Executive Summary

During the second half of 2010 and the first six months of 2011, a team of educators, academic administrators and business leaders from Northern California conducted our study under the auspices of Perkins "Tech Prep" grant funding to review and to understand several topics:

> 1) Does a shift during the last three decades of the California economy towards more service-sector jobs mean that high school CTE [shop] courses are irrelevant--or are they more important now than ever?
>
> 2) Does the California decline of Career Technical Education [CTE] and high school shop curriculum adversely affect employment opportunities for (i) 2-Yr/trade pathway students; (ii) 4-Yr Academic pathway students?
>
> 3) Can existing or future CTE programs mesh with A-G [academic, college preparatory] required coursework? Is there merit to an alternative to A-G?
>
> 4) Does California's current public-education environment: i) restricted funds; ii) persistent high drop out rates; iii) changing socio-economic profiles; and, iv) the current economic down-cycle... preclude us from reversing the decline of CTE programs?
>
> 5) Are specialized credentials such as-- NIMS[1] - AWS[2] - ACT[3] Career Readiness - MSSC/CPT[4] --and the extensive curricula provided through public/private entities-- a valuable source of future curricula for the California CTE System? Is there evidence to suggest outcomes [students finding career placement] will improve if we utilize these?

Many prior studies[5] seek to understand the linkage between a student's high school experience and later success in a variety of career opportunities.

Our Study was focused on understanding career opportunities for high school, 2-Yr and college graduates in the manufacturing industry. Manufacturing continues its transformation toward highly automated, technical and high-value add industries-- as U.S. producers seek to differentiate from low labor-cost countries.

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[1] National Institute for Metalworking Skills, Inc.; https://www.nims-skills.org/web/nims/6;
[2] American Welding Society; http://www.aws.org/w/a/certification/index.html;
[3] National Career Readiness Certificate; ACT, Inc.;
http://institute.nam.org/page/edu_workforce_skills_cert_partners
[4] Ibid; Manufacturing Skills Standards Council; Certified Production Technician;
[5] Here are just a few: CALPADS, 2006-2010; The Silent Epidemic, 2006; Pathways to Prosperity, 2010; Planck, 2005; GetREAL, 2009; California Dropout Research Project, Rumberger-Lim, 2009.

While some manufacturing has definitely gone out of state [seeking low labor costs, local country markets or for tax/policy reasons] there are many sectors... clean energy, instrumentation, medical devices, micro-fluidics, wireless communications, consumer electronics, custom semiconductor, electric cars, commercial spacecraft, aircraft components, organic foods and 'nutraceuticals', biotech and defense systems... for which California remains the technological hub of the world market.

One part of our study was a survey of manufacturers throughout the nine Bay Area Counties to understand a future outlook: Will there continue to be good career opportunities in manufacturing? What skills are most important?

Another part of our study was to visit and examine a variety of manufacturing instructional or CTE programs. We took a look at a variety of programs designed to prepare high school students to successfully enter a college preparatory career track or for those who would enter the manufacturing workforce through post secondary apprenticeships, on-the-job training or other trades and skills training programs.

Finally, to obtain a sense of "what students are thinking" and what career "role models" might exist for them--we conducted video interviews with several high school classes, a class of machinist apprentices, and a variety of different manufacturers--from "high tech" to traditional. The video--and a brief narrative of this report--are intended to help study participants and high school staff understand both the opportunities for manufacturing careers--and to demonstrate industry's willingness and desire to become more engaged as a "partner" in the effort to better prepare our students for their future.

A summary of our Findings is presented, and in more detail within the full report. **We also present a series of recommendations**, that include:

- **Near Term**
  Actions that local school officials, counselors, teachers, students, parents and employers can take immediately to: (i) conform to existing education policies; and, (ii) emphasize "linkages" to potential employers and parents to improve outcomes and increase efficacy within today's context of limited funding.

- **Midterm Programs**
  Based on existing models both in and outside of California, how local high schools, CTE staffs and California's Department of Education can revitalize CTE, and begin a transformation to better serve our high school population.

- **Long Term**
  Transforming and blending CTE and A-G Curriculum for better outcomes, utilizing readily available Industry and Education Credentials to shape course offerings in California High Schools.

