

ADVANCED MANUFACTURING

*San Diego and
Imperial Counties*

Ruishan Chow, 2020



COMMUNITY COLLEGES

SAN DIEGO & IMPERIAL COUNTIES

CAREER EDUCATION

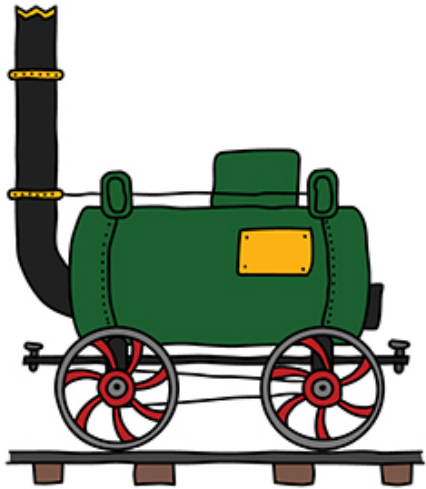
Purpose

- What is Advanced Manufacturing?
- Methodology
- Trend
- Recommendations

What does *Advanced Manufacturing* look like for an employer?

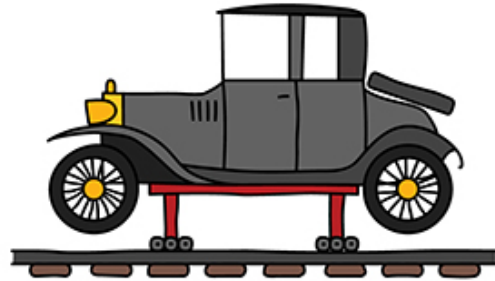


Future of Manufacturing: The Smart Factory



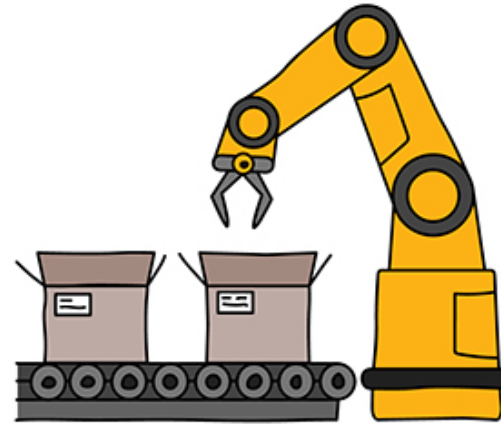
Industry 1.0

The Industrial Revolution begins. Mechanization of manufacturing with the introduction of steam and water power



Industry 2.0

Mass production assembly lines using electrical power



Industry 3.0

Automated production using electronics, programmable logic controllers (PLC), IT systems and robotics



Industry 4.0

The 'Smart Factory'. Autonomous decision making of cyber physical systems using machine learning and Big Data analysis. Interoperability through IoT and cloud technology.

Source: Daborn, C. (2018). Behance. Industry 4.0 Infographics. Retrieved from: <https://www.behance.net/gallery/61690915/Industry-40-Infographics>

Methodology

- Reviewed and analyzed LMI reports
- Conducted secondary research to identify data sources
- Interviews with Employers to validate findings
- Surveys
- Labor Market Analysis by COE for Labor Market Research
- Direct Interactions with Employers in Multiple Venues

Employers and Organizations

- Etogen Precision
- Hunter Industries
- Fanuc
- Providien
- Argonaut
- CNC Western
- Genentech
- GenMark Diagnostics
- SeaSpine
- Taylors Guitar
- TransPower
- Cohu
- CIM
- Beckman Coulter Diagnostics
- Henry Schein
- Watkins Wellness
- General Atomics
- Solar Turbines
- Johnson Matthey
- Deering Banjo
- MagnaFlow
- Sendx Medical
- Anonymous...

