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# The Future of Credentialing

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I.C.E. would like to recognize the members who volunteered their time for this project. Numerous members participated in interviews that helped the researchers select and refine the drivers of change, while a dedicated pool of member volunteers participated in focus groups conducted by Crystal Lake Partners.

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# INTRODUCTION

Welcome to the I.C.E. Future of Credentialing project. This resource is intended as a long-term conversation about what the future may hold for credentialing organizations and their programs. This resource is also intended to assist you with strategic conversations with your organization's leadership.

This is a dynamic resource with many future tools and platforms under construction by I.C.E. to aid in sustaining this conversation well into the future. There will likely be future phases of this resource that will either continue to evolve the drivers of change and data included here, or branch into entirely new areas of thought around the future of credentialing. The decision to focus on three categories of drivers in this release (see Project Design, p. 9) was an intentional decision that incorporates many factors, not the least of which is creating a manageable set of themes to cultivate focused and fruitful conversations.

We invite you to give us feedback on this tool: your insights and observations, the ways you plan to use the tool, your successes and challenges in using the tool, and where the conversations lead your organization. Please use this link — [www.surveymonkey.com/r/8S2ZKXB](http://www.surveymonkey.com/r/8S2ZKXB) — to give us that feedback and even provide case studies on your experience with this resource.

This paper is not a comprehensive state of the industry as it currently stands, nor is it a one-size-fits-all assessment of trends. Viewing it as such can diminish the value of the paper as a thought-provoking exercise to evaluate and consider the future implications of the data and ideas presented.

## Intended Audience

The intended audience for this project includes the following individuals:

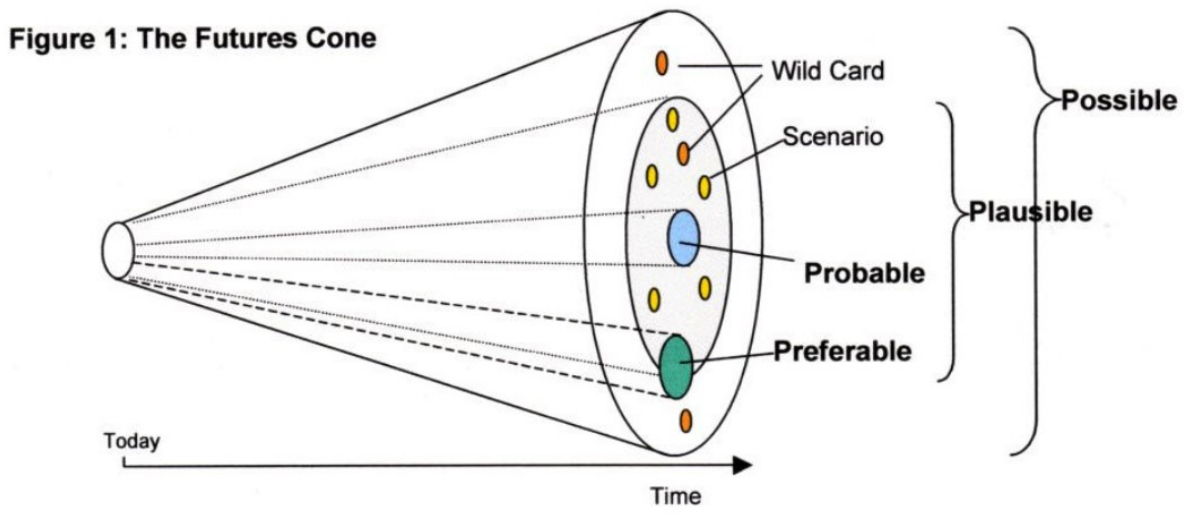
- CEOs and C-suite level staff members of credentialing organizations,
- executive directors or directors of programs embedded in a larger membership organization who are responsible for the strategic planning for credentialing programs,
- members of strategic governing bodies of credentialing organizations, and
- consultants who work with strategic governing bodies on strategically thinking about the future.

## What Is Foresight?

The field of foresight study has roots in public policy and the academic world as a research-driven practice of exploring expected and alternative futures. For this project, the following are accessible definitions to cast foresight work as a tool for organizations to consider the future in organizational planning.

The following definition of Trends vs. Foresight was provided by [Foresight Alliance](#), the consulting firm that worked with I.C.E. on this project. Foresight Alliance specializes in foresight, strategy and research.

- **Trends analysis** is a valuable activity to increase awareness of one's environment. It is anchored in the present and diminishes in value beyond the short term as a trend is, by definition, happening now and in the past. Trends analysis *indicates a potential trajectory for future change*.
- **Foresight** goes beyond trends to consider how they will develop, change, be reversed or face discontinuities in the future, and how trends and other drivers will combine to create outcomes. Foresight takes on longer time horizons and uses structured methodologies to explore multiple potential futures and the *potential actions and strategies to achieve (or avoid) them*.



(Source: adapted from Hancock & Bezold 1994).

A second look at the definition of foresight is included in [ASAE's ForesightWorks](#) project, which inspired this I.C.E. project. The following definition is found in the *ASAE ForesightWorks User's Guide*:

Foresight is a structured process for discerning, analyzing and acting on potential futures. Foresight is a leadership competency with disciplined ways of thinking, a language, and processes that help followers envision the future and prepare to engage with it. Futures thinking is inquisitive, critical, and imaginative (Rhea, 2018, pp. 3-8).

See Appendix A for more of ASAE's extensive explanation of foresight and insight into creating a culture of foresight. (The information included is reproduced with the permission of ASAE.)

## How to Use This Paper

This resource is dense with information and insights, but it is intended to be digested according to your organizational lens and priorities. While other topics could be addressed in future phases, this resource focuses on the trends or data that may affect the *credentialing organization* vs. individuals (i.e., test takers or staff). This resource does not take on the task of trying to prioritize or express levels of urgency, or even inevitability. These are questions you must address and analyze, depending on your organization's specific details. Some data may not be as relevant or compelling as others, and some "take action" recommendations may not be useful for your profession or industry. This paper could not endeavor to prioritize the same data points for all organizations or even assess broadly which data points are more salient. Instead, the following approaches might be helpful as you consume this information and determine which areas are most likely a challenge or an opportunity.

- **Lens:** It may be helpful to determine what lens is most important to you and your organization. Those lenses might include the following:
  - the size and scope of the organization,
  - the industry or profession,
  - the capacity of the organization or profession for change or evolution,
  - the financial assets of the organization that might predict how much can be acted upon,
  - the current usage and awareness of aspects of the drivers,
  - partnerships or alliances, and
  - whether the organization is in a highly regulated or highly competitive environment.



Determining which of these lenses are most important in advance is a critical step in consuming this report.

- **Prioritize:** It may be helpful to determine a methodology for prioritizing the information. The report includes some natural overlaps and connections between the three drivers, but some data points may present themselves as more urgent in the near-term versus others. Gathering input from your sphere of influence could also be a tactic for prioritizing the areas to focus on immediately. Which drivers fuel immediate and actionable ideas, and which drivers will require more input, more data or more preparation going into a discussion with leadership?
- **Conversations:** This project aims to enable organizations to begin critical conversations about the future. These conversations might include one of the tools that I.C.E. develops (see below), your strategic thought questions, or scenario-based discussions. Look for future case studies on how fellow I.C.E. members are using the paper and information to chart a strategic future.

