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Approaching the challenges with the new data eco-system

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Challenges of the new data eco-system

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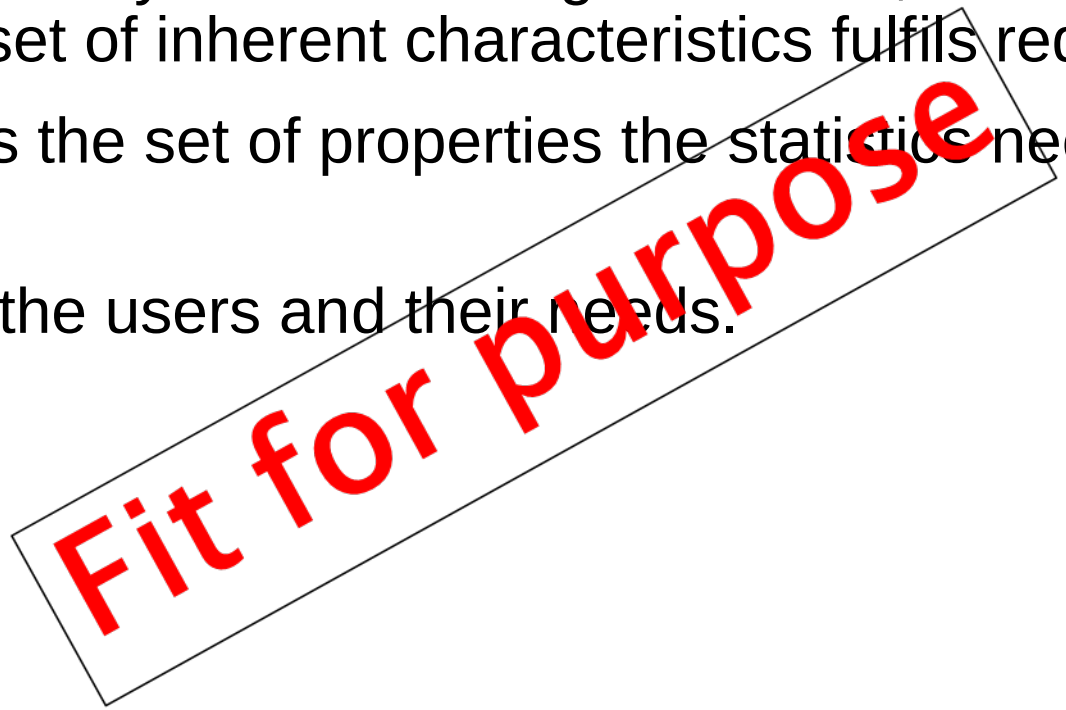
Examples From Denmark

- Long tradition of using administrative data sources for official statistics.
- This presentation will elaborate on:
    - how the Danish statistical system relies on administrative sources and
    - how this is also a base for exploring new data sources and
    - what is done to ensure quality in official statistics in the new data eco-system.

Quality in statistics

- ISO, an international body for formulating standards, has defined quality as: “Degree to which a set of inherent characteristics fulfils requirements”.
- Quality in statistics is the set of properties the statistics needs to have to fulfil the users’ needs.
- Our starting point is the users and their needs.



Administrative data

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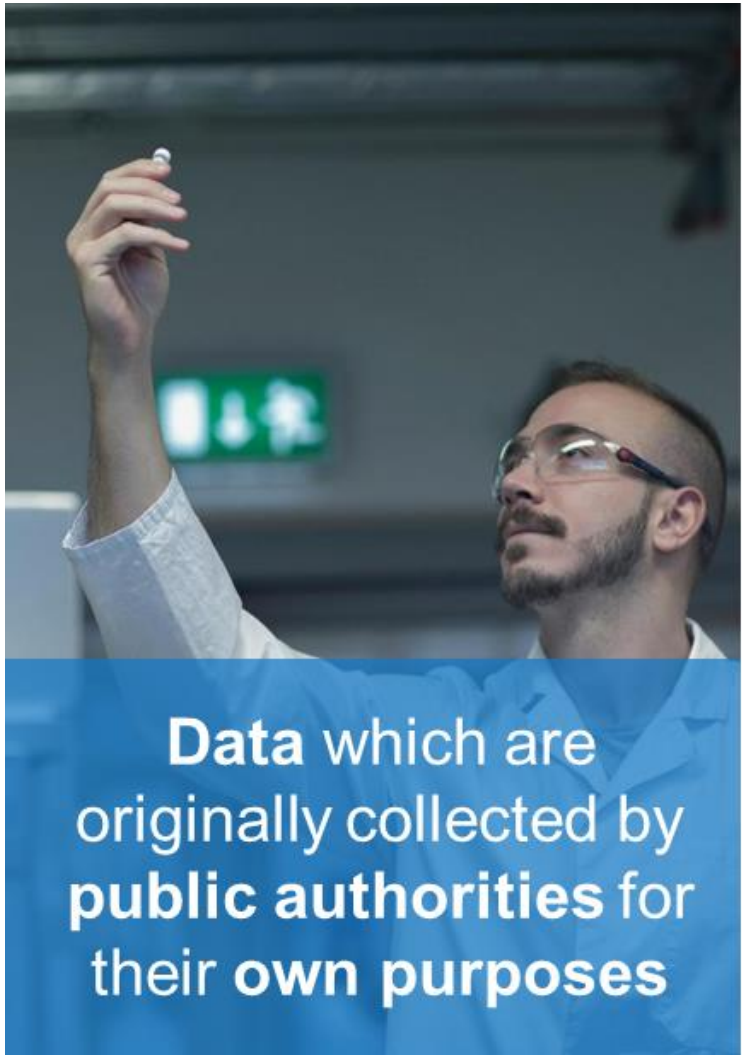

Data which are originally collected by **public authorities** for their **own purposes**

Usually organised and structured in **administrative registers**

Administrative registers are **a valuable asset** also for producing statistics

Data flow from data owners to end-users

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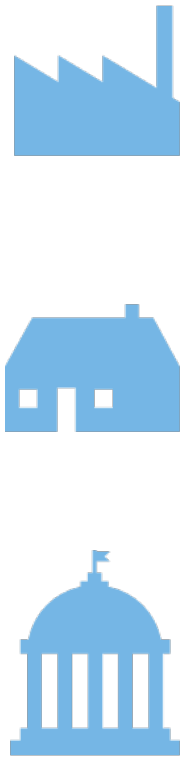

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Data are collected in registers as by-products of administrative routines

