

The NIST logo is rendered in a bold, black, sans-serif font. The letters are closely spaced, with the 'I' and 'S' being particularly prominent. The background behind the logo is a vertical split: the left side shows a low-angle view of a modern glass skyscraper against a clear blue sky, and the right side shows a close-up of bright orange and yellow flames with a white metal truss structure in the foreground.

**National Institute of
Standards and Technology**
U.S. Department of Commerce

SETTING THE STANDARD FOR COMPETING GLOBALLY

**International Standards,
Codes and Practices**

NIST Building and Fire
Research Laboratory

June 29-30, 2009

National Institute of
Standards and Technology
Gaithersburg, MD

BFRRL



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SPONSOR

The National Institute of Standards and Technology Building and Fire Research Laboratory (BFRL), as part of the U.S. Department of Commerce, aims to promote U.S. innovation and competitiveness by anticipating and meeting the measurement science, standards, and technology needs of the U.S. building and fire safety industries in ways that enhance economic security and improve the quality of life. BFRL studies building materials; computer-integrated construction practices; fire science and fire safety engineering; and structural, mechanical, and environmental engineering; and BFRL is the lead agency for the National Earthquake Hazard Reduction Program. Products of the laboratory's research include measurements and test methods, performance criteria, and technical data that support innovations by industry and are incorporated into building and fire standards and codes.

PURPOSE & APPROACH

The BFRL International Standards Workshop was held on June 29 and 30, 2009 to identify opportunities for standards development organizations and U.S. industry to optimize their global competitiveness through standards, codes, and practices. For the first time, researchers, practitioners and standards development organizations from across industries – fire protection, building energy, building materials, structural safety and performance, and construction—were brought to the table to compare and contrast perspectives. This two-day workshop engaged leaders from key U.S. building and fire safety standards and codes organizations—and the industries that rely on them—to:

- 1. Gain a clear understanding of their high-level approaches to international engagement;**
- 2. Identify their needs for technical assistance support that fit within the NIST/BFRL mission.**

The approach used to generate participant responses revealed unifying trends as well as cultural differences in the technical needs and priorities raised by three working groups. Participants were asked to choose one of the following working groups for the duration of the workshop:

- **Fire standards, codes, and practices**
- **Energy standards, codes, and practices**
- **Materials and construction standards, codes, and practices**

A complete list of participants in each sector working group can be found at the end of this report. For most of the two-day workshop, participants were divided into these three groups to prioritize sector-specific technical needs, in areas consistent with NIST/BFRL missions, and to discuss the benefits of meeting these needs.

Breakout groups were charged with answering the following questions:

- **What is the nature of your internationally focused work?**
- **What technical barriers are you facing?**
- **What do you need to address these obstacles?**
- **What might be relevant for an organization such as NIST to address?**

Mid-way through the workshop, the three groups were intermingled to share emerging ideas and listen for themes across groups, after which they returned to their working groups to refine and prioritize the issues in response to the questions above. Each group's set of priorities was revealed in a final plenary session, with further observations and comments offered by panelists and speakers.

PARTICIPANTS

A total of 54 participants from 36 different organizations attended. (A complete list of participants and organizations can be found at the end of this report.) The participant mix was intentionally designed, after consulting with technical experts in the relevant fields, to bring a representative cross-section of industry leaders to the discussion. Participation was on the basis of an established track record, or leadership in industry, standards development, or particular competence in an area of special relevance.

SPEAKERS

Ms. Mary Saunders, Deputy Assistant Secretary for Manufacturing and Services, International Trade Administration, U.S. Department of Commerce

Dr. Charles H. Thornton, Ph.D., P.E., Founding Principal, Thornton Tomasetti

Dr. Tom Chapin, Director, Underwriters Laboratories Inc., Corporate Research Department

Mr. Tim McEnery, Vice-President, International, U.S. Green Building Council

PANELISTS

Mr. Gary Kushnier, Vice President, International Policy, ANSI

Mr. Steve Bipes, Director, International Policy - Regional and Bilateral Programs, ANSI

Dr. Belinda Collins, NIST Technology Services

TECHNICAL EXPERTS PLANNING GROUP

Mr. Russ Fleming, National Fire Sprinkler Association

Mr. Wayne Crew, Executive Director, Construction Industry Institute

Mr. James Walters, American Heating and Refrigeration Institute

Mr. James Rossberg, Structural Engineering Institute, ASCE

Dr. Kurt Reimann, plastics industry consultant

OUTCOMES

Workshop attendees identified priority technical needs with high potential for producing breakthroughs that could advance industry effectiveness, efficiency, and competitiveness internationally. This report reflects the collective output of the workshop attendees, including the key technical challenges and solutions that will help integrate building and fire codes, standards, and practices both domestically and internationally in the near (less than three years), medium (three to eight years), and long (more than eight years) terms. Although significant challenges exist, workshop participants identified clear needs and early ideas to begin addressing some of these issues.

This report of the BFRL International Standards Workshop identifies key technical challenges for U.S. industries and standards development organizations (SDOs) competing internationally in construction projects, in engineering services, and in building products and materials. The report reflects the collective output of the workshop attendees, which included fifty-four researchers, professionals, and practitioners representing academia, national laboratories, standards development organizations, and industry in the United States and abroad.

The industries BFRL serves are huge and disaggregated. According to the U.S. Census Bureau of the Department of Commerce and the Bureau of Labor Statistics, U.S. construction and buildings was a \$1.2 trillion industry in 2008, representing approximately 7 percent of the gross domestic product and employing 5 to 7 percent of the U.S. workforce or ten million workers. Currently, the building materials, engineering, construction, building energy, and fire safety industries operate generally independently in terms of standards, testing, and measurement needs and requirements. Because these industries represent different perspectives of the entire whole, effective conduits for the cross-industry transfer of knowledge are insufficiently developed.

Lack of integration and ready access to the full spectrum of standards, testing and measurement tools directly impacts the quality and integrity of building design, construction, and operation, setting up complexities and inefficiencies that could otherwise be avoided with a more seamless approach. Despite best efforts, tremendous resource efficiencies and opportunities are not being realized due to lack of knowledge, interoperability, unifying leadership, and coordinated action.

Disaggregation affects directly the ability of U.S. industry stakeholders to operate and compete effectively both within the U.S. and abroad. The industry is grappling with standards, codes and practices not just domestically, but in a global context. The global and domestic contexts are generally intertwined and the distinction is often blurred. As SDOs vie overseas to win adoption of a specific set of standards, the U.S. is challenged

to field a consistent position in international venues, since no one organization is empowered to represent all U.S. interests.

