



EARTO Webinar Series

Standardisation in research and
technology for practitioners

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- Background: EDU4Standards
- Pilot EARTO

EDU4Standards.eu - Empowering Standardisation through Education in Europe

OBJECTIVES

Obj.1: Develop and disseminate teaching material about standardisation

Obj.2: Increase the visibility via "Academic Standardisation Days" (ASDs)

Obj.3: Increase the number of HEI & universities offering teaching on standardisation

Obj.4: Increase number of teachers offering courses and students attending courses about standardisation

Obj.5: Set up a Students' Standardisation Association (SSA)

Community

- Standardisation Student Association created
- 100+ HEIs exposed to standard education
- 100+ teachers with standardisation knowledge
- 500 students educated in pilots
- 1,500+ engaged community members
- EURAS
- External Advisory Group (EAG)

Innovative Teaching Concept of Standardisation (ITCoS)

Web Platform

Student Standardisation Association & Academic Standardisation Days



Pilots

- a. B.Sc course
- b. M.Sc course
- c. In-company Training Format
- d. Extra-curricular

- e. Seasonal university school
- Pan-EU EARTO**
- g. Distance learning

EU & International Synergies

- > 10 Mutual cooperations with National, European, and Int'l organisations and initiatives
- Continuous engagement and exchanges on all ICT standards topics
- Interaction with Policy makers: (Including: EURAS, MSPs, Sherpa Groups of the High-level Standardisation Forum, STAIR, ISO, IEC, ITU & IEEE etc)
- Collaborations with HE Standards projects:



Outreach

- 4 Pilot Workshops
- 10 Webinars
- 5 Academic Standardisation Days
- 2 CEN Workshop Agreement Meetings
- 1 Final event
- 12 newsletters
- 3 Press Releases
- 10 Professional Videos
- Visibility at >15 3rd party events
- PPC Campaign
- Social media channels

Reports & other value-add output

- Whitepapers & Scientific Publications
- Online Teaching Content
- CEN Workshop Agreement
- Pilot evaluation reports
- Sustainability strategy
- Policy Recommendations
- EU Standardisation Roadmap
- All Results published via zenodo

SG 1
HEIs/universities

SG 2
Teachers & standards educators

SG 3
Students & Student Associations

SG 4
Standard Development Organisations

SG 5
Policy Makers

SG 6
Environmental and consumer organisations

SG 7
Research organisations & EU projects

SG 8
Industry & SMEs

SG 9
Citizens and citizen groups

Target groups:

- Beginners “Research & Development and Standardisation” course provides a concise yet in-depth understanding of standardisation as relevant from a Research and Technology (RTO) perspective.
- Intermediate experts “Effectively participating in standardisation bodies” course addresses skills to operate in standards bodies.
- Sophisticated experts “Strategic standardization for RTOs” high-level course, aimed at senior researchers, offers a tailored format for standardisation topics for management level also related to RTO’s business models (e.g., IPRs, SEPs, Open Source)

Webinar series Standardisation in research and technology for practitioners:

- Modul 1: Standardisation Landscape 6.11. 2025
- Modul 2: Types and Impacts of Standards 13.11. 2025
- Modul 3: Research and Standardisation 20.11. 2025
- Modul 4: IPRs and Standardisation 27.11. 2025
- Modul 5: Open Source and Standardisation with Mirko Böhm LF 4.12. 2025
- Modul 6: Geopolitics, Values and Standardisation with Barbara Reiter Uni Graz 11.12. 2025



EDU4
Standards.eu

Module 1

Standardisation

Landscape



Funded by
the European Union

1. [Introduction](#)
2. [Basics of standardisation](#)
3. [Standards organisations](#)
4. [Standardisation landscape](#)
5. [Linkages between standard development organisation](#)

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

- The learning objectives of this webinar are:
 - To know the **difference** between **standards** and **regulations**.
 - To **understand and apply** the different **criteria** for the classifications of **standardisation organisations**.
 - To **understand** why **standards** are usually **referenced by legislation**, and the need to issue **standardisation requests** when a societal need is identified in a specific area.
 - To be able to **describe** the role in **standardisation of Standards Development Organisations (SDOs), recognised SDOs, and industrial consortia**, as well as their **interplay**.
 - To **identify** the **characteristics** of **formal and de facto standardisation**, and to be aware of the processes through which **de facto standards are adopted by SDOs**.
 - To **understand** the differences among **National, Regional and International** organisations, the benefits derived of their **coordination**, and to be aware of the main **agreements** and procedures supporting it.

