Use of artificial intelligence in enterprises

Statistics Explained

Data extracted in December 2023
Planned article update: 29 May 2024

" In 2021, 8 % of EU enterprises used artificial intelligence technologies. "

" In 2021, 28 % of large EU enterprises used artificial intelligence technologies. "

" In 2021, AI was used the most by enterprises in the information and communication sector. "

" In 2021, 53 % of EU enterprises that used AI purchased ready-to-use commercial artificial intelligence software or systems. "

This article presents recent statistical data on the use of artificial intelligence (AI) technologies by EU enterprises . AI is developing quickly and can bring many benefits, such as safer and cleaner transport, more efficient manufacturing, cheaper and more sustainable energy, and better decision-making. AI refers to systems that use technologies such as text mining, computer vision, speech recognition, natural language generation, machine learning or deep learning. These technologies can be used to gather and/or use data to predict, recommend or decide, with varying levels of autonomy, the best action to achieve specific goals. AI systems can be software-based (e.g. image recognition software, virtual assistants, speech and face recognition systems) or embedded in devices (e.g. autonomous robots, self-driving vehicles, drones).

Enterprises using artificial intelligence technologies

In 2021, 8 % of enterprises in the EU, with 10 or more employees and self-employed persons, used at least one of the following AI:

- technologies analysing written language (text mining)
- technologies converting spoken language into a machine-readable format (speech recognition)
- technologies generating written or spoken language (natural language generation)
- technologies identifying objects or people based on images (image recognition, image processing)
- machine learning (e.g. deep learning) for data analysis
- technologies automating different workflows or assisting in decision-making (AI based software robotic process automation)
- technologies enabling machines to physically move by observing their surroundings and taking autonomous decisions

3 % of enterprises used at least two of the above-mentioned AI technologies and 2 % of the enterprises used at least three of these technologies (Figure 1).

As shown in Figure 1, large enterprises used AI more than small and medium enterprises. In 2021, 6 % of small enterprises, 13 % of medium enterprises and 28 % of large enterprises used AI. This difference might be explained, for example, by the complexity of implementing AI technologies in an enterprise, economies of scale (i.e. enterprises with larger economies of scale can benefit more from AI) or costs (i.e. investment in AI may be more

affordable for large enterprises).