Workshop attendees identified several priority technical needs with high potential for producing rapid changes in new technologies that could advance industry effectiveness, efficiency, and competitiveness internationally. Many of these needs address issues of concern to more than one industry sector. These cross-cutting needs include:

- 1. An online standards clearinghouse:** The development of a neutral, centralized, and federated database where all stakeholders are able to find current, freely accessible, standards and background information on an international level, plus proposals for new standards projects. This would not just be a list of standards; rather, stakeholders envision an online platform that leverages innovative technologies, with NIST adding value through analysis. This “standards hub” would serve as a platform to integrate digital data related to international standards and codes.
- 2. Building Information Modeling (BIM) Standards:** There was a consistent call for BFRL to take more of a leadership role in building a more robust and functioning BIM standards infrastructure for the United States. There is a need to more effectively engage the larger building and design communities in developing and demonstrating BIM standards.
- 3. Communication, outreach and education:** Greater communication and coordination is needed within and among stakeholders from industry, government and SDOs, including coordinated research and outreach efforts that would engage U.S.-trained engineers and architects overseas to drive U.S. practices, and public/private partnerships to encourage cross-industry synergies.
- 4. Global best practices:** By looking at global practices for other sectors and regions, the attendees recommended creating a best practice guide on how to track, manage, analyze, and disseminate international standards, codes, and practices.

Addressing the priority technical needs will require high-level support, coordination, and buy-in, along with active participation from a broad range of stakeholders, many of whom are competitors. Along with institutional issues, there are technological and workflow issues that must be dealt with to make the eventual implementation of viable solutions across the industries. These issues include, for example, building the semantic foundation (e.g., industry data dictionaries) for federated information resources and next generation engineering tools; establishing work process models, information models and protocols for automating and integrating multidisciplinary collaboration across multiple enterprises; and committing to changes to contractual structures and risk/reward equations to achieve integrated project delivery practices.

Today, there is no one existing national or international solution for a consistent, unified knowledge hub to manage and disseminate international codes, standards, and practices; although small collections of ad-hoc information resources have been established throughout the industry. While these resources meet the immediate need for a researcher or particular stakeholder, they fall short of enabling integration into neutral and credible resources that best serve the interests of U.S. industry to compete globally.

This workshop was part of an ongoing effort to enhance collaboration among and between BFRL stakeholder industries to facilitate effective industry-wide engagement in international standards, codes, and practices. The end goal was to define and implement a coordinated effort to understand cross-industry international standards needs, understand enforcement mechanisms for these standards, and better coordinate measurement standards and codes creation among fire, energy, and materials and construction sectors to optimize global competitiveness.

Workshop participants agreed that BFRL should help drive this enhanced collaborative process. A key part of this process would be a neutral, federated repository of data, where stakeholders could find titles and abstracts of up-to-date standards and meaningful background information on an international level.

The first goal of the workshop was to gain a clear understanding of the high-level approaches to international engagement of U.S. building and fire safety standards and codes organizations—and the industries that rely on them. While not all participants were able to articulate a concise approach to the international engagement of their organization, most participants were able to identify challenges to their organization in the international arena, including education of stakeholders, enhanced communication among stakeholders, and dissemination of the right information to stakeholders when and where needed.

The second goal of the workshop was to identify stakeholder needs for technical assistance support that fit within the NIST mission. To this end, participants identified the following generic needs for BFRL staff that cross all sectors: to act as the knowledge source for their colleagues and the stakeholders by becoming experts on relevant national and international standards in their work; and to contribute to the international standardization dialogue in their specific area of expertise. In addition, BFRL programs need to provide critical solution-enabling tools and to promote performance-based standards that are used by international building and fire safety industries.

A key outcome of this workshop was a realization of the benefit of meeting as a cross-disciplinary community of building and construction professionals spanning academia, government, and industry to gain insight from different sectors sharing similar frustrations, needs, and stories. The sectors working separately identified overlapping needs and envisioned similar solutions—most notably the need to address lost opportunity, redundant efforts, and real barriers from disaggregated, uncoordinated data and lack of knowledge-sharing across sectors—which speaks to the broad-based nature of the issues uncovered during the workshop.

MESSAGE FROM THE DIRECTOR

BFRL strives to be the principal source of critical solution-enabling tools—metrics, models, and knowledge—needed to support innovation and industrial competitiveness in this sector of the economy. However, standards can become barriers when platforms and standards compete, communication is stalled, consensus fails, and/or regulatory mandates differ. Unfortunately, these roadblocks occur frequently because the industries we serve operate independently in terms of standards, testing, and measurement needs and requirements. This lack of knowledge integration directly impacts the quality, efficiency, and integrity of building design, construction, and operation. It stalls innovation.

To compound the complexity, our stakeholders are competing in an ever-tightening global market. Industry disaggregation has a direct impact on the ability of our stakeholders to operate and compete effectively both domestically and abroad. They are trying to solve and reconcile complex issues without the benefit of an integrated perspective.

In an effort to engage and unite the stakeholder community, the first-ever NIST Building and Fire Research Laboratory (BFRL) International Standards Workshop was held on June 29 and 30, 2009. The call for enhanced, cross-sector standards and measurement communication was reinforced. Interestingly, whether or not BFRL is hitting the mark with the data and resources we produce for our stakeholders

was not in question—access to, storage, coordination, and dissemination of the information was the hot issue. In fact, the workshop revealed that stakeholder needs are in line with BFRL's core competencies. Workshop participants identified critical needs for technical assistance—such as industry-specific national and international code development to facilitate interoperability, and internationally comparable metrics to measure the cost-effectiveness of sustainable manufacturing practices—that align with NIST/BFRL missions.

With increasing globalization across BFRL stakeholder industries, now is the time to act on some of the breakthrough ideas seeded by this workshop. Workshop participants agreed that NIST should help drive this enhanced collaborative process—and, in doing so, provided an unparalleled opportunity for NIST. A key part of this process would be the creation of an international, interoperable knowledge hub (dynamic repository of data) to manage and disseminate international codes, standards, and practices to stakeholders. In the January 2009 Report of the Interagency Working Group on Digital Data to the Committee on Science of the U.S. National Science and Technology Council titled “Harnessing the Power of Digital Data for Science and Society,” it was reported that “The ability to achieve innovation in a competitive global information society hinges on the capability to swiftly and reliably find, understand, share, and apply complex

information from widely distributed sources for discovery, progress, and productivity...information access capabilities are critical to the progress of individuals, nations, science, and society.”

This struck a specific chord with me as director of the nation's primary laboratory resource for the building and fire safety communities. We have critical efforts underway to bring this idea to fruition.

BFRL will build on the workshop momentum. We are committed to increasing the efficiency and effectiveness of our stakeholders and better position the United States for global competition. We look forward to creatively and innovatively engaging and meeting the needs of our stakeholder communities in today's dynamically changing economic landscape.