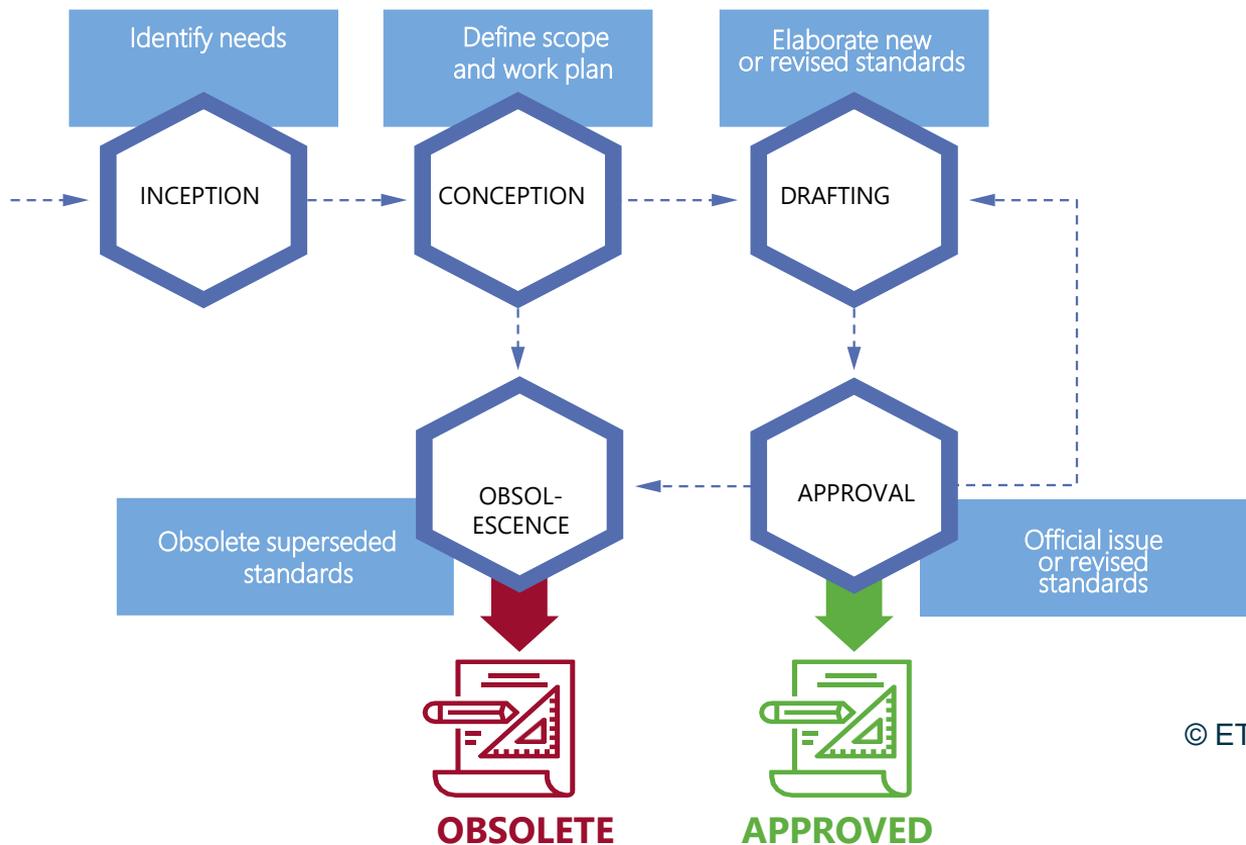
- The standardisation **landscape is rich and complex**, because of the variety in standard development organisations (SDOs) and the documents they produce...
- The current chapter aims to provide some **basic concepts** to help readers **find their way** around the **standards ecosystem**.



- Formal standardisation is a well-defined process (see next slide), in general open to any individual or organisation, and its results are produced in consensus with all interested stakeholders (e.g., manufacturers, providers, consumers, and regulators) and guaranteeing the quality of the final deliverables.
- Formal standardisation is inspired by international directives on standardisation, the most important being the principles produced by the Technical Barriers to Trade (TBT) Committee of the World Trade Organization (WTO).
- Formal standardisation is the process adopted by SDOs to produce standards. Hence, we refer to these standards as SDO standards



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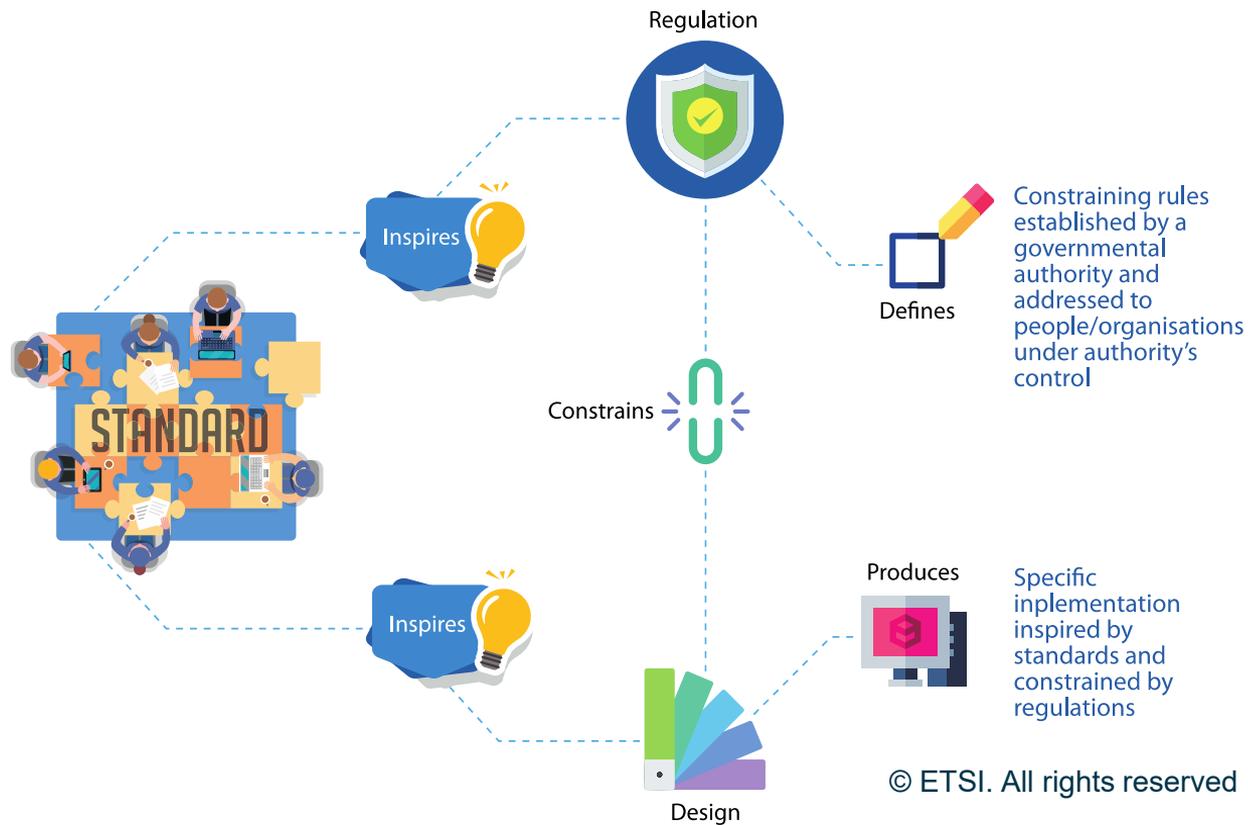