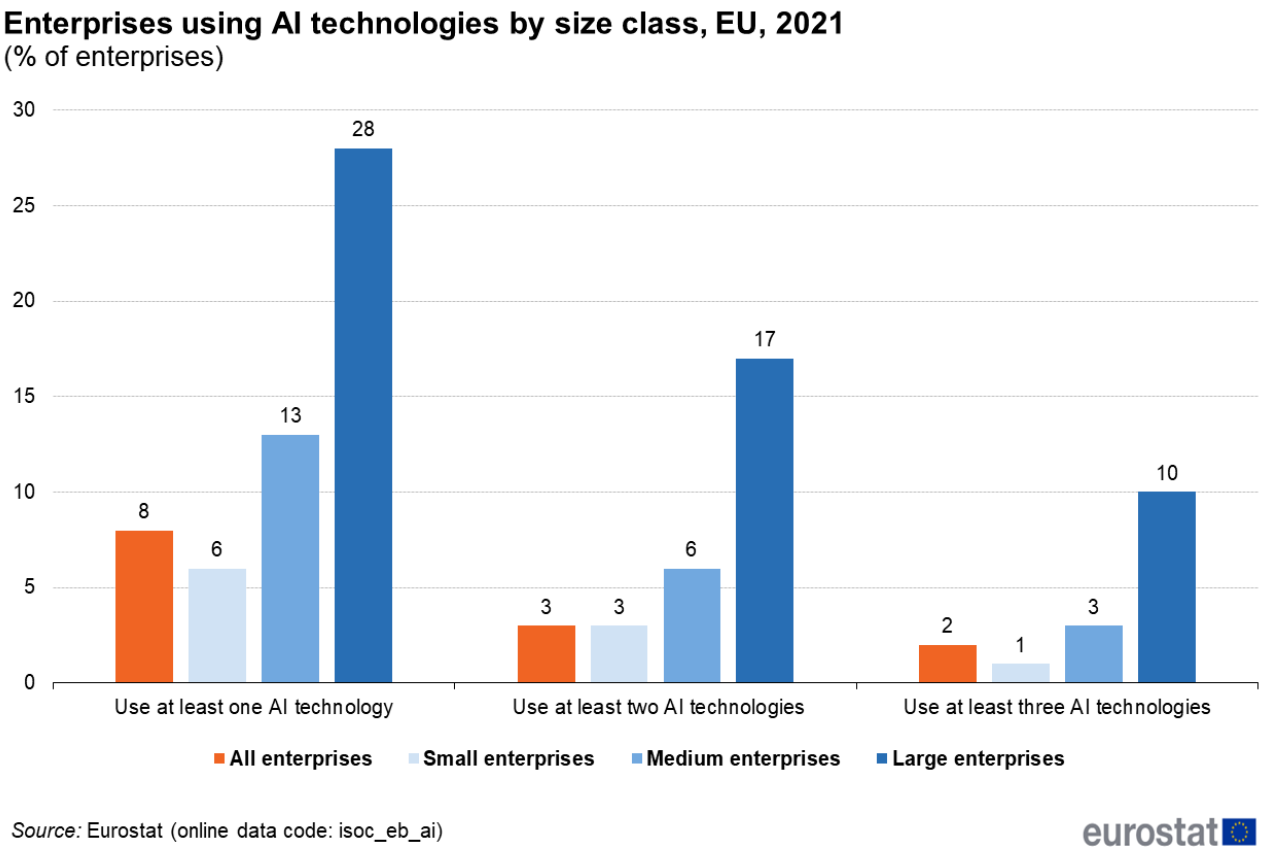


Figure 1: Enterprises using AI technologies, by size class, EU, 2021 (% of enterprises) Source: Eurostat (isoc_eb_ai)

Comparing enterprises using at least one AI technology among EU countries (Figure 2) shows that the share of enterprises using AI ranged between 1 % and 24 %. The highest share was recorded in Denmark (24 %), followed by Finland (16 %), the Netherlands and Luxembourg (both 13 %) , while the lowest shares were recorded in Romania (1 %) and Cyprus, Greece, Estonia, Poland, Hungary and Bulgaria (all 3 %).

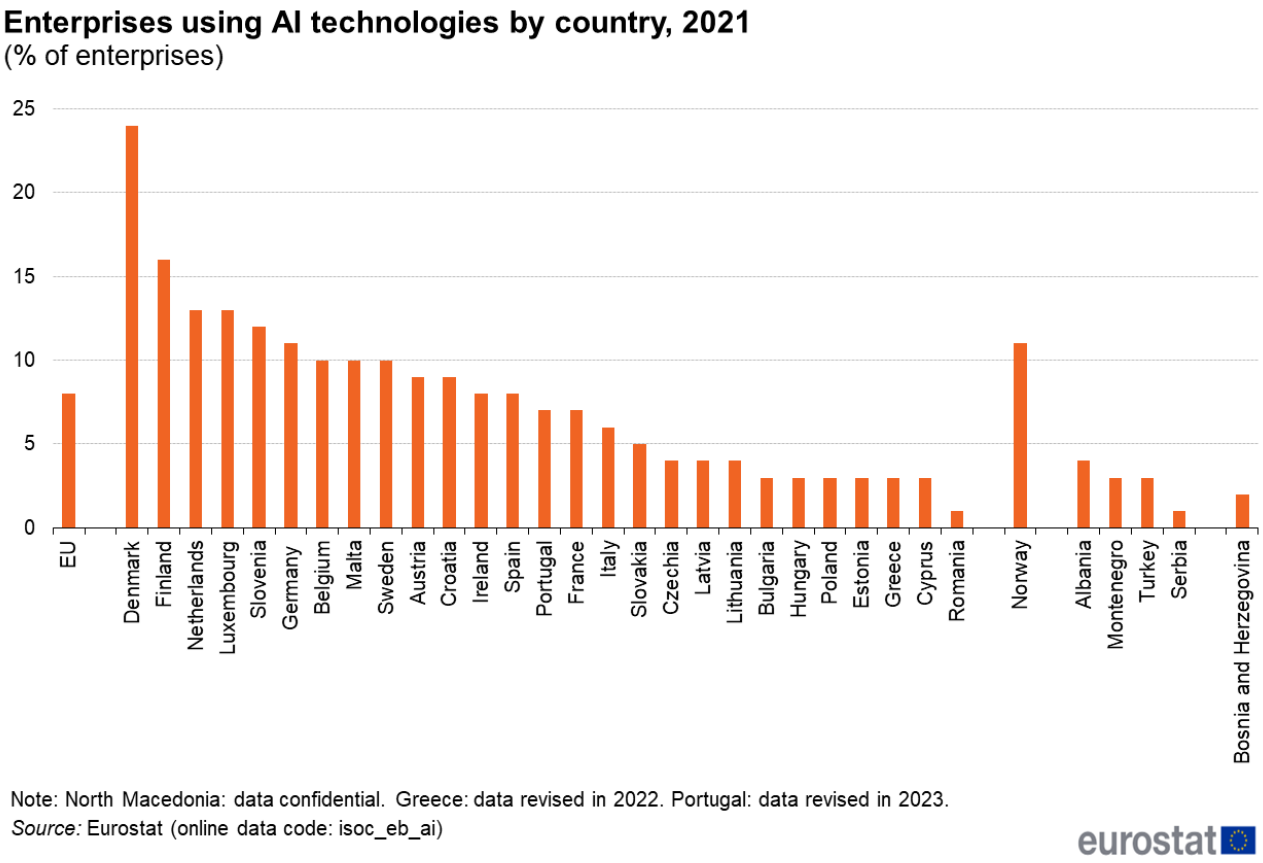


Figure 2: Enterprises using AI technologies by country, 2021 (% of enterprises) Source: Eurostat (isoc_eb_ai)

