# Standardization Readiness : Ensuring the Integrity of the International Standards Ecosystem

Standards are an integral part of creating a fair and open market for nascent technologies in which innovations can compete on a level playing field, and common interfaces enable even small suppliers to sell products into a large market. Robust standards are science-based and industry-driven. When done well, standards create a common language, provide for open markets and business opportunities, and protect consumers and the environment. However, when the standards development process is poorly executed, standards can fragment the market with overlapping and conflicting specifications, create barriers to trade and close markets, give unfair advantages to countries or companies, stifle innovation, impede interoperability, and entrench inferior technologies. Instead of enabling new markets and new technologies, poorly defined standards represent an economic risk.
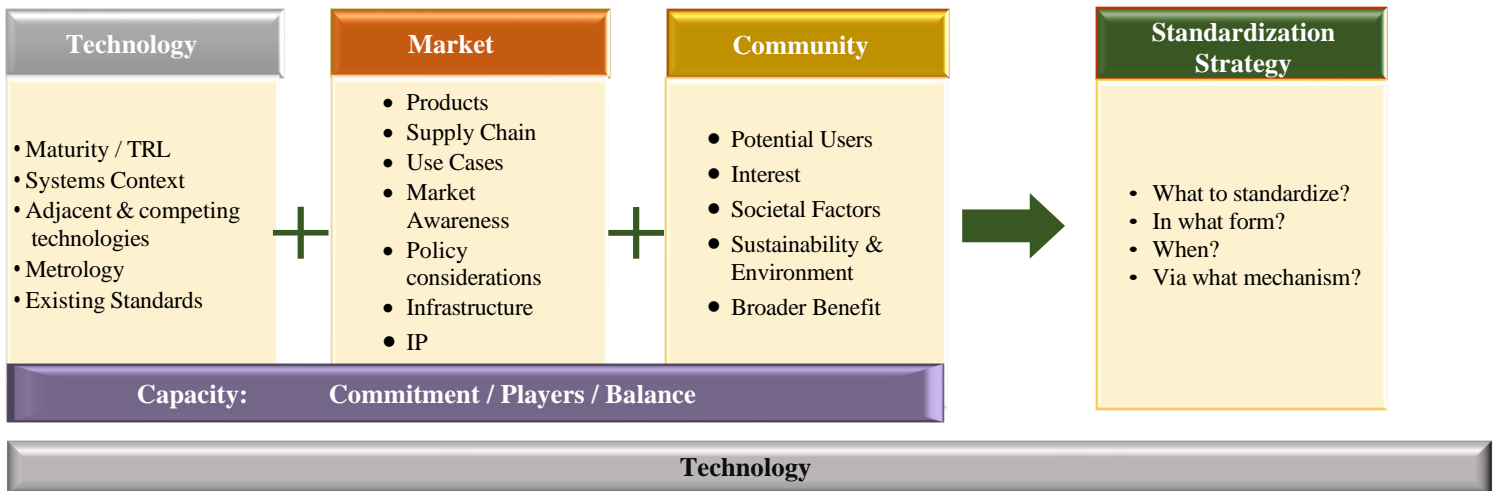
How might standards be used?

- Accelerate new technology / product development
- Enable equitable international market access
- Safety & reliability
- Support legislation and policies (e.g., Reference in regulatory submission)
- Framework to achieve quality, compatibility, repeatability, efficiency, and interoperability
- For conformity assessment: demonstrate that specified requirements. (e.g. as defined in a standard) are fulfilled, thus enhancing customer confidence
- For accreditation: third party attestation that an entity has formally demonstrated its competence per a set of requirements (e.g. standards)

Figure 1. SR Consideration Areas
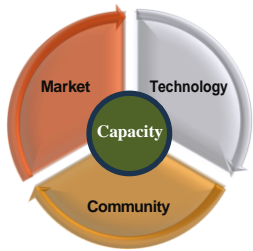
The concept of "**Standardization Readiness**" (SR) is proposed as a tool to assist in evaluating whether conditions are right to embark on a standardization activity for a given technology, and to help guide the development and timing of a standardization strategy. An SR decision can be informed by considering three interdependent criteria for standards development: technology, market, and community, as shown in Figure 1. Additionally, capacity is a key component of each area. Armed with an understanding of considerations in these areas, such as those in Figure 2, a well-informed standardization strategy can be derived.

