STANDARDIZATION: JOURNAL OF RESEARCH AND INNOVATION

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RESEARCH-ARTICLE

The Safety Science Behind New York City's Lifesaving Micromobility Legislation

By Alec Krabbe

The popularity of micromobility devices (such as electric bikes and electric scooters) has grown due to their decreasing cost, environmental friendliness, and convenience compared to gas-powered vehicles. However, these devices can pose electrical and fire-related hazards due to the lithium ion (li-ion) batteries that power them. Over the last three years, cities across the United States have seen a drastic increase in hazardous events related to micromobility devices. These incidents can be triggered by overcharging, short-circuiting, puncturing, crushing, or exposure to high temperatures, leading to thermal runaway events, toxic gases, and corrosive liquids.

On March 6, 2023, New York City (NYC) Mayor Eric Adams signed into law Introduction 663-A, which requires powered mobility devices that are sold, rented, or leased within the city to be certified to the following UL standards:

- UL 2849, the Standard for Electrical Systems for e-Bikes, for the electrical system of any powered bicycle;
- UL 2272, the Standard for Electrical Systems for Personal E-Mobility Devices, for all powered mobility devices, including e-scooters; and
- UL 2271, the Standard for Batteries for Use in Light Electric Vehicle (LEV) Applications, for any storage battery for a powered bicycle or mobility device.

This new law demonstrates the commitment NYC has made to promoting a safe transition to micromobility, but what is the safety science behind the standards, and what are the requirements set forth by these standards?

MICRO MOBILITY, MAJOR PROBLEMS

The main sources of the electrical and fire-related hazards of micromobility devices are the li-ion batteries that power these devices.

A li-ion battery fire is a serious hazard that can cause severe damage to property and people and cannot be properly mitigated by traditional means, such as dousing with water or using a standard fire extinguisher. These fires become even more disastrous when they occur in multi-family dwellings such as apartment buildings.

A battery fire can occur when a battery is overcharged, short-circuited, punctured, crushed, or exposed to high temperatures. These conditions can trigger a thermal runaway event, which UL Research Institutes defines as "a phenomenon in which the li-ion cell enters an uncontrollable, self-heating state." When a cell is in thermal runaway, its temperature rises at a rate greater than 20°C per minute, leading to the release

of flammable gases, sparks, and flames and even causing explosions (all of which can result at the time of the initial incident or even days later due to stranded electrical energy inside the damaged battery). A battery fire can also produce toxic fumes and corrosive liquids that can be harmful to human health and the environment. Therefore, it is important to handle batteries with care and follow proper safety procedures when using and disposing of them.

From January 2021 through November 2022, the U.S. Consumer Product Safety Commission (CPSC) received reports of at least 208 micromobility fire or overheating incidents. These incidents resulted in at least 19 fatalities—five associated with e-scooters, 11 with hoverboards, and three with e-bikes.

In response to these incidents, the CPSC called on micromobility device manufacturers to ensure their products comply with established voluntary safety standards or face possible enforcement action. The CPSC stated that failure to adhere to applicable UL safety standards might subject consumers to an unreasonable risk of fire and serious injury or death.

WHAT'S IN THE STANDARDS?

The safety tests required by UL 2271, UL 2272, and UL 2849 are designed to help ensure that battery-powered personal mobility devices such as e-bikes, electric scooters, and hoverboards are safe to use and will not cause harm to the user or the environment.

The requirements address the following safety concerns:

Electrical safety

These requirements cover the design of the electrical circuits, the insulation of the wiring, and the grounding of the electrical components. They include specifications for testing to help ensure each device can handle the voltage and current levels without causing a fire or electrical shock hazard.

Fire safety

These requirements cover the flammability of the materials used in the device, the heat resistance of the battery, and the ability of the device to prevent or extinguish a fire. They include specifications for testing to help ensure each device can withstand high temperatures without causing a fire and prevent or extinguish a fire in the event of a thermal runaway incident.

Mechanical safety

These requirements cover the durability of the device, the strength of the materials used, and the stability of the device. They include specifications for testing to help ensure each device can withstand various impacts, vibrations, and stresses without breaking or tipping over.

Environmental safety

These requirements cover the resistance of the device to water, dust, and other environmental factors. They include specifications for testing to help ensure each device can withstand exposure to the environment without causing a hazard to the user or the environment.

Performance and reliability

These requirements cover the battery life, charging time, and overall performance of the device. They include specifications for testing to help ensure each device can perform as expected and will not fail prematurely, causing harm to the user or the environment.

Overall, these safety tests are designed to help ensure battery-powered personal mobility devices are safe to use, reliable, and durable.

CONCLUSION

By enacting legislation requiring certification to UL 2271, UL 2272, and UL 2849 for

micromobility devices, New York City has taken an important step toward addressing the safety concerns and reducing the number of hazardous incidents from li-ion batteries. These standards are designed to help ensure that battery-powered personal mobility devices are safe to use without causing harm to users or the environment, and compliance with these standards is essential to promoting safe expansion in the transition to electrification. With these safety concerns in mind, however, users should always take caution and follow proper safety procedures when using and disposing of these devices. If you are involved in the design, construction, sale, or operation of e-mobility devices, and you would like to help improve safety for these devices, please visit ULSE.org/get-involved to learn how you can take part in our standards development process.

Alec Krabbe is a standards project engineer for UL Standards & Engagement with a broad background in electromagnetic compatibility, RF spectrum management, and information technology. He serves as a technical contributor to the development and maintenance of UL and ULC standards, with a focus on electrical safety and electrification. He holds a bachelor of science degree in electrical and computer engineering from Northern Illinois University.

STANDARDIZATION: JOURNAL OF RESEARCH AND INNOVATION

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RESEARCH-ARTICLE

Climate Change and Standardization

By Wathma Jayathilake

Did you know that approximately 35 million adults in the United States don't think global warming is happening? (Marlon et al. 2022) Additionally, a 2020 study conducted by the United Nations showed that of the 1.2 million people surveyed, 36% didn't believe that climate change was an emergency requiring immediate action. (Carrington 2021) But the science cannot be ignored: glaciers are shrinking, the frequency of wildfires is increasing, the number of cold- and heat-related deaths is becoming more prevalent, and bodies of water are freezing later and later.

Proof of this exists in Ottawa, Ontario, home to the world's largest outdoor ice-skating rink, the Rideau Canal Skateway, which is 8 kilometers (5 miles) long and has a surface area equivalent to 90 Olympic ice hockey rinks. This canal has opened to the public every year since 1971, but due to an unusually mild winter in 2022, the city was not able to open the canal for the first time in more than 50 years. Climate change is happening, and we need to act.

CLIMATE CHANGE

Earth's climate has changed throughout history, mostly due to slight variations in the planet's orbit. However, the changes in climate that we are experiencing today are due to an abrupt increase in the Earth's temperature—a change caused not by variations in the Earth's orbit, but likely by human activity.

Modern human activities and industrial production have increased the release of non-naturally-occurring greenhouse gases, mostly from burning fossil fuels. Gases in our atmosphere such as water vapor, carbon dioxide (CO_2), nitrous oxides, methane, and chlorofluorocarbons allow sunlight to pass through but prevent some heat from escaping. As we release more greenhouse gases into the atmosphere, more heat gets trapped, strengthening the greenhouse effect and increasing the Earth's temperature.

