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ORIGINAL PAPER

Bringing values to standardisation: from policy concepts to a value-based framework for education about standardisation

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Abstract

The present paper investigates the relationship between the European Commission's policy vision for standardisation and current educational practices in European universities. The study is motivated by the following observation: although EU policy documents emphasise the need for a human-centric and responsible approach to standardisation, including the integration of ethical and societal considerations, recent research reveals that these aspects are largely absent in the teaching portfolios of recognised standardisation educators in European universities. More so, the educators find it difficult to understand how to assess or ensure that their teaching complies with the policy-invited orientation. This work examines the relevant EU policy documents to understand how the notion of responsible standardisation is framed and proposes a solution that emphasises the inclusion of specific values in standardisation education. This involves enlisting the rather abstract EU core values and interests and translating them into more tangible and familiar concepts for educators, such as competencies, knowledge, and skills, on the basis of a value-based Intended Learning Outcomes (ILOs) framework. Since ILOs are traditionally used for aligning educational programmes with labour market and policy demands, they offer a practical tool for this transformation. By identifying current knowledge gaps and proposing actionable solutions, this paper advances the discourse on responsible standardisation and lays the groundwork for implementing value-based education about standardisation, fostering the development of educational models that reflect novel societal needs, ethical values, and support the EU's political vision for value-based standardisation.

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Introduction

In the most general terms, a standard (or a norm) establishes a way of doing something, be it designing a product, implementing a procedure, or providing a service, whereas standardisation is the process of developing standards (Spivak & Brenner, 2001). In this broad sense, standards span across millennia and encompass a multitude of different domains, ensuring efficiency, consistency, and organisation in human affairs. In the contemporary industrial and academic worlds, a standard is understood as a 'document, established by consensus and approved by a recognised body, [that] provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context' (ISO, 2024). While the term 'recognised body' lacks a universally agreed-upon definition (particularly in the context of the Technical Barriers to Trade Agreement—see Delimatsis, 2014), in practical terms, standards-setting is often carried out by European National Standards Organisations

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(NSOs), European Standards Organisations (ESOs) such as CEN, CENELEC, and ETSI, international standard-setting organisations (SSOs) such as ISO, or industrial consortia such as IEEE, W3C, of 3GPP (Fomin, 2023, 241). Today, these and other standardisation organisations play a crucial role in developing and maintaining thousands of technology and service standards, as well as in catering to the demands of national and international policies.

Although the very phenomenon of NSOs/SSOs is relatively novel in the history of standards, the recent EU policy on standardisation invites the established practices that drive the development of standards—arguably largely based on the knowledge of the Industrial Age—to be revisited and updated. With the advent and proliferation of digitalisation and the penetration of information and communication technologies (ICT) to all walks of private life and business, the new EU standardisation and industrial policies now call for a turn towards a human-centric and value-based approach to standardisation (European 2024e; Commission, 2022a)—a relatively new and still somewhat nebulous idea that only recently began to gain traction (Fomin et al., 2024b).

The aim of the present article is to contribute conceptually to the idea of value-based standardisation (VBS) by framing it in the context of recent EU policies and the future education of European standardisation professionals. Specifically, it seeks to justify the need for a standardised policy tool that can translate new policy demands into actionable educational guidelines and to propose such a tool in the form of a provisional framework of value-based Intended Learning Outcomes (VB ILOs) for education about standardisation. To achieve its aims, the article will consider the current practices in standardisation education against the background of new policy demands, draw on the successes of relevant previous policy initiatives, and provide tentative suggestions on integrating EU core values and interests into this framework.

The article is structured as follows: the next section critically reviews the history of standards and standardisation against the backdrop of the concepts of responsibility and policy in order to assess the feasibility of the new strategic priorities and the potential for European standardisation to implement the policy-desired turn. Following this, the section on the EU's turn towards value-based and human-centric standardisation presents this idea as articulated in the policy documents and maps it onto the current educational landscape, noting that standardisation education still requires adaptation to meet the policy vision. The subsequent section outlines a VB ILOs framework as a tool that allows one to translate abstract value concepts and the notion of human centricity into more specific skills, competencies, and knowledge. This choice is then further justified by discussing the importance and effectiveness of competence frameworks as standardised tools in bridging policy goals with educational outcomes. Finally, concluding remarks are offered.

The history of standards: from techno-economic drivers to responsibility and values

Over centuries, standards have been evolving along with the technological, social, and economic development of societies. By examining the historical examples, one can probe into the concept of 'responsible standards' and the intricate dependencies between standardisation and different domains of life. Some important examples of early standards include alphabets, standardised weights and measures in ancient civilizations (e.g., in the Indus Valley—see Iwata, 2008), standardised monetary systems (Kurke, 2021), laws (e.g., the Code of Hammurabi), architectural standards (e.g., the Ancient Greek architecture—see Leonardis, 2016), military standards (e.g., the standardised tactics and military equipment of the Roman legions—see Bishop, 2006), and many others.

Today's international standardisation system was first legitimised during the Industrial Age and is rooted in its techno-economic traditions and societal developments. Consider the expansion of railroads (Carr, 2004; Lee et al., 2019), the rise of telecommunication technologies (e.g., the telegraph—see Friedlander, 1995), and the shift from handmade goods towards mass production (Hoyt, 1919). Standardising rail gauges allowed one to expand transportation networks, decrease transit times, and reduce transportation costs (Gross, 2016), whereas the early technical, operational, and tariff-related telegraph standards made the systems more efficient, less prone to errors, and more accessible (Wenzlhuemer, 2010). The shift towards mass production required numerous new standards related to safety, quality control, interchangeability of parts, production processes, and logistics, among others. The challenges and opportunities brought about by industrialisation also prompted the involvement of policy in what had previously been mostly private capital and technical expertise-driven efforts.

