Role of standards in ICT: StandICT2026 Webinar 1

Contents

General Information

Accompanying textbook:

- Understanding ICT Standardization: Principles and Practice (Published 2021)
    - Includes supporting material, e.g. quizzes to prove knowledge
    - More detailed information about the topics
    - Available at: www.etsi.org/standardization-education

Accompanying scientific articles:

- Blind, K. (2022): Standards and innovation: What does the research say? https://www.iso.org/publication/PUB100466.html

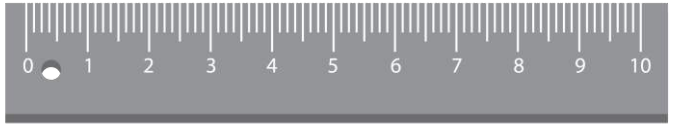
Role of standards in ICT

- The learning objectives of this webinar are:
  - To know the various **functions of standards**
  - To understand **Compatibility/ Interface Standards, Minimum Quality/ Safety Standards, Variety Reduction Standards, and Information/ Measurement Standards**
  - To be able to **apply the different types of standards to ICT specific topics**

1 Introduction

1 Introduction

- Standards support everyday private and professional life much more than people think
- Society recognized importance of standardised measurements thousands of years ago: e.g. weight, distance or length
- Development of common reference systems agreed within and across societies



1 Introduction

- Rapid technological progress → need for new standards, but also update of existing standards grows
- Dynamics especially high in Information and Communications Technologies (ICT)
- Standardisation and standards boost progress and create basis upon which technology, but also science can evolve

2. Basics of standards

What standards are (in a wide sense) and why they're needed

The most general definition for a «standard» may be

«**a widely agreed way of** doing something» .....

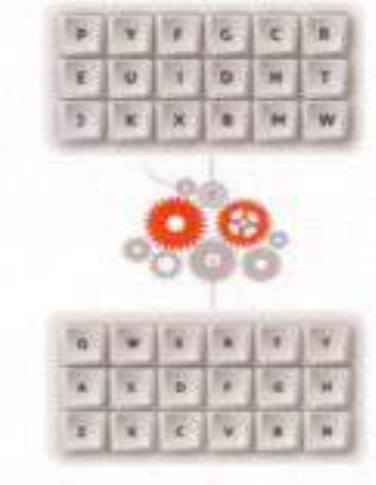
.... where, depending on the specific area of application, "doing something" may be replaced by, e.g., "**designing a product**", "**building a process**", "**implementing a procedure**" or "**delivering a service**".

«Standard» (i.e. agreed and common) ways of doing things bring lot of benefits; our technological world without «standards» simply **would not work (or, at least, it would be much harder to make it work)**

2. Basics of standards

What standards are (in a wide sense) and why they're needed

For instance, what if



each computer had its own type of keyboard

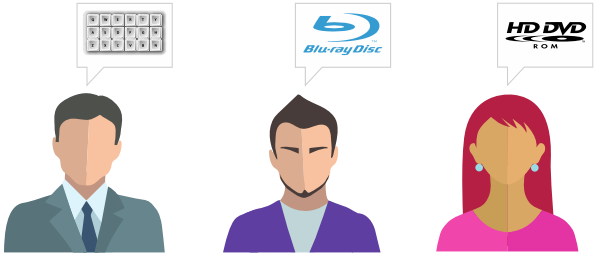
each smartphone and PC had its own specific set of connectors and charger (though some have by choice ... more on this in next slides)

each device had its own protocol for interoperation

2. Basics of standards

Two main different types of “standards”

Different types of standards according to the development process (standardization)



De facto standards, or standards in actuality, are adopted widely by an industry and its customers. These standards arise when a critical mass simply likes them well enough to collectively use them.