We see the effects of climate change everywhere, including North America. In 2022, there were more than 500,000 emergency responses to fires for more than 800 structures across California, and wildfires were responsible for 9 fatalities and over 360,000 acres of land burned in the state. (CAL FIRE 2022) In that same year, there were more than 100 fatalities from floods in the United States and more than 100 fatalities from Hurricane Ian. (National Weather Service 2023; Bucci et al. 2023) According to the National Oceanic and Atmospheric Administration (NOAA), the total damage from Ian exceeded $112 billion. (Bucci et al. 2023)

As the concentration of greenhouse gases (particularly CO_2) in our atmosphere continues to increase, we will also see an increase in global warming, ocean acidification,

rising emissions costs, and increased sea levels. Sea levels will continue to rise as glaciers melt, flooding coastal regions and displacing millions of people. If we don't do anything to address our warming planet, we will see a rise in sea levels of almost 1 meter (3.2 feet) by the end of the century. Cities such as Jakarta, Houston, Dhaka, Venice, Lagos, Bangkok, New Orleans, and Miami will be completely flooded by the end of the century. (Lakritz 2019)

According to data provided by the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA), we are already seeing a rise in the Earth's surface temperature on every continent. It is estimated that we will experience a 2.1% increase in deaths from extreme heat by 2100 in North America alone, which equates to approximately 9.4 million people. (En-ROADS v23.2.1) Southeast Asia will experience an 8.9% increase in deaths from extreme heat by the end of this century, which equates to approximately 66 million people. (En-ROADS v23.2.1) We can expect air pollutants from energy to increase to almost 40 megatons by the end of the century. As the concentration of air pollutants in our atmosphere increases, we can expect an increased prevalence of adverse pregnancy outcomes, strokes, heart disease, lung cancer, and pneumonia. (IPCC 2023)

STANDARDS THAT ADDRESS CLIMATE CHANGE

Standards are playing a major role in helping us adapt to the changing climate. Standards developers have the opportunity to take climate action by prioritizing standards solutions that address sustainability for a variety of products and services. Standards offer practical and actionable measures that help us adapt to a variety of circumstances. They help us establish requirements that can be voluntarily implemented by the public or adopted through regulation.

At UL Standards & Engagement (ULSE), we develop standards that are climate-aware and supportive of sustainability practices for new and emerging technologies in a variety of industries. One example is UL 110, the Standard for Sustainability for Mobile Phones, which helps to reduce electronic waste (E-waste) from outdated cell phones through requirements that help to make it easier for devices to be disassembled and recycled. E-waste has become a growing problem over the past several decades because cell phones and other electronic devices contain toxic materials such as lead and lithium. These materials can cause serious harm to people and the environment if they are not disposed of properly. Through its requirements for the design, manufacture, use, and end-of-life management of mobile phones, UL 110 helps to reduce these unhealthy environmental and social impacts.

To help prevent usable electronic vehicle (EV) batteries from adding to the accumulation of E-waste, ULSE published ANSI/CAN/UL 1974, the Standard for Evaluation for Repurposing Batteries. This standard provides guidance on the sorting and grading of batteries that are intended for repurposing. Although used EV batteries may not be suitable for electric vehicle propulsion at 70-80% capacity, they can be repurposed in applications that do not require as much power, such as stationary energy storage systems.

To help improve overall confidence and trust in the sustainability claims of companies, ULSE published UL 3600, the Standard for Measuring and Reporting Circular Economy Aspects of Products, Sites and Organizations. As companies shift away from linear production models in favor of circular ones—prioritizing sustainability practices such as eliminating waste, reusing materials, and regenerating natural resources—this standard helps them communicate their sustainability efforts to consumers transparently by measuring sustainability at the site, product, and company level.

PARIS AGREEMENT

The Paris Agreement is a legally binding international treaty on climate change that was adopted by 196 parties at the 2015 United Nations Climate Change Conference. The purpose and goal of this agreement is to limit the global temperature increase to 1.5°C by 2100. In support of their international commitments to take climate action, the signatory countries communicated their nationally determined contributions (NDCs) to reduce greenhouse gas emissions and ultimately build resilience to adapt to the rising temperatures.

Countries like the United States and Canada have been working to reduce their footprint by implementing more sustainable and climate-conscious initiatives. The United States committed to reducing greenhouse gas emissions by 50–52% by 2030 (compared to 2005) by deploying zero-carbon solutions, creating jobs in low-carbon economies, and supporting the development of low-carbon technologies. Canada committed to reducing its contributions to greenhouse gas emissions by 30% by 2030 by pricing carbon pollution, phasing out coal-fired electricity, and investing in green infrastructure and clean technology.

CLIMATE-RESILIENT BUILDINGS AND CORE PUBLIC INFRASTRUCTURE INITIATIVE (CRBCPI)

The Climate-Resilient Buildings and Core Public Infrastructure initiative was a five-year partnership between the National Research Council of Canada (NRC) and Infrastructure Canada. Instituted in 2016, CRBCPI was intended to help ensure Canada's existing and new buildings and public infrastructure were more resilient to the effects of climate change and extreme weather events. Through this initiative, the NRC and Infrastructure Canada led the development of new and revised codes, standards, specifications, guidelines and decision support tools. This initiative was in direct support of the Pan-Canadian Framework on Clean Growth and Climate Change, which was built to meet Canada's international commitments for climate action.

In support of this initiative, and by using data in a predictive way, UL Standards & Engagement published 23 National Standards of Canada (NSCs) to support standards users in understanding and applying requirements related to climate change adaptation. These product standards covered areas related to public infrastructure, including lime thermal insulation and fuel tanks. The updated requirements were designed to adapt to future impacts of climate change such as extreme heat, increased severe weather events, and rising sea levels.

THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

In 2015, the United Nations and its member states adopted the 2030 Agenda for Sustainable Development, a comprehensive, far-reaching, and people-centered set of universal and transformative goals and targets intended to be achieved in three balanced and integrated dimensions: economic, social, and environmental. This agenda set a 15-year global framework centered on an ambitious set of 17 sustainable development goals (SDGs), with the vision of a secure world free of poverty and hunger, access to education and health, gender equality and women's empowerment, and reduced negative impacts on our environment.

At ULSE, we understand the importance of international collaboration and standardization. More importantly, we are acutely aware of the role we play in addressing our world's greatest challenges through the support of international commitments like the 2030 Agenda for Sustainable Development. In 2022, we prioritized support of the 2030 Agenda by aligning our standards catalog and standards development process with its 17 SDGs to help advance these critical goals. While the success of these goals will re-

quire dedicated collaboration from a multitude of industries, our standards can help improve and strengthen existing sustainability efforts and also support and encourage investing into new sustainability initiatives and technologies.

ULSE has published more than 1,700 standards and other documents, with 50 standards for sustainability. Although these standards were not developed with the SDGs in mind, the majority of them still directly or indirectly align with these goals.

To better understand the relationship between our standards portfolio and the SDGs, we conducted quantitative and qualitative analyses to identify the correlation between each of our standards and the SDGs. We discovered more than 950 individual cases in which a UL standard supports one or more SDGs. We also found at least one standard that supports each of the 17 SDGs. The SDGs with the most associations were the following:

SDG 11, Sustainable Cities and Communities;
SDG 7, Affordable and Clean Energy;
SDG 12, Responsible Consumption and Production;
SDG 9, Industry, Innovation and Infrastructure; and
SDG 13, Climate Action.

