

THE INCREASING IMPORTANCE OF GROWING STEM IN THE ORANGE COUNTY ECONOMY

OCTOBER 2014

A STRONGER STEM TALENT SUPPLY BENEFITS ORANGE COUNTY IN SIGNIFICANT WAYS

Orange County, a leading region in terms of high-tech employment, will continue to depend upon the competitiveness of firms that employ increasing numbers of STEM workers to drive economic growth. Labor market information clearly demonstrates that a growing number of open STEM positions go unfilled in Orange County. Aligning education and workforce training with STEM workplace needs is vital to improving Orange County's competitiveness as a center for technological innovation. Good opportunities exist to increase STEM workforce supply at all education levels and amongst Orange County's diverse population to drive future economic growth and keep expansion on track. STEM shortfalls are not due to lack of employer demand, but from the limited supply of qualified candidates available in the county.

Growing an educated, skilled STEM workforce is a critical driver of regional economic success in the modern, knowledge based economy and is increasingly important to Orange County's long-term competitiveness and prosperity. Building a strong and expanding STEM-savvy education system is essential for Orange County to remain a world-class tech center. Orange County's robust, diverse economy has all the necessary ingredients to be a STEM leader, but needs to proactively make STEM education a priority in order to develop a stronger STEM talent pipeline of the future.

A new STEM definition highlights the significance of STEM to the Orange County economy, broadening STEM employment opportunities for all career stages. Brookings Institution's expanded definition of STEM encompasses a wider range of occupations and industries skills, experiences, and education levels than previous, outdated STEM classifications. The skills-first, knowledge-based approach implies that good-paying STEM occupations can be attainable at all education levels, providing students with career-relevant educations and better job prospects upon graduation.

Orange County needs to significantly increase STEM workforce pipeline supply to meet employer demand. Labor market information clearly demonstrates that a growing number of open STEM positions go unfilled in Orange County. Workforce talent supply issues are closely linked with STEM educational capacity. The foundation of regional STEM excellence has proven to originate from a strong pipeline of students. Encouraging continued interest in STEM disciplines will keep Orange County at the forefront of innovation and generate lasting benefits throughout the region.

Investing in increased STEM education is a win-win proposition for Orange County. If Orange County's STEM graduation rate doubled in the next 10 years, benefits include:

- Economic growth and competitiveness would significantly increase, more successful businesses would flourish, and more jobs would be created;
- New jobs would be filled by a steadily increasing-supply of locally grown STEM talent; and
- STEM provides a significant opportunity for employers to invest in STEM career pathways for Orange County students, closing the STEM workforce supply gap, ensuring job vacancies will be filled faster.

STEM (science, technology, engineering, and mathematics) employment is responsible for significant jobs creation, economic growth, innovative capacity, and wealth creation in nearly every successful modern economy through high-paying jobs and high industry multiplier effects that ripple throughout the rest of the economy. For decades, Orange County's competitive advantages have built upon a solid foundation of well-trained STEM workers in sufficient supply. New evidence suggests that in order to maintain its leading position in a knowledge-based global economy, Orange County must continue to strengthen and expand STEM educational capacity and career pathways to keep our economy strong and vibrant.

REDEFINING ORANGE COUNTY'S STEM ECONOMY Traditional vs. Expanded STEM Economy Definition

Until recently, defining a STEM economy relied on a narrow set of characteristic occupations closely tied to STEM skills and knowledge attained through graduate school, further research at universities and involvement in the corporate sector. While these occupations play a critical role in Orange County's economy, they only represent 6.4 percent of all jobs in the county.

Traditional Definitions: STEM Employment, 2013

SOC	Occupation	Total Employment (U.S.)	Total Employment (OC)
00-0000	All Occupations	132,588,810	1,452,430
15-0000	Computer and Mathematical	3,696,180	48,280
17-0000	Architecture and Engineering	2,380,840	35,000
19-0000	Life, Physical, and Social Science (excluding Social Science)	1,010,060	9,810
Sum of STEM Occupations		7,087,080	93,090
STEM % of Total Occupations		5.3%	6.4%

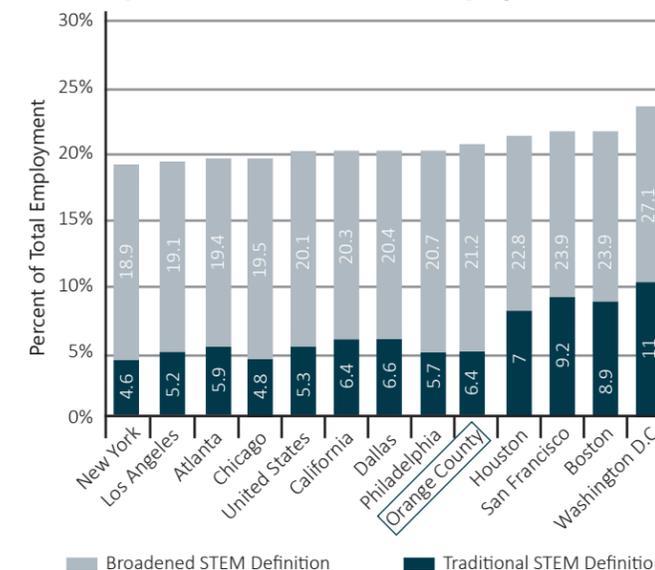
Source: Georgetown University — STEM, U.S. Bureau of Labor Statistics, OCBC Analysis

