2020

ORANGE COUNTY

WORKFORCE INDICATORS REPORT

ORANGE COUNTY BUSINESS COUNCIL

CONTENTS

INTRODUCTION

THE FUTURE OF ORANGE COUNTY'S WORKFORCE

Of all the trends and forces currently impacting the workplace, Artificial Intelligence (AI) has the greatest transformative potential. The scale and scope of the impact of the 'Age of AI' promises to be more profound than any other period of transformation in recent history. AI has the potential to radically transform every industry, community, and potentially the life of every worker.

On May 1, 2019, Governor Gavin Newsom signed an executive order announcing the formation of California's Future of Work Commission, stating that:

> *"Whereas California is a leader in innovation and development of technology that has been an engine of progress, driving new products that connect people across the globe, leaps in science, art, and education, access to high quality goods and services that improve quality of life, and economic growth that builds prosperity,*
>
> *Whereas rapid advancements in technology, specifically automation of jobs and expanded artificial intelligence capability, have had and will continue to have a profound impact on the type, quality, and number of jobs available in our 21st century economy."*

This follows the example of several other states which have established similar commissions. Indiana was the first, establishing a Future of Work Task Force in 2017. New Jersey Governor Phil Murphy signed a similar executive order on October 5, 2018 establishing the Future of Work Task Force, charged with studying how technological innovation will impact the development of jobs and New Jersey's economy. According to a recent Aspen Institute brief, "45 of the nation's governors addressed concerns and priorities around the future of work and preparing the future workforce in their state of the state addresses earlier this year."

California's Future of Work Commission will look at the impact of technology on work, workers, employers, jobs, and society; the methods of promoting better job quality, wages, and working conditions through technology; and how the state can create the most skilled workforce in the world.

While many different individuals and organizations have attempted to forecast the future of the nation's labor market, with wildly different predictions of what the world of work will look like in 2030 or 2050, all agree that technology in general, and specifically AI and automation, will continue to be the key drivers in future workplace transformations. Indeed, few narratives in economics, politics, and social policy have hit the media with such alarming headlines about the disruptive nature of automation and AI in the workplace, not just in traditional industry segments as manufacturing but also in transportation, professional services, healthcare, and even government and education.

While new technology will likely create more jobs than it replaces in the long term, the labor market may face disruption and widening skills gaps in the short term. A recent CompTIA report, for example, found that more than half (52 percent) of millennials are concerned about automation and its possible impact on their careers.

Many of these trends will impact California first, and Orange County will be one of the first places in the state to feel their full force.

These transformations on the horizon can in fact provide a catalyst for expanded economic and workforce development opportunities for Californians. This is a chance for Orange County to once again show leadership in adapting to these forthcoming transitions. The county has the knowledgeable, skilled workforce to adapt nimbly to future of work trends and create workplaces enabled to use the most advanced technologies in a number of settings, from manufacturing to healthcare to arts and entertainment.

[1] *https://www.in.gov/dwd/3162.htm*
[2] *https://www.aspeninstitute.org/blog-posts/creating-a-future-of-work-commission/*

THE BUSINESS COMMUNITY WILL PLAY A KEY ROLE IN THE COMING TRANSITION TO THE AUTOMATION/AI ERA

Technological changes, especially in a highly educated area such as Orange County, could actually help improve the quality and productivity of work – both from an employer and employee perspective. In the words of Tony Blair, former UK Prime Minister and current executive chair of the Institute for Global Change:

"AI will allow us to do what it is that we are uniquely meant to do: to focus on high-level thinking, strategy, and paving the way for innovation."

Recently, BCG's Henderson Institute and Harvard Business School published an international survey of executives on the complexities of tomorrow's world of work. Surveyed business leaders listed the following three driving forces as having the most significant impact on their organizations in the next five years:

- Employee expectations to find balance between personal and work life through flexible work mechanisms (46 percent);
- The need to improve the level of skills in the workforce (44 percent); and
- The difficulty in finding workers for the newly evolving jobs (44 percent).

In a 2018 article entitled "Can IT rise to the digital challenge?" McKinsey concluded that IT functions will be key to addressing the ongoing digital transformation of the workplace. On average, executives reported that they expect 40 percent of their IT workforces will need to be retrained or replaced in the coming years. Out of every 100 IT employees, in the next 3 years technology leaders expect that:

- 42 percent will be fundamentally retained and retrained;
- 31 percent will be replaced with new-full time talent; and
- 27 percent will be replaced with contract workers and/or vendor employees.

Most executives want their organizations to be digitally converted or fully digital in the next two years, but less than one-fifth say they are there now, mainly because IT organizations are struggling to keep up with overall demand for their services. The best IT performers are proactive about embracing changes to technology and the ways people work, with the top attributes of successful digital transformation being:

- Strategic thinking, a key skill for technology leaders;
- CIOs being very involved in shaping business strategy and agenda; and
- Digitization strategies and IT's delivery model having been pursued for at least the last two years.

OCBC's 2017 report *The Dimensions of Defensibility: Human-Centered Design in an Automated Workplace* found a complex relationship between defensibility and specific work aspects. *The Dimensions of Defensibility* drew on the research framework developed by Oxford professors Carl Benedikt Frey and Michael A. Osborne, who ranked the defensibility, or resistance to automation, of more than 700 occupations in their 2013 paper "The Future of Employment: How Susceptible are Jobs to Computerization?". Using a sizable big data set, *The Dimensions of Defensibility* tests the defensibility of more than 323 job characteristic variables, including work values, work styles, skills, abilities, knowledge bases and work activities across 954 occupations.

Across the entire labor market, four work values have a strong, consistent relationship to defensibility indicated by their correlation score:

- Achievement (0.74)
- Recognition (0.71)
- Working Conditions (0.69)
- Independence (0.66)

[3] *Artificial Intelligence: A Roadmap for California, page 13*

Three work activities have a strongly positive relationship with defensibility:

- Developing Objectives and Strategies (0.63)
- Thinking Creatively (0.63)
- Provide Consultation and Advice to Others (0.61)

Highly defensible skills include Active Learning (with a correlation of 0.67), Critical Thinking (0.64), Systems Evaluation (0.64), Systems Analysis (0.63), Learning Strategies (0.63) and Judgment and Decision Making (0.63).

Taken together, these findings from "The Future of Employment" and *The Dimensions of Defensibility* help clarify the future of workforce in Orange County, in part by dispelling some common misconceptions about automation. First, both paint a more nuanced picture of technology-driven labor market change than what a recent Little Hoover Commission report characterized as "doomsday scenarios featuring job-stealing robots" typical of most reports on the subject. While automation will continue to replace some jobs, much of its future impact will likely be in automating specific job activities, changing the nature of – but not replacing – many occupations. In financial services, for instance, ubiquitous ATMs have not made human employees obsolete. Instead, letting machines handle routine tasks allows bank associates to focus on higher-level tasks such as customer service and financial planning.

Another common narrative is that the current wave of automation will primarily affect physical work, as in the first Industrial Revolution during the 18th and 19th centuries. Frey and Osborne, however, list many white-collar occupations as highly vulnerable to automation. The following occupations, for example, each have an automation potential of more than 90 percent:

- Real Estate Brokers
- Budget Analysts
- Accountants and Auditors
- Tax Examiners and Collectors, and Revenue Agents
- Insurance Sales Agents
- Appraisers and Assessors of Real Estate

Additionally, a wide variety of other non-manual labor jobs, from Market Research Analysts and Marketing Specialists (0.61) to Atmospheric and Space Scientists (0.67), have an automation potential of more than 50 percent. While wage levels and educational attainment generally correlate with defensibility, this is not a hard-and-fast rule. Instead, new technologies will quickly have the ability to perform routine activities more efficiently but will continue to struggle with non-routine, human-centered work activities.

With all of these changes in mind, what will Orange County's workforce look like in 10, 20 or even 30 years?

A recent McKinsey report entitled *The Future of Work in America: People and Places, Today and Tomorrow* provides some clues. In this report, McKinsey researchers focus on the varying impact that automation and other labor market shifts will have on different geographical areas and industry sectors. For the former, McKinsey divides US counties into one of thirteen categories; Orange County, as part of the greater Los Angeles metropolitan area, falls under the "megacity" category and is expected to see significant job growth between now and 2030. McKinsey also predicts that more well-educated areas, such as Orange County, will likely see higher job growth in the future and could capture 60 percent of US job growth through 2030.[4] Other regions are positioned for much more modest job gains, with trailing regions and rural counties predicted to see a decade of flat or even negative net job growth.

In terms of industries and sectors, McKinsey's midpoint automation projections[5] show that many of the country's largest occupational categories are in danger of being disrupted by automation between now and 2030. This next wave of automation will displace:

- Office support;
- Food service;
- Transportation and logistics; and
- Customer service roles.

At the same time, the economy will continue to create jobs, particularly roles in:

- Healthcare;
- STEM/STEAM fields;
- Business services; and
- Work requiring personal interaction (across many sectors).

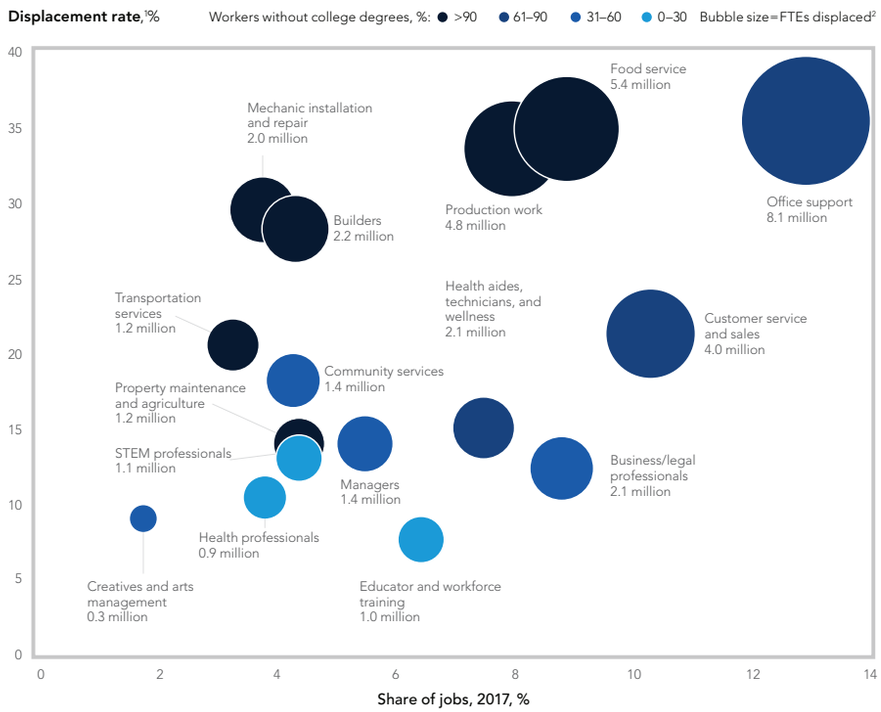
While positive net job growth will most likely occur at the national level, growth will be distributed unevenly with different trajectories across areas with different occupational mixes. In other words, the major task for education, workforce, and economic development leaders going forward will be in addressing local mismatches and help workers gain new skills.

As seen below, McKinsey estimates office support workers, food service workers, production workers, builders and mechanical installers and repairers are projected to all have a greater than 25 percent chance of being displaced by automation.

[4] Ibid, p.11
[5] Ibid, p.17

The largest occupational categories in the US economy have the highest potential displacement rates.

Occupational categories by share of US employment and displacement rate[1] through 2030, midpoint adoption scenario



[1] Based on the share of automatable activities for occupations within each category.
[2] Full-time equivalents displaced in midpoint automation scenario by 2030. In office support, for example, technology could handle the activities that account for more than 35 percent of all hours worked, or the equivalent of 8.1 million full-time workers.
Source: US Bureau of Labor Statistics; McKinsey Global Institute analysis

Some occupational categories, on the other hand, could see significant growth by 2030 under McKinsey's scenario, fueled by emerging technologies, shifting demographics, and higher productivity. In this scenario, the highest percentage growth between 2017 and 2030 will occur in:

- Health professionals (48 percent growth);
- STEM professionals (37 percent);
- Health aides, technicians, and wellness (30 percent);
- Creatives and arts management (21 percent); and
- Business/legal professionals (20 percent).

Education will be key to adapting to this new labor market. McKinsey's recent work estimates how potential workforce displacement will impact certain segments of the workforce differently – for example, finding that workers with a high school diploma or less face a four times greater risk of displacement than those with higher educational attainment. Other groups projected to be significantly impacted by the coming era include:

- Young workers 18-34 (14.7 million)
- Workers over age 50 (11.5 million)

In their follow-up to "The Future of Employment," the 2016 Citi GPS report *Technology at Work v2.0: The Future is Not What It Used to Be*, Frey and Osborne – along with colleague Craig Holmes – write that "part of the solution will clearly lie in revamping education."[6] Increasing automation will exacerbate long-running problems in education, such as quickly adapting to changing labor market needs. Challenged "to anticipate where technological innovation may lead to job creation,"[7] education and workforce training leaders need to use predictive labor market information in order to properly prepare students for tomorrow's labor market.

This is especially important because the kind of "in demand" labor market skills may likely change radically in the next several years, as seen in the tables below. The World Economic Forum's *2018 Future of Jobs Survey* lists the top ten trending and declining job skills between 2018 and 2022. While declining skills tend to be technical, such as technology installation and maintenance and quality control and safety awareness, trending skills tend to be "soft", such as analytical thinking and innovation, active learning and learning strategies, creativity, originality and initiative.

Comparing Skills Demand, 2018 vs 2022, Top Ten

TODAY, 2018	TRENDING, 2022	DECLINING, 2022
Analytical thinking and innovation	Analytical thinking and innovation	Manual dexterity, endurance and precision
Complex problem-solving	Complex problem-solving	Memory, verbal, auditory and spatial abilities
Critical thinking and analysis	Critical thinking and analysis	Management of financial, material resources
Active learning and learning strategies	Active learning and learning strategies	Technology installation and maintenance
Creativity, originality and initiative	Creativity, originality and initiative	Reading, writing, math and active listening
Attention to detail, trustworthiness	Reasoning, problem-solving and ideation	Technology use, monitoring and control
Reasoning, problem-solving and ideation	Emotional intelligence	Quality control and safety awareness
Emotional intelligence	Leadership and social influence	Coordination and time management
Leadership and social influence	Technology design and programming	Visual, auditory and speech abilities
Coordination and time management	System analysis and evaluation	Management of personnel

Source: Future of Jobs Survey 2018, World Economic Forum.

[6] *P. 97*
[7] *Ibid, p.119*

The *Future of Jobs Survey* also lists examples of new and redundant occupations, as seen in the table below. This paints a somewhat different picture; the top new roles tend to deal with emerging technologies and technology in general, whereas redundant roles tend to involve routine tasks that can be easily automated to be performed by machines.

REDUNDANT ROLES

- Data Entry Clerks
- Accounting, Bookkeeping and Payroll Clerks
- Administrative and Executive Secretaries
- Assembly and Factory Workers
- Client Information and Customer Service Workers*
- Business Services and Administration Managers
- Accountants and Auditors
- Material-Recording and Stock-Keeping Clerks
- General and Operations Managers
- Postal Service Clerks
- Financial Analysts

NEW ROLES

- Data Analysts and Scientists*
- AI and Machine Learning Specialists
- General and Operations Managers*
- Big Data Specialists
- Digital Transformation Specialists
- Sales and Marketing Professionals
- New Technology Specialists
- Organizational Development Specialists
- Software and Applications Developers and Analysts*
- Information Technology Services
- Process Automation Specialists

Note: According to the Future of Jobs Survey, starred roles "might be seeing stable or declining demand across one industry but be in demand in another."

A key test for educators and workforce professionals will be the challenge of not simply keeping up with current information on the very significant labor market changes in the coming years as jobs appear, disappear, and evolve — but trying to get ahead of the game by developing relevant predictive tools and models as to where the labor market is going. In addition, two overarching trends can guide educators and policymakers through this period of transition. First, many of the most defensible skills in tomorrow's labor market are frequently termed "soft skills" – as opposed to technical skills – such as teamwork, communication skills, and management. By focusing on these skills, relevant across a wide variety of industries and occupations, educators can build a strong foundation for their students' career success.

Second, the speed of change in tomorrow's labor market means that workers will have to develop new skills throughout their careers instead of ending their education with a high school or college degree. Increasing collaboration between educators and employers will be key to this expanded lifelong learning and training process, which will give workers the necessary tools to navigate tomorrow's economy.

SOFT SKILLS

While the half-life of many hard skills is shrinking, soft skills stay relevant: a particular programming language may go out of fashion, but creativity, adaptability, and collaboration skills will always be valuable.

– LinkedIn *2019 Global Talent Trends*

LinkedIn's *2019 Global Talent Trends* report found that identifying and hiring employees with the right "soft skills" is a significant challenge for many employers. While 80 percent of companies surveyed by LinkedIn identified soft skills as "increasingly important to company success"[9] and 92 percent value soft skills as least as highly as hard skills, many employers lack the ability to effectively identify and assess these skills.

More than half (57 percent) of surveyed companies struggle to assess soft skills and, according to almost 90 percent, "bad hires typically lack soft skills."[10] Less than half of companies surveyed by LinkedIn reported having a systematic process for assessing soft skills, with the majority assessing job candidates' soft skills through asking behavioral questions (75 percent), reading body language during interviews (70 percent), and asking situational questions (58 percent); only 17 percent used new data analytical tools. As the report notes, these common methods are "susceptible to bias and often elicit well-rehearsed answers."[11]

Employers' challenges in finding job candidates with the right mix of soft skills might come at least in part from the vagueness of the term, which includes everything outside of specific technical skills such as a programming language or a certification to operate a certain machine. "Soft skills" can refer to anything from the kind of creativity exhibited by writers and painters to the ability to work well in a group to leadership, communication, and time management.

These skills, however, will likely prove to be some of the most defensible skills in an era of increasing automation; as LinkedIn notes, they will survive long after many technical skills become obsolete. By focusing on non-automatable skills and activities such as creativity, critical thinking and teamwork, educators can help their students find career success regardless of which occupation they pursue.

[8] *LinkedIn 2019 Global Talent Report, page 7*
[9] *Ibid*
[10] *Ibid, p.9*
[11] *Ibid, p.11*

THE FUTURE OF CAREERS

While automation continues to feature in most headlines and inspire the most speculation of any labor market trend, other trends – many at least partially enabled by new technologies – could also have transformative effects on Orange County's workforce. One of the most significant is a change in the employer-employee relationship known by various names, including the "gig economy." A recent Brookings report, *The US Labor Market In 2050: Supply, Demand and Policies to Improve Outcomes*, describes the gig economy as including:

> Uber drivers who work on an online, on-call basis; temporary (or "contingent") workers, whose jobs are more regular in any given day or week but only for short periods of time; those working permanent jobs but as independent contractors, who are technically self-employed; those working permanent jobs but for a company that is contracting out work from another employer; working for franchises, whose human resources practices will be partly decided by themselves and partly by larger parent companies; and workers in "supply chain" companies whose practices might be determined by other firms in other parts of those chains.[12]

How can educators prepare tomorrow's workers to take more and more responsibility for their career development in this new economy? Soft skills will be crucial because of their relevance across the job market. Just as importantly, education itself will have to expand into more of a lifelong process rather than just a degree or certificate. As technology and other changes continue to transform jobs, workers will need to constantly develop and refine skills in order to keep up; many labor market projections refer to the "race between education and technology," a phrase first coined by Harvard professors Claudia Goldin and Lawrence F. Katz more than a decade ago.

A recent *Wall Street Journal* article[13] uses the term "reskilling" to refer to the practice of companies retraining their workers to develop the skills necessary in tomorrow's economy. While many companies use a "buy, not build" strategy of dismissing workers in redundant positions and hiring new workers with necessary skills, this model "is getting more difficult – and expensive – to pull off, especially in a market where the supply of skills like cloud computing and cybersecurity can't satisfy the immense demand for them" according to Accenture Chief Technology and Innovation Officer Paul Daugherty.

Instead, it will become increasingly more efficient and cost effective for companies to reskill their current employees. While the United States government invests relatively little in workforce development for adults over 25, many employers have begun to fill this gap by creating their own reskilling programs, including JPMorgan Chase, Disney, and AT&T.

For example, AT&T's Future Ready program lets employees:

> Assess their skills, then pursue short-term badges, nanodegrees taking up to a year to complete, or master's degrees in fields like computer science and data science in partnership with institutions such as the Georgia Institute of Technology and the University of Notre Dame.

Thus far, approximately 180,000 employees have participated in this program, which has been primarily funded by AT&T.

Disney Aspire offers another recent example of company-sponsored reskilling in action. Disney is currently investing $150 million in the initiative in the first five years, with additional annual funding of up to $25 million. Disney Aspire, according to Walt Disney Company Senior Executive Vice President and Human Resources Director Jayne Parker,

> "…is the most comprehensive program of its kind. To make participation easier for eligible employees, The Walt Disney Company will cover 100 percent of tuition upfront and will also reimburse application fees and required books and materials, removing the worry of paying to start or continue school. The program is designed for working adults and offers our Cast Members and employees maximum choice and flexibility with their studies, regardless of whether the program and classes they choose are tied to their current role at Disney."[14]

At least 80,000 hourly employees are eligible for Disney Aspire, which will pay for all of their tuition upfront and also reimburse employees for application fees, textbooks, and class materials. Guild Education brings together students, employers, and universities and collaboratively creates job training, career advancement, and educational opportunities all focused on streamlining workforce development opportunities that benefit employees. Participants in the program will also receive personalized coaching from Guild, and will be able to choose from a variety of educational options that do not have to directly relate to their job duties: from Bachelor's and Master's degrees to English language learning and vocational education.

[12] *P. 14*
[13] *Lauren Weber, "Why Companies are Failing at Reskilling," Wall Street Journal 19 April 2019*
[14] *Walt Disney Company press release*

ORANGE COUNTY DEMOGRAPHIC TRENDS

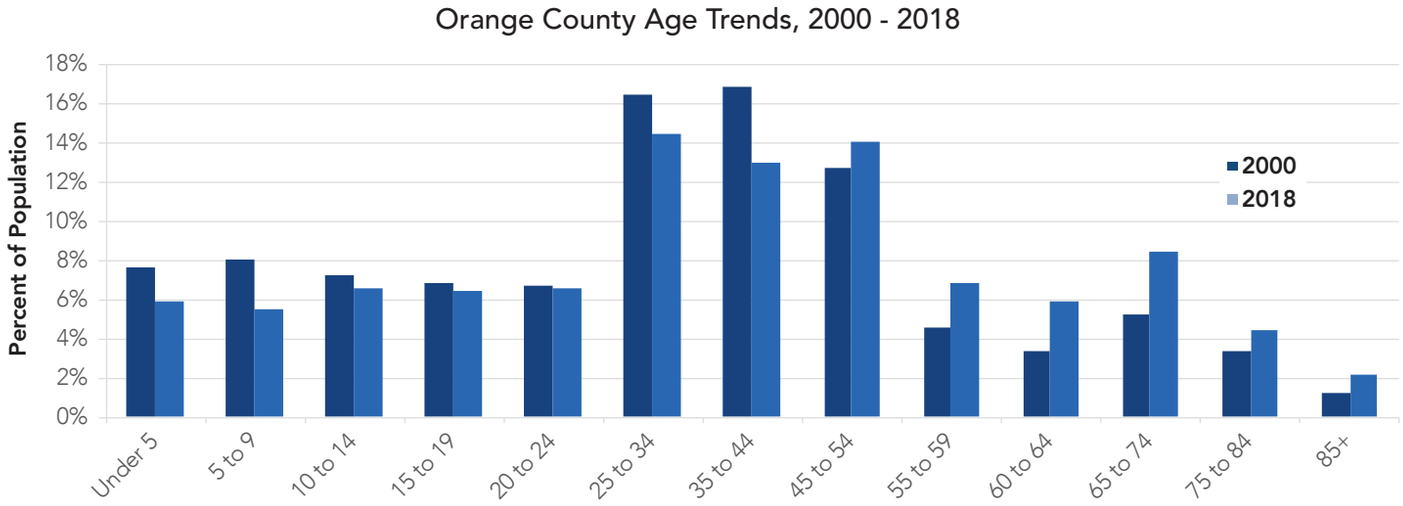
Orange County's demographic shifts – especially aging and increasing diversity – are transforming communities, industries and even individual occupations across the county. The county's rapidly aging population, for example, will likely increase demand for Healthcare jobs such as Nurses and Home Health Aides over the next several decades. This section summarizes past and projected trends in order to provide local community, business and government leaders with the information they need to continue the county's economic growth in the face of these changes.

INTRODUCTION

Orange County's most important demographic shift is its aging population. As the county's large baby boomer population continues to age and begins to retire, the knowledge and experience vacuum created will combine with Orange County's preexisting skills gap to put pressure on local employers, educators and all involved in workforce development. The rapidly aging population will increase demand for Healthcare, likely leading to further growth in that industry, and put pressure on retirement benefits such as Social Security. This could be a significant challenge, as Orange County is predicted to have a much higher ratio of dependents to working age residents than it currently does. In short, aging will transform Orange County and local policymakers and stakeholders must prepare for these changes.

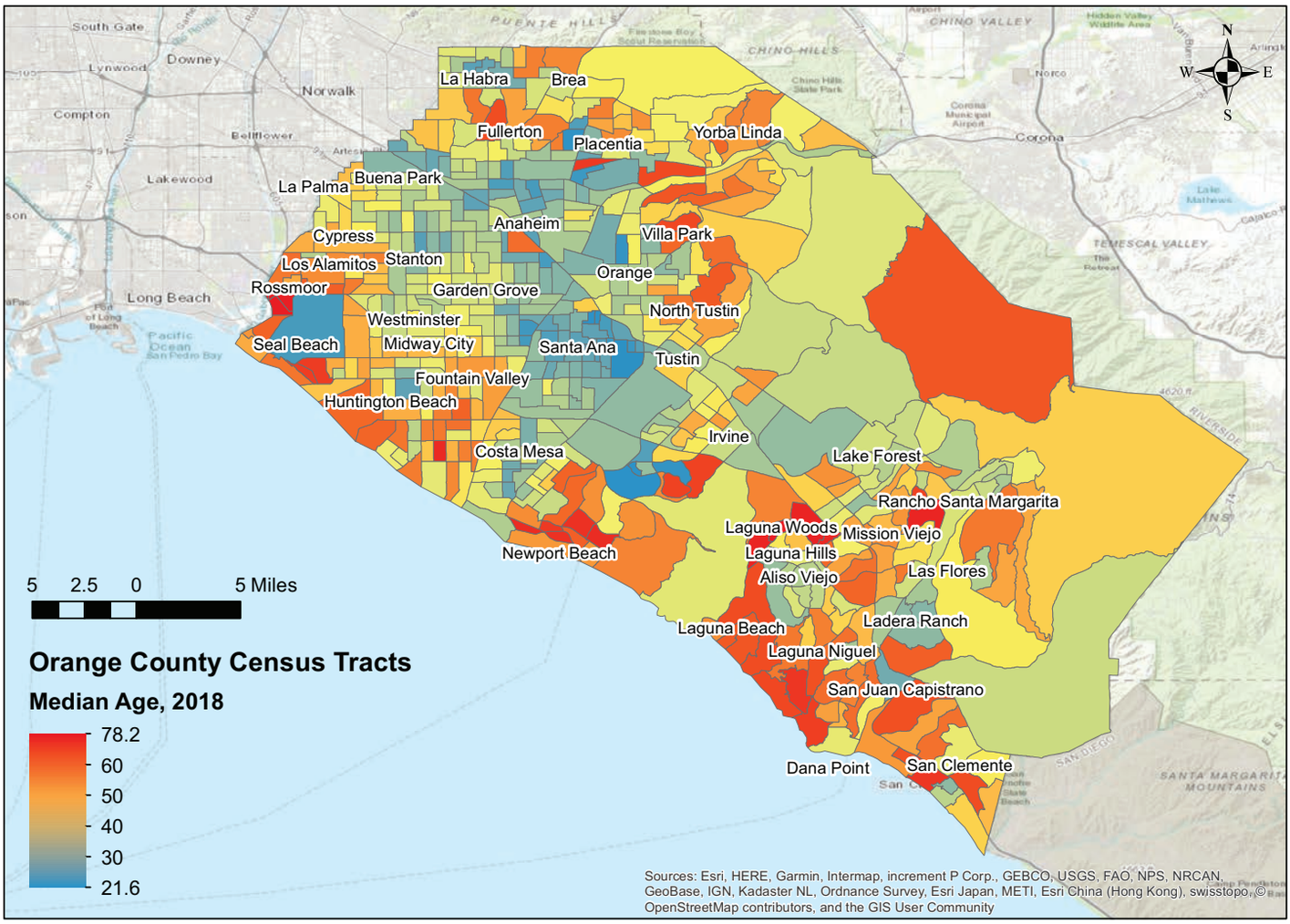
PAST AND PRESENT

The chart below illustrates Orange County's dramatic age shift since the turn of the millennium. The county's median age increased from 33 in 2000 to 38.3 in 2018, while its proportion of residents aged 65 and older increased from 9.8 percent to 14.9 percent over the same period. The proportion of residents under 24, on the other hand, has shrunk from 36.4 percent in 2000 to 31.0 percent in 2018.



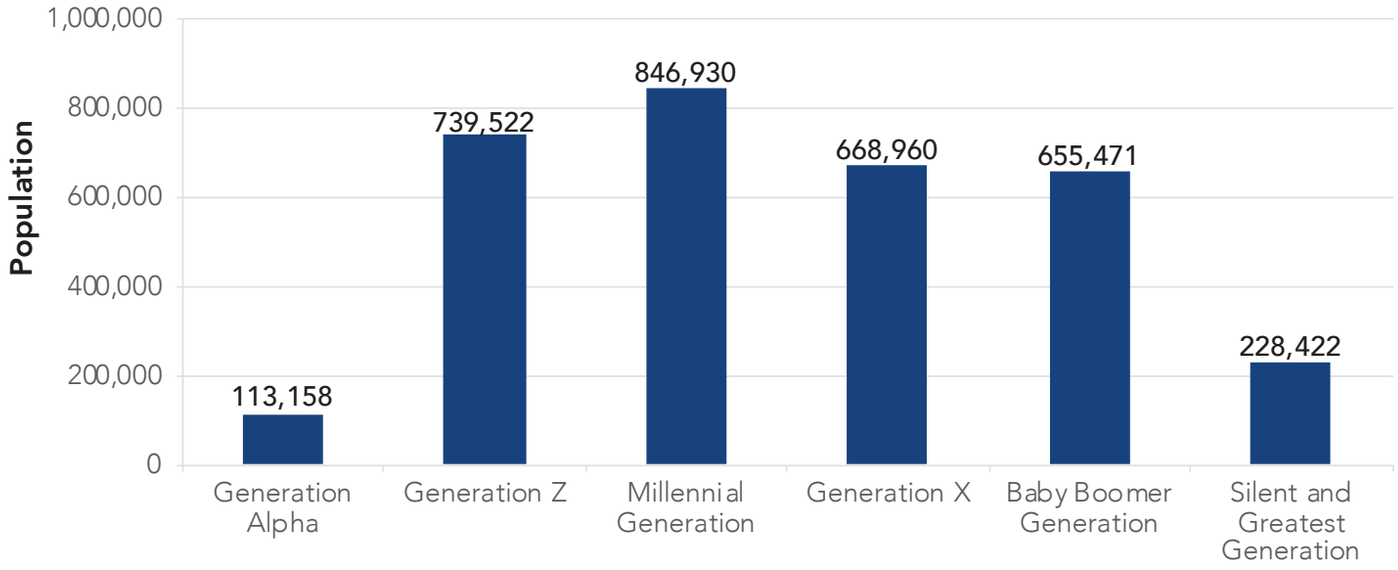
Source: U.S. Census Bureau, American Community Survey

Median Age in Orange County by Census Tract, 2018



Orange County's increasing median age makes it important to understand the county's various generational groups. The 'Alpha' generation, residents born in 2017 or later, accounted for 113,158 county residents in 2019, as seen on the next page. Generation Z, which includes residents born between 1999 and 2016, accounted for 739,522 individuals. As illustrated in the map on the following page, Generation Z residents were the dominant generation in several census tracts throughout the region, including many in north county cities such as Anaheim, Garden Grove and Santa Ana. Millennials, born between 1981 and 1998, are the county's largest generation with almost 850,000 residents and tend to live in northern parts of the county, likely due to lower housing prices and proximities to educational and job opportunities.

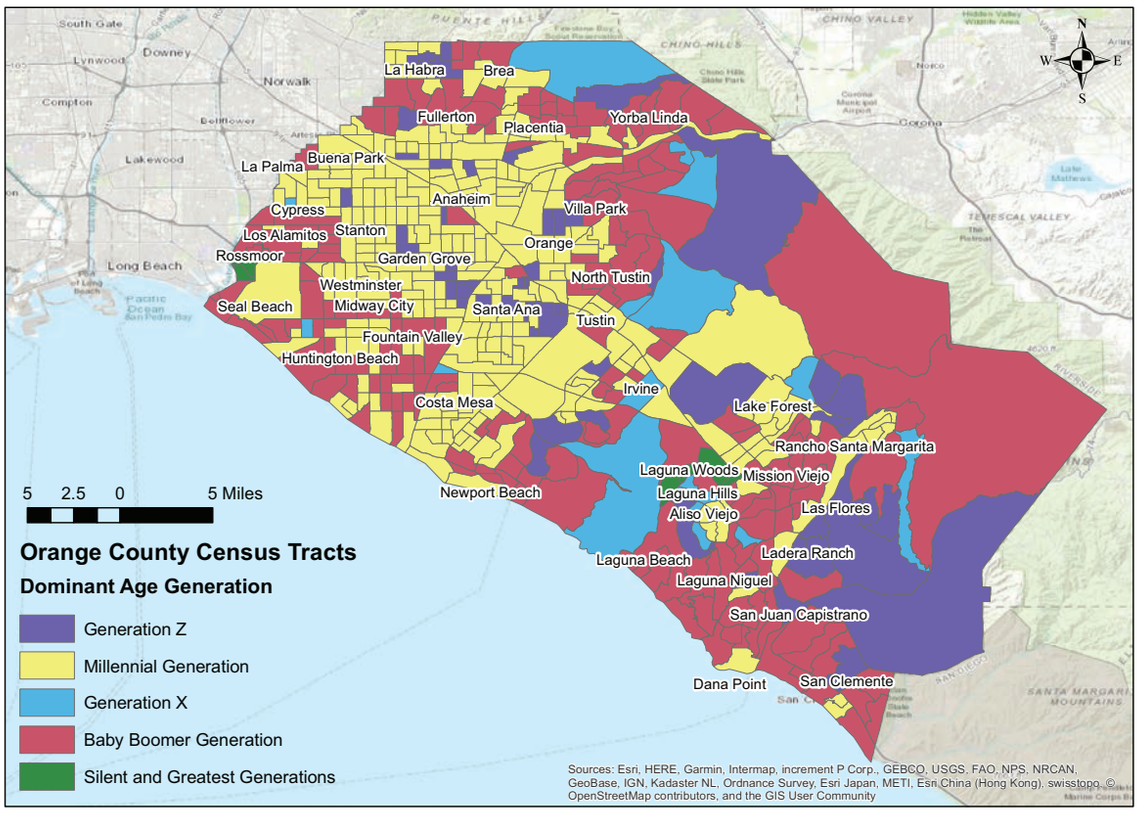
Orange County Population by Age Generation, 2019



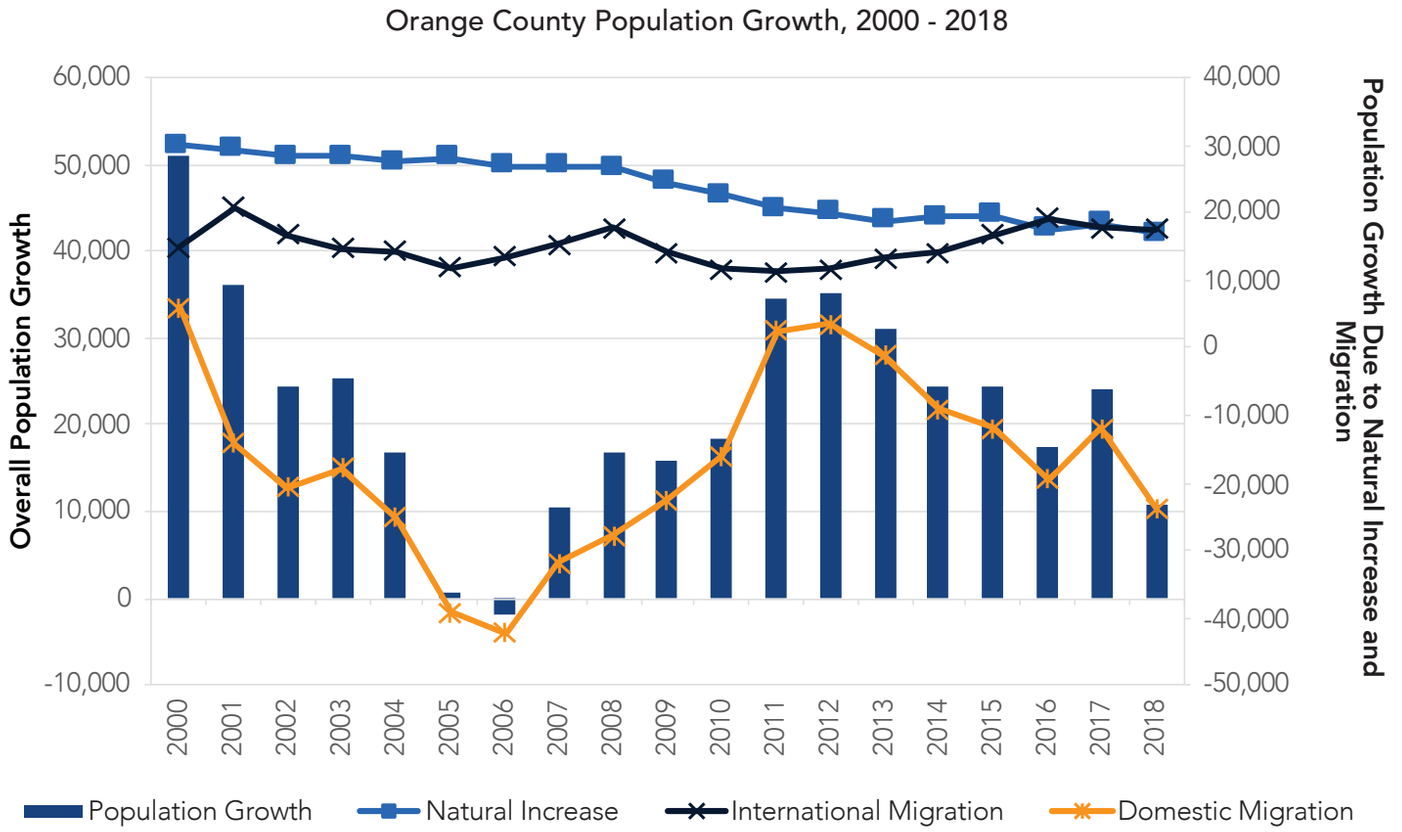
Source: Esri

Generation X, those born between 1965 and 1980, accounted for 668,960 county residents but were rarely the dominant age group in any census tract. Baby Boomers – born between 1946 and 1964 – were the county's fourth largest age group with just over 650,000 residents, followed by the Silent Generation (those born between 1925 and 1945) and Greatest Generation (those born between 1900 and 1925), which together had 228,422 residents in Orange County. By understanding the generational groups in the region, city and business leaders can gain an understanding of how markets may shift in the future, allowing for better, more informed strategic plans to be created.