Summary of Findings

I. More New Manufacturing Jobs Will be Available, Many for High School Graduates and Recipients of 2-Yr Certificates

More than one-half of the manufacturers we surveyed say they intend a substantial increase in hiring of engineers and production personnel during the next five years. There are approximately 2,800 small to midsized non-food or beverage San Francisco Bay Area manufacturers. Extrapolating the survey findings to all of California, that means about 57,700 new jobs will be available, taking into consideration key assumptions that only 1 in 3 retirees' jobs will be replaced, and that 10% [cumulative] of firms will relocate or cease operations.[6]

At least two-thirds of these jobs are suitable for students with a 2-year specialized certificate or high school graduates with the requisite skills and on-the-job training.

II. Manufacturing Careers are More Highly Compensated - Compared to the Average of All Occupations

For the 14 Production Job Categories we surveyed-- Supervisor, CAD/CAM/CAE, Electrical Engineer, Mechanical Engineer, Manufacturing/IE Engineer, Quality/ Inspection Technician, Assembly/Welder, Machinist, Tool & Die, Automated Equipment Operator, Manual Operator, Setup, Maintenance Technician and Material Handling-- average compensation levels were 20% above the average compensation for all employment categories--according to statistics published by the California EDD and the U.S. BLS[7].

III. A Wave of "Baby Boomer" Retirees: Manufacturers are Concerned Whether they Will Find Qualified Replacements

Three of every five employers we surveyed are "concerned" or "very concerned" that they may not be able to fill new or replacement highly skilled jobs, because they are experiencing difficulty finding applicants with the right skills and experience.

A more telling concern was also revealed**: Fewer than 30% of responses rated current job candidates** "best-in-class" or "very competitive" --indicating that we are not training students for the skills employers need most. **Today, nearly 40% of the manufacturing workforce** is at or within three years of retirement age--suggesting that even if employers hold levels steady there will be a significant demand for new skilled workers.[8]

[6] Manufacturing 2.0, Milken Institute, 2009
[7] County Business Patterns, US BLS, 2009
[8] ARC Insights, T# 2007-21M, 2007

IV. Shop Skills and Experience are Relevant to the Skills Employers Need

More manufacturer responses listed "Mechanical/Technical Aptitude" and "Job Specific Skills" than "Basic Science, Math, Language" as the skills they were most concerned about, for 2-year/technical [non college/post-grad] employees.
Among college and post-grad candidates, employers ranked "specialized expertise," "research experience," and "advanced engineering degree" as the most important skills--by a wide margin. As one Video Interviewee stated [the CEO of a highly successful California Medical Products Company]

> " *We have a lot of engineers that we interview who are trained to be managers and they're book-smart, but they've never touched metal ... the [students who] are really valuable to us are practically trained guys that like touching metal ... [they] like running machines themselves ... they get to college ... they think 'if I don't make it to engineer I can still be a toolmaker, a high level machinist' ... so I think math and science are really important, but there has to be practical application ... as they grow up... We need to create a hands-on generation of people."*
>
> Jim Happ, CEO, Labcon North America

V. Industry Certifications and Shop Classes are Relevant to What Employers Want - Poor Recognition of Available Programs

Fewer than one-third of survey respondents were able to recall either the standards [credentials] or specific secondary or technical institutions, when asked, "What specific skills certifications does your company require?" and "What local high school or trade programs are you aware of?"

However, among those who specifically identified programs [CTE, Junior College, Apprenticeships and Job Skills Certifications] respondents were adamant that "sourcing these [credential] candidates are the key," and, "this type of [certification] doesn't guarantee success but it does make a difference in who we're willing to hire."[9]

The geographic distribution of survey responses is skewed--therefore we cannot unilaterally stipulate exactly the same findings statewide, however we believe there is strong anecdotal evidence for:

> **More industry involvement...** and more 'targeted' job oriented curriculum, by expanding or even requiring specific skills certification and curriculum;

[9] J. Adam, CEO, Triformix; J. Judd, Pres., J&M Manufacturing; J. Happ, CEO, Labcon North America; R. Payn, Sr. Mgr, Shell Oil Products; Rick Lemos, VP, Unico; T.J. Shadid, VP, SMC Stoesser; R. Hunt, Pres. Datum Technologies; M. Maendl, Pres., Protofab; S. Sapers, VP, Raydiance ... to name several ...

Earlier identification of high school students who would benefit from access to shop courses in addition to academic studies... as they prepare for an engineering or scientific career.