As shown in Figure 3, in some economic activities AI is used a lot more than in others. This might indicate that AI is more relevant for certain activities. In 2021, the information and communication sector (with 25 %) and professional, scientific and technical service activities (with 17 %) stood out with the highest share of enterprises that used AI. In all other economic activities, the share of enterprises using AI was below 10 %. This ranged from 9 % (electricity, gas steam, air conditioning and water supply) to 5 % (accommodation, construction).

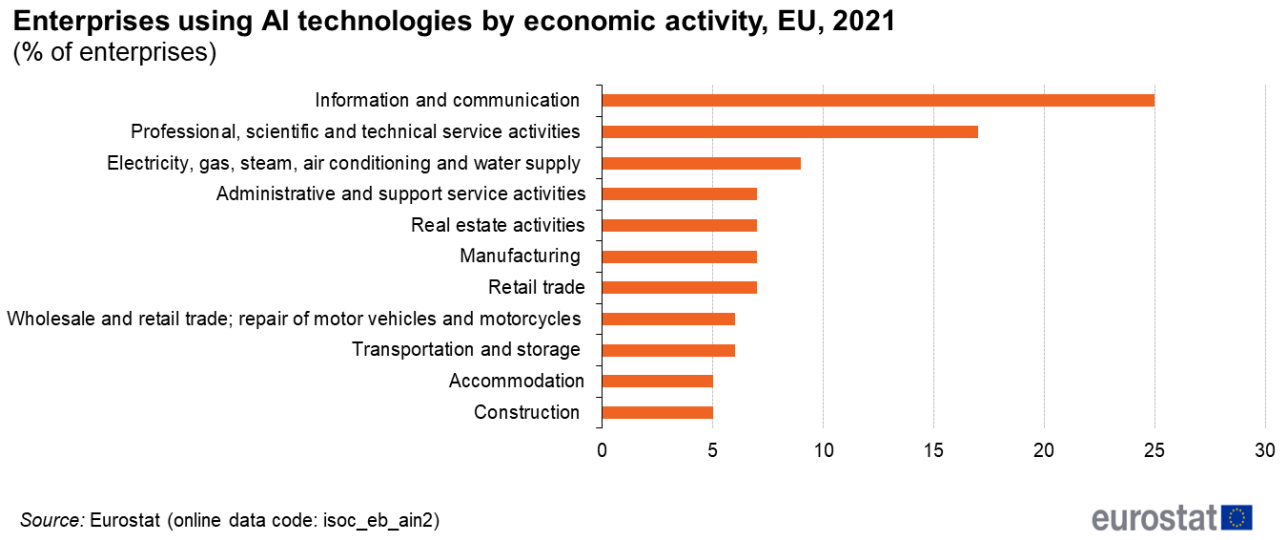


Figure 3: Enterprises using AI technologies, by economic activity, EU, 2021 (% of enterprises) Source: Eurostat (isoc_eb_ain2)

Types of AI technologies used

EU enterprises used different types of AI technologies. As presented in Figure 4, there was no predominant AI technology. The AI technologies that were used slightly more often were AI technologies automating different workflows or assisting in decision-making (e.g. AI-based software robotic process automation). In 2021, these AI technologies were used by 3 % of enterprises. AI technologies identifying objects or persons based on images (image recognition, image processing), machine learning (e.g. deep learning) for data analysis, technologies analysing written language (i.e. text mining) and technologies converting spoken language into a machine-readable format (speech recognition) were each used by 2 % of enterprises. Technologies enabling machines to physically move by observing their surroundings and taking autonomous decisions (e.g. self-driving vehicles) and technologies generating written or spoken language (natural language generation) were each used by 1 % of enterprises.

Although there was no predominant AI technology used by all enterprises, Figure 4 shows a different situation when looking at the size of the enterprises, in particular large enterprises. AI technologies automating different workflows or assisting in decision-making, with 15 %, were the most used technologies, followed by machine learning for data analysis (13 %). The least used AI technologies were those generating written or spoken language (5 %).