In addition to understanding how our standards portfolio supports and impacts the SDGs, this research will also help us identify new opportunities for standards development. We are committed to advancing the security, safety, and sustainability of our world by putting safety science into action. We will continue to research how our standards portfolio can support and advance the UN 2030 Agenda for Sustainable Development and its Sustainable Development Goals; more importantly, we will continue to communicate and be transparent with the public on our sustainability efforts.

We are also evaluating potential options for integrating the UN SDGs into our standards development process and establishing a new precedent for discussing SDGs and their individual targets in our conversations. To learn more about our initiative to support the UN SDGs, visit ULSE.org to read "The UN Sustainable Development Goals and UL Standards & Engagement: A Report."

CONCLUSION

Rising sea levels, changing landscapes, and natural disasters are only a few examples of the impacts of climate change. If we don't act, climate change has the potential to cause irreversible harm to our environment and our health. We need to adapt to our changing climate, and standardization is an important tool that can help implement mitigation tactics to reduce the risk of climate change. Standardization at the local and international levels can help ensure trust and integrity in greenhouse gas mitigation efforts and new and emerging technologies that are sustainable and climate conscious. As standards developers, it is crucial that we take accountability and initiative to address the impacts of climate change through our work.

Standards developers can leverage international frameworks to help guide and support the implementation of impactful climate solutions for slowing global temperature rises and reducing greenhouse gas emissions. We can also use international standards development efforts to help guide and shape our own national climate change-related standards initiatives, leading to consistency across regions and eliminating obstacles to trade. Standards developers can also invest in research and innovation for new technologies to reduce greenhouse gas emissions, increase efficiencies, and reduce waste, while continuing to support our needs and standards of living. Lastly, we can explore how our existing portfolios of standards impact climate change and we can re-evaluate their requirements to consider the associated environmental and health risks. If you would like to take part in these initiatives, please visit ULSE.org/get-

involved to learn how you can get involved in our standards development process.

REFERENCES

Bucci, L., L. Alaka, A. Hagen, S. Delgado, and J. Beven. 2023. *Hurricane Ian (AL092022). National Hurricane Center Tropical Cyclone Report*. Washington, D.C.: U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

CAL FIRE. 2022. *2022 Incident Archive*. Sacramento, Calif.: State of California.

Carrington, D. 2021. "UN global climate poll: 'The people's voice is clear – they want action."' *The Guardian*, 27 January.

En-ROADS Climate Solutions Simulator (v23.2.1). Additional Deaths from Extreme Heat. Climate Interactive.

Intergovernmental Panel on Climate Change. 2023. Synthesis Report of the IPCC Sixth Assessment Report (AR6). United Nations Framework Convention on Climate Change.

Lakritz, T. 2019. These 11 sinking cities could disappear by 2100. *Geneva: World Economic Forum*.

Marlon, J., L. Neyens, M. Jefferson, P. Howe, M. Mildenberger, and A. Leiserowitz. 2022. *Yale Climate Opinion Maps 2021*. New Haven, Conn.: Yale Program on Climate Change Communications.

National Weather Service. 2023. NWS Preliminary US Flood Fatality Statistics. La Crosse, Wisc.: *Weather Forecast Office*.

Wathma Jayathilake is a standards scientist at UL Standards & Engagement, where she is responsible for driving human health and safety considerations in standards. She works to identify hazards and risk factors in the areas of human and environmental health and climate change to strengthen the technical rigor of ULSE standards. In 2023, Jayathilake presented on climate change and standardization at the SES Annual Conference.

STANDARDIZATION: JOURNAL OF RESEARCH AND INNOVATION

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Making a Positive Impact on the World Through Standardization

By Wathma Jayathilake

For as long as I can remember, I have wanted to give back to my community and the world. Early in my education, I pursued a medical degree because I thought that was the only career path that would allow me to accomplish this goal. Additionally, I felt pressured by societal and cultural expectations into pursuing a career in medicine.

After earning my honours bachelor of science in biomedical sciences, I soon came to realize that medicine might not be the right path for me. While working as a medical assistant and pursuing a career in the medical field, I was presented with an opportunity in the standards industry. Little did I know that being involved in the world of standardization would give me a completely new and energized perspective on my professional career and ultimately support my pursuit of making a positive impact on the world.

In 2018, I was fortunate to join UL Standards & Engagement (ULSE), an organization rooted in safety science and committed to addressing the greatest safety challenges facing our local and global communities. Over the past five years, I have learned about the invaluable impact that standardization has on the world, and I am grateful that I get to work every day to help make the world a safer, more secure, and more sustainable place.

I first joined ULSE as a standards specialist, where I administered the standards development process for standards for the fire protection and security industries in Canada and the United States. Over the years, I learned how standards impact every aspect of our lives, from the security alarms in our homes that keep us safe from intruders to the fire hoses that help firefighters save lives. Personally, I believe every product and service that exists in our world today needs standardization to help make it safe, secure, and sustainable.

In 2022, my career shifted from administering the standards development process to influencing it by providing technical expertise. As a standards scientist on the ULSE Data Science & Engineering team, I work to strengthen the technical rigor of ULSE standards by identifying hazards and risk factors in the areas of human health and climate adaptation. I leverage these identified risks and hazards in our development of an ecosystem that helps drive the impact and relevancy of standards in relation to human health, environmental health, and the climate.

There are many opportunities in the standards profession for young and emerging professionals who want to make a positive impact on the world. As we innovate and identify new technologies that make our lives

easier, new standards will be needed. The unique, inspired, and fresh perspectives of younger generations should be leveraged to help develop standards that address as many risks and hazards as possible.

As standards developers, we need to expand our focus to address common hazards like fire, electricity, and security while also prioritizing other issues like accessibility, gender responsiveness, sustainability, human factors, and physiological effects. Addressing traditional hazards like fire, electricity, and security is as crucial as ever, but we can have an even greater impact by taking a more holistic approach to standards development.

Being involved in the standards profession, building strong and lifelong relationships with other standards professionals who share the same passion for helping others, and working each day to make the world a safer place has had a lasting impression on my life. I am proud of the work that I do, and I am grateful that I have platforms such as *Standardization: The Journal of Research and Innovation* to share the value of standardization and the positive influence it can have on people and the world.

Wathma Jayathilake is a standards scientist at UL Standards & Engagement, where she is responsible for driving human health and safety considerations in standards. She works to identify hazards and risk factors in the areas of human and environmental health and climate change to strengthen the technical rigor of ULSE standards. In 2023, Jayathilake presented on Climate Change and Standardization at the SES Annual Conference.

STANDARDIZATION: JOURNAL OF RESEARCH AND INNOVATION

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RESEARCH-ARTICLE

Setting a Higher Standard to Get Rid of Greenwashing

By Caitlin D'Onofrio

As a globally influential standards development organization working in partnership with national and regional stakeholders around the world, UL Standards & Engagement (ULSE) is dedicated to incorporating sustainability and sustainable practices into our diverse portfolio of standards and documents. Our sustainability program strives to provide a higher level of focus for our contribution to, and impact on, global sustainability through standardization while also proactively addressing industry trends and emerging technologies.