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- Standards address mainly expert technical audiences in order to define some characteristics for a set of a specific items (which may be a product, material, procedure, service or process), but non-technical aspects (e.g., human rights) are becoming more relevant
- Standards are not intended to fully specify an item, or to provide a thorough scientific-technical elaboration on a subject, but they're aimed to define the minimum requirements in order to meet certain well defined objectives (e.g., to guarantee a certain degree of interoperability or a minimum level of performance)

- It shall be clear and unambiguous
 - It shall help readers to clearly understand what is essential to ensure compliance
 - It shall include and clearly separate parts that are
 - Normative, i.e. which describe mandatory standard requirements, i.e. the individual characteristics that the item being standardised must implement if it is to fully comply with the standard
 - Informative, i.e. which help with conceptual understanding
- It shall be written in plain language
 - Simple and short sentences
- Its requirements must be consistent, testable and not be redundant
- It shall have well-defined objectives that meet real needs
 - It has NOT to be fruitlessly over-prescriptive

- Standards are NOT regulations.
- Standards are NOT a set of thorough design rules.
- Standards are voluntary NOT compulsory from a legal perspective
- Yet, they may inspire each other



- Standards are NOT regulations
 - While conformity with standards is de jure voluntary, regulations are compulsory; i.e.
 - An item (product, service, process, etc.) that doesn't fit regulations is not allowed in the territory/market where those regulations apply;
 - On the contrary, non-compliance to standards doesn't limit 'by law' the diffusion of an item (e.g., remember the case of some smartphones' proprietary connectors)
 - Standards are often (fully or partially) captured into regulations, as this simplifies and accelerates regulatory work thanks to the directions of established best practices defined in standards
- Standards are NOT a set of thorough design rules
 - Standards are aimed at defining a minimum set of requirements for an item (product, service, process, etc.) in order to make it meet certain well-defined objectives (e.g., to guarantee a certain degree of interoperability or to define a minimum level of performance)
 - Many 'standard-compliant' implementations are possible

From here on, we will focus on “SDO standards”; so, in the following and unless otherwise explicitly stated when referring to “standards” we will mean “SDO standards”



- Formal standardisation is based on **well-defined processes**, open to any individual or organisation, and its results are produced in consensus with all interested parties.
- The processes are inspired mainly by the six principles of the **Technical Barriers to Trade (TBT)** Committee of the World Trade Organisation (**WTO**): Transparency, Openness, Impartiality and consensus, Effectiveness and relevance, Coherence, and Development dimension.
- Organisations doing formal standardisation are known as **Standard Development Organisations (SDOs)**. They act in response to specific industry or societal needs.

- Some SDOs are officially **recognised by regulatory systems**, e.g. the **European Commission**, as providers of standards. They are known as **recognised SDOs**.
- Sometimes, the expression "**de jure**" standards is used as an equivalent to **SDO standards**.
 - However, "de jure" fits only in the case of a subset of these standards, i.e., those that are used by legislation, e.g., harmonised European standards.

- Regulation (EU) No 1025/2012 of the European Parliament and of the Council:
 - Designates **CEN, CENELEC and ETSI** as the **European Standardisation Organisations (ESOs)**.
 - The aims set out in the EU treaties are achieved by several types of legal act: regulations, directives, decisions and opinions.
 - Example: Directive (EU) 2016/2102 on the accessibility of the websites and mobile applications of public se



EUROPEAN STANDARDIZATION ORGANIZATIONS

- Besides the officially recognised SDOs, there are **well respected and long existing SDOs**,
 - like **W3C, IETF, OASIS, IEEE, OMG**.
- These are **not officially recognised** by the authorities, **but they have well established procedures** to ensure the quality of their standards.

- W3C's Web Content Accessibility Guidelines (WCAG) standard is explicitly referenced by CEN/CENELEC/ETSI standard EN 301 549 on ICT accessibility requirements.
- IEEE counts on a specific board (the IEEE-SA Standards Board) for coordinating the development and revision of IEEE standards:
 - This includes approving the initiation of standards projects and reviewing them for consensus, due process, openness, and balance.
- IEEE 802 is just an example of an IEEE family of standards with a significant impact in society.
 - 802 standards deal with local area networks and metropolitan area networks, also important for autonomous driving.

- Public organisations have been in generally created by treaties. This is the case of ITU, which is an agency of the United Nations



- Other standards organisations are private, such as ISO, IEC, ETSI or ANSI.

- Some de facto standards have significant economic and societal impacts.
- These **ICT-related items** have in common that they have had a **huge impact**...
 - QWERTY keyboard**: The layout for most keyboards is a de facto standard, though others exist.
 - PDF**: a document format created by Adobe Systems, but meanwhile published as ISO standard.
 - HTML**: a language for describing the structure of Web pages. It was originally created by Tim Berners-Lee, and it is currently published and maintained by W3C.
 - Microsoft Windows**: an operating system that became an industry standard due to Microsoft's market power, and so did its specifications (e.g. the Microsoft Web Services Security specification, WS-Security).
- ... They are called “**de facto standards**”. They are **common practices adopted by the market**, which are initially not the result of a standardisation process.