One of the first examples of what can be referred to as responsible standardisation was the industrial and policy response to the new dangers of the Industrial Age. Consider the example of the risk of steam boiler explosions. Some of these explosions were so powerful that factory buildings were destroyed, and parts of buildings were thrown several hundred metres into the air. Industrial workers were often killed or seriously injured in these accidents (Uekötter, 2021, 56). The industry's own interest in safe operations was so great that private monitoring organisations were founded. This marks the beginning of systematic technical standardisation in Europe during the second half of the nineteenth

century (Marburger, 1979, 193). As a result of the success of these private monitoring associations, European states increasingly relied on private expertise to define safety standards. This blended model for the monitoring of hazardous industrial plants would later emerge as the foundation stone of modern product safety law in Europe (Vec, 2011, 25).

As industries, transportation, and communication networks scaled rapidly in the twentieth century, the need for formalised and widely accepted standards became more pressing. This led to the proportional growth in the number and importance of SSOs, which played a crucial role in ensuring the safety, quality, and efficiency of the emerging complex systems. In the second half of the twentieth century, it became increasingly clear that the very standards that laid the foundation for establishing regional and global markets could also establish (technical) barriers hindering market access. This is why a multilateral agreement on Technical Barriers to Trade was adopted under the Framework of the General Agreement on Tariffs and Trade or 'GATT' (replaced by the World Trade Organisation in 1995) and approved by the European Economic Community (Council, 1979). After failed attempts to achieve a single market by establishing uniform governmental regulations in a top-down fashion ('total harmonisation'), the Community adopted a co-regulatory model that became known as 'New Approach' (Council, 1985, 1). This regulatory model explicitly included private standardisation bodies into the process of regulation (European Commission, 1985, 3). Under this approach, the legislator would focus on defining essential safety objectives (the 'what') while delegating implementation (the 'how') to standardisation organisations. This marked a shift whereby standardisation became a tool for implementing regulatory objectives. This system enabled more efficient and faster standardisation in Europe (Zubke-von Thünen, 1999, 789). Following a positive evaluation, the New Approach was further developed in 2008 into the New Legislative Framework (NLF), which, along with Regulation (EU) 1025/2012 on European standardisation, constitutes the core of the EU's legal framework for standardisation to this day. The NLF helped support the EU's response to the rising demand for standardisation—a trend largely driven by the rapid proliferation of ICT technologies and their increasing complexity.

Whereas the mechanical industrialisation of previous centuries had fuelled rapid growth in the demand for technological standards, the new surge driven by the expansion of ICT has been even more dramatic. Unlike the industrial era, where standards primarily addressed physical products, the rise of digital technologies has introduced the need for standardisation on an unprecedented scale and complexity. This is not only due to the sheer volume of digital products, which have become ubiquitous, but also because of the critical need for both horizontal interoperability (ensuring that different devices, platforms, and services can function together) and vertical interoperability (enabling integration across different layers of digital infrastructure) (Van De Kaa et al., 2011; West & Fomin, 2011). The growing importance of standards was also captured in studies on regional and global economic development. For example, a recent study by ISO (2021, 14) reported a GDP increase of approximately 28% in the UK (analysis period: 1921–2013) and in Nordic countries (1976–2016), resulting from the implementation of standards across multiple domains.

While the regulatory function of standards and their contribution to economic growth and technological advancements have traditionally been in the focus of academic research (Blind, 2025, 2004, 2016; Fomin et al., 2008; Funk, 1998; Swann, 2010; Yao & Suttmeier, 2004), standards also have societal and ethical dimensions, as the choice of adopting one standard over another can have a considerable impact on society, for better or worse (Edwards, 1998; Edwards et al., 2009; Kammer, 2000). This aspect is commonly discussed in the context of what is known as responsible standardisation, which, broadly speaking, refers to the process of developing standards that are socially desirable and sensitive to ethical principles and societal needs (Jakobs, 2020; Wiarda et al., 2022, 65; Wickson & Forsberg, 2015). This approach emphasises not only technological aspects, like quality, efficiency, and interoperability, but also ethical values like societal welfare, justice, inclusion, transparency, democratic participation, value-sensitive design, stakeholder diversity (which is essential for incorporating as many different values, perspectives, and interests in standards as possible), and others. In this context, responsibility should be conceived primarily in the moral sense—where each individual is accountable for their actions (Jonas, 1984)—rather than solely in legal terms. Moral responsibility entails a commitment to fundamental ethical values, which go beyond mere compliance with legal norms and regulations. In standardisation, this means that decision-makers, educators, and policymakers should not only adhere to formal rules but also consider the broader societal impact of standards and their alignment with human values.

While the term 'responsible' has been commonly used in the fields of research and innovation (Meijer et al., 2023), as well as in business (e.g., 'corporate social responsibility'–see Sen & Bhattacharya, 2001) for about two decades, the notion of responsible standardisation has only relatively recently begun to gain traction (see Wickson & Forsberg, 2015 for the first articulation). Tartaro (2024) links the concept of responsible standardisation (RS) to the 'fourth wave' of standardisation, contrasting it with the three previous ones, which primarily focused on technological issues (Yates & Murphy, 2019). According to this perspective, the current period of standardisation is characterised by intensified

integration of societal, ethical, and environmental considerations into standards (e.g., ISO 26000, ISO 14000, and SA 8000),[1] all of which fall under the purview of responsible standardisation. This development is owed to several different factors, including the emergence of complex socially disruptive technologies (e.g., artificial intelligence (AI), blockchain, internet of things (IoT), etc.) that gave rise to new ethical and societal concerns (e.g., the issues of machine bias and epistemic opacity in AI—see Alvarado, 2023a, 2023b), society's increased dependency on technologies (Gibson et al., 2007; Moser & Law, 1999; Rauhala & Topo, 2003), new regulatory and policy requirements (Regulation [EU] 2024/1689), growing demand for corporate responsibility (Carroll, 2021), and others.

Moreover, compared to the early days of SSOs and industrial consortia, when the primary concerns were interoperability and industry coordination, the widespread proliferation of ICT has brought up a new challenge—current users routinely interact with complex standardised technologies (e.g., computers, smart devices, etc.) while largely remaining unaware of the thousands of standardisation decisions that shape them (Jakobs, 2023; Shim et al., 2019) or the profound implications of technological standards for safety, privacy, health, economy, environment, and more (Feenberg, 2012; Timmermans & Epstein, 2010). In a way, the recent emphasis on responsibility in standardisation urges us to reexamine not only the very foundations of how standards are developed, distributed, mandated, and controlled against the background of the modern proliferation of technologies, but also what the society should know about standards, given the society's ever-growing reliance on them. Currently, the question of what exactly constitutes responsible standardisation remains an open one. We may conceive of it as a set of evolving values and ideals, continuously shaped by scholars, policymakers, and practitioners through the theory and practice of standard-setting in different domains, rather than something rigidly defined and readily applicable.