Dominant Age Generation by Orange County Census Tract, 2019



Orange County continues to experience high levels of negative domestic migration, with 23,743 residents leaving the county in 2018. A combination of national increase (births minus deaths) and international immigration, however, more than offset outmigration, as seen in the graph on the following page. Nevertheless, high levels of negative domestic migration remain a troubling sign of the county's high and rising cost of living.

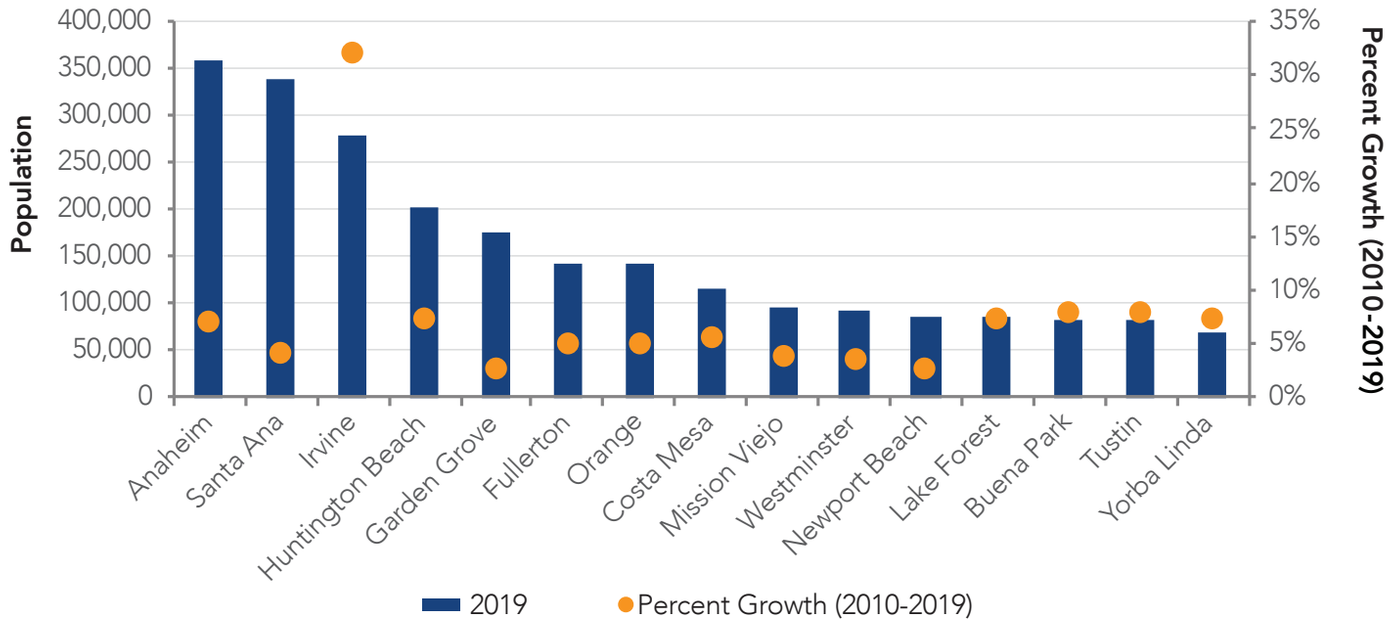


Source: California Department of Finance

Anaheim remains Orange County's largest city, with a population of 359,339, followed closely by Santa Ana (337,716) and Irvine (280,202). Irvine, which registered year-over-year growth of 2.2 percent, has seen incredible growth – 31.9 percent – since 2010. Brea and Lake Forest saw the second and third highest population growth since 2010, growing by 16.4 percent and 11.6 percent, respectively. Irvine's growth is attributable to its central location, master-planned communities, and reputation as one of the nation's safest cities.

Orange County's unincorporated areas, including Coto de Caza, Ladera Ranch, Trabuco Canyon and North Tustin, are expected to see dramatic population and employment growth over the next several decades, as highlighted in OCBC's *2019-20 Workforce Housing Scorecard*. This growth will be driven by increasing housing scarcity in established county cities.

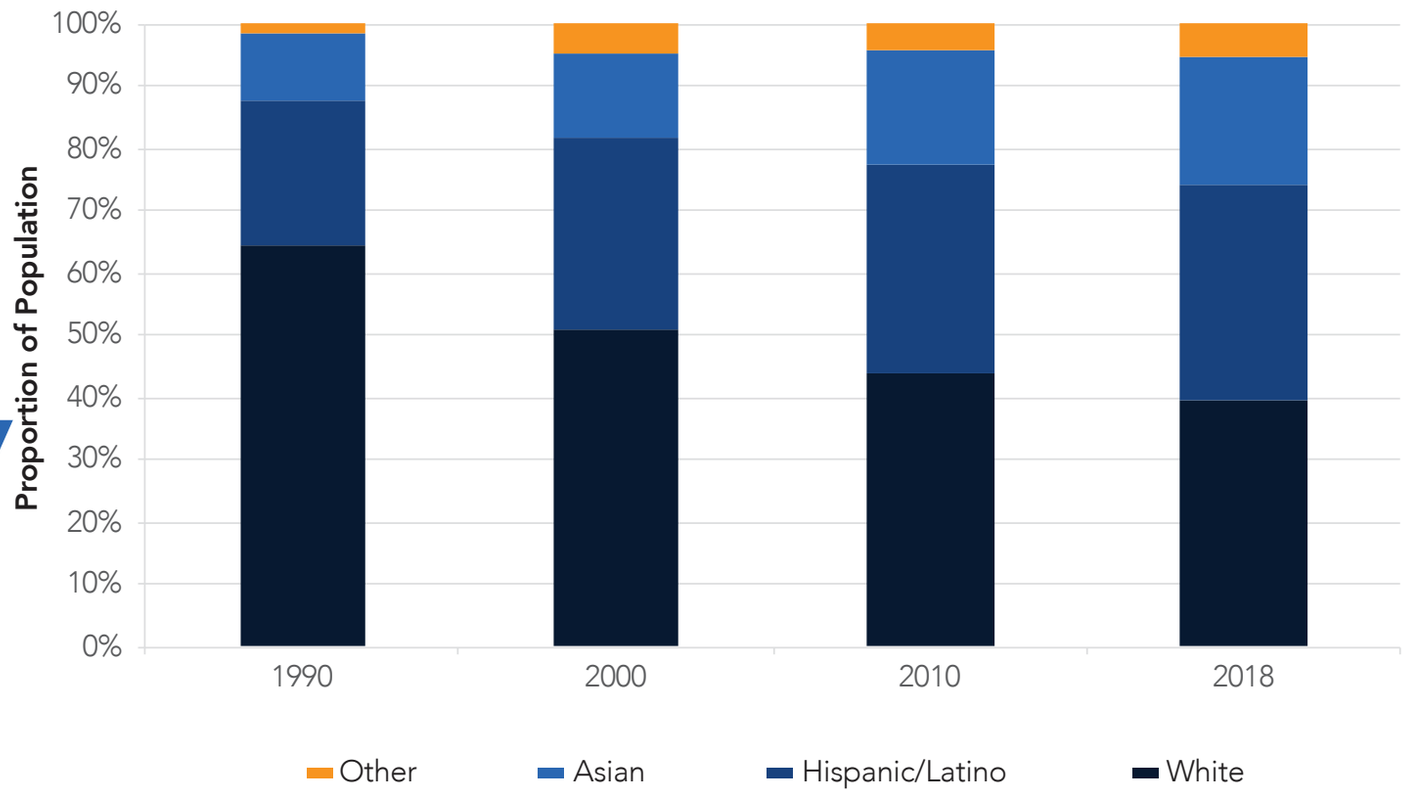
Largest 15 Orange County Cities and 2010 - 2019 Population Growth Rates



Source: California Department of Finance

Orange County has also become increasingly ethnically diverse since 1990. In 1990, as illustrated by the graph below, Whites, Latinos or Hispanics and Asians made up 64.6 percent, 23.4 percent and 10.5 percent, respectively, of the county's population; these numbers changed to 39.9 percent, 34.2 percent and 20.7 percent by 2018. While this increased diversity provides significant benefits to Orange County, it also creates a few challenges, such as pressure on the educational system to create more robust English Language Learner programs. Fortunately, as discussed in a later section of this report, county educators have generally responded well and have made major progress on this issue.

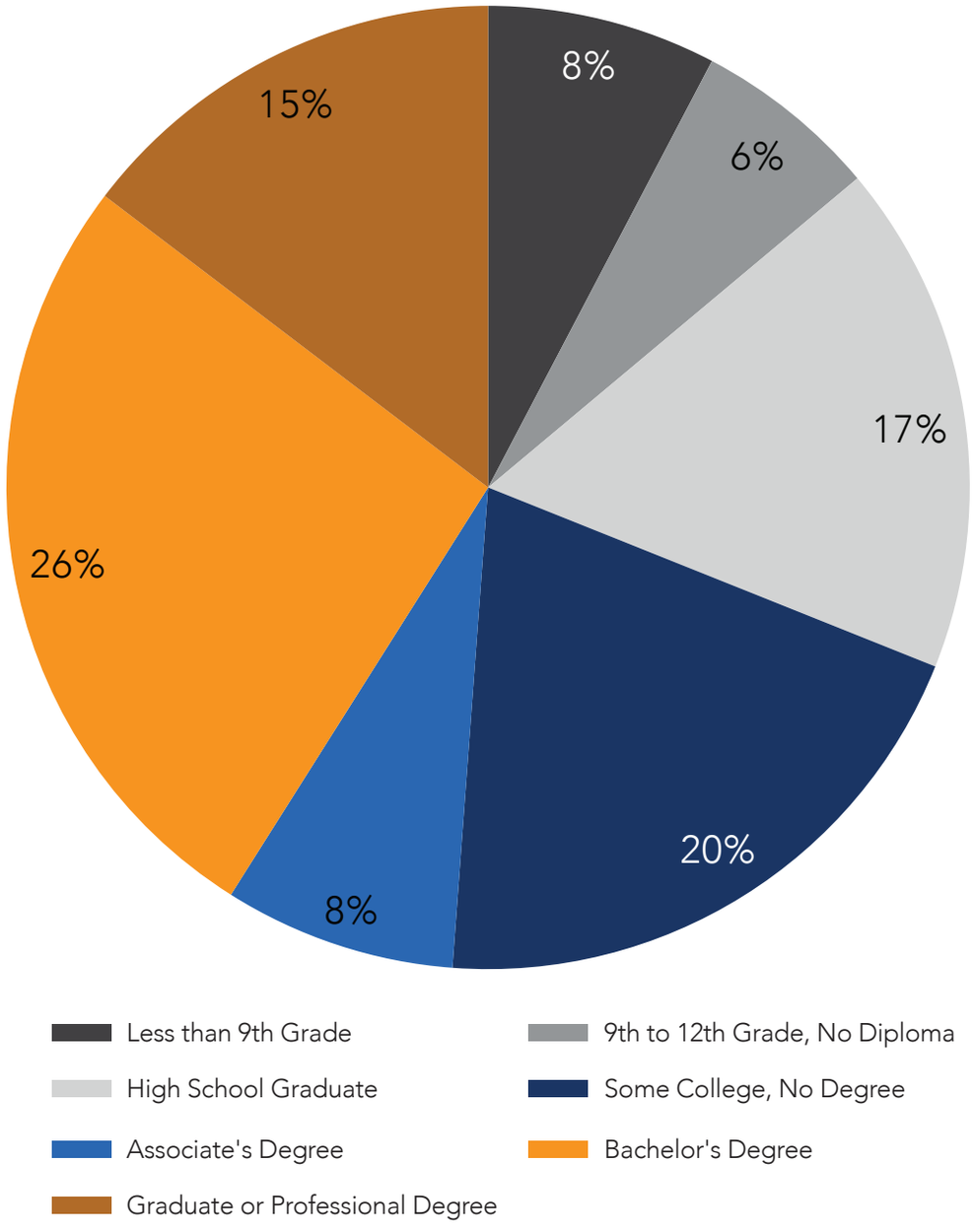
Orange County Ethnic Composition, 1990 - 2018



Source: U.S. Census Bureau, American Community Survey

The county has also seen rising rates of educational attainment, with 26.4 percent of students holding a Bachelor's degree and 14.7 percent holding a Graduate or Professional Degree in 2018, compared to only 20.4 percent and 10.4 percent, respectively, in 2000. Over the same time period, the percentage of county residents without a high school diploma decreased from 20.5 percent to 13.9 percent.

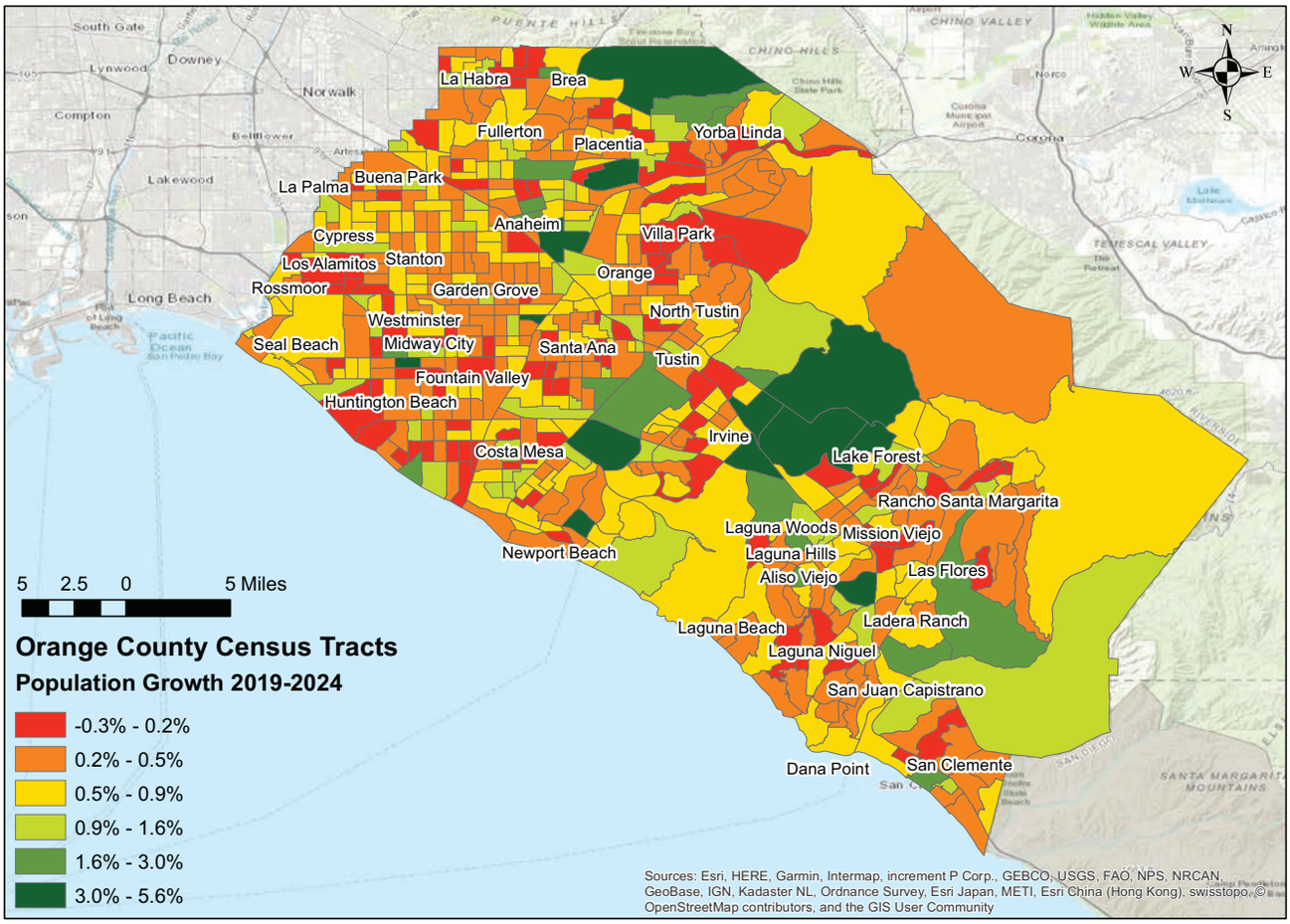
Orange County Educational Attainment of Population Age 25+, 2018



Source: U.S. Census Bureau, American Community Survey

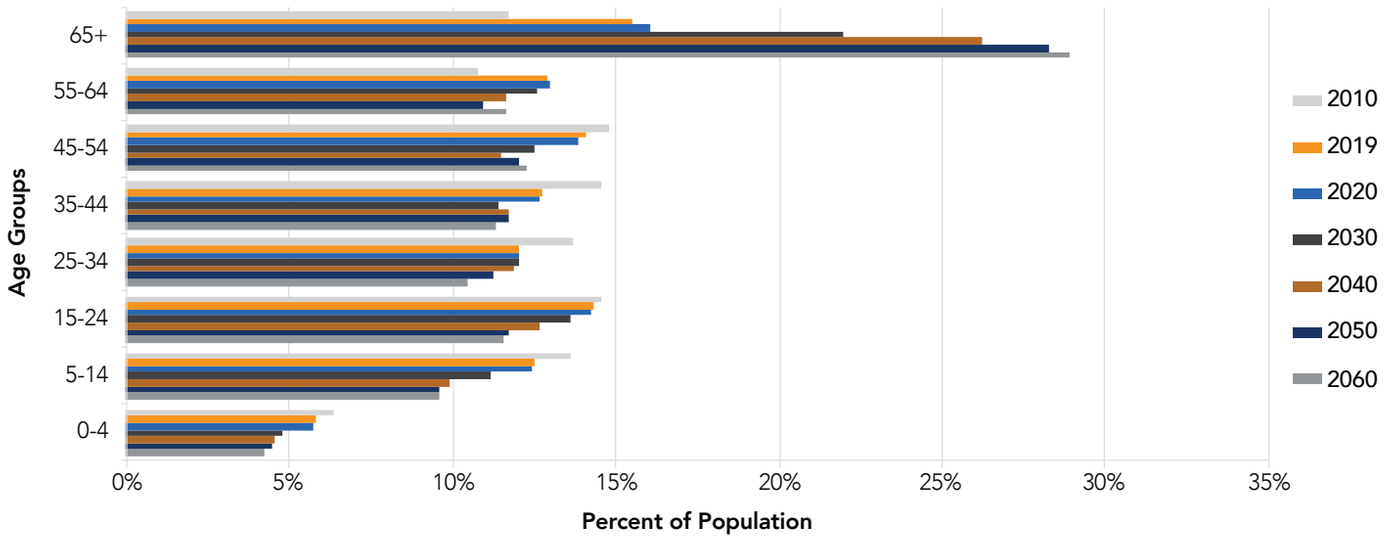
FUTURE

Population Growth Rates by Orange County Census Tracts, 2019 - 2024



As seen in the following chart, the proportion of residents aged 65+ in Orange County is expected to increase substantially between 2020 and 2040 and represent 28.9 percent of the population in 2060. Concurrently, all other population groups, with the exception of the 55 to 64 year old group, are expected to shrink, most notably the 5 to 14 age group which is expected to decline by 4 percent and the working age group (25 to 44) which is expected to decline by 3.2 percent. These trends will increase the county's dependency ratio and put significant pressure on the county's Healthcare sector.

Projected Components of Population by Age in Orange County, 2010 - 2060



Source: California Department of Finance

This trend is not unique to Orange County. Statewide, the *Seniors* age group (aged 85 and older) is expected to grow by 491 percent while *Mature Retirees* (aged 75 to 84 years) are expected to grow by 239 percent. Among comparable counties, Riverside is expected to see the largest growth of *Seniors* (716 percent), followed by San Bernardino (608 percent) and Los Angeles counties (599 percent). Los Angeles will also see dramatic declines in younger age groups, with especially concerning declines in their *College Age* group (-14 percent) and *Working Age* group (-7 percent). Orange County is expected to see no growth in its *College Age* group and only two percent growth in its *Working Age* group, which could significantly impact the county's labor market.

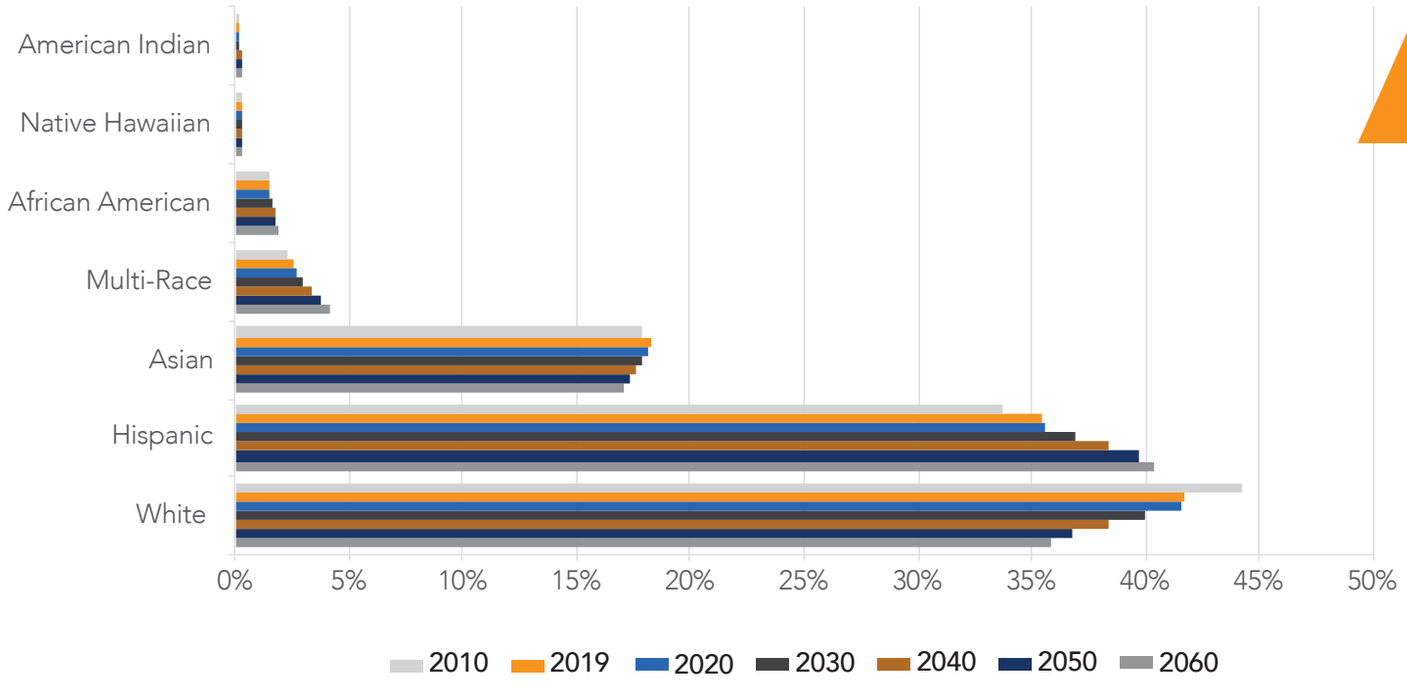
Projected Change in Proportion of Age Groups in Orange County and Peer Regions, 2010-2060

	Preschool Age (0-4)	School Age (5-17)	College Age (18-24)	Working Age (25-64)	Young Retirees (65-74)	Mature Retirees (75-84)	Seniors (85+)	Total
San Francisco	37%	60%	9%	16%	115%	267%	402%	47%
San Diego	0%	20%	15%	9%	105%	231%	429%	32%
Orange County	**-20%**	**-15%**	**0%**	**2%**	**103%**	**223%**	**488%**	**20%**
California	-7%	0%	12%	19%	126%	239%	491%	36%
Los Angeles	-33%	-27%	-14%	-7%	116%	243%	599%	13%
Santa Clara	7%	21%	44%	31%	139%	297%	610%	54%
Riverside	-7%	-1%	17%	54%	201%	295%	716%	63%
San Bernardino	11%	16%	35%	53%	172%	277%	608%	58%

Source: California Department of Finance

The California Department of Finance also projects changes in the populations of Orange County's ethnic groups. The Hispanic or Latino community is expected to grow from 35.4 percent in 2019 to 38.4 percent by 2040. It is expected to reach 40.4 percent by 2060 while the White community is expected to decline from 41.7 percent in 2019 down to 35.9 percent by 2060. Orange County's Asian community is expected to decline slightly from 18.2 percent in 2019 to 17.1 percent by 2060. All other ethnic groups, excluding Multi-Race, are expected to remain under 2 percent until 2060.

Projected Components of Population by Ethnicity in Orange County, 2010 - 2060



Source: California Department of Finance

EDUCATION AND WORKFORCE TRAINING TRENDS

Orange County educators will play a central role in preserving one of the county's central competitive advantages – its deep talent pool – in an era of significant demographic and technological change. Certificate programs and Career Education initiatives will play an especially important role in helping close the county's middle-skills gap.

INTRODUCTION

In recent years, the skills gap and various technological advances have created more positions requiring a mix of soft and technical skills, a trend that poses challenges for local educators. Both have also led to a significant focus on creating and improving programs which better align with employer expectations. Increasingly, partnerships between educational institutions and the private sector are beginning to take shape, allowing for clear communication and collaboration resulting in more robust programs which provide students with a better understanding of the current labor market. This collaboration will become even more important as technology further transforms nearly every industry in Orange County. While most collaborative programs begin in college, additional focus should be placed on programs in the K-12 environment, where appropriate skills such as coding can supplement common core programs and career fairs.

K-12 EDUCATION – PAST AND PRESENT

This section highlights six metrics in order to provide a comprehensive view of Orange County student performance:

- Dropout rates;
- Percentage of English language learners;
- UC/CSU eligibility;
- College-going rates;
- SAT scores; and
- Percentage of students taking Career Education coursework.

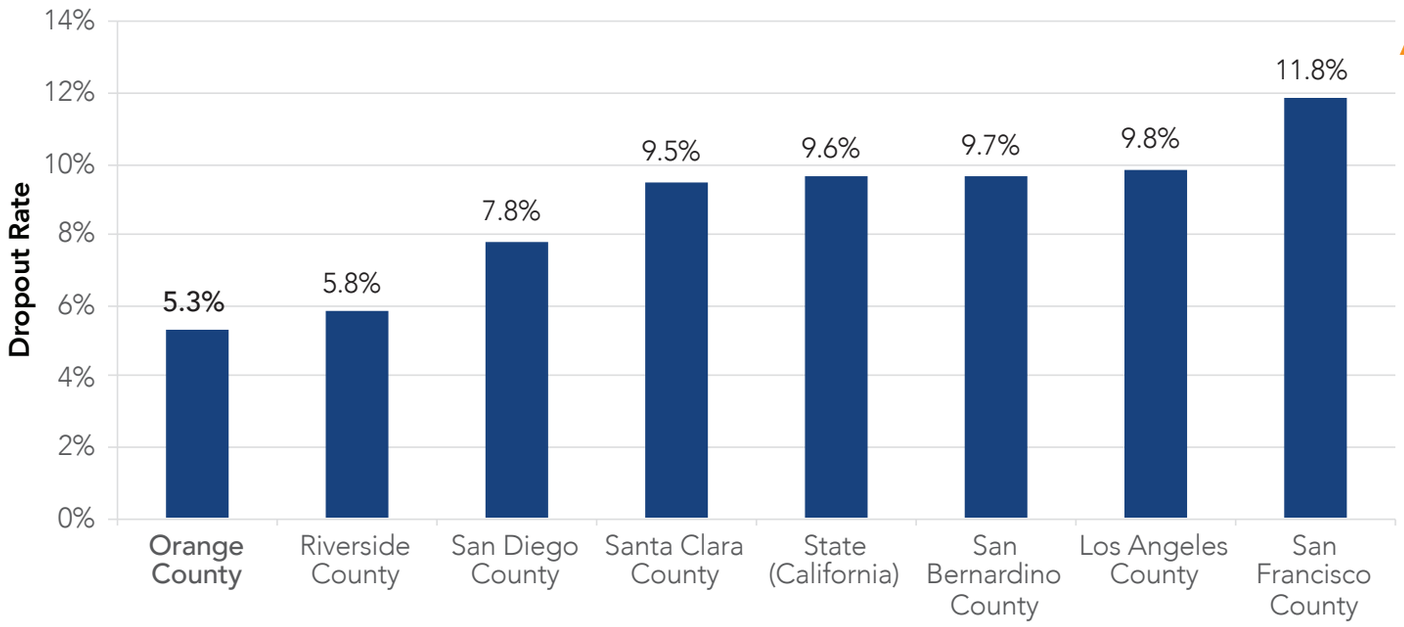
Dropout rates provide an overview of student engagement and student success during their formative high school years, which is especially important considering the strong link between education and career success.

English Language Learning (ELL) programs in Orange County have become vitally important in the last several decades due to the county's large and growing Hispanic and Latino population. English-speaking ability is a foundation for success in both education and the workplace, making the effectiveness of these programs significant for ensuring that the region has a pool of well-educated workers from which to find qualified employees. Additionally, improving the region's ELL programs will help to reduce dropout risks while increasing the likelihood these students will attend post-secondary institutions and further their education, increasing the likelihood these students will find lucrative employment opportunities after college.

The final four metrics track how Orange County's K-12 schools prepare students for the transition into higher education or the workplace. While college-going rates, UC/CSU eligibility, and SAT scores all help highlight student readiness to attend two- or four-year colleges, Career Education coursework helps determine how many students could potentially enter the workforce sooner. Trades such as pipefitters, electricians, and heavy machinery operators have all seen declining employment in recent years, impacting several local industries and forcing local employers to import workers from surrounding counties. Career Education coursework, typically followed by apprenticeships, certifications or other forms of on-the-job training, helps prepare individuals who may not need extensive college educations to join the workforce earlier, allowing them to benefit from hands-on training while also setting them on their career paths earlier in life.

Orange County enjoys one of the lowest dropout rates when compared to regional peers at 5.3 percent in 2017-2018, well below the state average of 9.6 percent. Riverside County had the second lowest rate (5.8 percent), followed by San Diego County (7.8 percent) and Santa Clara County (9.5 percent).

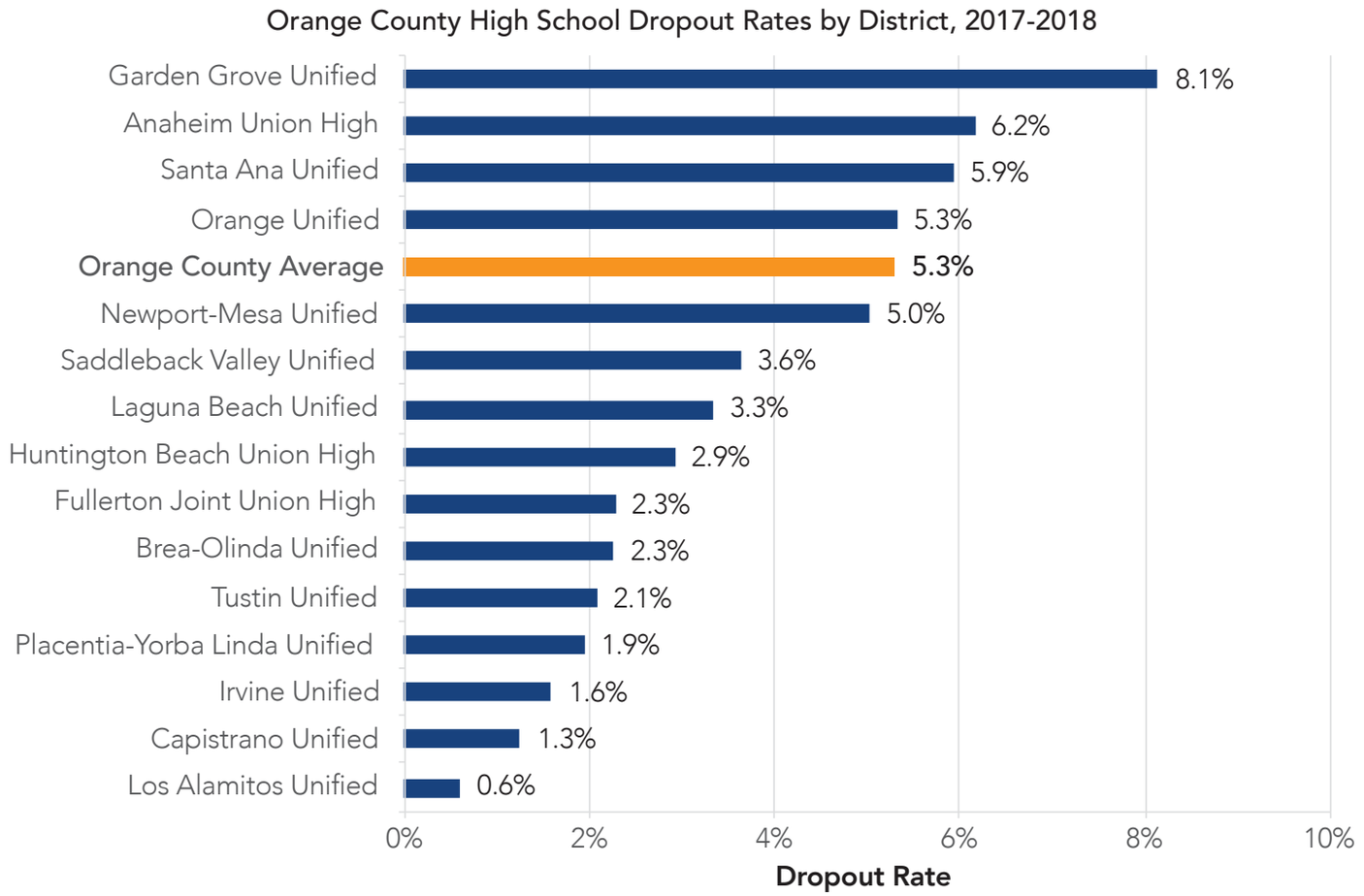
Four-Year Adjusted Cohort Dropout Rate for Orange County and Peer Regions, 2017-2018



Source: California Department of Education, Data Reporting Office

The way dropout rates are measured has changed in recent years. In previous years, students who transferred to an adult education program were subsequently removed from their cohort and counted as dropouts. Now, students who transfer to an adult education program will be counted as dropouts unless they graduate from an approved adult education program within the cohort outcome period and with acceptable written documentation. This new methodology allows published dropout rates to more accurately reflect students who have transferred out and failed to complete their programs within the cohort outcome period.

Among Orange County school districts, Garden Grove Unified had the highest dropout rate at 8.1 percent, followed by Anaheim Union High (6.2 percent), and Santa Ana Unified (5.9 percent). Los Alamitos Unified had the lowest dropout rate in 2017-2018 at 0.6 percent, followed by Capistrano Unified (1.3 percent) and Irvine Unified (1.6 percent).

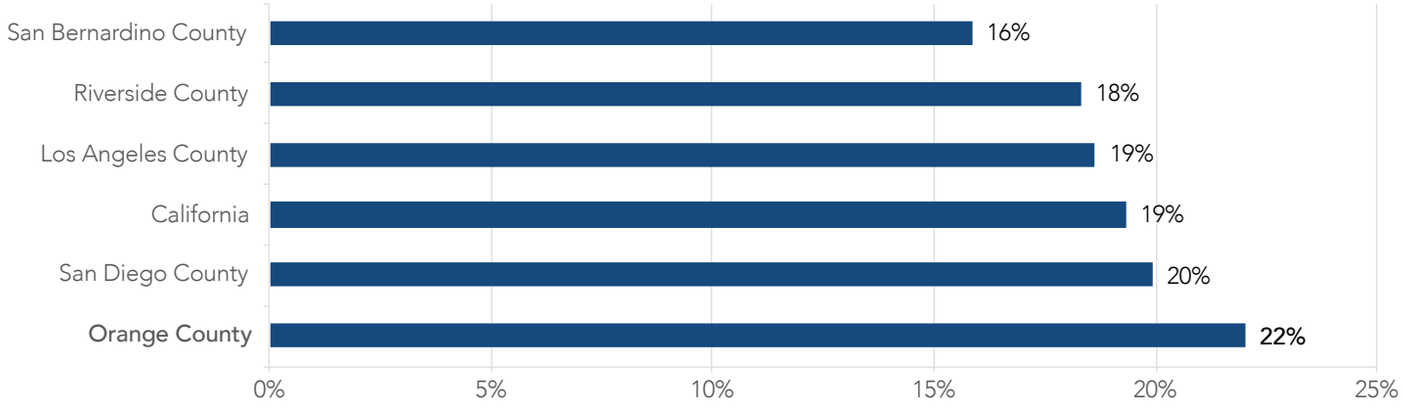


Source: California Department of Education, Data Reporting Office

Highlighting the various dropout rates by district in the region helps identify struggling areas and allocate resources to where they are needed most. Unfortunately, many of the districts with the highest dropout rates are located in economically struggling regions, indicating dropout rates may reflect schools or programs which are ill-equipped to properly support students. In particular, families in these areas may lack resources such as tutoring and other tools, and tend to have a higher proportion of English Language Learners (ELL); additional investment in these areas could have a major positive impact on the county as a whole. Many of these ELL students also have foreign parents who themselves struggle to speak English, reducing the likelihood that they can rely on their parents for academic support.

Orange County has recently had a higher percentage of ELL students than neighboring counties and the state as a whole; 22 percent of Orange County students are classified as ELL students compared to 19.3 percent at the state level. This rate has declined from 2018's rate of 23.5 percent, indicating the continued progress made by county ELL programs.

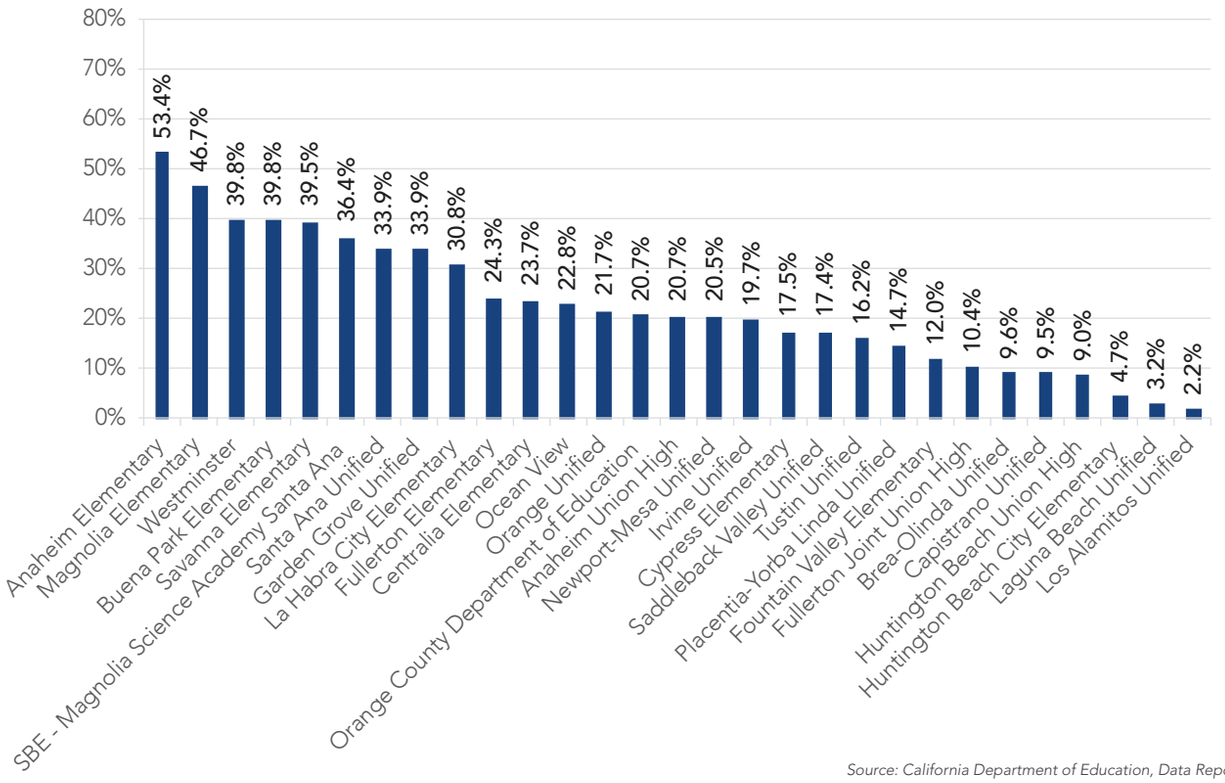
English Leaners as a Percent of Total Enrollment, 2019



Source: California Department of Education, Data Reporting Office

School districts located in more central, northern portions of the county tend to have higher rates of ELL students compared to southern coastal cities such as Laguna Beach. Anaheim Elementary had the highest proportion of ELL students in 2019 at 53.4 percent followed by Magnolia (46.7 percent) and Westminster and Buena Park Elementary (both at 39.8 percent).