- A de facto standard is a custom or convention that has achieved a dominant position, like Windows, by public acceptance or market forces, and that usually has the attractive characteristic of having been **validated by market processes** (Maxwell 2006)
- Abernathy and Utterback (1978) introduced the ‘**dominant design**’ concept.
 - Dominant designs may not be better than other designs; they simply incorporate a set of key features that sometimes emerge due to technological path- dependence and not necessarily strict customer preferences.

- De facto standards may be adopted as formal standards by recognised SDOs:
 - ISO/IEC 15445:2000 Information technology -- Document description and processing languages -- HyperText Markup Language (HTML).
 - ISO 32000-1:2008 (reviewed and confirmed in 2023) Document management -- Portable document format -- Part 1: PDF.

SDO STANDARD	DE FACTO STANDARD
<ul style="list-style-type: none"><li data-bbox="98 331 459 364">■ Developed in SDOs<li data-bbox="98 594 923 725">■ Open and consensus oriented with the option of opposition, which may sometimes lead to lengthy decision procedures<li data-bbox="98 790 954 823">■ Clear and transparent participation and voting rules	<ul style="list-style-type: none"><li data-bbox="987 331 1843 517">■ Dominant design through a standard war or natural selection. A company achieves a dominant position by public acceptance or market forces, e.g. Windows<li data-bbox="987 583 1850 670">■ Standardisation process with restricted access; homogeneous environment may allow fast decisions<li data-bbox="987 801 1746 888">■ Direct participation of company alliances (e.g. consortia) and individual companies

- Some standards organisations were created as industrial consortia, e.g.:
 - AUTOSAR develops open and standardised software architecture for automotive electronic control units.
 - The Home Gateway Initiative (HGI) developed a smart home architecture that enables applications to connect with devices on any home network interface.
 - The EnOcean Alliance created a wireless standard to develop self-powered wireless monitoring and control systems for sustainable buildings as well as energy harvesting solutions.
- In the context of rapid developments, consortia benefit from a **lighter process** and a **lower level of consensus** of document approval than SDO standards go through.
- Documents developed by a **single company** (e.g. Windows as a Microsoft standard) **do not fall into this category**.

- Standardisation landscape has become rather diverse (see Teubner et al.. 2021) and includes multiple SDOs that may differ in
 - Geographical coverage
 - Technical scope of activities (as per each SDO's statute)
 - Level of recognition from regulatory or political organisations
- SDOs often establish liaisons or set up common working groups to generically coordinate their activities or to join forces on specific items

International SDOs

- These have members worldwide, including national or regional standard bodies, and their deliverables have worldwide coverage.



Regional SDOs

- These have members (industries, academia and national SDOs) from well defined geographic regions that usually share, or are interested in promoting common standards.



ITU

- Since 1947 it's a specialised agency of UN, with study group members comprising state members, sector members, associates from industry, international and regional standard organisations, and academia.
- ITU sectors: ITU-T (telecommunication standardisation), ITU-R (global radio spectrum, satellite orbits), ITU-D (promotion of fair and affordable access to telecommunications)



ISO

- Independent, international non-governmental organisation founded in 1946
- Members from more than 170 countries work in hundreds of technical committees and subcommittees
- ISO standards cover ICT, healthcare, energy and automotive, etc.



IETF

- Governing body of the Internet as part of the Internet society (ISOC)
- It is controlled by the Internet Architecture Board (IAB), which is both a committee of the IETF and an advisory body of the Internet Society



ETSI



- ETSI with more than 900 members is a European Standards Organisation (ESO), recognized regional standards body dealing with telecommunications, broadcasting and other electronic communications networks and services.
- ETSI supports European regulations and legislation through the creation of Harmonised European Standards. Only standards developed by the three ESOs (CEN, CENELEC and ETSI) are recognized as European Standards.

ARSO



- Main goals: harmonize national and/or sub-regional standards as African Standards, to initiate and coordinate the development of African Standards (ARS) with reference to products that are of particular interest to Africa, such as agriculture and food, civil engineering, chemistry, and chemical engineering, and to encourage and facilitate the adoption of international standards by member bodies.

PASC

- Main objectives: to strengthen ISO and IEC international standardization programmes, to improve the ability of Pacific Rim SDOs to participate in these programmes effectively, to improve the quality and capacity of standardization and to promote standardization



● National Standard Bodies (NSBs)

- NSBs operate at the single country level and issue country-specific standards; they often collaborate with International and Regional SDOs.
- Some relevant NSBs outside Europe are:

