

## **Documentation of statistics for ICT Use in Enterprises 2023**

## 1 Introduction

The purpose of the statistics is to shed light on the use of ICT in enterprises, including e-commerce and benefits/barriers to the use of ICT technologies. The survey is harmonized with the EU model questionnaire, which is used in most member states. The statistics form part of Statistics Denmark's focus on the information society. The survey has been carried out annually since 1998.

## 2 Statistical presentation

The statistics are published annually and describes the use of ICT in enterprises in Denmark. The following areas are covered: The prevalence and use of ICT, including ICT technologies and e-commerce. A considerable number of variables are replaced each year as a result of the development in user needs and new technology. The survey covers enterprises in the private, non-financial urban industries.

### 2.1 Data description

In 2022 there are new questions regarding 3D print technology, data analytics and quantum technology. Other questions are repeated after few years, e.g. the enterprises' use of digital business solutions (ERP and CRM software, RFID tags) and E-invoicing. Finally, some questions are included in the questionnaire every year, such as enterprises e-commerce sales, websites and ICT security. In the 2023 survey, the statistics cover the following main topics related to ICT usage and e-commerce in enterprises:

- Access to the internet
- Webpage
- Use of mobile apps
- Social Media
- IT skills
- IT security and security incidents
- Data types and ethics
- Use of business software
- Cloud computing
- Internet of Things
- 3D printing
- Data sharing and analysis
- Robotics
- Artificial intelligence
- Quantum technology
- Web sales

Limitation of the population to enterprises in the private, non-financial urban industries with at least 10 full-time employees is determined by EU regulation. In 2019 and 2021 the population also covers microenterprises with 5-9 employees. The following industries are included in the population: Manufacturing, construction, trade and transport etc., information and communication, other business services.

## **2.2 Classification system**

Survey results are reported by activity and size class. The applied activity nomenclature is Danish Industrial Classification 2007 (DB07), internationally NACE Rev.2. By activity groupings, Statistics Denmark's standard groupings are applied. For further information, see [Danish industrial classification](#).

In the StatBank, the size of the enterprise is defined by the number of full-time employees, divided into groups 10-49, 50-99, 100-249 and 250+ full-time employees - see tables ITAV3, ITAV4, ITAV9, ITAV12, ITAV13, ITAV15, ITAV16, ITAV17, ITAV18, ITAV19, ITAV20 and ITAV21. Information regarding microenterprises with 5-9 full-time employees (2019 and 2021) can be found in the tables ITAV10 and ITAV11.

## **2.3 Sector coverage**

The survey covers private, non-financial enterprises, excluding primary activities such as agriculture, forestry and fishing, mining and quarrying. The financial sector is only covered in the reference periods 2005-2010.

## **2.4 Statistical concepts and definitions**

**Use of 3D printing:** Use of 3D printing - also called additive layer manufacturing - refers to the use of special printers either by the enterprise itself or the use of 3D printing services provided by other enterprises for the creation of three-dimensional physical objects using digital technology.

**Cloud Computing:** Cloud computing refers to ICT services that are used over the internet to access software, computing power, storage capacity etc., where the services have all of the following characteristics: i) are delivered from servers or service providers, ii) can be easily scaled up or down, iii) can be used on-demand by the user, at least after the initial set-up, iv) are paid for, either per user, by capacity used, or they are pre-paid.

**E-commerce sale :** E-commerce sale is the sale or purchase of goods or services conducted over the internet or other computer networks. Orders placed by e-mail are not included. The payment and delivery of the goods or services do not have to be conducted online. E-commerce covers: i) web e-commerce, i.e. orders made at an online webshop or via web forms on the internet or extranet, and ii) EDI e-commerce, i.e. orders placed through electronic transmission of EDI-type business messages allowing for automatic processing and without the individual message or order being manually typed. EDI e-commerce in practice is business-to-business e-commerce.

**GPS and satellite-based services:** Satellite-based services include the use of signals and data from satellites. E.g. navigation signals, positioning signals, GPS signals, satellite images or communications outside internet coverage through satellites. GPS is included only in cases where the use is integrated with the enterprise's ICT-systems, or where the data generated is subsequently processed further (e.g. for fleet management or driving records).