Percent of English Learners by District in Orange County, 2019



Source: California Department of Education, Data Reporting Office

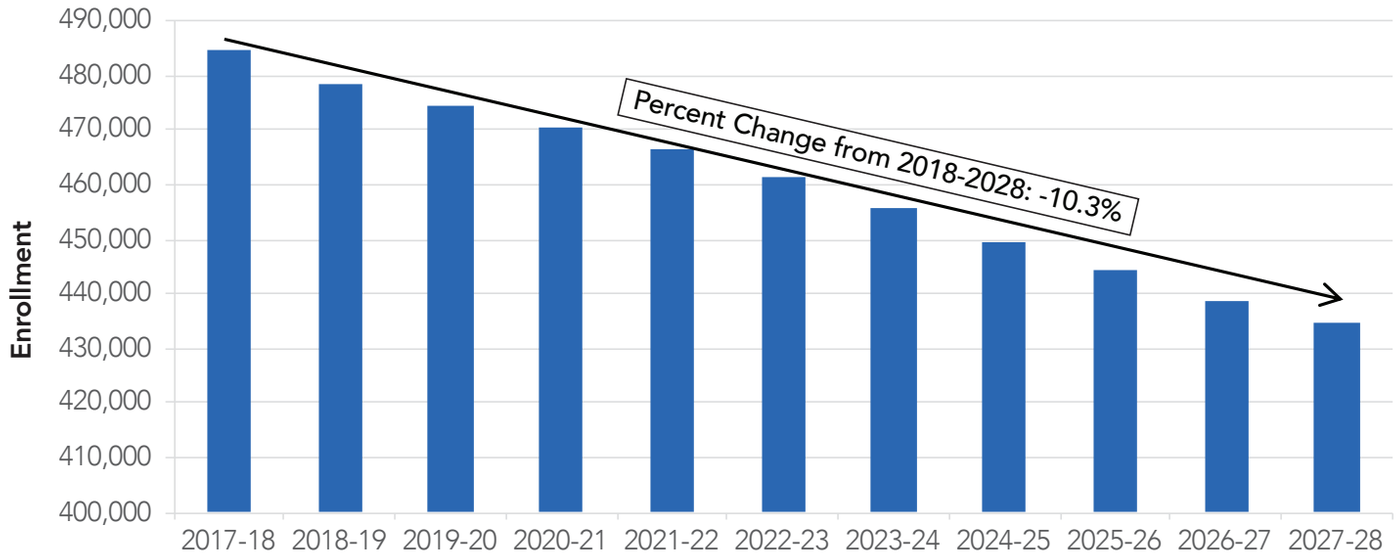
Together with Orange County's low dropout rates, the reduction in ELL students and the high proportion of UC/CSU graduates reflect a strong K-12 educational system. In addition to measuring the ELL student population, the California Department of Education also tracks the number of Fluent English Proficient students and "Redesignated" students. Fluent English Proficient students speak a language other than English at home but test as proficient in English on the English Language Development Test, while Redesignated students include those who were originally classified as ELL but who have been reclassified as proficient in English. While the number of both ELL and Fluent English Proficient students has decreased in recent years, this likely reflects an overall decrease in enrollment rather than the effectiveness of these programs. Overall, enrollment levels have declined from 497,116 in 2015 to 478,823 in 2019, a reduction that is expected to continue over the next decade.

FUTURE

As previously touched on, Orange County's shifting demographics will lead to fewer younger residents, which will have a significant effect on the county's K-12 enrollment. Total enrollment is expected to decline by 10.3 percent between 2018 and 2028, a loss of more than 49,000 students. This quick reduction will require a shift in educational strategies as class sizes shrink, a trend which will become more prevalent in different cities requiring innovative strategies to mitigate impacts. Additionally, shrinking enrollment translates to smaller graduating classes, which then may impact the number of college graduates in a region and subsequently may impact the region's future workforce.

This trend, like several others covered in this report, reflects Orange County's lack of affordable housing, as many young families have been priced out of the area. While wages are increasing and home price growth has slowed, additional support should be provided to extremely low and low-income groups throughout the county to ensure they can afford to live here and enjoy the county's high quality of life.

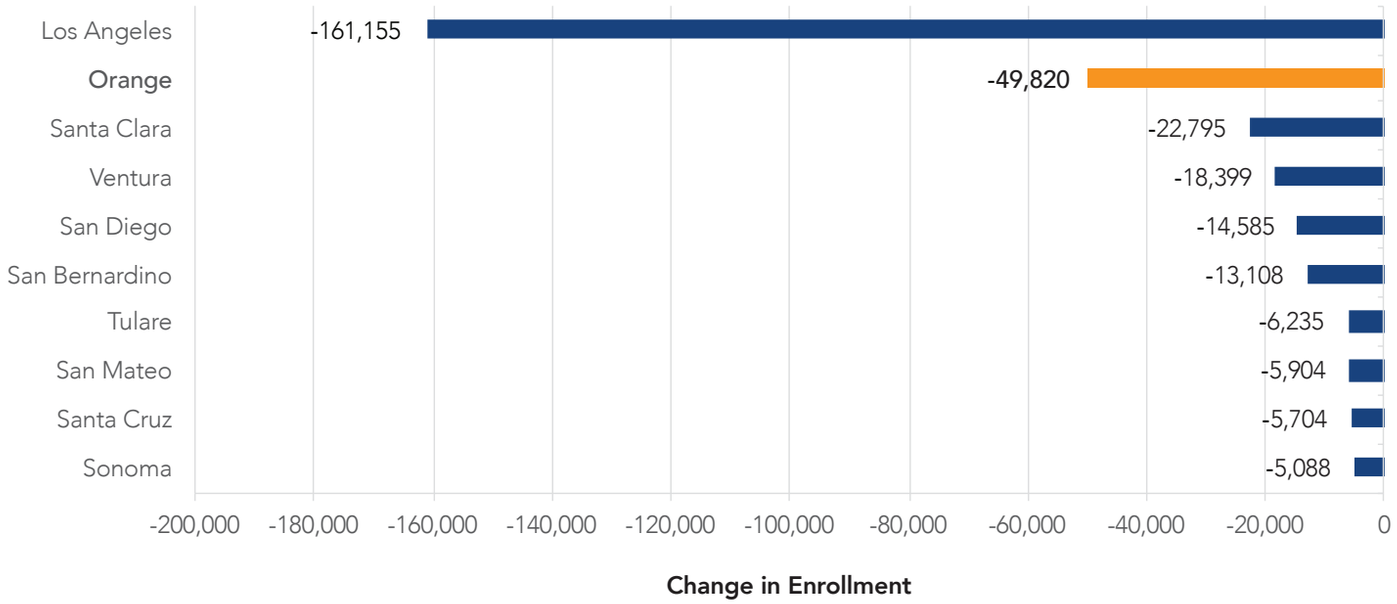
Orange County Projected K-12 Enrollment, 2018-2028



Source: California Department of Education, Data Reporting Office

Schools across the nation will have to adjust to declining K-12 enrollment. While overcrowded classrooms were a major talking point in the early 2000s, smaller classrooms – and their potential impact on school funding – will become a major conversation for educators going forward.

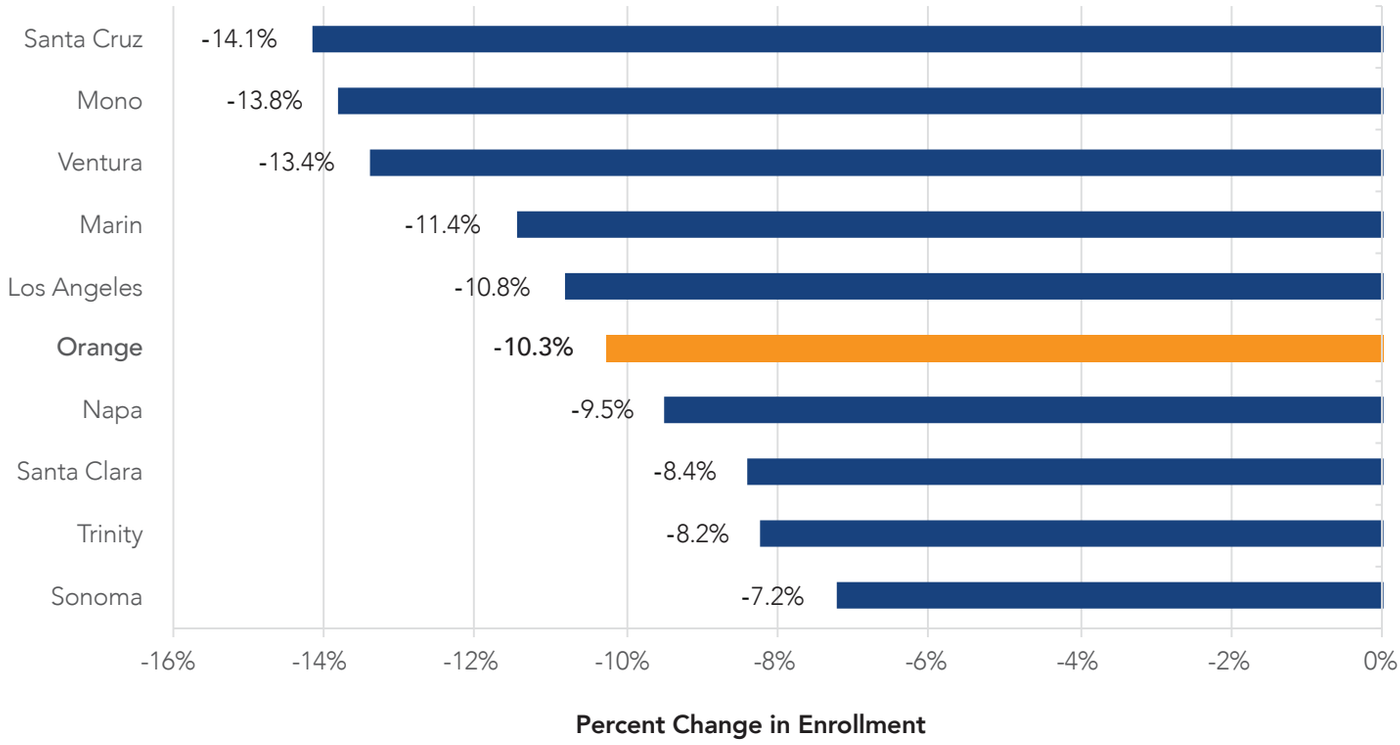
Top 10 California Counties by Reduction in Total K-12 Enrollment, 2018-2028



Source: California Department of Education, Data Reporting Office

For example, the California Department of Finance estimates that Los Angeles County will have 161,155 fewer students in 2028 than in 2018. While Orange County is predicted to lose just under 50,000 students over the same time period, this is still enough to have a significant impact on its K-12 education system. While Los Angeles and Orange Counties are expected to lose the largest numbers of students, Santa Cruz, Mono and Ventura counties are expected to lose a larger percentage of students, as seen in the following graph.

Top 10 California Counties by Percent Reduction in Total K-12 Enrollment, 2018-2028



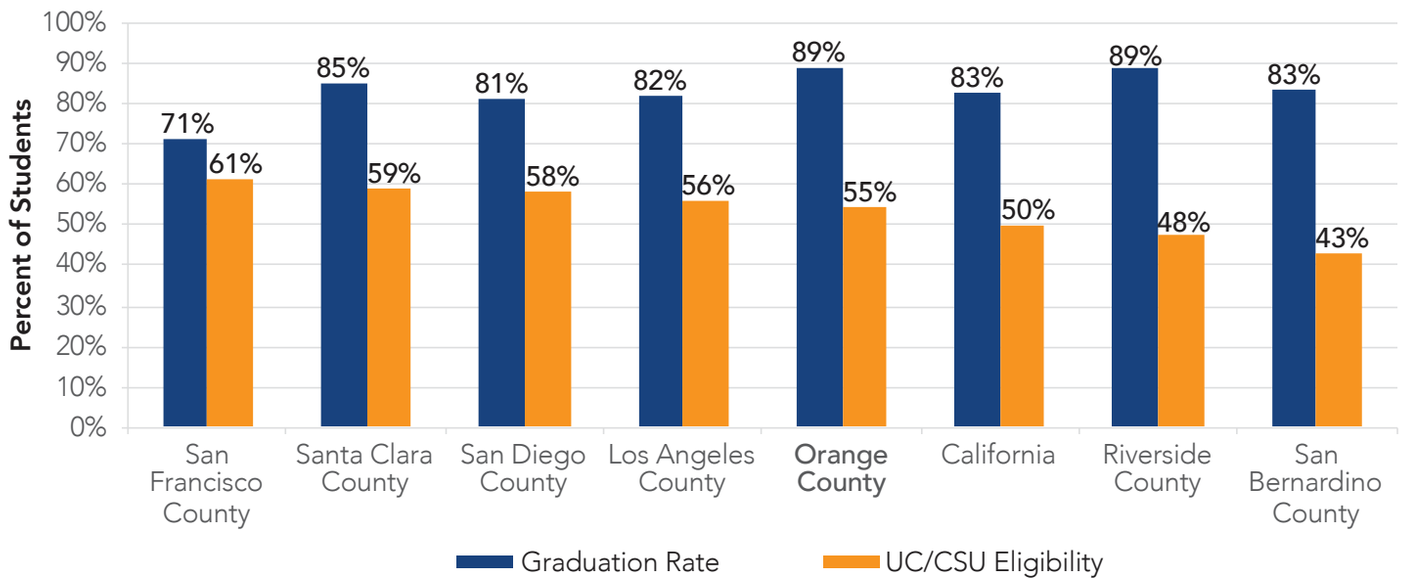
Source: California Department of Education, Data Reporting Office

SPECIAL FEATURE: COLLEGE READINESS

Colleges and universities provide students with the skills, knowledge and abilities necessary to gain entry into and advance through their careers. Orange County is home to two schools in the prestigious University of California (UC) and California State University (CSU) systems, which are recognized by employers across the country and across the world, as well as several prominent private universities such as Chapman University and Brandman University.

One key strength of Orange County's K-12 educational system is its ability to prepare students for college. This contributes to the region's deep, highly educated talent pool, which helps it attract and retain employers. The California Department of Education tracks the number and percentage of students graduating with eligibility for entry into UC and CSU college systems providing a gauge of college readiness for high school graduates. Orange County is at the top in terms of enjoying one of the highest graduation rates for high school students (89 percent), while 55 percent of Orange County high school graduates were eligible for entry into the UC/CSU system, a rate that has steadily increased over the past two decades.

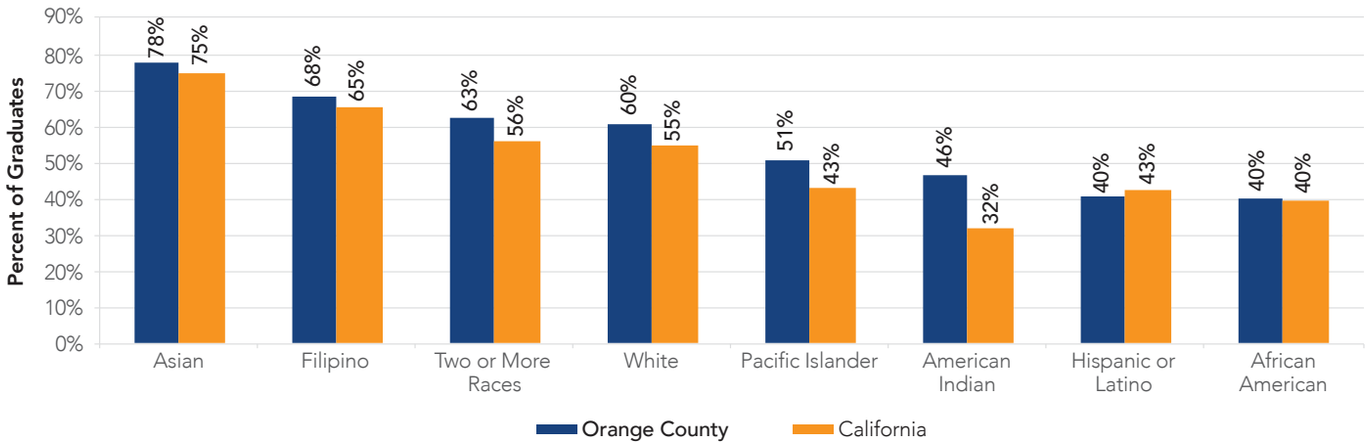
Graduation Rate and UC/CSU Eligibility for Orange County and Peer Regions, 2017-2018



Source: California Department of Education, Data Reporting Office

Examining UC/CSU eligibility by ethnicity in Orange County, Asians had the highest UC/CSU eligibility at 78 percent, followed by Filipino students (68 percent) and students of Two or More races (63 percent). Nearly all Orange County ethnic groups beat out statewide UC/CSU eligibility rates except for Hispanic and Latinos, suggesting that, while the region's K-12 ELL programs are successful, more can be done to ensure entry into UC or CSU programs.

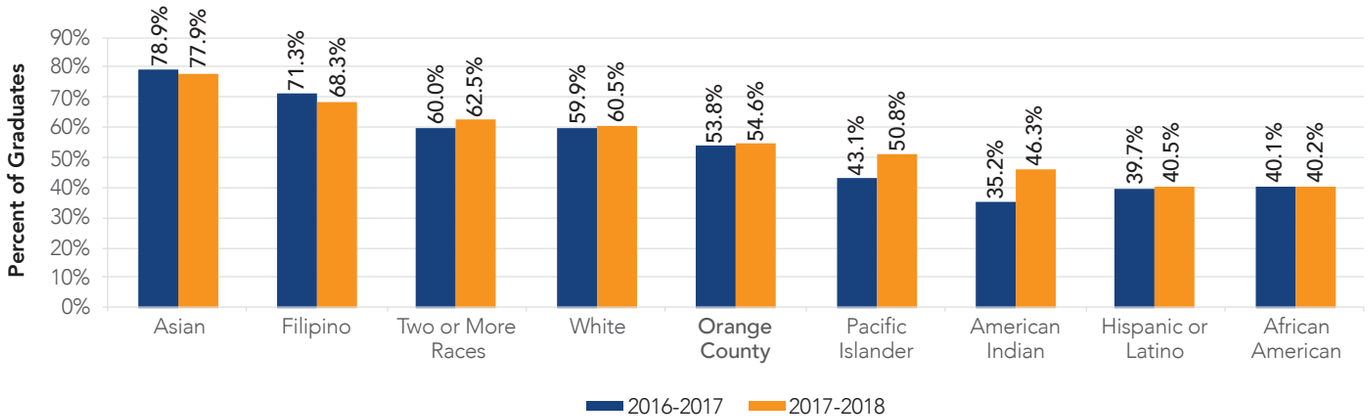
UC/CSU Eligible Graduates by Ethnicity in Orange County and California, 2018



Source: California Department of Education, Data Reporting Office

Orange County high school graduates' UC/CSU eligibility rate has increased by approximately 0.8 percent over the past year. Ethnic groups which saw the largest increase year-over-year included the American Indian cohort which jumped by 11.2 percent and the Pacific Islander cohort which jumped by 7.7 percent.

Orange County Graduates with UC/CSU Eligibility by Ethnicity, 2016-2017 and 2017-2018



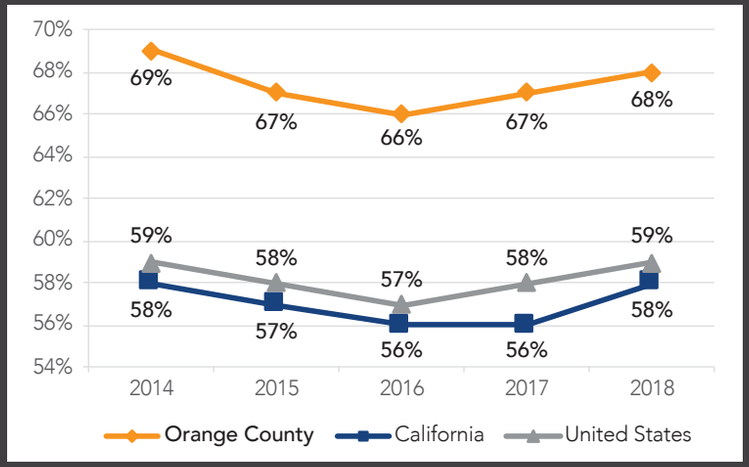
Source: California Department of Education, Data Reporting Office

ADVANCED PLACEMENT IN ORANGE COUNTY

Orange County high schools offer more than 30 Advanced Placement (AP) courses intended to prepare students for college-level work. AP exams are graded on a scale of 1 to 5, with scores of 3 and above indicating a pass, and student performance on these exams provides another important tool for measuring students' academic achievement and readiness for higher education. While policies regarding AP courses, exams, and grading scales may differ from one college to the next, many students earning passing scores are able to obtain course credit from those universities, giving them a head start on their college careers.

As seen on the chart here, the percentage of students passing AP exams has remained relatively steady at the county, state and national levels over the past several years; Orange County has consistently and significantly outperformed state and national averages over this time frame. Overall, in 2018, 68 percent of AP exams in Orange County had a score of 3 or higher, compared to 58 percent at the state level and 59 percent at the national level. If translated to rankings at the state-level, Orange County would rank 5th overall in 2018 behind only Connecticut, New Jersey, New Hampshire, and Utah; California as a whole ranked 29th.

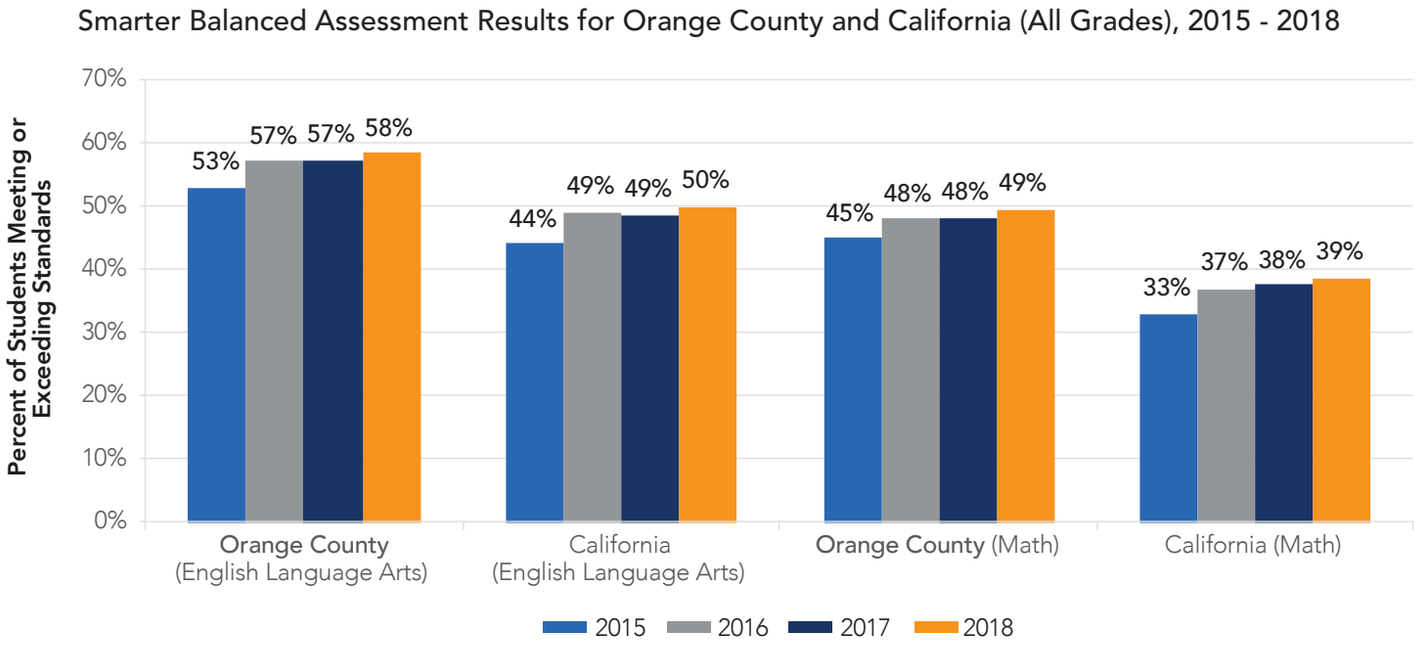
Percent of AP Exams with a Score of 3, 4, or 5 in Orange County, California and the United States, 2014-2018



Source: Orange County Department of Education

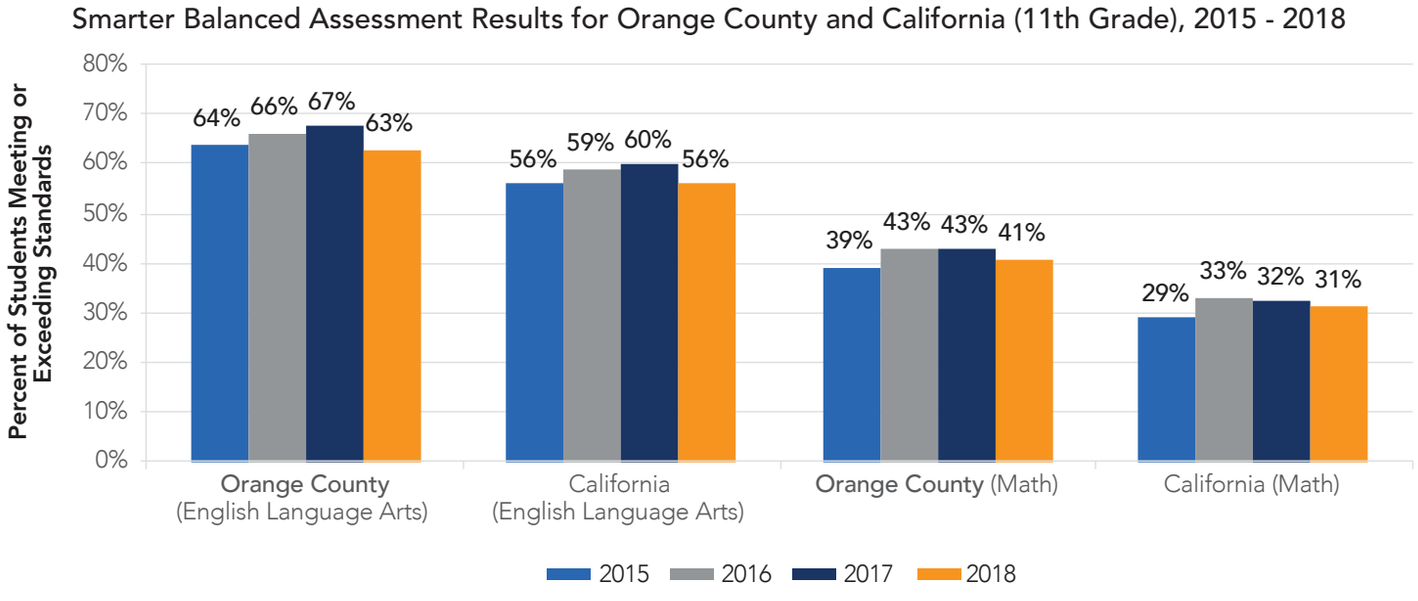
The California Assessment of Student Performance and Progress (CAASPP) system provides an end-of-year assessment of student progress towards college and career readiness aligned with the Common Core State Standards for English Language Arts/ Literacy (ELA) and Mathematics. In general, students meeting or exceeding the CAASPP achievement standard are prepared for success in college coursework.

Orange County has significantly outperformed the rest of the state in CAASPP performance for the last several years, as seen in the following graph. Since 2015, the percentage of county students meeting or exceeding ELA standards has increased from 53 to 58 percent, while the percentage of students meeting or exceeding Mathematics standards has increased from 45 to 49 percent; these scores also improved at the state level but remain well below Orange County's performance. While Orange County continues to outperform the state, it still has significant room for improvement, especially considering that less than half of students meet or exceed the CAASPP Mathematics standards.



Source: California Department of Education, CAASPP

The California Department of Education found that the percentage of county 11th graders meeting or exceeding ELA standards decreased from 64 percent in 2015 to 63 percent in 2018. Despite this small decrease, Orange County students continue to outperform state averages, as seen in the following graph.



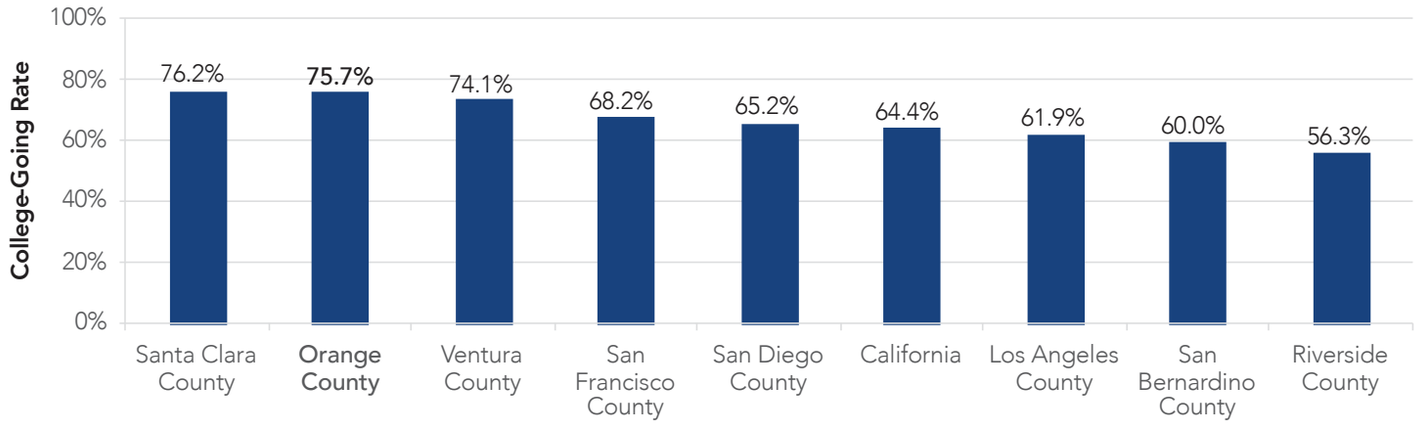
Source: California Department of Education, CAASPP

ORANGE COUNTY COLLEGE-GOING RATES

The California Department of Education provides 'college-going' rates for students across California, including the overall college-going rate, and the number of students going to colleges in the University of California and California State University systems, California Community Colleges, other private colleges, and colleges out of state. This data helps illustrate how well students are prepared for post-secondary education.

In Orange County, 75.7 percent of high school graduates enrolled in college in the 2017-2018 school year, second behind only Santa Clara County (76.2 percent) among its peers. Orange County's college-going rate was 11.3 percentage points higher than the state average.

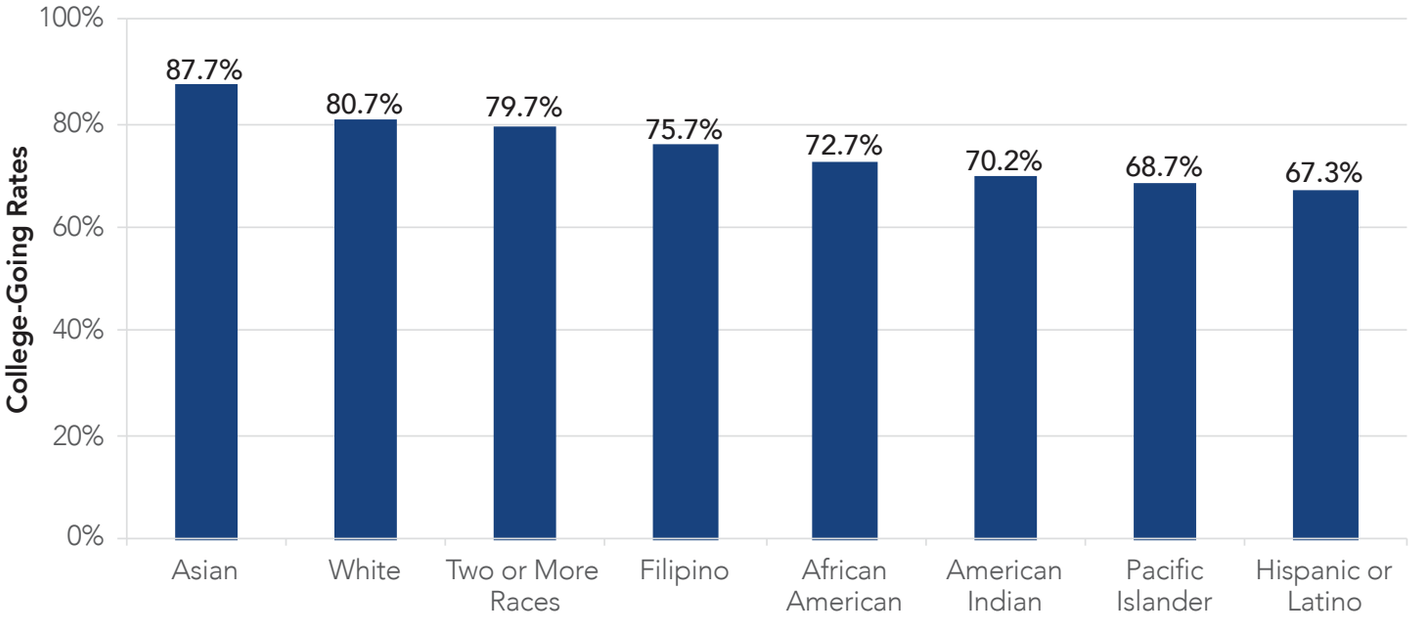
College-Going Rates by Orange County and Peer Regions, 2017-2018



Source: California Department of Education, Data Reporting Office

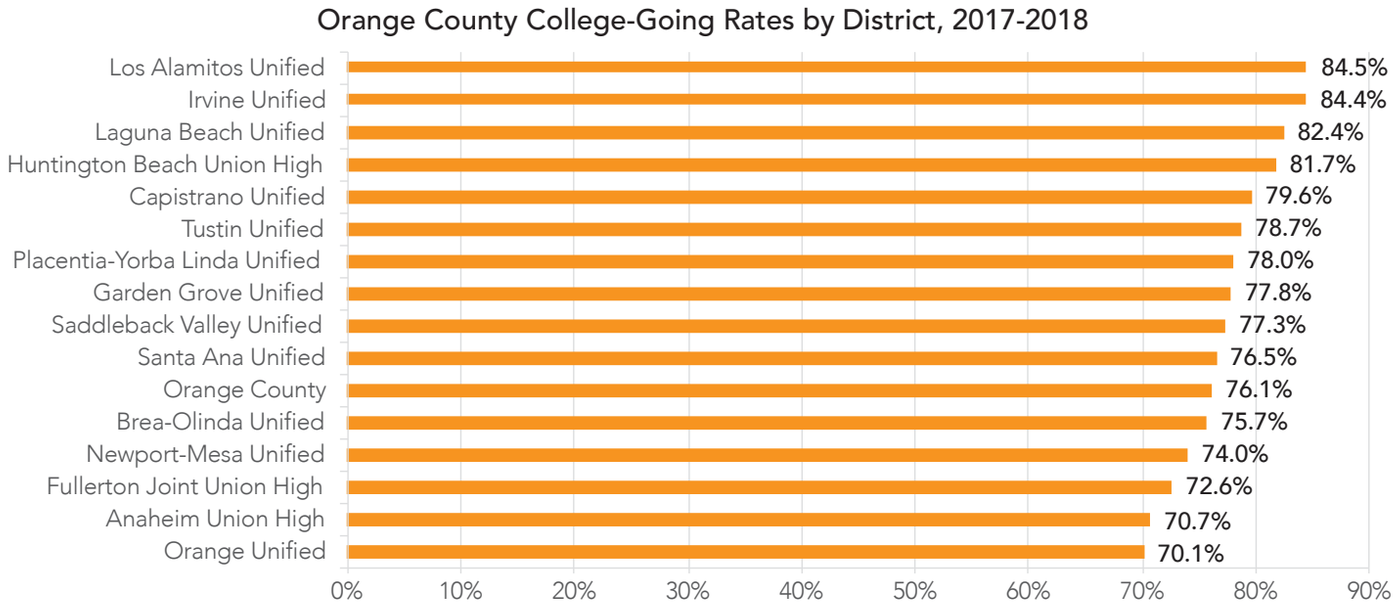
Looking specifically at Orange County college-going rates by ethnicity, the Asian cohort had the highest college-going rate at 87.7 percent, followed by the White cohort (80.7 percent) and Two or More Races (79.7 percent).

College-Going Rates by Ethnicity in Orange County, 2017-2018



Source: California Department of Education, Data Reporting Office

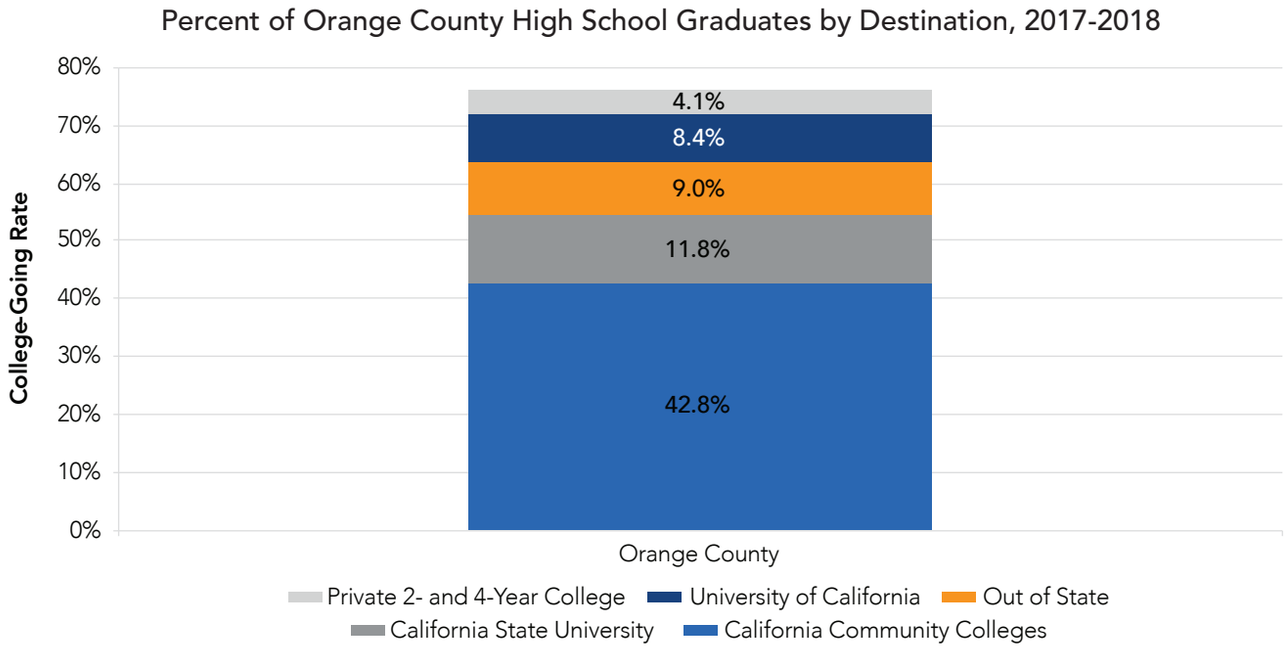
By district, students at Los Alamitos Unified were most likely to go to college, at a rate of 84.5 percent, followed by Irvine Unified (84.4 percent) and Laguna Beach Unified (82.4 percent). Orange Unified had the lowest college-going rate at 70.1 percent. Many of the school districts with the highest college-going rates also happen to be in more affluent areas of the county, suggesting college preparation courses, which may be out of reach for lower-income students due to their high price, have a major impact on whether students go to college.