Dr. S. Shyam Sunder

Director, Building and Fire Research Laboratory
National Institute of Standards and Technology

KEY IDEAS FROM PRESENTATIONS



The workshop featured six speakers who articulated the purpose of the event—to gather in one place government and industry standards stakeholders to engage in a meaningful dialogue about their specific achievements, challenges, opportunities, and perspectives. The task of the speakers was to lay the groundwork for productive discussion in the working groups through an overview of the significant issues related to international standards, codes and practices. These “framing” presentations occupied much of the first day and, together with a moderated panel

discussion on the current status of international engagement across the sectors represented by this workshop, helped to provide a common baseline for the remainder of the event. The cross-agency perspectives, coupled with the common challenges identified by these leaders, further reinforced the critical needs that emerged from the workshop—education of stakeholders, enhanced communication among stakeholders, dissemination of the right information to stakeholders when and where needed. Brief summaries of speaker presentations follow.



C. Deanease Anderson/NIST

Dr. Gallagher welcomed participants to the workshop and provided context by sharing NIST's mission and goals, discussing key programs and laboratories, and explained the composition and organization of the agency, its facilities and joint institutes. Dr. Gallagher reminded participants that NIST priorities include:

- Focus new activities on critical national priorities, including energy, environment, manufacturing, health care, physical infrastructure, and information technology
- Strengthen laboratories and facilities to ensure U.S. leadership in measurement science
- Leverage critical programs, including the Technology Innovation Program (TIP), Hollings Manufacturing Extension Program (MEP), and Malcolm Baldrige National Quality Award

Dr. Patrick D. Gallagher

Director, National Institute of Standards and Technology, U.S. Department of Commerce

- Maximize impact through effective collaboration and coordination with industry, universities, states, and other federal agencies

He also discussed NIST's role in standards development by transferring research results into documentary standards, including testing methods, interoperability specifications, building and fire codes, protocols, and international standards efforts. NIST provides technical support to the private sector and to other government agencies, including:

- Conducting measurement science research that provides the technical basis for practice, standards, and codes
- Disseminating research to practicing professionals
- Staff participating on technical and standards committees

- Providing technical assistance to the building and fire communities through standards development in strategic areas of national interest.

On the international front, NIST's efforts include:

- Development and use of effective standards to support competitiveness for U.S. industry
- Support for expanded and stabilized markets, improved technologies, lower costs, and economic growth and development
- Standards-related activities that are increasingly important to global competitiveness in technology-intensive markets



NIST

Ms. Saunders discussed “Framing the Issues in the International Trade Context.” Her presentation emphasized that standards provide the underpinning for the exchange of products, systems, and services. Standards are the bridge between research and product delivery and between technology and the needs of users; they ensure compatibility, provide platform stability for innovation, and enable interconnectivity and interoperability. Common acceptance of standards is fundamental to the success of robust, fair and free trade both domestically and internationally. Key messages included:

- Global standards that incorporate critical technologies are key to U.S. competitiveness

Ms. Mary Saunders

Deputy Assistant Secretary for Manufacturing and Services, International Trade Administration, U.S. Department of Commerce

- Standards that are voluntary and consensus-based, developed through a process that is open, transparent and balanced with broad stakeholder input are important to global confidence
- Standards that are market relevant, meeting the needs and concerns of all relevant stakeholders, are most likely to be used
- U.S. stakeholders must engage strategically as technical contributors and policy shapers in the international standards discussions



Dr. Charles H. Thornton

Ph.D., P.E., Founding Principal, Thornton-Tomasetti, Inc.

Dr. Thornton brought an international construction industry perspective to the cross-disciplinary discussion, presenting on the “Implication of Codes on Global Structural Engineering Practices.” He illustrated the lack of uniformity in building and construction codes and standards through an examination of structures across the globe and the wide variety of building and structural codes involved in their construction. The national differences in standards and codes to meet safety, energy, and construction regulations became glaringly apparent, underlining the disaggregated approach not only among domestic stakeholder sectors, but also among international stakeholder groups.



Sandy Chapin

Dr. Chapin presented on “The Impact of Global Standards on the Product Lifecycle.” His presentation discussed how product safety standards play a significant role in the lifecycle of a product—and how these standards become particularly relevant in a global marketplace. The product design cycle encompasses all aspects including safety and performance requirements, conceptual design, prototyping, manufacture/processing, raw materials supply, storage and distribution, and use and end-of-life including disposal and/or resource recovery. This process makes clear how diverse standards can facilitate or constrain the timely introduction of safe and reliable products into the marketplace.

Dr. Tom Chapin

Director, Corporate Research
Department, Underwriters
Laboratories Inc.

The impact of safety codes and standards on product development, distribution, and sale (globally) is profound. Attendees came away from Dr. Chapin’s presentation with an:

- Appreciation of the global nature of product standardization and how local requirements can affect global access
- Understanding of the difference between consensus-based standards and self-declaration of conformity
- Understanding of the difference between a test report and the process for product certification

Mr. Tim McEnery

Vice-President, International, U.S.
Green Building Council

Mr. McEnery discussed the green global market landscape. His presentation illustrated a model of efficiency and success, focused on how—through communication, outreach, and collaboration—the U.S. Green Building Council stewards market transformation, provides tools and expertise, and builds community. The council facilitates forums for industry dialogue, builds consensus, and educates the industry and the public about Leadership in Energy and Environmental Design (LEED). As a result of their efforts, LEED has become a leader in the international green building phenomenon, providing a suite of rating tools and requirements, setting the standards for sustainability and green building design principles, and becoming a catalyst for the development of a national green-building rating tool.



Kellie Beall/NIST

Dr. Sunder discussed global competition including drivers for and barriers to change in stakeholder industries/sectors. Standards can become barriers when platforms compete, technology is frozen prematurely, consensus fails, regulatory mandates differ, and deliberate trade barriers are enacted. Government's role in helping to address these challenges includes participating in standards development, being a major user of standards, providing technical underpinnings such as research, and advocating for the national interest. Dr. Sunder provided a high-level overview of the legal and policy framework for these activities.

In this context, BFRL's strategic goals are the "magnetic north" for all programming and operations within the Laboratory and provide the enabling measurement science for:

Dr. S. Shyam Sunder

Director, Building and Fire Research Laboratory, NIST

- Net-zero energy, high-performance buildings
- Advancing infrastructure delivery
- Sustainable infrastructure materials
- Innovative fire protection
- Disaster-resilient structures and communities

Success stories abound that illustrate how BFRL contributes substantially to improving U.S. economic security and quality of life. The stretch goal for BFRL, however, is to go beyond such accomplishments to become the source for critical solution-enabling tools in the strategic goal areas and to promote performance-based standards that are

truly leveraged by the U.S. industries represented at this workshop, helping them to compete and lead in domestic and international markets.