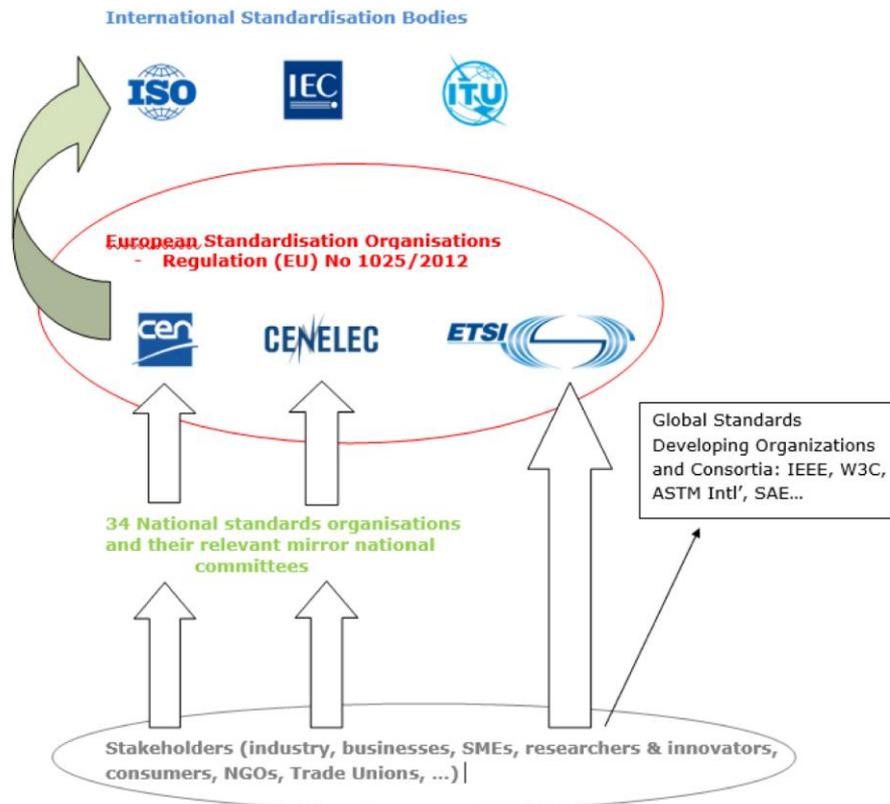


中国国家标准化管理委员会
Standardization Administration of the P.R.C.



- A non exhaustive overview of the ecosystem, where International, Regional and National SDOs, professional organisations and industrial consortia operate

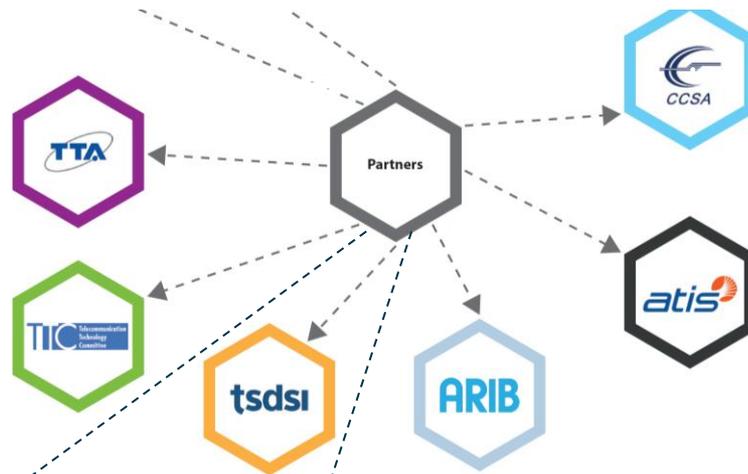
Organisation	Typical technical scope of activity
ITU	Accessibility; Broadband; Cybersecurity; Digital Divide; Digital financial inclusion and digital currency; Emergency Telecommunications; Environment and climate change
ISO	Coverage of a wide range of sectors, including technology, healthcare, agriculture, and manufacturing, but also ICT services, protocols incl. application protocols
IEC	Electrotechnical standards, incl. connectors, electrical safety and tests
ETSI	Standards for ICT-enabled systems, applications and services
CEN/CENELEC	Accessibility; Artificial Intelligence; Ecodesign, Labelling and Traceability of Products; Energy Efficiency and Management; Environment and Sustainability; Personal Protective Equipment; Quantum Technologies; Smart Grids and Meters;
IEEE	All LAN specifications: IEEE 802.xx, including cabled LANs, Token Ring and Bus, MAN Wireless LANs, e.g. WiFi)
IETF	All internet related specifications including protocols, generic applications, addressing rules (IP, url)



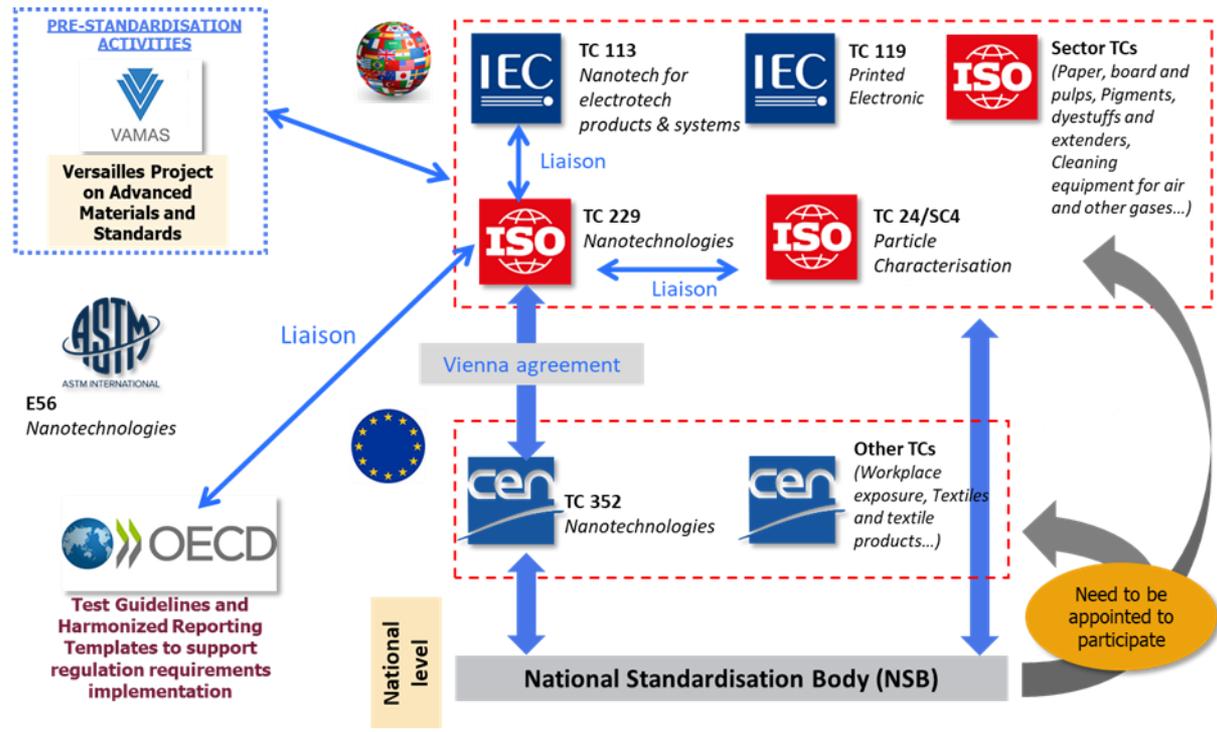
Source: CEN/CENELEC Guide 39, 2022, p.10