Source: California Department of Education, Data Reporting Office

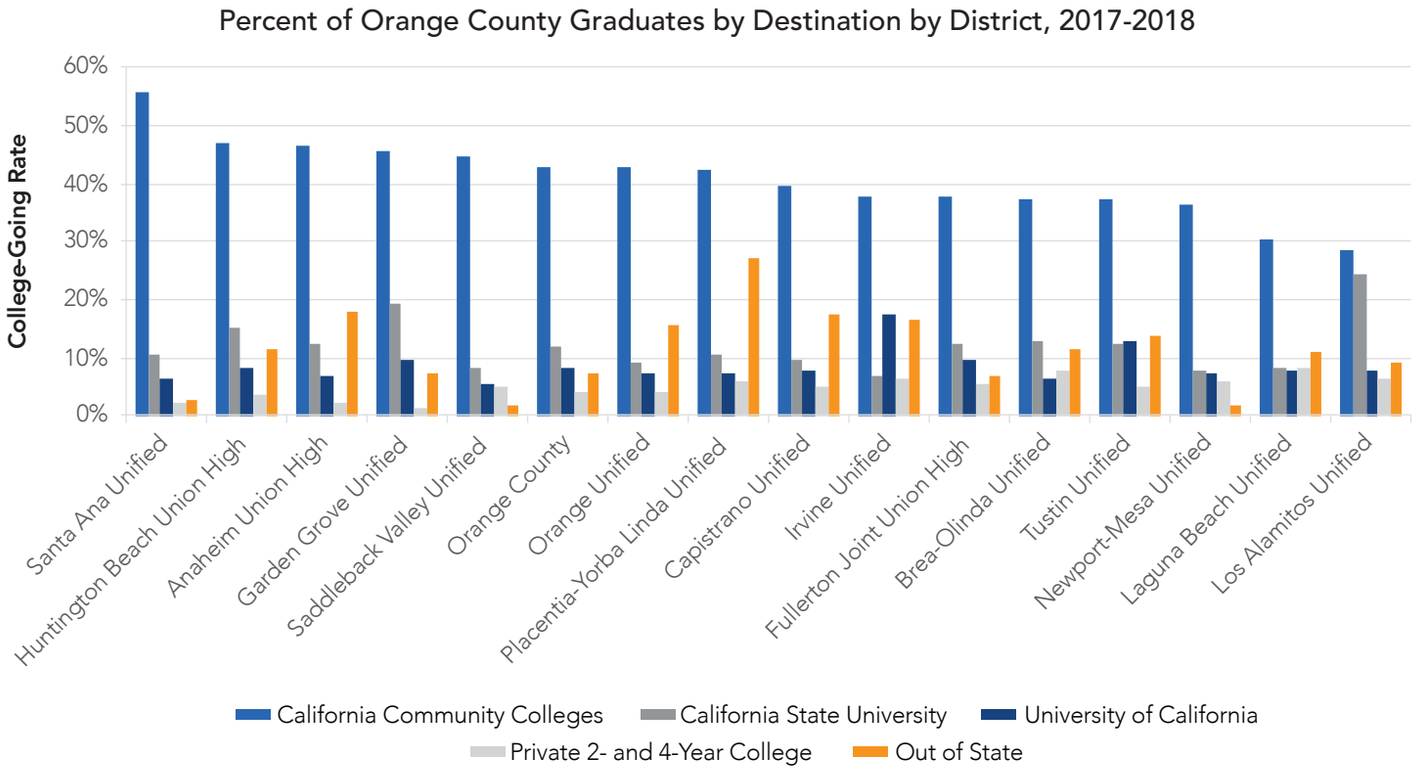
In addition to the significant benefits conferred by four-year colleges and universities, community colleges are providing more and more attractive alternatives for many prospective students. Community colleges offer a variety of options, from Associate's degrees for transfer to certificates and Career Education programs, as well as help students enter the workforce with less investment in time and money than four-year college degrees. Career Education coursework at community colleges will be spotlighted later in this report.

The largest percentage of college-bound Orange County students are heading to California Community Colleges (42.8 percent), followed by the California State University system (11.8 percent) and out of state institutions (9.0 percent). Interestingly, of the approximately 20,000 Orange County graduates meeting UC/CSU requirements, only 7,672 are currently enrolled at UC/CSU institutions.



Source: California Department of Education, Data Reporting Office

The chart below illustrates college choices by Orange County high school district. Across the county, community colleges are by far the most popular destinations, likely due to their lower overall costs and the flexibility they offer students to either specialize in certain subjects or eventually transfer to four-year institutions. Los Alamitos Unified had a comparatively high rate of students going to California State University systems, while Irvine Unified had the highest rate of students going into University of California systems, most likely due to its proximity to the University of California, Irvine. Placentia-Yorba Linda Unified had the highest rate of students going to out-of-state 2- and 4-year colleges and universities.



Source: California Department of Education, Data Reporting Office

ORANGE COUNTY SAT PERFORMANCE

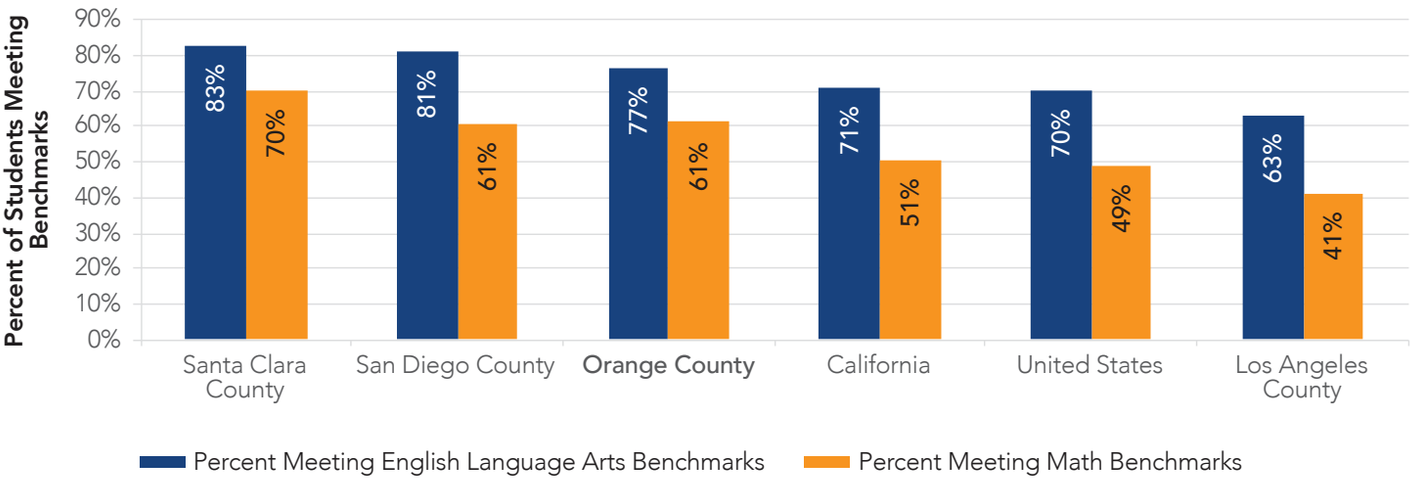
The College Board made sweeping changes to the content, format and scoring of the SAT test in 2016 in order to better measure overall student performance and ensure the content reflects material and subjects which students will encounter in college and in their professional lives. As more and more colleges and universities do not require SAT or ACT testing due to perceived unfairness between students from affluent and less affluent backgrounds, the College Board has indicated additional, controversial changes may come by 2020. The College Board has indicated the addition of an "Adversity Score" will be included by 2020 which will provide a score of up to 100, measuring or gauging potential socioeconomic advantages or disadvantages students have which may impact their scores.

While not directly impacting actual SAT scores, this Adversity Score or Index will be based on the proportion of students at a school who are eligible for free or reduced lunch, housing instability, and educational status. As students from more affluent families may be able to afford better schools or SAT preparation classes which provides them with a significant advantage over less affluent students, the Adversity Score is meant to level the playing field and provide universities and colleges with additional background information on students. While controversial, many support the inclusion of an Adversity Score as it may provide more students from less affluent areas better chances at entering prestigious universities, further enhancing their ability to progress through their careers and improve their quality of life.

Statewide SAT scores have declined over the last several years. In Orange County, the percentage of students meeting ELA benchmarks declined from 79.7 percent in 2017 to 76.7 percent in 2018; this number declined from 72.3 percent to 71.0 percent at the state level. San Diego County was one of the only regions measured which saw improvement as its ELA benchmarks increasing from 80.8 percent to 81.3 percent.

Approximately 53 percent of Orange County high school seniors took the SAT in 2018 compared to just 48.3 percent of all California students. In terms of scores, 76.7 percent of Orange County students met ELA benchmarks compared to 71 percent at the state-level. 61.2 percent of Orange County students met Math benchmarks compared to just 50.7 percent state-wide. While Orange County was able to outperform both state and national benchmarks, it trailed San Diego and Santa Clara counties.

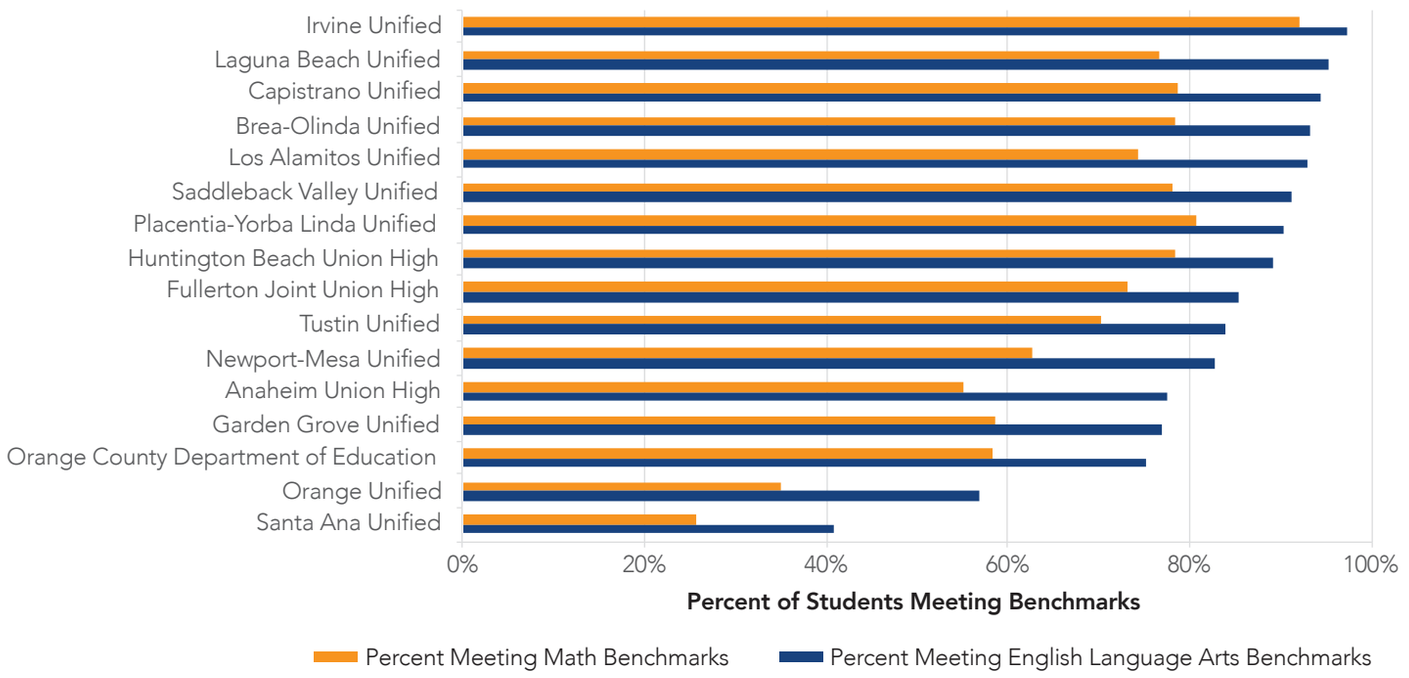
SAT Student Performance by County, 2018



Source: California Department of Education, Data Reporting Office

Among Orange County school districts, Irvine Unified was the top performer in both ELA and Math Benchmarks at 97.2 percent and 92.2 percent, respectively. Laguna Beach Unified and Capistrano Unified were not far behind, with 95.4 percent of Laguna Beach Unified students and 94.4 percent of Capistrano Unified students meeting ELA benchmarks; Irvine Unified and Laguna Beach Unified school districts performed best on the Math benchmark as seen below. In general, more affluent parts of the county tended to have higher scores, likely as a result of more access to and ability to afford SAT preparation courses and other resources often unavailable to students in less wealthy areas.

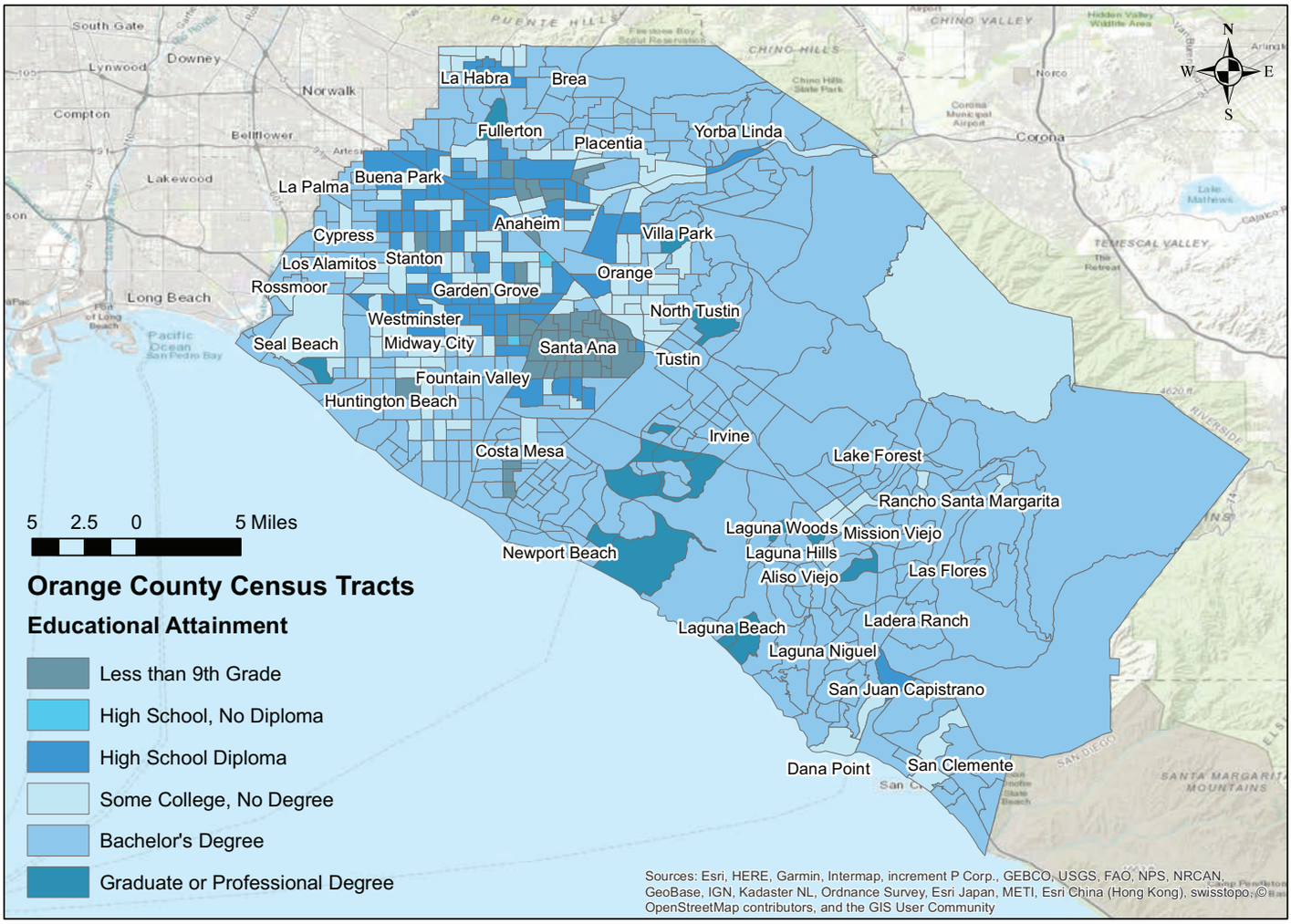
Percent of Students Meeting English Language Arts and Mathematics Benchmarks by Orange County School District, 2017-2018



Source: California Department of Education, Data Reporting Office

While the new SAT format is still being assessed, Orange County educators should understand these changes and their impacts so that they may better prepare students for the test and ensure more individuals are prepared for the rigors of college courses.

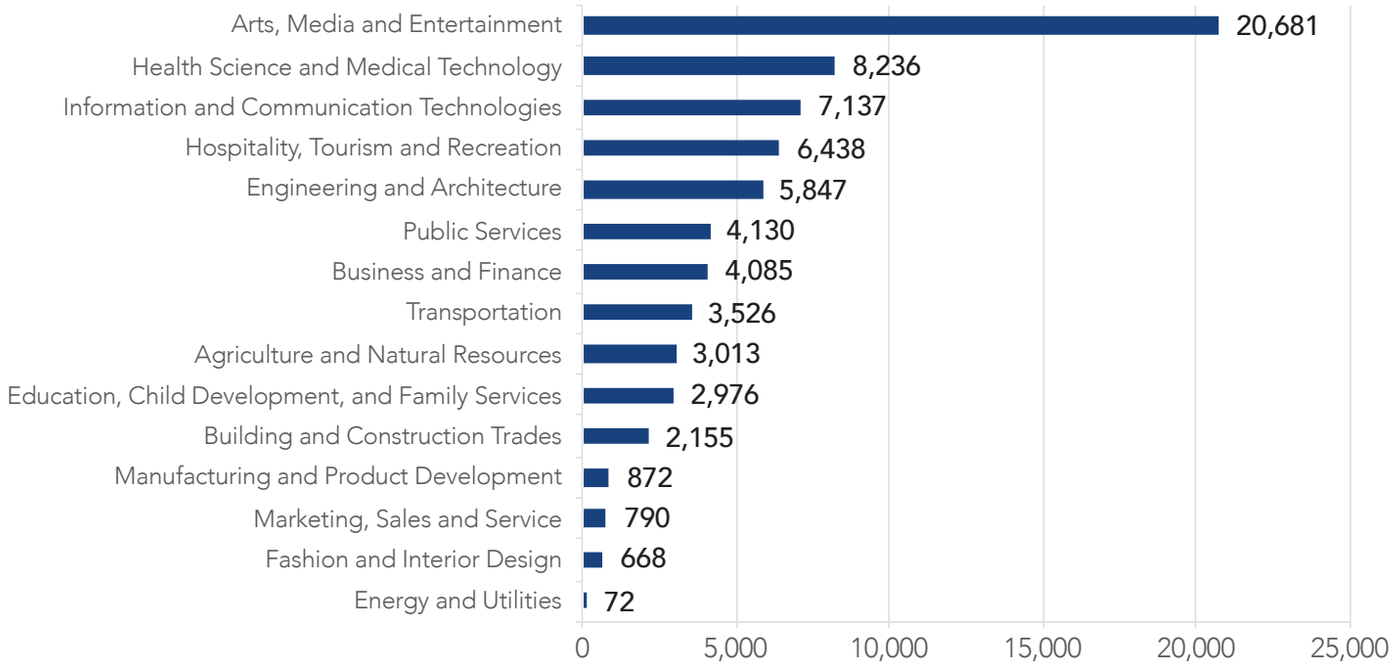
Dominant Level of Educational Attainment by Orange County Census Tracts, 2018



Next to overall academic performance, another important metric for Orange County high schools is Career Education enrollment by subject. Career Education courses provide students with a real-time look at the features and characteristics of particular occupations or industries which, in turn, allows students to gain a better understanding of their potential career paths after graduation. Additionally, Career Education enrollment can give educators insight into potential college enrollment by subject and workforce development professionals insight into which fields will see a large and growing demand for potential workers. With this information, courses can be tailored to student demand while businesses can predict how many potential employees with relevant experience will graduate in the region.

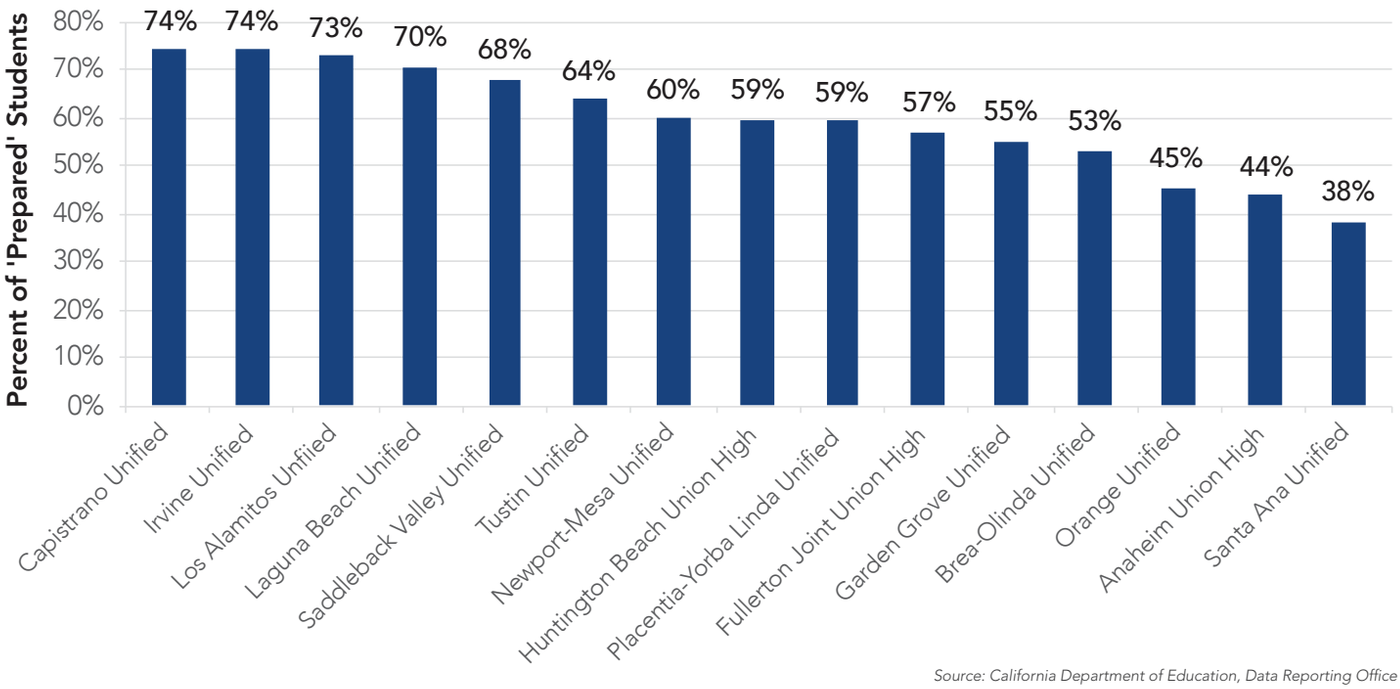
In Orange County, a large majority of Career Education students were enrolled in Arts, Media and Entertainment, followed by Health Science and Medical Technology and Information and Communication Technologies. Reflecting Orange County's industry specialties – Tourism, Healthcare, and Information Technology – student enrollment in these sectors suggest that the Orange County labor market will be continually replenished by students with relevant work experience in currently in-demand industries.

Orange County Career Education Class Enrollment by Subject, 2017-2018



Source: California Department of Education, Data Reporting Office

Percent of Students in Current Year Graduation Cohort Who Earned 'Prepared' on the College/Career Indicator, 2018



Source: California Department of Education, Data Reporting Office

FUTURE

As Orange County's demographic and economic landscape continues to evolve, it is imperative that educational institutions understand these shifts and how to prepare students for them. The recent change to the SAT test highlights how the education community is responding to these shifts. The SAT experienced its first major revamp in 2005 when the point scale was increased to 2400 and a written essay was required. In addition to a return to the traditional 1600-point scale, the redesigned SAT is an attempt to link the exam more closely to the work high school students encounter in the classroom. Additionally, to address perceived advantages of students who can afford costly SAT test preparation courses, the College Board announced a new partnership with Khan Academy to offer free online practice problems and instructional videos.

The new SAT is designed to be more reflective of knowledge required for smooth progression within the college system and through the labor force. While only time will tell whether or not this new format is more or less effective, ensuring that all students, even those unable to afford costly college preparation courses, have a fair shot at entry into the college of their choice is a move in the right direction. As the economy and workforce continues to shift, there will likely be further modifications to testing and admission standards, including the SAT, in the future.

UC/CSU eligibility rates provide another example of a major progress for Orange County high schools. County students' eligibility rates, as previously mentioned, reached an all-time high last year, a testament to the effectiveness of local educators and administrators. Preparing Orange County high school students for success at the post-secondary level will become even more important going forward, as higher educational requirements strongly correlate with both career success and jobs resistant to automation.

SPECIAL FEATURE: EMERGING TECHNOLOGIES AND CAREER EDUCATION AT ORANGE COUNTY'S COMMUNITY COLLEGES

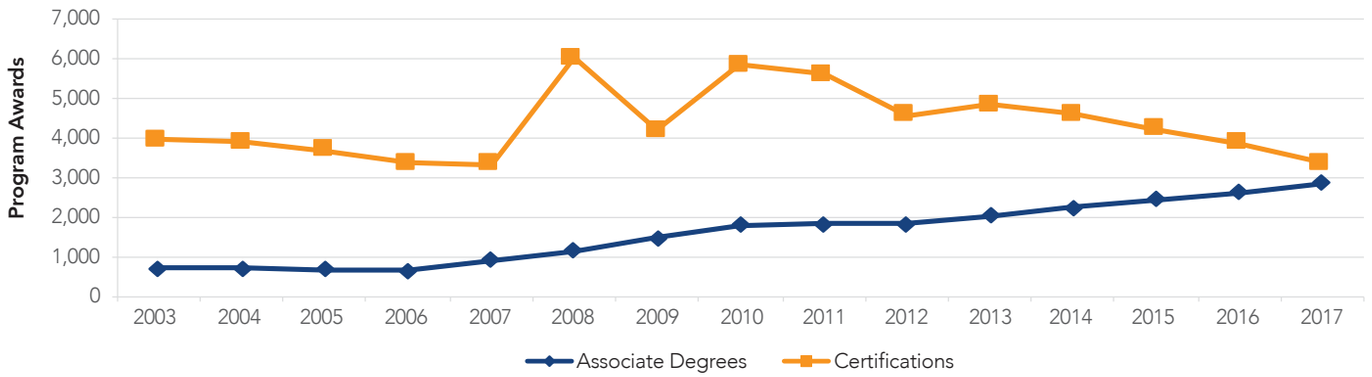
As highlighted in Orange County Business Council's *Future Built 2019: The Growing Importance of Community Colleges to Orange County's Economy* report, California's 114 community colleges play a significant role in STEM (Science, Technology, Engineering and Mathematics) education at the state level. Orange County is no different with STEM-related Associate degrees rising steadily since 2003 and totaling 2,843 program awards in 2017, representing 11 percent of the state total. Included in these STEM program awards are Health Professions and Related Programs, a discipline representing over half of all Associate degrees granted in the region as the industry itself has exploded throughout the county and state.

STEM-related certifications, which include Health-related certifications, peaked in 2008 at just under 6,000 before gradually decreasing over the past decade to 3,340 in 2017. The massive jump in certifications from 2008 to 2011 was largely a result of the recession spurring many individuals to return to school in order to improve their marketability to local employers, with that big jump being primarily experienced in Healthcare-related fields – resulting from the dramatic expansion of Orange County's Healthcare industry.

More than **142,000** California Community Colleges students are on track to receive a degree or certificate this year, an all-time record.

48 PERCENT of UC STEM students transferred from California Community Colleges.

Orange County STEM-Related Associate Degree and Certification Awards, 2003-2017

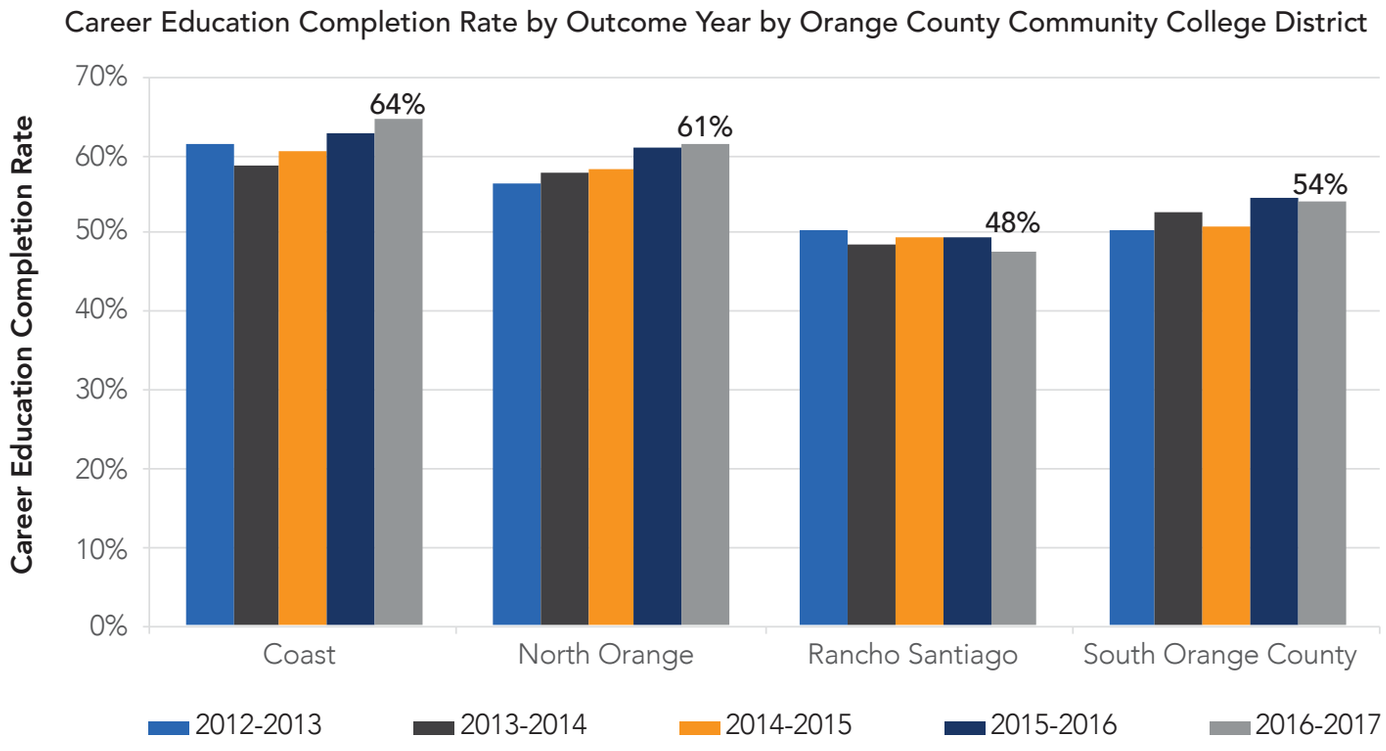


Source: Economic Modeling Specialists International

In many cases, community colleges are able to adapt to the needs of a rapidly changing labor market much more quickly than their four-year counterparts, making them essential to many cutting-edge industries. "Nimble" perfectly describes the unique role that community colleges can play in today's labor market. They simply offer the best option to prepare students for employment in cutting-edge industries by providing flexible solutions in a tight labor market for both students and employers. Brian Linville, the owner of Sacramento video game developer Stigma Games, found that "students with two-year degrees or certificates were better designers than students with four-year degrees… I get far better results from the community colleges than I do the trade schools."

To that end, Career Education at Orange County community colleges has been an incredible resource for the region as it serves to prepare students for entry into gainful employment positions while also helping to reduce the skills gap currently impacting the region. Career Education provides students with the resources and knowledge to learn skills and abilities specifically tailored to certain careers and occupations, effectively allowing them to find jobs in high-wage sectors which they are already familiar with, reducing the likelihood of unemployment or underemployment. Additionally, by being specifically trained and educated in successful and innovative industry-focused programs, individuals are better able to perform their tasks and duties in occupations with cutting-edge technologies, allowing those businesses and industry sectors to expand rapidly, potentially creating localized industry clusters which help to drive overall economic activity throughout the region.

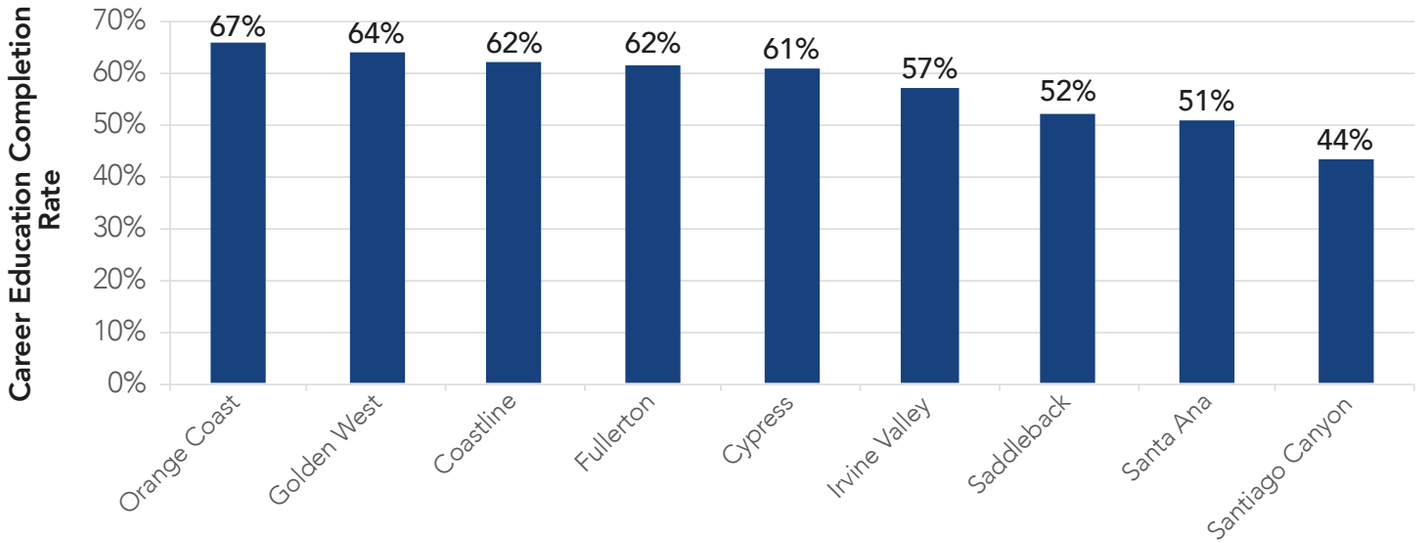
According to the California Community Colleges Chancellor's Office, Orange County community college districts have been steadily improving Career Education outcomes – that is the percentage of students who have attempted a Career Education course and earned an Associate's degree, certification, transfer to a four-year institution or achieved "Transfer Prepared." While Coastline, North Orange and South Orange County Community College Districts have all seen improvements in their Career Education completion rates, Rancho Santiago's completion rate remains below 50 percent. North Orange Community College District saw the greatest improvement over the 5 year period measured, increasing from 56.6 percent to 61.3 percent.



Source: California Community Colleges Chancellor's Office, Management Information Systems Data Mart

Looking at individual community college completion rates for the 2016-2017 outcome year, Orange Coast had the highest completion rate at 67 percent followed by Golden West (64 percent) and Coastline and Fullerton (both at 62 percent). These colleges provide students with access to a significant number of Career Education programs ranging from Information and Communication Technology to Process Technology and Energy Efficiency and Renewables. Alongside sectors such as Health Science and Medical Technology, these technical programs can help regions quickly and effectively respond to demands by the labor market and local businesses. As such, organizations involved in emerging technologies can locate and expand in the region and, through partnerships and collaboration, can find qualified individuals to fill newly available positions.

Career Education Completion Rate by Orange County Community College, Outcome Year 2016-2017



Source: California Community Colleges Chancellor's Office, Management Information Systems Data Mart

As highlighted in OCBC's *Future Built: The Growing Importance of Community Colleges to Orange County's Economy*, Cypress College provides another example of community colleges responding to employer needs for emerging technology skills. Projection mapping is a new program at Cypress College spearheaded by Media Design Arts Professor Katalin Angelov, who has a background in animation and digital media. "Projection mapping," she said in an interview for a feature on the college's website, "is a cutting edge technology which is the future of entertainment. It's the art of projecting visuals onto architectural spaces and surfaces." Professor Angelov mentions the lighting of Disneyland's Sleeping Beauty Castle at night as an example and notes that "it's used in theater production, live entertainment and in many more fields." Cypress College projection mapping students have already partnered with other departments, including music and dance, on multimedia projects, and have collaborated with Panasonic on a presentation for the college's IDEATHON competition.[15]

Orange County community colleges already play a significant role in the county's Advanced Manufacturing sector, which has a long history in the area, from aerospace and other defense industries during World War II to computers and hard drives, advanced electronics and medical devices. It currently employs more than 150,000 workers at above average wages and has the county's largest share of Gross Regional Product (GRP) at $29.8 billion or just under 12 percent of the total. The sector is currently transforming at a national and even global level, a change referred to as "The Fourth Industrial Revolution" or "Industry 4.0," which has been fueled by new technologies such as 3D printing, robotics, cloud computing and smart devices.

Two Orange County community colleges, Saddleback and Irvine Valley colleges, have taken the lead in preparing the county's workforce for Industry 4.0 employment by adding 3D printing classes. "The goal," according to Dr. Christopher McDonald, Irvine Valley College's Vice President for Instruction, "is to give the engineering students something practical, some engineering technology experience," which "makes them more employable." Irvine Valley College graduate Richard Livingston, who went on to transfer to California State University, Fullerton, concurred in an interview for the CCCCO website, suggesting that engineering students "take as many additive manufacturing courses as possible. That experience makes you that much more competitive in the job market, that's for sure."

[15] *https://www.katiangelov.com/student-projection-mappinge*

Saddleback College's Division of Advanced Technology and Applied Science embodies the spirit of planning for the future by providing students with the skills, training and knowledge necessary for the future of work. Through extensive hands on learning, students are properly instructed in a variety of fields including Advanced Manufacturing, Automotive Technology, and Electronic Technology. Similar programs exist across all Orange County community colleges such as Coastline's Electronics program which prepares students for entry into semiconductor or electro-medication fields or Orange Coast College's Electronics Technology courses such as Robotics 1 – Mechanics and Design or Automation 2 – Semiconductors Motor Control.

Overall, by offering Associate degrees, certifications, transfer degrees and career-focused programs, Orange County community colleges are uniquely positioned to address the growing demand for individuals well-trained in cutting-edge technologies and processes. Helping to drive the innovative mindset necessary for the expansion of emerging technologies, local community colleges enable the region to respond quickly to labor market shifts and disruptive technologies. In turn, this serves to continually attract avant-garde businesses into the county, driving economic development while solidifying the region as a hub where new, inventive ideas can be properly supported and developed.

IT FUNDAMENTALS VOUCHER CERTIFICATION PROJECT

The IT Fundamentals Voucher Certification Project is a collaboration between CompTIA, ITPro.TV, and Practice-Labs that enables to students across Orange County Community Colleges to obtain a free CompTIA IT Fundamentals (ITF and ITF+) Certification. This pre-career certification introduces middle school, high school and community college students to the world of IT, offering a broad summary of the sector for individuals with little to no technical experience.