One specific trend on which we have focused in recent years is "circular economy" - a term often used to describe the sustainability efforts of companies as they shift away from a linear production approach in favor of a circular model to mitigate the effects on the triple planetary crises of climate change, biodiversity erosion, and pollution. This circular model keeps materials and products in a looped system longer to help reduce waste, reuse materials, and lower the emission of greenhouse gases caused by the energy needed to make these products.

In the past, it has been difficult for companies to quantify their circular performance. This has often led to "greenwashing," which occurs when companies advertise incorrect or generic environmental claims of a product's circular performance. To help prevent greenwashing and provide consumers with a reliable metric for analyzing a company's sustainable practices and products, ULSE collaborated with industry stakeholders to develop and publish *UL 3600, the Standard for Measuring and Reporting Circular Economy Aspects of Products, Sites, and Organizations*.

HOW UL 3600 CAN HELP COMPANIES SUBSTANTIATE SUSTAINABILITY CLAIMS

UL 3600 is the first standard that assists companies in evaluating their circular economy efforts and measuring corporate sustainability at the site, product, and/or company level. The standard provides a gauge of the circularity of a company's material flows and social governance as well as a comprehensive assessment of a company's circular economy initiatives of material flow and corporate social responsibility elements. These elements include worker safety and health as well as diversity, equity, and inclusion (DE&I) in the company's workforce. UL 3600 thus helps encourage continuous improvement and reporting on environmental, social, and corporate governance (ESG) to stakeholders.

The UL 3600 assessment creates a framework for a company to publicly share its sustainability and safety performance, enabling consumers and stakeholders to assess the

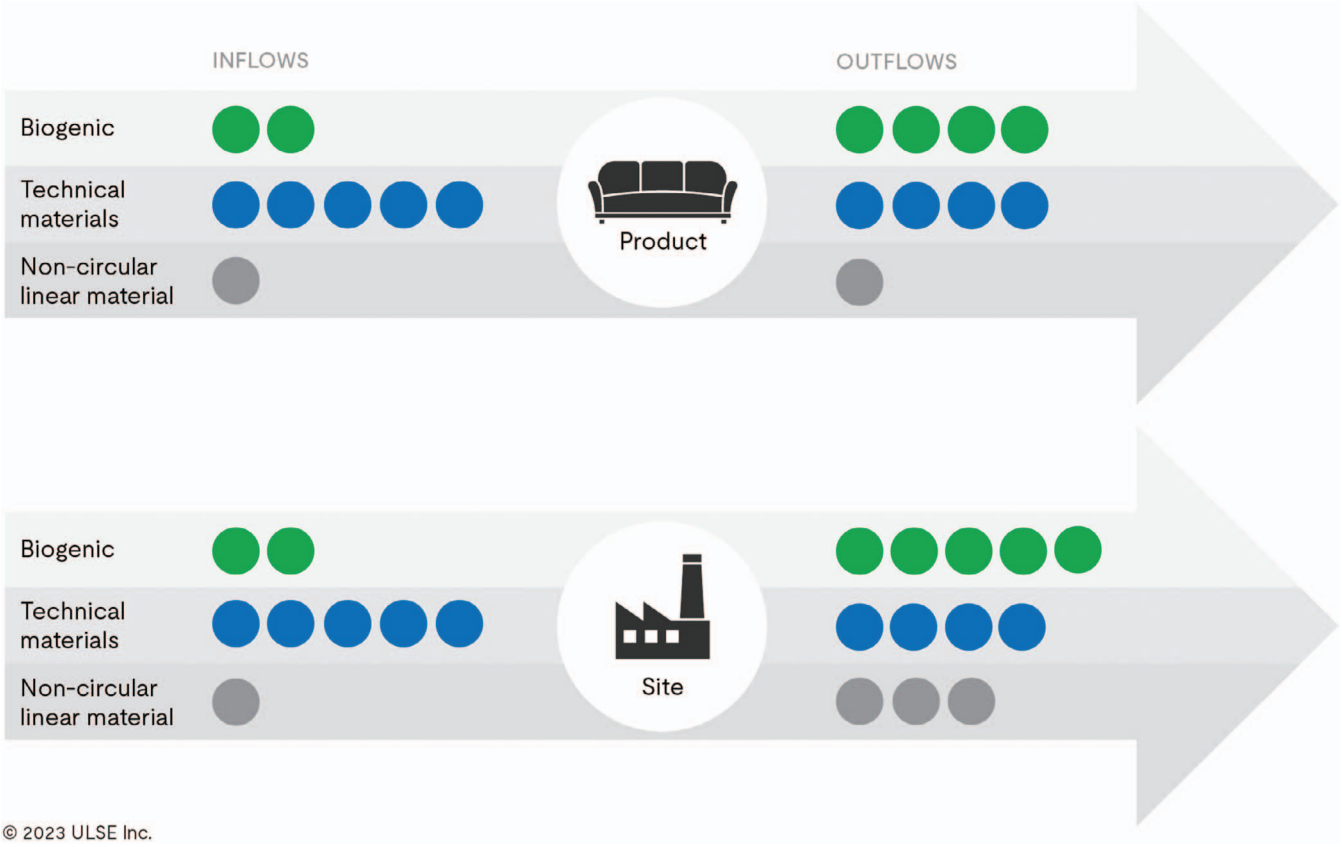

Figure 1. ***Material Inflows and Outflows for a Product and for a Site*** *Circular classification options for material inflows and outflows are defined for both technical material and biogenic material streams. An example of biogenic and technical material flow within the wood carbon life cycle is shown in Figure 2.*

company's commitment to the circular economy and its impact on the environment and human health. It also provides a benchmark for a company to compare its performance against its peers, which can help it differentiate itself from competitors and build a reputation as a leader in sustainability and safety.

The circular economy report is compiled using methods and metrics outlined in UL 3600. Aspects include, but are not limited to, material flows and the impacts of those flows. The standard is split into two major parts: measuring the material flows (measurement methods) and measuring the impacts of those flows (analytics). The metrics and measures are focused on materials and the flow of those materials as a result of the activities of an organization and any products manufactured by the organization.

In addition to the materials and flows, activities and impacts from those materials and flows in other parts of the supply chain should be included where they represent a significant impact and will be used as a modifier on the material flows. By addressing both flows and impacts, UL 3600 seeks to address progress toward sustainability in a more holistic way.