Trends: San Diego-Imperial County

Exhibit 1a: Number of Jobs for Industrial Automation Occupations (2009-2024)⁴

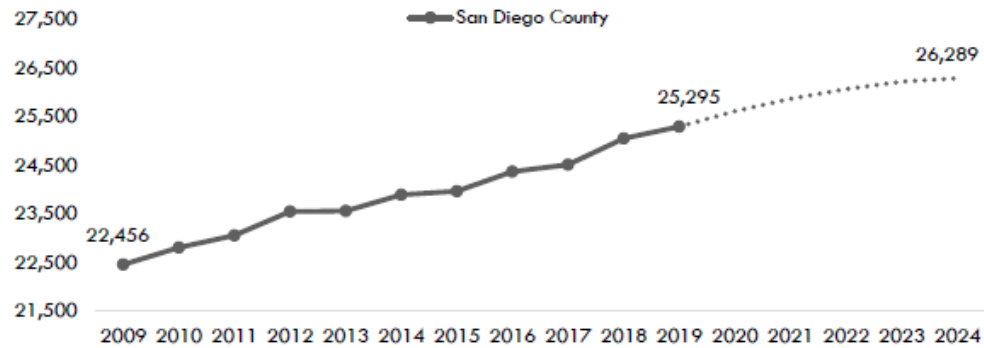


Exhibit 1a: Number of Jobs for Industrial Automation Occupations (2009-2024)⁴

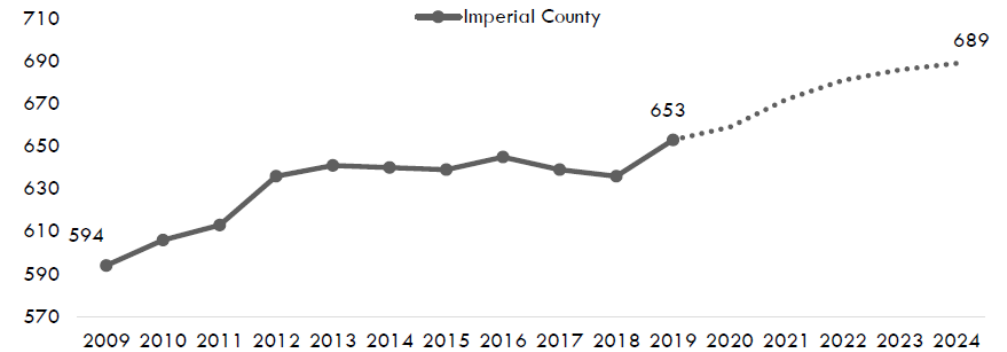


Exhibit 6: Labor Demand (Annual Openings) Compared with Labor Supply (Average Annual Awards)

Community Colleges and Other Postsecondary Educational Institutions	Demand (Annual Openings)	Supply (Total Annual Average Supply)	Supply Gap or Oversupply
San Diego	2,719	258	2,461
California	27,830	3,604	24,226

Exhibit 6: Labor Demand (Annual Openings) Compared with Labor Supply (Average Annual Awards)

Community Colleges and Other Postsecondary Educational Institutions	Demand (Annual Openings)	Supply (Total Annual Average Supply)	Supply Gap or Oversupply
Imperial	73	26	47
California	27,830	3,604	24,226

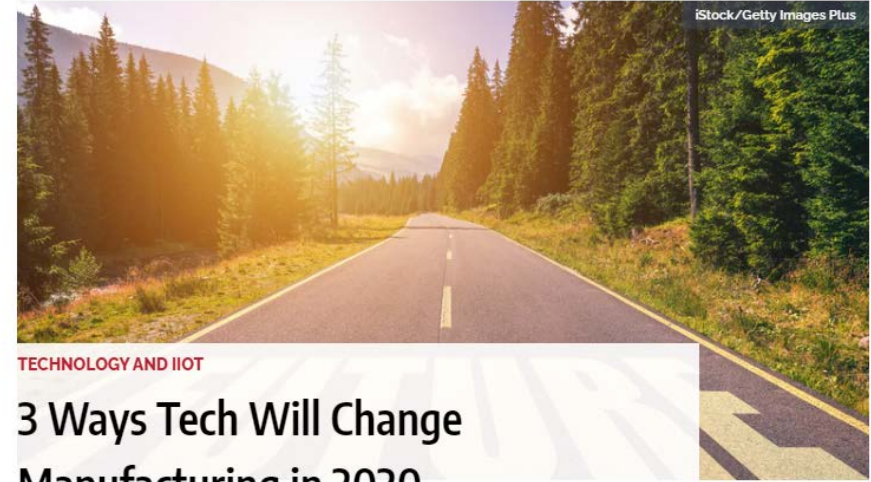
Source: Bartel, T. N. & Edwards, J. (2020). Center of Excellence for Labor Market Research. Industrial Automation Occupations.