While vouchers may be purchased individually, Orange County's Community Colleges can purchase $30 vouchers in bulk, reducing the overall cost and enabling them to offer this program to students at no charge. In Orange County, 1,000 vouchers have already been purchased and allocated with a pass rate of 95 percent for the 427 vouchers reported thus far. Even more encouraging is the youth pass rate of 93.8 percent. The project's second phase has already been implemented. It includes the creation of updated courseware designed to meet new exam goals as the certification exam is updated to reflect the evolving realities of the IT sector.

INTERNSHIPS:
IMPORTANT TO BOTH STUDENTS AND EMPLOYERS

Irvine Valley College (IVC) is focused on increasing internship opportunities for students by partnering with businesses. IVC's career education programs are actively placing students in student internships to provide relevant job skills, training, and experience in their major. IVC has successfully placed students in many areas, including marketing, accounting, information technology, and engineering.

To prepare students to achieve success in their future careers is the predominant goal of higher education. Internships provide an avenue for students to apply what they have learned in a professional setting; experiential learning is an important aspect of internships. Students also discover their passion for their chosen career through internships; it gives them the chance to see themselves working and advancing in their profession. Networking is key to landing full-time employment after graduation; interns can network with professionals in their field, both within and outside the organization, to learn from these experts and build their professional circle. Work training and experience in the industry can be the best advantage of internships since students can apply what they have learned, and gain professional and leadership skills to become an excellent candidate for full-time employment. Internships not only benefit the students, they also benefit the employers.

Employers have multiple advantages from offering internships. Employers can gain from the services provided by the interns without a hiring commitment. Interns may be an important part of a team, contributing substantially to the company. Talent acquisition managers use internships as a way to supplement their recruiting efforts. An intern may be a good "test employee" for future full-time positions. In fact, according to a study by the National Association of Colleges and Employers (NACE), about 65% of paid internships turn into official job offers, compared with 39% for unpaid internships; only 37% of outside applicants are hired. The internship period offers an extended period to evaluate the individual's drive, technical and professional skills to see if it matches the company's culture and expectations. Fresh ideas and innovative thinking can come out of interns since they see things differently. Internships help provide their current employees with mentorship opportunities and provides valuable leadership skills. In addition, offering structured internships helps to build a trained workforce in the industry. Hence, internships offer benefits for both students and employers.

IVC offers Cooperative Work Experience (CWE) courses in the form of internships that not only award students with compensation and college credit, but they also result in higher paying jobs that drive economic growth. As part of a CWE course, the IVC faculty in conjunction with the employer and student, create work-based learning objectives, which align with the career goals, for the student to accomplish during the internship period. Although many businesses focus on summer interns for 2-3 months, some companies are looking into longer internships that may last several months, or up to one year. IVC is working toward expanding the number of CWE opportunities for students and employers. Since 2014-15 the college has placed 536 students into CWE courses. In addition, the college has placed many students directly with employers in lieu of CWE courses.

The college is interested in continuing to develop partnerships with businesses to create new industry-driven, paid CWEs in high-need employment areas of information technology, cyber security, financial services, accounting, and other disciplines.

IVC's new School of IDEA (Integrated Design, Engineering and Automation) in Tustin is a catalyst for innovative career education. IVC is focused on the careers of tomorrow, and recognizes that every student has a different vision for their future. Our new 32,000-square-foot IDEA building boasts the latest technology, serves as the hub for this program and allows students to leave IVC with skills that can lead directly to a lucrative career. Find out more at career-education.ivc.edu

IVC draws more than 15,000 students a year. IVC is #1 in transfers to UC Irvine among all community colleges in California, and #1 in transfers to UCLA, UC Berkeley, UC San Diego, UC Davis, and UC Riverside among all Orange County community colleges. IVC also has among the highest rates of student transfers in the state, including to prestigious universities like Brown, Columbia, Caltech, Harvey Mudd, Penn, and USC. Initially established as a satellite campus, IVC became an independent institution in 1985, becoming the 105th California Community College. The college serves the residents of Irvine, Tustin, Laguna Beach, Newport Beach, Lake Forest and surrounding communities, as well as international and online students. To learn more about Irvine Valley College, visit ivc.edu

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SPECIAL FEATURE: LATINO EDUCATIONAL ATTAINMENT INITIATIVE (LEA)

OCBC's Latino Educational Attainment Initiative (LEA) is a grassroots, community-based program that educates Orange County's immigrant parents on the skills needed to navigate California's school system. For the past fifteen years, LEA trainers – volunteers from a variety of partner organizations – have empowered parents to serve as advocates for their children's education and future.

Inspired by a 2003-4 *Orange County Register* series[16] on the difficulties faced by Latino students and parents, OCBC partnered with a variety of local business, governmental and community groups to address these challenges. *Orange County Register* reporters found that a lack of understanding of the American educational system was a major problem for parents and students, an issue that OCBC and its partners sought to address through a training program for parents. Starting with a train-the-trainer model,[17] the LEA mobilized volunteer facilitators to lead the program and recruit and instruct parents.

Founding partners included:

- Orange County Business Council
- The Orange County Department of Education;
- The United Way of Orange County;
- The Roman Catholic Diocese of Orange;
- Santa Ana College;
- Santa Ana Unified School District;
- Boy Scouts of America, Orange County chapter;
- Garden Grove Unified School District; and
- Saddleback Valley Unified School District.

Additional current coalition partners include the Anaheim Elementary School District, Girl Scout Council of Orange County, Huntington Beach Union High School District, The Wooden Floor, Fullerton Collaborative and the Fullerton Joint Union High School District. Funding partners include AT&T, Chevron, Cox Communications, US Bank Time Warner Cable and the Wells Fargo Foundation. The Initiative's current Chair is Richard Porras, Assistant Vice President of External Affairs at AT&T.

[16] *"Our Children, Our Future," 12-part series published between June 2003 and March 2004*
[17] *Araque et al p. 235*

The program material is currently in its third edition with a fourth edition upcoming in fall 2019. The LEA program is offered in Korean and Vietnamese as well as English and Spanish in order to serve the needs of the county's diverse population. Taught in a variety of settings, from schools to community centers to churches, the program generally involves 10 hours of training spread over several weeks, with refreshments and childcare provided. Parents are typically recruited either by educators or by members of 30 parent coalitions in seven cities throughout Orange County.

The "10 Education Commandments," the core of the LEA Initiative, are listed below. Individual sessions generally cover three or four commandments at a time, in order, with a questionnaire and survey at the end to test the program's impact.

1. Commit as a family to be involved in school
2. Do my part in helping my child study
3. Understand how grades work
4. Learn how schools are structured
5. Learn what my child needs to graduate successfully from high school
6. Support the learning of mathematics, science, and English
7. Encourage my child to take honors and advanced courses
8. Help my child to take honors and advanced courses
9. College options are affordable
10. Teach my child to be creative, to communicate, and to view challenges as opportunities

The 10 commandments are based on a large body of research that parental engagement and parental aspiration for their child have a positive influence on academic performance. With a better understanding of the educational system and its opportunities, parents are in a position to guide and advocate for their child's academic success.

The Initiative also includes "Development Assets," a five-session program that helps parents identify ways to support their children's growth inside and outside of the classroom.

While initially focused on specific challenges faced by Latino parents and students, the LEA has since expanded to address the needs of all county parents, especially those of the county's diverse immigrant population. It has served more than 30,000 Orange County parents since it began 15 years ago; the "Ten Educational Commandments" program has been administered at 149 schools in 12 school districts. LEA has also participated in a White House initiative to improve education achievement among Hispanic students.

A fourth edition of the LEA workbook is scheduled for release in fall 2019. It will reflect recent updates to California's educational system, such as the phasing out of the California High School Exit Examination (CAHSEE), changes to Free Application for Federal Student Aid (FAFSA) deadlines, and the implementation of the English Language Proficiency Assessments for California (ELPAC).

Additionally, the upcoming LEA Trainer's Manual will formalize many of the current practices used in LEA's train-the-trainer model and will serve as a tool and guide for this process going forward.

A 2017 *School Community Journal* paper entitled "Impact of Latino Parent Engagement on Student Academic Achievement: A Pilot Study"[18] analyzed the effects of the 10 Educational Commandments program. "Results from both parent survey questionnaires and student report cards," according to the report,

> **Strongly suggest positive outcomes in three areas: increase in parents' understanding and knowledge of the U.S. educational system, greater parent engagement in their children's education, and improvement in student achievement.**[19]

Partnering with the Orange County Department of Education and the Santa Ana Unified School District,[20] researchers studied the impact of a five week-long parent training program involving ten hours of instruction. Surveys completed by these parents showed two consistent themes. First, participation in the program contributed to "a greater engagement with their children's academic achievement… parents explained that increasing their knowledge on how the schools are structured and operate, how to calculate a GPA, and how to access college opportunities has empowered and reenergized them to be more active in helping their child at home."[21]

Second, participating in the program helped parents build a social network and support system for both themselves and their children. One parent, for example, wrote that he and his wife "learned how to help our child at home" and "also met other parents. Now, we know who to call in our neighborhood when we need help and have questions."[22] Another parent who completed the program reported "I feel these learning sessions were beneficial. Learning about the 10 Educational Commandments for parents and children, I think that it is a parent's duty to care and focus closely about their child's education at school and in the family."

This is exactly the type of awareness the program is intended to create; influencing a parent to take an active role in their child's education can make a tremendous impact on academic performance and career readiness. Students whose parents participated in the program performed better in mathematics, science, and language arts, generally improving from basic to proficient in these subjects; students in the control group, on the other hand, tended to remain at the basic level.[23]

The paper ends with several recommendations for replicating and improving the LEA Initiative:

- First, "continued leadership training for parents is the next logical step,"[24] as it would encourage parents to spread the word about the program through their own social networks.
- Second, similar programs in other areas could learn from how OCBC and its partners tailored the program to specific communities through programs in multiple venues, at several different times of day and on weekends, and in several different languages.
- Finally, OCBC heading the project "offers an effective model for businesses and community organizations who are interested in engaging in partnerships with schools and other community groups to support parent engagement."[25]

By serving some of Orange County's most disadvantaged parents, providing them with the necessary tools to support their children's education, the LEA Initiative is making a significant contribution to Orange County's future workforce.

[18] *By Juan Carlos Araque, Cathy Wietstock, Heather M. Cova and Steffanie Zepeda*
[19] *Page 229*
[20] *Page 238*
[21] *Page 242*
[22] *Quoted on page 243*
[23] *Ibid, page 245*
[24] *Ibid*
[25] *Ibid*

STE(A)M – PAST AND PRESENT

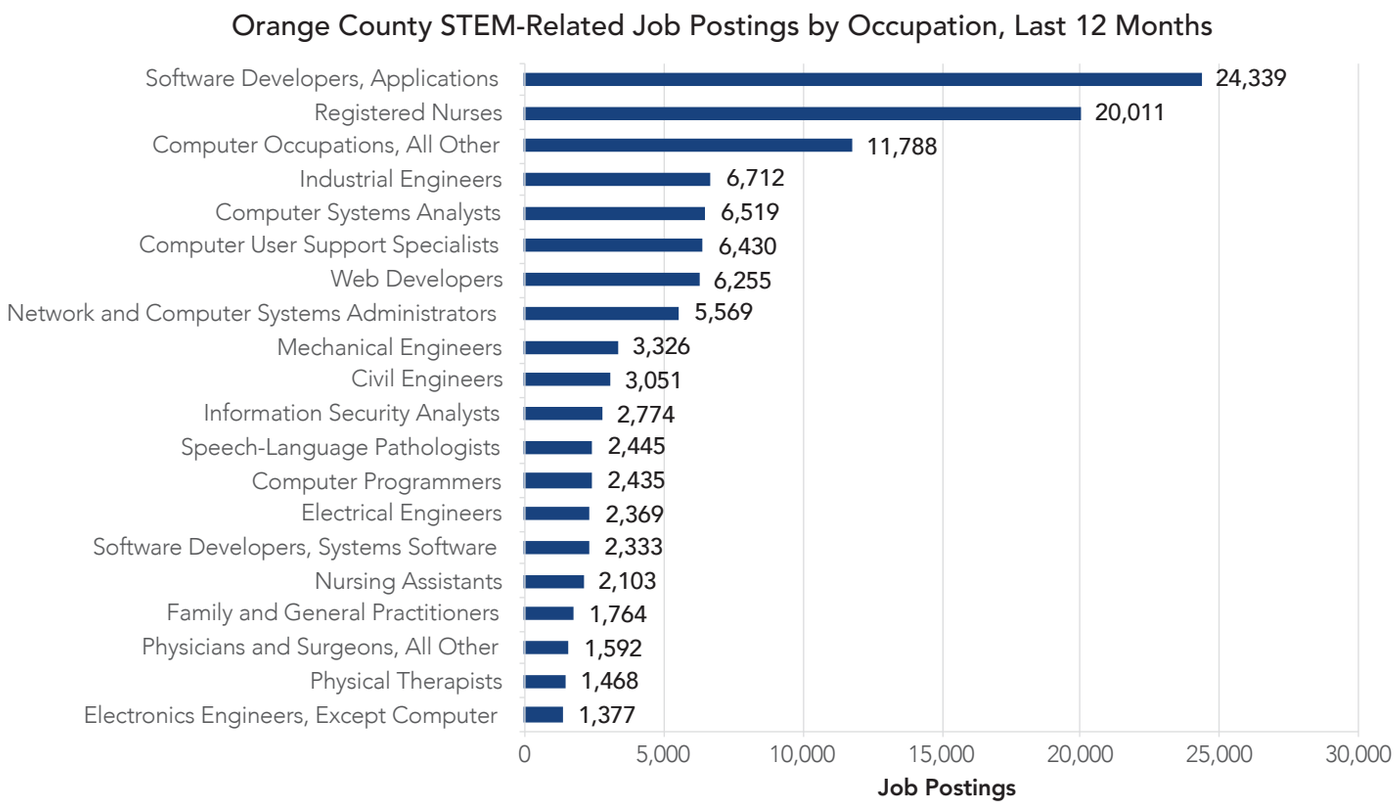
Science, Technology, Engineering and Mathematics (STEM) disciplines provide high-quality, high-wage positions in innovative fields that drive regional economic growth and activity. STEM jobs have two other significant advantages. First, the technological transformation of nearly every industry means that they will likely see significant growth in the near future and will be highly resistant to automation. Second, these jobs tend to have scalable career ladders with significant career advancement opportunities.

The Arts is another growing, defensible sector whose inclusion changes STEM to STEAM. Orange County, due in large part to a highly educated talent pool, has long been a hub for innovative STEAM-related businesses, from Disney and Blizzard Entertainment to Broadcom and Edwards Lifesciences. Successful STEAM-related programs at internationally-recognized institutions such as University of California, Irvine, California State University, Fullerton and Chapman University have played a large part in this success. The University of California, Irvine in particular is known as one of the nation's top research universities, successfully integrating the expertise of faculty, creativity of students, and collaborative initiatives with industry-leading businesses in the region. This has encouraged the formation of several industry clusters: aggregations of similar, complimentary and supplementary businesses which effectively create concentrated, innovative areas where businesses and employees can benefit from their proximity to one another. Industry clusters often result in increased patent generation, high levels of economic activity, increased start-up activity, above-average wages and a variety of other benefits. Examples of industry clusters include Hollywood's Entertainment sector and Silicon Valley's Information Technology sector. Orange County currently calls itself home to industry clusters including Aerospace Manufacturing, Biotechnology and Hospitality and Tourism.

The presence of these clusters means that local educators, policymakers and other should continue to focus on STEAM-related education. STEAM occupations have a broad range, including jobs from Registered Nurses to Software Developers and Engineers to Fashion Designers, Actors, and Musicians. While this diverse range of occupations complicates industry and occupational analyses, it highlights the sheer number of opportunities in STEAM occupations. While the first portion of this analysis will focus specifically on STEM occupations, an Arts highlight has been provided to help showcase this sector apart from other industries.

The most in-demand STEM occupations over the past twelve months were:

- Software Developers, Applications (24,339 job postings);
- Registered Nurses (20,011 job postings); and
- Computer Occupations, All Other (11,788 job postings).

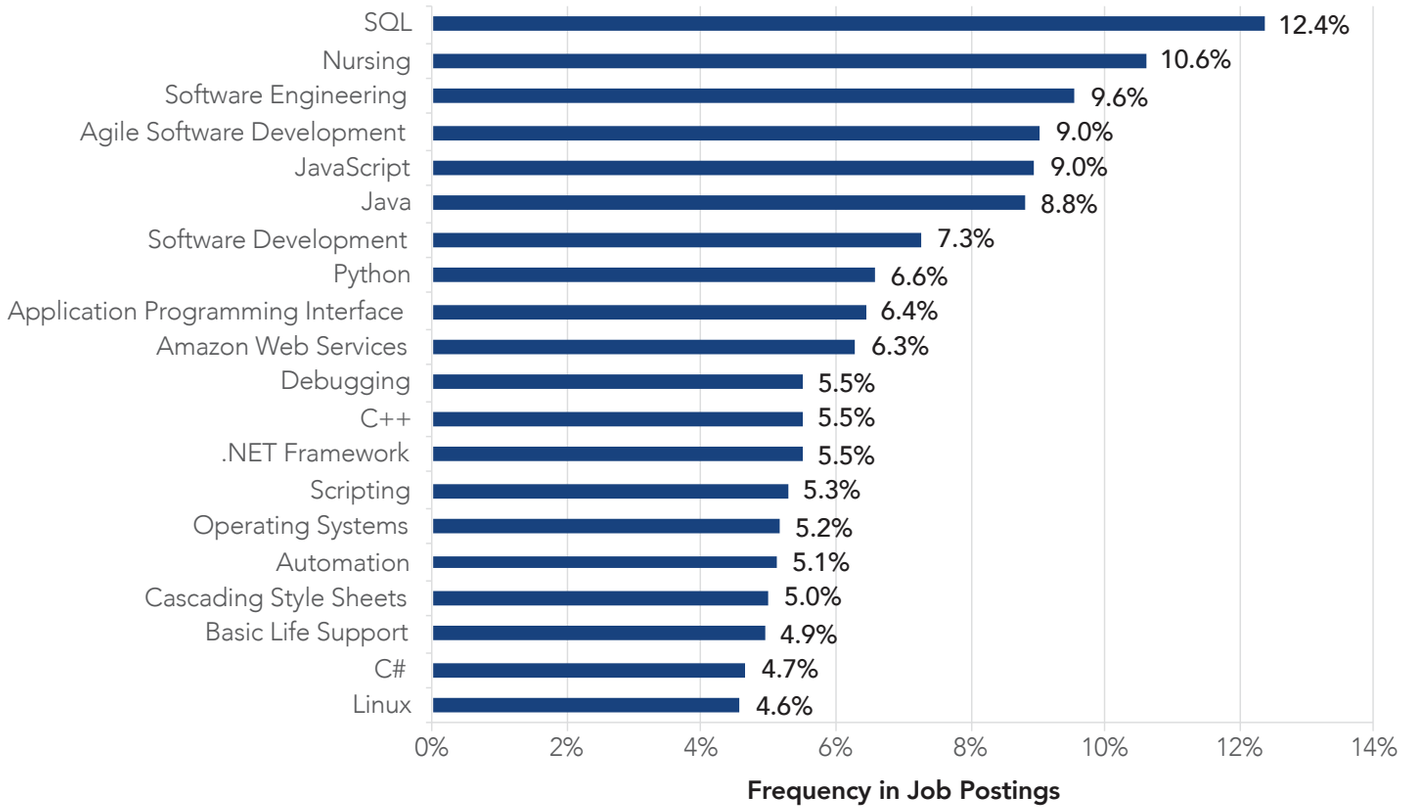


Source: Economic Modeling Specialists International

There were a total of 139,672 STEM-related job postings between August 2018 and July 2019 (Emsi). The most in-demand skills included Structure Query Language, which appeared in 12 percent of all postings, followed by Nursing (11 percent) and Software Engineering (10 percent). These skills reflect the regional importance of Information Technology, a cross-cutting sector present in nearly every county industry. In-demand Healthcare skills reflect the increasing Healthcare needs of Orange County's aging population.

As technological advancements continue to impact every industry, the line between Information Technology and Healthcare is becoming increasingly blurred as these two sectors increasingly intersect. One emerging occupation which exemplifies this is Health Information Technology which, over the past year had 1,929 job postings, compared to 1,231 job postings measured in the previous *Workforce Indicators Report*. This represents growth of 698 job postings or an increase of 56.7 percent.

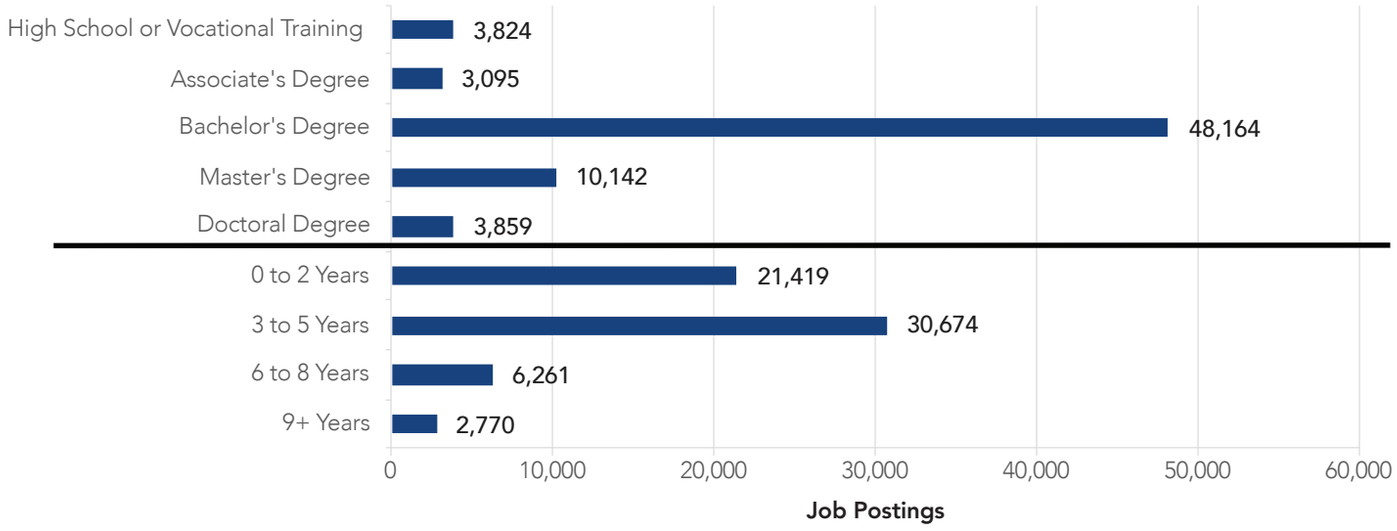
Orange County STEM-Related Skills by Frequency in Job Postings, Last 12 Months



Source: Economic Modeling Specialists International

While many associate STEM-related occupations with extensive education and experience requirements, a significant majority of these occupations only require a Bachelor's degree. Overall, 69.7 percent of STEM occupations require a Bachelor's degree, compared to just 14.7 percent requiring a Master's degree and 5.6 percent requiring a Doctoral degree. Additionally, 50.2 percent of these occupations required just 3 to 5 years of experience and 35 percent required 0 to 2 years of experience, which further highlights STEM occupational accessibility in the region.

Orange County STEM-Related Job Postings by Educational Attainment and Experience, Last 12 Months



Source: Economic Modeling Specialists International

Rapid technological advances mean that the importance of STEM-related degrees cannot be overstated, especially in fields such as Biological Sciences, Engineering, Information and Computer Science, Physical Sciences, Math and Health. STEM-related degrees will continue to grow in importance as new technologies transform the world of work. Several growing industry clusters in Orange County - such as Medical Devices, Biopharmaceuticals, Advanced Manufacturing, Information Technology, Professional and Business Services, Cybersecurity and Data Analytics - all depend on a steady stream of well-educated workers in order to fill new positions.

Orange County's three major universities – the University of California, Irvine, Chapman University, and California State University, Fullerton – awarded a total of 6,972 STEM-related Bachelor's degrees and 3,608 STEM-related graduate degrees in 2017. Health has seen the largest overall growth in Bachelor's degrees since 2004, growing by 626.2 percent, while Mathematics has seen the largest growth in Graduate degrees, growing by an impressive 332 percent.

Regional Completions of STEM-Related Degrees at Orange County Colleges and Universities, 2004 - 2017

	2017		2004-2017 Percent change	
Discipline	Bachelor's Degrees Granted	Graduate Degrees Granted	Bachelor's Degree Change	Graduate Degree Change
Biological Sciences	1,022	153	31.4%	188.7%
Engineering	1,235	876	114.8%	257.6%
Information and Computer Science	1,081	467	10.2%	166.9%
Physical Sciences	266	130	131.3%	51.2%
Math	238	108	124.5%	332.0%
Health	3,130	1,874	626.2%	220.3%
Total	**6,972**	**3,608**	**142.8%**	**208.6%**

Source: Economic Modeling Specialists International

Orange County's community colleges produced a total of 3,625 completions in 2017, a significant increase over the early years of this millennium. As traditional college degrees become more and more expensive, community colleges will continue to increase in importance as a vital part of the STEM education and workforce training system.

Regional Completions of STEM-Related Program Completions by Major Field of Study at Orange County Community Colleges, 2004 - 2017

Discipline	All Completions (2004)	All Completions (2017)	2004-2017 Percent Change
Biological Sciences	35	171	388.6%
Engineering	252	642	154.8%
Information and Computer Science	248	485	95.6%
Physical Sciences	45	385	755.6%
Math	26	270	938.5%
Health	829	1,672	101.7%
Total	**1,435**	**3,625**	**152.6%**

Source: Economic Modeling Specialists International

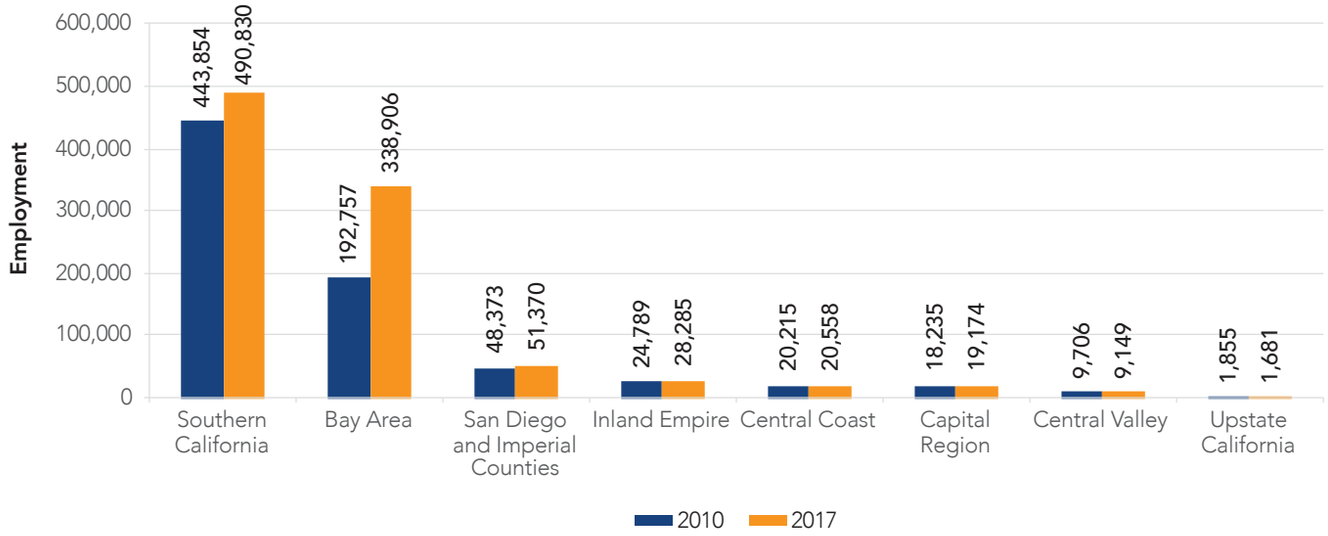
A FOCUS ON THE ARTS

The Southern California region had a total of 490,830 individuals employed in Creative industries in 2017 (Otis College of Art and Design, LAEDC). These creative industries include:

- Entertainment and Digital Media;
- Fashion;
- Creative Goods and Products;
- Architecture and Related Services; and
- Fine Arts and Performing Arts.

Statewide, the Creative sector employed over 1 million workers with a significant majority (71 percent) in Entertainment and Digital Media. Since the recession, this sector saw jobs increase by 177,000, accounting for 88 percent of all Creative industry growth since then. Southern California represented just under half of total Creative sector employment with 490,830 workers in 2017 while the Bay Area employed approximately 338,906 Creative sector workers.

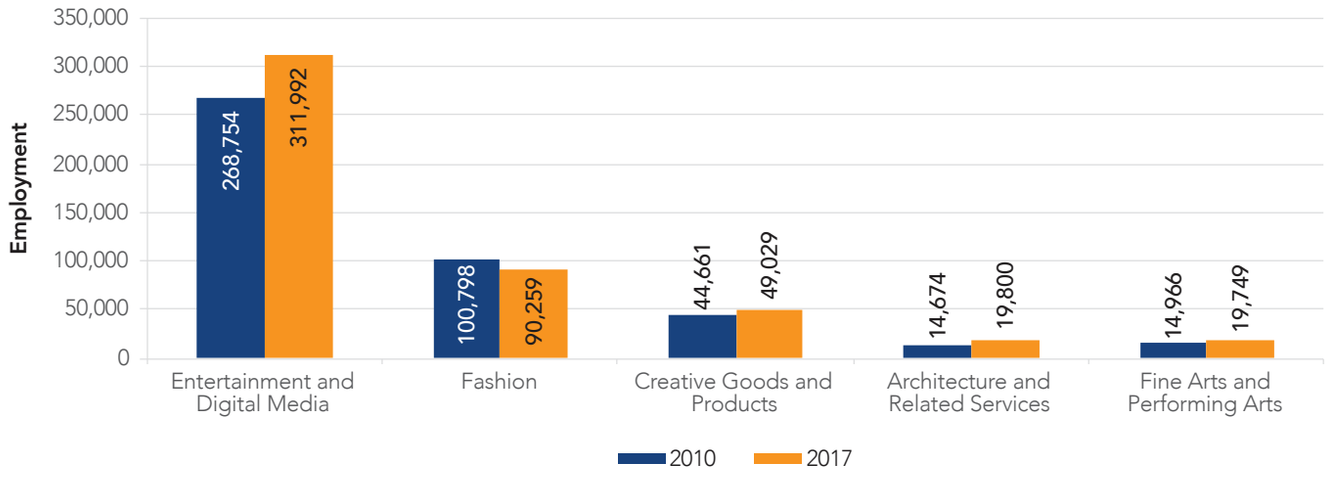
Creative Industry Employment by Major California Region, 2017



Source: Otis College of Art and Design, 2019 Otis Report on the Creative Economy

In Southern California, a significant majority of Creative industry workers were employed in Entertainment and Digital Media, followed by Fashion and Creative Goods and Products. Since 2010 the most significant percent growth occurred in Architecture and Related Services which grew by 34.9 percent, followed by Fine Arts and Performing Arts (32 percent) and Entertainment and Digital Media (16.1 percent). The Fashion industry actually saw an employment decline of 10.5 percent or 10,539 jobs since 2010.

Southern California Creative Industry Employment, 2010-2017

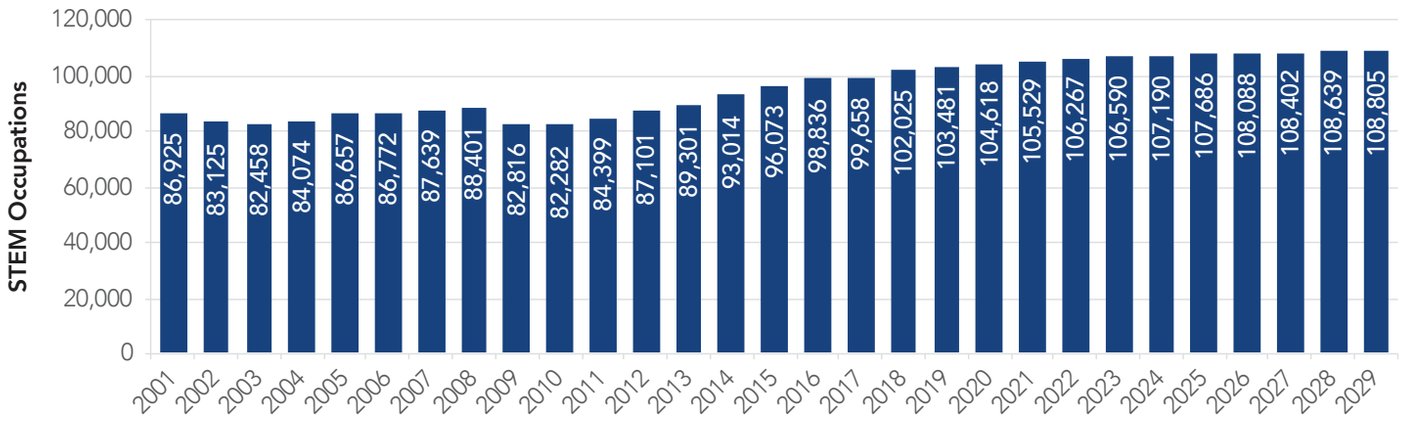


Source: Otis College of Art and Design, 2019 Otis Report on the Creative Economy

FUTURE

The number of STEM-related jobs in Orange County is expected to increase from 103,481 in 2019 to 108,805 by 2029. This further emphasizes the critical importance of local education and workforce training programs, which will prepare students for thousands of future jobs. Educators will need to constantly update their curricula in order to ensure that students are properly prepared; doing so will help Orange County maintain one of its most important competitive advantages, its deep pool of educated job candidates.

Estimated and Forecasted STEM Occupations in Orange County, 2001-2029



Source: Economic Modeling Specialists International

The table below shows Orange County STEM jobs over two time periods, 2019-2024 and 2019-2029. Registered Nurses are expected to see the most job growth over the next five years, adding 2,255 jobs to bring the occupation's total to 26,976. The second highest job growth is expected for Software Developers (+1,328) and Licensed Practical and Licensed Vocational Nurses (+672). These same occupations are also expected to increase the most over the next 10 years, adding 3,766, 2,146 and 1,137 jobs, respectively. Overall, the fastest growing STEM occupations include Information Technology, Healthcare and Engineering.

Top 10 Orange County STEM Occupations, 5-Year and 10-Year Outlook

STEM Occupations	2019 Jobs	2024 Jobs	2029 Jobs	Absolute Change	
				2019-2024	2019-2029
Registered Nurses	23,210	25,465	26,976	2,255	3,766
Software Developers, Applications	10,279	11,608	12,425	1,328	2,146
Software Developers, Systems Software	8,000	8,128	8,131	129	131
Computer User Support Specialists	7,998	8,430	8,653	433	655
Computer Occupations, All Other	6,524	6,755	6,860	231	336
Computer Systems Analysts	6,128	6,349	6,437	221	309
Licensed Practical / Licensed Vocational Nurses	5,876	6,548	7,014	672	1,137
Civil Engineers	5,621	5,897	6,079	276	458
Network and Computer Systems Administrators	3,893	3,994	4,030	101	136
Industrial Engineers	3,694	3,856	3,921	162	228

Source: Economic Modeling Specialists International

The Arts' growing importance in the job market, combined with the increasing importance of technology to almost every industry, mean that STEAM-related degrees will continue to be an essential pathway going forward. Ensuring that Orange County residents have access to a variety of STEAM-related degree programs will be crucial in maintaining its world-class workforce. Before students reach colleges and universities, K-12 will play a key role in introducing students to STEAM career opportunities.

SPECIAL FEATURE: THE ARTS IN ORANGE COUNTY'S LABOR MARKET

The Arts have a long history in Orange County, from Laguna Beach's heyday as a plein air artists' colony more than a century ago, to the first generation of Imagineers building Disneyland in the 1950s, to the rise of Irvine computer game developer Blizzard Entertainment in the 1990s. Each city's artistic history forms a major part of its current economy and identity.

The Disneyland Resort, for example, is Anaheim's largest employer, while Blizzard is Irvine's third largest employer. Laguna Beach is home to more than 100 art galleries and artists' studios,[26] including the Laguna Art Museum. The annual Festival of the Arts, which began in 1932, features the Pageant of the Masters, where performers recreate classic paintings as living works of art. The Festival has become an Orange County institution, attracting more than 210,000 visitors each year. Laguna Beach also hosts the Sawdust Art Festival, which highlights the work of local artists and draws more than 200,000 attendees each summer.

The Performing Arts also play a major role in Orange County. In addition to the Pageant of the Masters, Costa Mesa's Segerstrom Center for the Arts has been home to the Pacific Symphony since 1986 and also hosts the Pacific Chorale, Philharmonic Society of Orange County and South Coast Repertory.

The region is also home to several film festivals located in Newport Beach and Huntington Beach, the biennial Vietnamese International Film Festival in Orange, and the Orange County Film Festival which showcases student filmmakers and their projects. The Newport Beach Film Festival exhibited films from 56 countries to 58,000 viewers in 2019, a year that marked its twentieth anniversary.

Combined, the Arts in Orange County form an integral part of its identity and "brand" as a world-class Hospitality and Tourism destination. Over 50 million visitors came to Orange County in 2018, generating an estimated economic impact of $13 billion and fueling a sector that employs almost 220,000 workers. The sector is a critical part of the county economy for several reasons; it serves as a gateway into the world of work for many students and recent graduates, a place to develop key career skills, and a steady creator of jobs at almost all skill and salary levels.

[25] *https://www.visitlagunabeach.com/things-to-do/art-culture/art-galleries/*

UCI INSTITUTE AND MUSEUM FOR CALIFORNIA ART

Orange County, especially Laguna Beach, has played an important role in California's art history; for more than a century, painters from across the world have flocked to the county for its sunshine and beaches. California Impressionist paintings of Laguna Beach and surrounding areas will form a core part of the UCI Institute and Museum for California Art (IMCA), predicted to open by 2024. The museum will be housed in a 10,000 square foot building next to the Irvine Barclay Theater. IMCA, according to its website, "will be comprised of a museum housing a collection of California art in every genre and medium and a research institute engaged in collections research and interdisciplinary projects in partnership with scholars from all of UCI's academic units and the broader art world."[27]

IMCA's first director will be Kim Kanatani, a native of Southern California who most recently served as the Deputy Director and Director of Education at the Solomon R. Guggenheim Museum in New York. "I am absolutely thrilled to have the opportunity to develop a world-class art museum that will showcase and celebrate the most significant collections and exhibitions of California art and give this work the recognition it deserves," Kanatani said in a press release. "I envision the museum serving as a state-of-the-art teaching and learning institution, which will offer unparalleled arts and cross-curricular experiences for the campus and the wider community."[28]

Two donations make up the core of IMCA's collection. First, Joan Irvine Smith and her son, James Irvine Swinden, have given a foundational gift of more than 1,200 California Impressionist paintings from the late 19th and early 20th centuries currently housed in the Irvine Museum. Second, UCI received the Gerald E. Buck Collection, featuring more than 3,200 rarely seen paintings, sculptures, drawings and other works by California artists, as a bequest after Buck's death in 2013. Buck, an Orange County-based real estate developer, amassed a collection of 20th century California art described by *Los Angeles Times* art critic Christopher Knight as "the finest holding of its kind in private hands." The collection, which spans from early 20th century Impressionism to the 1990s, includes such names as Richard Diebenkorn, David Hockney and Ed Ruscha, and is one of the largest gifts in the history of UCI.

While the full IMCA will not open for several years, portions of the collection are currently displayed in temporary exhibitions at the Joan Irvine Smith and Athalie Richardson Irvine Clarke Gallery.