Dr. Sunder emphasized that while NIST is a non-regulatory agency that does not set codes and standards, BFRL does have statutory authority in the areas of fire prevention and control, earthquake risk mitigation, windstorm impact, and construction safety. As such, BFRL provides technical support in developing codes, standards, and practices through research, disseminating results, committee work, and technical assistance. He emphasized that BFRL is an advocate for stakeholders, citing numerous examples of partnerships with industry, other agencies, and industry groups.

REPORTS FROM KEY SECTORS



Instructions to the breakout groups representing three key sectors of the building industry—Fire Safety, Energy, and Materials & Construction—were to create graphic snapshots (“mind maps”) to reflect each sector group’s discussion. A mind map is a diagram used to represent words, ideas, tasks, or other items linked to and arranged around a central key word or idea. Mind maps are used to generate, visualize, structure, and classify ideas. By presenting ideas in a radial, graphical, non-linear manner, mind maps encourage a brainstorming approach to planning and organizational tasks. Though the branches of a mind map represent hierarchical tree structures, their radial arrangement disrupts the prioritization of concepts typically associated with hierarchies presented with more linear visual cues. This orientation towards brainstorming encourages users to enumerate and connect concepts without a tendency to begin within a particular conceptual framework. Given some of the process goals of this meeting (e.g., bring disparate perspectives together, break through “siloesd” thinking, collect and synthesize large amounts of qualitative data), mind maps lent themselves well to these objectives. An example of a mind map structure is shown in Figure 1.

Each group was assisted by a facilitator, who guided them through a series of questions to foster

brainstorming and discussion, in this order of inquiry:

BLACK: In your internationally focused work, what is your future focus?

RED: What technical barriers are you facing related to each area of future focus?

GREEN: What do you need to address these technical barriers?

BLUE: What would you like to see from an organization such as NIST that might possibly address these issues?

During initial rounds, participants were encouraged to offer unfiltered responses, withhold editing or criticism, and push for breakthrough ideas. Only after each group had the opportunity to explore a range of ideas were they asked to step back and identify trends and patterns in the data. From there, they pulled key themes as a foundation for deeper investigation in the next day’s World Café.

Building Energy Systems

The Energy group worked in two smaller teams to produce these early outputs:

TASK: MIND MAP

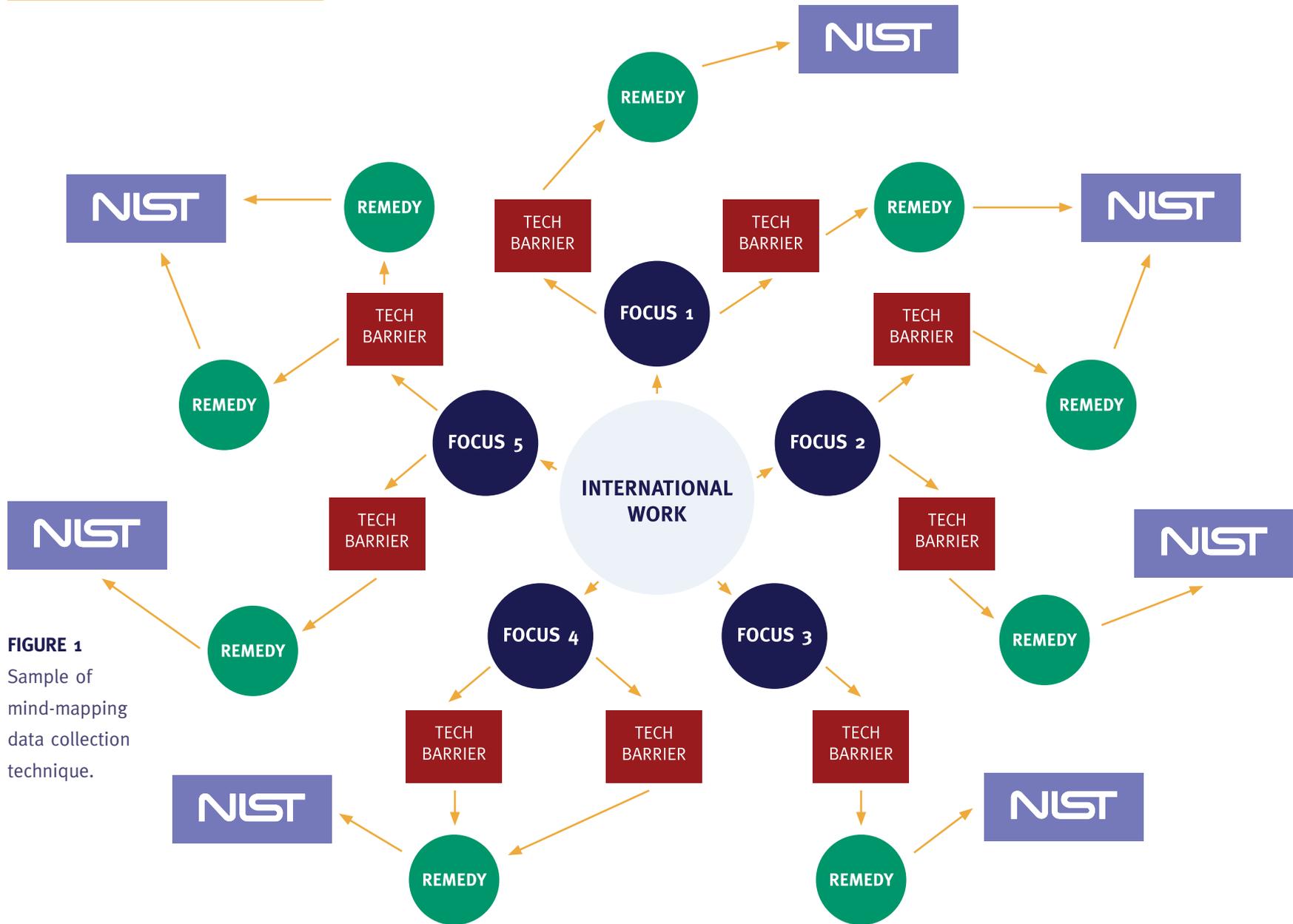


FIGURE 1
Sample of mind-mapping data collection technique.

