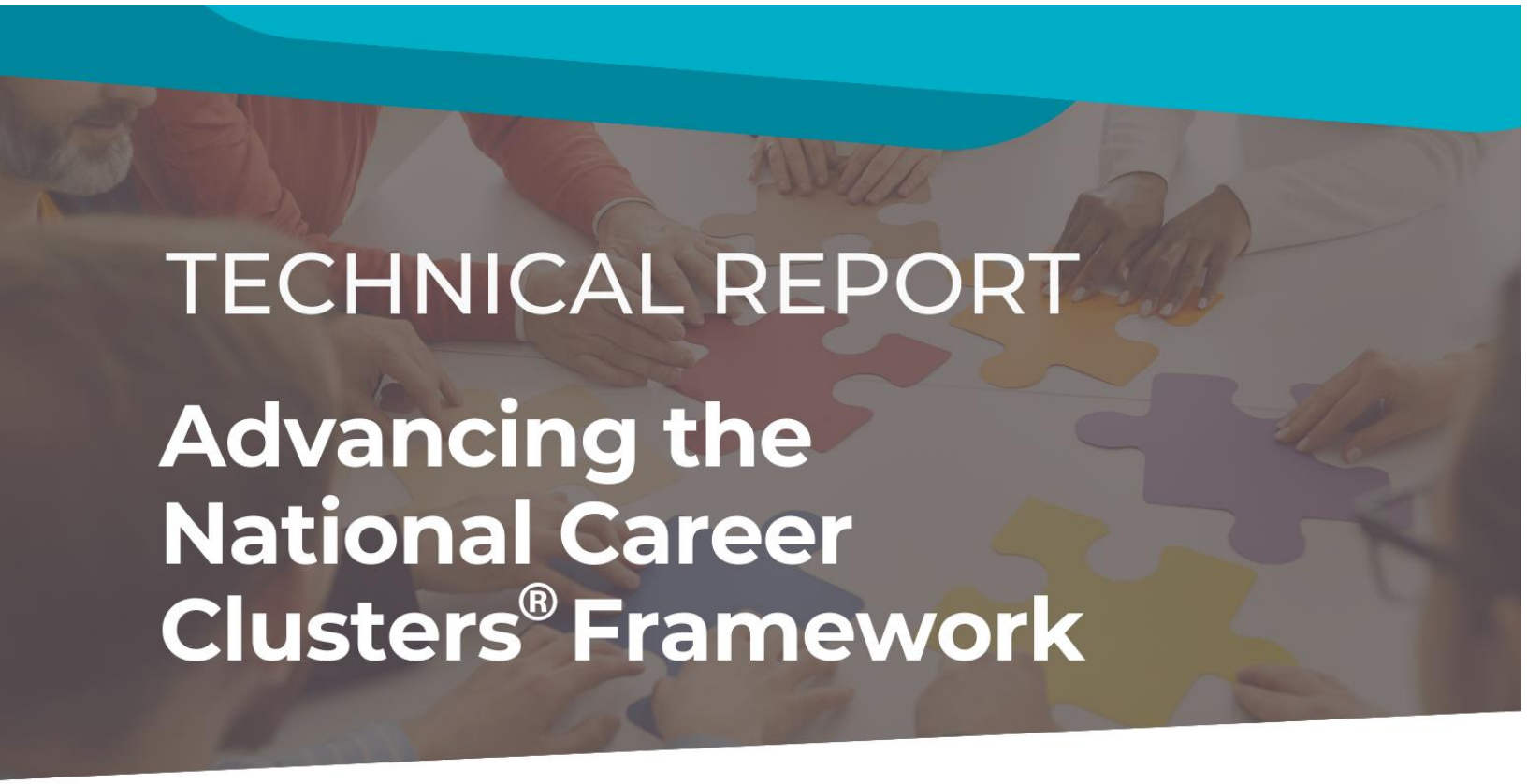

TECHNICAL REPORT

Advancing the National Career Clusters® Framework

ADVANCE CTE
State Leaders Connecting Learning to Work

Career Clusters
Pathways to College & Career Readiness

Add Acknowledgements

In addition to the individuals and organizations listed below, Advance CTE expresses its deep gratitude to the more than 4,000 Career Technical Education professionals and supporting partners who contributed their time, expertise, and perspective to the modernization process.

Dan Hinderliter, associate director state policy, Advance CTE
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Stacy Whitehouse, associate director communications, Advance CTE
Indigo Education Company
WestEd
National Advisory Committee members
Industry Advisory Group members

Introduction

In the late 1990s, with the support of the U.S. Department of Education's Office of Career, Technical, and Adult Education (OCTAE; then called the Office of Vocational and Adult Education), Advance CTE began the process of creating a new framework for Career Technical Education (CTE) to build consistency in program design and quality nationwide, centered around the knowledge, skills, and standards a learner would need to complete each career pathway. This work was led by states with industry partners and managed by Advance CTE. Advance CTE published this new framework, known as the National Career Clusters Framework® (the Framework), on behalf of states in 2002. The framework is used in the vast majority of states and territories and by national vendors providing curriculum tools and CTE instructional support. The Framework has not had substantial updates since its initial release.

In December 2022, Advance CTE announced the launch of an ambitious initiative to modernize the National Career Clusters Framework. This effort, led in partnership with Indigo Education Company and WestEd, was supported by a National Advisory Committee, Industry Advisory Groups (IAGs), and additional feedback channels involving thousands of professionals connected to Career Technical Education (CTE). The initiative seeks to ensure that the Framework evolves to meet the changing demands of industries, educators, and learners alike.

Since the Framework's creation in 2002, there have been tremendous shifts in the labor market demand, the nature of work and the workplace, and the role of technology. Such transformations range from the new normal of hybrid and remote work, instant information access, the frequency of career changes, the rise of artificial intelligence, and more. The modernization process was designed to reflect these changes to the world of work.

Advance CTE's Vision for a Modernized Framework

This modernization is an exciting opportunity to remove silos among industry and education, state and local levels, and across Career Clusters that keep learners from being fully prepared for the world of work. Through the *Advancing the Framework* initiative, Advance CTE aimed to create a modernized Career Clusters Framework that will:

- **Empower learners** by providing more personalized pathways to living-wage jobs while equipping them with the skills needed for a wide variety of careers
- **Enable CTE educators** to align, design, and deliver programs that reflect the interdisciplinary nature of both Clusters and the workforce. These programs will include stronger career exploration and advising models, and create better connections between in- and out-of-classroom experiences, such as work-based learning opportunities

- **Support industries** by helping them hire learners who possess a lifelong learning mindset, whose interests, skills, and experiences align with industry sector needs
- **Assist state CTE leaders** in designing responsive programs and experiences that are better aligned with industry and to use data-driven practice to identify occupational demand. This includes providing resources and guidance to local leaders to ensure the needs of the modern workplace are reflected in CTE programs

The new Framework aims to be a significant step forward in fostering career readiness language that bridges industry and education, enabling more seamless communication and alignment between these two critical sectors.

Overview of This Report

The ensuing report provides a comprehensive summary of the development process for the modernized Career Cluster Framework. The report details the design principles that guided the process, the methodology and timeline of investigation behind the modernization efforts, and the quantitative and qualitative research methodology engaged in the Framework update. Finally, it outlines the new Career Cluster Framework structure and provides the rationale for the adjustments made to the Framework based on the mixed-methods investigation.

The report also includes detailed appendices containing supplementary information for each Career Cluster along with details on the Industry Advisory Groups (IAGs) and broader stakeholder inquiry and engagement strategies.

Section 1: Design Principles

The guiding principles behind the Advancing the Framework modernization initiative is working to build an industry-informed, learner-centered, and responsive Framework that can support changes in work that have taken place and continue to evolve. Our north star through this process was a renewed purpose statement, unanimously approved by Advance CTE's Boards of Directors:

> *The National Career Clusters Framework provides structural alignment and a common language to bridge education and work, empowering each learner to explore, decide on, and prepare for dynamic and evolving careers.*

This modernization is an exciting opportunity to remove silos among industry and education, state and local levels, and across Career Clusters that are keeping learners from being fully prepared for the world of work. The modernized Framework is flexible for every state and:

- is grounded in multi-method research that engaged the CTE community throughout
- reflects the truly interdisciplinary nature of work through more intersectionality across Clusters
- updates language and groupings to better bridge industry's organization of work with education
- includes new sectors, skills, and approaches from the entire world of work, while providing flexibility for the future
- serves as a bridge for education to reflect this structure in their CTE systems and programs
- gives learners more personalized paths to living wage jobs and skills gains for a variety of careers
- provides CTE leaders and educators a means to align and design programs that better prepare learners for these careers
- ensures that industry has learners of all ages with interests, skills, and experiences that match their hiring needs

A modernized Framework is a major next step to improving the quality of CTE programs and ensuring all learners are fully prepared for the workplace no matter what career they pursue.

Framework Features: Organizational Overview

In response to feedback from both educators and industry, the modernization effort shifted the organizing principle for what is considered a Career Cluster. In the past, Career Clusters were built around generalized education programs. To reflect CTE's focus on alignment to labor market needs, the modernized Framework has shifted to industry-oriented, sector-specific Career Clusters defined by labor market information and industry sector research and validation. This shift aims to achieve an industry-driven Framework that more accurately reflects the interdisciplinary nature of the world of work.

The Framework contains several taxonomy changes. In particular, the use of the word 'pathways', now used in numerous contexts across education and work, has been changed to the broader level of 'Sub-Cluster'. This change allows for flexibility for states and communities to adjust the Framework to their needs, and to accommodate future high-skill, living-wage industry sectors as they emerge.

Important Definitions:

- **Career Cluster (Cluster):** Industry sector as defined by groupings from Standard Occupational Classification and North American Industry Classification System codes.
- **Sub-Cluster:** Major grouping of career areas within a given field that have similar skills as defined by the industry context and aligned by 3-digit NAICS code. Each Sub-Cluster is designed to be able to potentially support multiple state or local programs of study, depending on the needs of the local or regional labor market.
- **Cross-Cutting Cluster:** Clusters that are based on both sector-specific and contextualized functions instead of purely discrete industry sectors. These Clusters have both Sub-Clusters and implications for courses taken in other Clusters.
- **Sample Programs of Study:** Examples intended to show potential alignment with currently existing programs of study as well provide inspiration for the expansion and innovation of future programs. Please note that the programs of study mentioned in the Framework are purely illustrative, are not comprehensive, and may vary from state to state.

Framework Features: Interdisciplinary Design

In the modern world of work, many careers have interdisciplinary characteristics and can be contextualized within multiple Clusters/Industry Sectors, as driven by state, regional, and local industry needs. To address and prepare learners for the interconnected nature of the modern world of work, the modernized Framework introduces Cross-Cutting Clusters. While all Clusters contain interdisciplinary careers and the possibility for interrelated programs of study that overlap with other Clusters, careers in Cross-Cutting Clusters have industry-specific applications as well applications in *each* of the other 13 Clusters.

For example, occupations within the Construction Cluster may have regular application within some clusters such as Advanced Manufacturing, Energy & Natural Resources, Supply Chain & Transportation, and Agriculture. However, occupations within the Management & Entrepreneurship Cross-Cutting Cluster exist in each of the other 13 Clusters, as individuals start small businesses in every industry and every company needs managers with similar overarching skillsets no matter what industry they exist in.

Section 2: Project Methods and Timeline

Modernizing the National Career Cluster Framework required a stakeholder-engaged, multi-method approach to ensure that the design principles were achieved. To that end, our approach employed a variety of methods including:

- **Surveys:** Several surveys were designed and deployed to support the research process, including:
    - Educator surveys on current methods of supporting learners in discovering career pathways, use of the existing Framework, identifying best practices, and understanding challenges with the existing Framework and resources
    - An implementation survey, designed to elicit input on the types of resources and supports educators will need to implement the framework
    - A validation survey, designed to garner input from educators, industry, and the general public about a draft of the framework to inform revisions and refinements.
- **Interviews** One-on-one interviews with stakeholders and partners were conducted to gather in-depth information about their experiences and outcomes.
- **Focus Groups:** Advance CTE issued a national call for participants in Industry Advisory Groups, whose purpose was to inform the Framework organization, including the identification of Sub-Clusters and informing the language used to describe each Cluster. More information about Industry Advisory Groups and National Advisory Committee can be found in Section 4.
- **Quantitative Data:** Data from industry, association, state, and national sources such as the U.S. Bureau of Labor and Statistics (BLS), National Center for Education Statistics (NCES), and Lightcast Labor Market Analytics and Economic Data were collected and aggregated for analysis. Indigo Education's proprietary data set on learner behavioral styles, durable (soft) skills, interests, motivators, and preferences was also employed for analysis.

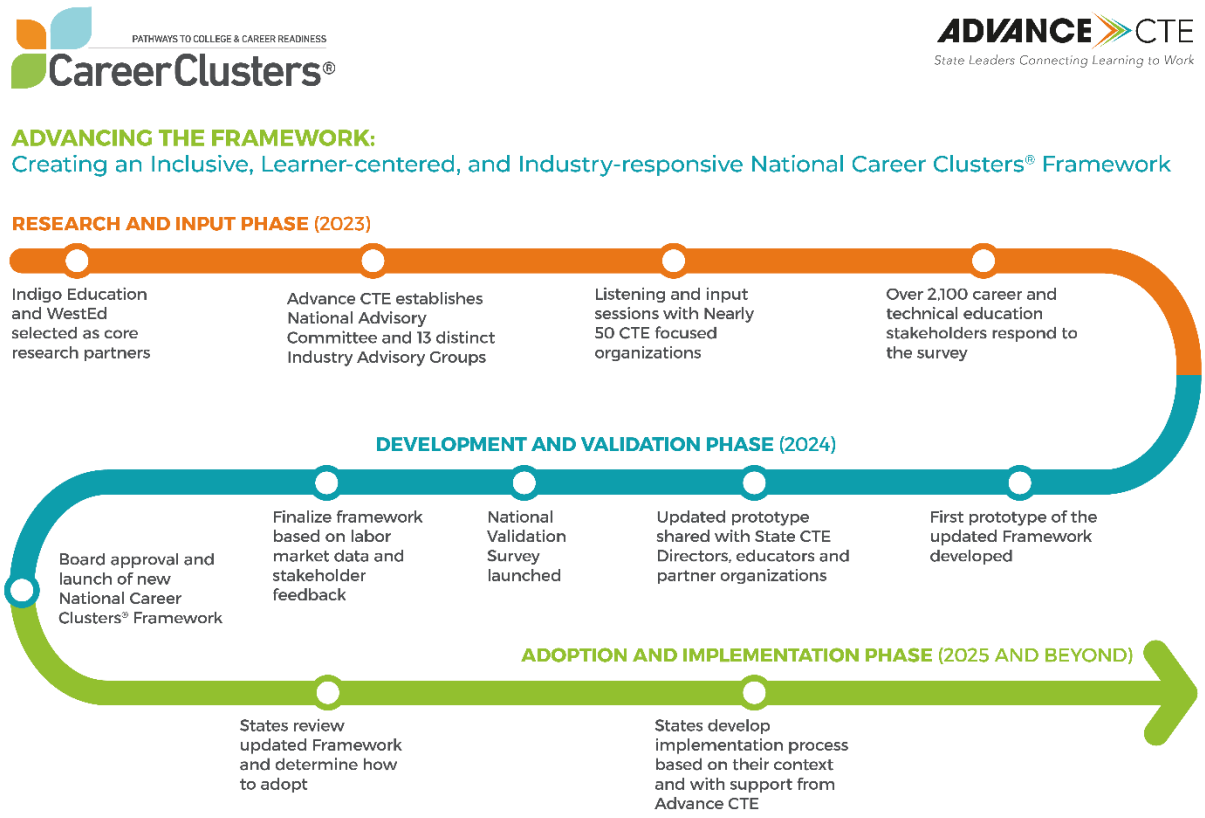
In addition to the multi-methods approach, the research process was designed with rigorous attention to diverse perspectives and opportunities for iterative feedback loops, designed for continuous improvement throughout the research process.

To ensure that we achieved this, research adopted an entrepreneurial approach, where a minimum viable product (MVP) prototype of the new Framework was rapidly created to solicit feedback from key stakeholders. This approach enabled research to quickly make necessary adjustments, ensuring that the final product met the needs of all stakeholders and delivered the desired outcomes.

Project Timeline Overview with Key Milestones

The ensuing chart provides a visualization of the research and adoption process for the modernized Framework. The chart is followed by a narrative timeline laid out by major phase (1) Research and Input Phase (2) Development and Validation Phase, and (3) Adoption and Implementation Phase.

Chart 1: Framework Modernization Timeline Overview Graphic



Research and Input Phase 2023

- **Spring-Summer 2023:**
    - **Indigo Education and WestEd selected** as research partners for the modernization effort on March 27, 2023
    - **National Advisory Committee (NAC) established** by Advance CTE. The NAC, composed of 23 diverse CTE leaders, provides strategic guidance and insight into the decision-making process
    - **Development of detailed industry profiles** based on the U.S. Bureau of Labor Statistics research, NAICS, and SOC codes. These Frameworks were crucial in ensuring that Career

Clusters are aligned with federal industry and occupational standards. Details on these profiles are outlined in the Research Methodology section.

- **Creation of 13 Industry Advisory Groups (IAGs):** 160+ members across 13 distinct IAGs were selected through an open nomination process to serve as sector-specific representatives. These groups ensured the Framework bridges education and workforce needs, with diverse representation in company size, geography, and racial diversity. Details are included in the IAG section of this report.

- **Fall 2023 – Spring 2024:**
  - **Listening and input sessions** conducted with nearly 50 CTE-focused organizations. Contact points included:
    - Advance CTE Fall Meeting
    - CTE Educator Advisory Groups
    - Career Cluster Input Surveys for Administrators, Instructors, National Organizations, and State CTE Leaders
  - **National Implementation Survey** gathered insights from over 2,000 CTE professionals across the country, reflecting on the current and future needs of the Framework.
    - **Responses and feedback:** Responses from CTE educators, administrators, and industry representatives across 50+ organizations and agencies were received.
    - **Conducted Live IAGs Sessions (two live sessions per IAG)**
    - **Current State and Gap Analysis:** Conducted a thorough analysis of how all 50 states adopted the existing Career Clusters.