All I.C.E. research products rely heavily on and refer to the [I.C.E Basic Guide to Credentialing Terminology](#) for consistency. However, many terms in this paper were not part of I.C.E.'s terminology document. A glossary of terms relevant to this paper can be found in Appendix C.

## Coming I.C.E. Tools

I.C.E. is developing a number of tools to be released on the heels of this project. While the timing of the release has not yet been determined, you can expect the following tools to aid in your use of the project.

- Facilitator's Guide
- CEO Series Discussions
- "How to Think like a Futurist" training
- I.C.E. Exchange sessions
- Online community for ongoing discussion
- Collection of case studies for further learning environments
- Future of Credentialing Phase II

# EXECUTIVE SUMMARY

## Project Background

The Institute for Credentialing Excellence (I.C.E.) conducted this Future of Credentialing study to be a deliberate, evidence-based research initiative to assist credentialing organizations in environmental scanning and planning for change. The report provides a stream of research and resources to empower credentialing leaders to create a culture of foresight in their organizations, leading to a vibrant culture of foresight across the credentialing community. I.C.E. envisions a future in which credentialing leaders not only are aware of potential changes ahead but are also actively engaged with their organizational leadership, staff, members or certificants, and peers to evaluate, plan for and create opportunities from these changes.

While most of the research has been derived from the United States, the research and corresponding future envisaged in this report have been considered by stakeholders across North America. It is I.C.E.'s view that the thoughts and ideas presented in this report are relevant to the credentialing industry in both the United States and Canada, since the report's global relevance more broadly would require significant additional research and analysis.

## Project Design

Inspired by the ASAE ForesightWorks project, the I.C.E. Future of Credentialing project started in January 2022. A four-phased approach was established:

**Phase I: Framing.** This phase focused on preliminary research (performed by Foresight Alliance), domain mapping of topics, framing up of the research and incorporation of interviews.

**Phase II: Research.** This phase focused on the articulation of the key driver concepts to be developed through the research inventory, to be discussed and evaluated by the Advisory Group with input from the Board of Directors.

**Phase III: Writing.** This phase included writing the report, creating the Take Action sections (written by the Advisory Group) and organizing the content into the final report.

**Phase IV: Evaluation.** A second consultant (Kristine Metter, Crystal Lake Partners) conducted a series of five focus groups involving over 40 I.C.E. members. These focus groups tested the concepts, created critical feedback on the paper and provided recommendations for future refinement.

The collaboration between the Advisory Group for this project and Foresight Alliance, a professional consultant experienced in foresight analysis, was critical to the formation of this work. Together, they identified key questions for the research topics and themes for the project. Foresight Alliance conducted an initial research scan that resulted in data from approximately 86 sources. (See Appendix B for sources.)

Subsequently, I.C.E. and Foresight Alliance conducted interviews with credentialing experts identified by I.C.E. who represent views from both internal and external stakeholders to the traditional credentialing community, including those in the academic arena, small and large tech companies, policy influencers, and other trade and professional associations.

As the categories of drivers came into focus and were prioritized, Foresight Alliance performed further research on trends and data with a focus on the impact on credentialing, and investigated issues identified in the expert interviews. Based on I.C.E. feedback, Foresight Alliance synthesized the findings into three topic areas, modeling the format on the change drivers developed by ASAE's ForesightWorks futures research project. The trends were then grouped and prioritized by the I.C.E. Advisory Group. The three drivers of change developed for this report are as follows:

- credentials under pressure,
- government and credentials and
- technology innovation.

For each driver of change section, you will notice the organization includes four elements. These elements are arranged to present that data up front, followed by the potential impacts on credentialing, and wrapped up with suggested action steps.

Beyond the Executive Summary, each focus area expands to multiple pages, which include the following elements:

- **Forecasts** are based on trends and data points and represent probable futures that are likely to happen.
- **Supporting Trends** are weak signals that inform the action brief and serve as background for the forecasts.
- **Strategic Insights** outline potential opportunities and risks for credentialing organizations and I.C.E. They provide tangible suggestions to help frame discussions on the change driver.
- **The Take Action** section provides initial steps to help you take advantage of opportunities or minimize risks associated with a change driver.



**Cross-topic Insights:** As you read through the drivers of change sections, you will notice areas of crossover between topics. The following insights cut across all three focus areas and are important enough to highlight assumptions that form a foundation for all focus areas.

- **Rapid change:** The pace of change is accelerating in areas touching on credentialing, and credentialing organizations need to be able to monitor and adapt to rapid changes in technology, the political landscape and higher education.
- **Quality and credibility:** New types of assessments and the proliferation of alternative credentials will require credentialing organizations to demonstrate the real value of their assessment techniques and develop new tools to assess the quality of the new credentials that emerge.
- **Standards and leadership:** Governments, technology companies and new forms of credentialing will pose challenges to incumbent credentialing organizations. Providing leadership on developing new standards is one way to meet the challenges of new competition.
- **Sociopolitical pressures:** New social and political pressures will impose new demands on credentialing, but such changes can also create new opportunities.
- **Direct assessment technology:** Technology innovation will create new ways to measure knowledge, skills and abilities through monitoring or experiential simulations, expanding assessment beyond knowledge-based testing.

Each driver of change is examined further in the body of this paper. For this Executive Summary, a brief list of findings is included for each of the three drivers below. Greater context is gained by reading the full text for each driver, which includes the supporting data.

## Credentials Under Pressure

The world of credentials is under rising pressure from many forces, including changes in education, the workforce and society.

- Credentialing will be affected by rising distrust of institutions, increasing political polarization, rapid change in higher education and encroachment from new competition.
- The proliferation of credentials (and microcredentials) will result in the development of new evaluations and institutions to provide information to credential-seekers and organizations around the value and competencies represented by a certification, as well as quality control.



- Implementing diversity, equity and inclusion (DEI) initiatives will create ongoing challenges for credentialing organizations but can also provide new opportunities to expand equitable access to professional credentials.
- Changing demographics will lead to tightening demand for skilled workers. This will create new needs for both alternative credentials and internationally recognized credentials.
- The credentialing world needs to develop capabilities that enable it to thrive in an environment that is becoming increasingly volatile, uncertain, complex and ambiguous.

## Government and Credentials

The role of government in credentialing will grow more uncertain as the forces of political polarization intensify.

- Growing political polarization could add to the forces driving more government encroachment into credentialing.
- Credentialing will increasingly be used as a battleground for ideological pursuits. However, there is also the possibility for nonpartisan support for licensing deregulation or alternative pathways to authorized practice of occupation. These perspectives on regulation may be pursued in the name of equity and economic efficiency.
- Credentialing organizations will need to work to demonstrate their value and relevance to ensure that they continue to play a central role in their industries, despite growing counterforces.
- Credentialing organizations need to closely monitor emerging credentials influencing policy shifts at all levels of government and play a larger role in managing potential conflicts between jurisdictions.
- Political polarization could lead to professional credential divides across state and/or provincial borders. Credentialing organizations need to assess how such shifts will affect licensing, markets and educational systems.