[27] *https://imca.uci.edu/about/*
[28] *https://imca.uci.edu/media-release-visionary-museum-leader-kim-kanatani-is-appointed-museum-director-of-the-uci-institute-and-museum-for-california-art/*

The Arts, in addition to being a significant part of the county's past and present, could play an even more significant role in its future. In a transitional job market rapidly transformed by new technologies and innovations, the Arts sector – along with more creativity and design-focused thinking across the job market – offers some of the jobs and work skills least likely to be automated.

In a pioneering 2013 study, Oxford professors Carl Benedikt Frey and Michael A. Osborne argue that, while machines have the potential to take over more and more traditionally human work activities, three specific kinds of activities will prove resistant to automation:

- First, machines tend to struggle when performing **complex perception and manipulation tasks**, especially in unstructured environments.
- Second, robots still cannot successfully perform **social intelligence tasks**; no artificial intelligence has managed to pass a Turing test despite numerous attempts.
- Finally, machines simply cannot perform the kinds of creative intelligence tasks that human beings perform every single day, from composing music to telling jokes to creating scientific theories. "The principle obstacle to computerizing creativity," write Frey and Osborne, "is stating our creative values sufficiently clearly that they can be encoded in a program;" creative or aesthetic values vary greatly between different cultures, time periods and individuals and depend on intuitive judgments of whether novel combinations of ideas and images "make sense."[29]

In their paper, Frey and Osborne use Standard Occupational Classification (SOC) codes to rank more than 700 occupations by vulnerability to automation. They list Recreational Therapists, with a 0.28 percent chance of automation, as the most defensible occupation, while a dozen different occupations – including Telemarketers, Data Entry Keyers and Photographic Process Workers and Processing Machine Operators – have a 99 percent chance of automation. Arts-related occupations show high levels of defensibility in Frey and Osborne's list, with the following appearing in their top 100 most defensible jobs.

Art-Related Occupations with High Levels of Defensibility

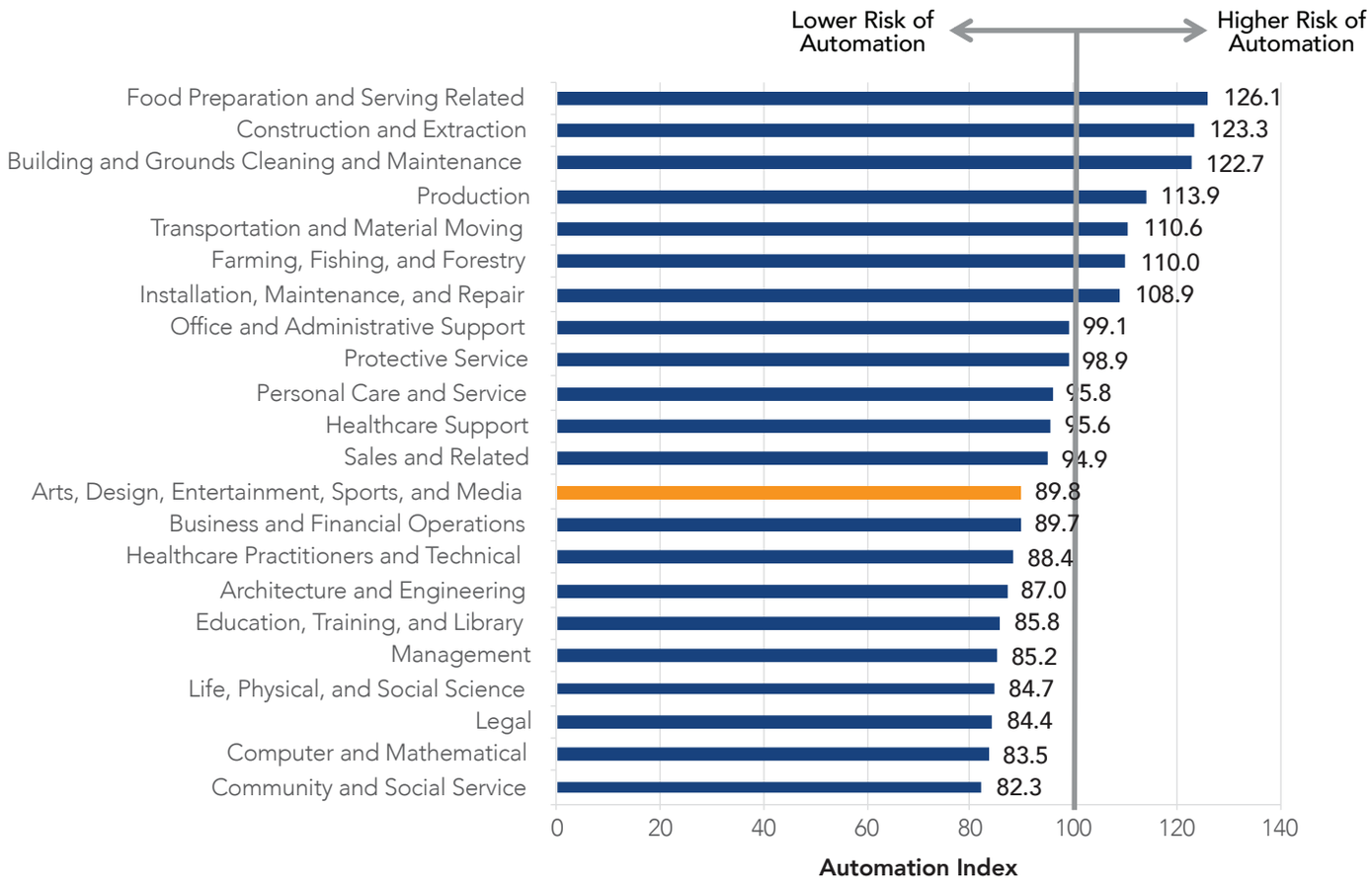
Occupation	Chance of Automation (%)
Choreographers	0.40
Fabric and Apparel Patternmakers	0.49
Set and Exhibit Designers	0.55
Curators	0.68
Makeup Artists	1.00
Multimedia Artists and Animators	1.50
Music Directors and Composers	1.50
Architects, Except Landscape and Naval	1.80
Fashion Designers	2.10
Photographers	2.10
Producers and Directors	2.20
Interior Designers	2.20
Art Directors	2.30

Source: Carl Benedikt Frey and Michael A. Osbourne, The Future of Employment: How Susceptible Are Jobs to Computerisation? September 17, 2013

[29] *Frey and Osborne, 25-6*

As a whole, Orange County's Arts, Design, Entertainment, Sports and Media sector is at a fairly low risk of automation, with a score of 89.8 (Emsi). Occupational groups with a score above 100 have an above average risk of automation while those with a score below 100 have a lesser risk. The chart below provides automation index scores for all occupational groups in Orange County. The Food Preparation and Serving Related occupational group has the highest risk of automation (126.1) followed by Construction and Extraction (123.3) and Building and Grounds Cleaning and Maintenance (122.7). The occupational groups with the lowest automation indexes include Community and Social Service (82.3), Computer and Mathematical (83.5) and Legal (84.4). Overall, the Arts occupational group had the county's tenth lowest automation index.

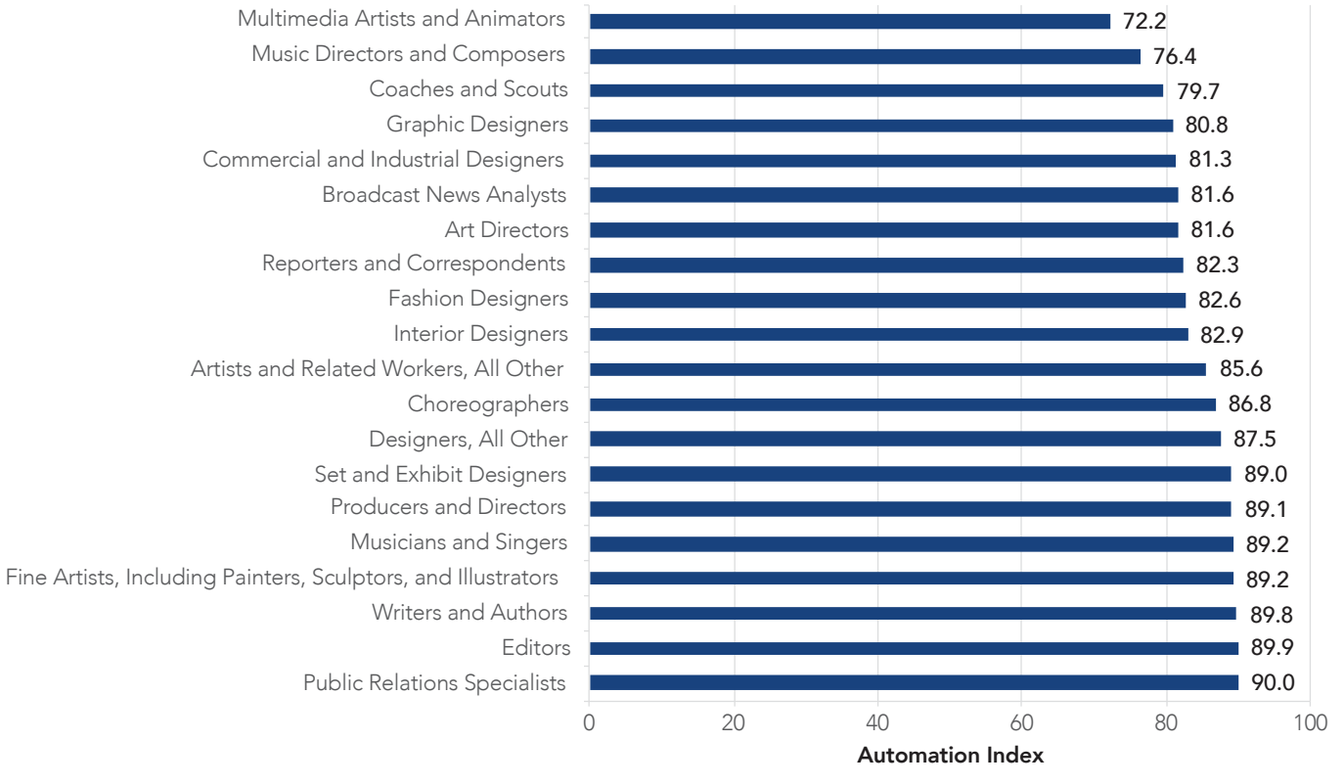
Automation Index by Occupational Group in Orange County, 2019



Source: Economic Modeling Specialists International

Among individual Arts, Design, Entertainment, Sports and Media occupations, Multimedia Artists and Animators had the lowest automation index at 72.2, followed by Music Directors and Composers (76.4) and Coaches and Scouts (79.7). These occupations have high degrees of creativity, which will be extremely difficult for software or systems to replicate effectively. Additionally, Coaches and Scouts rely heavily on soft skills or face-to-face interactions which often go beyond teaching someone proper techniques to involve highly defensible skills such as leadership, communication and problem solving.

Top 20 Orange County Arts-Related Occupations with the Lowest Automation Index, 2019



Source: Economic Modeling Specialists International

OCBC's 2017 report *The Dimensions of Defensibility: Human-Centered Design in an Automated Workplace*, which built on Frey and Osborne's research, found that the "Artistic" interest, which is relevant to a variety of occupations, correlates more strongly with defensibility than other interests. The Artistic interest had a correlation of 0.49, while two other interests, Conventional and Realistic, actually had negative correlations with defensibility, as seen below:

- Artistic (0.49 correlation with defensibility)
- Social (0.47)
- Investigative (0.43)
- Enterprising (0.26)
- Conventional (-0.30)
- Realistic (-0.40)

The six work interests or Holland Codes were developed by psychologist John L. Holland in the 1950s and continue to serve as a cornerstone of the United States Department of Labor's online career database, the Occupation Information Network (O*Net).

"**Realistic** occupations frequently involve work activities that include practical, hands-on problems and solutions;"

"**Investigative** occupations frequently involve working with ideas, and require an extensive amount of thinking and solutions;"

"**Artistic** occupations frequently involve working with forms, designs and patterns;"

"**Social** occupations frequently involve working with, communicating with, and teaching people;"

"**Enterprising** occupations frequently involve starting up and carrying out projects; "and

"**Conventional** occupations frequently involve following set procedures and routines."[31]

These interests form the basis of the O*Net Interest Profiler, a career exploration tool, and are used by students, jobseekers, career counselors, human resource professionals and others.

[31] *https://www.onetonline.org/find/descriptor/browse/Interests/*

Artistic occupations, according to the Bureau of Labor Statistics, "frequently involve working with forms, designs and patterns. They often require self-expression, and the work can be done without following a clear set of rules." O*Net website lists a variety of occupations in the performing arts as examples, from Actors to Poets, Lyricists and Creative Writers.

In addition to the Artistic interest, arts-related skills, work activities and other relevant job characteristics are some of the most defensible across the entire labor market. Analysis of more than two hundred job characteristics in *The Dimensions of Defensibility* found that **Originality** is the single most defensible aspect of work across the entire labor market. In terms of specific work activities, **Thinking Creatively** ties with **Developing Objections and Strategies** as the most defensible.

In a recent report, *The Future of Work in America*: *People and Places, Today and Tomorrow*, McKinsey researchers suggest that creative work may prove more than just resistant to automation; automation may actually fuel growth in creative industries by boosting workers' productivity and disposable income thereby increasing consumer spending for creative or artistic products and services. McKinsey's 2030 employment projections show "strong job growth in healthcare, STEM occupations, creatives and arts management, and business services," with a variety of arts-related occupations expected to add significant numbers of jobs.

Illustrative Examples of Fast-Growing Occupations, 2017-30

Creatives	Percent Growth (%)
Dancers	54
Interior Designers	42
Multimedia Artists and Animators	41
Merchandise Displayers and Window Trimmers	37
Musicians and Singers	34
Actors	33
Curators	30

Source: McKinsey Global Institute, The Future of Work in America, July 2019

Orange County's educational system is front and center to preparing for this future, which can put an emphasis on defensible skills such as creativity and critical thinking. In addition to being highly resistant to automation, these skills are also much more transferable between industries than technical skills which tend to be unique and tied to specific occupations.

One challenge will be getting beyond stereotypes of liberal arts majors and of the arts in general. As a recent Emsi/Strada Institute for the *Future of Work* brief puts it, "not all liberal arts graduates become baristas, nor do they all go to graduate school or become teachers."[32] In fact, liberal arts majors go on to work in a variety of industries and occupational categories, from management to human resources to tech. In another report, entitled *Degrees at Work: Examining the Serendipitous Outcomes of Diverse Degrees*, Economic Modeling Specialists International (Emsi) found that, while some fields such as IT have a strong relationship between major and career choice,[33] generally "education isn't as deterministic of our work as we might believe."[34] Analysis of a subset of liberal arts graduates – those with language- and philosophy-related majors – shows employment in "a broad array of jobs," from education to sales to management.[35]

Another common narrative is that too many students are pursuing liberal arts degrees instead of more career-oriented degrees. This is simply not true; Emsi and Strada found that liberal arts major accounted for only 23 percent of US bachelor's degrees in 2016 compared to 36 percent in 1970.[36]

Simply put, education in the liberal arts, and the arts in general, will help tomorrow's workers navigate two ongoing labor market transformations: automation and the trend of increasing career mobility between occupations and industries. More generally, they can help workers navigate through the complexity of modern work, as noted in the conclusion of *Degrees at Work*:

> **"…there are many management, operations, and communications roles in the economy that require a blend of specialized technical skills and more generalized soft skills. Workers may find themselves managing people one minute and an annual budget the next, collecting data today and writing a report on the findings tomorrow…"**
>
> **"Liberal arts programs may be especially well-positioned to serve students in this regard. Rather than scrapping the liberal arts, colleges can help students understand the value of an education that cultivates a nimble mind and establishes intellectual habits conducive to life-long learning. The kinds of foundational, transferable skills that are emphasized in these programs can also help students through the likely transitions (both voluntary and involuntary) they will experience in their working lives."**[37]

[31] *https://www.onetonline.org/find/descriptor/browse/Interests/*
[32] *Weise et al, "The Real, Long-term Labor Market Outcomes of Liberal Arts Grads," p. 7*
[33] *Degrees at Work p.34*
[34] *Ibid, p.6*
[35] *Ibid, p.12*
[36] *Weise et al, p.3*
[37] *Degrees at Work, p. 53*

CHAPMAN HILBERT MUSEUM

The Hilbert Museum of California Art at Chapman University, which opened in 2016, is currently housed in a space in Old Towne Orange. Founded through a 2014 gift of more than 200 paintings and $3 million from Mark and Jan Hilbert, the museum attracted approximately 30,000 visitors last year.

Between 2021 and 2023, the Hilbert Museum – whose collection focuses on California Scene Painting, including artists such as Rex Brandt and Joan Irving – will relocate to a new space, the historic Villa Park Orchards Association Packing House. This will enable it to almost triple its floor space, from 7,500 square feet to 21,700, and display a variety of Mexican and Native American art in addition to paintings. It will also include a recent gift, a 16.5 by 40 foot Millard Sheets glass tile mosaic entitled "Pleasures Along the Beach," which was created for a Santa Monica bank in 1969.

Former Chapman President Jim Doti, currently a Business and Economics Professor, played a key role in bringing the Hilbert Museum to the university. In an interview with *Voice of OC* he reflected that "one of the things I'm very proud of, or most proud of, is that (the) collection became part of the university during my tenure… It's everything and more than I ever expected. It has surpassed my wildest imagination in terms of its impact, and the incredible community response to it." [38]

[38] *https://voiceofoc.org/2019/06/chapmans-hilbert-museum-of-california-art-to-expand-and-nearly-triple-in-size/*

MCKINSEY DESIGN INDEX

Creativity and design thinking, rather than being limited to the arts sector, is an integral part of success across all industries. The term "design thinking," popularized by design and consulting firm IDEO, refers to "a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success" in the words of IDEO CEO Tim Brown.[39] Examples of design thinking include the creation of an Apple iPhone, Disneyland ride, or even emergency room patient experience;[40] all three share a constant focus on the end user experience throughout every step of the process.

Design thinking, according to a recent McKinsey Quarterly report entitled *The Business Value of Design*, "…is a CEO-level priority for growth and long-term performance." McKinsey tracked the design practices of 300 publically traded companies in the medical technology, consumer goods and retail banking industries over a five year period, collecting more than two million data points. The result of this research, the McKinsey Design Index (MDI) aggregates four aspects of businesses' design practices:

- Measuring and driving design performance with the same rigor as revenues and costs;[41]
- Design as an integral part of the company rather than a single, isolated department;
- A companywide focus on the user experience; and
- An openness to continual testing, development, and gathering feedback from both inside and outside of the company.

High MDI scores correlate with higher revenues and shareholder returns, especially in the top quartile; McKinsey found that "… the market disproportionately rewarded companies that truly stood out from the crowd."[42] Many companies, however, struggle to implement effective design, a challenge McKinsey attributes to a lack of long-term strategic leadership. Effective design practices "can't be tackled by designers alone and often take years of leadership commitment to establish."

Top MDI performers share several characteristics[43]:

- A focus on tracking and assessing design performance;
- A companywide "bold, design-centric vision;"
- A willingness to take risks;
- Personal investment in the consumer experience at all levels;
- An openness to unconventional thinking and design across multiple platforms;
- Investment in user research; and
- The ability to recognize opportunities beyond "their own ecosystems."[44] McKinsey highlights IKEA, Pixar and T-Mobile as examples,[45] and Disneyland, Google's home page, and the Swiss Army Knife as examples of "iconic designs" that drive success.[46]

Simply put, companies need to get beyond what McKinsey calls "the tired caricature of traditional design departments," where "a group of tattooed and aloof people operate under the radar, cut off from the rest of the organization." Instead, design – and, more broadly, creativity – needs to be part of every employee's day-to-day work.

Orange County's Arts sector is more than an integral part of the county's story up to this point; as a sector specializing in some of the most defensible jobs and skills, it will likely be a key cornerstone of the county economy and labor force going forward. While continued automation and other emerging technologies will continue to disrupt established industries and business processes, transforming the workplace and the entire economy, the Arts will remain central to the county's economy, status as a world-renowned tourist destination, and globally famous quality of life.

[39] *https://www.ideou.com/pages/design-thinking*
[40] *https://med.stanford.edu/news/all-news/2016/06/design-thinking-as-a-way-to-improve-patient-experience.html*
[41] *McKinsey, p.5*
[42] *Ibid, p.2*
[43] *Ibid, p.2-5*
[44] *P.10*
[45] *P.10*
[46] *Page 1*

INDUSTRY AND OCCUPATION TRENDS

This section highlights specific industry and occupational trends in Orange County in order to provide a comprehensive look at the county's current and future labor market. This allows for the identification of regional strengths, weaknesses and growth sectors, enabling policymakers and stakeholders to better plan for the future.

INTRODUCTION

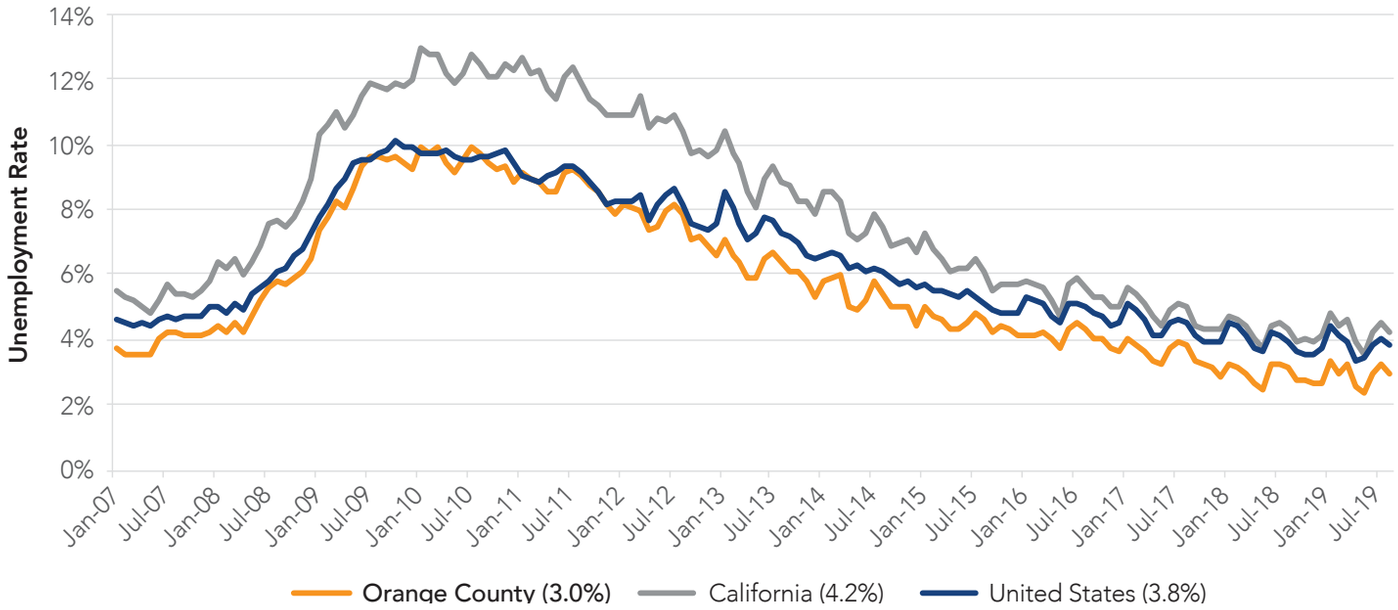
Orange County has seen continued economic growth for several years, resulting in almost record-low unemployment rates, increased wages at all income levels, and the continued growth of key industry clusters that drive innovation and attract venture capital investment. This thriving economy, however, still faces several challenges, including the aforementioned skills gap and a lack of affordable workforce housing. Mitigating the impacts of the skills gap, as previously discussed, will require a collaborative effort between academia and the private sector to ensure that employers can find job candidates with the right skills. This will help to reduce turnover while also increasing productivity, further driving economic growth and activity in the region.

OCBC has recently published the *2019-20 Orange County Workforce Housing Scorecard*, which ranks local cities based on a number of job and housing indicators to showcase which cities are making progress in reducing the current housing shortage in the region. Using this study, along with a generally accepted jobs-to-housing ratio of 1.5, Orange County currently has a housing shortfall of approximately **58,000**, which will grow to nearly **115,000** housing units by 2045.

LABOR MARKET OVERVIEW

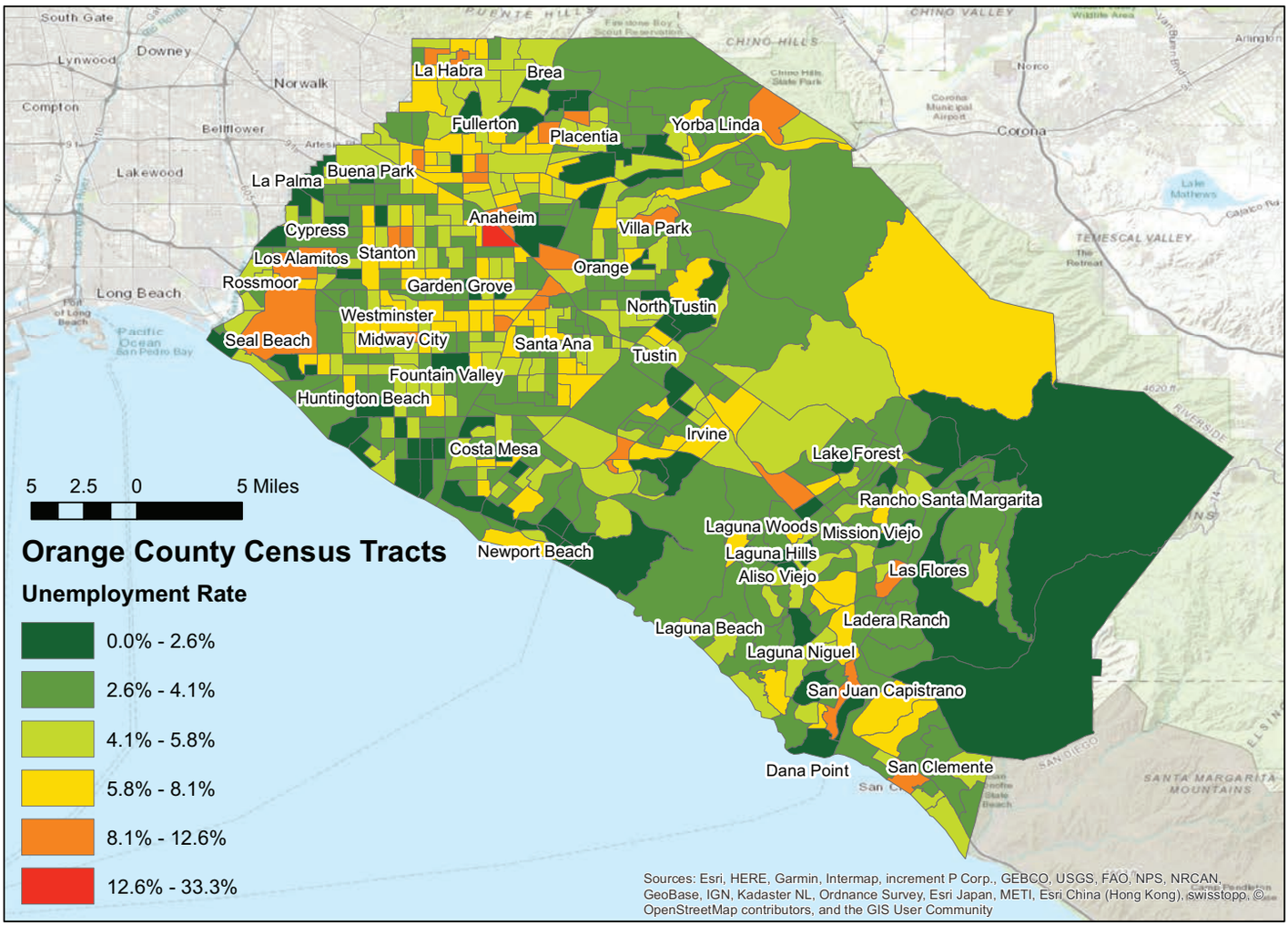
Orange County's unemployment rate has continued on a steady decline in 2019, reaching a near record low of 2.4 percent in April 2019. After rebounding slightly to 3.2 percent in July 2019, the regional unemployment rate fell back to 3.0 percent in August 2019, still well below the state (4.2 percent) and national rates (3.8 percent).

Unemployment Rates in Orange County, California and the United States, January 2007 – August 2019



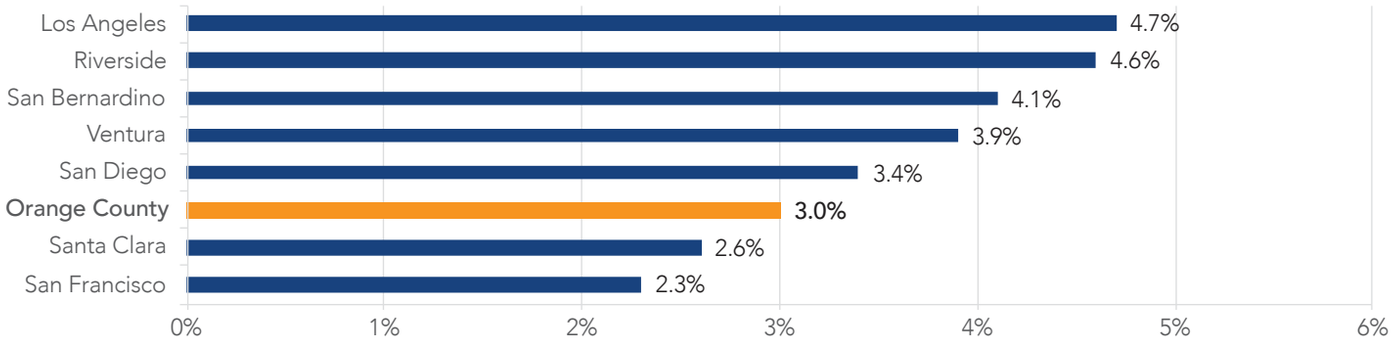
Source: California Employment Development Department

Unemployment Rate by Orange County Census Tract, 2019



When comparing Orange County to its peer regions, its unemployment rate ranked third behind San Francisco (2.3 percent) and Santa Clara (2.6 percent) and higher than any county in Southern California.

Orange County Unemployment Rate Compared to Peer California Counties, August 2019



Source: California Employment Development Department

Following long-term trends, employment growth over the past year has been largely focused in Leisure and Hospitality (+7,600), Educational and Health Services (+3,900) and Professional and Business Services (+2,700).

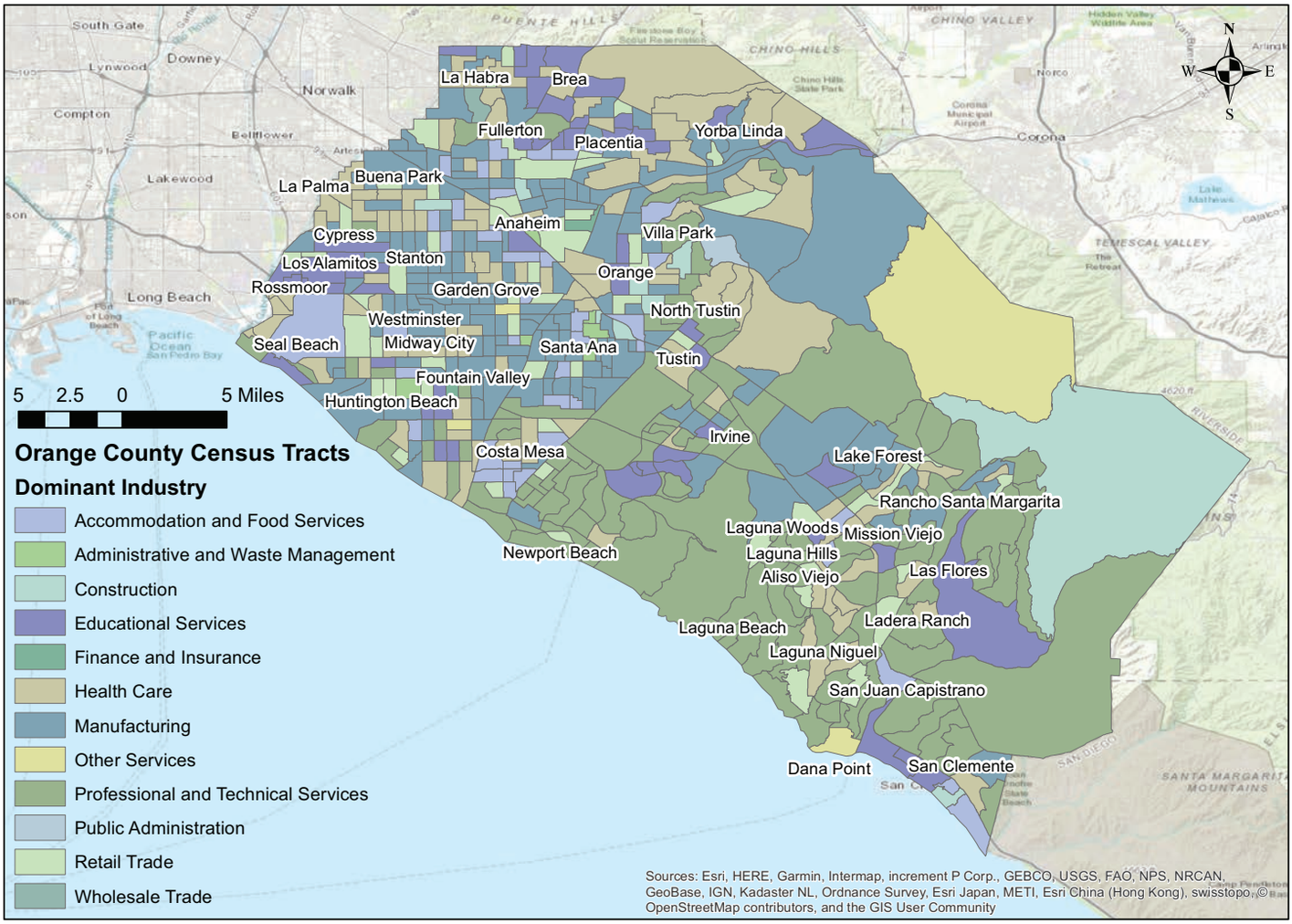
Since 2010, job growth has been focused in those same industries:

- Professional and Business Services (73,800 jobs added);
- Leisure and Hospitality (65,100 jobs added); and
- Educational and Health Services (59,200 jobs added).

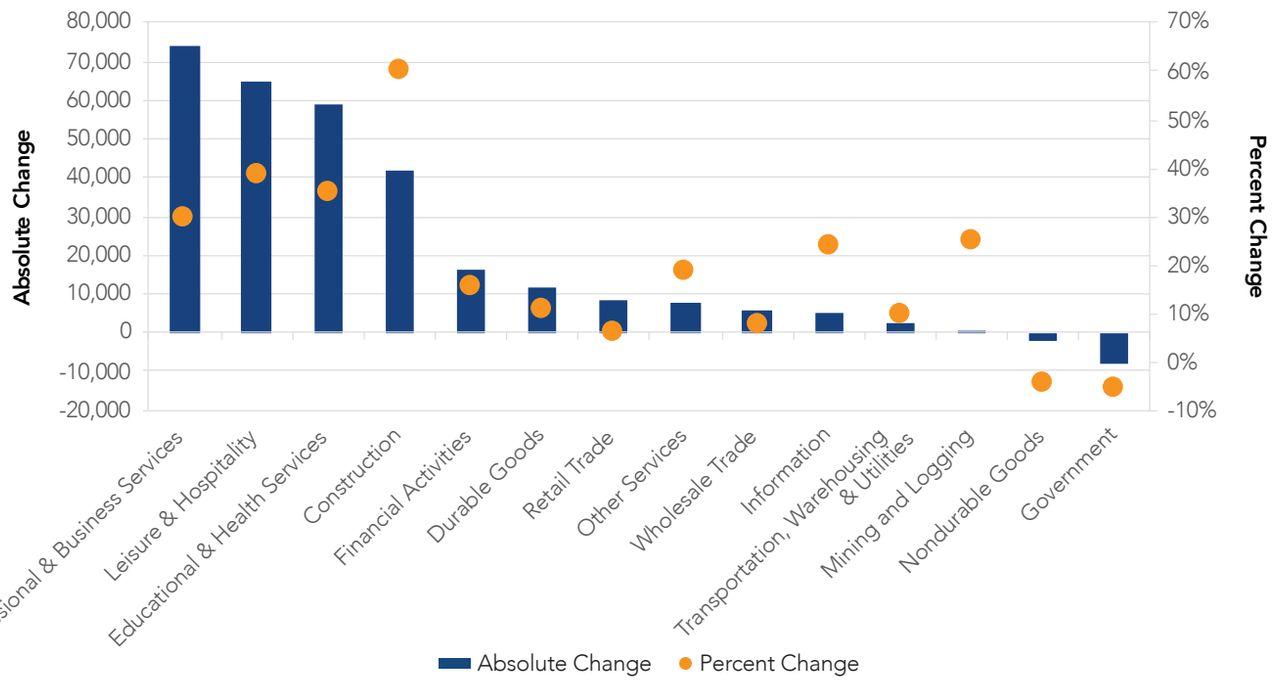
In percentage terms, Construction remains a bright spot in Orange County, increasing by 60.4 percent since 2010, followed by Leisure and Hospitality at 38.6 percent and Educational and Health Services at 35.0 percent. Construction's dominant growth since 2010 is attributable to the recovery from the Great Recession which stalled new construction and resulted in a glut of new construction when it eventually ended. Moving forward, Construction activity is expected to slow as the housing market begins to cool.

Overall, Orange County is home to a number of major industry sectors, with areas of the county specializing in certain sectors, as seen on the following page. Professional and Technical Services dominate in southern Orange County cities such as Irvine, Newport Beach and Laguna Beach, with Retail Trade, Health Care, and Manufacturing also present. In more central and northern portions of the county, Manufacturing and Healthcare seem to dominate while northern portions of the coast have a mix of a number of sectors. Accommodation and Food Services also seems to be fairly prevalent in the northern portion of the county, a reflection of the area's specialization in tourism and entertainment.