In the following section, we will frame the idea of responsible standardisation within the context of EU policies. In recent years, the European Commission has advocated for a value-based approach to standardisation (European Commission, 2022a), which broadly aligns with the notion of responsible standardisation presented above. The Commission's call also marks a shift away from the view of standards as purely techno-economic tools—a perspective that is rooted in Industrial-Age thinking and is increasingly insufficient for addressing today's societal and ethical challenges (Tartaro, 2024; Wickson & Forsberg, 2015). The new strategic priorities, combined with the impending retirement of the current generation of standardisation professionals (see Blind, 2019; Blind & Drechsler, 2017), give rise to the vital question of how to equip future professionals with the skills needed to identify and address the ethical and societal dimensions of standards.

Traditionally, labour skills geared towards policy priorities and market demands have been cultivated through educational institutions (Horwitch & Stohr, 2012; Lansu et al., 2013). Both in Europe and globally, Intended Learning Outcomes (ILOs)—a concept discussed in the further proceedings of this paper—have served as a framework for integrating relevant skills, competencies, and knowledge into curricula (O'Neill, 2015). Following the 1997 European Employment Strategy, the notion of individual employability began to shape the orientation of educational programmes, encouraging the adoption of selected ILOs designed to improve the graduates' prospects of entering the labour market (Winterton & Turner, 2019).[2] In parallel, the development or accreditation of new or existing university programmes increasingly involved assessing graduate employability in terms of the programme's alignment with specific market or policy needs (Fomin et al., 2024a). This approach—tailoring education to meet external demands—requires first analysing broad policy and market demands, such as the 'call for responsible standardisation,' and then translating them into specific knowledge or skills components that can be embedded into educational programmes in the form of ILOs (Fomin et al., 2024a; Lansu et al., 2013).

[1] An anonymous reviewer highlights the importance of distinguishing between the content of a standard and its development process. For instance, while the standards mentioned may incorporate societal, ethical and environmental aspects, they may not have been developed explicitly with these considerations in mind. ISO 26000 could be seen as an exception in this regard, though its direct influence has been constrained by certifiability issues (see Bijlmakers & Van Calster, 2015). While we concede this point, we would argue that even standards not originally developed with responsibility as a guiding principle can steer industries towards more ethical and sustainable practices. Moreover, the growing integration of ESG (Environmental, Social, and Governance) principles in general may reflect a shift towards responsibility in practice, even if not explicitly in name.

[2] Although the idea of developing educational programmes to enhance graduate employability has faced criticism (Winterton & Turner, 2019), and its merits may be less evident in the case of humanities (Louvel, 2007), graduate employability has nonetheless become an established proxy for measuring the impact of higher education. While in STEM programmes employability is more directly tied to labour market demands and policy objectives, in the humanities it tends to focus more on fostering competencies that influence students' transition from higher education to the workplace (Smith et al., 2000, 385). In either case, the concept of employability may be seen as supporting the broader aim of universities: to develop intelligent and ethical citizens (Winterton & Turner, 2019) who are capable of securing employment regardless of their specific field of study.

EU's turn towards human-centric and value-based standardisation

The new strategic vision

In recent years, there has been an important shift in the EU's strategic vision on standardisation. While the traditional role of standardisation has been to provide various technical solutions, ensuring safety, quality, compatibility, and efficiency across a multitude of different domains, the recent EU policy documents call for the integration of aspects that have generally not been part of the European standardisation agenda. For example, in the strategic policy document *An EU strategy on standardisation: Setting global standards in support of a resilient, green and digital EU single market*, which outlines the European Commission's recent initiative for a standardisation framework to enhance EU's global competitiveness, resilience, and sustainability, this new vision is presented as follows: 'The special status of the European standardisation organisations comes with responsibilities. More than ever, standards do not only have to deal with technical components, but also incorporate core EU democratic values and interests, as well as green and social principles' (European Commission, 2022a, 4).

The importance of standardisation in advancing EU interests, such as the resilience of the European single market, sustainable development, digital transformation, fostering innovation, and global competitiveness (European Commission, 2022a, 1, 5–6, 7), as well as promoting the EU's core values (European Commission, 2022a, 1, 2, 5–6, 10), such as respect for human dignity and rights, freedom, democracy, equality, and the rule of law, is consistently reiterated throughout various sections of the recent European Standardisation Strategy document.[3] In one form or another, the Commission's urge for a more holistic approach towards standardisation appears in other policy documents as well, including *The 2024 annual Union work programme for European Standardisation* (European Commission, 2024a), *Artificial Intelligence Act* (Regulation [EU] 2024/1689), and *ICT standardisation priorities for the Digital Single Market* (European Commission, 2016a). For instance, in the latter document, the Commission states that

> The actions to address the [new] challenges [in the development of ICT standards] needs [sic] to ensure a proper balancing in view of their compliance with fundamental rights, as standardisation may have implications in this area. For instance, the actions need to ensure full respect of the rights to private life and personal data protection, and should also take into account other **fundamental rights**, including freedom to provide business and right to property. (European Commission, 2016a, 3–4; emphasis in the original)

In short, the EU's need to enhance its global competitiveness, economic resilience, and strategic autonomy, along with the evolving socio-technological and regulatory landscape more generally, has compelled the Commission to issue several key development strategy documents, including the European Standardisation Strategy (European Commission, 2022a). In this context, some of the prominent aspects stressed by the Commission in the policy documents include respect for fundamental rights and the European core values, European interests (e.g., economic, strategic, and security interests), the twin digital and green transition, and various societal facets (e.g., gender responsiveness, cultural diversity, inclusion, and accessibility, among others).[4]

The Commission's new strategic vision and expectations regarding standardisation follows more than a decade-long debate on the competitiveness of European standardisation in the global arena (see European Commission, 2025a for a recent roadmap). Motivated by the notable success of Asian players (China in particular) in engaging with international and European standardisation organisations (OECD, 2005; Suttmeier et al., 2006; Zúñiga et al., 2024), and tracing the roots of that success to broad, highly successful educational programmes (Hesser & De Vries, 2011; Jachia et al., 2020; Kanevskaia, 2020; Puiu, 2020), the question arises of how education about standardisation in Europe can be leveraged to boost competitiveness to the desired levels (De Vries & Egyedi, 2007; European Commission, 2016a; 2025a).