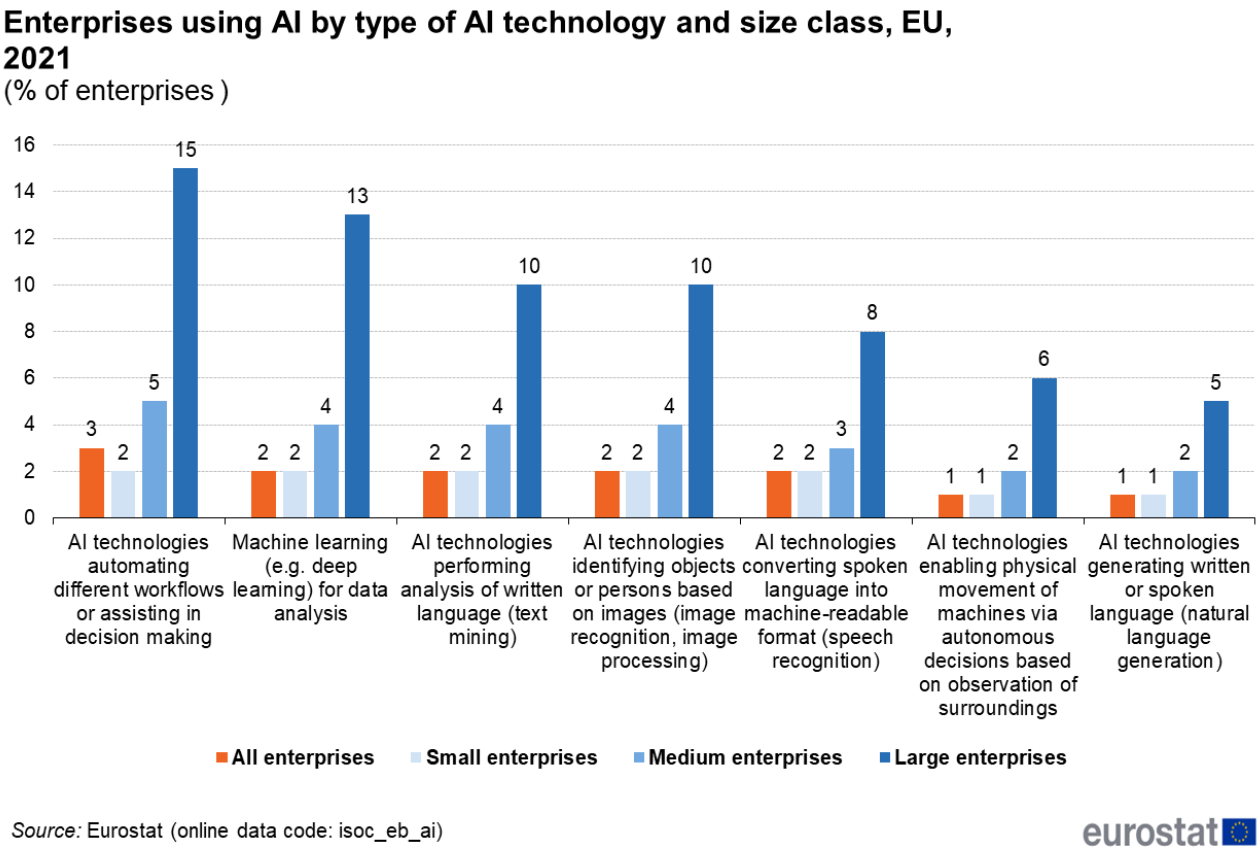


Figure 4: Enterprises using AI technologies by type of AI technology and size class, EU, 2021 (% of enterprises) Source: Eurostat (isoc_eb_ai)

Table 1 presents the different types of AI technologies used in different economic activities. In the information and communication sector, where the highest share of enterprises using AI was recorded, the most used AI technologies were machine learning for data analysis (15 %), followed by text mining (12 %). In professional, scientific and technical service activities, speech recognition was used slightly more than other AI technologies (7 %), followed by text mining (6 %), machine learning (6 %) and AI technologies automating different workflows or assisting in decision-making (6 %). In all other activities, shares of enterprises using specific AI technologies ranged from less than 1 % to 4 %.