## Technology Innovation

The credentialing industry faces a wave of transformational change from technological innovations.

- Continuous monitoring of workers could create new mechanisms to measure competency and knowledge.



- Technologies like VR and AR can enable new processes for using experiential simulation to assess competency.
- Digital credentialing technologies will require open standards and cross-compatibility to counteract the centralizing tendencies of Big Tech companies. Credentialing organizations can play an increasingly important role in developing and advocating for such standards.
- AI and machine learning may provide new techniques for assessment, but humans will remain crucial to designing and interpreting algorithm-based assessments.
- Developing and providing standards for digital accessibility is increasingly important to ensuring inclusion. Digital accessibility concerns should play a role in formulating new standards for machine readability and data sharing.

# CHANGE DRIVER: CREDENTIALS UNDER PRESSURE



# CREDENTIALS UNDER PRESSURE

The world of credentials is under rising pressure from many forces, including changes in education, the workforce and society. These forces, and the growing importance of credentials in a knowledge economy, are opening space for new approaches and will propel innovation in the medium term. This will bring rising potential for both cooperation and competition from governments, institutions of higher learning and the commercial sector.

## Forecasts

**Credentialing aggregators:** The vast panoply of credentials (and microcredentials) will drive the creation of these clearinghouses to aid in verifying, sorting and evaluating those credentials. The aggregators that succeed will provide the most useful frameworks for evaluating and comparing an increasingly complex credential landscape for their intended audience, whether that is employers, students, or trainees.

**Turmoil in higher education:** The rising ferment in higher education will change the sector's relationship to credentials. The increasing demands for practical training and demonstrated learning facing higher education have direct implications for credentials, creating greater uncertainty for the sector and new opportunities to expand credentialing into high school and technical instruction. These shifts could drive cooperation or competition with other credentialers, and the stakes will be higher as the pool of young people dwindles due to demographic change.

**DEI challenges:** Implementing initiatives to enhance DEI will present an ongoing, deep challenge to credentialing as it is, in part, an exclusionary activity. Balancing equitable outcomes with methodological rigor will pose problems and opportunities across the field: scrupulous fairness will not be enough, as the definition of fairness itself will be at issue, nor will the principle of avoiding extraneous factors suffice, as what is extraneous will also be in contention. On the other hand, DEI initiatives in credentialing can provide new equity-enhancing opportunities to validate skills derived from on-the-job training and life experience, while bringing in new talent to the workforce.

**Polarization intrusions:** Increased polarization will affect credentials, as it has the rest of society. Credentialing itself will be seen as a field of battle to pursue political and/or socioeconomic agendas. Some accreditors, credentialers and credentials will be seen as indicative of one side in sociopolitical issues and viewed with suspicion by the other side. (See the Government and Credentialing section, p. 21.)



**Falling trust in credentials:** Polarization will continue to blend with and reinforce the ongoing trend of falling trust in experts and institutions. Lack of trust will undermine both the status of those with credentials of all kinds and the status of credentialing organizations, whose standing and reliability will come under further question.

**Big Tech encroachment:** Big Tech companies' expansion into new areas will increase their interest in influencing or controlling new areas of credentialing, including, for instance, health care. Their national and international business models will drive them toward national or even global-level credentials and licensing.

**Push for cross-border credentials:** Pressure will rise to accept more international credentials in various fields. This could be driven by more remote work, labor needs in some markets and the perception that making foreign credentials more usable is an equity issue. This could increase competition in some fields and enable some dubious credentials to enter the marketplace if not carefully managed, as a result of compromised educational and professional testing regimes in some countries.

**Labor demand:** The retirement of the baby boomers, shrinking youth cohorts, and possible immigration changes will create intensifying demand for skilled workers. Sustained worker shortages will push employers to widen the scope of their recruitment and pursue workers who are not traditionally credentialed. Alternative credentials and certification models could grow increasingly important in helping employers identify promising employee candidates.

**Crowdsourced rating pressure:** Online rating services will continue to grow in scope and sophistication and will play a greater role in shaping the quality perceptions of professional services. While these will not replace other forms of credentialing, they will have a growing influence on the market and could begin to encroach on or be incorporated into some kinds of credentials.

## Supporting Trends

**Growth of corporate certification and training:** Companies are offering certification programs to bolster their recruitment needs. For example, Google is investing \$100 million to fund students to take infotech courses provided online by “massive open online courses.” American Airlines established its online Cadet Academy to train commercial pilots.

**Cross-sector business model disruption:** The movement of large tech companies like Apple and Amazon into new sectors is forcing many companies to reevaluate their business models. This is happening in areas as diverse as health care and groceries.

**Doubts about higher education:** A large percentage of the population is becoming skeptical of the role and benefits of higher education.



**Declining trust in experts:** Americans' willingness to trust experts of all kinds has been falling for decades. This trend extends across nearly all institutions, including health care, the media, science and business. The trend is exacerbated by sociopolitical polarization.

**Ditching college degrees:** Apple, Google and IBM no longer require a degree for software engineers, product managers and recruiters. Government agencies and companies, such as Random House, Hilton Hotels and Bank of America, have also loosened degree requirements.

### *Key Uncertainties*

- The degree of other credentialers' cooperation or competition with higher education
- The direction of the evolution of higher education
- The willingness of younger workers to pursue certifications in lieu of higher education
- The degree of government intrusion into certification and credentialing
- The effect of "disparate impact" and DEI requirements on testing and certification processes

### *Notable Data Points*

- **Credential requirements:** Eighty percent of jobs in the United States currently require some credential or certification (Marcus, 2021).
- **Proliferation of credentials:** Colleges and other postsecondary education institutions are a prominent source of credentials, offering 359,713 different degrees and certificates in the United States alone as of 2021. Nonacademic credentialers provide a wider range of badges, certificates and licenses, offering 549,712 varieties. Online course providers have a small but growing share, with providers issuing over 9,390 course-completion certificates, microcredentials and online degrees (Credential Engine, 2021).

## Strategic Insights

- There are win-win cases for how higher education, credentialers, governments and businesses could all better integrate knowledge acquisition, training and credentialing in collaboration in the face of change.
- Both DEI and sociopolitical issues will expose credentialers to battles over fundamental questions of what is ethical and preferable, sometimes without established frameworks to fall back on. These will require internal work and careful monitoring of what is emerging in the sociopolitical environment.
- The credentialing process will face growing sociopolitical controversy. Credentialing groups will need to anticipate such conflicts and take proactive measures before external actors seek to impose changes through legal measures or social backlash.
- The proliferation of industry credentials creates a need for independent frameworks for comparing and categorizing credentials, certifications and microcredentials. I.C.E or membership groups could collaborate to create frameworks to facilitate cross-industry or transnational comparisons.
- Employer-recognized credentials provide a means for credentialing organizations to reach out to high school students not on course to attend a college or university. Such outreach could expand the workforce, improve economic equity and provide meaningful measures to address social inequities.
- The credentialing world is becoming more volatile, uncertain, complex and ambiguous. Organizations in credentialing areas undergoing rapid change will have to consider how to make their credentials more responsive and dynamic and less prone to lagging relevance.