Dominant Industries in Orange County by Census Tract

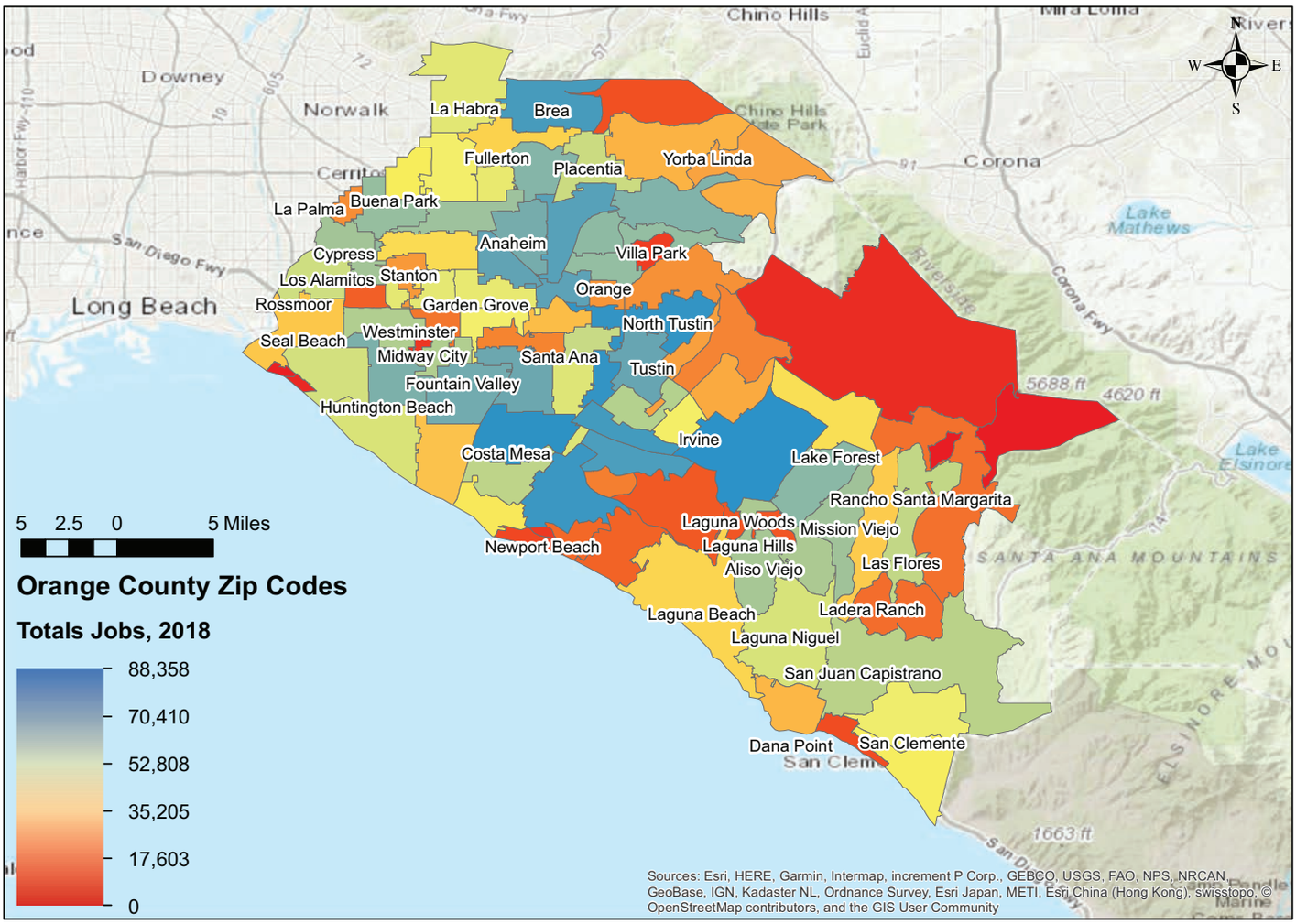


Orange County Industry Trends, 2010 to August 2019



Source: California Employment Development Department

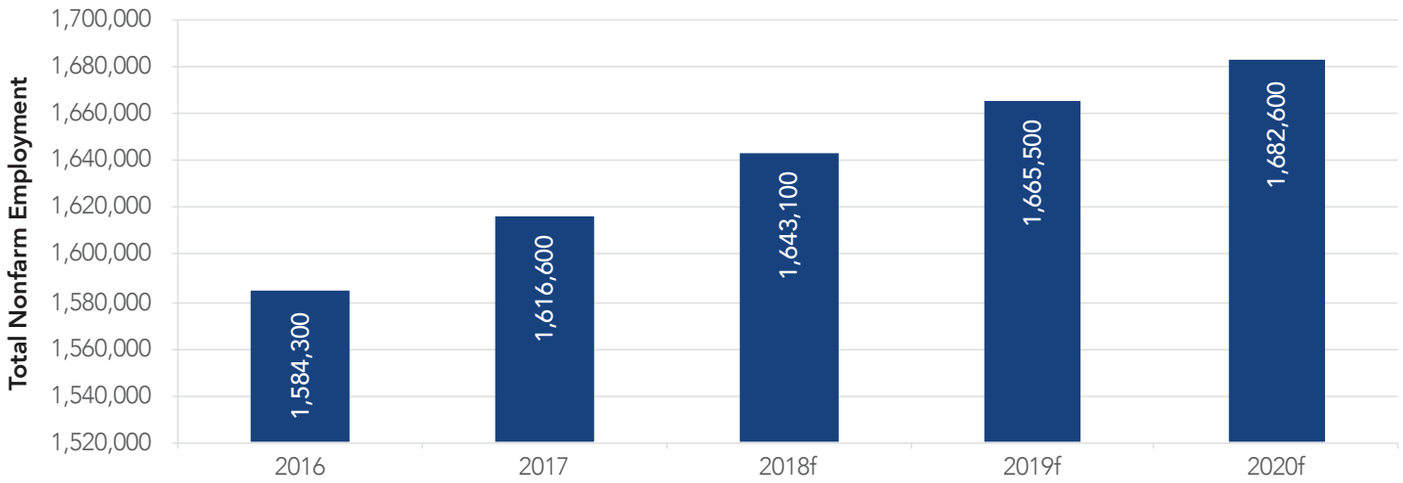
Total Jobs by Zip Code in Orange County, 2018



FUTURE

Orange County's total nonfarm employment is expected to grow by 22,400 or by 2.0 percent in 2019 and by an additional 17,100 in 2020, representing growth of 1.0 percent (California State University, Fullerton). Nonfarm employment growth is expected to slow as Orange County nears full employment.

Orange County Forecasted Nonfarm Employment, 2016-2020f



Source: California State University, Fullerton

Compared to every neighboring county, more workers commute into Orange County than commute to other counties. The most significant inflow comes from Riverside County, where 107,507 workers commute to Orange County. Only 38,488 Orange County workers commute to Riverside County, leaving 69,019 net commuters in Orange County. The second largest imbalance of commuting workers came from San Bernardino County, which sent 74,222 workers to Orange County and received only 37,733 workers, providing a total of 36,489 net commuters to the area. The table below highlights the various commuter inflows and outflows as well as the balance of workers.

These trends are primarily due to Orange County's strong job market and high housing costs, which have priced many workers out of the county. While highlighting the affordability issues currently impacting the region, this helps to reinforce one of the county's primary competitive advantages – a deep pool of well-educated, qualified workers for local employers. In order to maintain this advantage, it is important that the region's infrastructure is continually improved and updated to handle the large cross-county workers flows to local workplaces. Additionally, improving traffic congestion along the county's most used transportation corridors would help improve the quality-of-life for many commuters.

Commuter Inflows and Outflows from Orange County to County Neighbors

	Worker Inflows	Worker Outflows	Net Commuters into Orange County
Los Angeles	326,187	-312,035	14,152
San Diego	62,684	-37,069	25,615
San Bernardino	74,222	-37,733	36,489
Riverside	107,507	-38,488	69,019
Other California Counties	86,324	-64,786	21,538

Source: Jones Lang LaSalle, December 2017

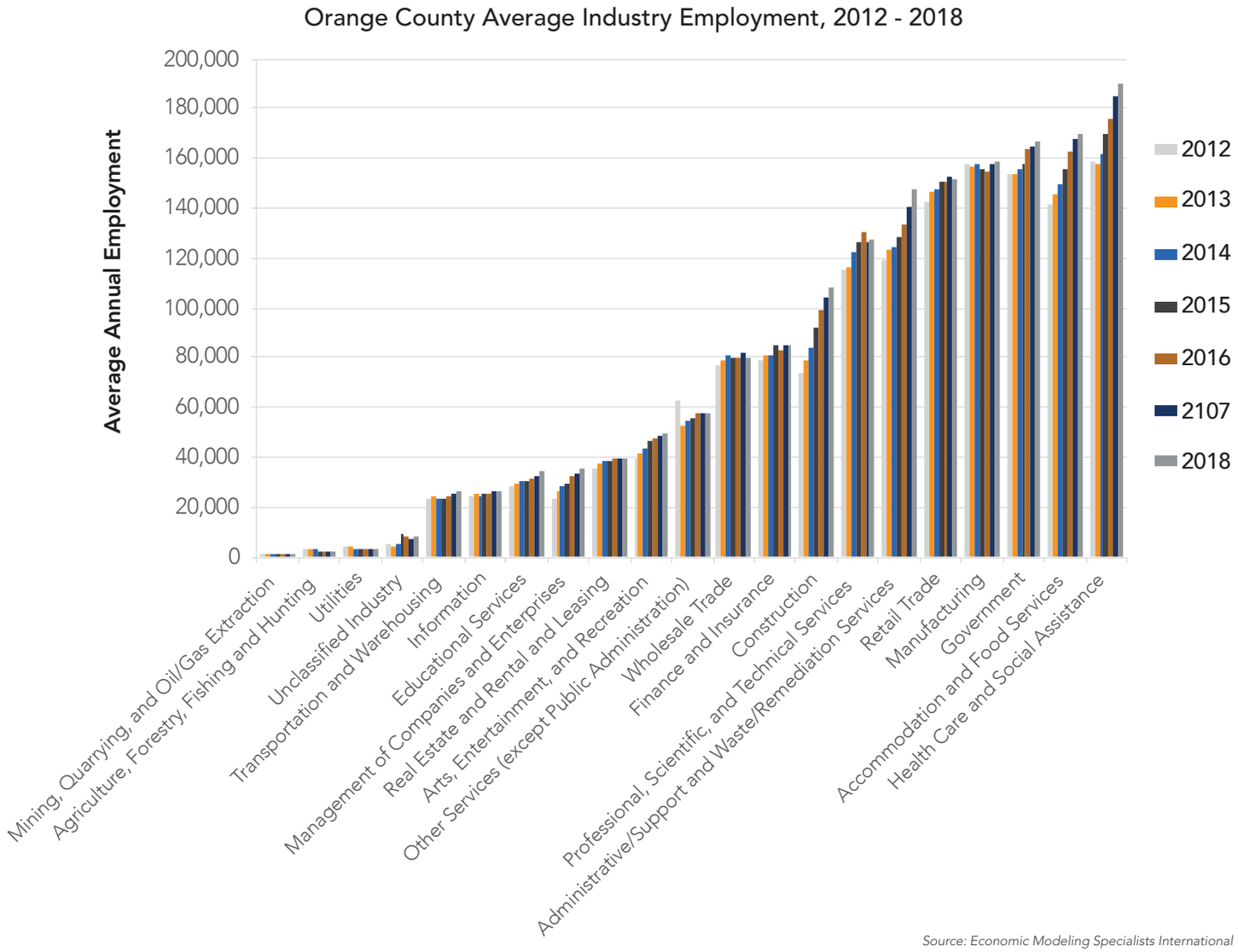
INDUSTRY CLUSTER EMPLOYMENT AND COMPENSATION TRENDS

As previously mentioned, industry clusters are areas where similar, complimentary and supplementary businesses leverage their proximity to one another to more rapidly develop their supply chains, processes and overall profitability. This fuels rapid employment growth, investment and technological progress, effectively creating a virtuous cycle of growth and expansion. Over time, these clusters become increasingly concentrated and specialized, driving regional and even national innovation through patent generation and venture capital investments.

Industry clusters have five primary characteristics:

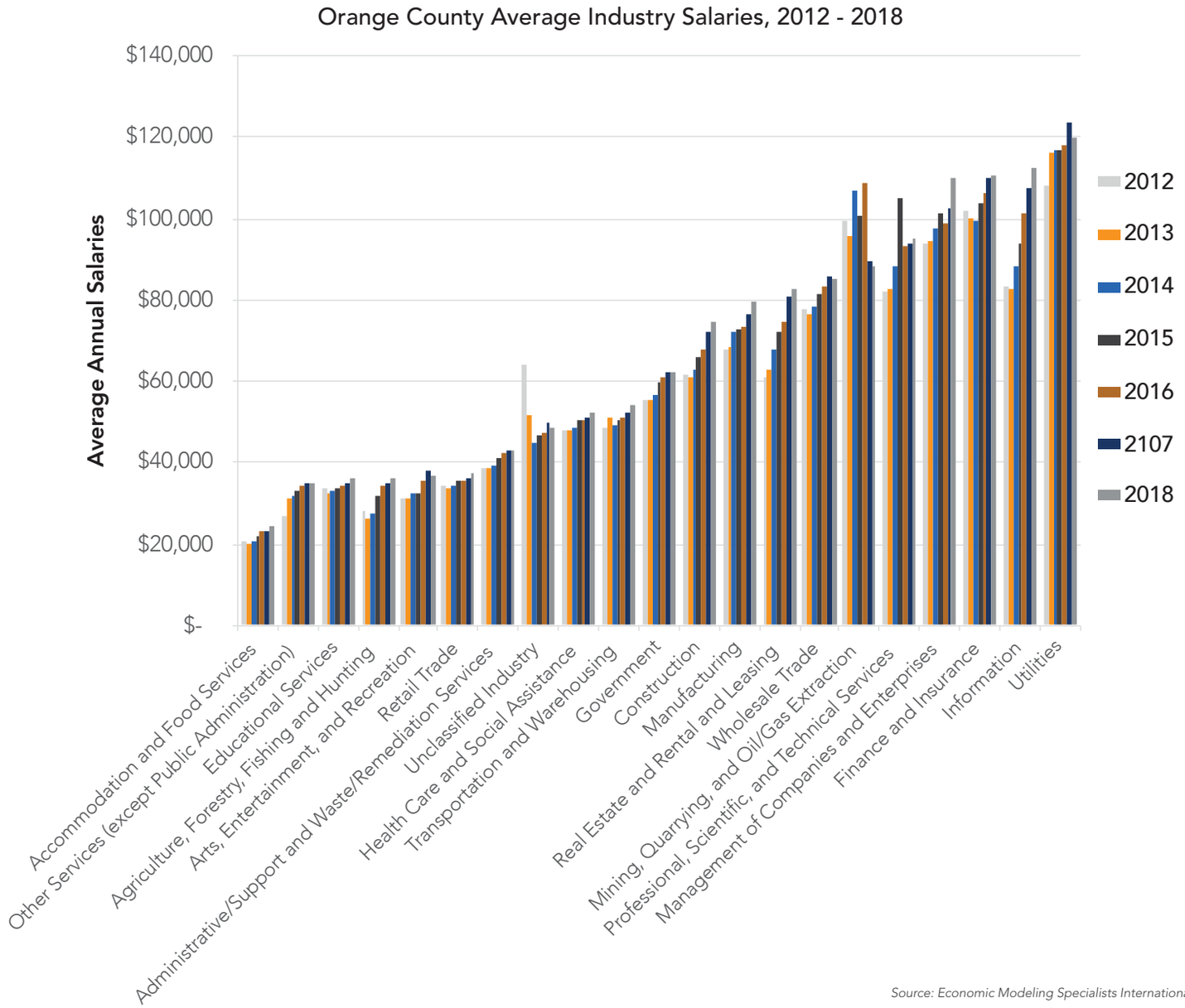
- Critical Mass: a large number of similar and support businesses, resulting in specialized labor pools, reduced logistical costs, and the promotion of both healthy competition and collaboration between those firms.
- Regional Specialization: businesses refine their processes and become more efficient, which leads to increased consumer spending and a high demand of exports, increasing general cash flow into the region.
- High Multiplier Effect: reflects the overall impact the industry has on the regional economy and its ability to spur job creation in other area industries.
- High Growth Rates: As previously mentioned, industry clusters' ability to attract new businesses and workers into the region, they dramatically boost their ability to grow and overall economic growth.
- World-Class, Industry-Leading Companies: the rapid growth of companies, high density of competitors and collaborators, and the increased specialization both creates and attracts world-class organizations which help to define the region as a center for that industry cluster.

Orange County's largest industry was Health Care and Social Assistance with 189,962 employees (Emsi). It has grown by 2.9 percent since 2017. Accommodation and Food Services was the second largest sector after expanding by 1.5 percent year-over-year, resulting in total employment of 170,229. Government (167,055), Manufacturing (167,055) and Retail Trade (152,014) rounded out the top 5 largest industries in Orange County.



Source: Economic Modeling Specialists International

Overall, Orange County had a weighted average industry salary of $74,595, an increase of 1.2 percent or $898 over the previous year. Orange County's highest paying industries in 2018 were Utilities, with an annual average wage of $159,042, Management of Companies at $127,960, and Finance and Insurance, not far behind at $127,749. The Management of Companies industry saw the largest year-over-year percentage growth (7.0 percent), followed by Manufacturing (4.6 percent), Educational Services (4.4 percent) and Information (4.3 percent).



Source: Economic Modeling Specialists International

Location quotients – measures of specific industry concentration in a given area – are useful tools for understanding a region's industry clusters and centers of excellence. A location quotient of 1 means that an industry is as concentrated in an area as it is at the national level, while indexes above and below 1 mean that it is more and less concentrated, respectively. In Orange County, at the four-digit NAICS level, the most concentrated industry is Amusement Parks and Arcades at 12.21, followed by Medical Equipment and Supplies Manufacturing (5.50) and Apparel Knitting Mills (5.20). These concentrations reflect the region's internationally famous tourist attractions, such as the Disneyland Resort, which attract millions of visitors per year. Over the years, the region has also become a hub for medical device manufacturing with major corporations such as Edwards Lifesciences and Johnson and Johnson Medical Devices locating in the area.

Top 10 County Location Quotients by Industry, 2014 - 2019

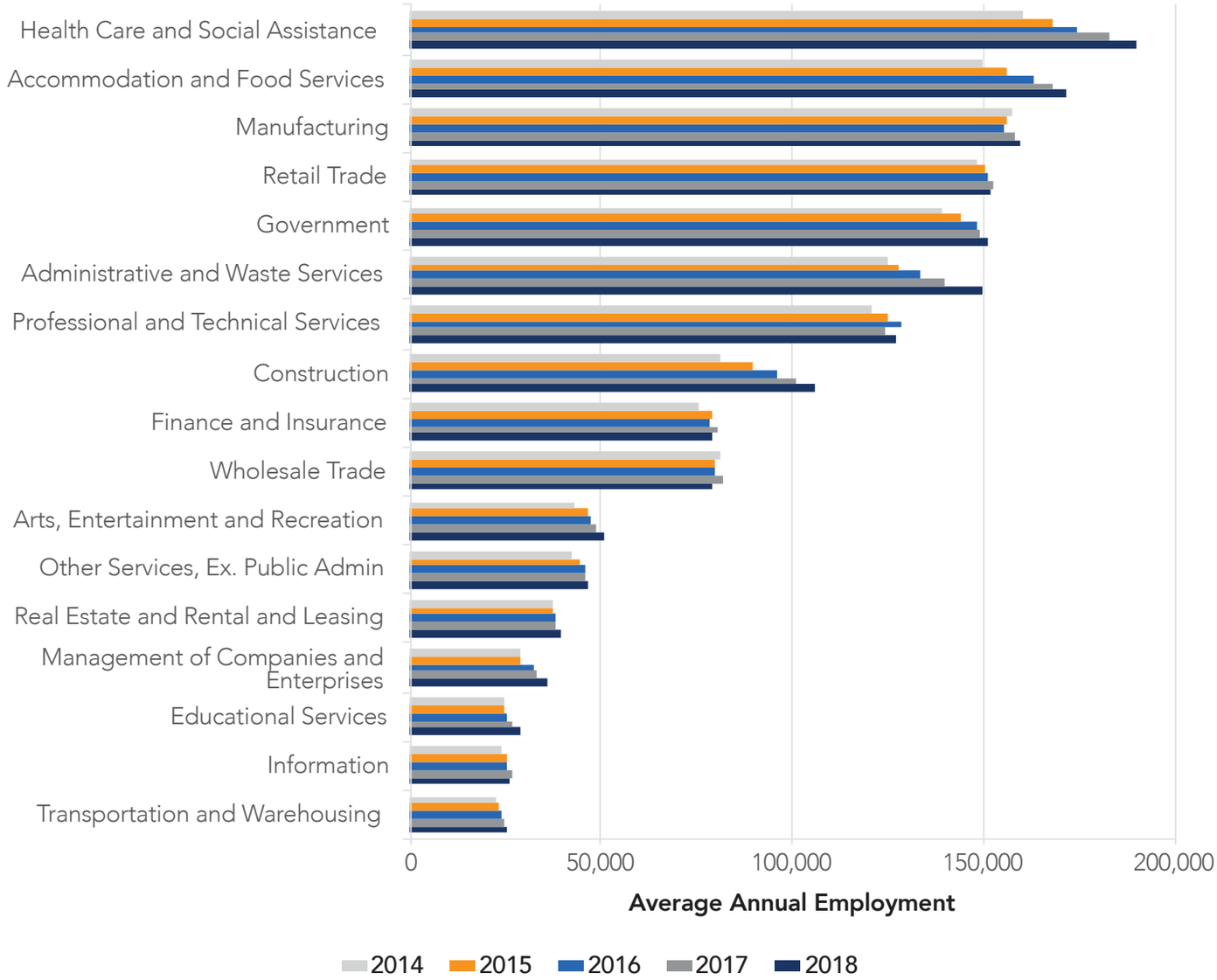
	2014	2015	2016	2017	2018	2019
Amusement Parks and Arcades	12.58	12.71	12.27	12.22	12.23	12.21
Medical Equipment and Supplies Manufacturing	5.82	5.26	5.28	5.15	5.45	5.50
Apparel Knitting Mills	5.93	6.40	7.03	6.17	5.40	5.20
Audio and Video Equipment Manufacturing	6.05	5.63	4.43	4.74	4.87	4.77
Land Subdivision	4.72	4.79	5.20	5.34	4.72	4.73
Cut and Sew Apparel Manufacturing	3.75	3.17	3.56	4.04	4.10	4.16
Semiconductor and Other Electronic Component Manufacturing	3.16	3.17	3.17	3.03	3.26	3.25
Manufacturing and Reproducing Magnetic and Optical Media	0.99	0.96	1.12	2.61	2.88	3.22
Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	2.79	3.45	3.64	3.10	3.00	2.94
Electric Lighting Equipment Manufacturing	2.33	2.32	2.30	2.58	2.61	2.61

Source: Economic Modeling Specialists International

The county's largest industries in terms of employment are Healthcare and Social Assistance (190,032 employees), Accommodation and Food Services (171,504) and Manufacturing (159,750). Industries with the highest growth from 2017 to 2018 included Administrative and Waste Services (9,879 employees added), Health Care and Social Assistance (6,840) and Construction (4,572).

Overall, EDD found that county industries employed a total of 1,627,859 workers in 2018, an increase of 33,592 jobs from the previous year. The Construction and Healthcare and Social Assistance industries have both seen dramatic growth since the Great Recession. Growth in Construction has been fueled by the county's thriving demand for housing and numerous transportation improvement projects, while growth in Healthcare has been largely due to its aging population, which increases demand for Healthcare-related products and services. The continued growth of the Accommodation and Food Services industry, on the other hand, reflects Orange County's continued status as a world-class tourism and retail destination.

Orange County Annual Industry Employment, 2014-2018

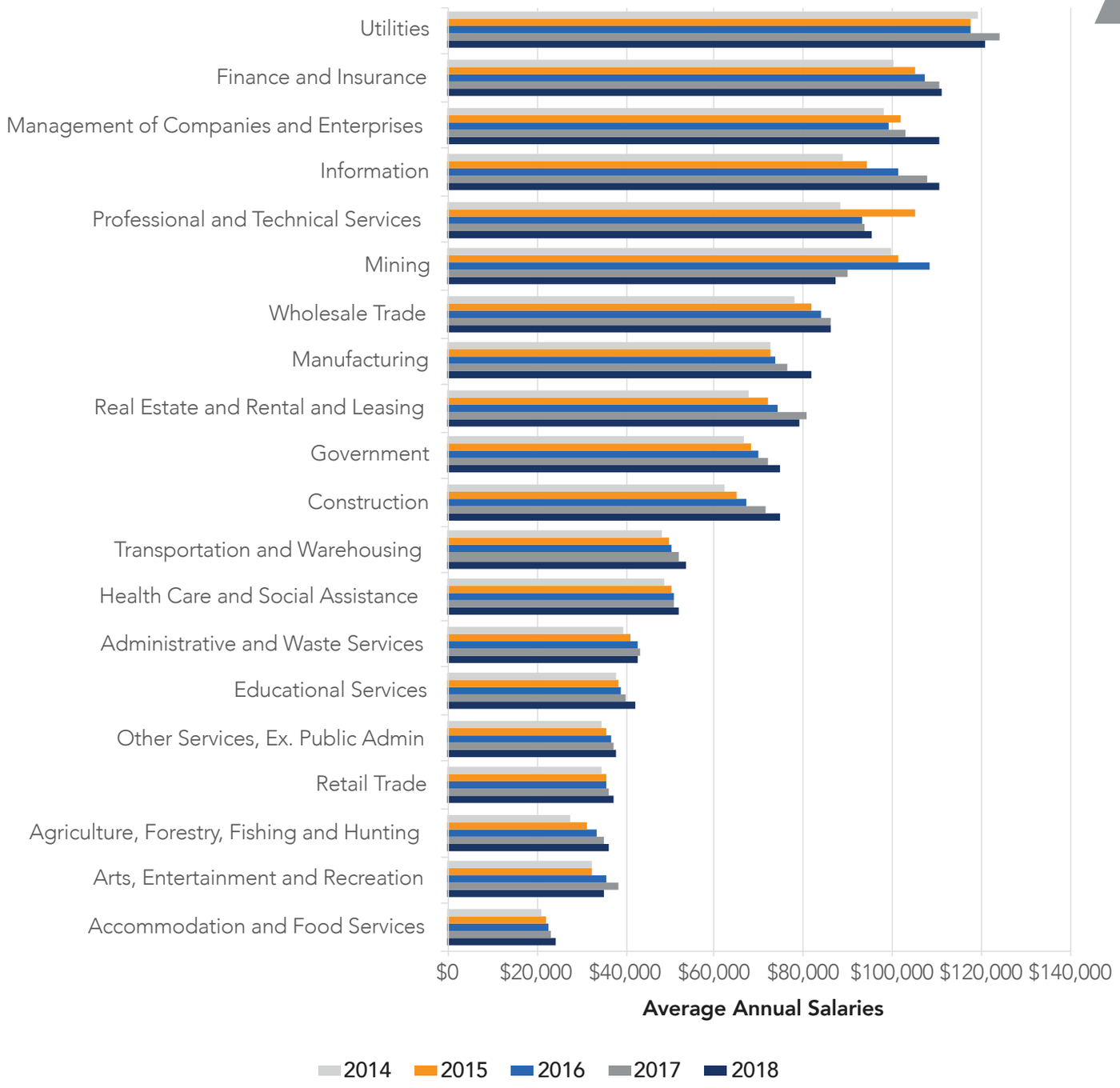


Source: California Employment Development Department, Quarterly Census of Employment and Wages

Orange County's highest paying industries in 2018 included Utilities, with an annual average wage of $120,796, followed by Finance and Insurance ($110,747) and Management of Companies and Enterprises ($110,474). The highest absolute growth occurred in the Management of Companies and Enterprise sector, where annual wages increased by $7,839, followed by Manufacturing (+$5,317) and Construction (+$3,315). A few sectors actually saw decreases in their wages with the largest in Arts, Entertainment and Recreation (-$3,198), followed by Utilities (-$3,094) and Mining (-$2,886).

Overall, average industry wages totaled $69,614 in 2018, representing growth of $1,090 or 1.6 percent since 2017. Orange County's annual wages have grown by an average of 2.5 percent annually since 2014.

Orange County Annual Industry Wages, 2014-2018

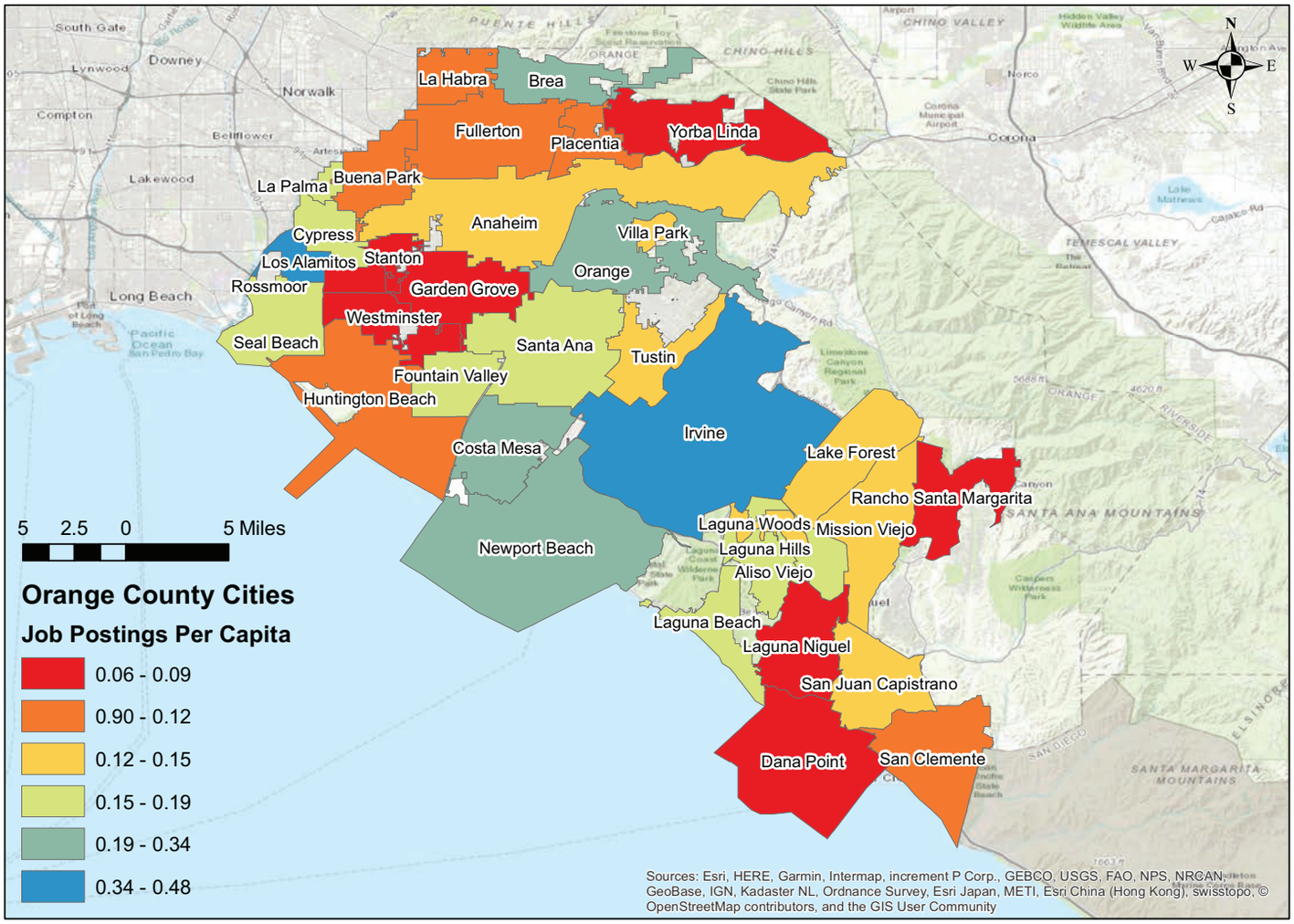


Source: California Employment Development Department, Quarterly Census of Employment and Wages

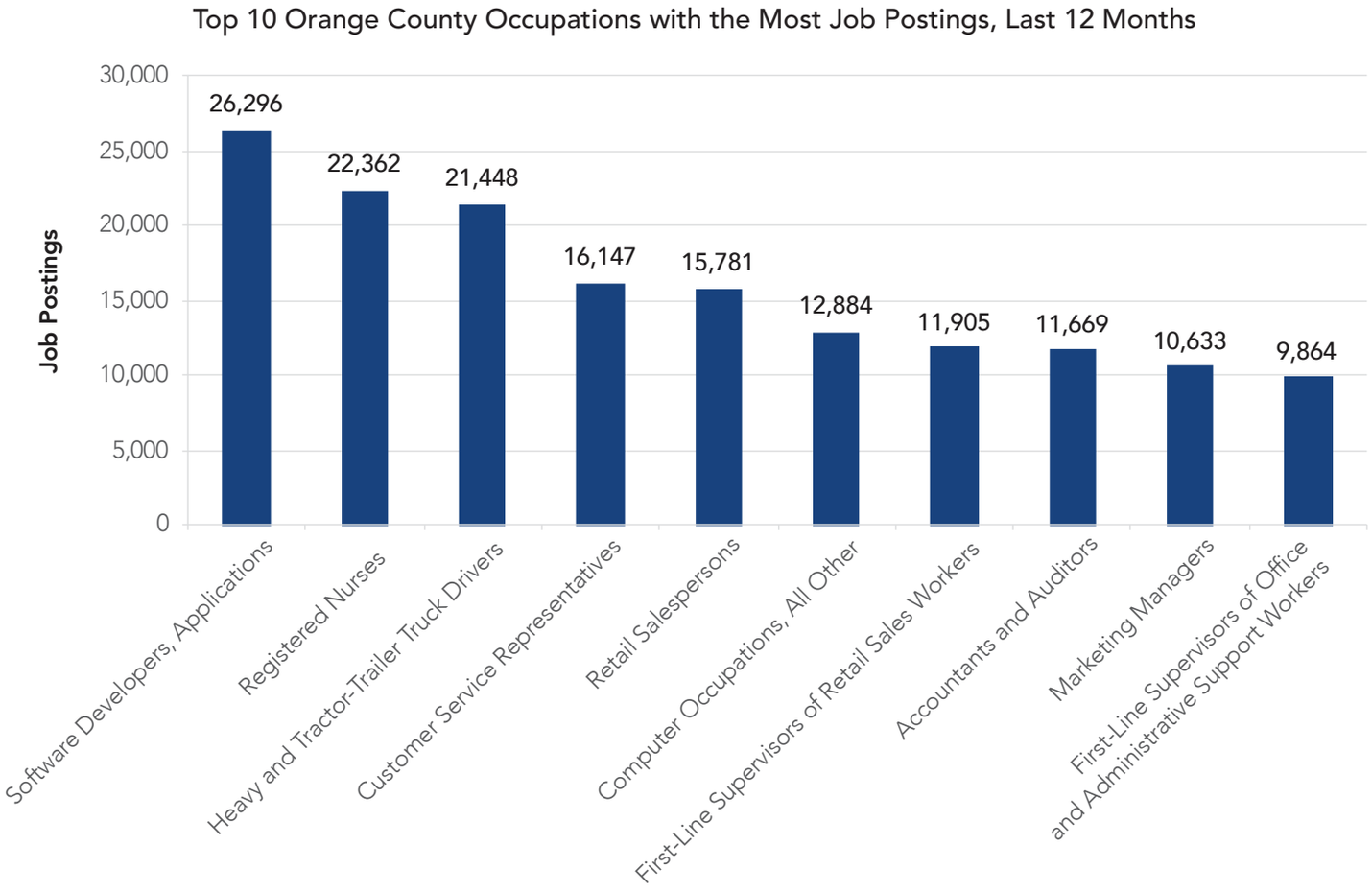
OCCUPATIONAL GROWTH TRENDS

The map below highlights the job postings per capita for major Orange County cities. This helps illustrate the relationship between population and job openings, providing an indication of whether certain cities are able to provide their residents with nearby employment opportunities. At the top of the list, Orange County's de facto business hub, Irvine had the highest job postings per capita at 0.48, followed by Los Alamitos (0.38) and Brea (0.34). This compares to other major cities such as Santa Ana and Anaheim, which both have populations of well over 300,000 but job postings per capita ratios of only 0.19 and 0.13, respectively.

Job Postings Per Capita by Orange County City, 2019

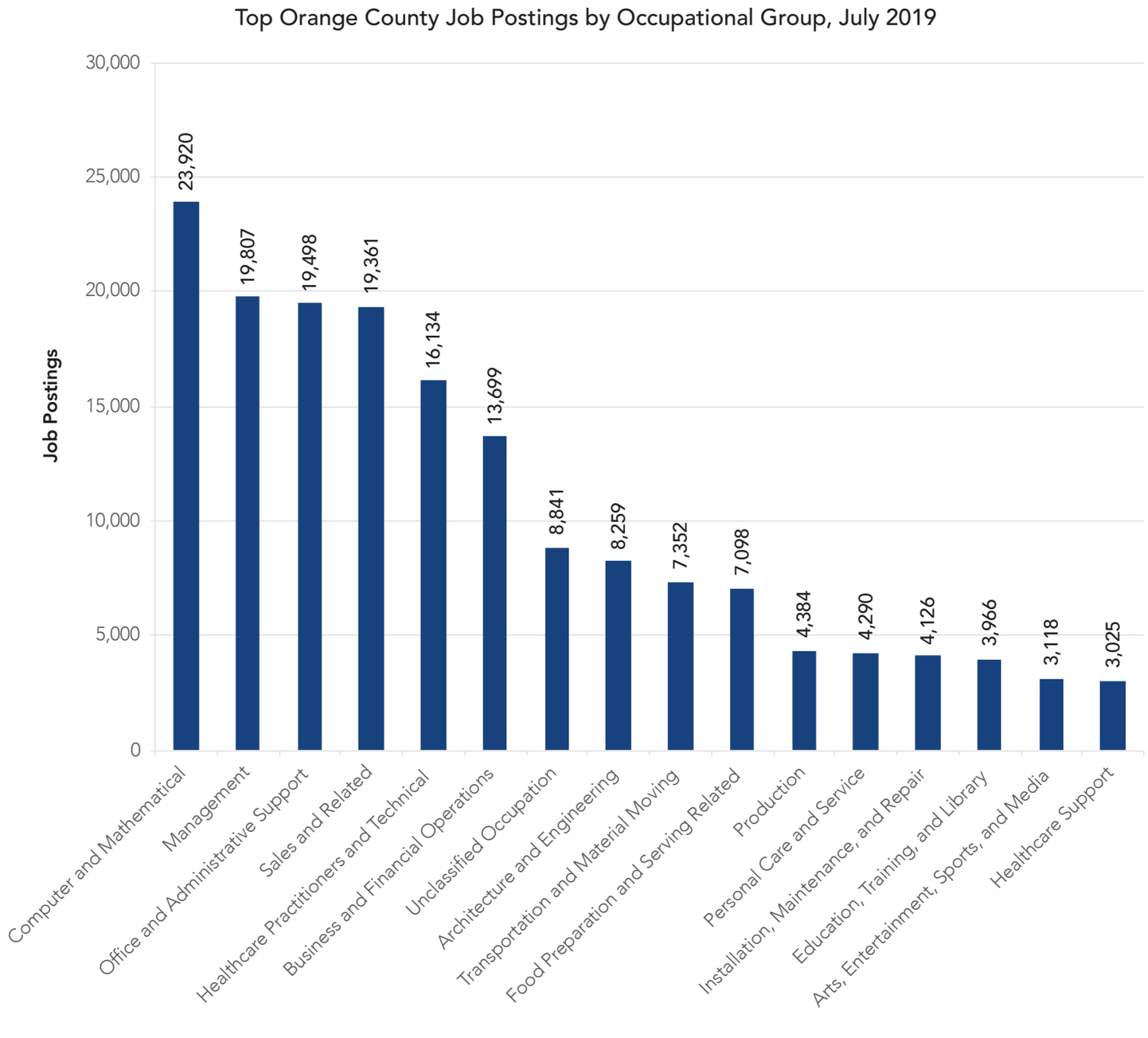


Highlighting individual job titles rather than industries or sectors, Software Developers, Applications had the highest number of job postings over the last 12 months with 26,296 job postings followed by Registered Nurses (22,362) and Heavy and Tractor-Trailer Truck Drivers (21,448).



Source: Economic Modeling Specialists International

Looking at more recent estimates of job postings from Emsi, which help to better reflect currently in-demand sectors, in July 2019 occupational groups with the most job postings included the Computer and Mathematical group with 23,920 job postings, followed by Management (19,807), Office and Administrative Support (19,498) and Sales and Related (19,361).



Source: Economic Modeling Specialists International

The table below provides the top common and hard skills currently most in-demand in Orange County. Looking at common skills, Management, Communications and Sales were present in the most job postings in July 2019: 46,425, 34,068 and 26,552, respectively. Top hard skills included Selling Techniques, Accounting and SQL which were present in 8,481, 7,634 and 6,697 job postings during the same time period. These skills reflect occupations across a number of industries but may be most prevalent in industries such as Retail and Wholesale Trade, Professional and Business Services, and Entertainment.