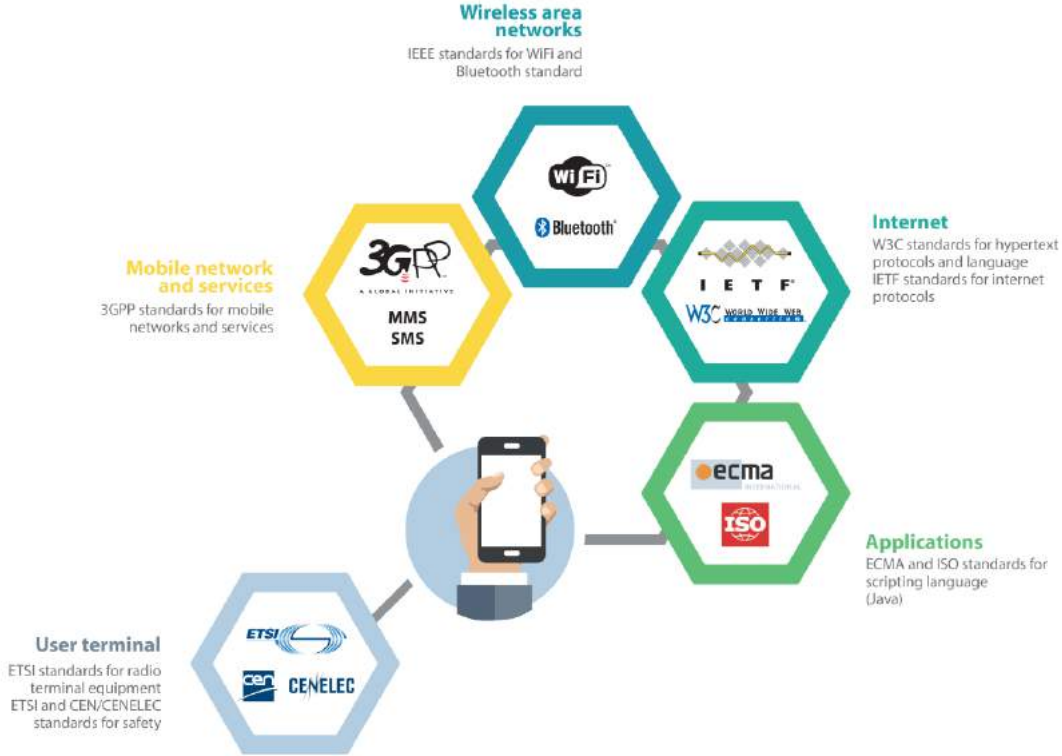
SDO standards are produced by devoted organizations, called Standards Development Organizations (SDOs). SDOs are organizations whose main purpose is to develop standards. They have that put in place formal well-defined procedures to guarantee a fair development process.

De facto standards can become formal standards if they are approved by a SDO. Examples: HTML PDF

2. Basics of standards
Standards in everyday life

Using a Smartphone for browsing (some probably deployed standards):

- User equipment, e.g. hardware characteristics and safety/security aspects
- Connectivity between user devices and wireless network, functionality of this network
- Internet access and the protocols to support web browsing



2. Basics of standards

Standards in everyday life

Using a Personal Computer
(some probably deployed standards)