Development and Validation Phase 2024

- **First Prototype of Updated Framework Developed and Validated with IAGs**
  - IAGs used this prototype for the digital validation phase and it was also used in the validation efforts with the Board and National Advisory Committee.
- **May 13, 2024: National Career Clusters Framework State Director Validation**
  - **Prototype shared for informal validation** with State CTE Directors, educators, and partner organizations.
  - **State Director Validation:** Feedback from 50+ State CTE Directors and staff from all states and territories.
- **June 2024: National Public Validation Survey Launched**
  - A public survey open to the entire CTE community and general public garnered almost 1,400 responses from 47 states, the District of Columbia, and the US Virgin Islands, providing critical input on the draft Framework and individual Career Clusters.
- **Final Framework Developed**
  - Framework finalized based on labor market data and stakeholder feedback, incorporating extensive consultation with CTE-connected partners through workshops, input groups, and focus groups involving educators, state and local CTE leaders, and national education and workforce organizations.
- **August 2024: Advance CTE Board approval**

- **August-October 2024: Materials Finalization**
    - Career Cluster Crosswalk Development
    - Final Report Development
    - Professionally Designed Materials were created for the official launch.
    - Formal launch of the new National Career Clusters Framework at the Advance CTE Fall Meeting October 2024

Section 3: Qualitative Inquiry - Industry Advisory Groups and Stakeholder Engagement

Industry Advisory Groups (IAGs) served as a key representative of the industry perspective throughout the development process, ensuring that the modernization of the Framework was grounded in both industry alignment and real-world workforce needs. The development and engagement approach for the IAGS had four key phases:

1. Establish an Industry Advisory Groupings by NAICS Sector
2. Development of a Comprehensive Industry Engagement Plan
3. Recruitment and Nomination of Diverse IAG Members and Formalized Groups
4. Data-Gathering, Industry Inquiry and Validation Processes

1) Establishment of Industry Advisory Groupings by NAICS Sector

The first phase involved forming industry groupings organized by industry sector according to the North American Industry Classification System (NAICS). These broad groupings were essential in ensuring that industry-specific insights were provided throughout the modernization process. By aligning IAGs with NAICS sectors, we were able to categorize industries in a way that reflected the current workforce landscape. A comprehensive overview of the research process for aligning NAICS sector codes to the IAGs is outlined in the Research Methodology section.

2) Development of a Comprehensive Industry Engagement Plan

Once the NAICS sector-based groupings were identified, a comprehensive industry engagement plan was developed. There was an acute focus on the types of members needed for the advisory groups, prioritizing diversity in sector representation and ensuring a mix of small, medium, and large employers were represented. Research also focused on geographic diversity, seeking input from both rural and urban areas.

The Industry Engagement Plan also included a carefully designed data aggregation and collection methodology to capture both quantitative and qualitative insights (see Research Methodology Section for more details.) This included beginning the process of creating national industry profiles which were used in Round 1 of the live IAG sessions. By focusing on this structured approach, we ensured that the advisory groups would provide valuable feedback on the current and future needs of their industries, guiding the modernization of the Career Clusters.

3) Recruitment and Nomination of Diverse IAG Members and Formalized Groups

The process of recruiting and formalizing Industry Advisory Groups (IAGs) began with an open nomination process, followed by a rigorous review and selection of qualified members. The goal was to ensure that each IAG included industry professionals with diverse backgrounds, perspectives, and experiences. Through careful vetting, it was ensured that members had the expertise necessary to provide valuable insights while reflecting a wide range of industries, company sizes, geographic regions, and other demographics. Comprehensive data on Industry Advisory Groups are located in Appendix II. Key details of the process are included below.

Recruitment Process

The project employed a multi-pronged approach to recruit IAG members, utilizing several outreach strategies to ensure broad participation:

- **Nomination Form**
    - Advance CTE distributed an online nomination form to the public and CTE stakeholders, which was open for one month.
- **Project Team Networks**
    - Advance CTE leveraged our Board and broader network to build awareness of the opportunity to serve on an IAG and engage a broad swath of industry professionals. Additionally, Indigo Education Company and WestEd's Center for Economic Mobility used their respective professional networks and personal contacts to identify qualified individuals. These connections were particularly useful for filling key roles in underrepresented sectors.

- **Social Media Outreach**
    - Announcements were made across Advance CTE, Indigo Education Company, and Indigo Pathway's social media platforms, including LinkedIn, Twitter/X, Instagram, and Facebook. These posts aimed to attract industry professionals interested in contributing to the Framework modernization.
    - Direct messaging via LinkedIn was used to reach out to potential IAG members.
- **Email Outreach:**
    - Targeted emails were sent to industry professionals, leveraging Advance CTE's network and professional contacts.
- **Additional Rounds of Outreach:**
    - To boost the number and industry diversity of nominations, several rounds of outreach were conducted. This included targeted communications to specific industry sectors and outreach to Advance CTE partners.
    - Some IAGs were ultimately combined based on similarities in skill sets and industries, with the approval of Advance CTE. This included combining Healthcare with Community

& Social Services as well as combining Civics & Public Service with Judicial Systems and Public Safety.

Selection and Approval Process

The approval process for IAG members followed a rigorous vetting procedure:

- **Experience Verification:**
  - After receiving nominations, the team thoroughly reviewed each candidate's application to ensure they had relevant industry experience.
- **Demographic Representation:**
  - Ensuring a wide demographic representation across each group, including diversity in geographic location, age, race, and gender was prioritized. This was essential in order for the IAG composition to be reflective of the broad array of industries and communities served by the Career Clusters Framework.
- **Industry and CSO Representation:**
  - In addition to individual professionals, the project team sought representation from other industry organizations and civil society organizations (CSOs) that could provide valuable insights.
- **Formal Invitations and NDAs:**
  - Once the final selections were made, members were formally invited to participate. Each selected member was required to sign a non-disclosure agreement to ensure participants could speak freely during IAG meetings and maintain the confidentiality of discussions.
- **Creation of a CTE Educator Advisory Group:**
  - Many IAG applicants, while lacking the direct industry experience necessary for the Industry Advisory Groups, possessed valuable expertise in Career Technical Education (CTE). Rather than include them in the IAGs, these individuals were invited to participate in one of two CTE Educator Advisory Group sessions held in late Fall 2023. Their insights provided important context for understanding how the Framework impacts learners and teachers.
  - In the CTE Educator Advisory Group sessions, participants offered critical feedback on how the Career Clusters Framework could better support educators and learners. Their experience in K-12 or higher education allowed them to highlight challenges in curriculum alignment, career exploration, teacher credentialing, and learner engagement. Their input helped ensure the final Framework would be responsive not only to industry needs but also to the practical realities of delivering quality CTE programs.

4) Data-Gathering, Industry Inquiry and Validation Processes

Each Industry Advisory Group (IAG) met twice virtually for two hours a session, with a third asynchronous, digital validation to achieve the following objectives (see the Research Methodology Section for detailed information regarding the results of research):

1. **Session 1**: *Industry and Labor Market Data Validation and Information Gathering* This Roundtable involved reviewing previous CTE Career Clusters and pathways relevant to their industry. Industry and labor market data profiles were presented to each IAG, with a structured, focused, and interactive inquiry methodology to garner input on Career Cluster organization and titles, associated occupations and career pathways. (2 hours each)
2. **Session 2**: *Validation of Proposed Career Cluster Structure*
   This Roundtable presented the refined findings from the first session in a proposed new Cluster and Sub-Cluster Framework along with occupational and employment opportunities, and top interdisciplinary skills. The focus was on an initial validation and critique highlighting any gaps, challenges or missing data from the proposed Cluster and Sub-Cluster changes. (2 hours each)
3. **Session 3**: *Digital Validation*
   Each IAG had the opportunity to review, provide input on, and validate their specific cluster. This validation was conducted asynchronously and participants could submit their feedback anonymously and approve the proposed Cluster details for their industry. Those who did not attend either of the two scheduled IAG meetings were not invited to participate in the validation process to ensure only engaged members had input in later stages.

Additional Stakeholder Feedback

In addition to participation from the Industry Advisory Groups, qualitative inquiry engaged over 4,000 stakeholders throughout the project. These engagement efforts were critical to ensuring that the modernization of the Career Cluster Framework was collaborative, inclusive, and data-driven, incorporating a wide range of perspectives from across the CTE landscape. Advance CTE was committed to a meaningful and transparent process for soliciting and responding to feedback from all Framework partners. This work was guided by Advance CTE's Board of Directors and a National Advisory Committee consisting of 23 national, state, and local CTE leaders. These leaders provided strategic insight into decision-making and helped ensure that diverse perspectives were represented throughout the process.

Public Engagement and Social Media Strategy

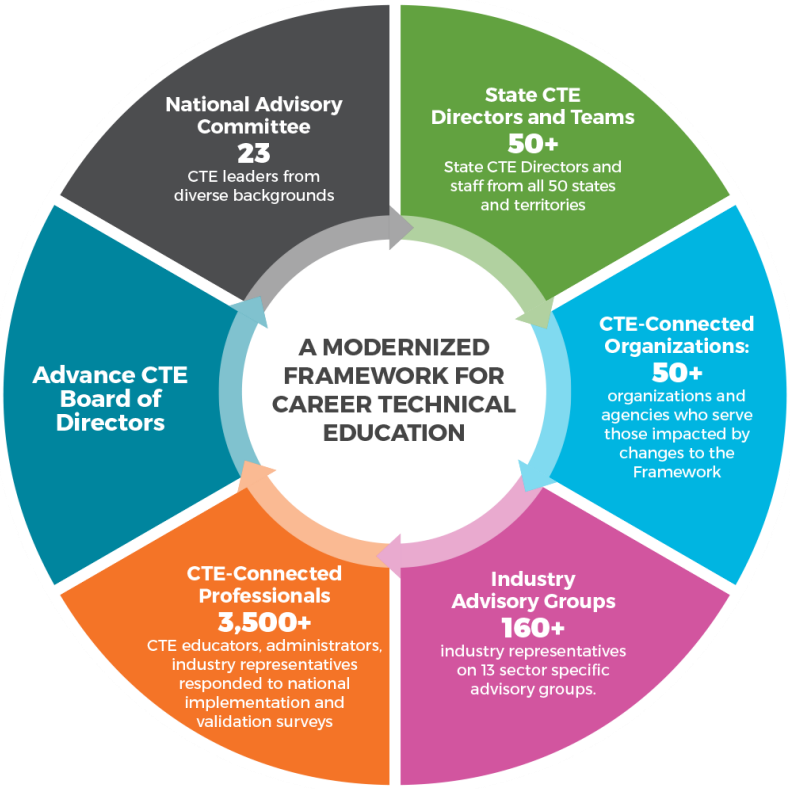
Public engagement also played a key role in gathering broad input for the Framework modernization effort. Through targeted outreach and consistent communication, the project was able to engage a wide array of stakeholders including educators, industry representatives, and the general public.

- **Social Media Announcements:**
  Recruitment and communications leveraged social media platforms such as LinkedIn, Twitter/X, Instagram, and Facebook to reach both potential IAG members and the general public. These platforms were used to make important announcements about opportunities for public participation in the Framework modernization process, driving engagement and ensuring that the broader community could contribute their insights
- **Public Survey Invitation:**
  In June 2024, an invitation was extended to IAG members and the broader CTE community to participate in a Public Validation Survey for the Framework. This survey was promoted through professionally designed communications, ensuring stakeholders had the opportunity to provide their input on the evolving Framework

Comprehensive Engagement Framework

The broader engagement strategy included structured engagement with CTE leadership from across the country and targeted feedback sessions that were both sector- and profession-specific. This strategy gathered critical information to guide the development of the Framework. During Spring of 2023, Advance CTE received ongoing input from over 4,000 professionals connected to CTE across all 50 states and multiple territories through interviews, focus groups, and surveys. This feedback came from a diverse array of stakeholders, including educators, administrators, industry representatives, and workforce organizations.

This robust engagement framework ensured that the input was not only comprehensive but also reflective of the diverse needs and experiences of all CTE-connected professionals. The data and insights gathered through these engagement points have been crucial in shaping a modernized Framework that balances the needs of education and industry. The graphic above provides engagement statistics prior to the launch of the National Public Validation Survey in June 2024



Section 4: Research Methodology for the Career Cluster Modernization

The modernized National Career Clusters Framework was constructed over a year of research and input gathering, using an industry-oriented framing. Research for the updated Career Cluster Framework involved a comprehensive mixed-methods approach to inform the model. Quantitative economic and labor market data was collected to produce the industry profiles which were then validated by a series of Industry Advisory Group meetings applying a structured, focused comparison for inquiry and a final industry validation survey. The resulting organization provided the foundation to the modernized Framework which was then informed by qualitative feedback garnered from a variety of stakeholder input sessions and input from a broad user-base survey that captured educator insight on Clusters, concerns for practical application and impacts, and administrator Perkins reporting. Finally, a national survey was conducted to include all potential user groups with input included in the final iteration of the Framework.

Table 1 below displays the fundamental pillars upon which research into the modernization of the Career Cluster Framework was built. The mixed-methods approach provided validation across the three dimensions of data gathering (LMI, industry, and stakeholders) involving deep statistical investigation into labor market information (LMI) and alignment between industry and employment, referenced against direct industry input on trends in productivity, technological advancement, and emerging skills and occupations; all supplemented by stakeholder feedback within the educational field garnered through surveys, workshops, and virtual meetings. Figure 1 outlines the primary data collected and how it informed the Framework iterations through the design process. Research implemented a continuous improvement process grounded in quantitative and qualitative data gathered consistently throughout the year-long investigation. The Framework modernization began with the design of a minimum viable product, Version 1.0, and proceeded through multiple iterations until the final Board approved version 4.2.

Table 1: Data Collection and Use

	Industry Advisory Groups	Labor Market Research	National Stakeholder Input
Data gathered	● Industry trends and emerging skills ● What and how goods and services are produced (productivity) ● Who the sector produces goods and services for ● Occupations within the sector ● Skills required to enter and advance in the sectors	● Gross National Product by industry ● 10-year employment projections and proportions ● Occupational demand (past and projected) ● Annual hires ● Annual job openings ● Wage data by percentile ● Entry-level education requirements ● High-demand skills	● National Advisory Committee ● Advance CTE Fall Conference Workshops ● CTE Educator Advisory Group ● Implementation Survey ● Validation Survey
How data informed the Framework	● Cluster title and definition ● Sub-Cluster organization, title, and definition ● High-demand skills ● Sample jobs ● Sample places to work	● Industry profiles ● Framework taxonomy ● SOC-CIP alignment and crosswalks ● Cluster NAICS-SOC alignment	● Framework organization ● Framework language ● Example Programs of Study

Industry Alignment

Industry sector profiles were built using the North American Industry Classification System (NAICS) and Standard Occupation Classification (SOC) codes and national labor market data from the U.S. Bureau of Labor Statistics (BLS) and other federal sources. The 20 primary industry sectors identified in the NAICS Framework were analyzed using the U.S. Bureau of Labor Statistics Industry-Occupation Matrix projections to provide clarity on the expected concentration of occupations within each sector. Furthermore, transferable skills across sectors were assessed, allowing the modernized Framework to condense some primary sectors into singular Clusters (i.e. finance with insurance and real estate) which informed the creation of Industry Advisory Groups.

The first step in the research was creating the Industry Advisory Groups and developing the Industry Profiles. To develop the typology for the Industry Advisory Groups, the existing Framework was cross-referenced against the listing of 20 2-digit NAICS codes for industry sectors and then analyzed based on common industry characteristics in terms of what and how goods or services are produced (productivity), who the sector produces goods or services for (sector purpose), occupations employed within the sector, and skills required to advance in each sector, all of which was grounded in the U.S. BLS

Industry-Occupation Matrix. Table 2 demonstrates this process and the final taxonomy for IAGs with associated NAICS codes. While this process derived the IAG structures which informed the foundation for the updated Framework, it did not dictate the final organization of the Career Clusters. This initial work established 15 Industry Advisory Groups. As displayed in Table 1, the IAGs do not reflect the titles and organization of the final modernized Framework as final titles were determined through the IAG sessions.

Table 2: Proposed Industry Advisory Groups based on NAICS Alignment

Existing CTE Career Clusters	NAICS Industries (2-digit)	Proposed IAGs with corresponding NAICS codes
1. Agriculture, Food & Natural Resources 2. Architecture & Construction 3. Arts, A/V Technology & Communications 4. Business Management & Administration 5. Education & Training 6. Finance 7. Government & Public Administration 8. Health Science 9. Hospitality & Tourism 10. Human Services 11. Information Technology 12. Law, Public Safety, Corrections & Security 13. Manufacturing 14. Marketing 15. Science, Technology, Engineering & Mathematics 16. Transportation, Distribution & Logistics	● 11 Agriculture, Forestry, Fishing and Hunting ● 21 Mining, Quarrying, and Oil and Gas Extraction ● 22 Utilities ● 23 Construction ● 31-33 Manufacturing ● 42 Wholesale Trade ● 44-45 Retail Trade ● 48-49 Transportation and Warehousing ● 51 Information ● 52 Finance and Insurance ● 53 Real Estate and Rental and Leasing ● 54 Professional, Scientific, and Technical Services ● 55 Management of Companies and Enterprises ● 56 Administrative and Support and Waste Management and Remediation Services ● 61 Educational Services ● 62 Health Care and Social Assistance ● 71 Arts, Entertainment, and Recreation ● 72 Accommodation and Food Services ● 81 Other Services (except Public Administration) ● 92 Public Administration (not covered in economic census)	1. Advanced Manufacturing & Engineering 31-33 2. Transportation & Logistics 42, 48-49 3. Agriculture 11 4. Management, Leadership & Entrepreneurship 55 5. Construction 23 6. Digital Technology 51, 54 7. Healthcare 62 8. Education 61, 92 9. Civics & Public Service 56, 92 10. Arts, Entertainment & Design 71 11. Financial Services 52,53 12. Hospitality, Culinary & Tourism 72, 44-45 13. Energy & Natural Resources 21, 22 14. Community & Social Services 81 15. Judicial Systems and Public Safety 92

Each Industry Advisory Group (IAG) met twice over the fall and winter of 2023-2024, with a third digital validation session in Spring of 2024 to achieve the following objectives and concomitant impacts on the updated Framework (a deeper discussion of the impacts on the Framework may be found in the Industry Insights and Framework Updates section):

Industry and Labor Market Data Validation and Information Gathering Session

The first roundtable involved reviewing previous CTE Career Clusters and pathways that are relevant to their industry. Industry and labor market profiles were presented at each IAG, with a structured, focused, and interactive inquiry methodology to garner input on Cluster titles, Cluster captions, industry sub-sectors and their relation to occupational Sub-Clusters, current and emerging occupations with associated skills, industry trends in production and purpose, and career pathways.