### *Potential Alternative Futures*

- **Industry/profession silos:** Industries increasingly care only about the credentials they create and evaluate, as those cover what matters to that industry.
- **Politicized credentials:** Credentials of all kinds are increasingly viewed as belonging to one sociopolitical side or another.
- **Higher education shakeup:** Traditional higher education faces transformative challenges from less-expensive online schools, business training and noncollege programs, reshaping the credentialing landscape.



### *Potential Alternative Futures, continued*

- **Globalized credentials:** Organizations expand their use of cross-border remote workers for white-collar work, creating new demand for internationally recognized professional credentials.

### Take Action

1. Focus on governments and educators as partners in the future, not as adversaries. Look for opportunities to embrace educational institutions and government as part of the credentialing process, with the credentialing body as the trusted foundation.
2. Let go of legacy approaches of right and wrong or good and bad in the credentialing industry. Take a leadership role in developing new alternative credentialing models that may challenge the status quo.
3. Cultivate an organizational commitment to establishing DEI strategies that will advance the participation of underrepresented credential holders.
4. Assess the opportunity to develop microcredentials to address new trends.
5. Reimagine entry-level and ongoing eligibility requirements and consider experiential learning and/or microcredentials as a means of meeting these criteria.
6. Be vigilant about your organization's authority, brand reputation and voice in its industry and/or profession. Strengthen your brand reputation and your credentialing programs' credibility.

### *Topics for Additional Research*

- Key drivers and outcomes of technology companies moving into training and credentialing
- Globalized fields that could benefit from internationally recognized credentials
- Emerging issues and opportunities in the DEI space and best practices for managing them
- Emerging industries that could benefit from the development of new credentials



*Topics for Additional Research, continued*

- Long-term outcomes for high school delivery of industry-recognized credentials
- Emerging skills that require formalization as credentials
- The opportunity for accreditation to support the value proposition of credentialing
- The emergence of soft skills as fundamental to competent performance

# CHANGE DRIVER: GOVERNMENT AND CREDENTIALING



# GOVERNMENT AND CREDENTIALING

The role of government in credentialing will grow less stable as the forces of polarization grow stronger. Some of these forces could propel additional government encroachment on the credentialing sphere. Even amid polarization, one credentialing issue may find nonpartisan appeal: pushback against overlicensing while still appropriately protecting the public.

Credentialing organizations will have to prove their value, utility and fairness to governments, and attempt to depoliticize credentialing and shield it from sociocultural disputes. While many of these issues are specific to the United States, the climate of sociopolitical polarization is growing globally, and no country is immune to the potentiality of these issues.

## Forecasts

**Oscillating policies:** Polarization may drive oscillation in policies at all levels, depending on the government in power at any given point. This oscillation will intrude into all policy areas, including credentialing in many professions and industries.

**Federal versus regional jurisdiction:** In the United States, polarization may also drive conflict between state and federal governments, as federal power is used to try to impose ideological visions on states, which will generate state pushback on federal power through legal measures or as open political defiance. This could impinge on credentialing at many points and create confusion over the legal status of some kinds of licensing and/or voluntary credentials. As increasing polarization is not unique to the United States, this issue has the potential to spill over into Canada and elsewhere.

**Credentialing as a political battleground:** Credentialing itself will be seen as a political battleground, as some analysts are already explicitly calling for credentialing to be used as another tool in the cultural conflict (e.g. viewing credentials as exclusionary, stifling of opportunities), or politicizing the credentialing process, especially in educational accreditation.

**Ideology-driven intrusion:** Ideological issues will drive greater involvement of governments in credentialing. Any political issue could trigger this, though strategies to enhance DEI may be a particularly potent area of conflict, as is the overlap between scientific or healthcare-related credentialing and politically polarizing issues. More generally, ideology could push various jurisdictions to either cede credentialing terrain to business on general principle or to take over formerly private credentialing to pursue social goals. Overlicensing could provide an arena of cross-ideological cooperation, as those who want to reduce licensing as a way to combat regulation may join with those who want to reduce it in the name of equity or expanded opportunities for ex-offenders.

## Supporting Trends

**City versus state versus federal government:** In the United States, political conflict is increasingly played out in battles between levels of government. Political polarization is helping drive this, and it is happening from the local to the federal level.

**DEI and the bottom line:** A growing body of research indicates that organizations prioritizing DEI may perform significantly better financially.

**COVID-19 pandemic spurs cross-border medical licensing:** The pandemic brought more acceptance of interstate medical care. Use of the Interstate Medical Licensure Compact grew by 47% during the pandemic (Credentialing Resource Center, 2021).

**America's polarized politics:** American society is increasingly polarized along political lines. Before, both major parties overlapped at the center, but now their voters are increasingly clustered on the left and right.

**Push for fair-chance licensing:** Advocates are pushing for lower barriers for those with criminal records to receive licenses. They are promoting clean slate laws to expunge criminal history and prohibit making decisions based on that history, which some professional bodies argue intrudes on their freedom to make organizational decisions and set their own standards.

**Declining trust in government:** Trust in government is at historically low levels. This decline is occurring across all demographic groups: racial, political and generational.

### *Key Uncertainties*

- The overall direction of regulation at all levels of government
- The significance of the role that politics plays in creating divergent regulation and licensing requirements in different jurisdictions depending on political stripes
- Unfolding effects of sociopolitical issues on government and policy
- The ways different levels of government approach DEI issues
- The degree of backlash against various accreditation and credentialing bodies



### *Notable Data Points*

- **Falling trust:** The share of Americans who say they trust the federal government to do the right thing always or most of the time declined from a high of 77% in 1964 to 24% in 2007 and 18% in 2017 (Pew Research Center, 2022).
- **Variable state licensing:** Occupational licensing varies considerably from state to state and province to province without a strong correlation to political leanings. For example, a study finds that the least regulated state is South Carolina, where 12.4% of jobs require licenses; the most regulated state is Iowa, at 33.3% (U.S. Bureau of Labor Statistics, 2022).

### Strategic Insights

- It will be increasingly important for credentialers to demonstrate the value of credentials to the relevant levels of government (and at the same time to business) so that new change-driven configurations of the government-business-credentialing triad still involve current credentialers. Demonstrated value could include value to the credential-holder and value to the consumer or service-buyer.
- The political power of associations at the state/provincial level will drive the role of government. Factors affecting that power are crucial to monitor.
- Credentialing organizations must anticipate that they could be thrust into political controversy at any point. They will need to monitor developing issues in their field on this basis and create internal capacities for rapid response and decision-making.
- Credentialing organizations may need to identify and mediate jurisdictional conflicts over credentials between states and jurisdictions.
- Tamping down such battles will be more important to avoid disruption within credentialing and, in some cases, reduce the potential for federalization of credentials.
- Credentialing organizations should have a role in coordinating the reciprocity of credentials between states/provinces. A growing part of reciprocity going forward is the machine readability of credentials.
- At the state level, divergent approaches to credentialing will create increasingly sharp credential divides at state borders in various professions. Understanding their potential effects on markets and educational systems will be important.