The Brookings Institution developed an expanded definition of a STEM economy. Key characteristics of the new definition include occupations not previously considered STEM such as health care, manufacturing, and financial services which increasingly require high levels of proficiency in at least one STEM skill. Factoring in Brookings new definition of STEM, Orange County's STEM workforce grows from 6.4 percent to 21.2 percent of the total economy – representing over 300,000 jobs — a significantly greater portion than previously thought.

Key Findings

- STEM employment is a critical part of the Orange County economy and much more prevalent than previously thought.
 - OC's STEM workforce is 21.2% of the total economy (2013);
 - An annual average salary for a STEM job requiring less than a bachelor's degree is \$55,503 compared to \$36,281 for all non-STEM related jobs (2011); and
 - In 2014, over 40% of all job vacancies in OC are related to STEM.
- OC has a significant mismatch between STEM occupational demand and the region's current STEM labor supply.
- If OC prioritizes STEM education and focuses on closing the STEM workforce gap, projected impacts in the next 10 years would be:
 - Economic activity and vibrancy would increase, more successful businesses would flourish, and more jobs would be created;
 - These new jobs would be filled by a steady-increasing supply of locally grown STEM workforce talent; and
 - STEM provides a significant opportunity for business to build/contribute to STEM career pathways for Orange County students.

Expanded Definition: STEM Employment, 2013



Source: Brookings Institution — The Hidden STEM Economy, Georgetown University — STEM, U.S. Bureau of Labor Statistics

WHY STEM MATTERS IN ORANGE COUNTY'S ECONOMY

STEM employment is a cornerstone of significant job creation, economic growth, innovative capacity, and wealth creation in nearly every successful modern economy. Today, STEM jobs in Orange County comprise a larger, growing share of total jobs in the economy than ever before.

STEM salaries on average are higher than non-STEM industries across all levels of educational attainment. In Orange County, an annual average salary for a STEM job requiring less than a bachelor's degree is \$55,503, compared to \$36,281 for all non-STEM related jobs. However, wage differences between STEM and non-STEM occupations are more greatly pronounced for those who have attained at least a bachelor's degree or higher.

There is a growing concern at the national level about a pervasive, increasing shortfall of STEM-educated skilled workers coming into the workforce compared to the increasing current and projected STEM needs of employers. Labor markets for STEM job applicants are highly competitive from the employer perspective, with hiring activity demonstrating the reality of an insufficient supply of highly-skilled STEM graduates in great demand.

Due to specific "in demand" skills and education requirements, Brookings found that STEM job openings take longer to fill than non-STEM openings. Much of this difficulty in filling vacancies can be linked to workforce talent supply issues. This is particularly challenging for STEM employers, as the core competencies that STEM graduates exhibit are increasingly desired by non-STEM employers, leaving a less skilled talent pool to pull from.

Orange County job vacancies in STEM occupations take longer on average to fill than the national average, with average duration of 42 days. This trend is projected to worsen, posing challenges to economic growth and competitiveness if left unchecked.

With a smaller pool of high-skilled STEM workers, combined with the high demand for STEM-experienced workers in non-STEM occupations, job openings in STEM occupations are longer-lasting and increasingly more difficult to fill.

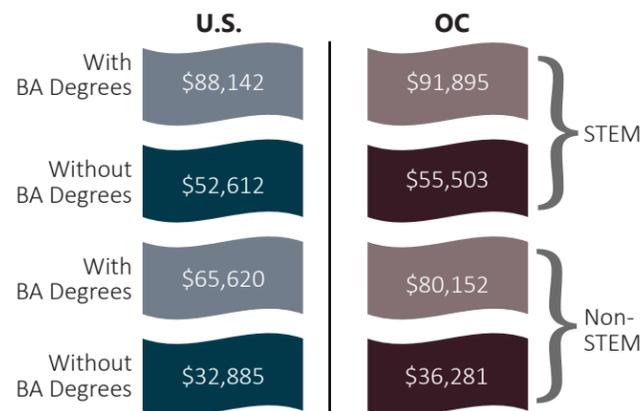
Furthermore, over 40 percent of all job vacancies in Orange County in 2014 are STEM-related, indicating a significant supply shortage of a STEM-capable workforce in Orange County.