Following the first round of IAGs, a minimum viable product (MVP) prototype of the new Framework was created to solicit feedback from key stakeholders. During this first iteration of industry inquiry, the 15 IAGs were reduced to 13 due to industry input regarding foundational skills required to enter the respective sectors, the productivity occurring in those sectors, the places of work for those sectors, and the occupations employed in those sectors. Four Clusters were impacted (1) Judicial Systems and Public Safety and Civics & Public Service IAGs combined to ultimately create the Public Service & Safety IAG and subsequent Cluster, and (2) Healthcare and Community & Social Services were combined to create the Healthcare & Human Services IAG and subsequent Cluster.

Feedback from the first session of IAGs identified Marketing and Sales occupations as discrete from the broader Management, Leadership & Entrepreneurship IAG, ultimately creating a new Cluster for Marketing and Sales though the industry input for this Cluster was gathered from all 13 IAGs due to the cross-sectoral nature of the field. Analysis of industry profiles and employment projections for the Management & Entrepreneurship, Marketing & Sales, and Digital Technology IAGs led to the creation of a new set of Clusters entitled “Cross-Cutting Clusters” defined as Career Clusters and occupations that exist within all industry sectors, a conclusion validated by industry.

Validation of Proposed Career Cluster Structure Session

The second roundtable presented the refined findings from the first session in a proposed new Cluster and Sub-Cluster Framework along with occupational and employment opportunities, and top interdisciplinary skills. The focus was an initial validation and critique of the Cluster title, Cluster caption, Cluster definition, Sub-Cluster titles, and Sub-Cluster definitions. This approach highlighted any gaps, challenges or missing information from the proposed Cluster and Sub-Cluster changes. Throughout this phase individual input sessions were conducted with industry experts to obtain further feedback on the

more nuanced updates such as the creation of the Energy and Natural Resources and consolidated Healthcare and Human Services Cluster.

Digital Validation Session

The final validation of the proposed Framework update was conducted digitally. The final Framework was shared with all participating members of the respective IAG, and members were able to provide additional feedback. Participants were able to submit their feedback anonymously and approve the final Cluster for their respective IAG. During this phase IAGs were provided with information regarding the structure and organization that other IAGs had developed for their respective Clusters so they could better understand where there might be overlaps or how perceived gaps in their Cluster had been addressed in other Clusters.

In sum, the Framework Blueprint went through 15 iterations to achieve the final version with adjustments coinciding with IAG and broader stakeholder input. Throughout the three phases of industry inquiry and labor market data analysis, several stakeholder input sessions were held including:

- Six National Advisory Committee meetings, as well as asynchronous document and data review and feedback gathering
- Two interactive workshops at the 2023 Advance CTE Fall Meeting
- Two CTE Educators Advisory Group meetings in Fall 2023
- National Implementation Survey in Fall 2023 consisting of seven user groups with over 4,900 respondents. User groups included local secondary instructors, local postsecondary instructors, local secondary administrators, local postsecondary administrators, state agency staff members (including State CTE Director), representatives of national CTE organizations (CTSO, national educators association), representatives of content delivery organizations.
- Public Validation Survey in Summer 2024 with nearly 1400 responses from 47 states, the District of Columbia, and the territories

These stakeholder input sessions and surveys informed the organization of the Framework and language used to define the Sub-Clusters and sample programs of study offered for each Cluster.

Industry Profiles

The modernized Framework leveraged quantitative labor market information contained in the Industry Sector Profiles and U.S. Bureau of Labor Statistics Industry-Occupation Matrix which were further validated by direct industry input from national Industry Advisory Groups.

Industry Sector Profiles contained 10 overarching data categories. These include:

- Industry proportions of gross national product

- Occupational demand: past five-year growth, projected five-year growth, annual hires, average annual job openings
- Occupational characteristics: 10th percentile wages (proxy for entry-level wages), median wage, typical entry-level education required
- High-demand specialized skills by Cluster
- High-demand software skills by Cluster
- Emerging skills identified by Industry Advisory Groups

As stated in the previous section on Industry Alignment, during the first IAG meeting, the Industry and Labor Market Data Validation and Information Gathering Session, economic and labor market data by sector was reviewed and validated to determine the best organization of the Clusters, including the derivation of new Clusters or reorganization of existing Clusters, and alignment of occupations by Cluster. Occupations were assigned to industry profiles based on the current U.S. Bureau of Labor Statistics' O-Net classification which uses the 5-digit Standard Occupational Classification (SOC) to assign occupations to O-Net Career Clusters that are aligned with the 2002 Framework. This alignment was evaluated by industry representatives, with adjustments made based on industry input and analysis of the proportion of employment within a sector by 5-digit SOC code. These adjustments from the original Framework better represent the current demand for occupations within each industry sector and the Career Clusters themselves.

Industry trends and emerging skills were then assessed by industry experts to inform the Sub-Clusters within each Cluster. Titles for Sub-Clusters were developed through a combination of industry input and alignment to 3-digit NAICS codes, which describe industry subsectors. Additionally, industry experts within the Management and Digital Technology IAGs validated the need for Cross-Cutting Clusters that would also include a distinct Marketing Cluster to reflect the evolution of industry and the ubiquitous nature of skills and competencies within these three fields.

The second IAG session, Validation of Proposed Career Cluster Structure Session, focused heavily on review of Cluster titles, captions, definitions, and Sub-Cluster titles and definitions. Industry experts were also asked to provide insight on interdisciplinary and cross-sectoral skills within their sector. Employers also supported the development of supplemental resources for educators including listings of potential places to work, job titles, and industry resources.

Framework Updates

Through months of investigation with IAGs, reconciliation of multiple stakeholder feedback exercises, research across the U.S. BLS Industry-Occupation Matrix, and industry specific analysis on emerging trends, several key adjustments were made to the Framework. These include:

The identification of three Cross-Cutting Clusters

1) Management & Entrepreneurship
2) Marketing & Sales
3) Digital Technology (an expansion of the traditional IT/CIS Cluster)

New Clusters and Combined Clusters

1) Energy & Natural Resources (new Cluster adding Energy and moving Natural Resources from its previous Cluster)
2) Law and Public Safety and Government and Public Administration combined into a single Cluster, called Public Service & Safety
3) Health Sciences and Human Services combined into a single Cluster, called Healthcare & Human Services

Dissolution of STEM Cluster

These fields now exist their relevant Clusters based on industry sector, such as Advanced Manufacturing, Healthcare, and Energy & Natural Resources

This section of the report will explore how qualitative inquiry and quantitative labor market research produced insights that ultimately framed the organizational structure of the model and informed all Cluster updates. This section also discusses how labor market, industry analysis, and stakeholder input pointed toward these updates, including why certain Clusters were consolidated and how emerging skills demand and the evolution of industry informed the creation of Cross-Cutting Clusters. This structure ensures that the Framework is both responsive to industry demands and flexible enough to support lifelong learning and skill development. These insights are itemized below.

Reconciliation of 20 Industry Sectors and Adjustment of Framework from 16 to 14 Clusters

The updated Framework contains 14 Clusters that are aligned with the North American Industry Classification System[1] (NAICS.) The listing of 20 2-digit NAICS codes for industry sectors were analyzed based on common industry characteristics such as:

- What and how goods or services are produced (productivity)
- Who the sector produces goods or services for (sector purpose)
- Occupations employed within the sector, and
- Skills required to advance in each sector

This analysis was grounded in the U.S. BLS Industry-Occupation Matrix that demonstrated the 10-year projection of employment proportions by 5-digit SOC code in each industry sector and subsector.[2] This analysis produced 15 categories of sectors which formed the initial Industry Advisory Groups.

[1] North American Industry Classification System (NAICS) U.S. Census Bureau
[2] Industry-occupation matrix data, by industry, U.S. Bureau of Labor Statistics

Industry sectors with more meaningful interdisciplinary characteristics, such as similar skills demand and industry functions, are often collapsed when performing economic development analysis (i.e. transportation and warehousing is combined with wholesale trade to best understand industry demand.) This traditional economic development methodology influenced the approach to analysis that narrowed the 20 NAICS sectors to 15 (see Table 2).

Once the 15 initial industry sector groupings were derived, occupations were assigned to industry profiles based on the current O-Net classification. This alignment was evaluated by industry representatives with adjustments made to the assignment of occupations per Cluster based on industry input on current and emerging skills needs and sector trends, supplemented by analysis of the proportion of an occupation within an industry sector at the national level[3]. This resulted in some adjustments from the original Framework to better represent the current demand for occupations within each industry sector and the Career Clusters themselves.

Through the second iteration of IAG meetings, industry experts verified the formation of their Cluster and alignment to industry, informed the title of their respective Cluster, the caption for their Cluster (a contribution about which employers felt passionate as this best captured the modernity of their sector), Cluster definitions, Sub-Cluster titles, and Sub-Cluster definitions. Many industry experts also provided individual written commentaries that were integrated into the broader IAG feedback. Stakeholder input garnered through the Fall 2023 Conference Workshops, Fall National Implementation Survey, National Advisory Committee meetings, and CTE Educator Group meetings also influenced the final organization and rhetoric used in the modernized Framework.

Development of New Cross-Cutting Clusters

Recognizing that the evolution of private, public and nonprofit sectors has created a common demand for specialized skills in management, marketing and digital technology, the updated Career Cluster Framework includes three Cross-Cutting Clusters comprised of occupations that are in-demand across all industries. Cross-Cutting Clusters are defined as Clusters that are based on both sector-specific and contextualized functions instead of purely discrete industry sectors. While there is intentionally no hierarchy to the Framework, three of the Career Clusters – Digital Technology Cluster, Management & Entrepreneurship Cluster, and Marketing & Sales Cluster – are identified as “Cross-Cutting Career Clusters,” meaning they serve as both a standalone Career Cluster but also have specialized applications within each of the other Career Clusters.[4]

Occupations aligned to these three Clusters were found across all industry sectors in the Industry-Occupation Matrix with industry experts in all sectors verifying the demand for occupations within

[3] Ibid.

[4] Harvard Business Review. (2016). "Managing the Interdisciplinary Workforce: A Guide to Best Practices."

Clusters, demonstrating that the skills and competencies encompassed in these fields were ubiquitous across industry sectors and regional economies.[5] IAG input validated the methodological approach for the design and purpose of the "Cross-Cutting" Career Cluster model. Industry experts in all sectors found that contextualizing the skills in these three Clusters to local and regional economic conditions would enhance the desirability of candidates in these professions. Careers in Cross-Cutting Clusters have applications in all 14 Clusters, with the potential for programs of study to be contextualized within each Career Cluster.

Defining these Clusters as Cross-Cutting does not mean a worker needs these skills to be successful in all fields; rather it is reflective of the fact that all industries hire people with these skills and/or perform these roles. For example, while knowing how to fly a drone is not a prerequisite for success in any industry, all industries use drones in various contextualized ways. Figure 1 displays the relationships among Clusters within the modernized Framework, with Cross-Cutting Clusters placed on the outer ring of the wheel to demonstrate the Cross-Cutting nature of those Clusters.

Figure 1: Career Cluster Framework Demonstrating Cross-Cutting Clusters

[5] U.S. Department of Labor. (2021). "Occupational Outlook Handbook: Cross-Cutting Occupations."

“Manufacturing” to “Advanced Manufacturing”

The term "advanced manufacturing" aptly captures the essence of a sector driven by innovation and modern technology and validated by IAG input. It signifies a field that goes beyond traditional methods, integrating automation, data analytics, and smart technologies. Here, "advanced" is not just an adjective but a modern industry term used across the US, indicating a commitment to progress and efficiency. As the sector evolves, industry experts verified this term will remain relevant, embodying the industry’s forward-looking nature and its ongoing technological advancements.

Grouping Energy and Natural Resources

The decision to group Energy and Natural Resources into a new Career Cluster, rather than keeping Natural Resources within the Agriculture Career Cluster, stems from the evolving focus and broader scope of natural resource management and energy production and transmission as validated by industry input and field research. Industry experts from Energy and Natural Resources felt that natural resource management in the 21st century was inextricably related to energy. While industry experts from the agricultural IAG were satisfied with natural resources being included with the Agriculture Career Cluster, they recognized that the technological advances and complexity of energy production and transmission had a more tangible tie to natural resources. This shift reflects modern priorities such as environmental preservation, resilience, and sustainability, which are increasingly central to the energy sector.[6]

Modern Focus of Natural Resource Management

1. Environmental Preservation: The primary goal of natural resource management today is to maintain the health and sustainability of our planet. This includes managing water, soil, minerals, and forests in a way that supports long-term ecological balance. The energy sector plays a pivotal role in this endeavor. Renewable energy sources like wind, solar, and hydroelectric power are critical in reducing carbon emissions and combating climate change. These efforts are directly aligned with the principles of sustainable natural resource management.[7]
2. Resilience and Sustainability: Resilience in natural resource management involves preparing for and adapting to environmental impacts and challenges. The energy sector is at the forefront of developing resilient infrastructure and technologies that can withstand and mitigate the impacts of climate change. Sustainability practices in the energy sector, such as the development of renewable energy projects, energy conservation, and efficient resource utilization, are integral to the responsible management of natural resources.[8]

Distinction from Agriculture

1. Scope and Focus: Agriculture, while also concerned with sustainability and resource conservation, has a more specific focus on the production of food, fiber, and other plant and animal products. This includes activities such as crop cultivation, livestock farming, and the harvesting of timber. Natural resource management, on the other hand, encompasses a broader range of activities aimed at the conservation and sustainable use of natural

[6] National Research Council. (2014). "Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond."
[7] Food and Agriculture Organization of the United Nations. (2018). "The State of the World's Forests: Forest Pathways to Sustainable Development."
[8] U.S. Department of Energy. (2021). "Sustainable Energy and Environmental Impact."

resources, which extend beyond the scope of agricultural production.[9] This broader focus aligns more closely with the objectives and practices of the energy sector.

2. Integration with Energy Sector: The energy sector's involvement in natural resource management is extensive and multifaceted. For example, the extraction and processing of minerals and fossil fuels, the development of renewable energy sources, and the management of water resources for energy production are all critical components of both fields. By grouping Energy and Natural Resources together, the CTE Career Cluster reflects this integration, providing learners with a comprehensive understanding of how these areas intersect and how they can contribute to sustainability and resilience efforts.

Grouping Energy and Natural Resources into a new Career Cluster aligns with contemporary priorities in environmental preservation, resilience, and sustainability[10]. It acknowledges the broader scope of natural resource management and its integral relationship with the energy sector, distinguishing it from the more specialized focus of agriculture. This reorganization not only reflects the modern landscape of these fields but also provides learners with a more relevant and comprehensive education, equipping them with the skills needed to address the pressing environmental challenges of our time.

Inclusion of Agribusiness as a distinct Sub-Cluster in Agriculture

The decision to include Agribusiness as a distinct Sub-Cluster within the Agriculture Career Cluster is rooted in the significant role that management and business operations play in the agricultural sector. While the field of agribusiness is reflective of the knowledge and skills captured in a traditional business administration program, the field of agriculture and commerce involves nuanced knowledge that does not exist within traditional business administration and management programs. Agriculture, encompassing both independent (small) and commercial farms, ranches, and other harvesting operations, is unique in its heavy reliance on management roles. The presence of a substantial number of management positions within this industry underscores the importance of agribusiness as a critical component of the broader agricultural ecosystem.

According to industry data, management occupations (SOC 11-0000) and farmers, ranchers, and other agricultural managers (SOC 11-9013) currently comprise 24% and 21% of the agricultural workforce respectively. These figures are projected to increase to 25% and 22% by 2032, highlighting the growing significance of management roles in agriculture.[11] This concentration of management positions necessitates specialized knowledge and skills in agricultural commerce, which justifies the establishment of Agribusiness as a distinct Sub-Cluster.

[9] U.S. BLS Occupational Outlook Handbook, Agricultural Workers

[10] World Economic Forum. (2020). "The Future of Jobs Report."

[11] Industry-occupation matrix data, by industry, U.S. Bureau of Labor Statistics

Title Change: Removing “Architecture” from the Construction Career Cluster Title

The decision to remove "Architecture" from the main title of the Construction Career Cluster was made to better reflect the overall structure and scope of the industry. While architecture remains an important Sub-Cluster within construction, the scale of the architectural sector is significantly smaller compared to the broader construction industry. Industry experts on the IAG verified Main Cluster titles are intended to represent larger, more encompassing sectors, and the inclusion of architecture in the title could imply an equivalence in scale that does not exist.

In the U.S. construction industry, architecture-related jobs account for approximately 3% of the total employment, with the vast majority of jobs (97%) spanning a wide range of other roles, including labor, project management, and specialized trades.[12] By focusing the main title on "Construction," we ensure that the Cluster more accurately represents the larger industry and provides clearer guidance for career exploration.