### *Potential Alternative Futures*

- **Legal chaos:** Politically driven conflict over laws and jurisdictions in the United States undermines national and state credentialing systems.
- **Federal devolution:** The federal regulatory state is drastically curtailed, granting far more power to the states, with many licensing and regulation impacts. Some states will wield this power and others will let it sit unused.
- **Political blocs:** Seeking efficiency in the face of polarization, blocs of politically aligned jurisdictions form multijurisdictional compacts to collaborate on credentialing.
- **Federalization:** Efforts at efficiency and U.S. state disinterest drive rising federalization and nationalization of credentials up from the state level.

### Take Action

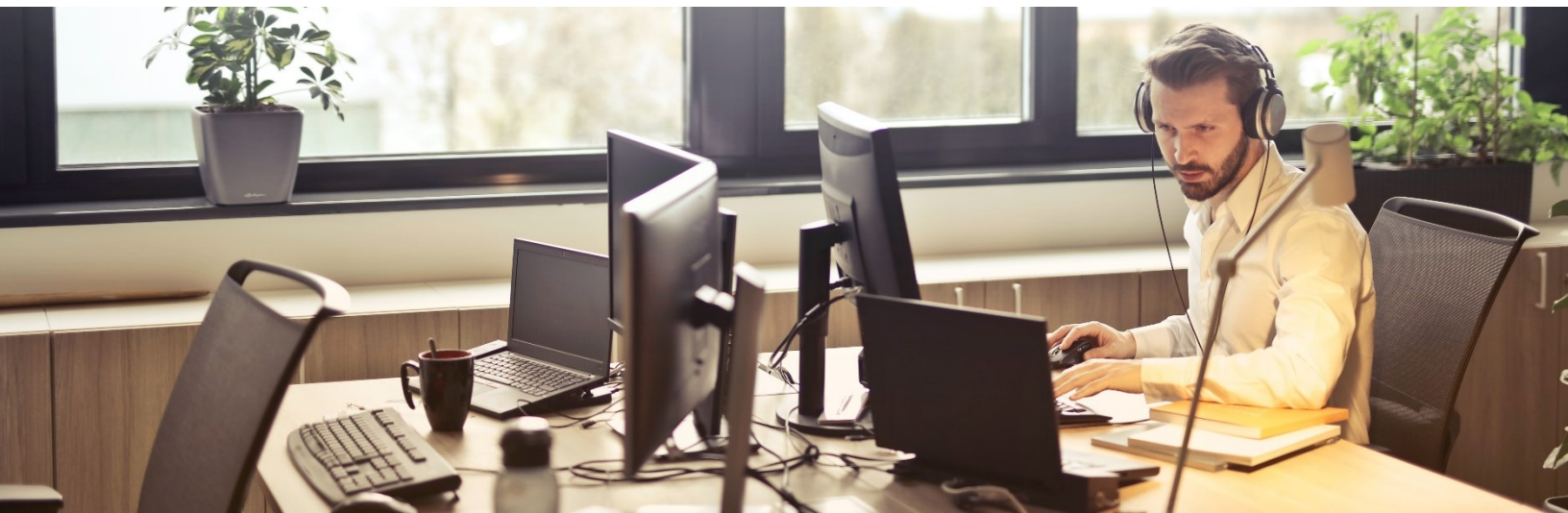
1. Become a trusted voice through more investment in government relations and public policy.
2. Partner with the industry/profession at both federal and state levels for combined advocacy on the value and importance of legitimate credentials and the nonpartisan nature and importance of public protection.
3. Initiate and promote research on the value of your credential(s).
4. Join forces with other credentialing organizations to keep a pulse on state, federal and global proceedings that may affect the credentialing industry and/or lead change.
5. Leverage the collective power of industry to organize strategic approaches to government actions.
6. Invest in efforts and initiatives (i.e., research, communication campaigns, etc.) that increase the perceived value of your credential(s) among all stakeholders.



### *Topics for Additional Research*

- Key drivers and trigger points for combining credentialing and licensure at the state level
- How polarization could affect credentialing at all levels of government
- Which political and culture war issues could affect credentialing in the future
- The ability to affect state licensure in the future
- Market and business effects of the divergence of licensing regimes across state borders
- Effects of a drastic curtailing of regulation at the federal level

# CHANGE DRIVER: TECHNOLOGY INNOVATION



# TECHNOLOGY INNOVATION

The credentialing industry faces a wave of transformational change from technological innovations. As information technology pervades work, continuous performance tracking, artificial intelligence (AI), and data analytics will create new forms of direct skills assessment and rating. Such new methods can give workers new opportunities to validate skills gained through experience and offer employers new options to find qualified workers.

## Forecasts

**Assessment through monitoring:** Technologies like the internet of things, digital twin models and ubiquitous online tracking tools will enable more continuous monitoring of worker performance. New tracking tools could create opportunities for employers to certify skills and give employees a new way to gain experience-based certifications.

**Artificial intelligence (AI):** Improvements in AI will enable the deployment of new automation tools in the workplace, driving more work to be broken down into functional tasks. This will create a growing knowledge base of work tasks that could support the creation of certifications and testing in new areas at a useful granular level.

**Simulations for competency testing:** Advances in virtual reality (VR) and augmented reality (AR) will create new ways to conduct competency assessments using digital simulations. Simulation-based assessments will more directly measure competence, including noncognitive skills, potentially reducing the need for knowledge-based tests.

**Open standards versus Big Tech:** New digital monitoring systems could potentially lead to vendor domination of these platforms as they pursue digital “walled garden” strategies. The centralization of new digital platforms will likely be restrained by new intra-industry standards bodies (e.g., Institute of Electrical and Electronics Engineers [IEEE] working groups) or new regulatory transparency guidelines (e.g., new European Union digital mandates).

**Digital credentialing technology:** Blockchain innovation will result in new types of nonfungible tokens (NFTs) that represent new forms of property ownership, access rights and institutional validation. Mass adoption will require new forms of cross-chain portability and the widespread adoption of blockchain wallets and blockchain-authenticated identities by both institutions and individuals (and their credentials).



## Supporting Trends

**Tracking workers:** Technology is increasingly enabling comprehensive tracking of employees. Once confined to drivers and factory workers, employee surveillance is expanding into white-collar professions. Productivity tracking systems monitor computer usage and inactivity and are used by 8 out of 10 of the largest American employers (Kantor, J. & Sundaram, A., 2022).

**Blockchain for cybersecurity:** Blockchain's inherent security features are being applied to a multitude of digital security issues, including securing sensitive records, authenticating users and devices, preventing fraud and protecting supply chains.