MEASURING OVERALL CIRCULARITY

The overall circularity is determined by measuring upstream and downstream material flows, or inflows and outflows. Materials are grouped into product flows and site flows when determining inflows and outflows. Figure 1 represents the flow of materials through a site and/or product and includes materials that become products, along with

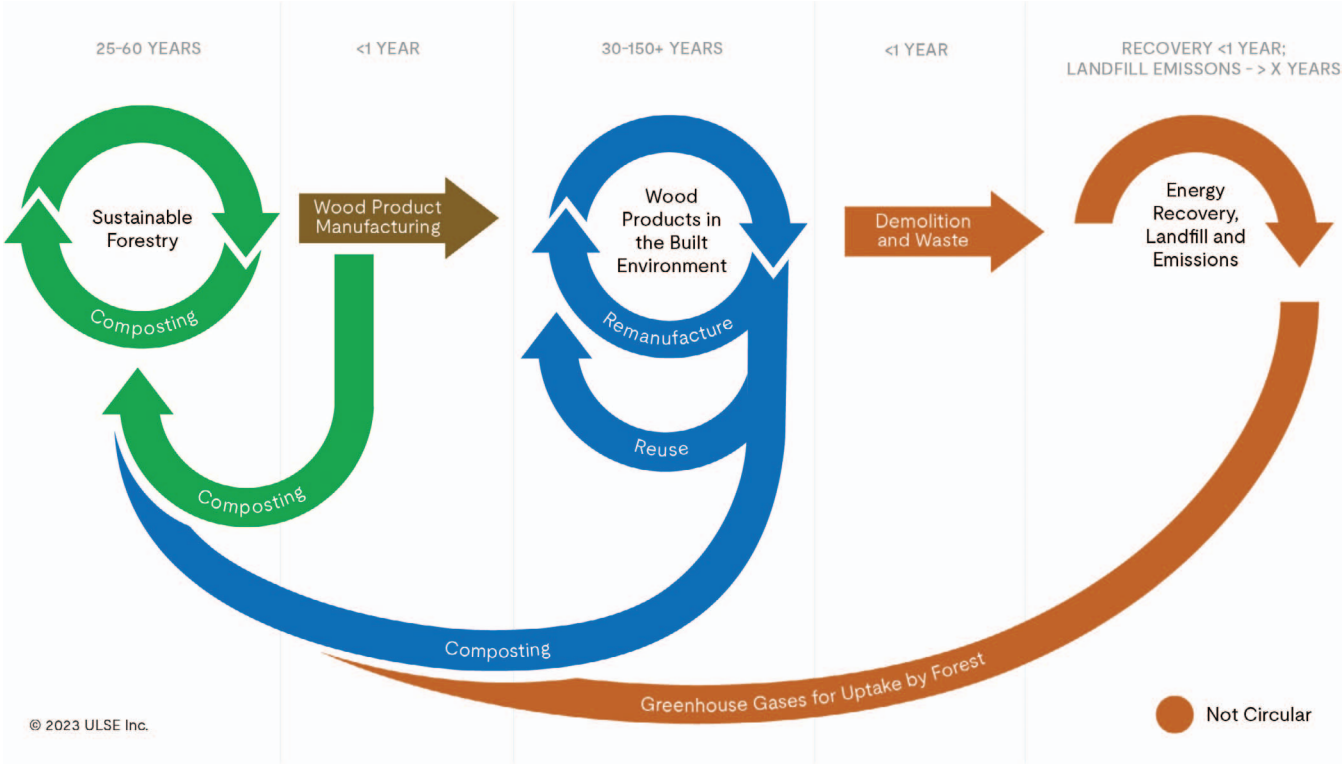

Figure 2. *Biobased and Technical Material Flows Within the Wood Carbon Life Cycle NOTE: Circular materials are subdivided into biogenic (green) and technical materials (blue); non-circular flows are orange; transition between biogenic and technical flow is shown in brown.*

the ancillary materials that are used at the site but are not shipped with the product. The material categories defined in the inflow side of the diagram can either be single materials or those contained in a component, product, or subassembly from an earlier stage in the material flow.

Biogenic inflows include new and recycled biobased materials; biogenic outflows include biochemical sources, composted materials, anaerobic digestion, biofuels, and recycled biobased content (all of which contribute to the regeneration of natural systems). Technical material inflows and outflows are those that are recycled, reused, refurbished, or circulated in a closed loop (along with byproducts), with the objective of keeping these materials in use rather than discarding them. Non-circular linear materials are composed of parts or components that do not meet any of the circular categories and are disposed at landfills, incinerated, or used for thermal processing with energy recovery after use.

Through the evaluation criteria and reporting methods listed above, UL 3600 can help to quantify the circular economy efforts of companies as they aim to eliminate waste, reuse and/or repurpose materials, and regenerate natural resources through their processes. As sustainability awareness continues to gain momentum and drive consumer behaviors, UL 3600 can serve as a valuable tool for companies looking to promote the sustainability and safety of their circular economy initiatives (without greenwashing) and can also help them improve their performance, increase transparency, and differentiate themselves in a competitive marketplace.

Caitlin D'Onofrio is the sustainability program manager for UL Standards & Engagement, a nonprofit organization dedicated to advancing the discovery and application of scientific knowledge. In her work, Caitlin collaborates with industry experts in sustainability and individuals from balanced standards development consensus bodies. She drives and manages ULSE's Sustainability Portfolio.

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Strategic Planning and Building Programmatic Capacity

By Alexis Shoemaker

Developing strategy and building programmatic capacity are cornerstones of transformational leadership. There are generally three approaches to formulating strategy: the visioning approach, the incremental approach, and the analytical approach (Kearns 2000). This article will discuss these approaches and address building capacity as a facet of strategic planning.

STRATEGIC PLANNING

Strategy development is a fundamental aspect of leadership and a core competency of effective change leaders. Strategy development begins with a foundational understanding of an organization's context in the competitive landscape and a department's context within the organization. Below is a discussion of three general strategy- and capacity-building techniques, followed by a review of the Harvard policy model for strategic planning.

Kevin Kearns's three approaches (2000) are helpful tools for leaders. Understanding the various approaches is valuable as leaders begin to build out their strategy development toolkit.

- The visioning approach "begins with the leader's vision and then works backward to determine what strategies, tactics, actions, and resources are needed to achieve it."
- The incremental approach "evolves out of experience as the organization goes along, one decision at a time, buffeted by bargaining and [the] push-and-pull of its constituencies."
- Finally, the analytical approach leverages "logic and in-depth analysis to improve the strategic fit between your organization and its environment."

Once a broad approach is identified, strategic planners can employ specific tactics to achieve their goals. Built for strategic planning, the Harvard policy model, developed at the Harvard Business School, directly applies to transformational leadership (Worth 2017). This model describes nine generic steps that easily can be adapted to fit contextual demands:

- Preparing for planning
- Assessing the situation (including internal strengths and weaknesses and external opportunities and threats)
- Clarifying the mission, values, and vision
- Identifying strategic issues/questions
- Developing goals, strategies, and objectives
- Writing and communicating the plan

- Developing operational/implementation plans
- Executing the plan
- Evaluating results

Importantly, strategic planning and, by extension, strategic management, "emphasize an ongoing process that integrates strategic planning with other management systems" (Koteen 1997). Strategic planning is not, however, "synonymous with and does not inevitably produce strategy" (Worth 2017). Instead, by employing this form of planning, leaders are forced to consider the department's and organization's mission and confront rudimentary questions about where they stand, what they do, and where they want to go (Worth 2017).

A valuable part of strategic planning is SWOT analysis. This methodology stems from the Harvard policy model described above. SWOT analysis involves surveying an organization to identify its strengths (S) and weaknesses (W) and examining the external environment to identify opportunities (O) and threats (T). This practice brings clarity to what can otherwise be a complex system of interconnected elements.

A SWOT analysis allows a leader to identify the organization's core competencies and distinctive core competencies. In this case, core competencies are "abilities that an organization can manage that ideally help it perform well" (Worth 2017). Meanwhile, "distinctive core competencies are, as the term suggests, something the organization does well that others would find difficult to do as well" (Worth 2017).