Total STEM Employment in the United States and Orange County, 2013

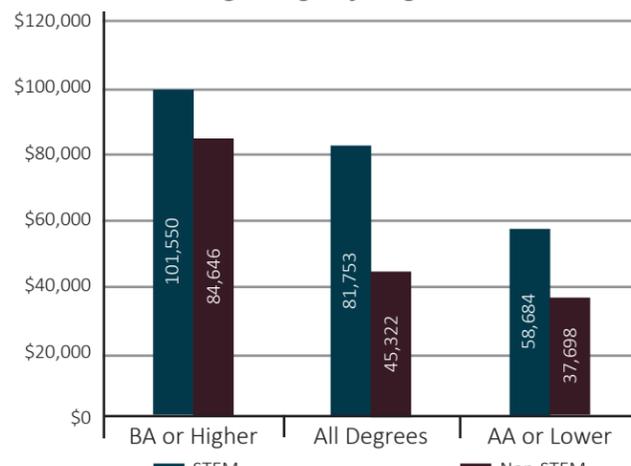


STEM employment is over 1/5 of Orange County's entire workforce – and the ratio is growing each year. Greater job volumes mean that STEM has a greater stake in the future of the Orange County economy.

Annual Average Salary for STEM and Non-STEM Jobs, United States and OC by Educational Attainment, 2011



OC Annual Average Wage by Degree Attainment, 2013



Source: The Hidden STEM Economy, OCBC Analysis

OC'S STEM SHORTFALL CREATES OPPORTUNITIES

Brookings found that skills common to STEM occupations are disproportionately valuable in the labor marketplace at all education levels. Improvements to STEM education capacity and relevancy will greatly benefit a broad cross-section of students and new graduates. Although STEM achievement is typically associated with advanced education, there exist many options and openings for employment in the expanded STEM realm for individuals with less than a bachelor's degree.

In Orange County, only 57.7 percent of STEM jobs require at least a bachelor's degree or equivalent education. With over 42 percent of Orange County STEM jobs requiring an associates degree or less, valuable STEM skills and abilities are attainable at all education levels, and even moderate familiarity can potentially help train low-income workers into greater STEM-oriented positions later in their careers. Furthermore, wage differences between STEM and non-STEM occupations are more greatly pronounced for lower education groups; the average Orange County worker with less than a bachelor's degree in a STEM occupation earns roughly \$20,000 per year more than non-STEM peers.

K-12 Education: The Root of Strong STEM Growth

The foundation of regional STEM excellence has proven again and again to originate from a strong pipeline of students who decide from an early age that STEM-related areas of study are a personal top priority. This direction cannot be determined without the guidance and support of experienced teachers and classes designed to inspire and prepare students for a bright future in STEM. (See ocstem.org for more information.)

SIGNIFICANT POSITIVE ECONOMIC BENEFITS OF A STRONG STEM TALENT SUPPLY IN OC

Brookings found that STEM-oriented regional economies perform more strongly on a wide variety of economic indicators, from innovation (patents) to economic growth to job creation. The following section explores the potential impact growing STEM and STEM-related graduates would have on the Orange County economy in terms of new jobs, income generated, increased annual economic activity, discretionary spending, and increased tax revenues for Orange County. This would answer the "what if" question of "Should the graduation rate of STEM degrees double over the next 10 years, what would be the impact on regional economic prosperity in Orange County?" The IMPLAN economic analysis tool is utilized to assess the regional impact of new graduates through an input/output model based on estimated labor income generated by newly hired graduates. It also measures impacts on region-wide job creation.

Significantly Increased Economic Vibrancy Over the Next 10 Years

An incremental doubling of Orange County's STEM graduation rate over the next 10 years would generate the following impacts:

- Direct Orange County labor income increases by an estimated **\$900 million**;
- With multiplier effects, total impacts forecast over **\$1.7 billion** in new labor income per year; and
- Almost **2.2 billion** in new economic activity.

Additionally, doubling the STEM graduation rate would drive new job creation and earnings generated by these jobs bringing benefits to the state, local and national government through new tax revenue of an estimated \$465 million.

Economic Impact Per Year of Doubled STEM Graduation Rates

Impact Type	Total Value Added
Value Added describes the net amount of new economic output generated – the increase in gross regional product. Impacts are divided into three types:	
Direct Effect: Immediate change in the industry – in this case, total STEM output.	\$1.326 billion
Indirect Effect: The impact of local companies buying goods and services from other local companies – when businesses expand their operations, their suppliers also benefit from increased productivity.	\$346 million
Induced Effect: The change in individual spending pattern as a result of direct industry change. More employees with more discretionary income benefit goods and service providers throughout the region.	\$504 million
Total Effect	\$2.176 billion

Increase Annual Tax Revenue from Doubled STEM Graduation Rate

State and Local Tax	\$131 million
Federal Tax	\$334 million
Combined Tax Effect	\$465 million

Source: IMPLAN; OCBC Analysis