Placing “Unmanned Vehicles” within the “Digital Technology” Cross-Cutting Cluster

The versatility and growing presence of drone technology across multiple industries suggested a strategic approach based on industry input. Industry experts in this field expounded upon the proliferation of drone-related roles across various sectors and the primary skills needed for operation of Unmanned Vehicles which fell within the Digital Technology Cluster; thus, the Unmanned Vehicle Systems was placed in the Digital Technology Cross-Cutting Cluster. Industry experts also provided input on the reality of unmanned vehicles as applied in various industry Clusters, making clear that the “manufacturing” of unmanned aerial vehicles was not a primary occupation, rather the operation of the UVs was the highest demand across sectors. This placement enables the program to be effectively adapted to meet the demands of multiple industries. The transportation sector’s interest in integrating unmanned vehicles, particularly drones, is understandable. However, insights from our Industry Advisory Group meetings reveal that drone-related occupations are emerging across all sectors.

Placing “Entrepreneurship & Small Business” as a Sub-Cluster in the “Management & Entrepreneurship” Cross-Cutting Cluster and elevating it to the Cluster title

Small businesses make up 99.9% of U.S. firms and employ 47.3% of the private workforce, according to the U.S. Small Business Administration.[13] Notably, these firms are primarily entrepreneurial ventures, with new companies less than five years old historically creating the majority of net new jobs annually since 1977. Of the 33.2 million small businesses, 81.7% are nonemployee firms, highlighting a trend toward sole proprietorships and emphasizing the growing importance of entrepreneurial skills in today’s

[12] Ibid.

[13] U.S. Small Business Administration Office of Advocacy, 2023. https://advocacy.sba.gov/2023/03/07/frequently-asked-questions-about-small-business-2023/#:~:text=There%20are%2033%2C185%2C550%20small%20businesses,net%20jobs%20created%20since%201995.

workforce. This robust contribution to job creation and economic dynamism underscores the necessity of including Entrepreneurship prominently in CTE programming.

Integrating entrepreneurship as a distinct CTE Sub-Cluster and elevating its inclusion in the title of a Cross-Cutting Cluster provides all learners with access to essential entrepreneurial skills such as creativity, opportunity recognition, and strategic thinking. These capabilities are vital not only for aspiring business owners but also for empowering learners to be innovative within various roles in larger organizations. Formalizing entrepreneurship education within CTE programs is essential to preparing learners for the future of work and maintaining the U.S.'s position as a leader in global innovation and economic competitiveness.

Inclusion of Ethics in the "Market Research, Analytics & Ethics" Sub-Cluster

The inclusion of "Ethics" within the "Market Research, Analytics & Ethics" Sub-Cluster is a deliberate and forward-thinking decision, underscoring the evolving landscape of marketing in the digital age. When analyzing job postings over the last year, Lightcast Job Posting Analytics identified 101,752 unique job postings nationwide that mentioned ethics and marketing. Based on industry expert feedback and research into real-time labor market information such as job posting, the integration of ethics serves several key purposes:

1. Rising Importance in the Digital Age: The advent of artificial intelligence (AI), coupled with expanding capabilities in data analytics, has transformed marketing strategies and their impact on consumers. With these technologies enabling more targeted and sometimes invasive approaches, ethical considerations have become paramount. Recognizing the potential for these tools to perpetrate harm, particularly through predatory advertising practices, necessitates a focus on ethics to safeguard consumer interests.
2. Consumer Protection and Trust: As marketing strategies become more sophisticated, there's an increasing risk of infringing on consumer privacy and autonomy. By emphasizing ethics, this Sub-Cluster promotes the development of marketing professionals who are not only skilled in analyzing data but also committed to using these insights responsibly. This focus is critical for maintaining consumer trust and fostering long-term business relationships.
3. Social Responsibility: Marketing campaigns have a powerful influence on public perception and behavior. With this influence comes a responsibility to avoid exploiting vulnerabilities, especially among historically marginalized populations. The ethical component of this Sub-Cluster advocates for marketing practices that are not only effective but also equitable, challenging the industry to prioritize health and financial well-being over profits.
4. Preparing for Future Challenges: The rapid pace of technological advancements and the global expansion of consumerism present new ethical dilemmas. By incorporating ethics into the core of marketing education and practice, this Sub-Cluster prepares professionals to navigate these challenges thoughtfully and to lead with integrity.
5. Regulatory Compliance and Reputation Management: An ethical Framework within marketing is essential for navigating the complex web of regulations governing data privacy, consumer

protection, and fair advertising practices. Companies and professionals attuned to these ethical considerations are better positioned to avoid legal pitfalls and reputational damage.

Using the term “Healthcare” in the Career Cluster title instead of “Health Sciences”

According to industry experts, the term "Healthcare" is more aligned with industry-standard terminology and reflects the broad range of professions and roles within the sector, encompassing both clinical and non-clinical positions.[14] While "Health Science" is traditionally associated with academic and research-focused careers, "Healthcare" is the preferred term within the industry as it more accurately represents the practical, service-oriented aspects of the field.[15] This alignment with industry verbiage not only enhances clarity for learners and professionals but also fosters stronger connections between education and employment pathways in the sector. The term "Healthcare" resonated more effectively with industry stakeholders, including employers and policymakers, who recognize it as encompassing the full spectrum of health services, from direct patient care to administrative roles. This broader, more inclusive term ensures that Career Clusters are reflective of real-world practices and needs, promoting better alignment between educational curricula and job market demands.

Combining Healthcare & Human Services in CTE Education

The IAGs for Healthcare and Community & Social Services involved deep deliberation about the current state of care, social work, community health. Discussion involved assessment of skills and jobs within healthcare and social assistance and the confluence between the two in the modern world of work. Growing demand for occupations such as community health workers are emblematic of the growing demand for knowledge across both areas of service.[16] Further investigation with IAGs into the sector and the operationalization of these services at the community level revealed that “health and human services” are public or public-private relationships at the community level that are housed together, thus career pathways in each service area have common entry-level skills that can branch into technical healthcare or administrative services within social and community service. Industry experts concluded that combining the two fields better reflects the reality of career pathways at the community level and would afford learners a broader understanding of care in the 21st century.[17]

The IAG discussion reflects the standard classification for these services as a single industry sector according to NAICS codes entitled Healthcare and Social Assistance. Combining health and human services as a Career Cluster within Career and Technical Education (CTE) programs significantly enhances

[14] U.S. BLS Occupational Outlook Handbook, Healthcare Workers

[15] National Consortium for Health Science Education. "Health Science Career Cluster." Retrieved from http://www.healthscienceconsortium.org/

[16] Bendowska A. et al. “The Significance of Cooperation in Interdisciplinary Health Care Teams as Perceived by Polish Medical Learners,” Int J Environ Res Public Health. 2023 Jan; 20(2): 954.

[17] The National Academies of Sciences, Engineering, and Medicine states that integrating health and social care education improves care quality by fostering interprofessional collaboration and understanding (2019). https://nap.nationalacademies.org/read/25467/chapter/5

educational attainment and increases opportunities for individuals entering the healthcare field. This integration fosters the transferability of skills between these interconnected realms, offering a robust foundation for learners and professionals alike.[18] Furthermore, IAGs engaged in substantive discussion on the increasing needs to serve behavioral health systems. As behavioral health expands, these programs are being embedded in health sciences pathways. The projected growth of the variety of Sub-Clusters will elevate the recognition of health sciences as the overarching field of study for health-related careers. Combining health and human services in CTE programs maximizes opportunities for learners entering the healthcare field. This integration enhances skill transferability, career flexibility, and workforce readiness, preparing a resilient and adaptable healthcare workforce.

- *Interdisciplinary Skill Development and Transferable Skills:* Skills such as communication, empathy, and problem-solving are essential in both fields, allowing for adaptability and success in various healthcare roles
- *Holistic Education:* A combined curriculum provides comprehensive education, equipping learners with versatile skills applicable to numerous careers
- *Increased Career Flexibility and Expanded Career Pathways:* Learners can access a broader array of career paths, easily transitioning between roles such as healthcare administration, social work, and patient advocacy
- *Job Market Responsiveness:* A versatile skill set allows individuals to respond to job market changes, increasing employability and career resilience
- *Enhanced Workforce Readiness and Real-World Applications:* Combining these fields ensures relevant training for real-world scenarios, preparing learners for modern healthcare environments
- *Interprofessional Collaboration:* Training in both fields fosters an understanding of various roles, promoting teamwork and improved patient outcomes

Using the title “Clean & Alternative Energy” versus Green or Renewable Energy as the Sub-Cluster Title

After consulting with experts and considering the debates surrounding the terms "clean," "green," and "renewable," it was determined that the terminology "Clean & Alternative Energy" should be adopted as the Sub-Cluster title. This title emphasizes that these energy sources can be both extraction-based energy while also performing with reduced emissions on the user end (extraction is addressed in a separate Sub-Cluster.)[19] The term "green" can sometimes be misleading, as even renewable energy

[18] The U.S. Department of Education highlights that CTE programs combining health and human services prepare learners for a broader range of careers, enhancing employability and adaptability. https://cte.ed.gov/initiatives/supporting-learner-success-in-cte

[19] Campbell M. “South America's 'lithium fields' reveal the dark side of our electric future,” 2022. https://www.euronews.com/green/2022/02/01/south-america-s-lithium-fields-reveal-the-dark-side-of-our-electric-future

sources involve substantial resource use during the extraction and production phases that produces emissions and effluent matter. For example, producing solar panels or lithium batteries requires minerals and metals, and their production often relies on energy from non-renewable sources. Moreover, the development of renewable energy infrastructure can have environmental impacts, including land use changes and habitat disruption. While these energy sources are cleaner than fossil fuels in terms of greenhouse gas emissions for the end user, they are not entirely free of environmental costs.

Experts recommend the adoption of alternative energy sources and use of this terminology primarily because they significantly reduce emissions and offer greater sustainability in the long term compared to fossil fuels. This transition is critical for combating climate change and reducing our ecological footprint, even as we continue to enhance the sustainability of renewable energy technologies.

Including Engineering as a Sub-Cluster in the Advanced Manufacturing Cluster

The decision to include Engineering more broadly within the Advanced Manufacturing Cluster, while delineating specific disciplines like Civil and Structural Engineering within Construction and Environmental Engineering in Energy, was made with careful consideration of the engineering field's diversity and its intersection with various sectors as specified by industry experts in multiple IAGs. Approximately 36% of engineering jobs may be found within the manufacturing sector, with the second highest sector being professional, technical, and scientific capturing about 30% of all engineering occupations.[20] Since the modernized Framework is grounded in industry input and quantitative accounting of occupational proportions by sector, Advanced Manufacturing was determined to be the best fit for this broader Sub-Cluster of engineering. Specific considerations provided by industry experts in manufacturing, construction, energy, and public service may be found below.

1. Broad Application in Manufacturing: The Advanced Manufacturing Cluster encompasses Engineering due to the sector's extensive utilization of various engineering disciplines. Manufacturing remains the primary industry employing a wide array of engineers, reflecting the integral role these professionals play in developing, optimizing, and innovating manufacturing processes and technologies.
2. Sector-Specific Disciplines: While many engineering disciplines are pivotal to manufacturing, certain specialties, such as Civil and Structural Engineering in construction and Environmental Engineering in energy, have a more pronounced focus on their respective sectors. Highlighting these disciplines within their relevant Clusters acknowledges their specialized applications and contributions to those fields.
3. Flexibility for Local Implementation: Recognizing the diversity of educational and industrial landscapes across states and districts, the Framework allows for flexibility in placing engineering

[20] Industry-occupation matrix data, by industry, U.S. Bureau of Labor Statistics; Career Cornerstone Center https://www.careercornerstone.org/engineering/engemploy.htm

programs of study. This ensures that local and regional needs can dictate the most logical and beneficial alignments of engineering disciplines with industry sectors.

4. Distinct Placement of Software Engineering: The separation of Software Engineering into the Cross-Cutting Digital Technology Cluster addresses the universal demand for software engineering skills across all industries, distinct from the more physically oriented engineering disciplines. This move aligns with a broader industry trend towards embracing more inclusive terminology such as "programming" and "software development." These fields are recognized for offering diverse pathways into the profession, including non-traditional routes like coding bootcamps, reflecting the evolving landscape of career entry and progression in the digital age.

Creating a Separate Early Childhood Sub-Cluster in the Education Main Cluster

The creation of a separate Early Childhood Sub-Cluster within the Education main Cluster was driven by the unique and specialized nature of early childhood education and advocated for by industry experts. Early childhood education, which focuses on the developmental needs of children from birth to age eight, requires distinct skills, knowledge, and teaching strategies that differ significantly from those needed in primary, secondary, and higher education settings.

Recognizing early childhood education as its own Sub-Cluster allows for more targeted professional development, curriculum design, and career pathways that cater specifically to the early learning environment. This differentiation also aligns with industry standards and the growing recognition of the critical role early childhood education plays in child development, as underscored by research indicating that 90% of a child's brain development occurs before age five. Moreover, the demand for early childhood educators is increasing, with the U.S. Bureau of Labor Statistics projecting a 7% growth in employment for preschool teachers from 2022 to 2032, reflecting the heightened emphasis on the importance of early learning.[21] By establishing a dedicated Sub-Cluster, we ensure that educational programs and career pathways are better equipped to meet the specific needs of this essential sector.

Crosswalk Design

Crosswalks for the updated Framework are provided for two purposes (1) to bridge the previous Framework to the updated model, and (2) to support educational program enhancements and new program design. The Framework crosswalk is designed to assist in aligning Classification of Instructional Program (CIP) codes, the federal taxonomy for educational programs, and Standard Occupational Classification (SOC) codes by Cluster with the updated Framework.

[21] Industry-occupation matrix data, by industry, U.S. Bureau of Labor Statistics

Occupational Alignment

Final occupational analysis for each Cluster occurred during the creation of the Cluster-CIP-SOC-NAICS crosswalk and was grounded in BLS Industry-Employment Matrix[22] to align occupational Clusters to industry sectors that may better inform pathway design, identify labor market demand conditions, and leverage resources and work-based learning opportunities. The Industry-Employment Matrix contains a 10-year employment projection and provides an account of the proportion of occupations by industry sector at a national level. This research applied the U.S. BLS Employment Projections: 2023-2033 Summary to assess the proportion of occupations within each industry sector.

The updated model aligns occupations by Cluster and Sub-Cluster based on the proportion of the industry sector that is comprised of each specific occupation as relayed in the Industry Alignment section. Occupations are organized by Standard Occupational Classification codes (SOC) with occupations being assigned to Clusters based on the industry sector/Cluster that comprises the largest proportion of the occupation at a 5-digit SOC level. For example, 23% of all jobs within the agricultural sector are management occupations while in the construction sector 7.8% of all jobs are management occupations. This approach supports an accurate accounting of employment options within each industry-aligned Cluster. Using the BLS Industry-Employment Matrix as the foundation for the organization of occupations and Clusters allows the Framework to more accurately reflect the reality of occupational opportunities and their respective industry context. The updated Framework crosswalk aligns Clusters and associated Sub-Clusters with their respective CIP codes, SOC codes, and NAICS codes.

CIP code alignment was derived from the current National Center for Education Statistics CIP-SOC crosswalk. CIP codes were then matched to the appropriate Cluster using the corresponding industry profile and inventory of occupations. Finally, NAICS codes were assigned to each Cluster based on the Industry Sector Profiles with IAG validation.

[22] Ibid.

Section 5: Career Cluster Framework Structure

This section outlines the major features of the updated Career Cluster Framework, designed to reflect the evolving needs of both the workforce and educational systems. Guided by input from Industry Advisory Groups, extensive labor market analysis, and ongoing stakeholder engagement, the Framework has been modernized to align with the realities of today's economy while also preparing learners for future opportunities.

One of the key updates is the shift from 16 to 14 Career Clusters, a decision driven by data and industry input that highlighted overlaps between sectors and the need for more streamlined categories that better reflect industry structures. Additionally, the introduction of Cross-Cutting Clusters, such as Management & Entrepreneurship, ensures that essential skills applicable across all industries are properly emphasized, enabling learners to pursue interdisciplinary pathways.