Enterprises using AI technologies by type of AI technology and economic activity, EU, 2021
(% of enterprises)

	Use of AI technologies						
	Performing analysis of written language (text mining)	Converting spoken language into machine-readable format (speech recognition)	Generating written or spoken language (natural language generation)	Identifying objects or persons based on images (image recognition, image processing)	Machine learning (e.g. deep learning) for data analysis	Automating different workflows or assisting in decision making	Enabling physical movement of machines via autonomous decisions based on observation of surroundings
Manufacturing	2	1	1	2	2	3	2
Electricity, gas, steam, air conditioning and water supply	3	2	1	2	3	4	1
Construction	1	2	1	1	1	1	1
Wholesale and retail trade; repair of motor vehicles and motorcycles	2	1	1	1	2	2	1
Retail trade, except of motor vehicles and motorcycles	2	1	1	1	2	3	1
Transportation and storage	2	1	1	2	1	2	1
Accommodation	2	1	1	1	1	1	0~n
Information and communication	12	8	6	9	15	11	2
Real estate activities	2	3	1	2	1	3	0~n
Professional, scientific and technical service activities	6	7	3	4	6	6	1
Administrative and support service activities	2	2	1	2	2	2	0~n

0~n - value close to zero

Source: Eurostat (online data code: isoc_eb_ain2)

eurostat

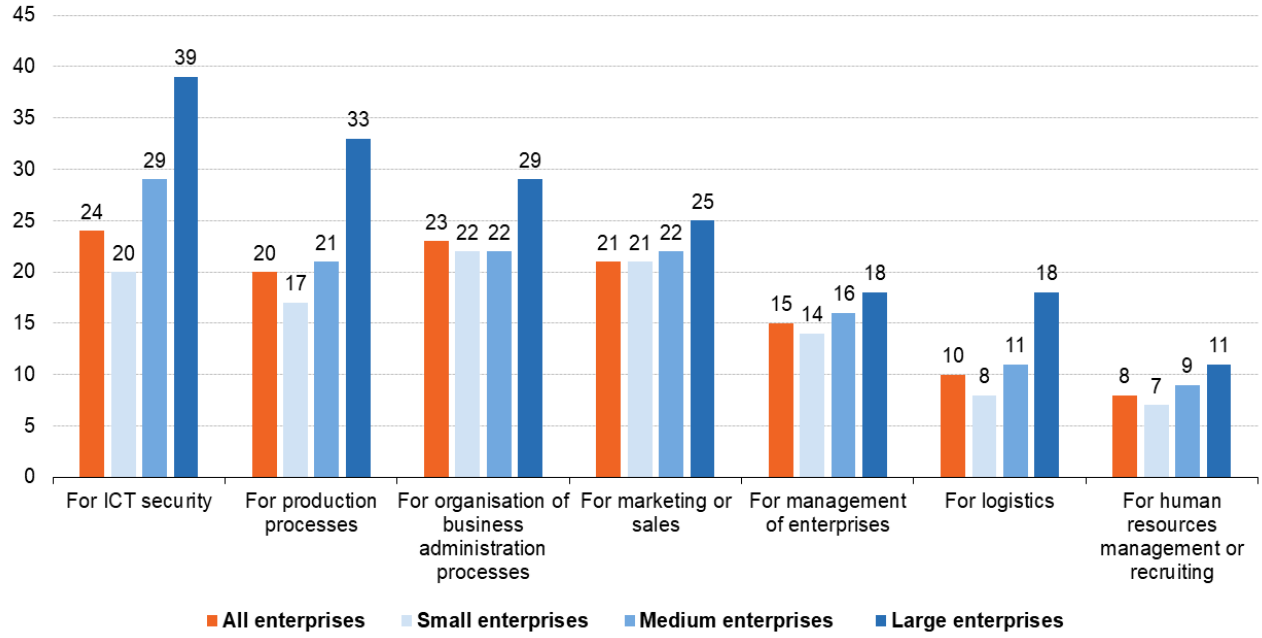
Table 1: Enterprises using AI technologies by type of AI technology and economic activity, EU, 2021 (% of enterprises) Source: Eurostat (isoc_eb_ain2)

Purpose of using AI software or systems

EU enterprises used AI software or systems for different purposes. In 2021, 24 % of enterprises used AI software or systems for ICT security (e.g. using machine learning for detecting and preventing cyber-attacks), 23 % for organising business administration processes (e.g. using machine learning for automated planning, business virtual assistants). AI software or systems for human resources management or recruiting (e.g. using machine learning to prescreen candidates) were used the least and by 8 % of enterprises (Figure 5).

The purposes for which enterprises used AI software and systems differed depending on their size. The biggest difference between small and large enterprises was recorded for those that used AI software or systems for ICT security (39 % large enterprises, 20 % small enterprises), followed by those which used them for production processes (33 % large enterprises, 17 % small enterprises) and those that used them for logistics (18 % large enterprises, 8 % small enterprises) (Figure 5).