TECH ISSUES: ENERGY 1

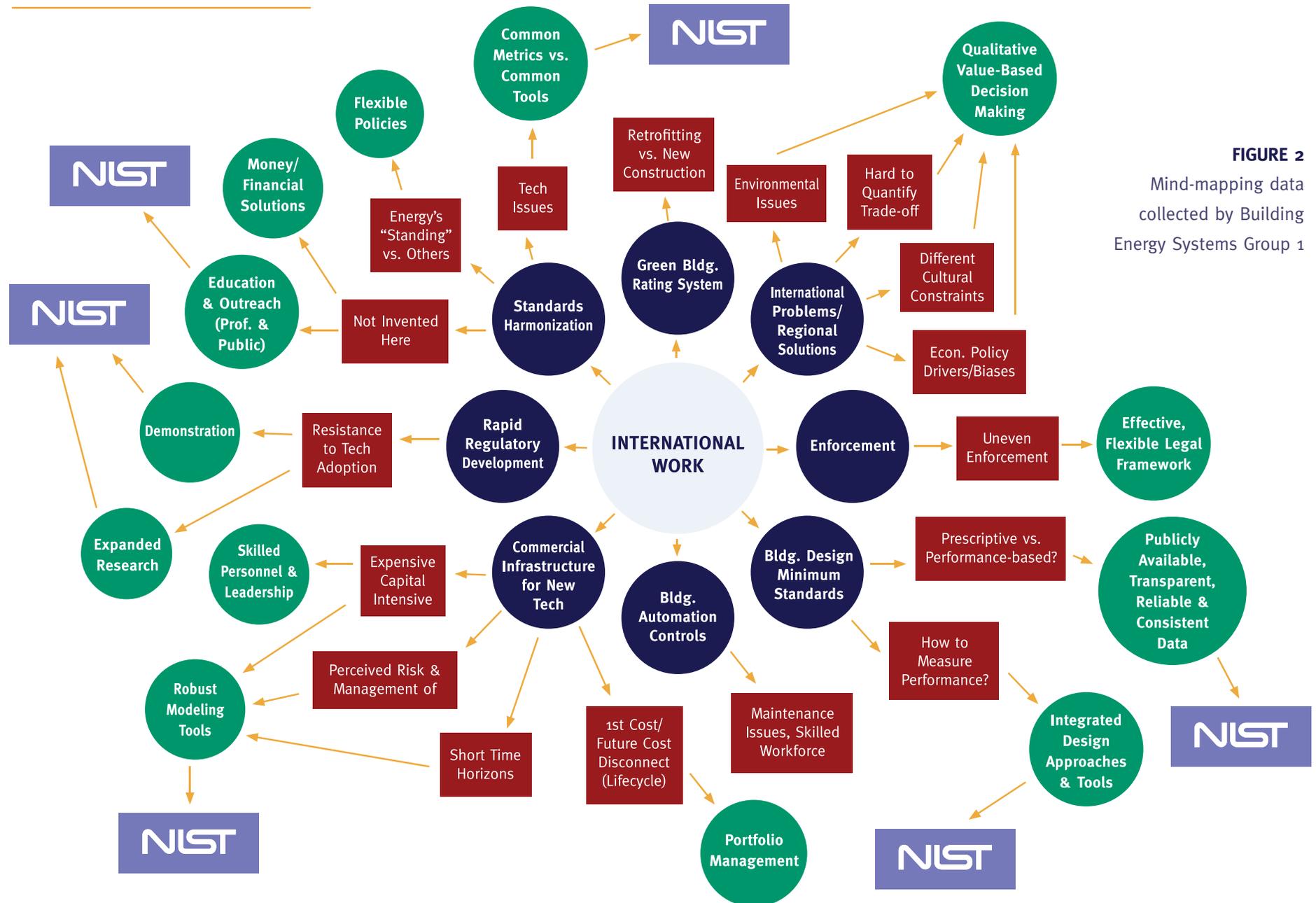


FIGURE 2
Mind-mapping data
collected by Building
Energy Systems Group 1

TECH ISSUES: ENERGY 2

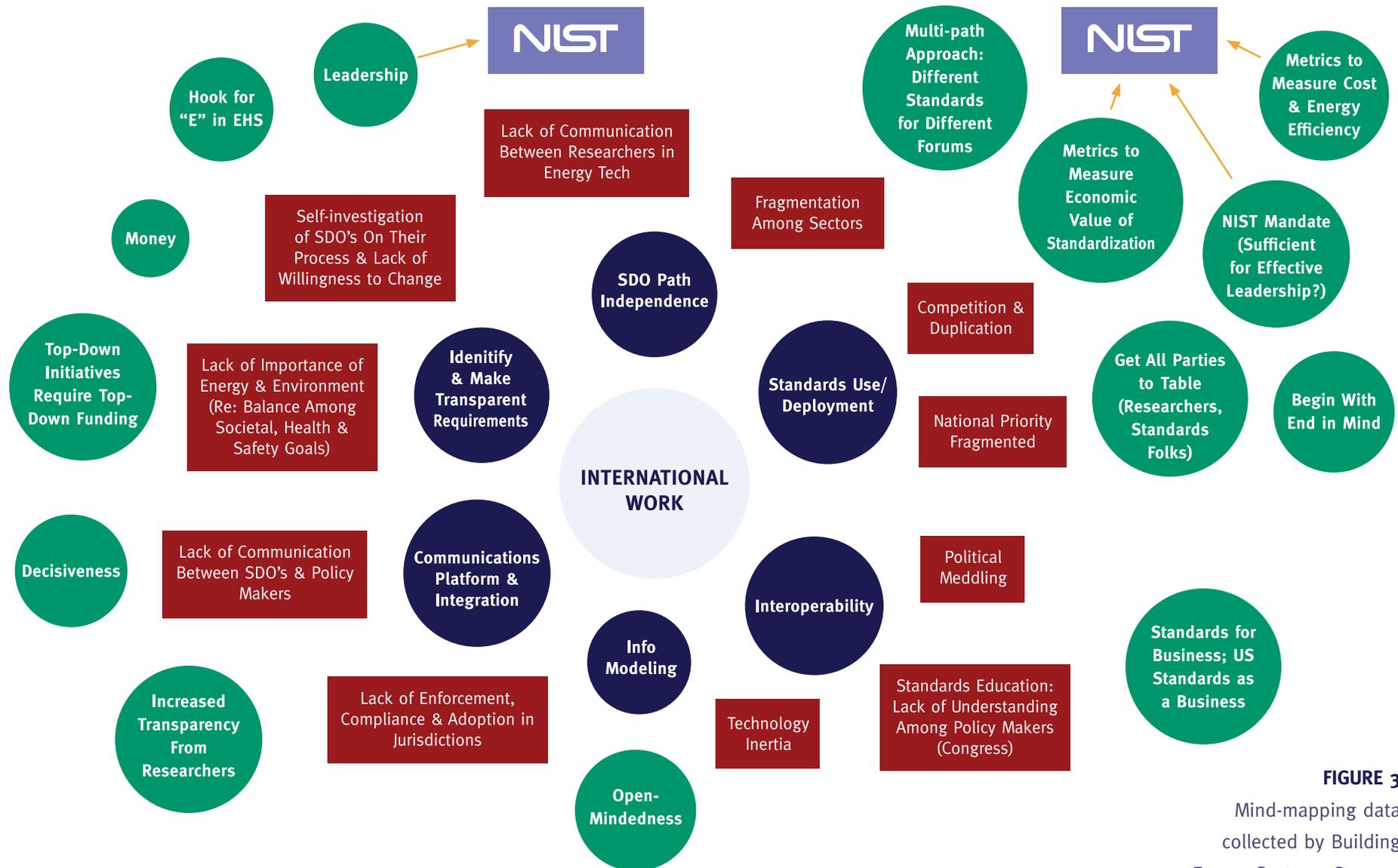


FIGURE 3
Mind-mapping data collected by Building Energy Systems Group 2

The Energy breakout group identified challenges to achieving energy-efficient, high-performance buildings, including the lack of measurement science to enable cybernetic building systems to communicate, interact, share information, and make decisions; and the need for standard data models, communication protocols, user-interface standards, security procedures, testing tools, and performance metrics.

Themes of the discussion highlighted how buildings are complex systems of interacting subsystems and past improvements in the energy performance of individual systems have not resulted in the expected reductions in overall building energy consumption. Additionally, a mismatch and disconnect exists between those who invest in energy efficiency and those who benefit from them.

In addition, group members identified the following challenges: developing a national energy construction code, accelerating interoperability, identifying emerging standards, leveraging collaboration, developing energy regulations and design standards, and providing education on available data.



Building Fire Safety

The Building Fire Safety group also worked in two smaller teams to produce the early outputs shown in Figures 4 and 5.

The Fire breakout group identified challenges to innovative fire protection and also to achieving disaster resilient structures and communities, noting that the link between research and building codes, standards, and practices is weak; and that the measurement science to predict structural performance failure, predict disaster resilience, and create innovative retrofit building options is lacking. In addition, current prescriptive fire standards and