**Internet of Things (IoT):** The Internet of Things (IoT) refers to interconnected devices or systems, often called "smart" devices or systems. They collect and exchange data and can be monitored or remotely controlled via the Internet. Examples of usage are: i) Smart thermostats, smart lamps or smart meters. ii) Radio Frequency Identification (RFID) or Internet Protocol (IP) tags applied or incorporated into a product or an object in order to track them. iii) Sensors for tracking the movement or maintenance needs of vehicles monitored over the Internet.

**Machine learning and artificial intelligence:** Machine learning and artificial intelligence includes the use of computer software, which with a starting point in data "thinks", analyzes, problem solves and forms connections in patterns, for instance images, audio and text. It may include computer generated annual report, chat bots or automated marketing.

**Radio Frequency Identification (RFID) technologies:** The use of Radio Frequency identification technologies (RFID) - refers to an automated identification method to store and remotely retrieve data using RFID tags or transponders. - includes the use of Near Field Communication (NFC) connectivity standard. An RFID tag is a device that can be applied to or incorporated into a product or an object and transmits data via radio waves.

**Use of robotics:** An industrial robot is an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications. A service robot is a machine that has a degree of autonomy and is able to operate in complex and dynamic environment that may require interaction with persons, objects or other devices, excluding its use in industrial automation applications. Software robots (computer programs) is out of the scope in the survey.

## **2.5 Statistical unit**

Enterprise.

## **2.6 Statistical population**

The population is private, non-financial urban industries.

## **2.7 Reference area**

Denmark.

## **2.8 Time coverage**

1998-

## **2.9 Base period**

Not relevant for this statistics.

## **2.10 Unit of measure**

Percent of enterprises and percent of revenue.

In the StatBank table ITAV3, ITAV4, ITAV9, ITAV10, ITAV11, ITAV12, ITAV15, ITAV16, ITAV17, ITAV18, ITAV19, ITAV20 og ITAV21. are specified the *percentage of enterprises* that either have answered "Yes" or "No" to a question (categorical variable). There are enterprises that have not answered all questions, so the sum of the categories "Yes" and "No" does not total up to 100 percent.

In the StatBank table ITAV13, enterprises e-sales and e-purchases are stated as *percentage of the year's turnover and total purchases*, respectively. Enterprises annual turnover is obtained from the latest version of the Business Register. The enterprises annual total purchase is calculated by the sum of domestic purchases and imports in the latest publication of the General Enterprise Statistics.

## **2.11 Reference period**

The reference period is January of the same year (for some variables the previous calendar year).

## **2.12 Frequency of dissemination**

The survey is published annually.

## 2.13 Legal acts and other agreements

The Act on Statistics Denmark (Lov om Danmarks Statistik), cf. Order no. 15 of 12 January 1972, as amended by Act no. 386 of 13 June 1990, Act no. 1025 of 19 December 1992, Act no. 295 of 2 May 2000 and Act no. 610 of 30 2018.

EU Commission Regulation (EC) No 960/2008. From 2006 the survey is a part of the EU regulation on statistics on the Information Society (EC regulation No. 808/2004). The regulation is extended in Regulation (EC) No 2022/1344.

## 2.14 Cost and burden

The reporting burden is set at 1,547 hours for 2,312 enterprises with 10 or more persons employed that have answered the question concerning time consumption (total sample was 4,557 enterprises). It gives an average time per enterprise about 40 minutes.

[ICT usage and e-commerce in enterprises 2023](#).

## 2.15 Comment

Find information on the subject website about [the use of ICT in enterprises](#). Additional information can be obtained from Statistics Denmark.

# 3 Statistical processing

The statistics is annual and questionnaire-based. Validation includes consistency checks built into the digital form, combined with subsequent checks and possible re-contact to reporting enterprises. The published results are grossed up to population level. Stratification is based on activity and enterprise size class.

## 3.1 Source data

The survey covers enterprises in the private, non-financial urban industries with at least 10 full-time employees. In 2019 and 2021 the population also covers microenterprises with 5-9 full-time employees. The survey is based on questionnaire information from a sample of enterprises. The sample is stratified by industry groups and size (defined by number of full-time employees).

Information is [reported digitally](#).