By assessing internal and external circumstances and the competencies of their team, leaders desiring change are empowered with contextual knowledge to effectively develop strategy. Relying on a theoretical framework and defined methodology for strategic planning enables leaders to position their desired change appropriately in their situational context and articulate it clearly to the impacted constituents.

BUILDING PROGRAMMATIC CAPACITY

Once a strategic plan is developed, it is necessary to build capacity. "Capacity building may mean more than making modest enhancements to staff skills or management systems. Like strategic planning, capacity building may also require disruptive transformational change that goes to the basic values and purpose of the organization" (Worth 2017).

Capacity building, as defined by Letts et al. (1999), is a process to "develop, sustain, and improve the delivery of a [company's] mission." The authors identify three elements of capacity: program delivery capacity, program expansion capacity, and adaptive capacity.

- Program delivery capacity grows out of the organization's knowledge of a specific field.
- Program expansion capacity comes from the expansion of program delivery and involves a more comprehensive organizational expansion plan.
- Adaptive capacity is an organization's ability to deliver on its mission, including its "ability to learn as an organization and identify new ways to improve, to change in response to client needs, to create new and innovative programs, and to create an environment that is motivating to staff" (Worth 2017).

Augmenting this understanding of capacity building, Hudson (2005) divides capacity into internal and external elements, writing that "building capacity is about systematically investing in developing an organization's internal systems (e.g., its people, processes, and infrastructure) and its external relationships (e.g., with funders, partners, and volunteers) so that it can better realize its mission and achieve greater impact."

With various types of capacity defined, and the importance of capacity established, the question turns to how capacity is built. McKinsey & Company (2013) offer a "com-

Figure 1.

prehensive capacity framework" and essentialize the undertaking into "a pyramid of 10 elements."

To use this framework, McKinsey & Company "emphasize the importance of following a process that begins at the top of the pyramid and works down" (Worth 2017). Stepwise processes, especially to institute transformational change, offer a safe framework to fall back on when things inevitably become chaotic.

CONCLUSION

Strategic planning and capacity building are vital facets of effective leadership and transformational change management. Ultimately, by leveraging the tools and methodologies described above, leaders can position their desired change appropriately in their situational context, articulate it clearly to constituents, build team and organizational capacity to achieve their goals, and set their organization on a path towards growth and success.

The final column in this series will explore reflexivity and the importance of metacritical analysis of one's leadership practice as it pertains to change leadership.

REFERENCES

Hudson, Mike. 2005. "Managing at the Leading Edge." San Francisco, Calif: Jossey-Bass.

Kearns, Kevin. 2000. "Private Sector Strategies for Social Sector Success." San Francisco, Calif: Jossey-Bass.

Koteen, Jack. 1997. "Strategic Management in Public and Nonprofit Organizations." 2nd ed. Westport, Conn: Praeger.

Letts, Christine W., William P. Ryan, and Allen Grossman. 1999. "High Performance Nonprofit Organizations: Managing Upstream for Greater Impact." New York: John Wiley & Sons.

McKinsey & Company. 2013. "The Organizational Capacity Assessment Tool (OCAT)."

Worth, Michael J. 2017. "Nonprofit Management: Principles and Best Practices." 4th ed. Los Angeles: SAGE Publications, Inc.

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STANDARDIZATION: JOURNAL OF RESEARCH AND INNOVATION

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RESEARCH-ARTCLE

The Changing Landscape of Professional Training

By Matt Mozer

In today's evolving business world, staying up to date with industry standards is crucial for success. Standards provide a framework for best practices, safety, quality, and efficiency in various industries. From health care and manufacturing to technology and finance, adherence to standards is essential to ensure consistency, safety, and compliance.

How organizations train people plays a vital role in equipping professionals with the knowledge and skills required to meet industry standards. The professional training industry itself is experiencing significant changes. As organizations seek to adapt to the needs of the modern workforce, professional training is evolving to keep pace. Let's take a closer look at how it's changing.

BLENDING TRADITIONAL AND DIGITAL LEARNING APPROACHES

Traditionally, professional training has been conducted through in-person workshops, seminars, and classroom-style training sessions. However, with the rapid advancement of technology and the increasing prevalence of remote work, digital learning approaches are gaining prominence in the training industry. Organizations are now incorporating a blend of traditional and digital learning methods to deliver effective standards training to their employees and partners.

Case in point: one of the world's leading providers of cloud computing infrastructure and services was growing quickly and needed to update its customer education program. It needed the ability to deliver training content in a secure manner to prevent unauthorized use while supporting audiences that included commercial training customers, event and boot camp participants, authorized instructors, and academic institutions. Plus, with a rapidly growing customer base and partner ecosystem, the ability to scale the solution was critical.

The ultimate solution involved converting traditional PDF-based training content into a secure eBook format that included defined digital rights management (DRM) settings as well as access restrictions based on user IP addresses of registered devices (including user-friendly mobile access). A white-labelled e-commerce system provided known user access for registered training partners as well as public (guest) access for transient students. In addition, a subscription-based access bridge provided instructors access to the associated content library to ensure that they were always using the most current materials. This digital transformation helped propel the learning program from startup to supporting 100,000-plus students in less than five years.

Online learning platforms, digital books, virtual classrooms, and e-learning are becoming popular choices for professional training, as they offer flexibility, accessibility, and

scalability. Professionals can now access training materials and resources from anywhere at any time, allowing them to learn at their own pace and convenience. Digital learning also enables organizations to reach a larger audience, making training more inclusive and cost-effective.

FOCUS ON PERSONALIZATION AND ADAPTIVE LEARNING

One-size-fits-all training programs are no longer effective in today's diverse workforce. Different individuals have different learning styles, preferences, and requirements. To address this, professional training is increasingly focusing on personalization and adaptive learning approaches.

Personalized training programs consider the individual needs and preferences of learners, allowing them to customize their learning experience. Learners can choose their learning path, set their own goals, and access relevant content that caters to their specific requirements. Adaptive learning, on the other hand, uses data and analytics to track learners' progress and provide feedback in real time, enabling them to adjust their learning journey accordingly.

Personalization and adaptive learning approaches in professional training ensure that learners receive training that is relevant, engaging, and effective, leading to better knowledge retention and skill development.

EMPHASIS ON PRACTICAL APPLICATION AND REAL-WORLD SCENARIOS

In the past, training may have focused primarily on theoretical concepts and principles. However, there is now a growing emphasis on practical application and real-world scenarios in professional training programs. Learners are expected to apply their knowledge and skills to solve real-world problems, make decisions, and address challenges they may encounter in their professional roles.

Practical application and real-world scenarios help learners develop critical thinking, problem-solving, and decision-making skills, which are essential for success in the workplace. Training programs may include case studies, simulations, role plays, and other interactive exercises that allow learners to apply their knowledge in a practical context. This approach ensures that learners are better prepared to handle real-world situations and comply with industry standards in their day-to-day work.

ARTIFICIAL INTELLIGENCE AND AUGMENTED/VIRTUAL REALITY

Organizations are leveraging technologies such as artificial intelligence (AI), virtual reality (VR), augmented reality (AR), and automation to enhance the effectiveness and efficiency of standards training programs.

For example, AI-powered chatbots and virtual assistants can provide instant support and guidance to learners, while VR and AR simulations can create realistic training scenarios, allowing learners to practice what they have been taught to gain hands-on experience in their specific area of study.