**Technology for microcredentials:** Microcredentialing technologies are being integrated into online platforms.

**Push for blockchain-based credentials:** The European Union is exploring using blockchain technologies in a European digital identity system to notarize and validate diplomas and other educational credentials.

**Proliferation of credentials:** The numbers and types of credentials beyond traditional academic degrees are rising. Alternative credentials include professional certifications, licenses, certificates of course completion and digital badges from traditional universities, and course certificates from online course platforms such as Udacity.

### *Key Uncertainties*

- The willingness of government institutions to adopt or create new digital standards
- The extent to which tech companies expand their workforce education initiatives to workers outside of information technology
- The potential backlash against continuous surveillance in the workplace
- The feasibility of decentralized systems for validating credentials
- The impact of cryptocurrency problems on perceptions of blockchain applications
- The success of augmented and virtual reality technologies



### *Notable Data Points*

- **COVID credential surge:** The issuance of alternative credentials has surged since the COVID pandemic began. IBM's digital badging program has issued 3.7 million credentials since 2015, growing 61% from 2019 to 2020 (EdSurge, 2021). The digital credentialing platform Credly reports that the number of organizations issuing industry credentials has increased 83% since 2020 (EdSurge, 2021).
- **Individually bound NFTs:** Ethereum creator Vitaly Buterin has proposed a new standard for soulbound NFTs, which would link crypto certifications to individual identities using distributed blockchain technology (Canales, 2022; Weyl, Ohlhaber, & Buterin, 2022).

### Strategic Insights

- The speed of technological innovation is accelerating, which will require a parallel acceleration in the development of new ways to measure competency. However, technologies like machine learning and continuous monitoring may provide competing alternatives for measurement and assessment.
- Tech companies like Google and Microsoft have expanded into delivering online training and certification, potentially encroaching on the certifications provided by other credentialers. Educational partnerships with tech companies would offer tech companies greater prestige for their training offerings while enabling other credentialing organizations to expand their reach in digital domains.
- New AI assessment tools will require skilled human professionals who are able to facilitate their use and interpretation by organizations. The credentialing industry could develop new standards and metrics for AI assessment systems, helping ensure that new assessment instruments deliver results that are unbiased, comprehensible and accessible to nonspecialists.
- Industry associations could play an important role in promoting and defending open and transparent digital platforms for certifications. Associations could also play a more active role in promoting credential portability and adopting open standards for digital certification and validation. Pilot initiatives in this area could build organizational expertise and provide a greater voice in future standards development.
- The development of digital credentials and new measurement and testing systems creates an opportunity to integrate greater digital accessibility into new technology standards and approaches at early stages.



### *Potential Alternative Futures*

- **Machine-readable résumé:** Digital credentials become ubiquitous and integrated into automated HR systems for identifying and screening potential employees.
- **Gamified learning:** Game-based training and testing become ubiquitous.
- **Speed of Big Tech:** Big Tech expands their digital credentialing to encompass vendors, workers and learners, dominating credentials in the fast-growing economic sector.
- **Automated expertise:** Credentialed human expertise is increasingly replaced by expertise embedded in AI and automated systems, challenging credentialing systems and undermining accountability.
- **SSN 2.0:** A national digital ID system becomes the basis for an ecosystem to manage online tracking and digital credentials.

### Take Action

1. Rethink legacy approaches to credentialing and testing. Invest in innovation to develop newer, faster, more seamless solutions through expanded use of technology.
2. Collaborate with technology providers that work to enhance knowledge and skill acquisition associated with practice.
3. Invest in technology to enhance business operations, efficiency and service delivery.
4. Continuously scan the environment for emerging technologies.
5. Regularly explore the implications of new capabilities such as blockchain, clarify their utility and educate stakeholders on how they might use them.

### *Topics for Additional Research*

- Big Tech's drive to provide more training and credentialing
- Credentialing applications of nonfungible tokens (NFTs) and soulbound crypto token technologies



*Topics for Additional Research, continued*

- Emerging standards for digital credentialing technologies
- Ways to manage digital credentials without official digital identity systems
- Blockchain innovations, including practical applications of crypto technologies for credentialing
- Simulation technologies and their application to testing
- Progress in AI tools and expert systems for worker performance monitoring
- Accessibility concerns and opportunities created by new technology
- Neurodiversity research related to assessing for competency

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# Appendix A: Initiating Foresight Practices



## Step 1: Initiating Foresight Practices

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Foresight is a structured process for discerning, analyzing, and acting on potential futures. Foresight is a leadership competency with disciplined ways of thinking, a language, and processes that help followers envision the future and prepare to engage with it. Futures thinking is inquisitive, critical, and imaginative. Foresight language (see glossary) equips people with a consistent way of describing the attributes of different types of foresight information and understanding their usefulness in decision making. This user's guide will introduce processes you can use to responsibly guide your association's efforts.

Governments, businesses, communities, associations and other organizations practice foresight to strengthen their decision making and enhance their ability to shape a preferred future. Once you have defined your objectives, you can choose the most appropriate practices and methods to support your efforts.

Though you may have a clear vision for what you expect foresight will accomplish for your association, other association leaders may not. By defining and setting the objectives for foresight, you can keep the project scope manageable and set your association on the path toward a successful outcome.

Whether you simply sketch out a project outline or do a more formal project concept and scope to share with others, there are four elements to launching successful foresight practices that need to be accounted for:

- **Purpose.** Why do you need to learn about the future? In what ways do you intend to use findings and insights to support and advance your association?
- **Champions.** Who needs to be part of this process to secure understanding and buy-in for future plans and actions?
- **Creating a foundation.** How can you stoke curiosity about the future and provide sufficient knowledge and training to support your foresight efforts at any commitment level?
- **Processes.** What are the most time efficient and cost-effective ways to accomplish your objectives?

Thinking through these four factors will help you define the best way to begin or refine your foresight efforts.

The key to a fast start is an understanding of what distinguishes futures thinking. Futures thinking includes continuous reflection on and questioning of new information and what that information could mean for your work. You may already do this, but if this isn't your typical mode of thinking, it's very easy to start practicing today. Engage key stakeholders in your processes to model futures thinking and to dig deeper into potential answers to your questions.

Futures thinking is critical thinking:

- What evidence do I have to support what I am seeing? Are these reliable sources?
- How is this change related to other changes I am observing?
- How pervasive is this change? How quickly will it occur?
- What am I missing in my observations and analysis?

Futures thinking is inquisitive:

- What assumptions are required for this change to occur? Why might this change not happen?
- What will this change mean for me, my organization, and my members?
- What can I learn from how this change has affected others?

Futures thinking is imaginative:

- What possibilities does this change create for my organization?
- What can I do tomorrow that I could not do today?
- What alternative futures or scenarios are also possible?

At the outset of your journey into foresight, don't be daunted by any lack of knowledge or proficiency. In the next sections, you will learn specific foresight tactics you can use to become comfortable with the practice of foresight. The appendices include features models and samples you can adapt for your work.