The survey covers enterprises in the private, non-financial urban industries with at least 10 full-time employees. The sample included 4,667 enterprises, and of these 3,523 units also extended to the 2022 sample, i.e. 75,5 percent of the sample in 2023 are repeats from last year. Net sample included 4,632 enterprises, and there were 4,557 responses. In the net sample, enterprises that are closed or bankrupt are deducted.

For the calculation of E-sales share of total revenue, information from the Business Register (ESR) is used. Enterprises e-purchases are calculated as a percentage of total purchases. Information about total purchase is obtained from General Enterprise Statistics.

### **3.2 Frequency of data collection**

Yearly.

### **3.3 Data collection**

Digital reporting via the form. The form can be seen [here](#).

### **3.4 Data validation**

A number of checks and validation mechanisms as well as reporting aides for the reporter's understanding of the questionnaire are built into the digital form. This includes among other things checks on sum totals of quantitative fields (e.g. that reported percentages add to 100 per cent) as well as filter and routing mechanisms (e.g. so that information cannot be reported in fields, where the enterprise should not provide any information).

Once data is received by Statistics Denmark a number of additional checks are performed. These are performed in part at macro level, where e.g. the results for a given variable for an activity group or size class are compared to the ones from the previous survey period. Further validation is carried out at micro level, i.e. at the level of the individual enterprise. This includes e.g. comparison of the reported e-commerce figures with those reported previously. In both macro and micro level validation background information from Statistics Denmark's Statistical Business Register is used. Finally, in addition to this, checks involve identifying outliers, i.e. reported data with extreme values, for certain variables. In some cases validation results in recontacting the reporting enterprise for a clarification of the reported data.

### **3.5 Data compilation**

The published results are raised to the level of the population.

A stratified random sampling is used on the basis of the activity of the enterprise and the number of employees. By grossing up a weighting and calibration using regression techniques is applied to the weight of the individual enterprise. Imputation is not used, neither in the case of partially lacking information from the enterprise (item non-response), nor in the case of completely lacking reporting from an enterprise (unit non-response). The latter, instead, is handling through reweighting as part of the grossing up procedure.

### **3.6 Adjustment**

No further corrections are undertaken than those already described under validation and treatment.

## **4 Relevance**

The results are used by ministries, organizations, researchers and journalists etc., as a basis for political interventions, analyses, articles and research projects etc. A considerable number of variables are replaced each year as a result of the development in user needs and the need to measure new technology. The on-going development of the survey contents takes place in close dialogue with national stakeholders as well as in the European Union fora. The statistics is co-funded by the European Union.

#### **4.1 User Needs**

In general there is substantial interest in the survey results from ministries, organizations, researchers and journalists etc. A considerable number of variables are replaced each year as a result of the development in user needs and the need to measure new technology. The statistics is co-funded by the European Union.

#### **4.2 User Satisfaction**

Dialogue with national stakeholders takes place, among other things, in Statistics Denmark's Contact Committee for the digital society. The on-going development of the survey contents takes place in close dialogue with national stakeholders as well as in EU forums.

#### **4.3 Data completeness rate**

Requirements in regulation and guidelines are met.

### **5 Accuracy and reliability**

The results from the survey for enterprises with at least 10 full-time employees are based on data from 4,557 enterprises from a total population of 18,213 enterprises. The survey is sample based and consequently there is some uncertainty in the results in the form of random variation from the branch and enterprise size. Every year uncertainty calculations are produced, and these show that the sampling uncertainty is limited.

#### **5.1 Overall accuracy**

The total uncertainty concerns primary unit and item non-response - both of which only to a limited extent affect the uncertainty of the survey results. The enterprises' responses were collected from January to July 2023. The response rate for the survey is very high (approx. 98 per cent), but during COVID-19 the response rate was slightly lower (96-97 per cent). The lower response rate only affected the results to a very limited extent.

## 5.2 Sampling error

The results are based on data from 4,557 enterprises from a total population of 18,213 enterprises with 10 or more persons full-time employed. The overall response rate is 98 percent.