- A non-exhaustive overview of an ICT ecosystem, where International, Regional and National SDOs, professional organisations and industrial consortia collaborate through liaisons and standard initiatives



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Source: NanoFabNet WP4 Survey on Validation, Harmonisation and Standardisation issues: September 2020 – February 2021.

Recognised SDOs

- These are officially recognised by regulation systems or political bodies
- ITU, UN specialised agency for information and communication
- EU regulation 1025/2012 rules the standardisation at an European level and lists a set of reference SDOs with either an international (ISO, IEC, and ITU) or European scope (CEN, CENELEC, and ETSI)



Not Recognised Organisations

- These are not recognised by any political bodies in the EU
- The Institute of Electrical and Electronics Engineers (IEEE), the American association of Electrical and Electronics Engineer, brings together and organises members from all over the world. IEEE is a primary SDO with a large number of active technical standards, ranging from artificial intelligence, wireless communications and digital health to cloud computing, power and energy, 3D video, electrical vehicle standards, and the Internet of Things.



- SDOs can create groups/projects, possibly also involving industries, for cooperating in the definition of specific standards

- 3GPP

- Created in 1998, it consists of SDOs operating in the telecommunication field in countries and regions across the globe
 - Shared environment in which to produce the reports and specifications that define mobile radio technologies (radio access, core transport network, service capabilities and hooks for non-radio access to the core network, and for interworking with Wi-Fi networks)



- OneM2M

- Purpose is to develop technical specifications, which address the need for a reference Machine-to-Machine Service Layer that can be embedded within various hardware and software.
 - One of the main goal is to involve organisations from M2M-related business domains, such as telematics and intelligent transportation, healthcare, utilities, industrial automation, smart homes, etc.



- In addition to SDOs, there are other organisations that do not strictly or entirely use the formal standardisation procedures but aim at defining standard in a specific area
 - Example Industrial Fora/ Consortia: they are composed of groups of companies that temporarily join their efforts on specific subjects to realise, accelerate, complement, or promote the development of standards on them



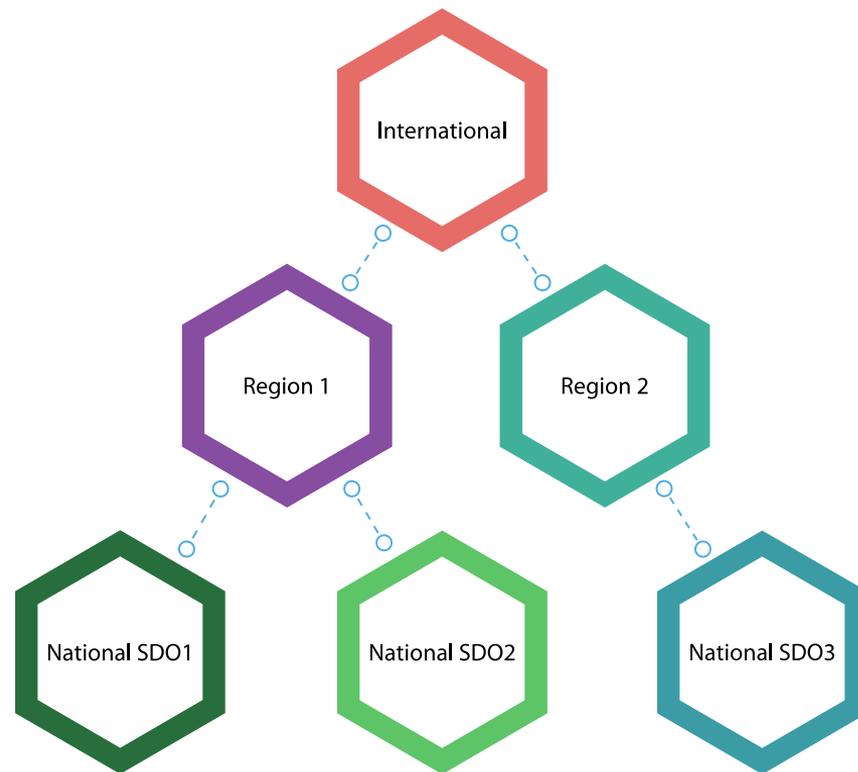
- Recognised SDOs have **national, regional or international geographical** scope, and so do the formal standards they produce:
 - ISO, IEC and ITU are official **international** standard organisations, with a worldwide scope.
 - CEN, CENELEC and ETSI are officially recognised as **European** bodies for standardisation.
 - PASC is a regional SDO the **Pacific** area.
 - DIN, NEN, UNE, ANSI, and BIS are national SDOs in, respectively, **Germany, Netherlands Spain, USA, and India.**