Some answers might be found in the Joint Initiative on Standardisation (JIS), a soft law initiative that was meant to modernise and speed up the European Standardisation System. The propositions of the initiative could indirectly contribute to improving education about standardisation, particularly through stakeholder engagement and alignment with EU values (European Commission, 2016b).

[3] The Standardisation Strategy does not explicitly mention all of these values, making only more general references to 'EU values,' 'democratic values,' and 'social, environmental, and ethical values' (see European Commission, 2022a, 2022b, 1, 4, 6). A more elaborate statement on the content of European core values can be found in the Treaty on European Union: 'The Union is founded on the values of respect for human dignity, freedom, democracy, equality, the rule of law and respect for human rights, including the rights of persons belonging to minorities. These values are common to the Member States in a society in which pluralism, non-discrimination, tolerance, justice, solidarity and equality between women and men prevail' (European Union, n.d.).

[4] With respect to the twin transition, consider the 'European Green Deal' (European Commission, 2023a) and the EU's Digital Competence Framework for Citizens (Vuorikari et al., 2022). For gender responsiveness, see the *EU Gender Action Plan (GAP) III* (European Commission, 2020).

However, considering that this is not a direct solution to the educational transformation challenge needed to boost competitiveness to Asian levels, a more structured, long-term educational initiative seems necessary to truly integrate standardisation education into Europe's industrial and technological strategy. Nevertheless, the question regarding competitiveness has not received satisfactory practical answers in Europe, not even in the context of what can be referred to as the 'traditional' technological view of standardisation, whereas the new human-centric and EU-value-oriented policy imperatives for standardisation raise the educational transformation challenge bar even higher. In short, there is a need to adapt and adopt the EU policy visions into educational curricula across Europe.[5]

The current state of standardisation education in Europe

Drawing on their domain expertise, some authors of this article hypothesised that current educational practices related to standardisation in Europe may not be aligned with recent policy initiatives. Motivated by this assumption (Baird, 2021), we set out to gain a clearer understanding of the extent of this potential issue. To that end, we adopted a convenience sampling approach to collect data through a survey of European standardisation educators, complemented by a series of follow-up interviews and sense-making sessions with the educators. Respondents of the survey were nine highly regarded European standardisation educators (university professors in particular) representing partner universities of the recently founded Horizon Coordination and Support Action (CSA) project, aimed at promoting education about standardisation in Europe.[6]

The findings of the survey suggest that at present the European higher education experts in the field of research and education about standardisation still largely adhere to a more traditional conception of standardisation, focusing predominantly on various technological domains (e.g., digital technologies, ICT, electronics, etc.), management, economics, and law, with limited attention being paid to the topics that align with the EU's new vision of responsible standardisation. For instance, out of nine respondents, each representing a different European university and a teaching programme or a course on standardisation, only three explicitly indicated covering gender issues[7] in standardisation (see Table 1). Five other educators responded negatively, while the remaining one only provided material recommendations. The situation is comparable when it comes to teaching green and digital skills, with only one respondent reporting covering digital skills in the context of standardisation and one only planning to teach standards that specifically serve sustainable development goals (SDGs) in the future.

In contrast, eight out of nine respondents indicated that they do, at least to some extent, address related societal facets (for example, the impact of technologies on society), although the survey responses do not make it very clear what the exact depth and breadth of these facets are in the lectures on standardisation. With respect to European interests, only two respondents reported covering them. Two others either gave a negative response or did not answer the question, while the remaining five respondents indicated that they do not address European interests 'directly,' 'explicitly,' or 'specifically' in their teaching. While the teaching domains and contents vary among the respondent universities to some degree, the overall responses suggest that the current educational landscape of European standardisation does not yet align with the EU's vision. At present, most of the surveyed educators do not address green and digital skills, gender issues, or European interests, and no single educator addresses all of the relevant aspects.

The survey results were complemented with targeted discussions involving representatives from international organisations (ISO) and European organisations (CEN/CENELEC, ETSI), as well as with interviews with education professionals and experts from several national standards organisations (Table 2). In total, 12 semi-structured interviews were conducted, with an average duration of 60 min.

[5] While the Strategy and other relevant documents promote a shift towards value-based and responsible standardisation in a manner that we find quite explicit, the Strategy notably does not extend its value-oriented language to its section on education (European Commission, 2022a, sec. 6). We are grateful to an anonymous reviewer for drawing attention to this point. We would like to make two clarifications in response: (1) although the section does not mention values explicitly, it does highlight the growing complexity of standardisation landscape and the need for new skills—both of which align with the broader policy vision outlined in the rest of the Strategy, and (2) the fact that the Strategy promotes values in standardisation but does not readily connect this to education illustrates a gap in the policy narrative, which serves as a key motivation for this research.

[6] The project 'Empowering Standardisation through Education in Europe,' https://www.edu4standards.eu

[7] An anonymous reviewer points out that since gender issues are part of societal concerns more generally, they should not be seen as equally significant, with the latter being considerably more important. While we agree with this perspective, our decision to include gender responsiveness separately in the survey is motivated by three reasons: (1) from an ethical standpoint, gender equality is a critical and cross-cutting dimension of overall human equality, which is a fundamental value, (2) our work is influenced by standardisation policy, which has increasingly focused on gender-responsive standards in recent years (see UNECE, 2022), and (3) gender responsiveness is explicitly identified as a key criterion for evaluating the pilots developed under the project 'Empowering Standardisation through Education in Europe,' which is the EU's recent initiative aiming to enhance standardisation education.