Every year uncertainty calculations are produced, and these show that the sampling uncertainty is limited. Examples of variables from the survey 2023, with estimated share of enterprises and associated 95 percent confidence interval, lower and upper:

- Enterprises with websales (total): 37 pct. (35; 39)
- Enterprises using cloud computing (total): 69 pct. (67; 71)
- Enterprises using ERP: 67 pct. (65; 69)

Put differently, the above implies that the share of enterprises with websale, with a probability of 95 percent, is between the lower and upper share in brackets above (35; 39), but that the estimated share in the statistics is the percentage prior to the brackets (37 percent).

For categorical variables in the 2023 survey published results, the absolute sampling error is at most 2%. with a 95 percent. statistical confidence interval for the entire population.

Uncertainty is higher when breaking down by activity or size class. For categorical variables, results for subgroups (main branch crossing with enterprise size) are published in the StatBank if the absolute uncertainty is below 7.5 percent associated by 95 percent confidence interval.

## 5.3 Non-sampling error

Other uncertainty relates to unit and item non-response, and this is in both cases limited in scale.

## 5.4 Quality management

Statistics Denmark follows the recommendations on organisation and management of quality given in the Code of Practice for European Statistics (CoP) and the implementation guidelines given in the Quality Assurance Framework of the European Statistical System (QAF). A Working Group on Quality and a central quality assurance function have been established to continuously carry through control of products and processes.

## 5.5 Quality assurance

Statistics Denmark follows the principles in the Code of Practice for European Statistics (CoP) and uses the Quality Assurance Framework of the European Statistical System (QAF) for the implementation of the principles. This involves continuous decentralized and central control of products and processes based on documentation following international standards. The central quality assurance function reports to the Working Group on Quality. Reports include suggestions for improvement that are assessed, decided and subsequently implemented.

## **5.6 Quality assessment**

The population covers private enterprises with 10 or more persons employed. The population covers private, non-financial enterprises (the financial sector is covered in the reference periods 2005 to 2010).

The net sample in 2022 consists of 4,325 enterprises from a total population of 18,213 formed the sample for the survey of enterprises with 10 or more persons employed. The sample is stratified by activity and size class. The response rate for the survey is very high (approx. 98 per cent), but during COVID-19 the response rate was slightly lower (96-97 per cent). The lower response rate only affected the results to a very limited extent.

The survey is questionnaire based, and data is collected by digital reporting through <http://www.virk.dk>. Validation comprises macro and micro validation and some extent of recontact with enterprises.

In the survey design, each observation will represent more elements in the population. The weights assigned to each observation are calculated using generalising regression estimates.

## **5.7 Data revision - policy**

Statistics Denmark revises published figures in accordance with the [Revision Policy for Statistics Denmark](#). The common procedures and principles of the Revision Policy are for some statistics supplemented by a specific revision practice.

## **5.8 Data revision practice**

Not relevant for this statistics.

## **6 Timeliness and punctuality**

The statistics are published 7 months after the end of the reference period. No preliminary figures are published. Results are published in September, where the reference period is January (and, for some variables, the previous calendar year).

### **6.1 Timeliness and time lag - final results**

The statistics are published 7 months after the end of the reference period. No preliminary figures are published. Results are published in September, where the reference period is January (and, for some variables, the previous calendar year).

### **6.2 Punctuality**

The statistics are usually published without delay in relation to the scheduled date. This also applies to data transmissions to Eurostat.

## **7 Comparability**

The survey is harmonized with the EU model questionnaire, which is used in most member states. A large number of questions in the survey are replaced annually, so there is not a continuous time series for all the results.

### **7.1 Comparability - geographical**

The survey is harmonized with the EU model questionnaire, which is used in most member states, and the results are therefore generally comparable.

### **7.2 Comparability over time**

By comparisons over time, the following changes should be taken into account. The StatBank, have results from 2004 onwards for enterprises with at least 10 full-time employees.

Enterprise size classes covered in the survey over time

- 2023: 10+ employees
- 2022: 10+ employees
- 2021: 10+ employees and 5-9 employees (enterprises with 5-9 employees received a reduced version of the questionnaire)
- 2020: 10+ employees
- 2019: 10+ employees and 5-9 employees (enterprises with 5-9 employees received a reduced version of the questionnaire)
- 2018: 10+ employees
- 2017: 10+ employees
- 2016: 10+ employees and 5-9 employees
- 2004-2015: 10+ employees
- 2000-2002: 5+ employees
- 1999: 10+ employees
- 1998: 20+ employees
- Change in industry coverage: From 2021 veterinarians are included.
- Notable changes in the industry coverage. The financial sector is only included in 2005-2010.