codes stifle innovation in fire-safety systems, technologies, and building design, and the measurement science to reduce the risk of fire spread in buildings and communities is also lacking.

Group members identified the following specific challenges/needs:

- Metrics for different social needs
- Partnerships with other organizations
- List or database for current contacts of other national codes and standards
- Web-based technology to enhance collaboration and outreach
- Centralized authority
- The development of fire product/material database
- International collaborations
- Foreign code liaisons
- Increased participation in international standards setting organizations

TECH ISSUES: FIRE 1

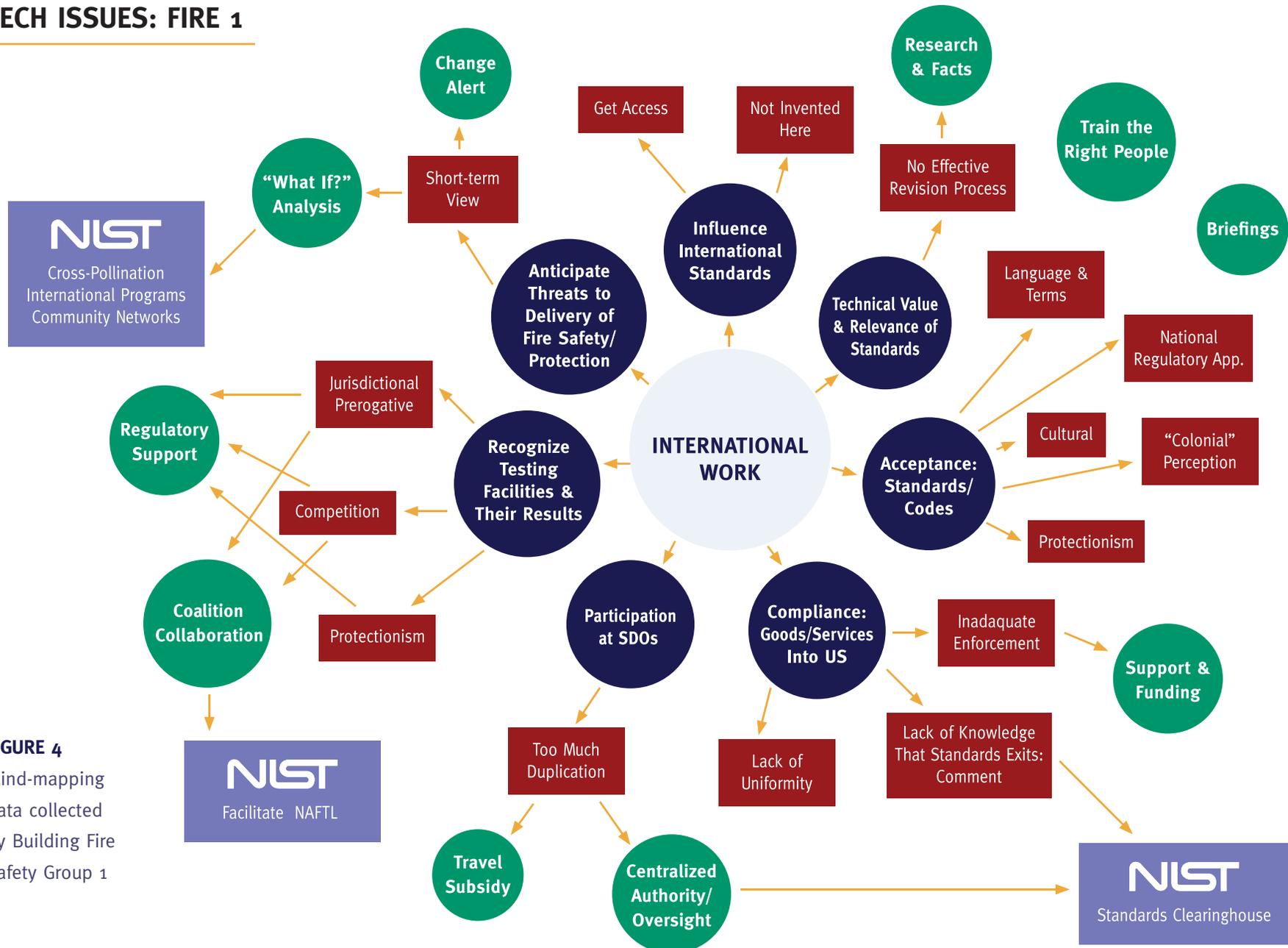


FIGURE 4
Mind-mapping data collected by Building Fire Safety Group 1

Building Materials & Construction

The Building Materials and Construction breakout group produced a single final output shown in Figure 6. The group identified challenges to advancing infrastructure delivery and for sustainable infrastructure materials, including the lack of reliable sustainability input data—especially service life data for materials, components, and systems; the absence of measurement science for gauging critical input; and the need for internationally comparable metrics to measure the cost-effectiveness of sustainable manufacturing practices. In addition, there is a lack of measurement science for determining construction productivity at both discrete and aggregate levels.



