Talent Factories for Chipmakers

Microelectronics and Advanced Packaging Technologies (MAPT) Roadmap Conference

Workforce Development (WFD) Technical Working Group (TWG)

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The US Needs a Talent Factory for Chipmakers
MAPT Roadmap - WFD Technical Working Group (TWG)

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Supply & Demand Modeling
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Effective Models of Engagement
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Winning Hearts & Minds
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Chapter 7. Key Challenges

• Supply and Demand Modeling
  • We need a more granular understanding of the WFD needs (who, what, where when) so that we can prioritize efforts to effectively attract and engage the future MAPT workforce.

• Models of Effective Engagement
  • We need to engage students and the transitioning workforce to build and sustain a diverse talent pipeline.

• Winning Hearts and Minds
  • We need to build awareness in a way that excites students and attracts them to careers in the MAPT industry.
Supply & Demand: One example of employment projections

 Aggregate numbers don’t tell the whole story!
**Demand: Where are the jobs? Where are they going to be?**

**Why does it matter?**

- Different workers have different geographic mobility
- Technicians and trade positions tend to be hired from local pool
- Engineering and research positions tend to be hired from a national (or international) pool

**When will they become available?**

1 year, 5 years, 10 years?
Demand: What types of jobs need to be filled?
Supply: What is the size of the talent pool?

**STEM Pipeline — Leaking Badly**

In 2001, there were a bit more than 4 million 9th graders. Four years later, 2.8 million of them graduated and 1.9 million went on to two- or four-year college; only 1.3 million were actually ready for college work. Fewer than 300,000 are majoring in STEM fields and only about 167,000 are expected to be STEM college graduates by 2011.

Source: NCES Digest of Education Statistics; Science & Engineering Indicators 2008
What type of engineers and technicians are needed?

Engineers / Scientists

- Chemistry
- Engineering
- Information Science / Systems / IT
- Materials Science / Engineering
- Mechanical Engineering
- Electrical and Computer Engineering
- Computer Engineering
- Physics
- Computer Science
- Chemical Engineering
- Materials Science / Engineering
- Electrical Engineering
- Mechanical Engineering
- Supply Chain Management

Job Function

- High Volume Manufacturing
- Design Engineering
- R&D

Academic Degrees

- BS/MS/PhD

Technicians

- Manufacturing
- Engineering
- Electrical
- HVAC
- Mechanical
- Environmental Water Treatment
- Gas/Chemical

- Manufacturing Technician
- Equipment Technician
- Automation Technician
- Facilities Technician

- HS/OTC/Military/AS
What knowledge, skills, and abilities (KSAs) are required for different jobs in the microelectronic and advanced packaging industry?
# KSA Matrix for Semiconductor Industry

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- **Skill is Critical**
- **Skill is Desired**
- **Increasing importance 5-10 year**
Key Recommendation

• Develop a detailed and quantitative supply/demand model for MAPT WFD
  • Who, what, where, when
  • Develop KSA Matrix to link specific KSAs to specific jobs in the industry
  • Update KSAs for evolution of job requirements (AI/ML, automation, sustainability)
  • Update it to keep up with the dynamics of the semiconductor industry

• Identify and engage an owner to drive the development, dissemination, and maintenance of the model
Chapter 7. Three Challenges

• Supply and Demand Modeling
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• Models of Effective Engagement
  • We need to engage students and the transitioning workforce to build and sustain a diverse talent pipeline.

• Winning Hearts and Minds
  • We need to build awareness in a way that excites students and attracts them to careers in the MAPT industry.
Models for Effective Engagement ➔
WFD Pathways through the Eyes of the Employer / Educator

Core Skills

Middle School ➔ High School

Advanced Skills

Career and Technical Ed ➔ Workforce

Four distinct, interconnected pipelines exist today with multiple talent pools (TP)
An earlier start with students creates more time to build skills and deepen industry awareness and understanding

Ongoing Skills

Direct-To-Work Pipeline (Core Skills built)
Goal: 2023 - 15,000 students HTU & kits; 2024 - Internships and semi CTE pathway established

CTE Pipeline (Career Skills)
Goal: CTE pathways est. by 2024

College Pipeline (College Skills)
Goal: 2023: align with CCs; 2023 - 350 apprentices placed, 2024: 125,000 users for the site; Modernize content/curriculum