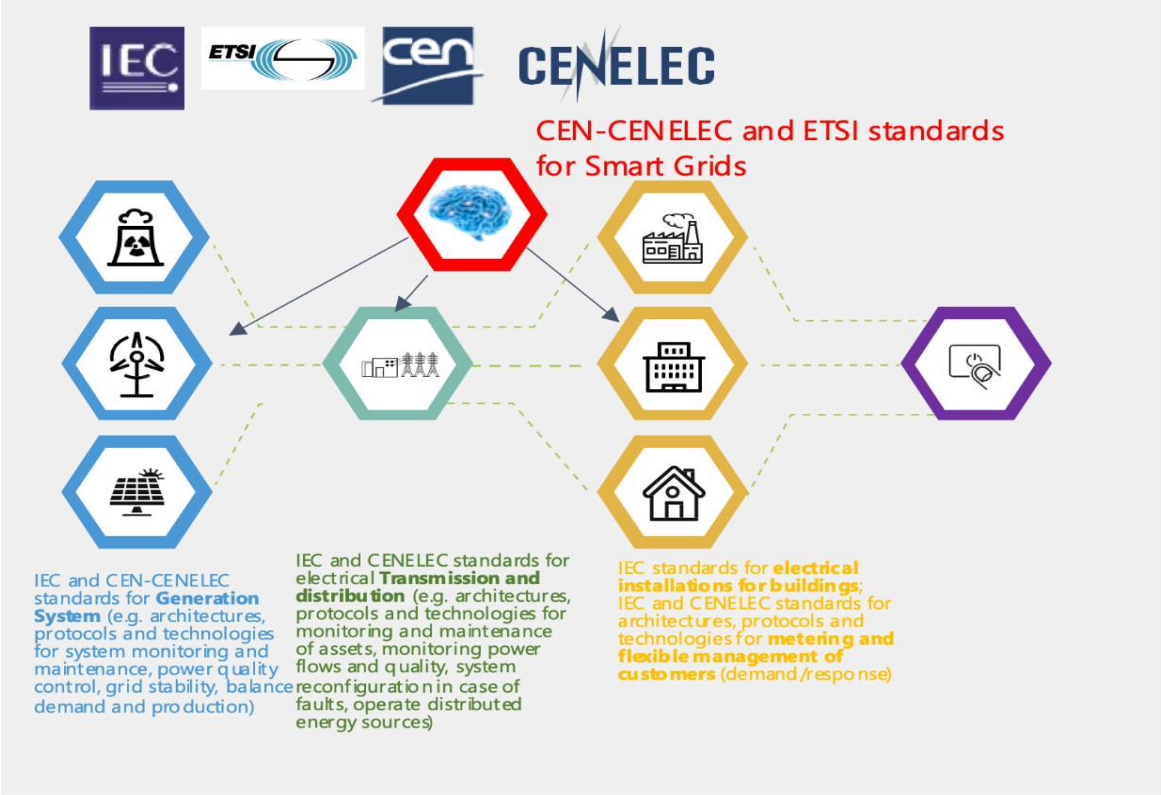
A 2010 paper (Biddle & al., 2010) identifies 251 technical interoperability standards implemented in a laptop computer, but total number estimated to be over 500

Out of the 251 identified standards, "202 (80%) were developed by SDOs and 49 (20%) by individual companies"

2. Basics of standards

Standards in everyday life

Switching on lights
(some of the standards deployed)



3. Effects of standards

	Positive Effects	Negative Effects
Compatibility/ Interface Standards	• Network externalities, like enabling seamless global communication • Avoiding lock-in in old technologies • Increased variety of system products • Efficiency in supply chains	• Anti-competition, leading to monopoly • Lock-in in old technologies in case of strong network externalities
Minimum Quality/ Safety Standards	• Avoiding adverse selection, i.e. supply of bad quality drives out good quality • Creating trust • Reducing transaction costs	• Regulatory capture • Increasing barriers to entry
Variety Reduction Standards	• Economies of scale • Building focus and critical mass	• Reduced choice • Leading to monopoly, barriers to market access
Information/ measurement Standard	• Facilitating trade • Reduced transaction costs • Providing codified knowledge	• Regulatory Capture

Source: Swann (2000), Pham (2006), Blind (2013), modified)

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3. Effects of standards
Compatibility / Interface Standards

- Compatibility
  An essential role of standards is to ensure compatibility.
- Compatibility includes two sub characteristics (ISO 25010):
  - **Coexistence**: An IT service/product sharing a common environment and resources with other independent services/products without adverse side effects
  - **Interoperability**: Ability of those components to work constructively with one another

3. Effects of standards
Compatibility / Interface Standards

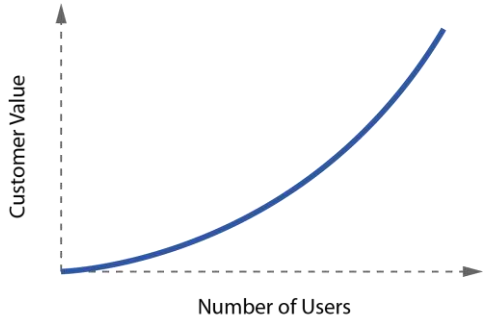
- Developments in the ICT sector demonstrate the economic importance of compatibility/interface standards

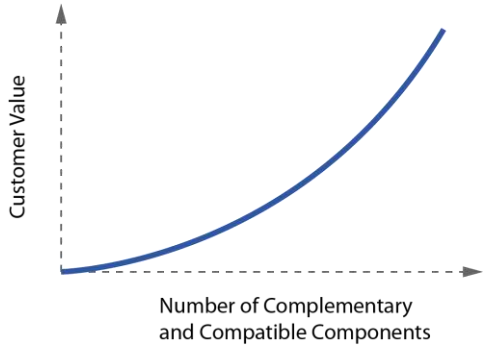
- Two economic phenomena can influence customers and producers in such markets:
  - **Network effects**
  - **Switching costs**