5 & 6

Producing statistics

Creating knowledge

7

Disseminating statistics to users in Society

Statistical information system

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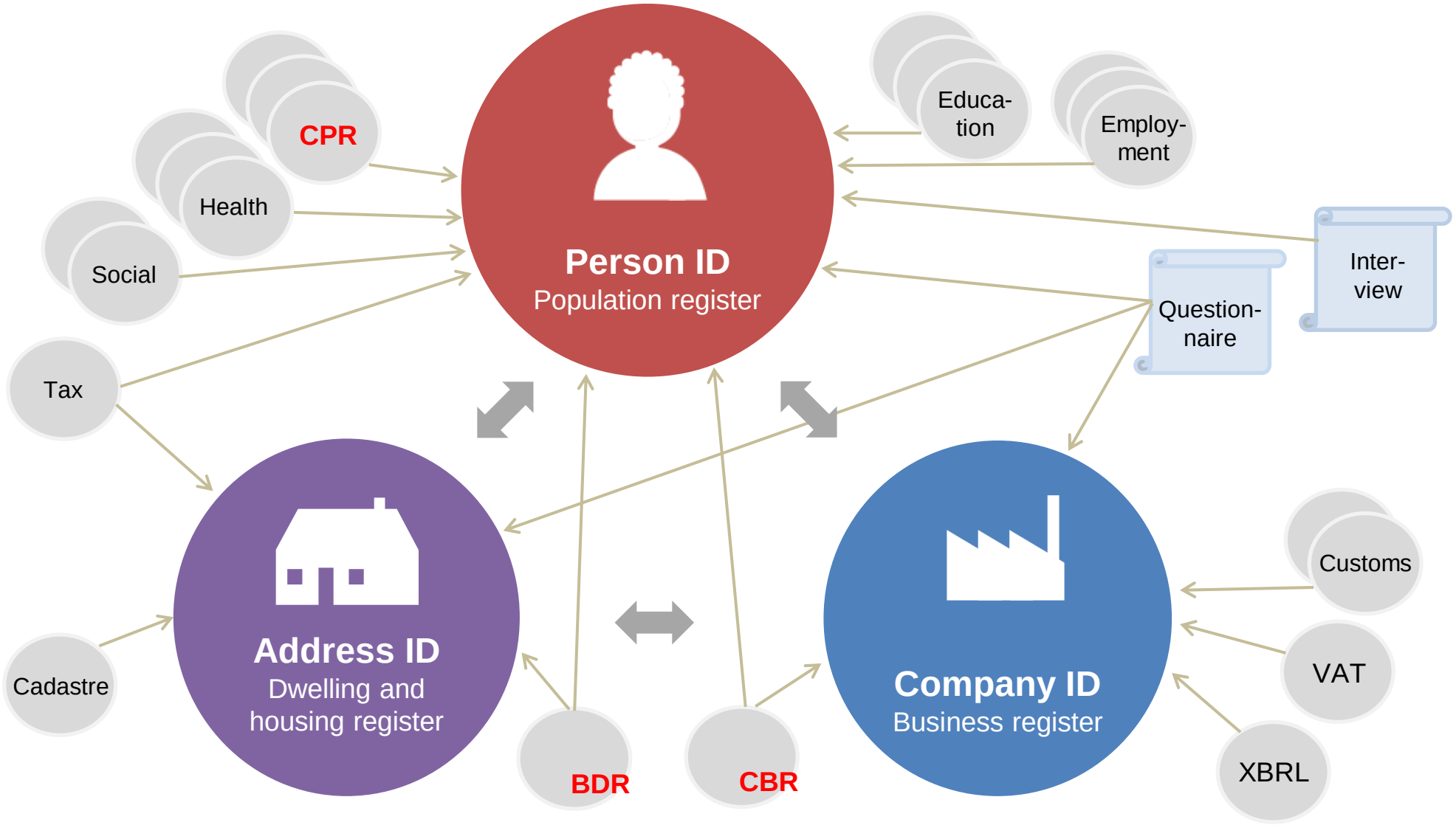

Examples of exploring data sources

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Administrative data

- Life Lines is an example of exploring existing administrative sources for new uses
- Networks of opportunities another example exploring existing administrative sources

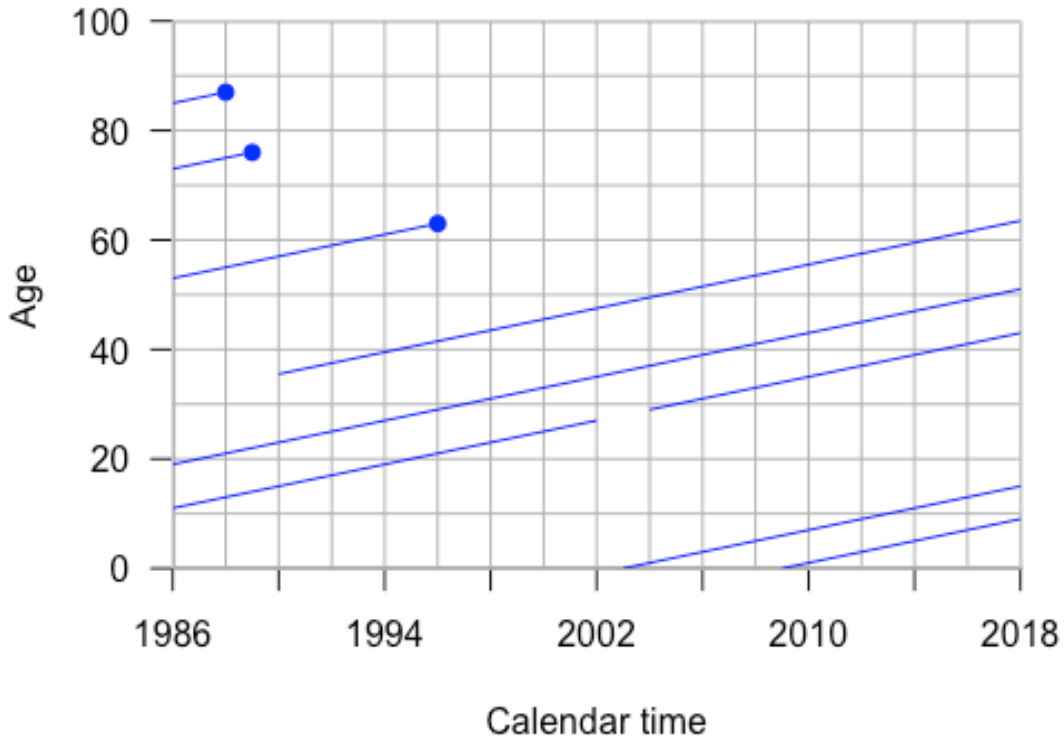
New data sources

- The use of scanner data for price statistics has been in regular use for many years
- AIS position data for ships is in use for experimental statistics on port calls
- Data from smart-meters on use of electricity is being explored for several uses.