Standardisation Structures:



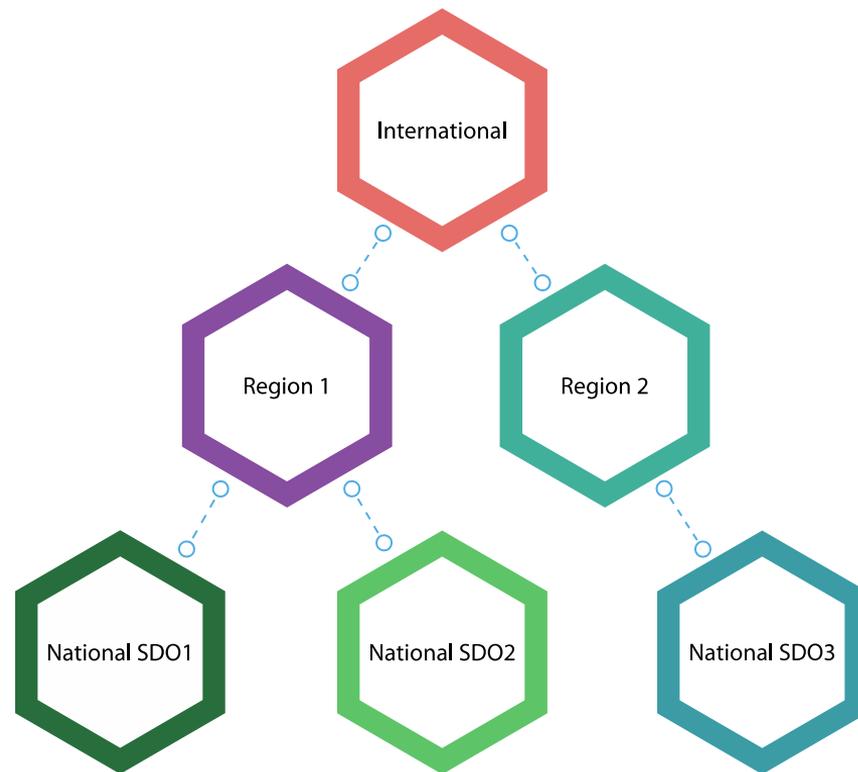
- ETSI publishes standards that are adopted globally, such as the GSM family of standards.
- PASC does not produce standards, but it supports the participation of the region's SDOs in the ISO and IEC activities.
- In the USA there are approx. 200 organisations producing American National Standards (ANS). These are SDOs, accredited by ANSI, the only official representative of the United States at ISO and IEC.

- The objective is to ensure that organisations make **the best use of their resources**:
 - to support **information exchange**,
 - to increase the **transparency** of procedures,
 - and to **reduce the possibility of duplicating** work unnecessarily at a national, regional or international level.



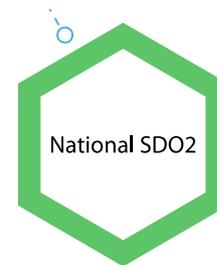
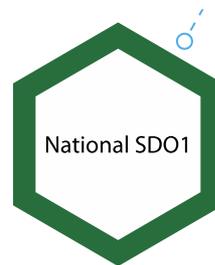
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- International standardisation usually takes **precedence** over **regional** standardisation, which again takes precedence over **national** standardisation.
- Ideally, approved **international standards** are simultaneously **adopted as regional standards**, and then as **national standards** in region's countries.

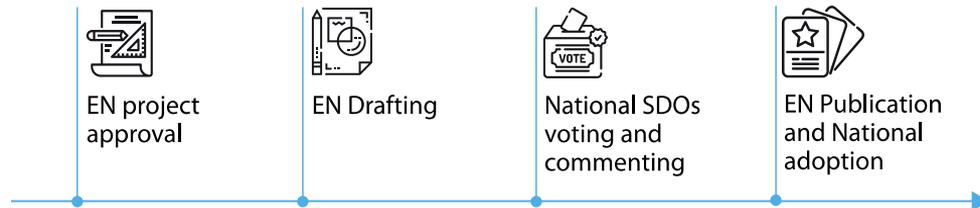


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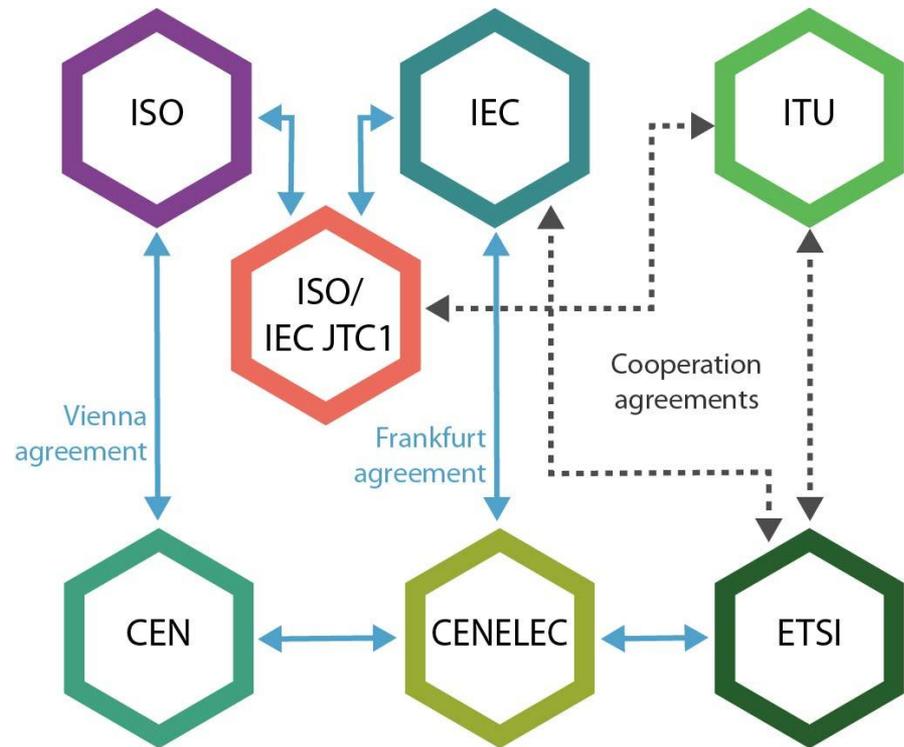
- National SDOs (NSOs) **represent** their own countries' standardisation activities in regional and international SDOs.
- They support national experts to **track regional and international standards**,
- They **adopt international standards** as national standards.
- There mostly **one NSO per country**.