- If both exist, there is a risk that another economic phenomenon occurs:
  - **Lock-in effect**

3. Effects of standards
Compatibility / Interface Standards

- Network effects – two forms:
  - **Direct:** The value of a good/services increases with the number of people using it
    Examples: Telephone, e-mail, Facebook, Twitter, …
  - **Indirect:** The value of a good/service does not depend directly on the number of users but rather on the availability of complementary and compatible components
    Examples: Video game consoles, computer hardware and software, …





Source: Greenstein and Stango (2008)

3 Effects of standards
Compatibility / Interface Standards

- Switching costs:
  Once producers or customers have invested into a particular interface or standard, switching to another one will become increasingly expensive
- Examples:
  - **Acquisition costs:** When new equipment has to be bought or adapted
  - **Training costs:** Associated with learning to use a new product
  - **Testing costs:** If there is uncertainty regarding the suitability of alternative products/services

Source: Parr et al.(2005)

3. Effects of standards
Compatibility / Interface Standards

- Lock-in: Markets and companies can get locked into inferior products/services/technologies because producers and customers will only switch to a better design if:
  - All others do so, too
  - They can afford the switching costs
- If one of the two conditions is not satisfied, a lock-in will occur
- If a standard has not been developed according to the principles of formal standardization and is owned by one single organization, lock-in is more likely to occur, because one party has full control over the standard.
- For the markets, lock-ins mean:
  - Barriers to market entry
  - Monopolies

Source: Parr et al.(2005), de Vries et al. (2008)

3. Effects of standards
Compatibility / Interface Standards

Lock-in: Examples:
Microsoft (Windows API, file formats etc.)

Regarding the Windows API, Microsoft's general manager for C++ development Aaron Contorer stated in an internal Microsoft memo for Bill Gates:

"The Windows API […] is so deeply embedded in the source code of many Windows apps that there is a huge switching cost to using a different operating system instead" (European Commission 2004, pp. 126–127).

- **Windows' exclusive franchise**: Windows grants other suppliers the right to use the Windows API (application programming interface) to produce systems according to its specifications
- The strategic role of API is to maintain network effects and block competition
- Use of proprietary file formats in Microsoft's application software drives the lock-in effect.

Source: Deek and Am McHugh (2007)

3. Effects of standards
Compatibility / Interface Standards

- **Lock-in: Examples:**
  Apple Inc. (iPod)

  - Digital music files with DRM (digital rights management) are purchased from Apple's iTunes store in proprietary AAC format only compatible with Apple Music media player software
  - Users could not play purchased music in other software environments
  - After the launch of the iPod in 2001 and following a licence deal with major music labels, Apple controlled almost 75% of US market for paid downloads
  - DRM conditions and incompatibility with other music players caused conflicts with consumer rights
  - After several suits for "unlawful bundling" DRM has been removed from digital music files since 2009

Source: based on Raustiala and Springman (2012)

3. Effects of standards
Compatibility / Interface Standards

- **Open standards** have several positive effects on the market
- Whether or not a standard is considered as open depends on the openness of the standardization process
  - In an open standardization process, any entity, be it an organization or individual, can participate in the creation of the standard.
  - The output of an open standardization process is an open standard.
  - As formal standardization process is expected to meet all World Trade Organization (WTO) principles of standardization, i.e. transparency, openness, impartiality, consensus, efficiency, relevance and consistency.
- With an open standard, the risk of lock-in is reduced, because the standard is accessible and implementable, leading to lower barriers to entry and lower switching costs for consumers.