Military Service Pipeline (Values + Career, College, and Leadership Skills)
Goal: 2023 - 5,000 reached; 2024 - 10,000 veterans placed
Winning Hearts and Minds ➔
WFD Pathways through the Eyes of the Individual

STEM is necessary but not sufficient
The MAPT Industry WFD Challenge is a STEM Education Challenge

The MAPT industry is not responsible for solving the STEM education challenge, but it can leverage and support the broader effort.
It’s not too early: The core skills needed for STEM (and MAPT) careers begins in middle school and extends through high school

**Recommendations**

- **Build and support regional MAPT Education Ecosystems** and that bring together learners, families, educators, communities, and employers

- Engage individuals who are knowledgeable about **age-appropriate and culturally-sensitive pedagogy** with practitioners in the semiconductor field to develop learning experiences that can be delivered in both formal and settings

- Develop and provide **training programs for teachers** that show how examples and activities featuring semiconductors can be incorporated into the curriculum

- Develop and deliver **authentic career exploration programs** (summer camps, shadowing experiences, career and technical training programs, and summer employment)
Examples of what is being done now

RIT Microelectronic Engr.
High School Mentorship Program

Micron Chip Camp
www.micron.com/gives/chip-camp

CNY (4/23)

SEMI High Tech U
Career & Technical Education:

Recommendations

• Work with local and regional CTE providers to **shape the post-secondary programs available to students**

• **Map current CTE competencies to desired MAPT KSAs**

• Engage with local and regional CTE providers to **support their recruiting efforts** through awareness, understanding, and relevance campaigns and to develop industry-specific and even company-specific content that complements existing programs and strengthens ties between students and prospective employers.

• Provide **scholarships and internships** to incentivize students to complete industry-specific training.
A Great Resource for Information about CTE

https://careertech.org
Recommendations

- Incentivize interest in the semiconductor industry by providing work-based learning (WBL) opportunities, such as scholarships, internships/coop, apprenticeships, fellowships, and other forms of experiential learning.

- Support professional student clubs and sponsor competitions to encourage extracurricular interests aligned with the industry needs.

- Programs with examples of microelectronics impact to the environment and society - now and in the future - to build “Change the World” awareness and motivation.

- Conduct survey and focus group studies of current college students to understand industry awareness, barriers to entry, and the types of incentives that will attract students to the careers in the industry.
Examples of what is being done now

Microelectronic Co-op Experience

Major: Microelectronics Engineering
Co-op Experience: Extreme Ultraviolet (EUV) Engineering Intern
Company: K-VI Incorporated

Provides immediate access to talent
WFD Programs to Amplify Undergraduate Supply to the Semiconductor Industry

- Summer Internships
- Bootcamp (3 credits)
- Seminar (1 credit)
- Campaign + Scholarships

SRC will aim to create a talent pipeline that is:
- Balanced representation across BS, MS, PhD
- Balanced representation across gender & ethnicity
- Increases the SRC talent flow to its members

Highly-skilled workforce
Examples of what is being done now

Vision: Facilitate the long-term growth and innovation of the U.S. microelectronics industry through investment in our most important asset - our talent.

Mission: Holistically strengthen the talent pipeline through attracting, training, recruitment, & retention strategies.

Objective: Stimulate collaboration between universities and industry to address workforce development needs for successful U.S. semiconductor manufacturing.

CHIP IN
Semiconductor chips may be tiny, but they have a giant impact on the world around us. They power how we communicate, travel, entertain ourselves, and live our daily lives. Follow three young people as they explore the high-tech, future-focused, and exciting world of microelectronics.
Military Service Pipeline

Recommendations

- **Develop an awareness program** for members of the military and soon-to-be veterans which highlights microelectronics job opportunities and training resources.

- **Develop a “map” of military experience, expertise, and KSAs** which are applicable to the semiconductor industry roles and jobs, at all educational levels.

- Ensure there are **effective training programs** and placement services to transition from military to semiconductor jobs.

- **Understand the constraints and barriers** to military veterans pursuing these job opportunities and training programs and find ways to eliminate them.