Examples – use of admin data - population

Life-lines

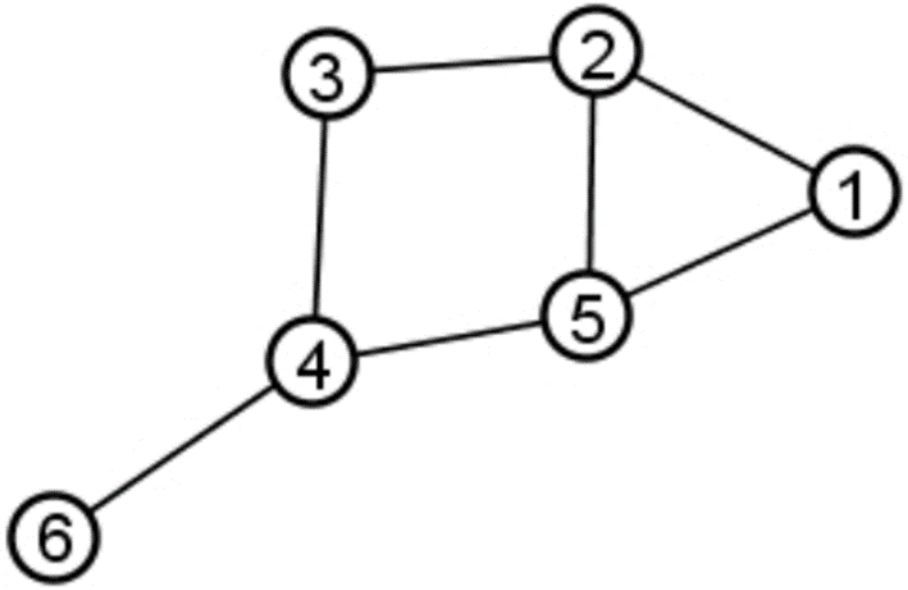
- The longitudinal Register (Life lines) is updated annually and shows the individuals that have been part of the Danish population through their life courses.
- Based on the population statistics register: all persons in Denmark from 1986 to 2021 plus an extraction from the CPR (Central Person register) from 1968.
- One line for each person's presence in the population, e.g. as a period from birth to death or from the person's immigration to emigration/death
- The purpose: form a population based on life lines, e.g. extraction of cohort, period, age, length of life line, etc.



Examples - use of Life Lines for networks

Network of opportunities

- Based on Life-Lines
- Networks composed of
- Nodes (individuals)
- Edges (relations between individuals)
- Degree (how many relations one individual has – edges per node)
- Statistics on number of family members, colleagues, class mates etc.
- Segregation (how many one potentially knows that ha a university degree, two vacation homes, a mother from Norway etc.)
- How something can spread through a network (sickness, education, employment etc.)