"[…] it is better to have a share of a large market than a monopoly of a tiny one." Swann (2000), p.5

3. Effects of standards
Compatibility / Interface Standards

- Compatibility standards help to reduce transaction costs: If buyers know that a particular piece of software is compatible with a particular operating system, the burden to verify that the software will run as expected is significantly reduced
- These reductions of transaction costs also facilitate division of labour; example from the computer industry:
  - A computer contains components from all over the world
  - Internationally accepted compatibility standards have led to a complete globalization of the industry
  - Producers specialize in a small part of the value chain to achieve economies of scale and sell their products around the world

3. Effects of standards

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Source: Swann (2000), Pham (2006), Blind (2013), modified)

3. Effects of standards
Minimum Quality / Safety Standards

- **Minimum quality standards** identify minimum acceptable requirements for the reliability, durability, and safety of products and services, as well as to other fields such as working conditions.
  - They can improve welfare in an economy (also in the areas of health and environment)
  - They help reduce the risk felt by the buyers and increase trust between traders
  - If set at an unnecessarily high level, they can also function as a barrier to entry
- **A minimum quality standard** can relate, for instance, to CO2 emissions generated through car usage. When adopted by regulation, such standards are compulsory by law, making it necessary for car producers to respect the minimum quality standard.

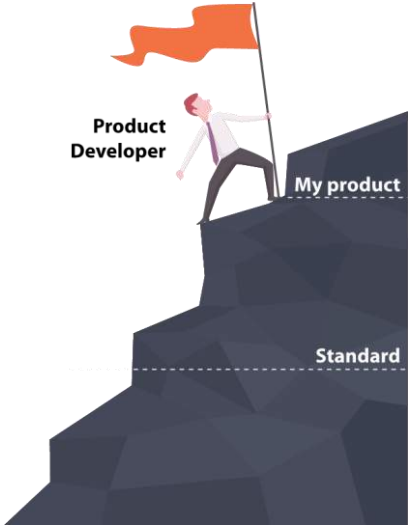
Source: based on Swinnen (2015) and Locksley (1990)

3. Effects of standards
Minimum Quality / Safety Standards

- Customers face a huge variety of different products and find it hard to assess which one is suited for their purpose
- If buyers cannot distinguish between different product variants, it is hard for the quality seller to sustain a price premium (if costs exceed those of low-quality sellers)
- Gresham's law: "bad drives out the good"
- Worst case: The market will break down and lead to market failure

3. Effects of standards
Minimum Quality / Safety Standards

- This problem is due to **information asymmetries.** It arises if one party (e.g., seller) has more or better information than the other (here the buyer), making it hard for the buyer to make an informed decision
- Leland (1979) showed **minimum quality standards can help to overcome information asymmetries,** as they function as a reference and define the minimum requirements a product should fulfil
- Some companies even trade on their reputation and can sustain a price premium because of a quality well above the minimum threshold of a standard
- Ex-post restitution (e.g., a guarantee) can also work as a substitute for a certified minimum quality standard



3. Effects of standards
Minimum Quality / Safety Standards

- Minimum quality standards **reduce transaction and search costs** caused by economic exchange

- If a product is defined in a way that reduces buyer uncertainty:
  1. The buyer's risk is reduced
  2. Less need for the buyer to spend money and time on evaluating different products before a purchase

- Product certification can function as a shortcut for buyers as it proofs the compliance to a standard

Source: Pham (2006); Swann (2000); Swann (2010)

3. Effects of standards
Minimum Quality / Safety Standards

- What do minimum quality standards mean for new market entrants?
  - General presumption: When a product characteristics are documented in a standard, the playing field between incumbent and entrant gets levelled
  - In the absence of the standard, incumbents have an information advantage over entrants
  - **BUT**: Quality standards can be set at an unnecessarily high level to deter entrants from entry
  - Even if those standards impose a cost burden on incumbents, this strategy can be very effective when the cost burden on entrants is greater still (raising rival's costs or increasing entry barriers)

  - The concept of "**regulatory capture**" can be considered as a variant of the "raising rival's costs" concept
  - **Basic idea**: Some producers may **lobby to persuade the regulator** to define regulations in their interest rather than in the interest of the buyer/customer (original intention of standards)

3. Effects of standards

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Source: Swann (2000), Pham (2006), Blind (2013), modified)

3. Effects of standards
Variety Reduction Standards

- Two main functions:
  1. Support of **economies of scale**, by minimizing the proliferation of minimally differentiated models
  2. Reduction of **transaction costs** for customers, because they do not have to choose between a vast number of slightly different products
- Many advantages:
  - **Prevention of market fragmentation** and support of a **joint vision**
  - For supplier,s less fragmentation also means reduced risk
  - Variety reduction standards can also reduce barriers to entry
    - Variety proliferation is sometimes used by incumbents to limit competition from small scale entrants who cannot provide the same degree of variety
    - Some incumbents try to restrict entry by companies with an idiosyncratic product specification

3. Effects of standards
Variety Reduction Standards

- Do variety reduction standards need to be defined publicly?