Table 1 Overview of policy-driven topics addressed in teaching across universities

Respondent Specific topics	U1	U2	U3	U4	U5	U6	U7	U8	U9
EU INTERESTS (2)			M	M	✓	M	M	M	✓
GENDER RESPONSIVENESS (3)		✓			M	✓			✓
SOCIETAL FACETS (8)	✓	✓	✓	✓	✓		✓	✓	✓
GREEN SKILLS (1)		✓		M				M	
DIGITAL SKILLS (1)		✓							

✓ – The topic is addressed in teaching.

M – The respondent indicated being aware of teaching materials on the topic (or a related topic) but does not address the topic explicitly

Table 2 Summary of Interview Participants

Interviewee type	Country of origin
Practitioner	Ireland
Lecturer	Ireland
Lecturer	Ireland
Practitioner	Italy
Lecturer/Practitioner	Italy
Lecturer/Researcher	The Netherlands
Practitioner	The Netherlands
Lecturer	Germany
Practitioner	Germany
Lecturer/Practitioner	Spain
Lecturer/Researcher	Lithuania
Practitioner	Lithuania

The interview questionnaire was carefully crafted to include a good balance of specific and open-ended questions about the education on standardisation. None of the respondents reported being aware of educational programmes or courses that directly adopt a value-based approach to education about standardisation. In follow-up discussions with standardisation educators, all participants acknowledged a lack of understanding—or agreement—on what exactly constitutes suitable content to support education about standardisation that directly references EU interests and core values.

Based on the aforementioned findings, we can conclude that implementing the policy-desired orientation for education about standardisation will pose numerous challenges for European educators. On the one hand, the policy documents effectively convey the EU's general strategic outlook on standardisation, stressing the necessity to broaden its scope and, in essence, to transform it. On the other hand, the statements in the documents that urge to integrate the European values, interests, and societal facets into standardisation—for example, the claim that 'proper balancing' must be ensured for ICT standards to comply with fundamental rights (European Commission, 2016a, 3)—are simply too vague to provide substantive guidance to educators on how these new aspects can be meaningfully incorporated into standardisation curricula to equip new generations of professionals with the necessary skills and competences. Moreover, some of the policy-driven concepts involved (e.g., digital skills, gender responsiveness, ethical values, etc.) may be seen as broad, context-dependent, and generally ill-defined in the policy documents—an issue that inevitably leads to further complexities when the multi-faceted and interdisciplinary nature of standardisation is considered.

To sum up, there is a gap between the policy vision and the current state of affairs in the EU standardisation education landscape, and while policy invites educators to help bridge this gap, several factors make this endeavour particularly challenging. First, as expected, the primary focus of the policy documents is on regulatory aspects. However, this means that actionable guidelines, practical examples, and specificity regarding how the educational sector can effectively respond to the Commission's vision for standardisation are not extensively covered. For example, the policy does not provide answers to questions such as which new skills are required for educators and students, how curricula should be developed, which methods and materials to use, or the extent to which the new topics should be covered in different study programmes and institutions. Second, leading standardisation educators report limited engagement with the new policy-desired topics. As a result, the policy's call for transforming standardisation education places considerable pressure on educators to devise a new, more inclusive and holistic conception of standardisation education. At the same time, it underscores the need for scholarly discussions on how the EU's vision of responsible standardisation is to be understood and fulfilled by delineating the relevant topics, methods, teaching materials, and learning outcomes that have traditionally been outside the purview of the discipline and finding the most effective approach to integrate them into standardisation education. In the next section, we will attempt to lay a foundation for such discussions by offering a basic conceptual framework for how the EU core values (and potentially interests) could be embedded in standardisation curricula.

A value-based intended learning outcomes framework for education about standardisation

Education as a medium for value transmission

Values serve as foundational standards of orientation and guiding principles that shape and direct our actions (Höffe, 2008). They have long been central to the ethical discourse in European philosophical traditions, encompassing concepts such as the good life, virtue, moral obligations, rights, and responsibilities. Even before the modern concept of value emerged—originally linked to mercantile value—philosophers had developed ideas that resonate with our understanding of value today. The roots trace back to ancient Greek virtue ethics, on the one hand, and extend forward to modern forms of ethics on the other, raising questions such as 'How should I live?' (Williams, 2011) and 'What is the right action to choose?' in deontological and utilitarian thinking.

Values manifest themselves on a personal, individual level as well as on a societal level. It is the values that people have that reflect how they perceive the world and how they interact with those around them. In that sense, the more values individuals share, the closer they tend to be. Having shared values tends to serve as a foundation for stronger connections, which in turn fosters more cooperative relationships. Understanding this dimension of values is essential in the context of policymaking, as these deeply held values are powerful motivators for people's decisions and actions. By understanding the shared values of groups, communities, and societies, policymakers can draft policies that align with these values and are thus more likely to be supported by the public, ensuring a deeper impact. Chinese techno-nationalism (Montresor, 2001; Yao & Suttmeier, 2004) is one example of such policymaking in the context of standardisation.

Another perspective sees values as a reflection of a shared societal worldview, encompassing three different levels: instrumental values, pragmatic values, and moral values (Höffe, 2008). Instrumental values, situated at the lowest level, are not inherently good; they require an extrinsic moral rationale in order to be deemed good. These values depend on the motivation from the higher levels. They influence behaviour in the pursuit of personal goals: 'If you want to become rich, you must spend less than you earn' is one typical formulation. Pragmatic values occupy the second level and govern the interactions in society, helping to maintain social cohesion (Joas, 2001). While they may not always refer to moral values, pragmatic values serve as guidelines for one's actions and provide underlying maxims that shape behaviour. At the third and highest level, there are moral values. They are intrinsic and pursued for their own sake. These values do not require reference to even more basic values and count as fundamental ideals in their own right.