**VetWorks**

VetWorks Guide Download
Diversity, Equity and Inclusion

Recommendations

• Develop a national awareness and information program to reach a diverse population

• Support for evidence-based practices that promote diversity, equity and inclusion in STEM education leading to MAPT careers

• Support evidence-based practices that promote diversity, equity and inclusion with the MAPT industries.
Chapter 7. Three Challenges

• Supply and Demand Modeling
  • We need a more granular understanding of the WFD needs (who, what, when) so that we can prioritize efforts to effectively attract and engage the future MAPT workforce

• Models of Effective Engagement:
  • We need to engage students and the transitioning workforce to consider careers in STEM fields, and particularly the MAPT industry, and to do so in a way that builds and sustains a diverse talent pipeline to meet the workforce needs.

• Winning Hearts and Minds
  • We need to build awareness, excitement and emphasize the global impact of the semiconductor industry to help students see how they can “change the world” through a career in the MAPT Industry.

Good things are happening
How do we scale these efforts and how do we sustain them?
Key Recommendation

• Establish and curate a global, on-line, open-source platform where semiconductor companies, professional societies and industry groups, universities and community colleges, K-12 educators can develop and post career guidance resources, curriculum content, internship, co-op, and apprenticeship opportunities, virtual and on-line training, and certificate programs.

• Create incentives for collaboration and require clear metrics to show and improve effectiveness

• Add new program content or updates to existing content as needed so that the site remains current.

• Use web analytics to measure the effectiveness of portal content to support the workforce objectives.

• Provide sustained government funding for the development of open-source content, as well as on-going support to build, expand, maintain, and curate the site.
Scaling Effective Engagement for Impact

Work Nationally Grow Locally

National Community for Winning Hearts and Minds

• AWARENESS
• UNDERSTANDING
• RELEVANCE

• Wrap-around Services
• Needs Substantial RESOURCES BEYOND CHIPS Act Funding
• Unique Role of Manufacturing Institutes

A Global, Online, Open-Source Platform*

Outreach & Awareness
For K-12 & Informal Learning
• Industry awareness / promo
• Classroom activities
• Career discovery tool
• After-school clubs / outreach

Supporting Education
For College & Community College Students
• Internship Programs
• Co-Op Programs
• Apprenticeships
• “Earn to Learn”
• Mentoring
• Student Clubs

Continuing Education
For Nontraditional students / Reskilling current workers
• Virtual manufacturing
• Online certificates
• Additional online resources
• Mentoring

Users & Developers of Content
Resourced and curated through public/private partnerships

Alignment between curricula & opportunities

K-12
[Teachers and Students, informal students]

Universities/
Comm. Colleges
[Faculty and students]

Underserved
Populations
[Women, Minorities, Veterans]

Transitioning
Workforce

Industry groups
and Professional societies

Semiconductor
Companies and
Consortia
Summary

• We need an effective supply/demand model including KSAs, timelines, numbers, pathways specific to national and regional areas and to different demographics to best plan for the workforce needs. Without such a model as highlighted earlier, we would be “shooting in the dark” as to where and when to target workforce with the needed KSAs which will also change with the evolution of the industry.

• Winning the Hearts and Minds of students and prospective future employees requires building the awareness, excitement and global impact of the semiconductor industry. Increasingly, students are interested in careers which can “change the world” and are impacted by what they hear, see and experience starting at a young age. Thus, we need to build awareness and excitement starting with STEM education but going “beyond” existing programs to add more emphasis on microelectronics and semiconductors.

• Effective engagement methods need to be identified along with a cost/impact estimation (leveraging the supply/demand model) which can be scaled for significant impact. There are already many very good examples in pockets across the U.S. which should continue, but many are not scalable to have nationwide industry impact as needed for the future. We need to continue to analyze these and identify gaps/opportunities to improve in order to meet demand.
Coming Up.... Panel Discussion

Based on the keynote address and WFD programs discussed

1. Who should “own” the semiconductor WFD program(s)? Industry, Academia, Government. Assume ALL need to be active participants but without lead/owner, there is a risk of misdirected or fragmented efforts.

2. If so, how should it be managed? Centrally for the nation? Fully distributed to regions due to regional unique differences and needs?
Thank you!