## Define Your Purpose

*Why do I need to learn about the future? In what ways do I intend to apply findings and insights to support and advance my association?*

Foresight can be used to both inform your members about changes that might affect their future and guide your association's strategy and business decisions. In fact, these goals may overlap. Your members are as likely to be affected by aging, immigration and changing demographics, and new technologies as your association will be. However, your association's priorities might be different from those of your members in important ways. This user's guide will focus primarily on using the drivers of change to inform association decisions while showing you ways to apply the research and use various foresight practices and activities to help your members explore their future.

Associations can use foresight to support four important purposes:

1. To support strategic planning and strategy development.
2. To inform anticipatory learning.
3. To conduct risk analysis.
4. To inspire innovation and business development.

Let's look closely at each of these four purposes to determine who your participants should be and what processes you might want to follow.

**Strategic planning and strategy development.** Many associations have well-established practices around who participates in strategic planning. Ultimately, approving the strategic plan is the board's responsibility, although many boards delegate some or all plan development to senior staff, a volunteer committee, or a task force. Many forward-looking associations find ways to engage younger members in aspects of this process. If affiliates or chapters are a critical component of an association's structure and member service delivery, they too will have a role and voice in strategic planning.

As you look at your cast of players in the strategic planning process, you should consider how to engage them around the ASAE ForesightWorks drivers of change and other relevant foresight research. They are all potential participants in information sharing, strategic conversations, or other foresight exercises you might undertake in support of strategic planning and strategy development. For more guidance on using foresight in strategic planning and strategy development, refer to step three, "Applying Foresight," specifically the sections on visioning and planning how to achieve your vision.

The foresight challenge in strategic planning is to think long term. Commit to exploring at least a 10-year time horizon. Some changes, such as technology developments, will occur faster, while many demographic and social changes will play out over longer periods of time—at least until they reach a tipping point. Don't limit your preparation for strategic planning to some variation on a strengths, weaknesses, opportunities, and threats (SWOT) analysis. While SWOT analyses have definite value, by setting your time horizon out 10 or more years, you are able to explore a wider range of potential changes ahead. The earlier you can detect an opportunity, the easier it will be to plan how you can seize it.

**FIGURE 2. Foresight Applications for Associations**



**Anticipatory learning.** If you think your leaders will more highly value foresight for the association if they can see direct value for themselves, you may want to begin your foresight journey with anticipatory learning. Anticipatory learning is the study of trends, issues, and patterns of change to better prepare for future decisions and behaviors, especially in an environment of uncertainty and rapid change. Foresight-based learning can provide the context and opportunities to explore and even rehearse options for adapting to necessary change.

Your natural participants in anticipatory learning will be your pioneers and early adopters. These are your members who are drawn to change and want to be the innovators, guides, and teachers for others. Because members want to learn about new developments in their field or industry, the potential audience for foresight in a learning setting could be quite large. The ASAE ForesightWorks drivers of change provide prompts for framing education sessions or a series of informative articles and briefings. You may need to do additional research and analysis specific to your members' interests and possible responses, but this can be accomplished to some degree through peer-to-peer learning.

Anticipatory learning also can be a vital part of association staff's professional development. As new forms of work emerge, association professionals have a pressing need to keep their own knowledge and skills current. Given their expertise in different association functions and on-the-ground experiences with member needs and requests, staff can also be the best scouts for identifying changes ahead that could affect association operations or members.

**Risk analysis.** You probably monitor political and legal changes that could affect your association or industry, but are you also identifying future risks to your association's business model, your programs, and other operational factors? The greatest risk for leaders may be in refusing to acknowledge and plan for important and predictable changes.

While advocacy and membership staff are likely accustomed to scanning for potential risks related to their work, key participants in foresight-informed risk analysis also include leaders in finance, business operations, information technology, and communications functions—where urgent threats are likely to emerge. Considering the ASAE ForesightWorks drivers of change will help staff leaders examine potential risks and identify potential action steps, enabling executives to take thoughtful and actionable recommendations to the board.

Ultimately, association executives will need to draw their boards and key committees into developing and enacting the steps required to mitigate future risk. Not only is it part of their fiduciary responsibility to protect the association's future, but volunteer leaders will need to make informed decisions when approving significant budget changes or taking the association's business model in new directions.

**Innovation and business development.** Disrupt or be disrupted has become something of a maxim for business leaders. Major businesses use foresight to discover new opportunities for disruptive innovation and new markets. Associations can approach the drivers of change in the same way—to identify new capabilities or new services and programs for members. By imagining possibilities and challenges related to specific drivers of change, forward-thinking association professionals can design better futures for their members and stakeholders.

As opportunity can often be the upside of potential risk, staff involved in risk analysis are also strong candidates to engage foresight for innovation and business development. They can use foresight to drive "what if" sessions that take advantage of emerging needs and preferences.

If your objective is to create a new service or program, you will want to include subject matter experts from your membership in these innovation and design thinking sessions. Some of the same people taking the lead in anticipatory learning may also be great recruits to any innovation and business development efforts you undertake.

## Become a Champion and Recruit New Champions

*Who are the best champions and allies to create a team of leaders vested in practicing foresight?*

In *Good to Great*, Jim Collins posited that it might be better to focus first on “getting the right people on the bus” in an organization before creating a vision and strategy. You might find Collins’ suggestion useful in deciding how to start your foresight journey. Foresight requires champions willing to lead change, and change agents always need allies to turn the insights of foresight into action.

The most influential team of potential champions: a visionary chief elected officer bold enough to embrace the future partnered with a courageous chief staff executive persistent enough to transform the association. It is hard to beat this combination of foresight and fortitude. But foresight can be championed from any corner—and hopefully many corners—of an organization. If you are reading this user’s guide, you already are on your way to becoming a champion for foresight in your organization. The next section identifies other potential champions, as well as the foresight roles and opportunities they may be well-positioned to support.

In fact, demonstrating foresight can be an effective way to differentiate your style of leadership and management among a team of people devoted to everyday matters. Be sure that championing foresight augments the essential work of supporting current programs and services. Associations that can deliver value in today’s conditions are more likely to have the trust and discretionary funds to invest in future changes.

**Championing foresight as a chief elected officer.** Your peers and the association’s staff look to you for leadership. Within the parameters set by your association’s bylaws, values, and strategic plan, you have considerable latitude to shape the association’s annual priorities. You exercise this latitude when you shape meeting agendas, encourage strategic conversation, and speak on issues of concern in the field. You can bring foresight into all these acts of leadership. Whatever your association’s vision and goals, you will find drivers of change in ASAE ForesightWorks that could inform your future success.

As the chief elected officer, you play a critical role in engaging the association’s board in strategic planning and strategy development. You also ensure the board upholds its fiduciary responsibilities, and that does include making sure your association is doing risk analysis to identify potential problems. If you take an active interest in anticipatory learning, so will other association volunteer leaders and members.

**Championing foresight as a chief staff executive.** Quite often it is the chief staff executive who must be both visionary and change agent, especially when it comes to assessing changing needs within the organization. Your board may look to you and your staff team as intelligence gatherers—spotting critical news and information that matters to the association and keeping them current on new developments in association management.