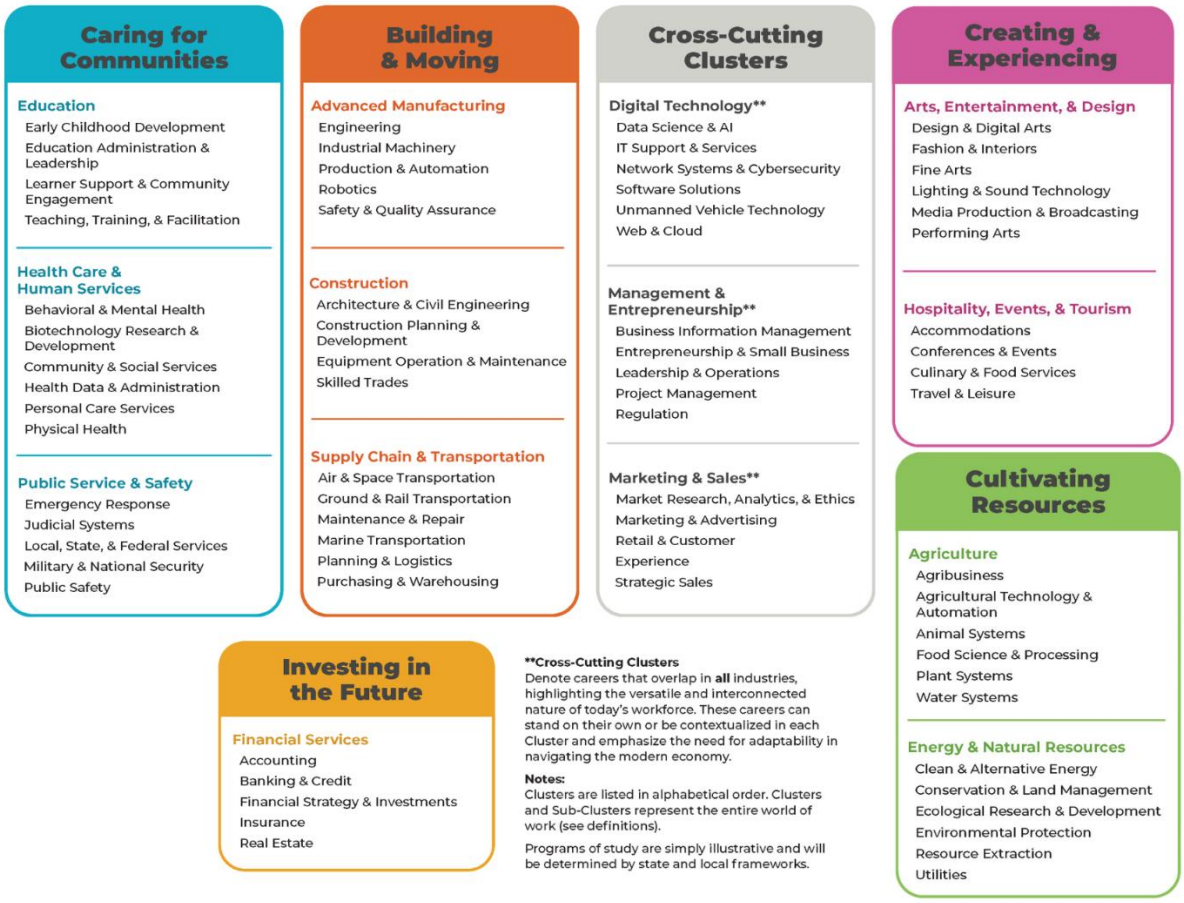
Modernized Cluster Overview

New Cluster Components

Each Cluster has five consistent elements. It includes a Cluster Title, a learner-focused caption describing the Cluster, an educator-focused Cluster definition, Sub-Clusters that highlight key occupational and skill groupings within the Cluster, and sample programs of study. These elements are common across Cross-Cutting Clusters as well.

Cross-Cutting Clusters are designed to be both stand-alone Career Clusters and also reflect the careers and organizational functions that can be further embedded within all other sectors of our economy. The Cross-Cutting Clusters are Digital Technology, Management & Entrepreneurship, and Marketing & Sales

Figure 2 Career Cluster Model



Distinguishing Cross-Cutting Clusters from Interdisciplinary Connections

Interdisciplinary Sub-Clusters, Jobs, and Roles

All Clusters contain interdisciplinary careers that overlap with other Clusters and are influenced by regional economic conditions. Interdisciplinary occupations span multiple industry sectors, integrating knowledge from different disciplines to solve complex problems. However, these roles are not present in all industries. For example, mechanics are crucial in agriculture, manufacturing, and transportation but not in every sector. Key characteristics of interdisciplinary jobs include:

- Sector-Specific Applications: Specialized skills essential within specific industries

- Integration of Multiple Disciplines: Combining knowledge from various fields to address industry-specific challenges
- Adaptability Within Contexts: Skills can transfer between related sectors, enhancing versatility

Cross-Cutting Clusters, Sub-Clusters, Jobs and Roles

Cross-Cutting jobs are found across all industries, characterized by broad applicability and universal need. For example, software developers are essential in healthcare, finance, retail, and more. Key characteristics of Cross-Cutting jobs include:

- Universal Applicability: Essential across all industry sectors
- Broad Skill Sets: Widely transferable skills relevant to numerous contexts
- Industry-Agnostic Functions: Core functions are not tied to a specific industry but organizational needs

Both roles are crucial in today's job market. Interdisciplinary roles meet sector-specific challenges, while Cross-Cutting roles maintain essential functions across sectors. Integrating both interdisciplinary and Cross-Cutting roles into CTE programs maximizes opportunities for learners.

Addition of Captions to Cluster Titles

Captions were added to the Cluster titles specifically designed to engage learners and spark their interest in exploring careers within these industries. The Cluster captions were developed by industry experts during the IAG sessions, an exercise which employers felt was particularly meaningful in light of the evolution of industry in the 21st century.

Below, the Cluster Titles and Captions are listed alphabetically.

- **Advanced Manufacturing:** Engineering and Producing Tomorrow's Solutions
- **Agriculture:** Cultivating Sustainability and Nourishing the World
- **Arts, Entertainment, & Design:** Inspiring Creativity, Innovation, and Artistry
- **Construction:** Building Futures and Pioneering Sustainable Horizons
- **Digital Technology (Cross-Cutting Cluster):** Modernizing Industries and Connecting Communities
- **Education:** Transforming Lives and Enriching Futures Through Lifelong Learning
- **Energy & Natural Resources:** Powering Progress and Preserving Our Planet
- **Financial Services:** Empowering Financial Resilience
- **Healthcare & Human Services:** Supporting the Whole Health of Individuals, Families, and Communities
- **Hospitality, Events, & Tourism:** Unlocking Adventures and Elevating Experiences

- **Management & Entrepreneurship (Cross-Cutting Cluster):** Driving Business Success Across All Industries
- **Marketing & Sales (Cross-Cutting Cluster):** Improving Communication and Connections
- **Public Service & Safety:** Shaping, Serving, and Protecting Our Communities
- **Supply Chain & Transportation:** Driving Efficiency and Streamlining Tomorrow's Transport

Addition of Cluster and Sub-Cluster Definitions

Cluster and Sub-Cluster titles and definitions were informed by industry input and further validated by industry representatives through the final Industry Validation Survey. Clusters are aligned to 2-digit NAICS codes while Sub-Clusters are aligned to 3-digit NAICS codes.

"Sub-Clusters" instead of "Pathways"

Sub-Clusters were derived through investigation of skills with Industry Advisory Groups and further alignment with the 3-digit NAICS code level defined as "industry Sub-Clusters" by the federal government. These Sub-Clusters are major groupings of career areas within a given field that have similar skills as defined by industry area. Each Sub-Cluster is designed to be able to potentially support multiple state or local programs of study, depending on the needs of the local or regional labor market. The Framework focuses on Sub-Clusters rather than using "pathway" language for a number of reasons. First, "pathway" is a general term that does not have a common definition in the field. In many places, a "career pathway" is often synonymous with a program of study, but this is not always the case. In the modernized Framework, each Sub-Cluster could have multiple related programs of study.

Additional Industries and Technology Focus

The modernized Framework includes new industry areas and a focus on new and emerging technologies. This shows up in the Framework in several ways. For example, Energy has been merged with Natural Resources into a new, realigned Career Cluster. The Framework includes the introduction of new technologies, including automation and robotics (Advancing Manufacturing Career Cluster), clean and alternative energy (Energy and Natural Resources Career Cluster), and artificial intelligence and unmanned vehicles (Digital Technology Career Cluster). It also includes major modern industry focuses, including advanced technologies, automation, robotics, and others. Finally, the Framework expanded the Information Technology Cluster to the broader Digital Technology Cluster to reflect the modern technological focus of the world of work.

Disaggregated and Consolidated Clusters

Several Clusters were combined or disaggregated through the modernization effort. The Law, Public Safety, Administration, and Public Service have been realigned into a combined Career Cluster. Similarly, the Healthcare Sciences & Human Services Career Clusters have been combined into the Healthcare & Human Services Cluster.

The four dimensions of STEM (Science, Technology, Engineering, and Mathematics) are now dispersed across multiple Career Clusters. Engineering has been further disaggregated and is represented in multiple Career Clusters, and the individual STEM Career Cluster has been eliminated to avoid duplication and more accurately reflect how both industry and programs of study are designed.
The decision to reallocate components of the former STEM (Science, Technology, Engineering, and Mathematics) Cluster into their respective industry-related Clusters reflects the evolving nature of workforce education and the need for a more integrated approach to career pathways. While STEM has played a crucial role in education by emphasizing critical thinking, problem-solving, and innovation, the shift towards industry-aligned Clusters in the new Career Cluster Framework necessitates a reorganization that better represents the world of work.
By embedding STEM components within relevant industry Clusters, we acknowledge that STEM skills are foundational across a broad range of careers rather than being confined to a standalone category. This reallocation ensures that learners and workers can see the direct application of STEM skills in specific industries, making career pathways more relevant and aligned with actual job market demands.
The new Framework, which focuses on representing the entire world of work through industry-aligned Clusters, renders the standalone STEM designation unnecessary. By integrating STEM into industry-specific Clusters, we promote a more holistic and accurate reflection of how STEM disciplines contribute to various sectors, ultimately leading to more cohesive and industry-relevant educational and career development opportunities.

Conclusion

The updated Career Cluster Framework brings the opportunity to advance Career & Technical Education across the K-16 spectrum at a time in society when the educational system is most in need to ensure an equitable and prosperous future for all. The Framework supports educators in their expansive role in modern society as a critical position affording both knowledge and social capital for learners of all backgrounds. The updated Career Cluster Framework is intended to support learner exposure to the modern world of work while also providing educators with resources needed to connect classroom learning with regional economic opportunities that support economic mobility.

Appendix I: Crosswalk From Old Framework to Modernized Framework

No field has been eliminated from the Framework, though some have been shifted into other Career Clusters, combined with other industry sectors, or renamed to more accurately reflect current industry taxonomy and structure. The following charts illustrate those shifts in detail.

Cluster Crosswalk

Yellow = Combined or Removed
Green = Cross-Cutting
Purple = New
Grey = Renamed/Reorganized

Current Cluster	New Cluster
Agriculture, Food & Natural Resources	Agriculture
Architecture & Construction	Construction
Arts, A/V Technology & Communications	Arts, Entertainment, & Design
Business Management & Administration	Management & Entrepreneurship
Education & Training	Education
Finance	Financial Services
Government and Public Administration	COMBINED into Public Service & Safety
Health Science	COMBINED into Healthcare & Human Services
Hospitality and Tourism	Hospitality, Events & Tourism
Human Services	COMBINED INTO Healthcare & Human Services
Information Technology	Digital Technology
Law, Public Safety, Corrections & Security	COMBINED into Public Service & Safety
Manufacturing	Advanced Manufacturing
Marketing	Marketing & Sales
STEM	Removed—Engineering was primarily placed in Adv. Manufacturing
Transportation, Distribution and Logistics	Supply Chain & Transportation
None	Energy & Natural Resources

Cluster and Career Pathways Crosswalk From Old Framework to Modernized Framework

Current Cluster	**New Cluster**
Agriculture, Food & Natural Resources	Agriculture
Current Career Pathways	**New Sub-Clusters**
Agribusiness Systems	Agribusiness
Animal Systems	Agricultural Technology & Automation
Environmental Service Systems	Animal Systems
Food Products & Processing Systems	Food Science & Processing
Natural Resources Systems	Plant Systems
Plant Systems	Water Systems
Power, Structural & Technical Systems	

Current Cluster	**New Cluster**
Architecture & Construction	Construction
Current Career Pathways	**New Sub-Clusters**
Construction	Architecture & Civil Engineering
Design/Pre-Construction	Construction Planning & Development
Maintenance/Operations	Operators & Maintenance
	Skilled Trades

Current Cluster	**New Cluster**
Arts, A/V Technology & Communications	Arts, Entertainment & Design
Current Career Pathways	**New Sub-Clusters**
A/V Technology & Film	Design & Digital Arts
Journalism & Broadcasting	Fashion & Interiors
Performing Arts	Fine Arts
Printing Technology	Lighting & Sound Technology
Telecommunications	Media Production & Broadcasting
Visual Arts	Performing Arts
Current Cluster	**New Cluster**
Business Management & Administration	Management & Entrepreneurship
Current Career Pathways	**New Sub-Clusters**
Administrative Support	Business Information Management
Business Information Management	Entrepreneurship & Small Business
General Management	Leadership & Operations
Human Resources Management	Project Management
Operations Management	Regulation

Current Cluster	New Cluster
Education & Training	Education
Current Career Pathways	**New Sub-Clusters**
Administration & Administrative Support	Early Childhood Development
Professional Support Services	Education Administration & Leadership
Teaching/Training	Learner Support & Community Engagement
	Teaching, Training & Facilitation

Current Cluster	New Cluster
Finance	Financial Services
Current Career Pathways	**New Sub-Clusters**
Accounting	Accounting
Banking Services	Banking & Credit
Business Finance	Financial Strategy & Investments
Insurance	Insurance
Securities & Investments	Real Estate

Current Cluster	New Cluster
Government & Public Administration	COMBINED into Public Service & Safety
Current Career Pathways	**New Sub-Clusters**
Foreign Service	
Governance	
National Security	
Planning	
Public Management & Administration	
Regulation	
Revenue & Taxation	

Current Cluster	New Cluster
Health Science	Healthcare & Human Services
Current Career Pathways	**New Sub-Clusters**
Biotechnology Research & Development	Behavioral & Mental Health
Diagnostic Services	Biotechnology Research & Development
Health Informatics	Community & Social Services
Support Services	Health Data & Administration
Therapeutic Services	Personal Care Services
	Physical Health

Current Cluster	New Cluster
Hospitality & Tourism	Hospitality, Events & Tourism
Current Career Pathways	**New Sub-Clusters**
Lodging	Accommodations
Recreation, Amusements & Attractions	Conferences & Events
Restaurants & Food/Beverage Services	Culinary & Food Services
Travel & Tourism	Travel & Leisure

Current Cluster	New Cluster
Human Services	COMBINED INTO Healthcare & Human Services
Current Career Pathways	**New Sub-Clusters**
Consumer Services Counseling & Mental Health Services Early Childhood Development & Services Family & Community Services Personal Care Services	

Current Cluster	New Cluster
Information Technology	Digital Technology
Current Career Pathways	**New Sub-Clusters**
Information Support & Services Network Systems Programming & Software Development Web & Digital Communications	Data Science & Artificial Intelligence Information Technology Support & Services Network Systems & Cybersecurity Software Solutions Unmanned Vehicle Technology Web & Cloud

Current Cluster	New Cluster
Law, Public Safety, Corrections & Security	Public Service & Safety
Current Career Pathways	**New Sub-Clusters**
Correction Services Emergency & Fire Management Services Law Enforcement Services Legal Services Security & Protective Services	Emergency Response Judicial Systems Local, State & Federal Services Military & National Security Public Safety

Current Cluster	New Cluster
Manufacturing	Advanced Manufacturing
Current Career Pathways	**New Sub-Clusters**
Health, Safety & Environmental Assurance Logistics & Inventory Control Maintenance, Installation & Repair Manufacturing Production Process Dev. Production Quality Assurance	Engineering Industrial Machinery Production & Automation Robotics Safety & Quality Assurance

Current Cluster	New Cluster
Marketing	Marketing & Sales
Current Career Pathways	**New Sub-Clusters**
Marketing Communications Marketing Management Marketing Research Merchandising Professional Sales	Market Research, Analytics & Ethics Marketing & Advertising Retail & Customer Experience Strategic Sales

Current Cluster	New Cluster
STEM	Removed Engineering was put into Advanced Manufacturing with a reference to Civil and Structural Engineering in Construction and Environmental Engineering in Energy
Current Career Pathways	**New Sub-Clusters**
Engineering & Technology Science & Mathematics	N/A

Current Cluster	New Cluster
Transportation, Distribution & Logistics	Supply Chain & Transportation
Current Career Pathways	**New Sub-Clusters**
Facility & Mobile Equipment Maintenance Health, Safety & Environmental Management Logistics Planning & Management Services Sales & Service Transportation Operations Transportation Systems/Infrastructure Planning, Management & Regulation Warehousing & Distribution Center Operations	Air & Space Transportation Ground & Rail Transportation Maintenance & Repair Marine Transportation Planning & Logistics Purchasing & Warehousing

NEW

Current Cluster	New Cluster
None	Energy & Natural Resources
Current Career Pathways	**New Sub-Clusters**
	Clean & Alternative Energy Conservation & Land Management Ecological Research & Development Environmental Protection Resource Extraction Utilities

Advanced Manufacturing Updates

The term "advanced manufacturing" aptly captures the essence of a sector driven by innovation and modern technology and validated by IAG input. It signifies a field that goes beyond traditional methods, integrating automation, data analytics, and smart technologies. Here, "advanced" is not just an adjective but a modern industry term used across the US, indicating a commitment to progress and efficiency. As the sector evolves, industry experts verified this term will remain relevant, embodying the industry's forward-looking nature and its ongoing technological advancements.
The decision to include Engineering more broadly within the Advanced Manufacturing Cluster, while delineating specific disciplines like Civil and Structural Engineering within Construction and Environmental Engineering in Energy, was made with careful consideration of the engineering field's diversity and its intersection with various sectors as specified by industry experts in multiple IAGs. Specific considerations provided by industry experts in manufacturing, construction, energy, and public service may be found below.

- Broad Application in Manufacturing: The Advanced Manufacturing Cluster encompasses Engineering as a whole due to the sector's extensive utilization of various engineering disciplines. Manufacturing remains the primary industry employing a wide array of engineers, reflecting the integral role these professionals play in developing, optimizing, and innovating manufacturing processes and technologies.
- Sector-Specific Disciplines: While many engineering disciplines are pivotal to manufacturing, certain specialties, such as Civil and Structural Engineering in construction and Environmental Engineering in energy, have a more pronounced focus on their respective sectors. Highlighting these disciplines within their relevant Clusters acknowledges their specialized applications and contributions to those fields.
- Flexibility for Local Implementation: Recognizing the diversity of educational and industrial landscapes across states and districts, the Framework allows for flexibility in placing engineering programs of study. This ensures that local and regional needs can dictate the most logical and beneficial alignments of engineering disciplines with industry sectors.
- Distinct Placement of Software Engineering: The separation of Software Engineering into the Cross-Cutting Digital Technology Cluster addresses the universal demand for software engineering skills across all industries, distinct from the more physically oriented engineering disciplines. This move aligns with a broader industry trend towards embracing more inclusive terminology such as "programming" and "software development." These fields are recognized for offering diverse pathways into the profession, including non-traditional routes like coding bootcamps, reflecting the evolving landscape of career entry and progression in the digital age.