  - **Not necessarily**: Economies of scale (best-known function of this type of standard) can also be obtained with an idiosyncratic model range
  - **But**: A store selling cloth in idiosyncratic sizes will not perform well

3. Effects of standards

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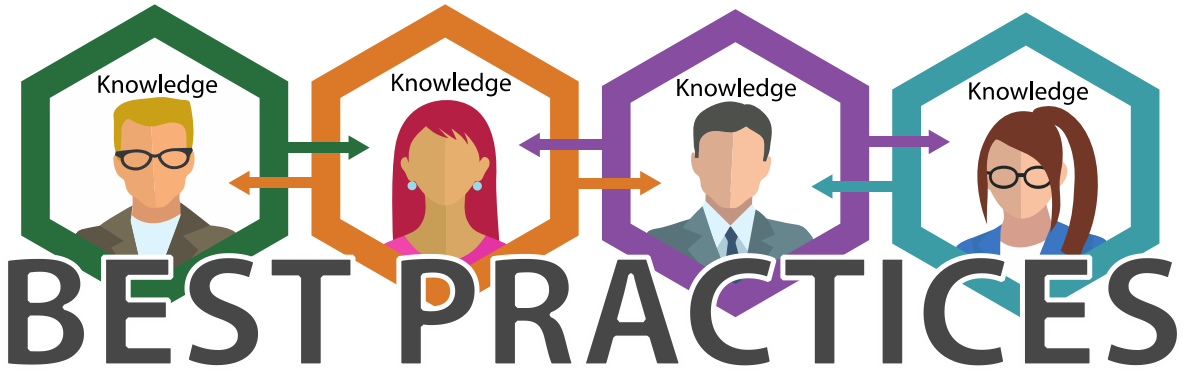
Source: Swann (2000), Pham (2006), Blind (2013), modified)

3. Effects of standards
Information / Measurement Standard

- **Information and measurement standards**: Standards that contain codified knowledge and product descriptions
- These standards an be seen as **important instruments of technology transfer** as they…
  - …contain the work and experience of generations
  - …act as instruments in the dissemination of best practices



3. Effects of standards
Information / Measurement Standard

- Information and measurement standards have a positive effect on the market by **disseminating knowledge**. They support…
  - …building up competencies
  - …spreading essential production knowledge, thus levelling the playing field for incumbents and entrants
  - …reducing information asymmetries
  - …reducing barriers to market entry
- These standards lower transaction costs between companies and contractors, e.g. employees, suppliers and customers, by providing a common language and therefore…
  - …ease the writing of job descriptions, contracts etc.
  - …achieve a feasible division of labour

3. Effects of standards
Example: Digital image compression

- During 1990s: rapid diffusion of image and video processing applications and advancement of multimedia technologies

  → **Increased importance of compression methods**

- International SDOs developed several standards describing different compression methods, e.g. JPEG (“Joint Photographic Experts Group”)

  → Offered new solutions for saving storage place and reducing transmission rate requirements to industry

- Many software products are based on these compression methods, e.g. sharing of digital images, remote sensing, archiving, image search

Source picture: Schelkens (2015)

Source: ANSI (n.d.)

List of abbreviations

AAC: Advanced Audio Coding
AFNOR: Association Française de Normalisation
ANSI: American National Standards Institute
API: Application Programming Interface
CEN: European Committee for Standardization
CENELEC: European Committee for Electrotechnical Standardization
DRM: Digital Rights Management
DTI: Department of Trade and Industry (United Kingdom)
ESS: European Standardization System
ETSI: European Telecommunications Standards Institute
EY: Ernst & Young Consulting Company
GDP: Gross Domestic Product
IEC: International Electrotechnical Commission
ISO: International Standardization Organization
ITU: International Telecommunication Union
JPEG: Joint Photographic Experts Group
SDO: Standard Development Organization
SME: Small and Medium-sized Enterprises
TFP: Total Factor Productivity
3GPP: 3rd Generation Partnership Project

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