : leverage government incentives and stay updated on regulatory changes and market-specific policies that may influence the feasibility and profitability

Obstacle for implementation[2], % (195)

For those who are not planning to invest in the technology within the next 5 years (34% vs. 4% in Germany and in Italy), main obstacles are:

72% a lack of interest / relevance

15% an uncertain strategic horizon

11% because costs are too high broadly speaking

ROI factors

Total Cost of Ownership : includes capex, operational and maintenance costs and replacement costs over the system's lifetime

Peak load shaving : potential savings can range from 20% to 30%[3]

Operational efficiency : reduced unplanned downtime due to energy shortages with backup power

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis (incl. "*Enabling renewable energy with battery energy storage systems*", 2023); survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

Cross-cutting technologies

Cyber-security | Protecting systems, data and networks

xx Sample size (N=)

Definition

Protection of systems and data against computer intrusions and cyberattacks

Usage (description + key figures)

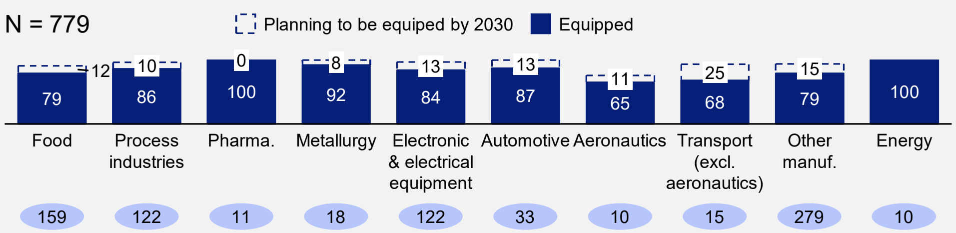
Protection against cyber threats – defend systems from malicious attacks targeting critical systems (eg : ERP), reducing the risk of disrupting operations

Compliance with Regulations – meet industry-specific standards and regulations to avoid legal liabilities and maintain customer trust

Enable digital transformation - enable secure adoption of digital technologies, and build resilience in increasingly connected environments

Protect IP and employee data – safeguard the company's property to maintain competitive advantage

Deployment[1], %



Cybersecurity is **broadly integrated in every sector** (in Germany and Italy too at similar rates) with a target adoption by 2030 of 95% across all industries. The only lagging sectors are the food and surprisingly, aeronautics industry.

Key elements to consider

Risks of cyber attacks : cyber attacks can permanently cripple a production factory, and damage customer opinion irrevocably. Cybersecurity is not an option

Integration : industrial environments often operate with legacy systems that were not designed with cybersecurity in mind. A secure environment ensures protection across all levels, from physical devices to enterprise systems

Obstacle for implementation[2], % 40

For those who are not planning to invest in the technology within the next 5 years (5%), main obstacles are:

78% a lack of interest / relevance

13% an uncertain strategic horizon

5% a lack of financing and **6%** other reasons (not detailed)

ROI factors

Cost avoidance from cyber attacks : avoid financial losses such as ransomware payments, crisis management, and litigation

Long term benefits : reduced cyber insurance premiums, reduced risks of fines and penalties, customer loyalty and brand reputation, driving and enabling innovation as a competitive edge

1. Share of respondents who know the technology, are already equipped or are planning to equip in the coming year
2. Share of respondents who do not plan to invest in the technology

Source: McKinsey analysis; survey carried out by Ipsos among 1,198 French, German and Italian SME CxOs, June-July 2025

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