You can stoke interest in foresight by sharing relevant news articles about changes you are monitoring. In every analysis of an issue or proposed project, you can include foresight-informed guidance about how future trends and events might unfold. You can use your board reports, annual reports or outlooks, and various speeches to share what you see on the horizon in areas of critical importance to the association. If you have the appetite for foresight, you have no shortage of opportunities to spread your enthusiasm throughout your association. You have the ability to apply foresight for all four purposes:

- Engaging your board in scanning for future trends and issues to inform strategic planning
- Analyzing your association’s programs and services against future risks
- Spotting areas where members could pursue anticipatory learning
- Innovating new programs and services and developing your association’s business to respond to emerging opportunities.

**Championing foresight from a staff role.** It is possible to champion foresight from any staff position within an association. As a staff person, you will have the best understanding of how different drivers of change will affect your work. Many of the drivers of change have specific implications for various functional areas and member services. You should not only be aware of these implications but also take on the critical role in helping leaders understand what it means for your organization's larger picture.

You can advance the cause of foresight in your organization by sharing trends and new developments in your area of responsibility or demonstrating that your plans and proposals have accounted for significant changes ahead. Staff who contribute to an association's content strategy (communication, publications, learning) have particularly powerful tools for supporting anticipatory learning among the members.

## Create the Foundation for Foresight Practices

*How can I develop the groundwork for a culture of foresight within my organization?*

Rather than launching a major initiative, sometimes the best way to introduce foresight practices into an organization is by stoking interest across the organization. This approach is especially useful if you are acting as champion from a staff role but is valuable for getting buy-in at every level. Once people understand the utility of what you are proposing, they will be more inclined to commit more effort to processes and activities and even seek additional training and assistance.

1. Share informative and provocative articles about future trends and issues. *Ask what could this mean for us?*
2. Share examples of what other associations are doing in foresight. *Ask could we do this?*
3. Explain how foresight could strengthen processes you already have in place, such as strategic planning or innovation. *Ask are we adequately anticipating the degree of change we might face?*
4. Assign people to scout for major trends and issues related to priorities to discuss at your next board or staff meeting. *Ask how could these changes increase or decrease our potential for success?*

## Deciding Where to Begin Your Foresight Journey

*Where should I focus my foresight efforts in my association to get early wins and strong results?*

Now that you are familiar with the key elements for initiating foresight practice, take a moment to consider how and in which order you might tackle these challenges. Change management experts counsel to look for and start with easy wins. Once you have some success, you can attempt more ambitious approaches.

Think about potential champions for your efforts. Will you need to be the champion, and if so, who will be your allies? Do they need to read this user's guide? Or can you save them time and effort by curating the most relevant elements for your situation?

Talking about the future is fun for many people. If you're the chief staff executive, perhaps your best option is to design your board's strategic conversations around a few select drivers of change. Or it might be easiest to introduce foresight into a process that people already support, such as strategic planning.

If you are facing a particular challenge, such as technology infrastructure or recruiting staff with the talents you need, addressing these challenges through a foresight-informed risk analysis could be an effective way to generate and make the case for innovative solutions and major investments. What association doesn't long for new sources of revenue or to future-proof its existing business model? If that is your priority, begin with using foresight to inform a more robust innovation and business development process.

However you choose to move forward, you can't go wrong also introducing foresight as anticipatory learning into your education programming. If your field is experiencing notable change related to your priorities, perhaps you begin to showcase what is changing and how members might respond through your conferences and publications. Members will appreciate that you are keeping them apprised of drivers of change.

However excited you might be about the potential to champion foresight and create a culture of foresight, you will be more successful if you focus your energies on early wins that prove the value of this kind of research and analysis. The worksheet on the next page will help you think through your options and put your efforts where they will yield the best results. As you move through this guide, you will be able to refine your choices by considering specific foresight experiences and activities at the exploratory, engaged, or leading levels of effort.

## Appendix B: Research on Trend Inventory



## Research on Trend Inventory

Foresight Alliance compiled a list of trends on I.C.E.'s behalf and direction. The trends serve as research background to the report.

Click the following link to access the research on trend inventory.

<https://my.credentialingexcellence.org/files/77ec02ae-7302-4397-ba72-aa50c6a7f268.bin>

# Appendix C: Glossary of Terms



## Glossary of Terms

All I.C.E. research products rely heavily on and refer to the [I.C.E Basic Guide to Credentialing Terminology](#) for consistency . However, many terms in this paper were not part of I.C.E.'s terminology document. A glossary of terms relevant to this paper can be found in Appendix C.

- **Artificial Intelligence (AI):** AI is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision (Burns, Laskowski, & Tucci, n.d.).
- **Alternative credentials:** Loosely defined as any microcredential, industry or professional certification, acknowledgment of apprenticeship (registered or nonregistered) or badging that indicates one's competencies and skills within a particular field. Some common characteristics of alternative credentials are that they take a relatively short time to complete, are focused on specific skills, can be earned consecutively ("stacked"), are verifiable, are often aligned to industries and can frequently be delivered digitally. (SHRM, 2021.)
- **Blockchain technology:** Blockchain is a shared, immutable ledger that facilitates recording transactions and tracking assets in a business network. An asset can be tangible (a house, car, cash, land) or intangible (intellectual property, patents, copyrights, branding). Virtually anything of value can be tracked and traded on a blockchain network, reducing risk and cutting costs for all involved (IBM, n.d.).
- **Digital accessibility:** refers to the inclusive practice of removing barriers that prevent interaction with, or access to websites, digital tools and technologies, by people with disabilities. (WCAG, n.d.)
- **Driver of change:** A confluence of trends or a forecast likely to result in significant change in a system (Rhea, 2018).
- **Environmental scanning:** In foresight, a systematic process for identifying potential signals of change in a system (Rhea, 2018).
- **Foresight:** See definitions on p. 6.
- **Microcredential:** The formal recognition awarded to an individual who has demonstrated attainment of a narrow (or specific or limited) scope of knowledge, skills or abilities. The scope of the microcredential can be as granular as a single skill or competency (I.C.E., n.d.).



- **Signal:** An indicator of trends or future changes, including:
  - **Strong signals:** Indicators of current change (trends) or more-likely future outcomes, often backed by quantitative data.
  - **Weak signals:** Indicators of possible trends or potential future changes, often in early stages and with anecdotal or observational data (Rhea, 2018).
- **Trend:** Change occurring in the present that is often indicative of future changes (Rhea, 2018).
- **Augmented and virtual reality:**
  - **Augmented reality (AR):** The real-time use of information in the form of text, graphics, audio, and other virtual enhancements, integrated with real-world objects. This real world element differentiates AR from virtual reality. AR integrates and adds value to the user's interaction with the real world versus a simulation (Gartner, n.d.).
  - **Virtual reality (VR):** A computer-generated 3D environment (including both computer graphics and 360-degree video) that surrounds a user and responds to an individual's actions in a natural way, usually through immersive head-mounted displays (Gartner, n.d.).