The European values enshrined in Article 2 of the Treaty on European Union (TEU)—human dignity, freedom, equality, democracy, the rule of law, and respect for human rights (European Union, n.d.)—are moral values. They form the foundation upon which the EU is built, shaping the structure of European societies and influencing the daily lives of its citizens. These core European values are rooted in the principles outlined in the United Nations' (UN) 1948 Universal Declaration of Human Rights. The moral values that are shared and cherished in a society are primarily instilled in its members through various social institutions, such as family, schools, religious institutions, or the workplace. In this way, education plays a crucial role in transmitting values among members of society. This central role of education extends further into the areas of value-oriented policymaking and policy implementation. Furthermore, while some instrumental and pragmatic values may be derived from moral values, their relative importance varies, particularly in the context of different economic activities. This highlights the need for education to equip individuals with the necessary skills to contextualise and prioritise values according to specific socio-economic circumstances.

At the backdrop of the importance of education in promoting knowledge on (shared) values, and in the context of the history of European policy for regional development over the last few decades, it is important to note that the educational system in Europe has increasingly emphasised STEM subjects (Science, Technology, Engineering, and Mathematics). STEM education was considered to be a critical contributor to the techno-economic development and competitiveness of EU (Bacovic et al., 2022). And while policy initiatives continue to draw on the core values (e.g., see European Commission, 2025b), value-oriented policies must be clearly understood by educators and citizens, particularly in terms of how these higher-level values can be operationalised within specific venues and contexts of economic and professional activity. To this end, the specific role of higher and professional education should be in reconciling the fundamental values that bind the EU as a society with the more fluid values shaped (often, and sometimes unexpectedly) by shifting political and economic interests (such as, for example, those encompassed by the broad concept of 'EU Interests' in various policy documents, including the latest 'Competitiveness Compass for the EU'—see European Commission, 2025a).

Bridging the value-oriented policy and standardisation: the value-based intended learning outcomes framework

Values and standards have always been closely connected. Standards play an important role in integrating values into the design, development, and implementation of technologies (Fomin, 2023; Gordon & Fomin, 2019). By embedding ethical considerations and values into standardisation process, both standards and the field of standardisation can become more responsible and human-centric—an idea that is captured by the concept of 'value-based standardisation' (Veljanova et al., 2024). The idea of incorporating values into standardisation is not new. Traditionally considered a technical field, standardisation has long prioritised values also viewed as technical characteristics, such as safety, efficiency, and interoperability (Hanseth et al., 1996; Lacore, 2004; West, 2006). On a European level, the moral values enshrined in Article 2 of the Treaty on European Union—human dignity, freedom, equality, democracy, the rule of law, and respect for human rights (European Union, n.d.)—are of paramount importance. However, these values have not yet been explicitly included in European standards and standardisation, with the previously discussed notion of 'responsible standardisation' (Jakobs, 2020; Wiarda et al., 2022; Wickson & Forsberg, 2015) arguably being the closest approximation. Given the foundational role of the EU core values, combined with the policy push towards a value-based approach to standardisation, these values should arguably become a fundamental component of standardisation education. But how can abstract concepts like moral values be rendered more concrete so they can be effectively incorporated into standardisation curricula?

Our suggestion is to do so by defining and introducing value-based learning outcomes in education about standardisation. Learning outcomes (LOs) are 'statements of what an individual should know, understand and/or be able to do at the end of a learning process, which are defined in terms of knowledge, skills and responsibility and autonomy' (Council Recommendation, 2017). The idea of LOs, which emphasises the learners' knowledge and skills gained at the end of the learning process, constitutes a vital part of enhancing the quality and relevance of education and training in Europe. LOs contribute to strengthening the feedback loop (dialogue) between education providers and the labour market in the sense that they reveal the demands of the market on the one hand, and the skills and knowledge provided by educational institutions on the other (Cedefop, 2021). Moreover, they serve as a basis for the development of qualifications frameworks, curricula, and/or assessment criteria (Cedefeop, 2022; Horwitch & Stohr, 2012; Hussey & Smith, 2003).

The European Qualifications Framework (EQF) is an example of a LOs-based qualification framework. It is developed by the EU to serve as a pan-European reference (standard) for different levels of qualifications. It also fosters cross-border mobility of learners and workers and promotes lifelong learning and professional development throughout Europe. The EQF distinguishes eight levels of qualifications: L1—the lowest, and L8—the highest. For each level, the relevant LOs, consisting of knowledge, skills, responsibility, and autonomy, are defined (European Commission, 2018).

Given the success and wide acceptance of the EQF, including its terminology and methodology, we will use the EQF as a guiding framework to propose a tentative Value-Based Intended Learning Outcomes (VB ILOs)[8] framework for standardisation education. The VB ILOs framework will define learning outcomes in terms of knowledge, skills, and responsibilities across nine levels of qualification for which there are corresponding learning outcomes (see Table 3 for a generic representation). It can serve as a standardised conceptual tool applicable to both formal and non-formal education. In formal education, and in line with the International Standard Classification of Education (ISCED), ILOs will be specified for each qualification level and matched with each of the nine levels of the education system (starting from Level 0—Early childhood education to Level 8—Doctoral level), indicating what students are expected to know and accomplish upon completing a level and attaining a specific qualification. For non-formal education, ILOs will similarly address qualification levels achieved outside the formal system, thereby supporting lifelong learning and in-company training (Veljanova et al., 2024).

To integrate a values dimension into the framework, the European core values will be taken as central to the VB ILOs framework, given their deep roots in European historical development, their prominence in the policy documents discussed, and their ongoing influence on societal and political landscapes, policymaking, and legal frameworks. For the purposes of our framework, the five[9] core values introduced in Art. 2 of TEU—human dignity, freedom, democracy, equality, and the rule of law—will be used as a foundation, as they are an integral part of the EU's moral and legal heritage. Nevertheless, the centrality of these values in the framework does not entail that they (directly) encompass the

[8] In the literature, a distinction is typically made between intended and achieved learning outcomes. The former relates to what is expected for learners to know at the end of a course or programme. The latter concerns the outcomes actually achieved at the end of the learning process (Cedefop, 2022).

[9] The sixth core value introduced in Art. 2 of TEU—respect for human rights—will be integrated under respect for human dignity. This is done for pragmatic reasons. Human dignity is a very broad concept that encompasses a wide array of human rights and thus covers issues that are addressed by human rights. Such an approach reduces the complexity of the proposed framework and seeks to minimise redundancies.