Figure 2. Standardization Readiness Considerations Inform an Effective Standardization Strategy

Technology	Market	Community	Standardization Strategy
• Maturity / TRL • Systems Context • Adjacent & competing technologies • Metrology • Existing Standards	• Products • Supply Chain • Use Cases • Market Awareness • Policy considerations • Infrastructure • IP	• Potential Users • Interest • Societal Factors • Sustainability & Environment • Broader Benefit	• What to standardize? • In what form? • When? • Via what mechanism?

Capacity: Commitment / Players / Balance

Technology

Technology can be examined from a number of perspectives, and requires an assessment of technology maturity that considers more than just the technology readiness level (TRL). Different types of standards tend to be more appropriate at particular stages of the technology / innovation lifecycle.

Considerations to assess technology readiness for standardization include:
- *Maturity/TRL (Technology Readiness Level)* - Has the technology been proven, and in what setting (ie: laboratory, test environment, operational environment, fielded as a product)?
- *Systems Context* - Is the technology intended to be part of a system of technologies? If so, what is the maturity level and forecast for system-level technologies? If the technology is at the system level itself, how mature are the component technologies? What potential risks might be associated with developing standards at this technology maturity level(s)?
- *Adjacent & competing technologies* - Are there alternate technologies that might overtake this technology, or co-exist with it? Does this technology rely on other technologies, components or systems, and how mature are they? Is it possible to create a technology-agnostic standard to allow interoperability across competing technologies?
- *Metrology* - Is there a consensus on what properties need to be measured to support the technology? Does the measurement science exist, is it proven, and is it accessible? Can you measure the properties that will differentiate performance in a meaningful way, that might warrant being included in a standard?
- *Existing Standards* - Do any relevant standards already exist, or that can be modified to accommodate the technology?

Market

Standardization readiness should consider evidence of a market need and expected product development cycles associated with the relevant technology sector(s). For technologies being developed for sectors with short product development cycles, one may need to anticipate market needs concurrently with product development. In any case, it is important to ensure that standards don't simply endorse a front-runner position.

Most SDOs require evidence of market need before they initiate a new standard to assure that the right standards and related deliverables will be available in time for appropriate windows of opportunity. For example, ISO technical committees are required to develop and regularly review a strategic business plan relevant to its entire portfolio. Additionally, every proposed new project must be submitted with a documented business case, including globally diverse consulted companies. The Internet Engineering Task Force (IETF), for example, requires a minimum number of products to be on the market before standards are initiated.

Below are several considerations to help assess market readiness for standardization:
- *Products* - How many products from how many companies exist, and how mature are they? Are there competing technologies? Would standards support competition or down-selection? How confident are consumers? What risks do consumers face in product adoption?
- *Supply chain* - How many suppliers exist? How secure and robust is the supply chain? Where are they geographically? Are there single points of failure? Is there adequate end user demand to support the suppliers? Does the supply chain support the full product space and multiple product generations?
- *Use cases* - Have use cases been defined? How relevant are they to what sectors? What is the status of the needed enabling technologies for these use cases?
- *Market awareness* - Have market forecasts been conducted, and has consensus emerged? Are there technology and/or commercialization roadmaps, in the public & private sectors?
- *Policy considerations* - Is the sector regulated? Are there national and/or international compliance requirements? What are the regulatory requirements that need to be met for market entry?
- *Infrastructure* - Does the infrastructure exist to support products in the field (e.g., do charging stations exist to support electric cars?) Can products be maintained and repaired? Are their means to support access and storage needs?
- *IP (Intellectual Property)* - Are there IP issues that need to be considered?