- Coordination among European and National standardisation activities
 - **European** and their **national** member SDOs **publish periodically their work programmes** and the list of **approved/adopted** standards
 - “**Standstill**”: obligation for the National SDOs not to take any action, neither during the preparation of a European Standard (EN) nor after its approval
 - The generic **process of coordination between European and National** standardisation can be described as follows: **project approval, drafting, National SDO voting and commenting, EN publication and National adoption.**



- There are cooperation and coordination agreements between European and international SDOs (modified from Jakobs, 2008)



Regulation (EU) No 1025/2012

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- The **Vienna agreement** provides rules and methods for the ISO-CEN collaboration.
- ISO standards are **automatically approved as European Standards**, and they are **adopted as national standards** by **each CEN national SDO** member, e.g.
 - ISO 9001:2015 Quality management systems – Requirements.
 - EN ISO 9001:2015 (European standard).
 - UNE-EN 9001:2015 (Spanish standard).
- 30% of CEN standards are developed under the **Vienna agreement**.
- The agreement **recognises** the particularities of the **single European market**, and foresees the participation of ISO members in CEN standards urgently required in EU.

- The Frankfurt agreement provides rules for the collaboration between IEC-CENELEC:
 - Around **80%** of all European electrotechnical standards are identical to or based on IEC International Standards.
 - New electrical **standards projects are jointly planned** between CENELEC and IEC, and where possible most are carried out at international level.
 - E.g., IEC 62236-3-2:2008 Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus is based on EN 50121-3-2:2006

- ISO/IEC Guide 21 provides guidance on Regional or National adoption of International Standards and other International Deliverables:
 - It provides methods for the **adoption of International Standards** (and other international deliverables) **as regional or national standards**
 - It defines a system for **indicating the degree of correspondence** between International Standards and their national or regional adoptions

- ISO and IEC formed ISO/IEC JTC 1 to avoid duplicative or possibly incompatible standards
- A guide contains a set of procedures for cooperation between ITU-T and ISO/IEC JTC 1
- ITU and ETSI have established a Memorandum of Understanding (MoU)

- The 3rd Generation Partnership Project (3GPP)
 - Includes organisational members from **America, Asia and Europe**.
 - Provides them with a **stable environment** to produce reports and specifications about **mobile communication**, including radio access, core network and service capabilities.
 - SDOs participating in 3GPP **transpose an identical text of 3GPP** deliverables as the corresponding deliverables



- Adoption of a 3GPP specification by ETSI:
 - There is a process through which a 3GPP specification text is adopted and published by ETSI.
 - When requested by the European Commission, the document may be adopted as a European Standard.

Example:

3GPP TS 23.401 version 14.7.0 Release 14,
adopted as ETSI TS 123 401 V14.7.0



- Difference between standards and regulation
- Different types standardisation bodies from formal over consortia to de facto standards
- Various linkages between the different levels of formal SDOs
- Liaisons between formal SDOs and consortia
- Dynamic landscape (with the exception of the SDOs) and relations

- 3GPP: 3rd Generation Partnership Project
- AAP: Alternative Approval Process
- AD: Area Director
- ANSI: American National Standards Institute
- ARSO: African Organization for Standardization
- BGP: Border Gateway Protocol
- CEN: Comité européen de normalization - European Committee for Standardization
- CENELEC: Comité européen de normalization en électrotechnique - European Committee for Electrotechnical Standardization
- CERN: Centre Européen pour la Recherche Nucléaire - European Organization for Nuclear Research
- DVD: Digital Versatile Disk
- ECMA: European Computer Manufacturers' Association
- ETSI: European Telecommunications Standards Institute
- IEC: International Electrotechnical Commission
- INCITS: InterNational Committee for Information Technology Standards
- ISO: International Organization for Standardization
- ITU: International Telecommunication Union
- JEDEC: Joint Electron Device Engineering Council

- HD DVD: High Definition Digital Versatile Disc
- HTML: HyperText Markup Language
- IEEE: Institute of Electrical and Electronics Engineers
- IETF: Internet Engineering Task Force
- IP: Internet Protocol
- IPsec: IP security
- HDMI: High Definition Multimedia Interface
- ICT: Information and Communication Technology
- LTE: Long Term Evolution
- M2M: Machine to Machine
- NSDO: National Standard Development Organization
- OSPF: Open Shortest Path First
- PASC: Pacific Area Standards Congress
- PDF: Portable Document Format
- SDO: Standard Development Organization
- TAP: Traditional Approval Process
- UMTS: Universal Mobile Telecommunications System
- VESA: Video Electronics Standards Association

- W3C: World Wide Web Consortium
- WG: Working Group
- WI: Work Item
- XML: eXtensible Markup Language

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