Enterprises using AI software and systems by type of purpose and size class, EU, 2021
(% of enterprises using at least one AI technology)



Source: (online data code: isoc_eb_ai)

eurostat

Figure 5: Enterprises using AI software and systems by type of purpose and size class, EU, 2021 (% of enterprises using at least one AI technology) Source: Eurostat (isoc_eb_ai)

Enterprises used AI technologies for different purposes depending on the branch of the economy in which they were operating. In the manufacturing sector, AI software or systems were used mostly for production processes (40 %), while AI software or systems were mostly used for ICT security in the information and communication sector (33 %), the electricity, gas, steam, air conditioning and water supply sector (31 %), and the transportation and storage sector (28 %). The main use for AI was for organising business processes in the professional, scientific and technical service activities sector (28 %), the real estate activities sector (25 %) and in the information and communication sector (25 %). Enterprises mainly used AI software or systems for marketing or sales in the retail trade sector (40 %) and the accommodation sector (38 %) (Table 2).

Enterprises using AI software and systems by type of purpose and economic activity, EU, 2021
(% of enterprises using at least one AI technology)

	Purpose of use						
	For marketing or sales	For production process	For organisation of business administration process	For management of enterprises	For logistics	For ICT security	For human resources management or recruiting
Manufacturing	14	40	16	12	13	24	5
Electricity, gas, steam, air conditioning and water supply	19	26	23	16	10	31	8
Construction	8	9	21	10	5	19	6
Wholesale and retail trade; repair of motor vehicles and motorcycles	34	16	24	19	17	24	7
Retail trade, except of motor vehicles and motorcycles	40	11	20	16	20	23	6
Transportation and storage	18	14	22	13	24	28	10
Accommodation	38	12	22	25	8	23	12
Information and communication	31	21	25	19	6	33	10
Real estate activities	16	6	25	11	3	24	7
Professional, scientific and technical service activities	14	13	28	13	3	21	8
Administrative and support service activities	20	16	24	11	4	24	14

Source: Eurostat (online data code: isoc_eb_ain2)

eurostat

Table 2: Enterprises using AI software and systems by type of purpose and economic activity, EU, 2021 (% of enterprises using at least one AI technology) Source: Eurostat (isoc_eb_ain2)

How enterprises acquire AI software or systems

Among EU enterprises that used AI, the most common way to acquire them was by purchasing ready-to-use commercial AI software or systems – this was the case for 53 % of enterprises. 38 % of enterprises used AI technologies developed or modified by external providers. 28 % of enterprises developed their own AI software or systems or modified commercial software of systems modified by their own employees. 22 % of enterprises using AI, modified open-source software or systems modified by their employees (Figure 6).

As shown in Figure 6, the way enterprises acquire AI software or systems varies and depends on the size of the enterprise. The biggest difference between large and small enterprises was recorded for enterprises that used AI technologies developed or modified by external providers as well as those modified by their own employees. Among large enterprises that used AI, 53 % used AI software or systems developed or modified by external providers, while the respective share was 34 % in small enterprises. 39 % of the large enterprises using AI used commercial AI software or systems modified by their own employees. For small enterprises, this was only 25 %.