Top Orange County Common and Hard Skills in Job Postings, July 2019

Common Skills	Job Postings	Hard Skills	Job Postings
Management	46,425	Selling Techniques	8,481
Communications	34,068	Accounting	7,634
Sales	26,552	SQL	6,697
Customer Service	20,278	Nursing	6,323
Operations	19,925	Merchandising	6,115
Leadership	17,416	Restaurant Operation	5,740
Innovation	13,473	Agile Software Development	5,210
Problem Solving	13,206	Java	4,629
Written Communication	11,875	Auditing	4,507
Microsoft Office	9,942	Software Engineering	4,482

Source: Economic Modeling Specialists International

FUTURE

Automation is potentially the most important trend impacting the national economy. As technology continues to disrupt entire industries, employers, educators and workforce development professionals will need to work together to plan and strategize for these disruptive trends. Understanding how automation will impact various sectors and their associated occupations will prove extremely valuable, allowing companies and regional governments to better plan for the future.

In the table below, an index score of above 100 indicates a higher likelihood of automation while a score below 100 indicates a higher resistance to automation. Occupations in Orange County with the highest likelihood of automation include Floor Layers, Except Carpet, Wood and Hard Tiles (139.1); Helpers – Pipelayers, Plumbers, Pipefitters and Steamfitters (137.3) and Reinforcing Iron and Rebar Workers (137.2). These occupations involve frequent repetitive physical labor, which is highly automatable. Occupations with the lowest automation index scores include Multimedia Artists and Animators (72.2); Physicists (72.8) and Astronomers (72.9). Many other occupations with a low-risk of automation are highly technical or creative occupations, involving activities that machines have difficulty performing; occupations involving "soft skills" or frequent social interaction will also likely prove difficult to automate. The table below highlights 20 of Orange County's most and least automatable occupations.

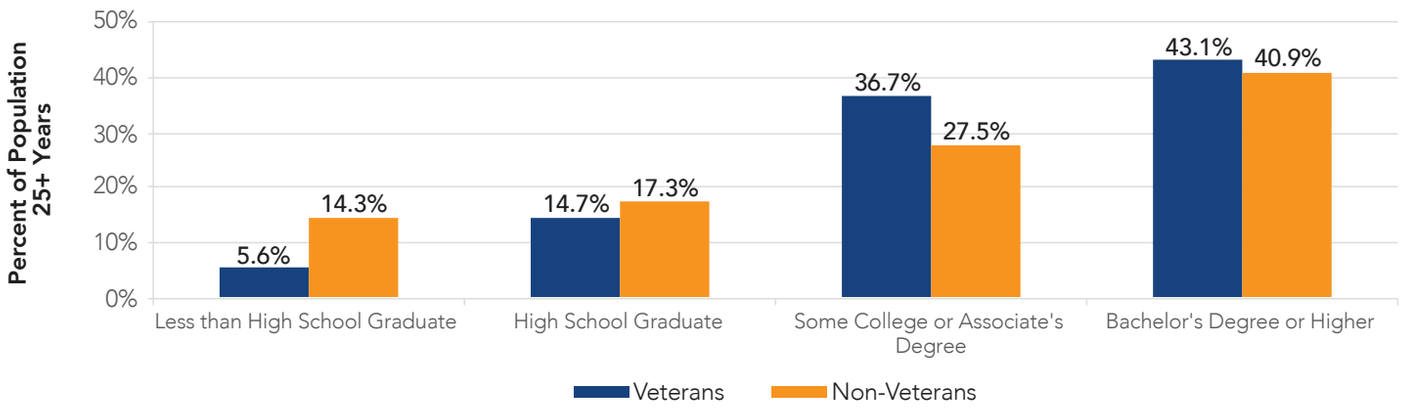
Top 20 Highest and Lowest Occupations in Orange County by Automation Index, 2019

Top 10 Highest (Most At-Risk)	Automation Index	Top 10 Lowest (Least At-Risk)	Automation Index
Floor Layers, Except Carpet, Wood and Hard Tiles	139.1	Multimedia Artists and Animators	72.2
Helpers - Pipelayers, Plumbers, Pipefitters and Steamfitters	137.3	Physicists	72.8
Reinforcing Iron and Rebar Workers	137.2	Astronomers	72.9
Terrazzo Workers and Finishers	137.0	Animal Scientists	73.3
Paperhangers	136.9	Farm Labor Contractors	73.4
Dishwashers	136.4	Materials Scientists	74.2
Painters, Construction and Maintenance	136.3	Biochemists and Biophysicists	74.6
Helpers - Painters, Paperhangers, Plasterers, and Stucco Masons	135.1	Environmental Scientists and Specialists, Including Health	74.6
Dancers	134.8	Actuaries	75.0
Helpers - Electricians	134.7	Epidemiologists	75.0
Helpers - Roofers	134.6	Oral and Maxillofacial Surgeons	75.1
Helpers - Carpenters	134.5	Medical and Health Services Managers	75.2
Stonemasons	134.4	Clergy	75.3
Cooks, Fast Food	134.1	Forest and Conservation Technicians	75.5
Insulation Workers, Mechanical	133.9	Health Educators	75.6
Helpers - Brickmasons, Blockmasons, Stonemasons and Tile and Marble Setters	133.7	Nuclear Engineers	75.7
Brickmasons and Blockmasons	133.5	Music Directors and Composers	76.4
Drywall and Ceiling Tile Installers	132.7	Physical Scientists, All Other	76.4
Tapers	132.5	Foresters	76.4
Structural Iron and Steel Workers	132.2	Architects, Except Landscape and Naval	76.6

Source: Economic Modeling Specialists International

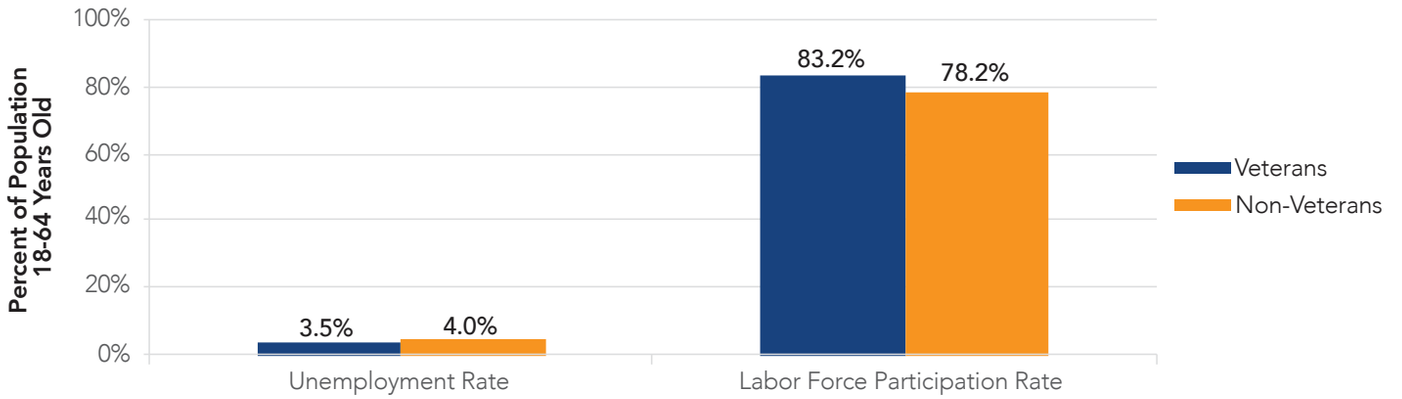
VETERAN EMPLOYMENT IN ORANGE COUNTY HIGHLIGHT

Orange County Veteran Educational Attainment Compared to Non-Veterans, 2018



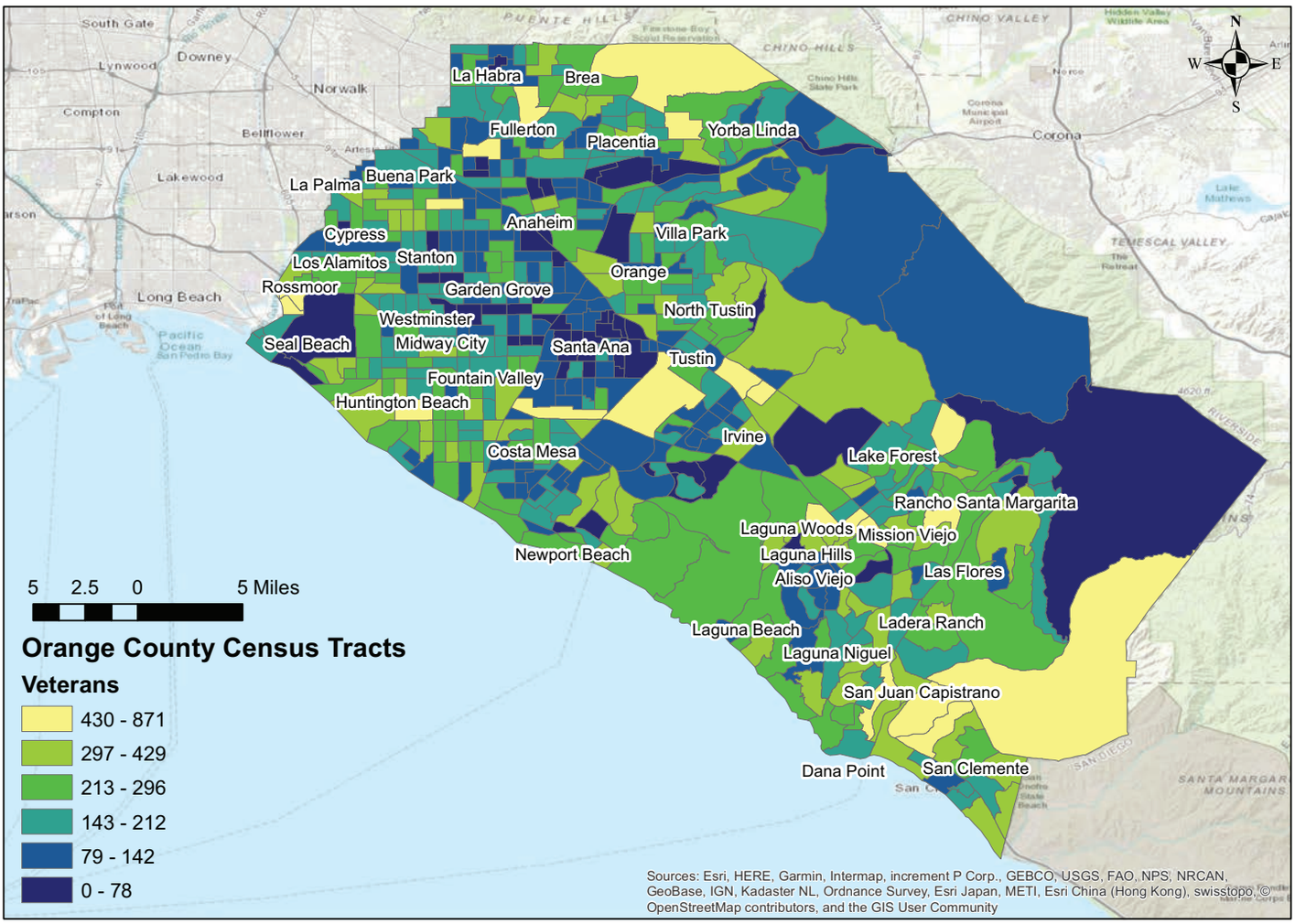
Source: U.S. Census Bureau, American Community Survey

Orange County Veterans Employment Status Compared to Non-Veterans, 2018



Source: U.S. Census Bureau, American Community Survey

Orange County Veteran Population by Census Tract, 2017



SPECIAL FEATURE: HEALTHCARE INFORMATION TECHNOLOGY

Information Technology (IT) is revolutionizing workplaces across the nation and Healthcare is no exception. Technological developments – including big data, automated processes, Internet-of-Things (IoT) and new ways to communicate – have transformed Healthcare, creating new occupations such as Medical Records and Health Information Technicians. This shift will dramatically change the current system. It will streamline the patient experience, allowing for collaboration between medical specialists and increase the ability of hospitals, urgent care centers and other healthcare organizations to more efficiently manage their facilities and operations. Additionally, and perhaps more importantly, IT analytics will result in better patient care as the interconnectedness of systems will allow for more rapid, accurate diagnoses and treatment at a lower cost.

Successfully integrating IT into the Healthcare industry means shifting from a largely manual and rigid system to a flexible and automated system, which will require a new database and software-driven approach with a focus on cybersecurity in order to analyze and protect patient data. The sheer amount of patient records and data, combined with the increasing pressure placed on healthcare organizations to efficiently deliver quality care, makes the development of Healthcare IT a likely continuing source of employment growth.

Approximately 2,084 Medical Records and Health Information Technicians were employed in Orange County in 2019. This emerging occupation, which grew by 2.5 percent in Orange County last year, represents the intersection between the Information and Healthcare industries and requires skills such as Medical Coding, Customer Billing, Medical Billing, Customer Service and International Statistical Classification of Diseases and Related Health Problems (ICD-10).

Medical Records and Health Information Technicians are not the only technology-related occupations in Healthcare. Many traditional IT occupations are already present in the Healthcare sector and have been rapidly growing over the past decade, highlighting the increased pervasiveness of technology in Healthcare delivery. These occupations typically provided above-average annual wages.

IT Occupations Within the Healthcare Industry in Orange County, 2009 - 2019

	Jobs (2009)	Jobs (2019)	Percent Change	Median Hourly Earnings	Entry Level Education
Computer User Support Specialist	155	275	77%	$26.47	Some College, No Degree
Computer Systems Analysts	108	220	104%	$44.03	Bachelor's Degree
Computer Occupations, All Other	57	186	226%	$38.96	Bachelor's Degree
Network and Computer Systems Administrators	152	156	3%	$42.80	Bachelor's Degree
Software Developers, Applications	68	134	97%	$52.99	Bachelor's Degree
Software Developers, Systems Software	26	63	142%	$59.19	Bachelor's Degree
Computer Network Support Specialists	40	62	55%	$31.83	Associate's Degree
Database Administrators	24	49	104%	$43.92	Bachelor's Degree
Computer Programmers	35	33	-6%	$40.93	Bachelor's Degree
Statisticians	5	34	580%	$40.50	Master's Degree

Source: Economic Modeling Specialists International

Healthcare IT occupations provide a variety of services, from big data analysis to remote patient monitoring, where patients can talk to doctors virtually and be diagnosed without having to step foot in a doctor's office. Advanced algorithms allow patients to input symptoms and receive a diagnosis from an automated software. These developing technologies will have a dramatic impact on Healthcare, with several new innovations in particular highlighting the industry's rapid transformation:

- 3-D Printed Devices allow for highly customized, low-cost products such as prosthetics.
- Point-of-Care (POC) Diagnostics allow for more convenient and timely testing resulting in faster, more cohesive and cheaper patient care.
- Telehealth offers convenient access to care while reducing office visits and travel time with the potential to increase self-care.
- Biosensors and Trackers allow consumers and doctors to efficiently monitor and track patient health enabling earlier intervention and prevention.
- Leveraging Social Media to Improve Patient Experience by tracking data on consumer experiences and population health trends.

While some of these innovations are already impacting the market, others, such as fully integrated Biosensors and Trackers, have not begun to reach their full transformative potential. Creating an environment which supports the development and implementation of these technologies will positively impact Orange County's Healthcare sector, increasing accessibility to Healthcare services while decreasing their cost.

One occupation, Medical and Health Services Managers, will be at the forefront of these efforts, with over three thousand job postings in the past twelve months. Medical and Health Services Managers are responsible for properly implementing and leveraging new technologies to ensure collaboration and oversight of Information Technology in the Healthcare environment in order to increase efficiency, improve patient care and protect patient privacy.

Other occupations which will be crucial as Information Technology and Health Care become increasingly intertwined include:

- Chief Medical Information Officer, a healthcare executive responsible for the health informatics platform required to work with clinical IT staff to support the efficient design, implementation and use of Healthcare technology;
- Medical Records and Health Information Technician, typically in charge of organizing and managing health information data helping to maintain its quality, accuracy, accessibility and security in physical files and electronic systems;
- Nurse Informaticists, defined by the International Medical Informatics as a "science and practice that integrates nursing, its information and knowledge, with management of information and communication technologies to promote the health of people, families, and communities worldwide;"
- Health Informatics Director, defined by the National Library of Medicine as those in charge of the design, development, adoption and application of information technology-based innovations in Healthcare services delivery, management, and planning.

The Healthcare Information and Management Systems Society (HIMSS), a global advisor and thought leader supporting the transformation of health through the application of information and technology, surveyed 369 Healthcare Information Technology leaders earlier this year. The table below shows the top five priorities identified by both hospitals and vendor/consultants:

Vendor/Consultants	Providers
Cybersecurity, Privacy, and Security	Cybersecurity, Privacy and Security
Improving Quality Outcomes Through Health IT	Improving Quality Outcomes Through Health IT
Data Science/Analytics/Clinical and Business Intelligence	Clinical Informatics and Clinician Engagement
Clinical Informatics and Clinician Engagement	Culture of Care and Care Coordination
Consumer/Patient Engagement & Digital/Connected Health	Process Improvement, Workflow, Change Management

Source: 2019 Annual HIMSS Survey

The importance of Privacy, Security and Cybersecurity, Data Analytics/Clinical and Business Intelligence and Clinical Informatics and Clinician Engagement to hospitals illustrates the impact technology continues to have on Healthcare; vendors and consultants are also focused on Information-related priorities.

Orange County stakeholders should take notice of these shifting priorities and position themselves to fully leverage the strong local presence of Healthcare and Information Technology industries and resources at their disposal to ensure the region becomes an industry leader in the field of Healthcare Information Technology. Growth in this new industry will require a talent pool with the right skillsets. The table below provides the hard and common skills, as well as top qualifications for Medical and Health Services Managers in Orange County.

Hard Skills, Common Skills, and Top Qualifications for Medical and Health Services Manager, Orange County 2018

Hard Skills	Common Skills	Top Qualifications
Managed Care	Management	Bachelor of Science in Nursing (BSN)
Nursing	Communications	Medical License
Utilization Management	Leadership	Licensed Clinical Social Worker (LCSW)
Medical Management	Innovation	Master of Business Administration (MBA)
Appeals	Operations	Licensed Vocational Nurse
Medical Necessity	Problem Solving	Licensed Marriage and Family Therapist (LMFT)
Management Process	Coordinating	Licensed Professional Counselor (LPC)
Medicare	Interpersonal Communications	Nurse Practitioner
Medicaid	Research	Licensed Practical Nurse
Quality Management	Microsoft Excel	Certified Case Manager

Source: Economic Modeling Specialists International

As technological innovations continue to impact both businesses and labor markets, understanding how occupations are being impacted is an important component of predicting future labor market shifts. The Brookings Institution, a nonprofit public policy organization, recently released a report highlighting the digitalization score of many occupations, indicating which occupations require high degrees of digital knowledge. In 2002, the majority of healthcare-related occupations had low digitalization scores as they often dealt primarily with customer or client interactions. As technologies have evolved, an increasing number of technologies have been instituted in these occupations resulting in higher digitalization scores in 2016. Virtual meetings, remote surgery or telesurgery, and improvements in digital health records have all impacted how healthcare professionals perform their duties, often dramatically improving their efficiency.

Top Movers on Digitalization Scores of Healthcare Occupations, 2002 v. 2016

Occupation	Digital Score (2002)	Digital Score (2016)
Audiologists	27	64
Chiropractors	16	60
Internists, General	27	58
Podiatrists	13	57
Physician Assistants	27	56
Surgeons	22	56
Pediatricians, General	27	54
Oral and Maxillofacial Surgeons	14	54
Orthotists and Prosthetists	13	51
Orthodontists	14	50
Dentists, General	17	50
Psychiatric Technicians	15	50
Occupational Therapists	38	50
Veterinarians	13	49
Opticians, Dispensing	17	48
Prosthodontists	14	48
Athletic Trainers	3	48
Veterinary Assistants and Laboratory Animal Caretakers	4	46
Surgical Technologists	8	42
Dietetic Technicians	8	28
Home Health Aides	3	23

Source: Brookings Institution

The Healthcare industry in Orange County has seen tremendous growth in recent years, growing by nearly 103 percent between 2001 and 2019. As of 2019, Orange County's Health Care and Social Assistance industry employed 201,176 individuals and is expected to grow by another 25 percent over the next decade.

Orange County Healthcare Industry Growth and Projected Growth, 2001-2029

NAICS	Description	2019 Jobs	2001-2019 % Change	2019-2029 % Change
62	Health Care and Social Assistance	201,176	102.8%	25.2%
621	Ambulatory Health Care Services	90,694	99.8%	26.0%
622	Hospitals	33,503	27.7%	8.9%
623	Nursing and Residential Care Facilities	28,316	79.4%	23.8%
624	Social Assistance	48,664	312.4%	35.7%
6211	Offices of Physicians	24,148	23.8%	8.0%
6212	Offices of Dentists	15,508	58.8%	18.3%
6213	Offices of Other Health Practitioners	17,749	214.8%	32.8%
6214	Outpatient Care Centers	15,863	696.7%	45.9%
6215	Medical and Diagnostic Laboratories	6,076	47.3%	15.9%
6216	Home Health Care Services	8,591	225.2%	46.1%
6219	Other Ambulatory Health Care Services	2,759	59.3%	29.3%
6221	General Medical and Surgical Hospitals	30,730	22.1%	6.8%
6222	Psychiatric and Substance Abuse Hospitals	896	61.6%	20.0%
6223	Specialty (except Psychiatric and Substance Abuse) Hospitals	1,876	274.9%	37.0%
6231	Nursing Care Facilities (Skilled Nursing Facilities)	12,210	77.1%	18.9%
6232	Residential Intellectual and Developmental Disability, Mental Health, and Substance Abuse Facilities	5,179	39.3%	37.4%
6233	Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly	10,290	174.7%	27.8%
6239	Other Residential Care Facilities	637	-55.3%	-58.8%
6241	Individual and Family Services	39,468	920.7%	43.3%
6242	Community Food and Housing, and Emergency and Other Relief Services	1,188	82.4%	5.1%
6243	Vocational Rehabilitation Services	2,246	-3.5%	-13.2%
6244	Child Day Care Services	5,763	16.3%	8.8%

Source: Economic Modeling Specialists International

On an occupational basis, Healthcare Practitioners and Technical occupations employed 75,087 individuals in 2019 and the Healthcare Support occupations employed 37,431 individuals. Over the next ten years, they are expected to increase by 17 percent and 25 percent, respectively.

Orange County Healthcare Occupation Growth and Projected Growth, 2001-2029

SOC	Description	2019 Jobs	2001-2019 % Change	2019-2029 % Change
29-0000	Healthcare Practitioners and Technical Occupations	75,087	61.2%	17.3%
31-0000	Healthcare Support Occupations	37,431	66.7%	25.1%
29-1000	Health Diagnosing and Treating Practitioners	46,788	65.6%	17.5%
29-2000	Health Technologists and Technicians	26,868	54.3%	17.1%
29-9000	Other Healthcare Practitioners and Technical Occupations	1,430	53.6%	12.6%
31-1000	Nursing, Psychiatric, and Home Health Aides	11,890	31.2%	35.4%
31-2000	Occupational Therapy and Physical Therapist Assistants and Aides	1,942	132.5%	44.2%
31-9000	Other Healthcare Support Occupations	23,599	87.9%	18.3%

Source: Economic Modeling Specialists International

Alongside measures of employment, a recently developed "Automation Index" indicates the likelihood of automation for occupations. An automation index below 100 indicates a below average risk of automation while scores above 100 indicate an above average risk of automation. Looking at the table below, the primary categories of Orange County Healthcare occupations all scored below 100 indicating that this sector will be somewhat more immune to the disruptive forces of automation.

Orange County Healthcare Occupations by Automation Index, 2019

SOC	Description	Automation Index
29-0000	Healthcare Practitioners and Technical Occupations	88.4
31-0000	Healthcare Support Occupations	95.6
29-1000	Health Diagnosing and Treating Practitioners	86.0
29-2000	Health Technologists and Technicians	92.6
29-9000	Other Healthcare Practitioners and Technical Occupations	91.9
31-1000	Nursing, Psychiatric, and Home Health Aides	95.4
31-2000	Occupational Therapy and Physical Therapist Assistants and Aides	89.2
31-9000	Other Healthcare Support Occupations	96.6

Source: Economic Modeling Specialists International

Looking at the automation index for specific, individual occupations, several scored over 100, **indicating an above average likelihood of automation**. The Orange County Healthcare occupation which scored the highest was "Orderlies" at 116.6, followed by Pharmacy Aides (113.1) and Medical Equipment Preparers (110.1). Many of these occupations are assistants to more established occupations, indicating that evolving technologies will most likely streamline the work required and thus reduce the need for assistants.

Orange County Healthcare Occupations with Automation Indexes Above '100'

SOC	Description	Automation Index*
31-1015	Orderlies	116.6
31-9095	Pharmacy Aides	113.1
31-9093	Medical Equipment Preparers	110.1
29-2052	Pharmacy Technicians	109.9
29-2092	Hearing Aid Specialists	106.8
31-9097	Phlebotomists	104.2
31-9094	Medical Transcriptionists	100.7

**An automation index above 100 indicates an above average likelihood of automation while a reading below 100 indicates a below average likelihood of automation.*

Source: Economic Modeling Specialists International

Healthcare occupations with automation indexes below 85, as seen below, are primarily occupations which have daily interactions with clients and customers or occupations which are highly technical in nature. Highly technical occupations or those which have high degrees of customer interactions, which can change dramatically depending on the clients, are very difficult to automate as they require a broad range of inputs and responsibilities which is difficult for software to replicate. Nurses, surgeons, and nearly every other health care practitioner therefore are highly unlikely to see their occupations be replaced by a computer any time soon.

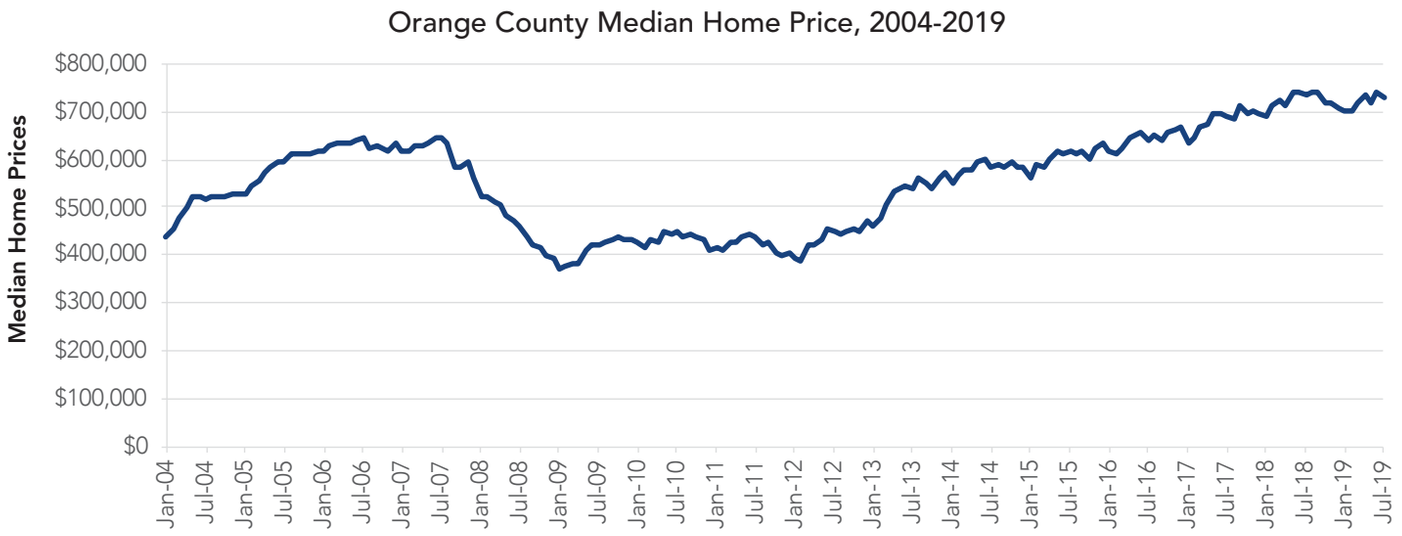
Orange County Healthcare Occupations with Automation Indexes Below '85'

SOC	Description	Automation Index
29-2061	Licensed Practical and Licensed Vocational Nurses	84.8
29-1031	Dietitians and Nutritionists	84.7
29-1067	Surgeons	84.2
29-2041	Emergency Medical Technicians and Paramedics	83.7
29-1063	Internists, General	83.3
29-1041	Optometrists	83.2
29-1171	Nurse Practitioners	83.2
29-1131	Veterinarians	83.1
29-1064	Obstetricians and Gynecologists	83.0
29-1065	Pediatricians, General	82.7
29-1199	Health Diagnosing and Treating Practitioners, All Other	82.3
29-1061	Anesthesiologists	82.1
29-1011	Chiropractors	81.8
29-1125	Recreational Therapists	80.4
29-2053	Psychiatric Technicians	79.4
29-1022	Oral and Maxillofacial Surgeons	75.1

Source: Economic Modeling Specialists International

WORKFORCE HOUSING HIGHLIGHT

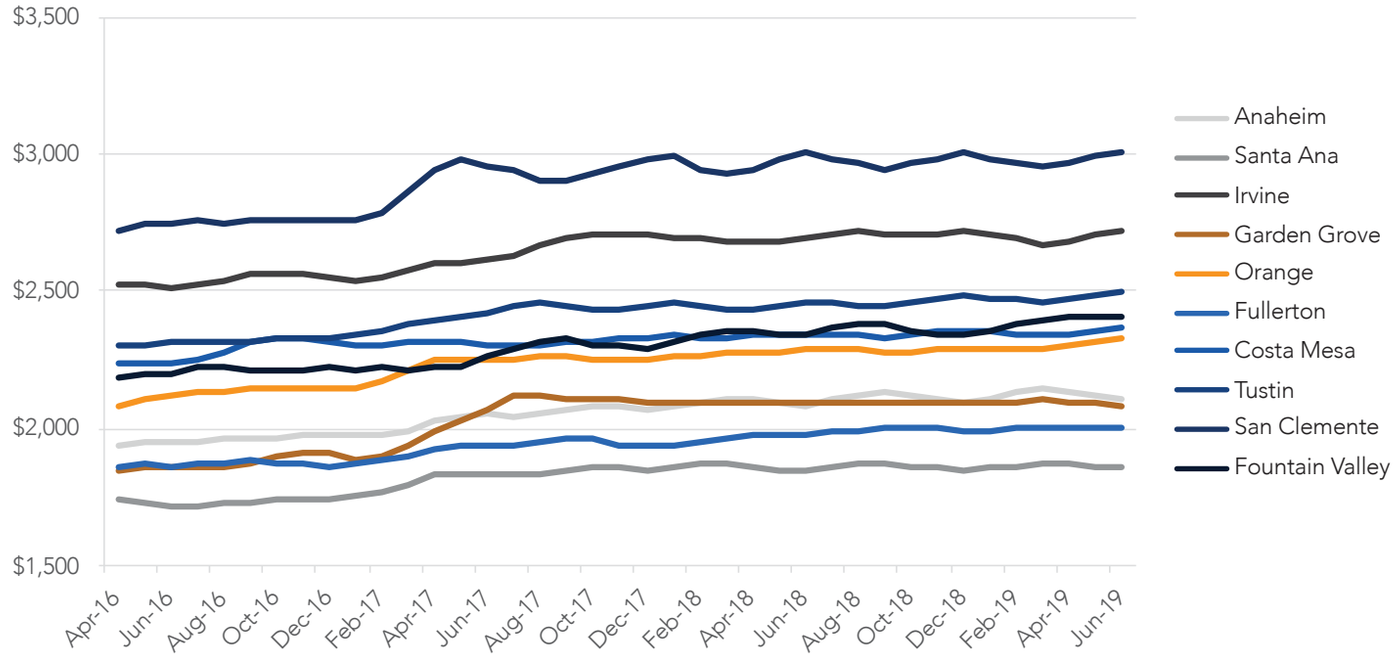
After a brief decline in late 2018 and early 2019, Orange County's median home price reached $729,000 in July 2019, representing a slight year-over-year decline of 0.8 percent.



Source: CoreLogic

Orange County cities with the highest median rent for a 2-bedroom apartment in June 2019 included San Clemente ($3,010), followed by Irvine ($2,725) and Tustin ($2,498). The lowest median rent for a 2-bedroom was in Santa Ana at $1,857. Over the past year, the most significant increases in rent occurred in Fountain Valley (+2.6 percent), Tustin (+1.6 percent) and Orange (+1.5 percent). Only one city, Garden Grove, saw a decrease (-0.2 percent) over the past year.

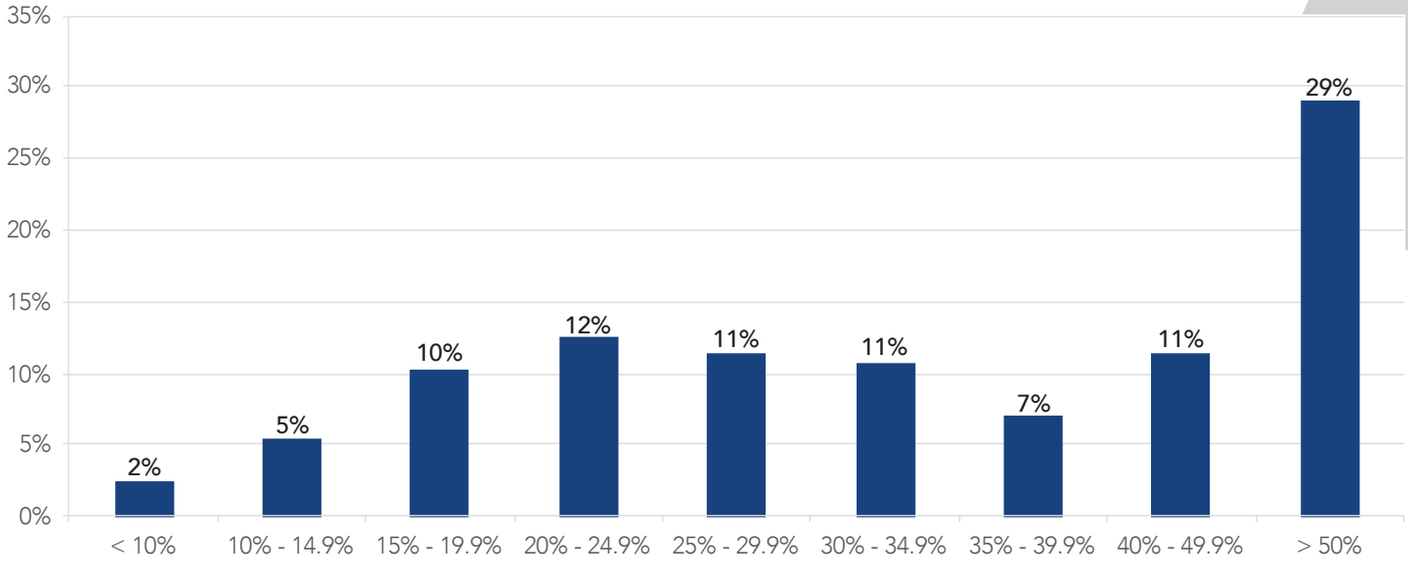
Monthly Median Rent for 2-Bedroom Apartments by Orange County City, 2016-2019



Source: Apartmentlist.com

Affordability has become more and more of a regional concern as rental prices to continue to climb. These concerns have been exacerbated by issues such as student debt and cost-of-living increases, which limit many residents' ability to save or to purchase homes. This leads many individuals to rent instead of buying a house, increasing the overall demand for rentals in the region, especially near places of employment. Since 1981, the Federal Government has recommended that individuals spend no more than 30 percent of the household income on housing-related costs such as mortgages or rent in order to ensure they can afford expenses while still being able to save. Today, the majority of renters spend over 30 percent. In 2017, 58 percent of Orange County renters spent more than 30 percent of their household income on rent while 29 percent spent over 50 percent of their income on rent.

Percent of Households by Gross Rent as a Percentage of Household Income in Orange County, 2017



Source: U.S. Census Bureau, American Community Survey

REPORT PARTNERS AND ACKNOWLEDGEMENTS

The 2020 Orange County Workforce Indicators Report is the product of a collaborative effort among many parties, whose support and involvement are critical to its ongoing impact. Many thanks to all who participated.

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DATA SOURCES

- Apartmentlist.com
- Brookings Institution
- California Association of Realtors
- California Department of Education, CAASPP
- California Department of Education, DataQuest – Educational Demographics Unit
- California Department of Education, Data Reporting Office
- California Department of Finance
- California Department of Finance, Demographic Research Unit
- California Community Colleges Information Management Systems Data Mart
- California Community Colleges Salary Surfer
- California Employment Development Department
- California Employment Development Department, QCEW Dataset
- California Employment Development Department, OES Dataset
- California State University, Fullerton
- California State University, Fullerton; Center for Demographic Research
- California State University, Fullerton; 2017 Economic Forecast
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- Corelogic
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- Georgetown Center on Education and the Workforce
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- International Medical Informatics
- Jones Lang LaSalle
- LinkedIn
- McKinsey Global Institute
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- The Dimension of Defensibility
- The Healthcare Information and Management Systems Society
- The International Assessment of Adult Competencies
- The World Economic Forum
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- U.S. Bureau of Labor Statistics, Occupational Employment Statistics
- U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages
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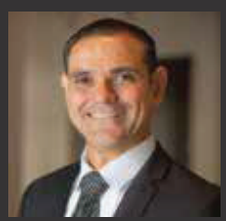

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Source: "Analysis of the Economic Impact and Return on Investment of Education," FY 2016-17, South Orange County Community College District, July 2018

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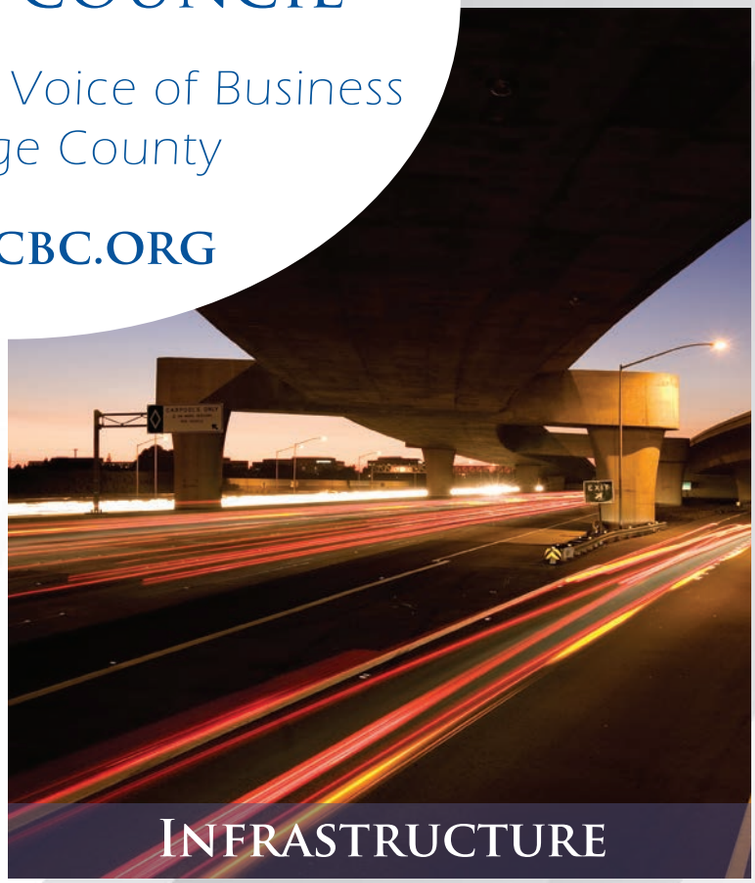

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Orange County Business Council's Research Team is led by Dr. Wallace Walrod. With over 25 years of experience, Dr. Walrod has led research projects with many prominent organizations including Toshiba America Information Systems, Hitachi Chemical, Bank of America/Merrill Lynch, The Irvine Company, First American Corporation, California Emerging Technology Fund.

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