Example – networks - descriptives

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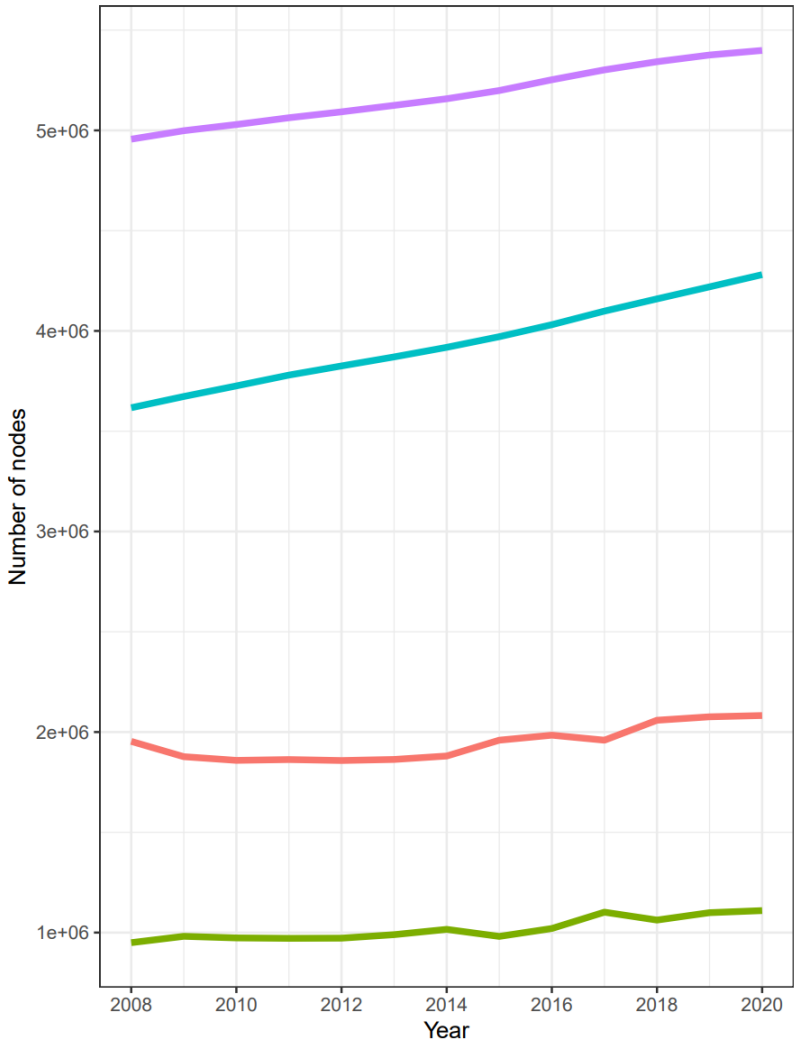
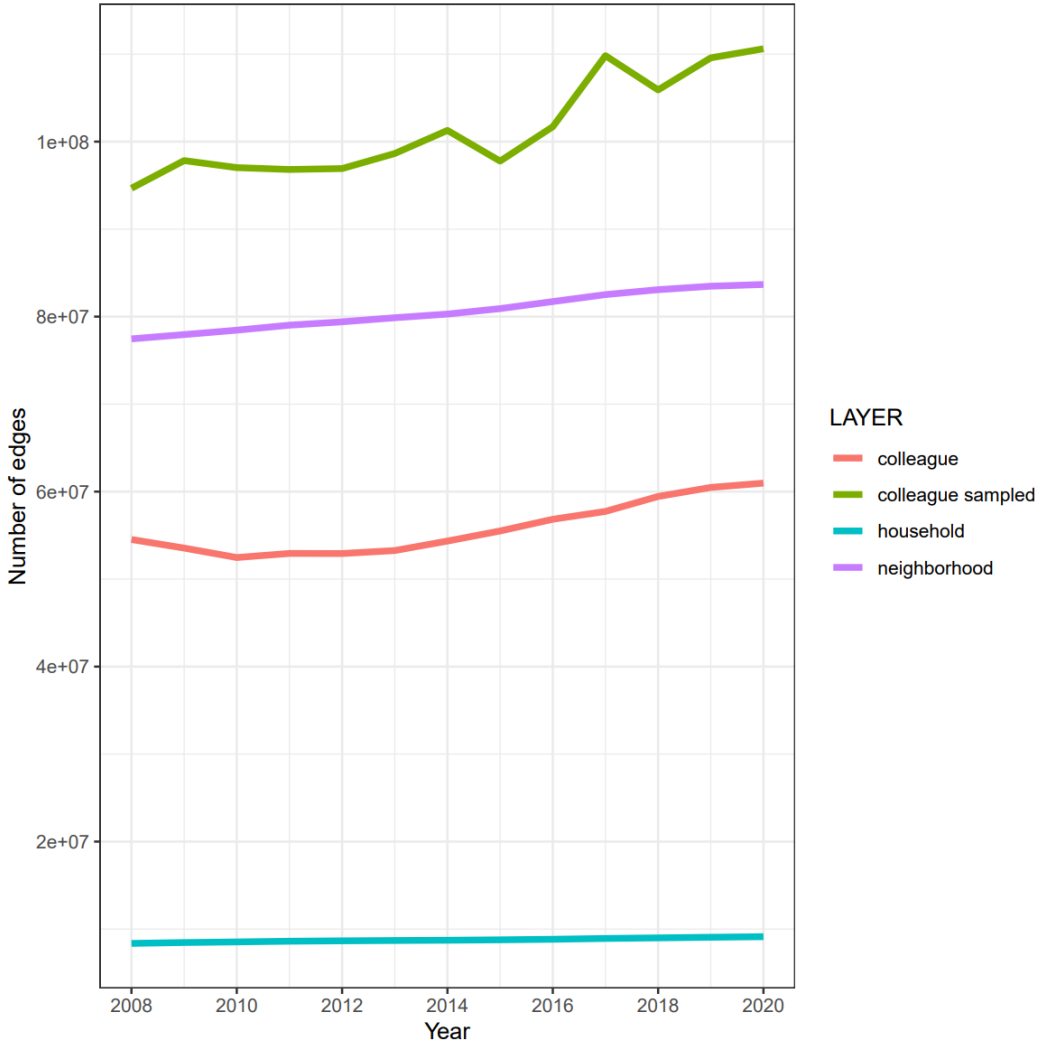
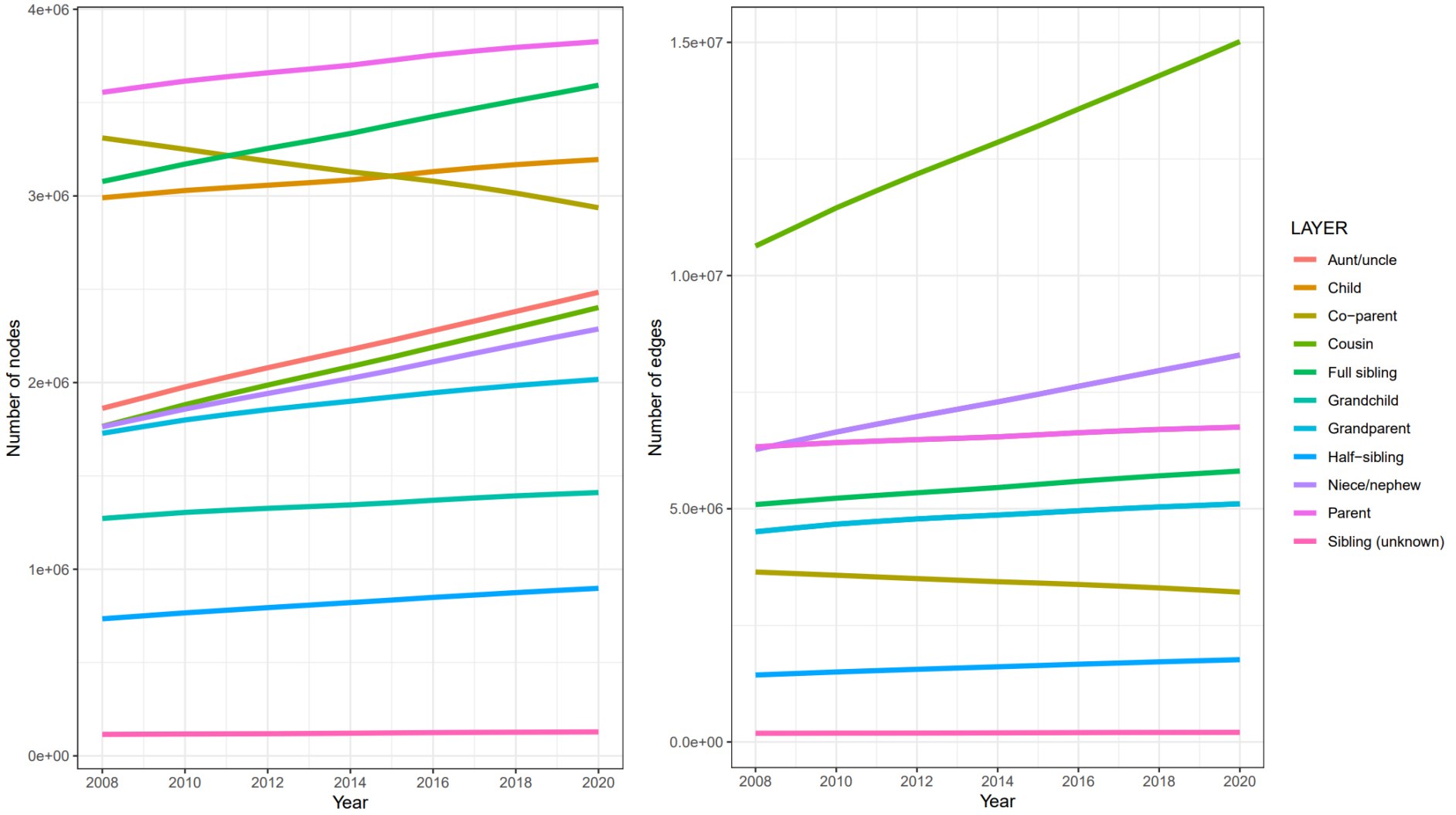
Descriptives