Summary of Major Barriers Across Sectors

The major barriers across sectors include international challenges, SDO independence and transparency, and quality assurance. International barriers include cultural constraints, language barriers, protectionism, fragmented national priorities, lack of knowledge about standards, an attitude of “not invented here,” the lack of a globally accepted process, IP ownership, and the drive to use local materials and suppliers. SDO barriers include competition and duplication among SDOs, lack of uniformity, self-investigation of SDOs on their process, and lack of communication between SDOs and policy makers. Quality assurance barriers include uneven or inadequate enforcement and lack of local QA on the ground.

Summary of Needs for Technical Assistance

Across all three sectors, participants indicated a need for technical assistance in addressing international standards adoption and competitiveness, and standards regulation and oversight. Needs related to international adoption and competitiveness include: coordination between international problems and regional solutions, help with influencing international standards, and support for compliance of goods and services that are imported to the US. Needs related to regulation and oversight include: surveillance, enforcement, third-party certification and rapid regulatory development.

TECH ISSUES: M&C

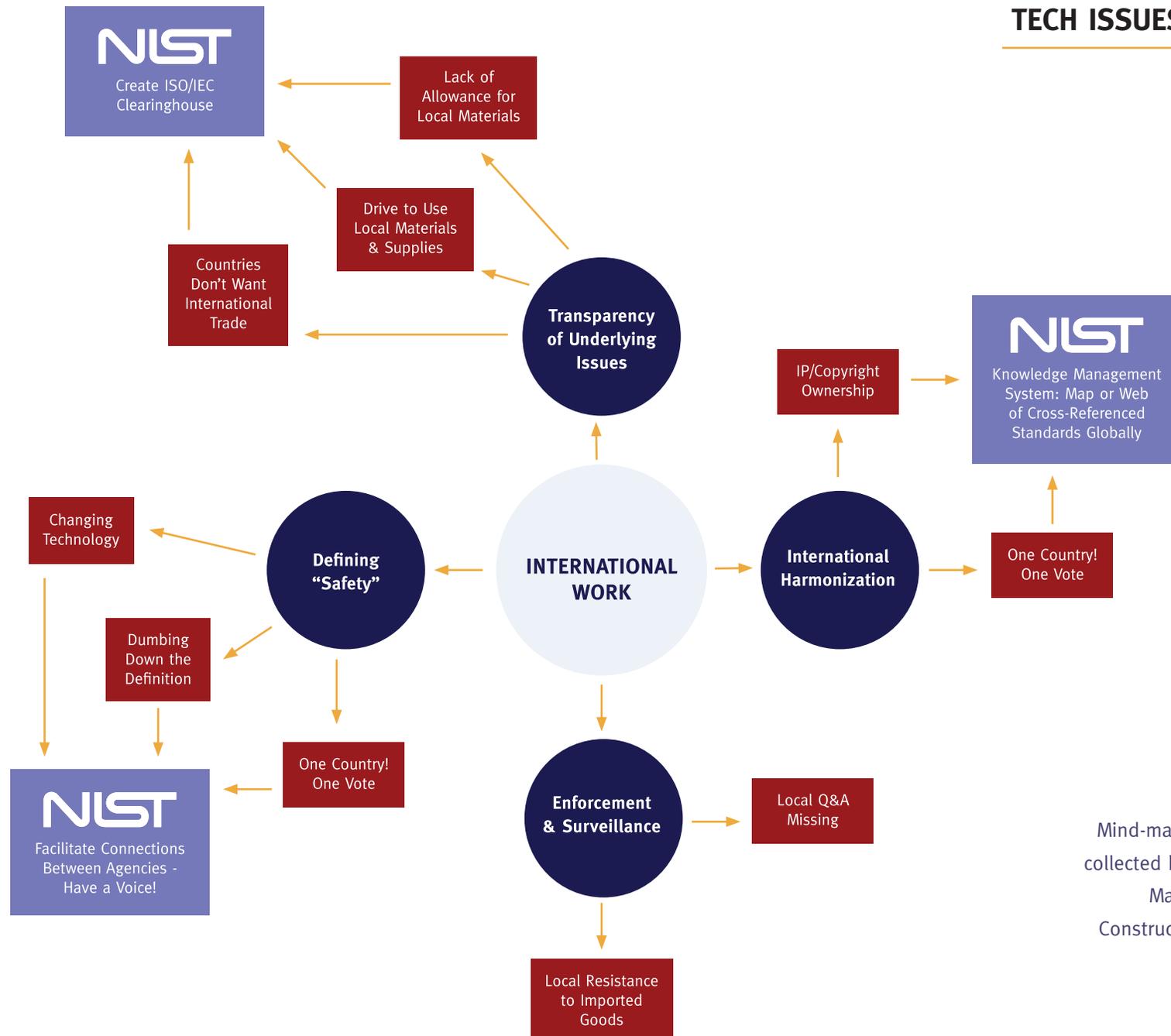


FIGURE 6
Mind-mapping data collected by Building Materials and Construction Group

INTERNATIONAL ENGAGEMENT



The first goal of the workshop was to gain a clear understanding of the high-level approaches to international engagement of key U.S. building and fire safety standards and codes organizations, and the industries that rely on them. To this end, input from participants both during and after the workshop revealed that the spectrum of international engagement strategies that workshop participants and their organizations report pursuing is largely strategic, with an emphasis on partnerships and agreements with international and regional institutions, the scientific community, and experts and awareness-building activities. A majority of participants named China and/or India their top choice(s) of preferred countries with which to engage, with the United States, European Union, and Mexico preferred by a little over half. The main reasons for focusing on these countries include:

- **China:** source of highest demand and offers the most opportunity
- **India:** source of highest demand and strong relationships in place

- **US:** offers the most opportunity and source of highest demand
- **EU:** strong relationships in place and more freedom to take design risks/innovate
- **Mexico:** strong relationships in place and more freedom to take design risks/innovate

Participants see the greatest opportunities in the next decade in China, Southeast Asia, and India. Key needs discussed across individual sector groups included industry-specific national and international code development to facilitate interoperability, processes to leverage collaboration, and inform regulations and design standards; cross-disciplinary partnerships and collaborations utilizing web-based technologies; a centralized federated information repository; increased cross-disciplinary participation in international standards-setting organizations; and the need for internationally comparable metrics to measure the cost-effectiveness of sustainable manufacturing practices.