The Career Cluster title and caption, full definition, and Sub-Clusters with definitions were informed by input from the Industry Advisory Group. During two rounds of nationwide Industry Advisory Group

meetings, employers and subject matter experts from industry provided feedback on prominent industry trends, emerging activity, and high-demand skills and competencies for their industry sector. Industry participants also reviewed and verified a selection of quantitative national economic data related to their sector that informed the Cluster taxonomy. Furthermore, they validated real-time labor market information derived from on-line job postings that provided the frequency with which skills were mentioned in digital job postings and contributed to the derivation of the sample skills and competencies listing in this appendix.

Industry experts validated the Cluster title and Sub-Cluster organization at focus group meetings and through the Industry Validation Survey distributed in Spring of 2024. Unique to this Framework, industry experts derived a brief, inspirational caption listed next to the Cluster title that they felt best captured the modernity of their sector.

Quantitative industry data validated by Industry Advisory Groups included:

- Industry proportions of gross national product
- High-demand specialized skills by Cluster
- High-demand software skills by Cluster
- Emerging skills identified by Industry Advisory Groups
- Occupational demand: past five-year growth, projected five-year growth, annual hires, average annual job openings
- Occupational characteristics: 10th percentile wages (proxy for entry-level wages), median wage, typical entry-level education required

Advanced Manufacturing Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Auditing • Automation • Construction • Customer Relationship Management • Electrical Engineering • Hand Tools • Housekeeping • HVAC • Machinery • Marketing • Mechanical Engineering	• Amazon Web Services • AutoCAD • Autodesk Revit • Automation • C++ • LESS • MATLAB • MicroStation (CAD Design Software) • Operating Systems • Python • Salesforce

High-Demand Specialized Skills	High-Demand Software Skills
• New Product Development • Plumbing • Power Tool Operation • Preventive Maintenance • Process Improvement • Project Management • Sales Prospecting • Selling Techniques	• SAP Applications • SolidWorks (CAD) • Spreadsheets • SQL

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Assembler & Fabricator • CAD/ Drafter • CNC Machinist • Coil Winder, Taper & Finisher • Electrical Assembler • Engineering Technologist • First Line Supervisor • Food Production Related Role • Industrial Machinery Mechanic • Lean Manufacturing Specialist • Machine Operator • Maintenance & Repair Worker • Millwright • Process Technician • Quality Control Inspector • Robotics Technician • Safety Coordinator • Sewers and Setters • Textile Dyeing & Finishing • Tool and Die Maker	• 3D Printing Technician • Automation Engineer • CMM Operators and Programmer • Composite Materials Engineer • Cybersecurity Analyst for Manufacturing Systems • Digital Twin Engineer • Environmental Safety • Industrial Internet of Things Specialist • Process Optimization Specialist • Quality Assurance Technologist • Supply Chain Role • Sustainable Manufacturing Specialist	• Aerospace and Defense Manufacturers • Automotive Manufacturers • Distribution Centers • Electronics Manufacturers • Engineering and Design Offices • Factories and Production Facilities • Food and Beverage Producers • Manufacturing Consulting Firms • Manufacturing Equipment Suppliers • Medical Device Manufacturers • Metalworking and Fabrication Shops • OSHA Consulting Firms • Pharmaceutical Manufacturers • Plastics and Rubber Producers

Sample Occupations	Emerging Occupations	Sample Places of Work
• Welders, Cutters, Solderers, and Brazers (also in Construction/Trades)		• Quality Control and Testing Centers • Research and Development Laboratories • Robotics Manufacturers • Self-Employed, Entrepreneur • Small Businesses • Steel/ Aluminum Mills • Supply Chain and Logistics Companies • Textile and Apparel Manufacturers

Agriculture Updates

The decision to include Agribusiness as a distinct Sub-Cluster within the Agriculture Career Cluster is rooted in the significant role that management and business operations play in the agricultural sector. While the field of agribusiness is reflective of the knowledge and skills captured in a traditional business administration program, the field of agriculture and commerce involves nuanced knowledge that does not exist within traditional business administration and management programs. Agriculture, encompassing both independent (small) and commercial farms, ranches, and other harvesting operations, is unique in its heavy reliance on management roles. The presence of a substantial number of management positions within this industry underscores the importance of agribusiness as a critical component of the broader agricultural ecosystem.

According to industry data, management occupations (SOC 11-0000) and farmers, ranchers, and other agricultural managers (SOC 11-9013) currently comprise 24% and 21% of the agricultural workforce, respectively. These figures are projected to increase to 25% and 22% by 2032, highlighting the growing significance of management roles in agriculture. This concentration of management positions necessitates specialized knowledge and skills in agricultural commerce, which justifies the establishment of Agribusiness as a distinct Sub-Cluster.

The Career Cluster title and caption, full definition, and Sub-Clusters with definitions were informed by input from the Industry Advisory Group. During two rounds of nationwide Industry Advisory Group meetings, employers and subject matter experts from industry provided feedback on prominent industry trends, emerging activity, and high-demand skills and competencies for their industry sector. Industry participants also reviewed and verified a selection of quantitative national economic data related to their sector that informed the Cluster taxonomy. Furthermore, they validated real-time labor market information derived from on-line job postings that provided the frequency with which skills were mentioned in digital job postings and contributed to the derivation of the sample skills and competencies listing in this appendix.

Industry experts validated the Cluster title and Sub-Cluster organization at focus group meetings and through the Industry Validation Survey distributed in Spring of 2024. Unique to this Framework, industry experts derived a brief, inspirational caption listed next to the Cluster title that they felt best captured the modernity of their sector.

Quantitative industry data validated by Industry Advisory Groups included:

- Industry proportions of gross national product
- High-demand specialized skills by Cluster
- High-demand software skills by Cluster
- Emerging skills identified by Industry Advisory Groups

- Occupational demand: past five-year growth, projected five-year growth, annual hires, average annual job openings
- Occupational characteristics: 10th percentile wages (proxy for entry-level wages), median wage, typical entry-level education required

Agriculture Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Auditing • Biochemical Assays • Biochemistry • Biology • Chemistry • Clinical Research • Clinical Trials • Data Analysis • Data Collection • Environmental Science • Forklift / Truck • Good Manufacturing Practices • Laboratory Equipment • Palletizing • Pest Control • Pharmaceuticals • Project Management • Standard Operating Procedures • Warehousing	• Adobe • Application Programming Interface (API) • Basic Statistical Analysis, SAS • Clinical Trial Management Systems • Electric Data Capture (EDC) • Farm Software • Geographic Information Systems • Geographic Information Systems, ArcGIS • Inventory Management System • Laboratory Information Management Systems • Microsoft Teams, Zoom • Python • R • SAP Applications • Spreadsheets • SQL • Warehouse Management Systems

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Ag Equipment Operator • Animal Breeder • Animal Science Technician • Environmental Service System Manager • Farmer / Farm Worker	• Ag Business and Risk Manager • Agriculture Communicator • Agri-tech Innovation Manager	• Agricultural Equipment Dealership • Agriculture Associations • Agriculture Consulting Firms • Aquaculture Operations • Educational Institutions

Sample Occupations	Emerging Occupations	Sample Places of Work
• Fisher • Food Processing Engineer • Greenhouse Manager • Logger • Marine Agriculture Expert • Meat Scientist • Natural Resource Manager • Plant Systems Analyst • Veterinarian • Veterinarian Technician	• Aquaponics and Hydroponics Technician • Climate Smart Agriculture Advisor • Food Security Analyst • GIS Analyst (also in Digital Tech.) • Precision Agriculture Technologist • Precision Livestock Farming Specialist • Sustainable Agriculture Consultant • Urban/Vertical Farming Specialist	• Environmental Service Systems • Fisheries • Food Processing Facilities • Forestry and Timber Companies • Government and Non-Profit Organizations • Greenhouses • Hydroponic Farming Facilities • Independent Farmers/ Regenerative Farms • Large Ag Corporations • Ranches • Research and Development Companies • Self-Employed, Entrepreneur • Small Businesses • Urban and Vertical Farms • Veterinary Clinics

Arts, Entertainment & Design Updates

The Career Cluster title and caption, full definition, and Sub-Clusters with definitions were informed by input from the Industry Advisory Group. During two rounds of nationwide Industry Advisory Group meetings, employers and subject matter experts from industry provided feedback on prominent industry trends, emerging activity, and high-demand skills and competencies for their industry sector. Industry participants also reviewed and verified a selection of quantitative national economic data related to their sector that informed the Cluster taxonomy. Furthermore, they validated real-time labor market information derived from on-line job postings that provided the frequency with which skills were mentioned in digital job postings and contributed to the derivation of the sample skills and competencies listing in this appendix.

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Quantitative industry data validated by Industry Advisory Groups included:

- Industry proportions of gross national product
- High-demand specialized skills by Cluster
- High-demand software skills by Cluster
- Emerging skills identified by Industry Advisory Groups
- Occupational demand: past five-year growth, projected five-year growth, annual hires, average annual job openings
- Occupational characteristics: 10th percentile wages (proxy for entry-level wages), median wage, typical entry-level education required

Arts, Entertainment, and Design Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Ability to work in a team environment • Auditing • Cash Register, Cash Handling • Conversion Specialist • Customer Relationship Management • Interactive Design, UX/UI, Wireframing, Visual Design	• Adobe • AI platforms (Chat GPT, Midjourney, DALLE etc) • B2B & Professional Networking, LinkedIn • Blender, Fusion360 • CAD: Vectorworks, AutoCAD, Rhino, etc. • ChatGPT

High-Demand Specialized Skills	High-Demand Software Skills
• Marketing • Merchandising, Visual Merchandising • Project Management • Research • Selling Techniques • Storytelling • Writing	• Collaboration and Project Management Software eg: Jira, Monday.com, Basecamp etc • Creative Software Operations • Figma for collaboration and UX Design • GenAI • Maya - 3D animation and visual effects software • Miro Boards for Virtual Brainstorms • Real-time games engines • Social Networking , TikTok & Instagram • Solidworks - 3D Cad Design software used by designers and engineers • Unity • Unity 3D and EPIC (creator of unreal engine) • Unreal Engine, Unity 3D (real-time physics engines) • VMIX or other streaming and switching platforms • ZBrush for digital sculpting, modeling, texturing, and painting for movies, games, animation

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Athletic Scout • Audio and Video Technician • Camera Operator • Choreographer • Coach • Dancer • Director • Fashion Designer • Film and Video Editor	• AR/VR Designer • Data Visualization Artist • Digital Fashion Designer • Digital Twin Creator (for film) • Eco-conscious Materials Designer • Exhibition and Event Design • Gameplay Animator	• Actors Guilds / Agencies • Dance Studios • Design Consultancies • eSports Organizations • Fashion Houses • Film and Art Associations • Film Production Companies • Interior Design Firms • Media Outlets

Sample Occupations	Emerging Occupations	Sample Places of Work
• Fine Artist • Graphic Designer • Interior Designer • Journalist • Lighting Technician • Music Composer • Musician • News Analyst • Performing Artist • Producer • Professional Athlete • Publisher/Editor • Reporter • Set Designer • Special Effects Artist/Animator • Stunt Coordinator	• Immersive Experience Designer • Lighting Designer • Motion Capture Technician • NFT Art Curator • Podcast Producer • Sound Design and Mixing • Streaming Media Analyst	• Museums and Art Galleries • Music / Entertainment Venues & Festivals • Non-Profits, Government Orgs, Schools • Post-Production Houses • Publishing Companies • Record Labels • Retail Clothing Brands • Runway Model Agencies • Self-Employed, Entrepreneur • Small Businesses • Talent Casting Agencies • Theaters • Video Game Companies

Construction Updates

The decision to remove "Architecture" from the main title of the Construction Career Cluster was made to better reflect the overall structure and scope of the industry. While architecture remains an important Sub-Cluster within construction, the scale of the architectural sector is significantly smaller compared to the broader construction industry. Main Cluster titles are intended to represent larger, more encompassing sectors, and the inclusion of architecture in the title could imply an equivalence in scale that does not exist.

In the U.S. construction industry, architecture-related jobs account for approximately 3% of the total employment, with the vast majority of jobs (97%) spanning a wide range of other roles, including labor, project management, and specialized trades. By focusing the main title on "Construction," we ensure that the Cluster more accurately represents the larger industry and provides clearer guidance for career exploration.

The Career Cluster title and caption, full definition, and Sub-Clusters with definitions were informed by input from the Industry Advisory Group. During two rounds of nationwide Industry Advisory Group meetings, employers and subject matter experts from industry provided feedback on prominent industry trends, emerging activity, and high-demand skills and competencies for their industry sector. Industry participants also reviewed and verified a selection of quantitative national economic data related to their sector that informed the Cluster taxonomy. Furthermore, they validated real-time labor market information derived from on-line job postings that provided the frequency with which skills were mentioned in digital job postings and contributed to the derivation of the sample skills and competencies listing in this appendix.

Industry experts validated the Cluster title and Sub-Cluster organization at focus group meetings and through the Industry Validation Survey distributed in Spring of 2024. Unique to this Framework, industry experts derived a brief, inspirational caption listed next to the Cluster title that they felt best captured the modernity of their sector.

Quantitative industry data validated by Industry Advisory Groups included:

- Industry proportions of gross national product
- High-demand specialized skills by Cluster
- High-demand software skills by Cluster
- Emerging skills identified by Industry Advisory Groups
- Occupational demand: past five-year growth, projected five-year growth, annual hires, average annual job openings
- Occupational characteristics: 10th percentile wages (proxy for entry-level wages), median wage, typical entry-level education required

Construction Skills

High-Demand Specialized Skills	High-Demand Software Skills
• AIA Documents • Auditing • Blueprints, Plan Reading • Call Center Management • Carpentry • CDL • Certified riggers & crane signalers • Change Orders • Code Enforcement • Construction • Construction Management • Customer Service • Estimating and Take offs • Financial Management & Taxation • Fundamentals of Construction and Safety • Hand Tools • HVAC • Industrial Welding • Machinery, Mechanical Skills: Gas, Diesel, Hydraulic, Electrical • Math, Fractions, Calculation • Occupational Safety and Health • Painting • Plumbing • Power Tool Operation • Preventive Maintenance • Procurement • Project Management • Project Schedules • Soft Skills • Subcontracting • TWIC Card	• AI, ChatGPT, VoiceOver • Amazon Web Services • Application Programming Interface (API) • AutoCAD • HubSpot, MailChimp, BaseCamp • Inventory Control Systems • Operating Systems • Primavera Software • Procore • Project Management Software • Python • Revit • SAP Applications • Spreadsheets • SQL • Video, YouTube, TikTok

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Brickmason • Building Inspector • CAD Technician • Heavy Equipment Mechanic • Carpenter • Drywall Installer • Electrician (also in Energy) • Equipment Operator • Highway Maintenance Specialist • HVAC Technician (also in Energy) • Iron and Steel Worker • Landscaper • Mason • Plumber, Pipefitter • Roofer • Sheet Metal Worker • Welder	• 3D Printing Specialist • Broadband Infrastructure Technician • Building Information Modeling Coordinator • Construction Data Analyst • Construction Robotics Technician • Modular Construction Engineer • Renewable Energy Systems Installer • Resilience Planning Specialist • Smart Building Integrator	• Architecture Companies • Building Materials Suppliers • Commercial Builders • Construction Associations • Construction Management Companies • Departments of Transportation (state and federal) • Engineering Firms • Environmental Consultancies • Facility Management Companies • Landscaping Companies • Large Infrastructure Contractors • Safety, Compliance, and Inspection Companies • Self-Employed, Entrepreneur • Small Business • Surveying Firms • Sustainability Consultancies

Digital Technology Updates

The versatility and growing presence of drone technology across multiple industries suggested a strategic approach based on industry input. Industry experts in this field expounded upon the proliferation of drone-related roles across various sectors and the primary skills needed for operation of a UV which fell within the digital technology Cluster, thus the Unmanned Vehicle Systems was placed in the Digital Technology Cross-Cutting Cluster.