Example – networks

Family



Example – use of electricity data

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What we have

- Database registry of construction projects
- Access to smart-meter electricity data on address level
- Machine learning estimation model correcting delay
- Quarterly statistics

- Issues
  - Late and incomplete registry regarding projects

New approach

- Combining electricity data with data about known construction projects
- Exploring patterns of interest e.g. identifying construction phases

- Pilot project
  - Find a sample project and follow the path through the registry

Example – use of electricity data

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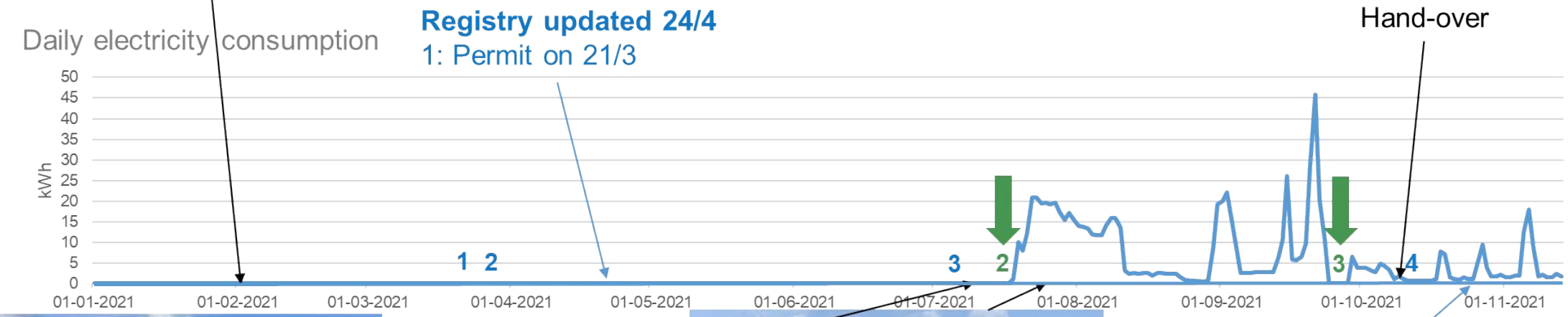
Smart-meter data: available with 8 days delay

New agreement from 15/06 appears in July

Use of electricity begins on 18/7

Purchase

Hand-over



Registry updated 24/4
1: Permit on 21/3

Registry updated 24/10
2: Commencing on 31/3,
3: Completion on 4/7 and
4: Use permit on 10/10

Example - Future work - electricity data

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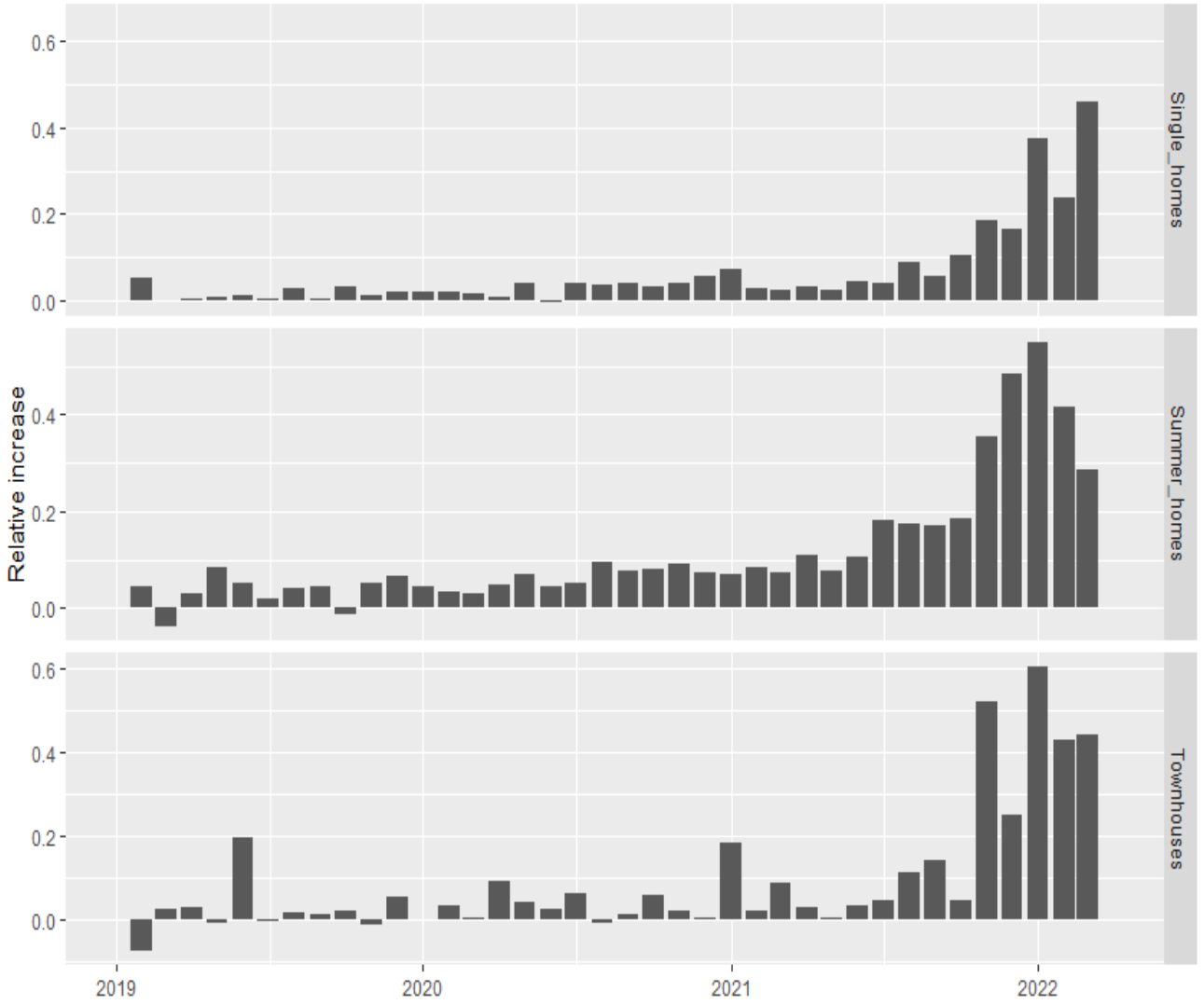
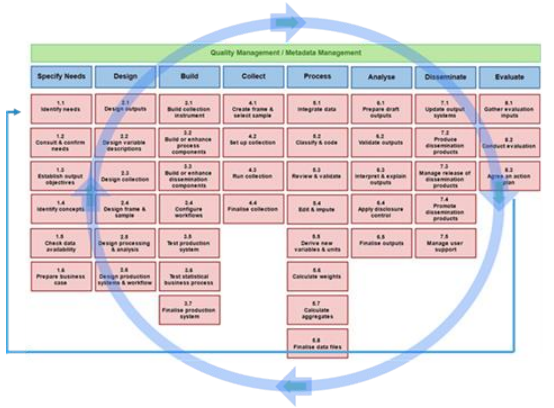
- Immediate potential
  - Using electricity data as proxy
  - Development of new indicator
  - Now-casting statistic
  - Pattern recognition for identifying more projects – data science lab
- Other uses of smart-meter data
  - Charging of electric cars
  - Identifying empty dwelling
    - Assessing use of summer homes
  - Forecasting bankruptcies