Community

Robust standards must serve an articulated need expressed by the community of potential users and stakeholders. As the successful implementation of any standard requires users to voluntarily purchase and adopt them, standards efforts should be informed by the diverse perspectives of the entire interest community. This extends to societal factors, sustainability, and environment. Any successful standard must also have a community of users committed to its implementation, both during and following the publication of a standard.

Below are several considerations to help assess community readiness for standardization:
- *Potential users* - Who are the intended users of the standardization deliverable? Have they expressed a need for this deliverable?
- *Interest* - Is there evidence of entities showing interest in following the progress of particular standards, even if not fully committed to developing the standard (e.g., due to insufficient resources for full participation)? Are there mechanisms in place to continually provide information and solicit feedback during standards development?
- *Societal factors* - What societal factors might affect one's approach to standardization? Are there societal risks in the production, use or disposal of the products? Are there safety, security, health, energy, or environmental concerns? Are there issues of equity, inclusion, … that should be considered?
- *Sustainability & environment* - Are there risks in the production, use or disposal of the products? Are there safety, security, health, energy, or environmental concerns?
- *Broad-Based Benefits* –distributed benefits that do not accumulate significantly to a single entity, e.g., Public interest

Capacity

Robust standards not only require consideration of technology, market, and community issues, but must also garner participation of a robust community of experts to provide and apply knowledge in these areas. Standards should be informed by the diverse perspectives of producers, users, government, academia, and other the standard is stakeholders. SDOs may identify and assign a set of interest categories as an aid to assessing balance of representation. Further, experts must be committed to contributing to developing standards as needed.

Below are several considerations to help assess community readiness for standardization:

- *Commitment* - Is there committed and available global expertise? - and who are the experts? Are these experts willing and available to develop the standard(s)? How can they be engaged? Are the committed experts representative of all aspects of the technology / standardization effort?
- *Players* - Who are the players in the standardization landscape? What has been their level / direction of commitment? Are there organizations already developing standards in this area?
- *Interest* - Is there evidence of entities showing interest in following the progress of particular standards, even if not fully committed to developing the standard (e.g., due to insufficient resources for full participation)? Are there mechanisms in place to continually provide information and solicit feedback during standards development?
- *Balance* - Is the participation in standardization appropriately distributed across a number of countries / regions and stakeholder communities? Is it specific to a region? market sector? part of a supply chain?

Standardization Strategy Development

Informed by technology, market and community considerations, one can develop a standardization strategy that should include in its approach some of the key characteristics shown in Table 1:

Question	Example Options	Considerations
What to standardize?	• Performance • Design • Test Method • Architecture • System • Terminology • Manufacturing practices	• Is it appropriate to develop a technology agnostic standard that could apply to competing technologies? • Horizontal vs vertical standard (broad usage or specific?) • Are there gaps (business or technical) that would prevent usefulness of the standard(s) under consideration?
In what form?	• International standard • Technical specification • Code • Benchmark • Test method • Recommendation • Practices, Best Practices • Guides, Guidelines • Technical Report • White Paper • Conformity assessment • Management system	• How extensive are requirements? • Consensus level required for approval? • Intended Use? • Life limit / review cycle? • What level of user assurance is needed? • How mature and stable is the technology?
When?	• Near term • Long term • Too late	• Windows of opportunity • Timing for standardization initiation and/or engagement Availability of experts, interested parties

Via what mechanism?	• SDO (or not) choice
	• Consortium
		• International, National or Regional
		• Voting process
		• Facilitation and Consensus approach
		• Level of engagement
		  o Lead
		  o Write
		  o Participate
		  o Stay tuned and "drop in"

Table 1. Standardization Strategy Development Approach