Industry experts also provided input on the reality of unmanned vehicles as applied in various industry Clusters, making clear that the "manufacturing" of unmanned aerial vehicles was not a primary occupation, rather the operation of the UVs was the highest demand across sectors. This placement enables the program to be effectively adapted to meet the demands of multiple industries. The transportation sector's interest in integrating unmanned vehicles, particularly drones, is understandable. However, insights from our Industry Advisory Group meetings reveal that drone-related occupations are emerging across all sectors.
Below is a detailed overview, presented in a bulleted list, highlighting the diverse applications of unmanned vehicles within different Clusters, along with examples of job roles associated with these applications:

Advanced Manufacturing

- Inspecting and monitoring equipment and facilities
- Enhancing inventory management through aerial inventory scans
- Sample Job Title: Manufacturing Drone Operations Specialist

Agriculture

- Crop monitoring and health assessment
- Precision agriculture for targeted pesticide and fertilizer application
- Sample Job Title: Precision Agriculture Technician

Arts, Entertainment, and Design

- Capturing aerial photography and videography for films and media
- Enhancing live event experiences with unique camera angles
- Sample Job Title: Aerial Cinematography Pilot

Public Service & Safety

- Conducting search and rescue operations
- Aerial surveillance for law enforcement
- Sample Job Title: Public Safety Drone Coordinator

Construction

- Mapping and surveying construction sites
- Inspecting structures for maintenance and compliance
- Sample Job Title: Construction Site Drone Surveyor

Education

- Providing instructional tools for STEM education
- Research and development in drone technology
- Sample Job Title: Educational Drone Program Developer

Energy & Natural Resources

- Monitoring pipelines and energy infrastructure
- Surveying land for natural resource exploration
- Sample Job Title: Energy Infrastructure Aerial Inspector

Financial Services

- Assessing property for insurance underwriting using aerial imagery
- Conducting aerial surveys for real estate appraisals
- Sample Job Title: Financial Aerial Analysis Specialist

Healthcare and Human Services

- Delivering medical supplies to remote locations
- Aerial transport of blood samples and laboratory specimens
- Sample Job Title: Medical Drone Logistics Coordinator

Hospitality, Events & Tourism

- Enhancing guest experiences with drone light shows
- Aerial surveillance for event safety and crowd management
- Sample Job Title: Event Drone Experience Manager

Supply Chain & Transportation

- Last-mile delivery of goods and packages
- Monitoring transport routes and cargo for logistics planning
- Sample Job Title: Drone Delivery System Operator

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Digital Technology Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Agile Methodology • Automation • Business Requirements • Communication / presentation of data / data-based arguments / digital technologies • Data Analysis • Engineering (Radio Frequency) • Information literacy	• AI Tools • Amazon Web Services • Angular (Web Framework) • Application Programming Interface (API) • Artificial intelligence • C# • C++ • Cascading Style Sheets (CSS) • Cloud

High-Demand Specialized Skills	High-Demand Software Skills
• Mathematics, statistics, probability computational abstraction • Problem-solving, project management • Project Management • Workflow Management	• Computer Science • Cybersecurity • Digital forensics • Error-checking / accuracy validation (de-bugging code, validation of data, checking for bias in AI training models, etc.) • GIS, ArcGIS • Git (Version Control System) • HTML • Information Systems • Java • Javascript • JIRA • Linux • Machine Learning • Operating Systems • PowerBI • Python • R / RStudio • RESTful API • Scripting • Software Development • Software Engineering • Tableau

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Computer Network Architect • Computer Network Support • Computer Programmer • Computer Systems Analysts • Computer User Support • Cybersecurity Specialist • Data Scientist • Database Administrator	• 5G Network Engineer • AI Ethics Officer • Bioinformatics & Computational Biologist • Chatbot Developer • Cloud Solutions Architect • Data Privacy Officer • DevSecOps Engineer	• Almost all companies especially large ones like airlines, manufacturing, food manufacturers • Big Tech Firms • Cloud Service Providers • Cyber Security Firms • E-Commerce Platforms

Sample Occupations	Emerging Occupations	Sample Places of Work
• Database Architect • GIS Specialist • Information Security Analyst • IT Support Specialist • Network and Systems Admin • Operations Research Analyst • Quality Assurance • Software Developer • UI/UX Specialist • Web and Digital Interface Designer • Web Developer	• Drone Operator • Edge Computing Specialist • Mobile App Developer • NFT Specialist • Prompt Engineer • Quantum Computing Researcher • Sustainability Software Developer • Voice Technology Developer • VR/AR Developer	• Large Data Science Companies • Self-Employed, Entrepreneur • Small Businesses • Social Media Companies • Software Development Contractors • Software development HR professionals • Telecommunications Companies

Education Updates

The creation of a separate Early Childhood Sub-Cluster within the Education main Cluster was driven by the unique and specialized nature of early childhood education. Early childhood education, which focuses on the developmental needs of children from birth to age eight, requires distinct skills, knowledge, and teaching strategies that differ significantly from those needed in primary, secondary, and higher education settings.

Recognizing early childhood education as its own Sub-Cluster allows for more targeted professional development, curriculum design, and career pathways that cater specifically to the early learning environment. This differentiation also aligns with industry standards and the growing recognition of the critical role early childhood education plays in child development, as underscored by research indicating that 90% of a child's brain development occurs before age five. Moreover, the demand for early childhood educators is increasing, with the Bureau of Labor Statistics projecting a 7% growth in employment for preschool teachers from 2022 to 2032, reflecting the heightened emphasis on the importance of early learning. By establishing a dedicated Sub-Cluster, we ensure that educational programs and career pathways are better equipped to meet the specific needs of this essential sector.

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Education Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Accounting • Auditing • Bilingual / Multilingual • Child Care Licensing • Child development, Working with families, Working in diverse communities • Classroom Management • Collaboration / Working in a Team • CPR Certification • Cultural Responsiveness / Trauma-Informed Skills • Data Entry • De-escalation Training • Educational Technology • Emergency Response • Finance • Industry Experience for CTE • Invoicing • Leadership Skills • Lesson Planning • Marketing • Office Equipment • Project Management • Special Education • Teaching Certificate • Technical Support	• Accounting Software, QuickBooks • Active Directory • Amazon Web Services • Databases • Firewall • Human Resources Information System (HRIS) • Learning Management Systems (LMS) • Linux • LMS • Operating Systems • Python • Qualtrics • SAP Applications • Spreadsheets • SQL • Statistics • Tableau • Various Learner Information Systems

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Academic Affairs Director	• Career Readiness Navigator	• After School Programs

Sample Occupations	Emerging Occupations	Sample Places of Work
• Admissions Officer • Community Outreach Coordinator • CTE, ABE, ASE, ESL Instructor • Education and Childcare Administrator • Educational Instructor • Family Social Worker • Instructional Designer • Post-Secondary Educator (Professor/ Instructor) • Researcher • School Administrator • School Counselor • School Social Worker • Special Education Teacher • Teacher • Teaching Assistant • Tutor	• Community Outreach Coordinator • Competency-Based Educator • Corporate Coach/Trainer • Digital Learning Specialist • EdTech Product Manager • Educational Technology Specialist • Expanded Learning (Afterschool Care) Specialist • Family Engagement Specialist • Gamification Specialist • Learning Analytics Specialist • MicroCredentialing Specialist • VR/AR Learning Developer	• Apprenticeship, Internship and Mentoring Programs • Childcare Centers • Corporate Training Providers • County, State and Federal Governments • CTE Programs or a CSO that supports CTE • Curriculum Providers/ Educational Publishers • EdTech Companies • Education Associations/ Unions • Education Consulting Companies • Higher Education Providers (Colleges, Universities, and Industry Specific Training) • Non-Profit, Thinktank or Research Orgs • Online Learning Companies/ MOOCs • Professional Development Companies • Schools (Public, Charter, and Private) • Self-Employed, Entrepreneur • Small Businesses • Work-Based Learning Organizations

Energy & Natural Resources Updates

After consulting with experts and considering the debates surrounding the terms "clean," "green," and "renewable," we decided to adopt "Clean & Alternative Energy" as the Sub-Cluster title. This title emphasizes that these energy sources provide an alternative to extraction-based energy, which is addressed in a separate Sub-Cluster. The term "green" can sometimes be misleading, as even renewable energy sources involve substantial resource use during manufacturing, installation, and maintenance. For example, producing solar panels and wind turbines requires minerals and metals, and their production often relies on energy from non-renewable sources. Moreover, the development of renewable energy infrastructure can have environmental impacts, including land use changes and habitat disruption.

While these energy sources are cleaner than fossil fuels in terms of greenhouse gas emissions during operation, they are not entirely free of environmental costs.
Experts recommend the adoption of alternative energy sources primarily because they significantly reduce emissions and offer greater sustainability in the long term compared to fossil fuels. This transition is critical for combating climate change and reducing our ecological footprint, even as we continue to enhance the sustainability of renewable energy technologies.

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Energy and Natural Resources Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Auditing • Biology • Carpentry • Construction • Electrical Systems • Electrical Wiring • Engineering • Facility Repair and Maintenance • Field Service Management • Hand Tools • Housekeeping • HVAC • Machinery • Occupational Safety and Health • Painting • Plumbing • Power Tool Operation • Preventive Maintenance • Project Management • Swimming Pool Maintenance • Systems Thinking	• AutoCAD • Cloud-Based v. Online Systems • Coding • Connected Technologies • Data Analysis • Data Analytic Programs • Data Science and AI • Databases • Disaster Planning Systems & Emergency Comm Systems • Distributed Systems Software Engineering • Embedded Software Development • Geographic Information Systems, ArcGIS • Inventory Control Systems • LESS • Operating Systems • Operational Technologies • Power Bi • Python • SAP Applications • SCADA / System Operations for Grid Control • Software Systems • Spreadsheets • SQL • Teams and other related comm systems

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Conservation Scientist • Electrician • Energy Analyst • Environmental Compliance Specialist • Environmental Engineer • Environmental Scientist • Forester • Geologist • HVAC Technician • Hydrologist • Lineworker • Mic & Arc Welder • Mining Engineer • Petroleum Engineer • Power Plant Operator • Renewable Energy Technician • Solar Photovoltaic Installer • Sustainability Manager • Waste Management Specialist • Wind Turbine Technician	• Battery Recycling Specialist • Battery Storage Specialist • Chemist/Chem Tech • Data Analyst • Data Science Engineer • Decarbonization Specialist • Electric Vehicle (EV) Infrastructure Developer • Electrochemist • Energy Procurement Specialist • Energy Storage Project Manager • Energy Transition Manager • EV Tech • Fiber Technician • Hydrogen Fuel Technician • Microgrid Engineer • Offshore Wind Specialist • Power Supply Analyst • Sustainability Officer	• Conservation and Wildlife Preservation Organizations • Environmental Consulting Firms • Environmental Impact Assessment Firms • Environmental Nonprofits • Environmental Policy Think Tanks • Geothermal Energy Developers • Government Agencies (e.g., the U.S. Environmental Protection Agency, Department of Energy) • Hydroelectric Dam Operators • Mining Corporations • Natural Gas Companies • Oil and Gas Companies • Power Generation Plants • Public Utility Companies • Recycling and Waste Management Companies • Renewable Energy Company • Research and Development Laboratories • Self-Employed, Entrepreneur • Small Businesses • Solar Panel Companies • Water Resource Management Organizations

Financial Services Updates

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Financial Services Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Accounting • Accounts Payable • Accounts Receivable • Auditing • Billing • Data Analysis	• Accounting Software • Applicant Tracking Systems • Dashboard • Human Resources Information System (HRIS) • LESS

High-Demand Specialized Skills	High-Demand Software Skills
• Finance • Financial Analysis • Financial Services • Financial Statements • General Ledger • Generally Accepted Accounting Principles • Invoicing • Loans • Marketing • Process Improvement • Procurement • Project Management • Purchasing	• Power BI • QuickBooks • Salesforce • SQL • Tableau

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Accountant • Bank Branch Manager • Bookkeeper • Claims Adjuster • Compliance Officer • Cost Estimator • Credit Analyst • Insurance Agent • Insurance Underwriter • Loan Officer • Management Analyst • Market Research Analyst • Mobile Notary • Payroll Assistant • Property Appraiser • Property Manager • Real Estate Agent • Tax Examiner • Title Examiner • Underwriter • Waste Management Specialist • Wind Turbine Technician	• AI Implementation Specialist • Business Resilience Expert • Credit Counselor • Cryptocurrency Analyst • Digital Banking Manager • Drone Operator (replacing adjusters) • Economist • Financial Wellness Coach • Fintech Developer • Insurtech Specialist • Mobile Payment Solutions Specialist • Personal Finance Advisor • Regulatory Compliance Analyst • Sustainable Finance Consultant	• Banks and Credit Unions • Consumer Credit Companies • Credit Card Companies • Education/ Training Companies • Government Agencies (i.e. SEC, Fed, FDIC) • Hedge Funds • Insurance Companies • Investment Banks • Lending Companies • Private Equity Firms • Real Estate and Finance Associations • Real Estate Companies • Self-Employed, Entrepreneur • Small Businesses • Tax Preparation Companies • Think Tank or Research Entities • Title companies - Law Firms • Venture Capital Firms • Wall Street • Wealth Management Firms

Healthcare & Human Services Updates

According to industry experts, the term "Healthcare" is more aligned with industry-standard terminology and reflects the broad range of professions and roles within the sector, encompassing both clinical and non-clinical positions. While "Health Science" is traditionally associated with academic and research-focused careers, "Healthcare" is the preferred term within the industry as it more accurately represents the practical, service-oriented aspects of the field. This alignment with industry verbiage not only enhances clarity for learners and professionals but also fosters stronger connections between education and employment pathways in the sector. The term "Healthcare" resonated more effectively with industry stakeholders, including employers and policy-makers, who recognize it as encompassing the full spectrum of health services, from direct patient care to administrative roles. This broader, more inclusive term ensures that Career Clusters are reflective of real-world practices and needs, promoting better alignment between educational curricula and job market demands.

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Healthcare and Human Services Skills

High-Demand Specialized Skills	High-Demand Software Skills
• ACLS Certification • Advocacy • Advocacy • Assessment & Evaluation • Basic Life Support Certification • Billing • Care Managers • Case Management (Active Listening, Asking Powerful Questions, Self-Management, and Accountability) • Certified Dietary Manager • Certified Nursing Assistant • Communication & Customer Service • Community Outreach • CPR Certification • Crisis Intervention • Cultural competency • Customer Service • De-escalation and crisis prevention • EHR documentation • Electronic Medical Records • Evidence-based practice • First Aid, AED along w/ CPR • HIPPA • Home Healthcare • Infection Control • Legal & Ethical Standards • Licensed Practical Nurse • Medical Assistance • Medical Records • Medical Terminology • Medication Administration • National Health Science Certificate • Nursing • Quality improvement • Registered Nurse	• Apache Spark • Clinic Management Systems • Dashboard • eClinicalWorks (ECW) • Epic EMR • Laboratory Information Management Systems • Learning Management Systems • MEDITECH HER • Operating Systems • Patient Management Software • Project Management Software • SAP Applications • Software Systems • Spreadsheets • SQL • Zoom

High-Demand Specialized Skills	High-Demand Software Skills
• Safety - CareerSafe Healthcare and OSHA Certification • Teamwork • Technical Skills	

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Allied Health Professional • Biotechnology Researcher • Clinical Laboratory Technologist • Cosmetologist • Emergency Medical Technician • Fitness Instructor/ Therapist • Hair Stylist • Health Education Specialist • Health Informatic Specialist • Health Science Educator • Health Scientist • Home Health and Personal Care Aide • Medical Billing and Coding Specialist • Medical Record Keeping • Memory Care Coordinator • Nail & Skin Technician • Nutrition Program Administrator • Pharmacy Technician • Phlebotomist • Physical Therapist Assistant	• Acupuncturist • Aging-in-Place Specialist • Clinical Ethicist • Community Health Worker • Digital Health Specialist • Genetic Counselor • Geriatric Nurse • Health Informatics Specialist • Marriage and Family Therapist • Patient Experience Officer • Patient Navigator • Peer Support Specialist • Social Gerontologist • Substance Abuse Counselor • Virtual Reality Therapy Designer	• Alternative Health Products and Services • Churches and Religious Organizations • Cities, Counties, States • Community Clinics and Health Centers • Corporate Wellness Programs • Health Advocacy and Public Policy Orgs • Indian Health Services • Individual Health Practices • Long Term Care Facilities • Medical Device Companies • Memory Facilities • Mental Health Clinics and Facilities • Nonprofit Organizations • Pharmaceutical Companies • Private Practices • Private sector R&D Firms • Public Health Departments • Public or Private Hospitals • Rehabilitation Centers • Research Institutions and Think Tanks • Schools • Self-Employed, Entrepreneur • Small Businesses • Social Service Agencies • Telehealth Providers (work from home)

● Radiation Therapist ● Radiologic Technician ● Registered Nurse ● Spiritual Activities Director ● Surgical Technologist ● WIC Nutrition Specialist		● Traveling Nurse Providers ● Tribal Lands ● Wellness Resorts and Spas

Hospitality, Events & Tourism Updates

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Hospitality, Tourism, and Events Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Accounting • Auditing • Cash Handling • Cash Register • Commercial Drivers License • Communications • Customer Relationship Management • Finance	• Adobe Creative Suite • Adobe Illustrator • Adobe InDesign • Adobe Photoshop • Collaborative Working Platforms • CVENT • Dashboard • Design Platforms, Canva

High-Demand Specialized Skills	High-Demand Software Skills
• Food Handling/Servsafe Certifications • Food Safety and Sanitation • Food Safety Management Certification • Food Services • Housekeeping • Inventory Management • Marketing • Merchandising • Product Knowledge • Project Management • Responsible Alcohol Certifications • Restaurant Operation • Retail Operations • Selling Techniques • State-based Certifications • Stocking Merchandise • Visual Merchandising	• Google Analytics • Inventory Management System • LESS • POS Software • Revenue Management • Salesforce • SAP Applications • Social Media Management - Platform/Wed/CRM Software • Social Table Event/Banquet Application • Spreadsheets • SQL • Tableau • Tripleseat / Toast • Virtual Meeting Platforms and Training

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Airline Customer Service • Beverage Director • Caterer • Chef/ Line Cook • Cruise Ship & Theme Park Staff • Facility Maintenance Technician • Flight Attendant • Food Director • Food Service Manager • Groundskeeper • Hotel Manager • Institutional Food Service Manager	• Conference/ Event Planner • Convention Center Worker • Cultural Heritage Tourism Coordinator • Digital Concierge • Experience Curator • Food Waste Manager • Health & Safety Officer • Hospitality Data Analyst • Smart Hotel Technology Specialist • Sustainability Coordinator for Events • Travel Writer/ Blogger • Virtual Event Planner	• Airlines • Amusement & Theme Parks, Attractions • Assisted Living Facility Dining Halls • Campgrounds and RV Parks • Craft Brewers, Distillers, and Winemakers • Cruise Lines • Golf Courses • Hotel Corporate Offices • Hotels, Motels, and Bed & Breakfasts • Local & Regional Travel Associations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Inventory Manager • Landscaper • Mixologist/ Bartender • Pastry Chef/ Baker • Quick Service Manager • Travel Agent/ Tour Guide	• Wellness Tourism Specialist	• Restaurant Associations • Restaurant Corporate Offices • Restaurants • Self-Employed, Entrepreneur • Ski Resorts • Small Businesses • Tour Operators • Travel Agencies

Management & Entrepreneurship Updates

Small businesses make up 99.9% of U.S. firms and employ 47.3% of the private workforce, according to the U.S. Small Business Administration. Notably, these firms are primarily entrepreneurial ventures, with new companies less than five years old historically creating the majority of net new jobs annually since 1977. Of the 33.2 million small businesses, 81.7% are nonemployer firms, highlighting a trend toward sole proprietorships and emphasizing the growing importance of entrepreneurial skills in today's workforce. This robust contribution to job creation and economic dynamism underscores the necessity of including Entrepreneurship prominently in CTE programming.