How we ensure quality

- Cooperation with data owners
- Cooperation with data providers (e.g. government agencies, municipalities, educational institutions etc.)
- Methods unit in Statistics Denmark
    - Sample selection
    - Standardised and modernised error detection
    - Other methodological issues
- Quality unit in Statistics Denmark
    - Quality assurance of documentation of statistics (quality reports)
    - Quality reviews
    - Standardisation – e.g. the process model (GSBPM)
    - Coherent metadata system
- Data science lab in statistics Denmark
    - Exploring existing data sources
    - Exploring new data sources
    - Exploring new methodology



Statistical processes (GSBPM 5.1)

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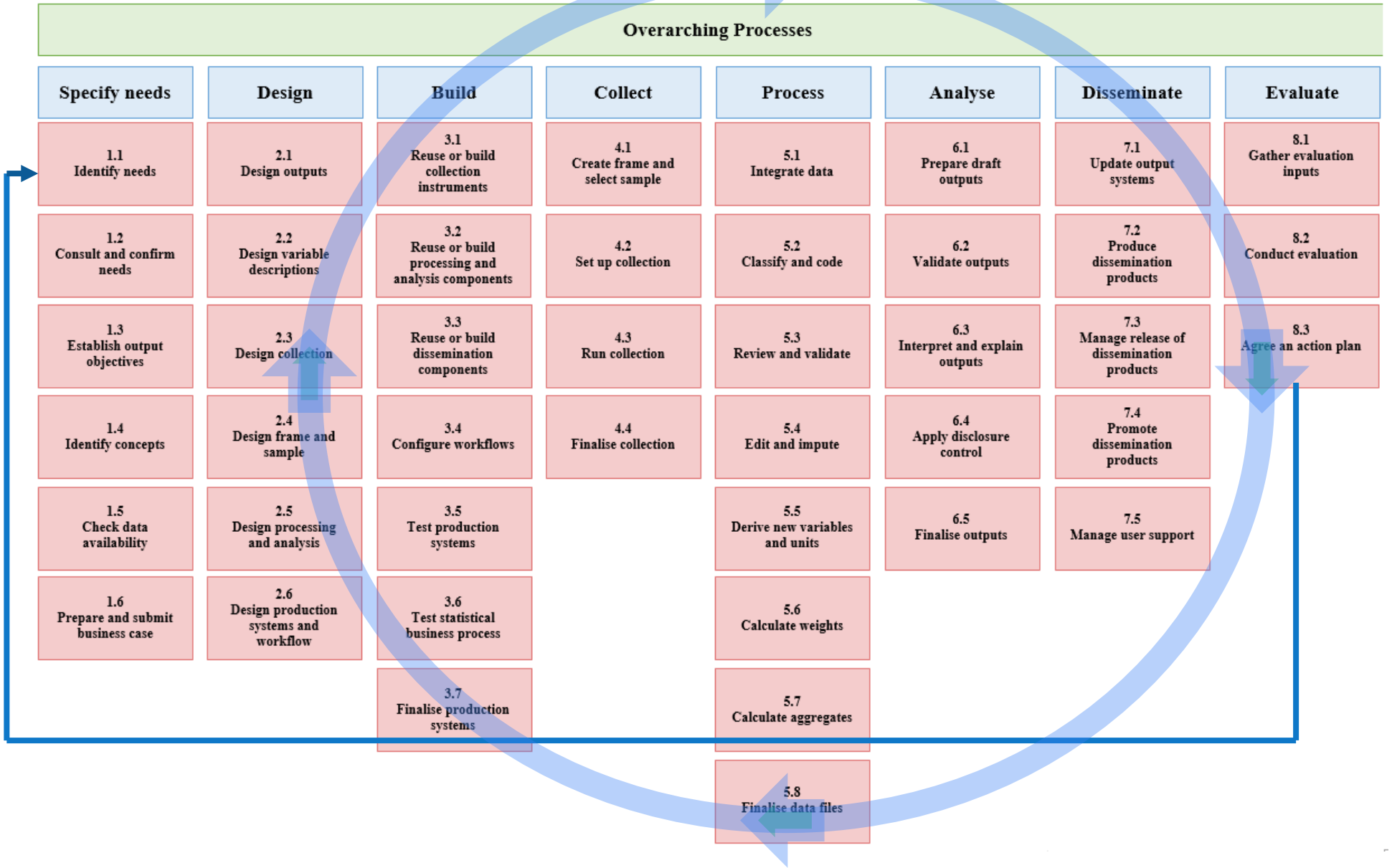
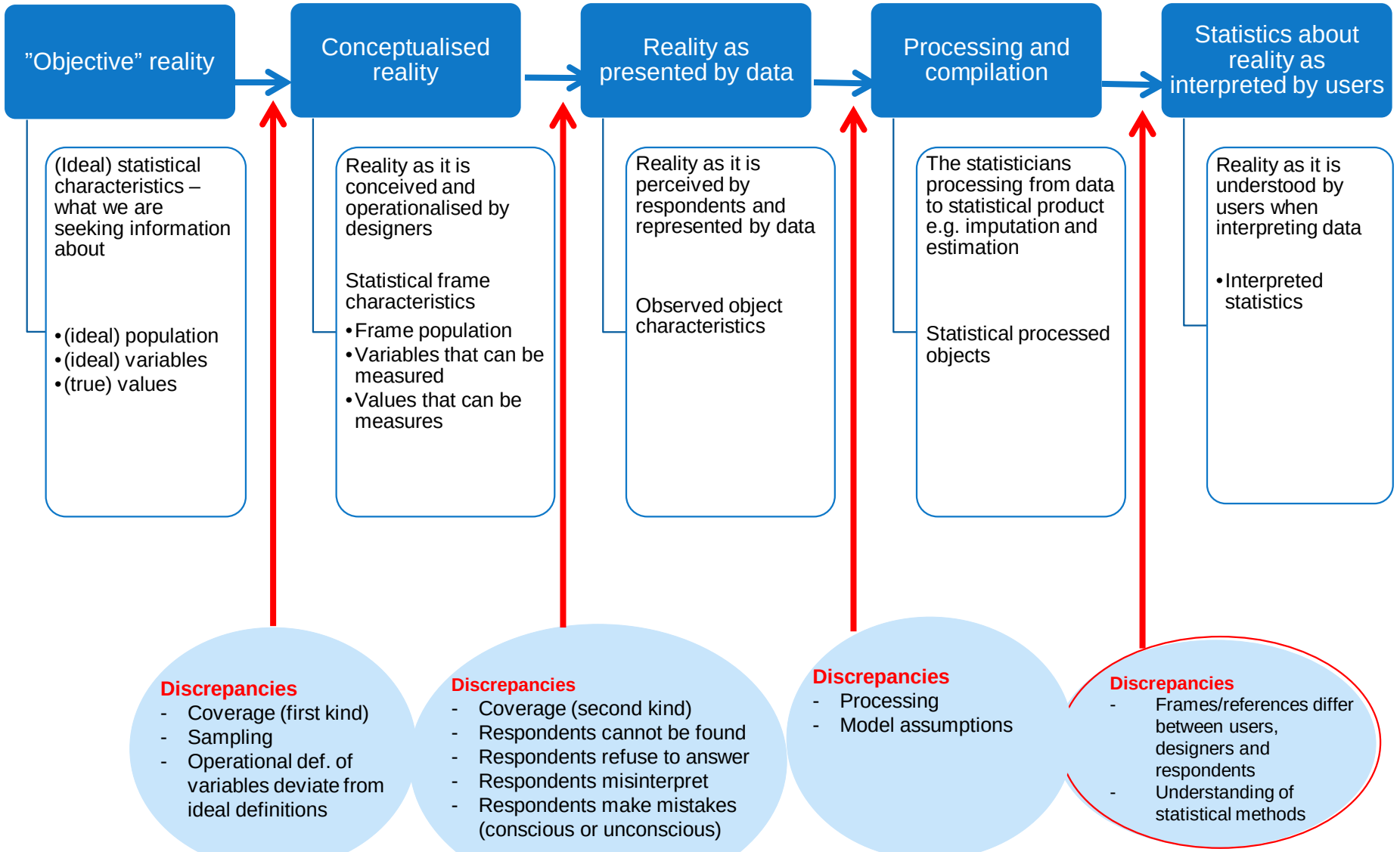