One example of the use of VR to enhance training is in the space of aircraft maintenance. Tools are now available to allow mechanics to experience and conduct a maintenance routine without initially accessing the actual equipment itself (which can be costly). By role-playing using VR, learners can apply what they have learned in a low-stakes and low-cost environment before moving on to the actual equipment itself.

In conclusion, while traditional classroom-style training continues to play a prominent role in the training industry, blended learning, adaptive learning, scenario-based training, and the use of AI and VR to enhance learning are growing in importance. Organizations are looking to embrace these and other available technologies to provide not only a better learning experience but also to ensure superior learning outcomes.

Matt Mozer, vice president of Gilmore Global, has been working with the world's largest professional training organizations since the mid-1990s. He has consulted on net-new certification training programs as well as providing insight and guidance for technology firms looking to evolve their learning strategies. Organizations such as AWS, Cisco, Dell, HP, Global Knowledge Network, Citrix, NetApp, Juniper Networks, VMware, and SAP America are a small selection of professional training organizations that have leveraged Matt's experience in support of their program development.

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RESEARCH ARTICLES

Navigating a Career in Standards: Let's Create a Visual CV

By Muhammad Ali, CStd

Strategic standardization, an approach that requires knowledge of the standards ecosystem, is more than a technical tool that can be used for planning the development and use of standards to respond to market needs and policy/regulatory objectives. The 21st century technology transformation is about the integration of physical and cyber systems. The cyber-physical solutions are systemic and multi-disciplinary. These solutions necessitate a deep knowledge of fundamentals and breadth in a range of other disciplines, giving rise to the need for T-shaped contributors in standardization. A visual CV is a method to help chart your work-life history using a graphical approach that highlights your past achievements and skillsets to ensure you are strategically in the right place.

TECHNOLOGY: THE RISE OF CYBER-PHYSICAL SYSTEMS

The innovations of the 19th and early 20th centuries shaped the machine (physical) age. It was an age of industrialization, of electro-mechanical (physical) inventions like the steam engine and the utility grid and the construction of city-scale civil infrastructure such as power, water, waste, transportation, and health care systems. The solutions of this era were built on fundamentals of science, engineering, and economics.

In the 20th century, we saw the rise of the information (cyber) age. The latter part of the 20th century was the age of the Internet. In the data-driven cyber age, which saw an explosive growth in commerce, social media, and entertainment over the Internet, the focus shifted from physical fundamentals to information sciences and software. The 21st century has witnessed the integration of physical and cyber technologies, resulting in a cyber physical age. Examples of cyber physical systems are 3D printers and electric vehicles such as the Tesla Model S.

DIGITAL TRANSFORMATION OF STANDARDS

In today's cyber physical age, almost every company is going through some sort of digital transformation effort to reduce manual work, increase efficiencies and save costs. The standards world is no different. In the context of standards development, digital transformation is about how standards are developed, delivered, and consumed. We know that our future standards users are visual learners who want information to be easily accessible and needs information in different electronic formats than just PDF. We need to be able to use the digital tools to develop the standards from drafting to publication, collaborate digitally, deliver the standards in a format other than

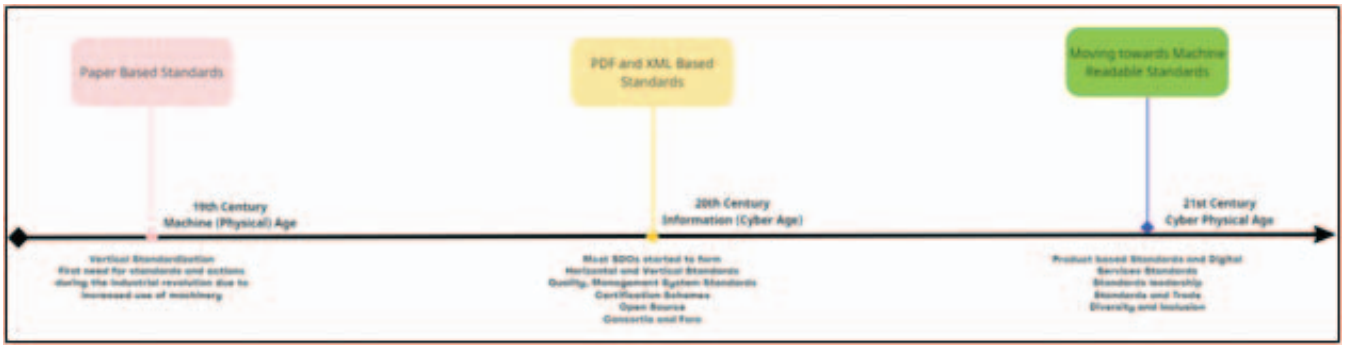

Figure 1. *Digital Transformation of Standards*

what is currently available and be able to utilize the standard in a way that reduces time to digest standards, makes information easily accessible, and reduce time to market products for conformity assessment purposes.

THE RISE OF T-SHAPED CONTRIBUTORS

Success necessitates depth in fundamentals and a holistic "T" shaped multi-disciplinary systems thinking and contributions. A T-shaped standards contributor has depth in one or more subjects and breadth in several subjects. Beyond technical breadth, standards professionals must embrace other subjects (such as social sciences) in light of current social and economic megatrends. This knowledge allows us to implement strategic standardization activities, understand the needs of society, and develop market-relevant solutions.