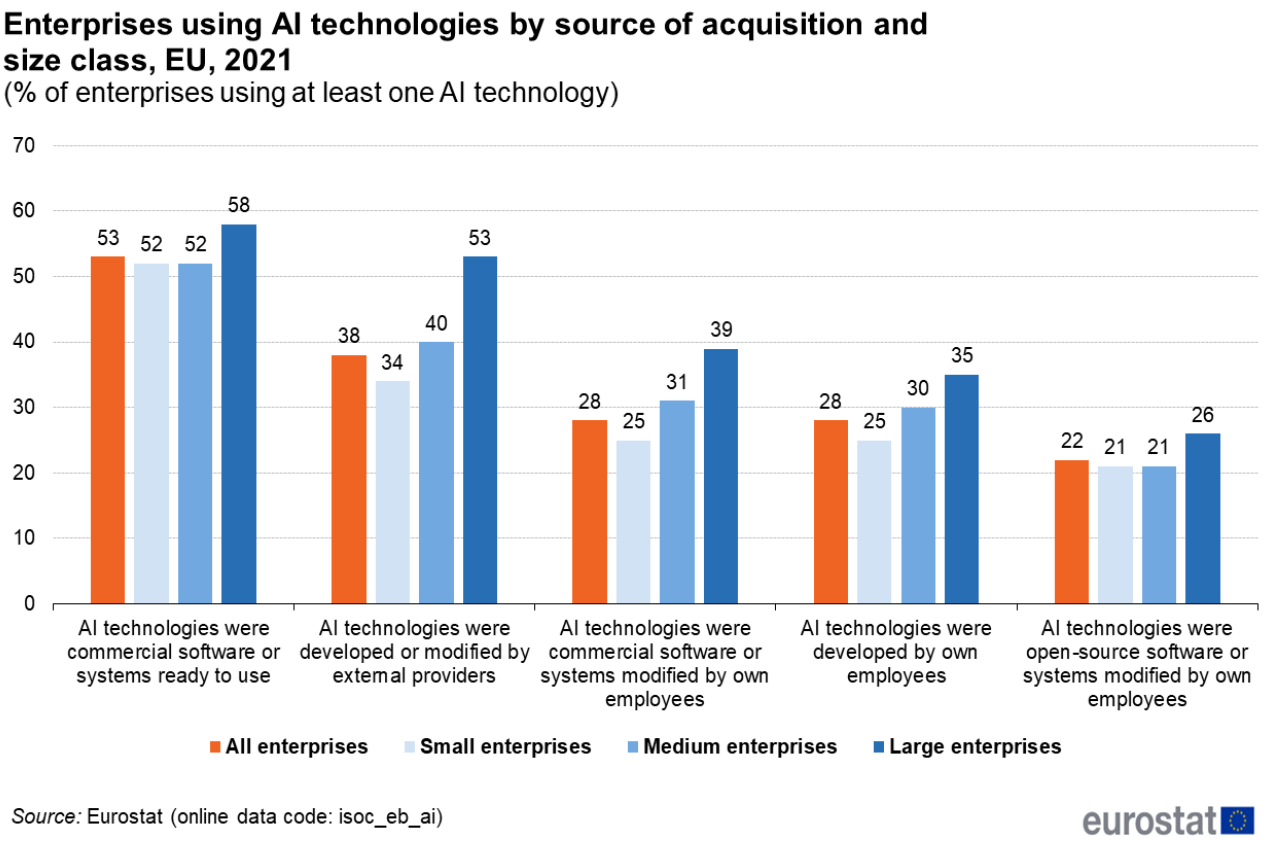


Figure 6: Enterprises using AI technologies by source of acquisition and size class, EU, 2021 (% of enterprises using at least one AI technology) Source: Eurostat (isoc_eb_ai)

The most common way to acquire AI software or systems in enterprises in all economic sectors was through ready-to-use commercial AI software or systems (between 40 % and 59 %) and AI technologies developed or modified by external providers (between 26 % and 52 %). The exception was the information and communication sector. In that sector, most enterprises (55 %) developed their own AI software or systems, and 44 % modified open-source software or systems (Table 3).

Enterprises using AI technologies by type of acquisition and economic activity, EU, 2021
(% of enterprises using at least one AI technology)

	AI technologies were developed by own employees	AI technologies were commercial software or systems modified by own employees	AI technologies were open-source software or systems modified by own employees	AI technologies were commercial software or systems ready to use	AI technologies were developed or modified by external providers
Manufacturing	21	24	15	57	45
Electricity, gas, steam, air conditioning and water supply	26	29	22	49	49
Construction	14	19	10	59	32
Wholesale and retail trade; repair of motor vehicles and motorcycles	21	: (u)	18	52	43
Retail trade, except of motor vehicles and motorcycles	18	26	15	50	41
Transportation and storage	22	25	17	54	45
Accommodation	8	24	10	58	52
Information and communication	55	38	44	40	26
Real estate activities	: (u)	19	6	53	42
Professional, scientific and technical service activities	30	26	23	56	30
Administrative and support service activites	27	32	20	53	41

(:) data unreliable
Source: Eurostat (online data code: isoc_eb_ain2)

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Table 3: Enterprises using AI technologies by type of acquisition and economic activity, EU, 2021 (% of enterprises using at least one AI technology) Source: Eurostat (isoc_eb_ain2)

Source data for tables and graphs

- Use of AI in enterprises - tables and graphs

Data sources

Data presented in this article are based on the results of the 2021 survey on 'ICT usage and e-commerce in enterprises'. Statistics were obtained from the surveys conducted by National Statistical Authorities in the first months of the year. In 2021, 148 000 of the 1.5 million enterprises in the EU were surveyed. Of the 1.5 million enterprises, approximately 83 % were small enterprises, 14 % medium and 3 % large enterprises. Enterprises are broken down by size: small enterprises (10-49 employees and self-employed persons), medium (50-249 employees and self-employed persons) and large (250 or more employees and self-employed persons). Source data shown as ':' refer to data that are unavailable, unreliable, confidential or not applicable. Unreliable data are included in the calculation of European aggregates. Data presented in this article may differ from the data in the database on account of updates made after the data extractions used for this article. Data in the database are organised according to the survey year. The observation statistical unit is the enterprise, as defined in the Regulation (EC) No 696/1993 of 15 March 1993. The survey covered enterprises with at least 10 employees and self-employed persons. Economic activities correspond to the classification NACE Revision 2.The sectors covered are manufacturing, electricity, gas and steam, water supply, construction, wholesale and retail trades, repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities, information and communication, real estate, professional, scientific and technical activities, administrative and support activities and repair of computers and communication equipment.