Production of statistics



Two types of metadata

Structural metadata

- Used to identify statistical data
- Headlines, variable names, unit of measure, reference time etc.
- Must go together with statistical data
- Impossible to interpret statistics without it

Reference metadata

- Describes content, statistical processing, relevance etc.
- Can be detached from the statistical output
- Quality Reports is a type of reference metadata
- …so is methodological metadata

Statistics without metadata

2 881 620
2 908 337

2 868 172
2 976 785

…with structural metadata

Population	
All Denmark	2018Q3
Men	2 881 620
Women	2 908 337
Unit : number	

Real estate market value	
One-family houses	2016
Brøndby	2 868 172
Vallensbæk	2 976 785
Unit : Average Market value (DKK)	

…and reference metadata

Population	
All Denmark	2018Q3
Men	2 881 620
Women	2 908 337
Unit : number	

Real estate market va	
One-family houses	
Brøndby	
Vallensbæk	
Unit : Average Market value	

Documentation of statistics - content

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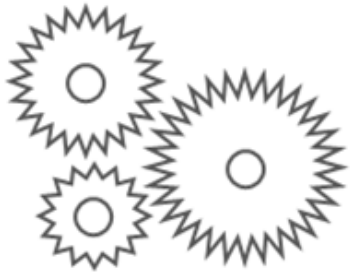
Introduction 	Statistical presentation 	Statistical processing 	Relevance 
Accuracy and reliability 	Timeliness and punctuality 	Comparability 	Accessibility and clarity 

User profiles

- General population
  - Everyone in contact with SD through the flow of news
  - Mr and Mrs Smith
  - People interested in social affairs
- Specially interested parties
  - Actively searching for facts
  - No special qualification
  - E.g. journalists, students and politicians
- Professional users
  - Systematically use figures from SD
  - Can combine and extract data
  - E.g. specialists, trade and business press and public servants
- Analysts
  - Awareness of statistics
  - Can extract and process complex data
  - E.g. researchers, large-scale consumers and data analysis units

← Documentation of statistics

Climate footprint (experimental statistics)

- Statistical presentation
- Statistical processing
- Relevance
- Accuracy and reliability
- Timeliness and punctuality
- Comparability
- Accessibility and clarity

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Climate footprint (experimental statistics)