*Weighting results:* The published results in 1998 and 1999 were not raised to the total population at the publishing. Figures from 1999 have subsequently been raised for later publications.

### **7.3 Coherence - cross domain**

Statistics Denmark also produces statistics on the ICT usage by households and individuals.

## **7.4 Coherence - internal**

A number of checks and validation mechanisms as well as reporting aides for the reporter's understanding of the questionnaire are built into the digital form. This includes among other things checks on sum totals of quantitative fields (e.g. that reported percentages add to 100 per cent) as well as filter and routing mechanisms (e.g. so that information cannot be reported in fields, where the enterprise should not provide any information).

## **8 Accessibility and clarity**

*News from Statistics Denmark* and the main results are available in Danish on Statistics Denmark's homepage at the address [Statistics Denmark's homepage](#).

### **8.1 Release calendar**

The publication date appears in the release calendar. The date is confirmed in the weeks before.

### **8.3 User access**

Statistics are always published at 8:00 a.m. at the day announced in the release calendar. No one outside of Statistics Denmark can access the statistics before they are published.

### **8.2 Release calendar access**

The Release Calendar can be accessed on our English website: [Release Calendar](#).

### **8.4 News release**

Most recent publications can be found at [Most recent publications](#).

### **8.5 Publications**

No publications have been scheduled.

## 8.6 On-line database

The statistics are published in the StatBank under the subjects in the following tables:

- [ITAV3](#): Enterprises access to ICT skills
- [ITAV4](#): Enterprises use of Web-sites and social media
- [ITAV9](#): Enterprises access to the internet
- [ITAV10](#): ICT usage in enterprises (5-9 employees)
- [ITAV11](#): Enterprises e-commerce (5-9 employees)
- [ITAV12](#): Enterprises e-commerce
- [ITAV13](#): Enterprises turnover due to e-commerce
- [ITAV15](#): Enterprises use of ICT security
- [ITAV16](#): Enterprises use of cloud computing
- [ITAV17](#): Enterprises use of 3D print
- [ITAV18](#): Enterprises analysis of Big data
- [ITAV19](#): Enterprises use of robot technology and artificial intelligence
- [ITAV20](#): Enterprises use of satellites and Internet of Things
- [ITAV21](#): Enterprises use of information sharing and invoicing

## 8.7 Micro-data access

The basic material (questionnaires and database) is stored for a number of years. Access to anonymised micro data may be granted under the rules for research access.

## 8.8 Other

Results are transmitted annually to Eurostat.

## 8.9 Confidentiality - policy

For a description of Statistics Denmark's policy on confidentiality, see (<https://dst.dk/Site/Dst/SingleFiles/GetArchiveFile.aspx?fi=formid&fo=datafortrolighed&ext={2}>).

## 8.10 Confidentiality - data treatment

In connection to publication and delivery of customized statistics, a so-called confidentiality test of data is made. The confidentiality test is made on the basis of two criteria:

1. The number criteria: If one data cell contains less than 3 observations (enterprises) employment and financial information can not be published
2. The dominance criteria: If one or two observations (enterprises) contained in one data cell, alone or together constitute a certain percentage of the total turnover of the cell, the turnover and other financial information for this group can not be published.

## 8.11 Documentation on methodology

More detailed documentation about the methodology is available in the report from the survey in 2018 (in Danish) *Danske virksomheder er i EU's digitale top* (<https://www.dst.dk/da/Statistik/Analyser/visanalyse?cid=32277>).

## **8.12 Quality documentation**

Results from the quality evaluation of products and selected processes are available in detail for each statistics and in summary reports for the Working Group on Quality.

## **9 Contact**

The administrative placement of this statistics is in the division of Science, Technology and Culture. The person responsible is Anton Erenbjerg, tel. +45 2014 5790, e-mail: ael@dst.dk

### **9.1 Contact organisation**

Statistics Denmark

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