Context

In 2019, the new European Commission President, Ursula von der Leyen, described how she wanted the EU to grasp the opportunities presented by the digital age. A Europe fit for the digital age is one of six Commission priorities for the period 2019-2024. Such a digital transformation is based on the premise that digital technologies and solutions should: open up new opportunities for businesses; boost the development of trustworthy technology; foster an open and democratic society; enable a vibrant and sustainable economy; help fight climate change. With this in mind, during February 2020 the European Commission adopted an overarching presentation of the Commission's ideas and actions for Shaping Europe's Digital Future , as well as specific proposals in relation to:

• A European strategy for data (COM(2020) 66 final) which seeks to promote the EU as a leading role model for a society empowered by data to make better decisions — in business and the public sector; and

• a White Paper on Artificial Intelligence — A European approach to excellence and trust (COM(2020) 65 final) which supports a regulatory and investment oriented approach with the twin objectives of promoting the uptake of artificial intelligence and addressing the risks associated with certain uses of this new technology.

In 2021, the Digital Compass for the EU's Digital Decade (COM(2021)118 final), set the EU's digital targets for 2030 evolving around four cardinal points: skills, digital transformation of businesses, secure and sustainable digital infrastructures, and digitalization of public services.

See also

- Cloud computing - statistics on the use by enterprises
- ICT specialists - statistics on hard-to-fill vacancies in enterprises
- E-commerce statistics
- E-business integration
- ICT security in enterprises
- Social media - statistics on the use by enterprises
- Digital economy and society statistics - enterprises
- Impact of COVID-19 on the use of ICT in enterprises

Main tables

- Digital economy and society

ICT usage in enterprises (isoc_e)

Database

- Digital economy and society

ICT usage in enterprises (isoc_e)

Dedicated section

- Digital economy and society

Methodology

- ICT usage and e-commerce in enterprises (ESMS metadata file — isoc_e_esms)

Legislation

- Regulation (EU) 2019/2152 of the European Parliament and of the Council of 27 November 2019 on European business statistics
- Regulation (EC) No 808/2004 of the European Parliament and of the Council of 21 April 2004 concerning Community statistics on the information society
- Regulation (EC) No 960/2008 of 30 September 2008 implementing Regulation (EC) No 808/2004 concerning Community statistics on the information society
- Regulation (EC) No 1023/2009 of 29 October 2009 implementing Regulation (EC) No 808/2004 concerning Community statistics on the information society
- Regulation (EU) No 821/2010 of 17 September 2010 implementing Regulation (EC) No 808/2004 concerning Community statistics on the information society
- Regulation (EU) No 937/2011 of 21 September 2011 implementing Regulation (EC) No 808/2004 concerning Community statistics on the information society
- Regulation (EU) No 1083/2012 of 19 November 2012 implementing Regulation (EC) No 808/2004 concerning Community statistics on the information society
- Regulation (EU) No 859/2013 of 5 September 2013 implementing Regulation (EC) No 808/2004 concerning Community statistics on the information society
- Regulation (EU) No 1196/2014 of 30 October 2014 implementing Regulation (EC) No 808/2004 concerning Community statistics on the information society
- Regulation (EU) 2015/2003 of 10 November 2015 implementing Regulation (EC) No 808/2004 concerning Community statistics on the information society
- Regulation (EU) 2016/2015 of 17 November 2016 implementing Regulation (EC) No 808/2004 concerning Community statistics on the information society
- Regulation (EU) 2017/1515 of 31 August 2017 implementing Regulation (EC) No 808/2004 concerning Community statistics on the information society
- Regulation (EU) 2018/1798 of 21 November 2018 implementing Regulation (EC) No 808/2004 of the European Parliament and of the Council concerning Community statistics on the information society for the reference year 2019
- Regulation (EU) 2019/1910 of 7 November 2019 implementing Regulation (EC) No 808/2004 of the European Parliament and of the Council concerning Community statistics on the information society for reference year 2020
- Regulation (EU) 2020/1030 of 15 July 2020 laying down the technical specifications of data requirements for the topic 'ICT usage and e-commerce' for the reference year 2021, pursuant to Regulation (EU) 2019/2152 of the European Parliament and of the Council
- Regulation (EU) 2021/1190 of 15 July 2021 laying down the technical specifications of data requirements for the topic 'ICT usage and e-commerce' for the reference year 2022 pursuant to Regulation (EU) 2019/2152 of the European Parliament and of the Council
- Regulation (EC) No 696/1993 of 15 March 1993 on the statistical units for the observation and analysis of the production system in the Community