Table 3 The general design of the VB ILOs framework

	Knowledge	Values			Skills	
Levels of qualification / education	Expected knowledge	Human Dignity	Freedom	…	Green skills	…
Level 0	Basic general knowledge	HD0:	FR0:		GS0:	
…						
Level 3	Knowledge of relevant facts, processes, and general concepts	HD3.1: HD3.2: HD3.3:	FR3.1: FR3.2: FR3.3:		GS3.1: GS3.2: GS3.3:	
…						
Level 8	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	HD8.1: HD8.2: HD8.3: HD8.4: HD8.5:	FR8.1: FR8.2: FR8.3: FR8.4: FR8.5:		GS8.1: GS8.2: GS8.3: GS8.4: GS8.5:	

whole spectrum of relevant moral values. The discourse on values among ethicists includes a wide array of other important values such as privacy, autonomy, responsibility, care, sustainability, transparency, and respect that are significant in today's technologically driven societies. Given their significance in the context of standardisation, they should arguably be integrated into standardisation education as well. In this way, by using the core EU values as a foundation for the framework and complementing it with additional ethical values,[10] the framework reflects EU's foundational commitments while remaining sensitive to contemporary societal challenges and thus ethically well-informed. Although there is not enough room in this paper to elaborate a fully-fledged programme of how to explicate the complete scheme of using the ILOs, the examples that follow should suffice to clarify our key point.

Values should not be viewed as isolated elements but rather as complementing and reinforcing one another. This relevance and interconnectedness can be made evident by invoking a few examples. The General Data Protection Regulation (GDPR) is considered to be a standard for data protection within the EU but it has also set an important example for data protection laws worldwide. At the core of the GDPR is promoting the value of privacy. Privacy is not explicitly mentioned in Art. 2 of TEU but its realisation is a precondition for both respect for human dignity and freedom. Another interesting example is ISO 19869:2019 Clean Cookstoves and Clean Cooking Solutions—Field Testing Methods for Cookstoves. This ISO standard incorporates sustainability considerations but in a strong relation with gender equality as well. Here, the goal of the value of sustainability is to ensure healthy living conditions, particularly for women as the primary users of cookstoves in rural and low-income households. These two examples highlight that considering relevant values in the context of standardisation requires a broader perspective to be taken in order to be able to fully comprehend the diversity of the value dimension (see Fig. 1), which in turn can help us clearly identify and recognise the values that a certain standard can enhance (or, conversely, undermine). By anchoring the VB ILOs framework in these core values and examples of relevant existing standards, as well as in good practices in general (Fomin, 2020), we can foster a cohesive and ethically grounded approach to standardisation education in Europe.

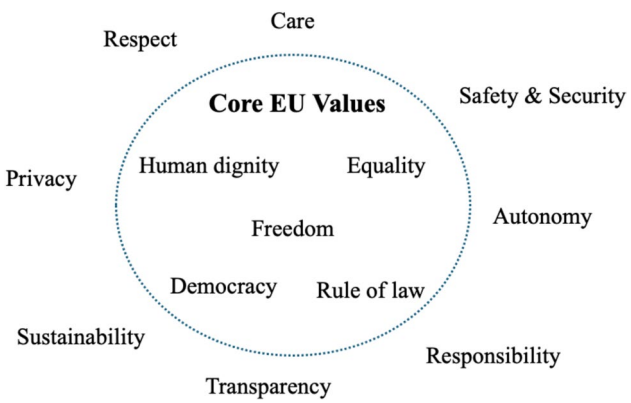

Fig. 1 The five foundational values of the VB ILOs framework and examples of other relevant values

[10] Inevitably, this framing raises questions about the relationship between different values, which is a complex and unresolved issue in moral philosophy. However, for our current purposes we propose treating the EU core values as a normative anchor or baseline due to their foundational status and institutional significance, whereas other values (e.g., privacy, sustainability, transparency, etc.) may be viewed as more context-dependent and derivative of the core ones (albeit not necessarily in a linear or straightforward fashion). The core values thus provide alignment with basic moral commitments and legal expectations, while the broader set offers the ethical granularity needed to address domain-specific challenges and applications.

With all this in mind, the VB ILOs framework, at this point, should arguably be formulated at a relatively abstract level, allowing for its adoption across various educational contexts, domains, and study programmes. For example, at the minimum qualification level, the knowledge of the value of 'Human Dignity' (HD) could be defined as 'The learner is expected to recognise that people are important and should be treated kindly.' Whereas at the highest qualification level this could evolve into: 'HD8.1: The learner is expected to have advanced theoretical knowledge of how standardisation processes can either uphold or undermine human dignity'; and 'HD8.2: The learner is expected to have comprehensive knowledge of legal, ethical, environmental, and gender aspects in standardisation, with the ability to formulate strategies that ensure human dignity is protected within regulatory and technical frameworks.' Over time, the framework could then be tailored to fit particular domains, with the development of a taxonomy of value-based LOs for standardisation serving as the initial step towards the policy-desired transformation of the EU standardisation landscape through educational initiatives. In this context, the key task for scholars becomes translating these abstract 'policy-desired' values into concrete LOs that can be effectively applied to standardisation education.

The overarching goal of the VB ILOs framework is to provide guidance to experienced and new lecturers on standardisation in the development of VBS curricula within educational systems. At the same time, the VB ILOs framework should also support national standardisation education strategies and initiatives.[11] Additional stakeholders who may benefit, directly or indirectly, include learners training to become standardisation professionals, standardisation bodies, industries, research organisations, NGOs, the public sector, and citizens interested in the topic. Ultimately, the proposed VB ILOs framework underscores the importance of pursuing value-based standardisation and explicitly embedding values in the development and implementation of standards. Education is the right way forward and the ILOs constitute the important initial step towards achieving this goal.