Integrating entrepreneurship as a distinct CTE Sub-Cluster and elevating its inclusion in the title of a Cross-Cutting Cluster provides all learners with access to essential entrepreneurial skills such as creativity, opportunity recognition, and strategic thinking. These capabilities are vital not only for aspiring business owners but also for empowering learners to be innovative within various roles in larger organizations. Formalizing entrepreneurship education within CTE programs is essential to preparing learners for the future of work and maintaining the U.S.'s position as a leader in global innovation and economic competitiveness.

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Management and Entrepreneurship Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Accounting • Accounts Payable • Administrative Support • Analytic skills/certs • Auditing • Bias training • Billing • CDL License • Coaching • Consultative Sales • Customer Relationship Management • Data Entry • DEI • Diversity training • Emotional intelligence • Ethical Decision Making • Ethical Leadership • Finance • Financial Statements • Formal sales training certifications • Hiring practices • Intellectual property; business law; patent law • Invoicing • Key Performance Indicators (KPIs) • Leadership skills • Marketing • Merchandising • Office Equipment • PMI certification	• AI • Airtable, Trello, Asana (project management software) • ATS • CRM • Google docs • Google Workspace • Human Resources Information System (HRIS) • LinkedIn - Social media presence • MS Project • Online business skills • Operating Systems • Power BI • Python • Quickbooks/Accounting Software • Salesforce • SAP Applications • Slack • Software Systems • Spreadsheets • SQL • Tableau • Zoom

High-Demand Specialized Skills	High-Demand Software Skills
• Process Improvement • Project Management • Purchasing • Salesforce • Secure data • Selling Techniques • Servant Leadership • Social media platforms • Time management • Workflow Management	

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Administrative/ Executive Assistant • Business Analyst • Business Owner • Consultant • Data Entry Manager • HR Director • HR Manager • IT Manager • Management Consultant • Manager • Office Manager • Operations Director • Project Manager • Receptionist • Recruiter • Talent Acquisition Specialist	• Creative (Gig Economy) • Data Governance Manager • Diversity & Inclusion Officer • Employee Engagement Manager • Growth Hacker • Remote Work Facilitator • Social Entrepreneur • Start-up Founder • Sustainability Manager	• Consulting Firms • Educational Institutions • Management, administrative, and HR in any company/organization • Payroll/Benefits Processors • Self-Employed, Entrepreneur • Small Businesses • State, Local or Federal Governments

Marketing & Sales Updates

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Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Account Manager • Advertising Analyst • Advertising Producer • Brand Strategist • Business Developer Manager • Client Relations Specialist • Inside Salesperson	• AI Based Marketing Content Creator • Communications Director • Content Marketer • Customer Experience Officer • E-commerce Analyst	• Advertising Agencies • Almost all companies hire marketing and sales professionals • Business-to-Business (B2B) Companies • Digital Advertising Platforms

Sample Occupations	Emerging Occupations	Sample Places of Work
• Loss Prevention Specialist • Market Researcher • Media Buyer • Outside Salesperson • Retail Buyer • Retail Operations Manager • Sales Director • SEO Specialist • Store Manager • Technical Salesperson	• Influencer Marketing Specialist • Sales Engineer • Social Media Manager • Social Media Marketer	• E-commerce and Online Retailers • Market Research Companies • Marketing Agencies • Outdoor Advertising Companies • Retail Locations • Self-Employed, Entrepreneur • Small Businesses

Public Service & Safety Updates

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Public Service and Safety Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Access Controls • Administrative Support • Analytical Skills • Auditing • Certified Information Systems Security • Conducting Legal Research • Conflict Management/Resolution/De-escalation • CPR Certification • Critical Thinking - Logic and Reasoning • Data Gathering and Analysis • Documentation • Email Etiquette • Emergency Response • First Aid Certification • Information Systems • Interpersonal Communications • Law Enforcement • Oral Communication • Organizational Skills • Presentation Skills • Project Management • Risk Analysis • Risk Management • Site Security • Social Work • Teamwork • Time Management and File Management	• Active Directory • Amazon Web Services • Computer Science • Creating databases to store confidential data/information • Cybersecurity • Develop and manage filing systems • Firewall • Java • Linux • Microsoft Azure • Operating Systems • Python • SAP Applications • Splunk • Spreadsheets • SQL • Unix • Video conferencing

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Adjudicator • Administrative Law Judge • Animal Control Worker	• Civic Organizer • Crime Analyst	• City/County/State/Federal Governments • Colleges and Schools

Sample Occupations	Emerging Occupations	Sample Places of Work
• Attorneys • Bailiff • Correctional Officer • Court, Clerk • Criminal Investigator • Detective • Fire Prevention Specialist • Firefighter • Forest Fire Inspector • IRS Agent • Judicial Law Clerk • Magistrate Counselor • Magistrate Judge • Municipal License Clerk • Paralegals/Legal Assistant • Police/ Patrol Officer • Police/Fire Training Officer • Probation Officer • Title Examiner and Searcher	• Digital Civic Engagement Specialist • Emergency Management Specialist • Forensics Examiner • International Tax Specialist • Public Policy Analyst • Urban & Community Planner • Urban Informatics Analyst	• Community Organizations • Correctional Facilities • Emergency Medical Service Providers • Event and Public Venues • Fire Departments • Government Surveillance Agencies • Law Firms • Local, State or Federal Courts • National Security Agencies • Nonprofit and Advocacy Organizations • Police Departments • Private Security Companies • Public Policy and Research Institutes • Restorative Justice Support Providers • Self-Employed, Entrepreneur • Small Businesses • TSA/Airports • US Military

Supply Chain & Transportation Updates

The Career Cluster title and caption, full definition, and Sub-Clusters with definitions were informed by input from the Industry Advisory Group. During two rounds of nationwide Industry Advisory Group meetings, employers and subject matter experts from industry provided feedback on prominent industry trends, emerging activity, and high-demand skills and competencies for their industry sector. Industry participants also reviewed and verified a selection of quantitative national economic data related to their sector that informed the Cluster taxonomy. Furthermore, they validated real-time labor market information derived from on-line job postings that provided the frequency with which skills were mentioned in digital job postings and contributed to the derivation of the sample skills and competencies listing in this appendix.

Industry experts validated the Cluster title and Sub-Cluster organization at focus group meetings and through the Industry Validation Survey distributed in Spring of 2024. Unique to this Framework, industry experts derived a brief, inspirational caption listed next to the Cluster title that they felt best captured the modernity of their sector.

Quantitative industry data validated by Industry Advisory Groups included:

- Industry proportions of gross national product
- High-demand specialized skills by Cluster
- High-demand software skills by Cluster
- Emerging skills identified by Industry Advisory Groups
- Occupational demand: past five-year growth, projected five-year growth, annual hires, average annual job openings
- Occupational characteristics: 10th percentile wages (proxy for entry-level wages), median wage, typical entry-level education required

Supply Chain and Transportation Skills

High-Demand Specialized Skills	High-Demand Software Skills
• Airplane Engine Mechanic • Communication Skills, Verbal and Written • Crane Operators • Customer Relationship Management • Diagnostic Tools • Diesel Mechanic • Electrical Diagnostics • EV Technician	• CRM • Inventory Control Systems • Inventory Management • Operating Systems • Order Management Systems • Salesforce • SAP Applications • Software Systems

High-Demand Specialized Skills	High-Demand Software Skills
• Financial Literacy • Forklift / Truck • Inventory Control • Inventory Management • Invoicing • Machine Operations • Marketing • Mathematics • Mechanics • Merchandising • Palletizing • Parts Ordering • Procurement • Product Knowledge • Purchasing • Sales • Sales Prospecting • Selling Techniques • Shipping and Receiving • Supply Chain • Vehicle Service Systems • Warehousing	• Spreadsheets • SQL • Warehouse Management Systems

Sample Occupations & Emerging Occupations

Sample Occupations	Emerging Occupations	Sample Places of Work
• Air Traffic Controller • Auto Mechanic (also Aviation, Rail, & Marine Mechanics) • Bus Driver • Customs Broker • Forklift Driver • Freight Forwarder • Health and Safety Inspector • Heavy Equipment Operator • Inventory Control Specialist	• Blockchain Specialist for Supply Chain • Circular Economy Coordinator • Drone Delivery Operator • E-Commerce Logistics Manager • Logistics Analyst • Supply Chain Data Scientist • Transportation Analyst	• Airports • Automotive Repair Shops • Car Dealerships • City or State (public transportation) • Departments of Transportation • Federal Transportation Administrations • Freight Rail Operators

Sample Occupations	Emerging Occupations	Sample Places of Work
• Logistics Coordinator • Maritime Operations Manager • Order Filler • Pilot • Procurement Specialist • Railroad Conductor • Ship Captain • Shipping Coordinator • Traffic Engineer • Transport Safety Officer • Transportation Planner • Truck Driver • Warehouse Manager		• Independent Owner/Operator (for trucking) • International Trade and Development Agencies • Large Supply Chain Companies • Large Trucking Companies • Port Authorities • RailRoad and Metro Stations • Self-Employed, Entrepreneur • Shipping Companies • Shipping Ports • Small Businesses • Third-Party Logistics Providers (3PLs) • Warehouses

Appendix II: Industry Advisory Groups

The approach to creation of the Industry Advisory Groups followed four key steps:

1. Establish Industry Advisory Groupings by NAICS Sector
2. Development of a Comprehensive Industry Engagement Plan
3. Recruitment and Nomination of Diverse IAG Members and Formalized Groups
4. Data-Gathering, Industry Inquiry and Validation Processes

Achieving broad representation from across the United States, including Washington, D.C., was critical to the Framework development process. To ensure a diverse and inclusive approach, we closely monitored the demographics of applicants, accepted Industry Advisory Group (IAG) members, and attendees. Special attention was given to ensuring that various sub-industries within larger sectors, company types and sizes, as well as demographic factors such as race, gender, and age, were fairly represented.

Recruitment Process

A multi-pronged approach to recruit IAG members was employed, utilizing several outreach strategies to ensure broad participation:

- **Nomination Form:** Advance CTE distributed an online nomination form to the public and CTE stakeholders, which was open for one month.
- **Advance CTE Connections and Advisory Board:** Advance CTE's connections were instrumental in identifying and reaching out to key industry partners, and their Advisory Board played an active role in conducting additional rounds of outreach.
- **Social Media Outreach:** Announcements were made across Indigo Education Company and Indigo Pathway's social media platforms, including LinkedIn, Twitter/X, Instagram, and Facebook. These posts aimed to attract industry professionals interested in contributing to the Framework modernization. Direct messaging via LinkedIn was used also to reach out to potential IAG members.
- **Email Outreach:** Targeted emails were sent to industry professionals, leveraging Advance CTE's network and professional contacts. Professionally designed emails were used to maintain consistent communication and professionalism throughout the process.
- **Personal and Professional Contacts:** In addition to digital outreach, the project team used our own professional networks and personal contacts to identify qualified individuals. These connections were particularly useful for filling key roles in underrepresented sectors.
  Additional Rounds of Outreach: As initial outreach did not yield the participation numbers desired, additional rounds of outreach were conducted. This included targeted communications

to specific industry sectors and outreach to Advance CTE partners. Some IAG groups were ultimately combined based on similarities in skill sets and industries, with the approval of Advance CTE. This included combining Healthcare with Community & Social Services as well as combining Civics & Public Service with Judicial Systems and Public Safety.

Selection and Approval Process

The approval process for IAG members followed a rigorous vetting procedure:

- **Experience Verification:** After receiving nominations, the team thoroughly reviewed each candidate's application to ensure they had relevant industry experience.
- **Demographic Representation:** We ensured wide demographic representation across each group, including diversity in geographic location (state), age, race, and gender. This was essential to ensuring that the IAGs reflected the broad array of industries and communities served by the CTE Framework.
- **Industry and CSO Representation:** In addition to individual professionals, we sought representation from other industry organizations and civil society organizations (CSOs) that could provide valuable insights.
- **Formal Invitations and NDAs:** Once the final selections were made, members were invited to participate via professionally designed emails. Each selected member was required to sign a non-disclosure agreement (NDA) to maintain the confidentiality of discussions.

Creation of a CTE Educator Advisory Group

Many IAG applicants, while lacking the direct industry experience necessary for the Industry Advisory Groups, possessed valuable expertise in Career Technical Education (CTE). Rather than include them in the IAGs, these individuals were invited to participate in one of two CTE Educator Advisory Group sessions held in late fall 2023. Their insights from the educational side of CTE provided important context for understanding how the Framework impacts learners and teachers. In the CTE Educator Advisory Group sessions, participants offered critical feedback on how the Career Clusters Framework could better support educators and learners. Their experience in K12 or higher education allowed them to highlight challenges in curriculum alignment, career exploration, teacher credentialing, and learner engagement. Their input helped ensure the final Framework would be responsive not only to industry needs but also to the practical realities of delivering quality CTE programs.

For the purposes of this section:

- **Applicants** refers to industry professionals and other stakeholders who either self-nominated or nominated someone else to participate via the online application form between May 10 and June 16 with an extension to June 20,2023. This online nomination form is the source of our demographics. A total of 360 formal applications were received.
- **Accepted** refers to applicants whose industry experience and expertise aligned with the requirements for IAG participation, allowing them to contribute to two live virtual Roundtable discussions and an asynchronous digital validation of the Career Cluster Framework. These individuals received an acceptance email, along with a non-disclosure agreement (NDA) to ensure confidentiality throughout the development process. Acceptance confirmations requested by July 21st. Not all accepted applicants responded to the invitation, and a few declined. A total of 341 acceptance notifications were sent to nominated participants.
- **Attended/Attendees** refers to those who accepted the invitation, signed the NDA, attended at least one virtual Roundtable, and actively participated in the discussions. A number of accepted participants did not attend any Roundtables and, therefore, were not included as active participants. These individuals were also excluded from the Digital Validation process, and their names were removed from the public list of IAG members. A total of 180 participants attended at least one Roundtable for their respective IAG and were invited to provide feedback in the digital validation of the updated Career Cluster Framework.

All Industry Advisory Groups

Industry professionals from 44 states and Washington, D.C., applied to participate in the Framework modernization project. However, no responses were received from some states in the New England region, West Virginia, or Alaska. Despite this, professionals accepted and invited to the IAG still represented 45 states and districts, with actual participation from 38 states and districts. While we had hoped for representation from all 50 states and Washington, D.C., the voices of industry professionals from a broad geographical range were well-represented in the project.
Across all IAGs, gender representation remained stable between applicants, accepted, and attendees with approximately 52% female and 34-35% male. Non-binary and prefer not to say constituted a very small percentage with the remaining 12% not replying to the question. Pronoun preference, if replied to, also remained stable across all stages.

The racial/ethnic composition of Industry Advisory Group (IAG) members revealed some notable deviations from U.S. Census Bureau data. The representation of Black participants increased from 5.83% among applicants to 8.33% among attendees. Hispanic/Latino representation, however, decreased substantially from 5% among applicants to just 1.67% among attendees, despite 5% of applicants being invited to participate. Asian representation stayed fairly consistent, while Native American/Alaska Native and Native Hawaiian/Pacific Islander groups remained underrepresented. Additionally, those

identifying with multiple races declined slightly among attendees, and "Prefer not to say" responses remained consistent at around 1.67%.

Age representation within the Industry Advisory Group (IAG) skewed heavily toward the 45-54 and 55-64 age groups, comprising over 50% of participants across all categories—applicants, accepted members, and attendees.
Participants came from a diverse range of organization types, including National or Multinational Corporations, Small or Medium-Sized Enterprises, Trade Organizations, Labor Unions, Non-Profits, and others, with the largest representation falling within the "other" category. This diversity is further underscored by the 175 unique employers involved, contributing to a broad spectrum of experience and perspectives. A full list of IAG members can be found here.

Industry Feedback and Validation Artifacts

Each Industry Advisory Group (IAG) met twice virtually for two hours a session, with a third asynchronous, digital validation to achieve the following objectives (Note: See the Research Methodology Section for detailed information regarding the results of research):

1. **Session 1: Industry and Labor Market Data Validation and Information Gathering**: This Roundtable involved reviewing previous CTE Career Clusters and pathways relevant to their industry. Industry and labor market data profiles were presented at each IAG, with a structured, focused, and interactive inquiry methodology to garner input on Career Cluster titles, associated occupations and career pathways. (2 hours each)
2. **Session 2: Validation of Proposed Career Cluster Structure**: This Roundtable presented the refined findings from the first session in a proposed new Cluster and Sub-Cluster Framework along with occupational and employment opportunities, and top interdisciplinary skills. The focus was on an initial validation and critique highlighting any gaps, challenges or missing data from the proposed Cluster and Sub-Cluster changes. (2 hours each)
3. **Session 3: Digital Validation:** The final validation of the proposed CTE Career Cluster changes, pathways, and skills was obtained via a digital mailing of the proposed Framework for the sector to all participating IAG members, while maintaining the opportunity for members to provide additional critique if they see fit. We conducted this digitally so participants can submit their feedback anonymously and approve the proposed Cluster details for their industry. Those who did not attend either of the two scheduled IAG meetings were not invited to participate in the digital validation process to ensure only engaged members had input in later stages.

Additional Stakeholder Feedback

In addition to participation from the Industry Advisory Groups (IAGs), we engaged over 4,000 stakeholders at multiple points throughout the project. These engagement efforts were critical to

ensuring that the modernization of the Career Cluster Framework was collaborative, inclusive, and data-driven, incorporating a wide range of perspectives from across the CTE landscape.

Advance CTE was committed to a meaningful and transparent process for soliciting and responding to feedback from all Framework partners. This work was guided by Advance CTE's Board of Directors and a National Advisory Committee consisting of 23 national, state, and local CTE leaders. These leaders provided strategic insight into decision-making and helped ensure that diverse perspectives were represented throughout the process.