PRIORITIZED NEEDS



The sector-specific groups prioritized their collective needs for technical assistance—what is crucial now, important now, crucial later, and important later. Across all sectors, results were as follows, with emphasis on the importance of committed private sector participation.

“Crucial/Important Now” technical needs included the call for:

- A clearinghouse of information including codes and standards knowledge management repository—this user-friendly and searchable knowledge source would include an international standards database that cross-references with a U.S. standards database
- A more robust and functioning BIM system to enhance global U.S. competitiveness and reduce production errors and omissions, resulting in fewer change orders
- Cross-disciplinary education and communication mechanisms (e.g., social

media) to educate and communicate with each other and policy makers—inherent to these channels would be an efficient feedback loop

- Incentives for each industry sector to serve as sources of information and adoption of cross-sector solutions

“Crucial/Important Later” Technical Needs included the call for:

- Change in focus from the individual, industry-specific component or product to a focus on the comprehensive system of standards and codes requests
- Enforcement and surveillance of adherence to codes and standards in international arena
- A method to ensure efficient international outreach to academia
- More effective accreditation process

Input from the breakout groups seeded further discussion and observations from a panel that wrapped up the two-day event. The groups and panel concluded that action items developed as a result of this workshop could best be met by researching existing domestic and international models and best practices for enhanced communication, collaboration, and information dissemination. NIST was identified as the best source for collecting, managing, and disseminating a searchable international codes and standards federated database, possibly using a “wiki” model. The group felt that NIST could also take the lead on facilitating collaboration—bringing the right people from the right public and private sectors together and creating a roadmap for navigating beneficial partnerships.

A significant finding that emerged is that, although groups were divided by sector, multiple challenges and technical priorities were similar across all sectors. This reinforced the following takeaway messages:

- There are numerous cross-sector technical issues related to BIM, accelerated green measurement standards, and the evolving definition of safety
- Opportunities for industries to optimize global competitiveness through standards, codes, and



practices are being missed, due to lack of communication and possible duplication of efforts

- Non-technical barriers associated with communication, collaboration, information dissemination, diverse cultures, and inadequate resources stand in the way of setting and leveraging standards, codes, and practices cross-industry, domestically, and internationally

There was a clear call for NIST to engage stakeholders and help develop and implement solutions to these cross-industry challenges.

IMPLICATIONS & NEXT STEPS

This workshop provided a unique forum for the cross-disciplinary community of building and construction professionals spanning academia, government, and industry to meet and voice their opinions and concerns, while also strategically prioritizing needs. That each sector worked separately, yet identified many similar needs and envisioned similar remedies, speaks to the broad-based nature of key issues that were uncovered during the workshop.

Currently, the building materials and construction sectors, energy, and fire safety industries operate largely independently in terms of standards, testing, and measurement needs and requirements. Because these industries represent different perspectives of the entire whole, effective conduits for the cross-industry transfer of knowledge are insufficiently developed. This lack of integration directly impacts the quality of building design, engineering, construction, and operation, impeding U.S. global competitiveness.

To tackle these challenges, workshop participants agreed that:

- All involved in the process (from standards creation to product lifecycle management) need to be actively engaged
- There should be consistent standards used across industries, domestically and abroad, they should be easily accessible, and regularly disseminated to key parties
- When closely related standards vary across sectors and/or international borders, their relationships and/or equivalencies should be clearly delineated
- Consistent intra-industry dialogue (both nationally and internationally) and regular inter-industry dialogue (both nationally and internationally) should be facilitated. New codes, standards, and regulations creation

should be implemented with both domestic and international input.

- Sector-specific products and systems should be conceptualized with an emphasis on performance-based design and in consultation with the other industries that will be using the products and systems
- Enhanced communication, education, and knowledge dissemination is key to the desired end result: a more transparent process which translates into increased efficiency, less duplication of efforts, faster delivery of building products and systems, easier entry into foreign markets, and enhanced U.S. competitiveness¹

Actions appropriate for NIST to take include:

- Implementing and managing an online standards clearinghouse, including a federated database
- Identifying priority topics, venues where standards development is occurring, where standards are needed, and covering both national and international venues
- Integrating regulator needs at both the state/local level and federal level, linking in with GSA and DOD, who have significant building portfolios that they manage
- Transitioning key research findings into standards and codes.²

¹Implementing this idea presents significant challenges since standards and codes are the intellectual property of the SDO and/or ANSI, requiring access and dissemination issues to be resolved.

²The way that the World Trade Center findings were provided to the International Code Council and other codes and standards organizations is a model for this action.

GLOSSARY OF ACRONYMS

ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
BFRL	Building and Fire Research Laboratory
BIM	building information model
ICC	International Code Council
IP	intellectual property
LEED	Leadership in Energy and Environmental Design
MEP	Manufacturing Extension Partnership
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
QA	quality assurance
SDO	standards development organization
TIP	Technology Innovation Program

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PUBLICATIONS AND ONLINE INFORMATION

Access to BFRL information and published research results can be found at the BFRL web site (<http://www.nist.gov/bfrl/>). Refer to the Building and Fire Research Laboratory Activities, Accomplishments, and Recognitions Report on the web site for the most recent description of BFRL projects and programs. Questions about specific programs should be directed to the contacts listed in the report.

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VISIT THE LABORATORY

Potential collaborators are encouraged to visit BFRL when in the Washington area. To schedule a visit, contact us at bfrl@nist.gov or call 301-975-5900.

The National Institute of Standards and Technology

The National Institute of Standards and Technology (formerly the National Bureau of Standards) was established by Congress in 1901 “to assist industry in the development of technology...needed to improve product quality, to modernize manufacturing processes, to ensure product reliability...and to facilitate rapid commercialization...of products based on new scientific discoveries.” An agency of the U.S. Department of Commerce’s Technology Administration, NIST’s primary mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. It carries out this mission through a portfolio of four major programs: Measurement and Standards Laboratories

that provide technical leadership for vital components of the nation’s technology infrastructure needed by U.S. industry to continually improve its products and services; a Technology Innovation Program provides cost-shared awards to industry, universities and consortia for research on potentially revolutionary technologies that address critical national and societal needs.; a grassroots Manufacturing Extension Partnership with a network of local centers offering technical and business assistance to smaller manufacturers; and a highly visible quality outreach program that confers the Malcolm Baldrige National Quality Award in recognition of business performance excellence and quality achievement by U.S. manufacturers, service companies, educational organizations, and health care providers.

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