Connecting values to standardisation contexts in education and in practice

The new EU standardisation policy invites us to rethink both the nature of standards and the role of standardisation experts. Whereas standards were traditionally viewed as technical documents guiding various stakeholders (ISO/IEC, 2004), the emerging view positions them as tools for enabling value-driven economic activity across a wide range of actors, including citizens. The new conceptualisation is shaped by a direct call for value-based standards and standardisation processes (European Commission, 2022a), as well as for strong citizen engagement and knowledge valorisation as key drivers for accelerating the uptake of innovative solutions and the development of new technologies, products, and services that address pressing societal challenges while ensuring fair green and digital transitions (European Commission, 2024d, 1). This significant shift will inevitably spark academic research and discussion (European Commission, 2024c).

One contribution of the present article lies in presenting the invited focus on values in standardisation as a new turn in standardisation policy, which requires a bi-directional orientation: in addition to the traditional view of 'standards and standardisation for citizens,' the idea of value-based standards and standardisation must also be accepted and upheld by citizens (European Commission, 2024d). This new understanding promotes the idea of leveraging the democratic powers of society in shaping its future by means of standardisation. We argue that the new turn in standardisation policy towards values (and the idea of human centricity) can be effective only if adequate mechanisms for promoting the policy are put into action. Traditionally, education has been the primary means for raising awareness of citizens on policy-promulgated societal, technological, or economic issues. Thus, the widely accepted and utilised concept of LOs can be used to translate the abstract notions of the core EU values into a framework of VB ILOs. In turn, these outcomes themselves then become a new standard for education about standards. It is through the adoption of standardised educational tools—such as the VB ILOs framework—for policy support that the idea of 'better standards for the nation' (De Vries, 1999) can be effectively promoted among EU citizens.

Our proposal to develop the VB ILOs framework as such a tool rests on the knowledge of numerous successful past initiatives aimed at promoting specific knowledge and skills among the general public by means of (higher) education (Council, 2022; European Commission, 2022c). For example, the inclusion of EU core values, as envisioned by the European Standardisation Strategy, can be compared to the formulation of the 17 sustainable development goals (SDGs) set by the United Nations (UN Department of Economic & Social Affairs, 2015a). While both the EU core values and the SDGs share a somewhat vague conceptualisation, the latter are supported by a comprehensive action plan addressing social, environmental, and economic well-being (UN Department of Economic & Social Affairs, 2015b). Importantly, in their shift towards sustainability, policymakers have recognised the value of bottom-up

[11] For example, the recently published Austrian Standardisation Strategy (Bundesministerium für Arbeit und Wirtschaft, 2024) explicitly calls for promoting education about standardisation, though without elaborating on the tools or methods necessary for this endeavour.

initiatives, as evidenced by policy documents such as the *Engagement of civil society, private sector and other stakeholders* (European Commission, 2024b). The policy explicitly identifies the engagement of 'civil society, private sector and other stakeholders' as 'the key strand' and advocates for a 'whole of government approach' in implementing the SDGs by the Commission. Furthermore, the policymakers emphasise the integration of the 'turn to SDGs' into educational initiatives: 'SDG relevance should be one of the important quality indicators and should be integrated into the programme development and course planning tools of higher education institutions' (European Commission, 2022b). Similarly, the relatively vague policy concepts of 'digital and green skills' have been promoted and progressively clarified through the development of the DigComp framework (European Commission, 2013), which establishes a 'qualification standard' that addresses 'a broader set of competences relevant to life and society in general' (Cedefop, 2017, 19).

One more example of an industrial policy of the EU that shares a human-centric focus with standardisation policy is that of the AI Act (Regulation [EU] 2024/1689). Besides advocating for a human-centric approach, both policies also share a lack of specificity regarding the implementation of the initiatives. Nevertheless, supplementary policies and recommendations concerning education have already been proposed for the AI policy. For instance, the report *AI and education: Guidance for policy-makers* (UNESCO, 2021) clarifies in detail what a human-centric approach entails in the context of the benefits and risks of AI in education and elaborates on the role of education in developing AI-related competencies. It offers a number of specific recommendations for creating policies that promote inclusive access to educational programmes (e.g., for students with disabilities and other vulnerable groups), facilitate personalised and open learning opportunities, enhance data-driven provisions and management to increase access and quality in education, track learning processes and notify teachers of potential risks of failure, and develop skills for using AI in a manner that is both ethical and effective (UNESCO, 2023, 18).

To sum up, in order for European standardisation to successfully align with the EU core values, the relevance of the new (and currently loosely defined) principles must be clarified and demonstrated to the educators. Achieving this requires the development of 'tools and concepts relevant to their practice' (Jarzabkowski et al., 2013, 4, referring to Riggio et al., 2003), and the VB ILOs framework advocated here could serve as such a tool. Our analysis shows that when it comes to recent policy-invited industrial and societal initiatives, LOs-based frameworks have proven their effectiveness in bridging academia and practice (Jarzabkowski et al., 2013, 5) and, as such, represent a well-tested approach to support policy shifts towards new goals.

Conclusions

The EU's efforts to cultivate specific knowledge of the general public and raise specific competencies of labour market are not a new phenomenon. Historically, successful policy implementations have relied on the introduction of standardised tools and reference frameworks, such as DigComp, SDGs, and language skill assessments, to clearly define and/or evaluate the relevant knowledge and competence levels. However, in the context of 'responsible standardisation,' we currently observe a considerable gap: there is a strong policy push, yet an actionable tool for the policy implementation is missing. Given the blur conceptualisation of the principles underpinning the policy (e.g., the idea of human centricity), the absence of policy-desired concepts in the teaching portfolios of European experts on education about standardisation, and a vague understanding on what establishes the value-based or human-centric approach in standardisation or in education about standardisation, development of actionable tools for European educational domain is required.

In order to address this gap, we propose a value-based framework that can serve as a standard tool (or a basis for developing other standard tools) to support the policy-desired transition towards responsible standardisation and, indeed, responsible education thereof. By building on this provisional framework, abstract value concepts can be translated into more specific competencies, which would in turn make them actionable and relevant for higher education institutions. However, at present this is merely a starting point that requires further development. Ultimately, the successful uptake of a value-based competence framework in this context is important to ensure that educational initiatives align with the labour market and regulatory policy demands, while also preparing future European standardisation professionals to tackle complex ethical and societal challenges in the decades to come.

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