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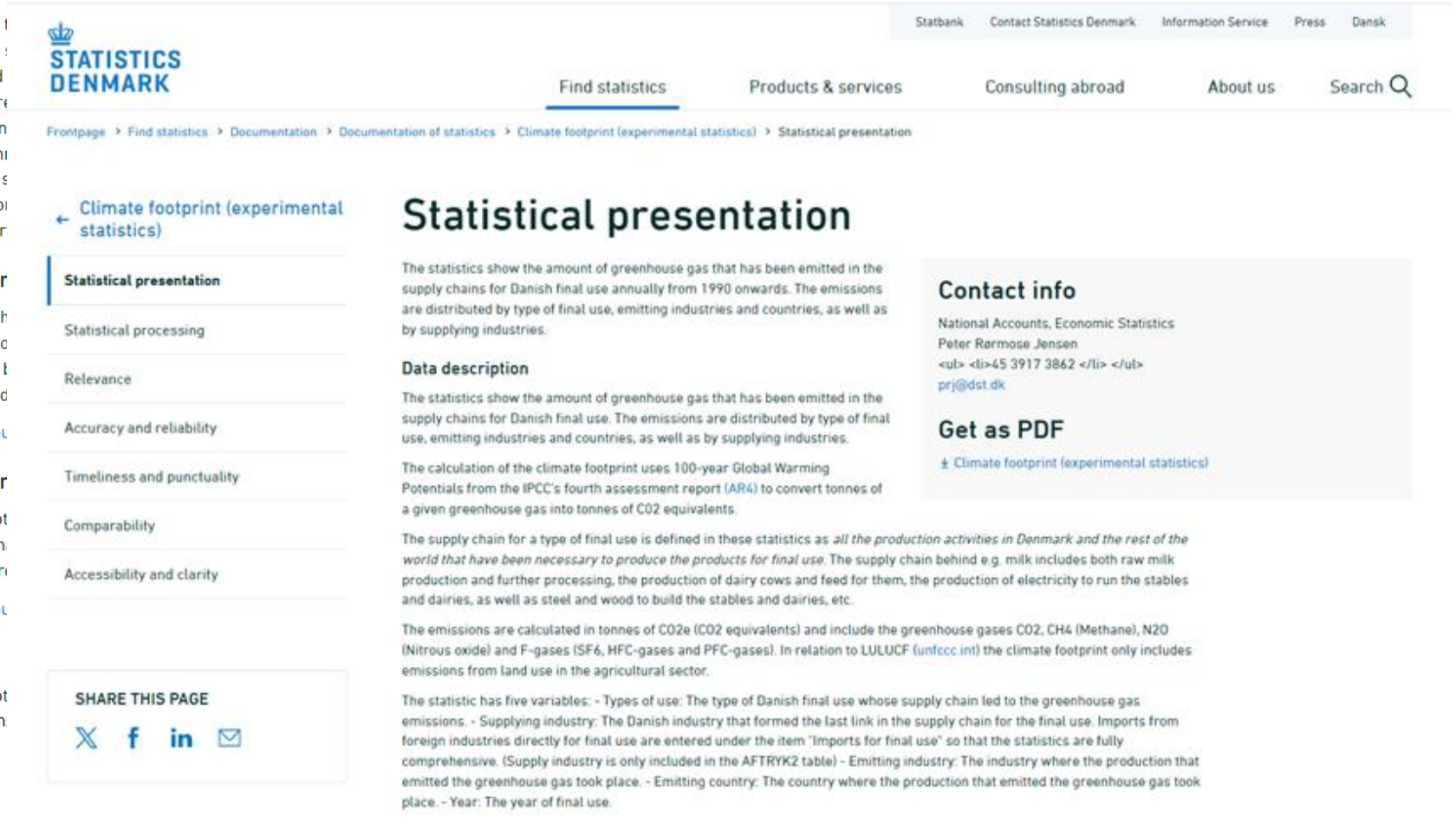

Vision: Metadata used in the entire production process

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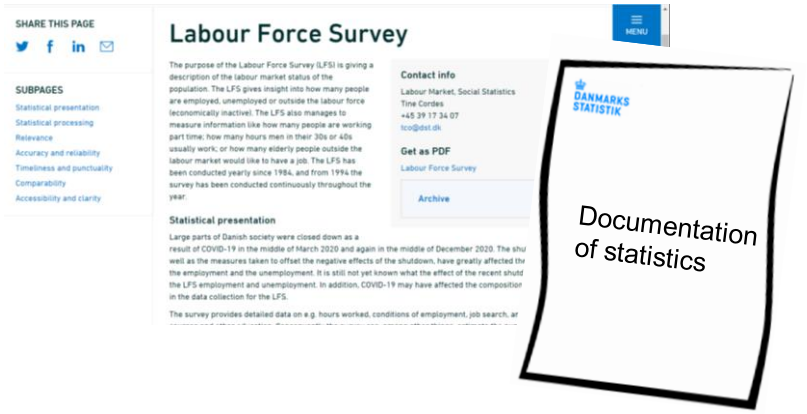
Overarching Processes							
Specify needs	Design	Build	Collect	Process	Analyse	Disseminate	Evaluate
1.1 Identify needs	2.1 Design outputs	3.1 Reuse or build collection instruments	4.1 Create frame and select sample	5.1 Integrate data	6.1 Prepare draft outputs	7.1 Update output systems	8.1 Gather evaluation inputs
1.2 Consult and confirm needs	2.2 Design variable descriptions	3.2 Reuse or build processing and analysis components	4.2 Set up collection	5.2 Classify and code	6.2 Validate outputs	7.2 Produce dissemination products	8.2 Conduct evaluation
1.3 Establish output objectives	2.3 Design collection	3.3 Reuse or build dissemination components	4.3 Run collection	5.3 Review and validate	6.3 Interpret and explain outputs	7.3 Manage release of dissemination products	8.3 Agree an action plan
1.4 Identify concepts	2.4 Design frame and sample	3.4 Configure workflows	4.4 Finalise collection	5.4 Edit and impute	6.4 Apply disclosure control	7.4 Promote dissemination products	
1.5 Check data availability	2.5 Design processing and analysis	3.5 Test production systems		5.5 Derive new variables and units	6.5 Finalise outputs	7.5 Manage user support	
1.6 Prepare and submit business case	2.6 Design production systems and workflow	3.6 Test statistical business process		5.6 Calculate weights			
		3.7 Finalise production systems		5.7 Calculate aggregates			
				5.8 Finalise data files			



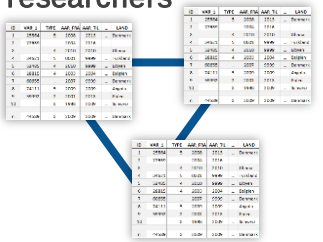
Input

- Surveys

- Validation
- Visual inspection
- Aggregation

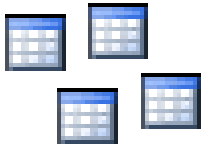
Output

Metadata on microdata to researchers



Classifikations on dst.dk

Statbank tables



Conclusion

- At Statistics Denmark, we are constantly discovering new applications and gains from having a single system based approach to metadata reporting and storage.
- In combination with a dedicated and expanding team of quality practitioners principles of…
    - relevance,
    - accuracy & reliability,
    - timeliness & punctuality,
    - coherence & comparability and
    - accessibility & clarity
- …are becoming routine and synonymous with the way we do business on a daily basis.

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Thank you for your attention