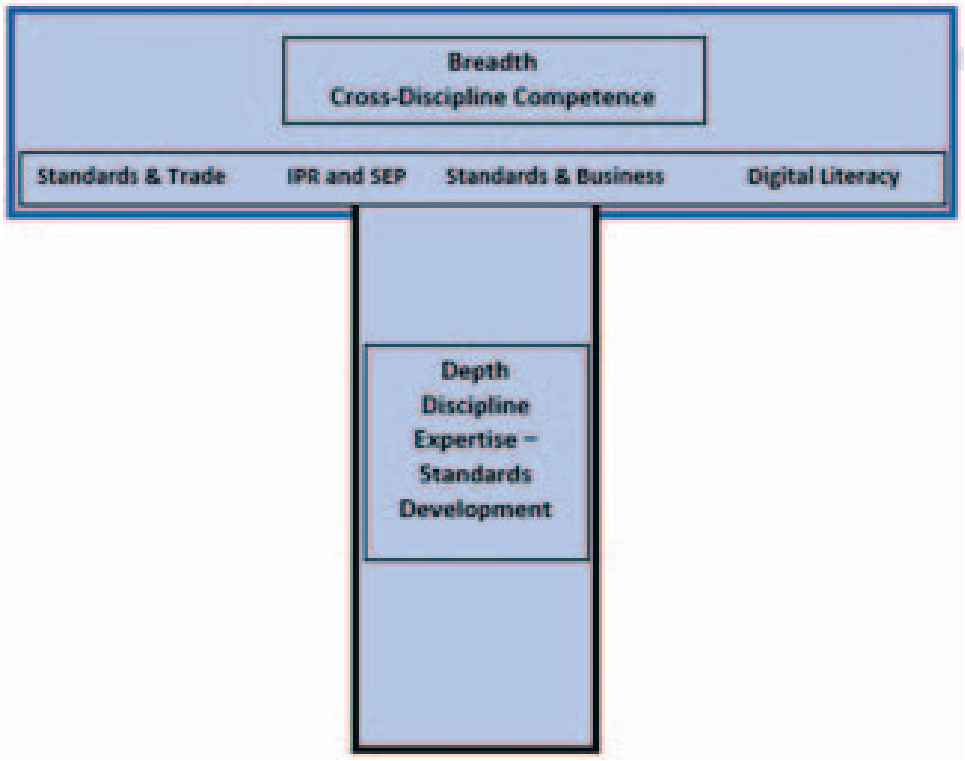

Figure 2. *T-Shaped Model for a Standards Committee Member*

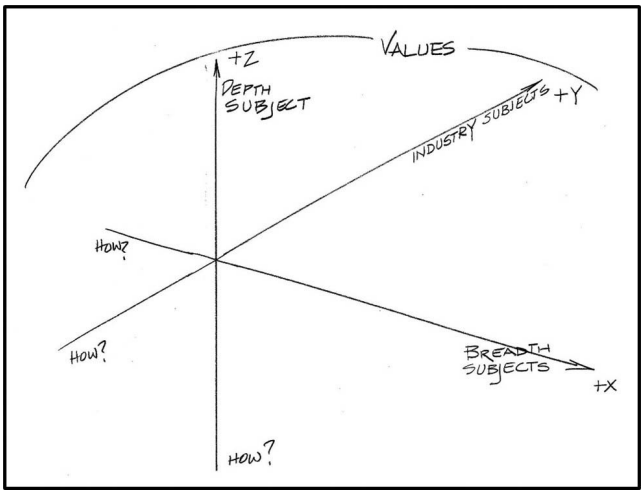

Figure 3. *Visual CV Structure*

Becoming a T-shaped contributor requires a significant amount of risk. It requires an individual, at some point, to step out and do something they are not yet an expert at doing. This is an individual who usually cuts across the company's silos, fosters a growth mindset, and is willing to take risks. This individual must have a point of view, passion, and a desire to pivot and become a practitioner of a new subject. One path to becoming a T-shaped contributor is to actively work on your professional development plan, which may incorporate categories such as Learn, Teach, Guide, Solve, Certifications, Education, learn by doing, and Training.

CREATING A VISUAL CV

A visual CV is a method to chart your work-life history using a graphical approach that highlights your past achievements and skillsets. It helps you identify how you developed your skills over the years and determine how you want them to mature in the future. It can guide you in your professional development by identifying areas in which to build technical depth, technical breadth, and industry business skills.

The first step in creating a visual CV is to create a set of values, as values drive our career decisions. Values are the key consideration in driving us strategically in the right place of the career path. Our values (and our opinions) are shaped by observations. For example, my values are as follows:

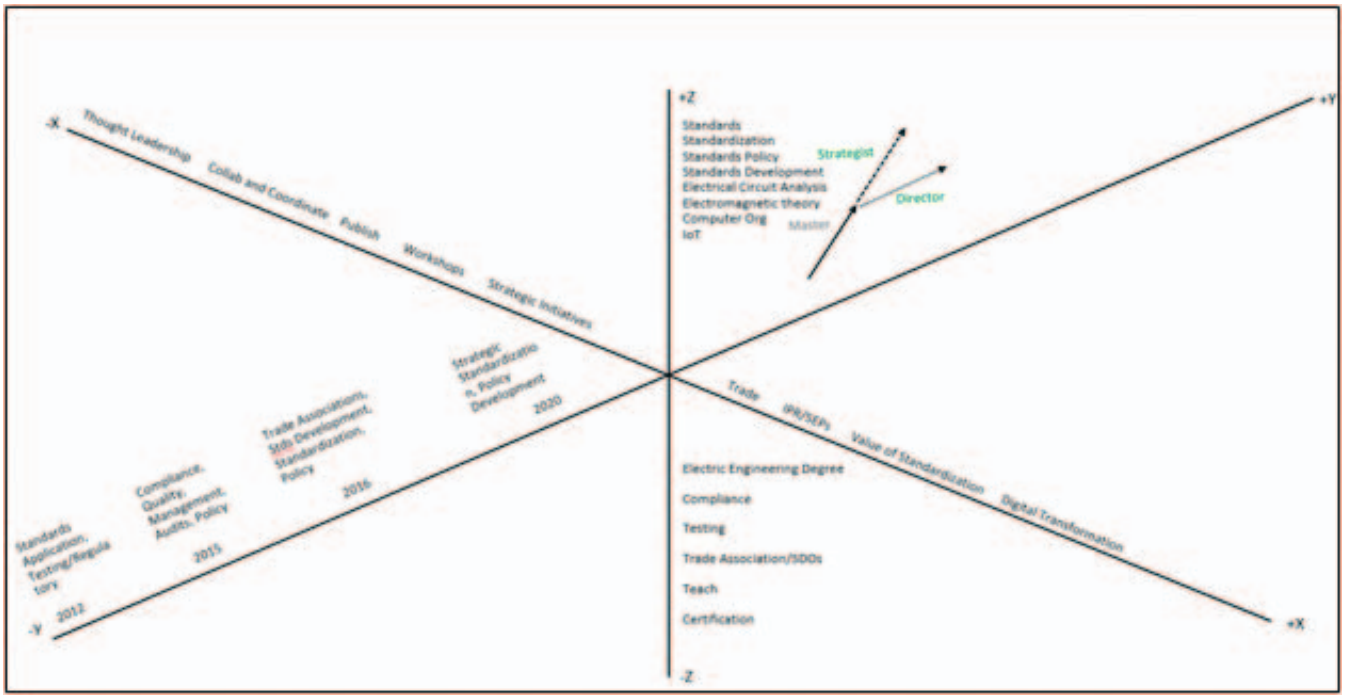

Figure 4. *Visual CV - Muhammad Ali*

- Leverage my top strengths (competition, strategic, focus, achiever, deliberative, and communication) in the work I do. These are my strengths as revealed by the Gallup StrengthsFinder assessment.
- Demonstrate leadership in key areas.
- Become a proven thought leader in a specialized area.

In creating a visual CV, I start with the X-Y-Z chart (Figure 3) to show depth, breadth, and industry subjects. On the +ve axes, I focus on subjects; on the -ve axes, I focus on "how" I garnered depth in those subjects. My values, which I show as constant lines, drive my career decisions.

In my own example (See Figure 4), my depth subject (+Z) is my degree in electrical engineering, and (-Z) is how I achieved them. My breadth areas (+X) are those I have mastered as a result of my experiences (-X). Last but not least, my industry subjects (+Y) are the areas in which I specialize as a result of my work experience (-Y). Collectively, this creates my visual CV.

Muhammad Ali is a senior standards strategy and policy leader for HP, Inc. He is responsible for managing the external standards engagement and leading HP's efforts in US-based standards organizations. He is a Certified Standards Professional with leadership in voluntary consensus-based standards development, conformity assessment, and emerging technologies in consumer and electrical industry sectors. Ali previously served as a Program Manager for the National Electrical Manufacturers Association (NEMA) where he was involved with maintenance of ANSI, NEMA, CANENA, IEC, and ISO Standards. He is a past recipient of the ANSI Next Generation Award, SES Emerging Professional Award, and INCITS Chair Award.