Latest Research & News



Digitization in Machinery & Industrial Automation

The machinery and automation industry is changing rapidly—as new technologies, customer demands, and players emerge. The industry is moving away from its traditional role as the hardware-centric supplier of equipment. Increasingly, it is embracing a new role as the provider of connected production solutions and services.



TECHNOLOGY AND IIOT

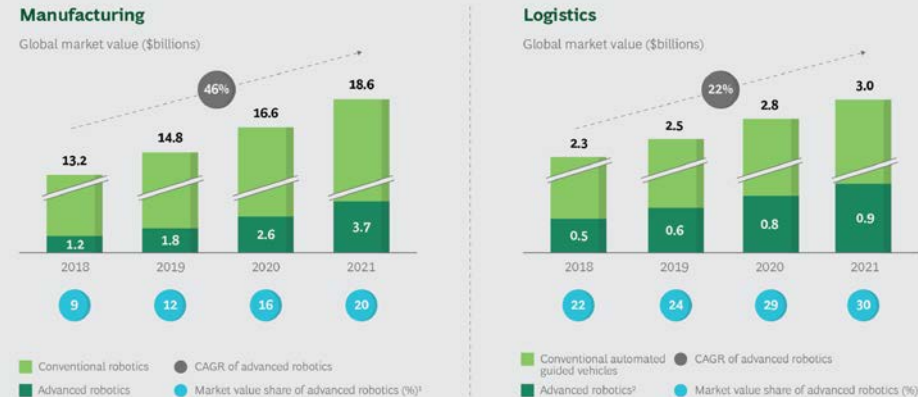
3 Ways Tech Will Change Manufacturing in 2020

... And you thought 2019 was exciting.

Antony Bourne
JAN 15, 2020

IndustryWeek

EXHIBIT 1 | Demand for Advanced Robotics Is Growing Rapidly



Sources: International Federation of Robotics' World Robotics Industrial Robots 2018 report; BCG research.
¹As a share of total industrial robotics in manufacturing environments.
²Indoor automated guided vehicles that can move autonomously without support from dedicated infrastructure (such as magnetic strips).
³As a share of total automated guided vehicles in logistics environments.

TECH TRENDS

5G is accelerating factory automation that could add trillions to the global economy

PUBLISHED SAT, JUL 11 2020 10:30 AM EDT

Tim Hornyak
@ROBOTOPIA

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No. of Jobs: SD-Imperial County (2019-2024)

Exhibit 1b: Number of Jobs for Industrial Automation Occupations in San Diego County (2019-2024)

Occupational Title	2019 Jobs	2024 Jobs	2019 - 2024 Net Jobs Change	2019-2024 % Net Jobs Change	Annual Openings (Demand)
Maintenance and Repair Workers, General	13,796	14,480	684	5%	1,508
Installation, Maintenance, and Repair Workers, All Other	3,290	3,358	68	2%	371
Electrical and Electronics Engineering Technicians	3,256	3,296	40	1%	329
Industrial Machinery Mechanics	2,343	2,450	107	5%	243
Electrical and Electronics Repairers, Commercial and Industrial Equipment	943	959	16	2%	88
Industrial Engineering Technicians	629	664	35	6%	70
Mechanical Engineering Technicians	530	562	32	6%	60

⁴ Emsi 2020.01; QCEW, Non-QCEW, Self-Employed.

Occupational Title	2019 Jobs	2024 Jobs	2019 - 2024 Net Jobs Change	2019-2024 % Net Jobs Change	Annual Openings (Demand)
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	222	227	5	2%	21
Electro-Mechanical Technicians	141	149	8	6%	16
Electrical and Electronics Installers and Repairers, Transportation Equipment	144	143	-1	-1%	13
Total	25,294	26,288	994	4%	2,719

Exhibit 1b: Number of Jobs for Industrial Automation Occupations in Imperial County (2019-2024)

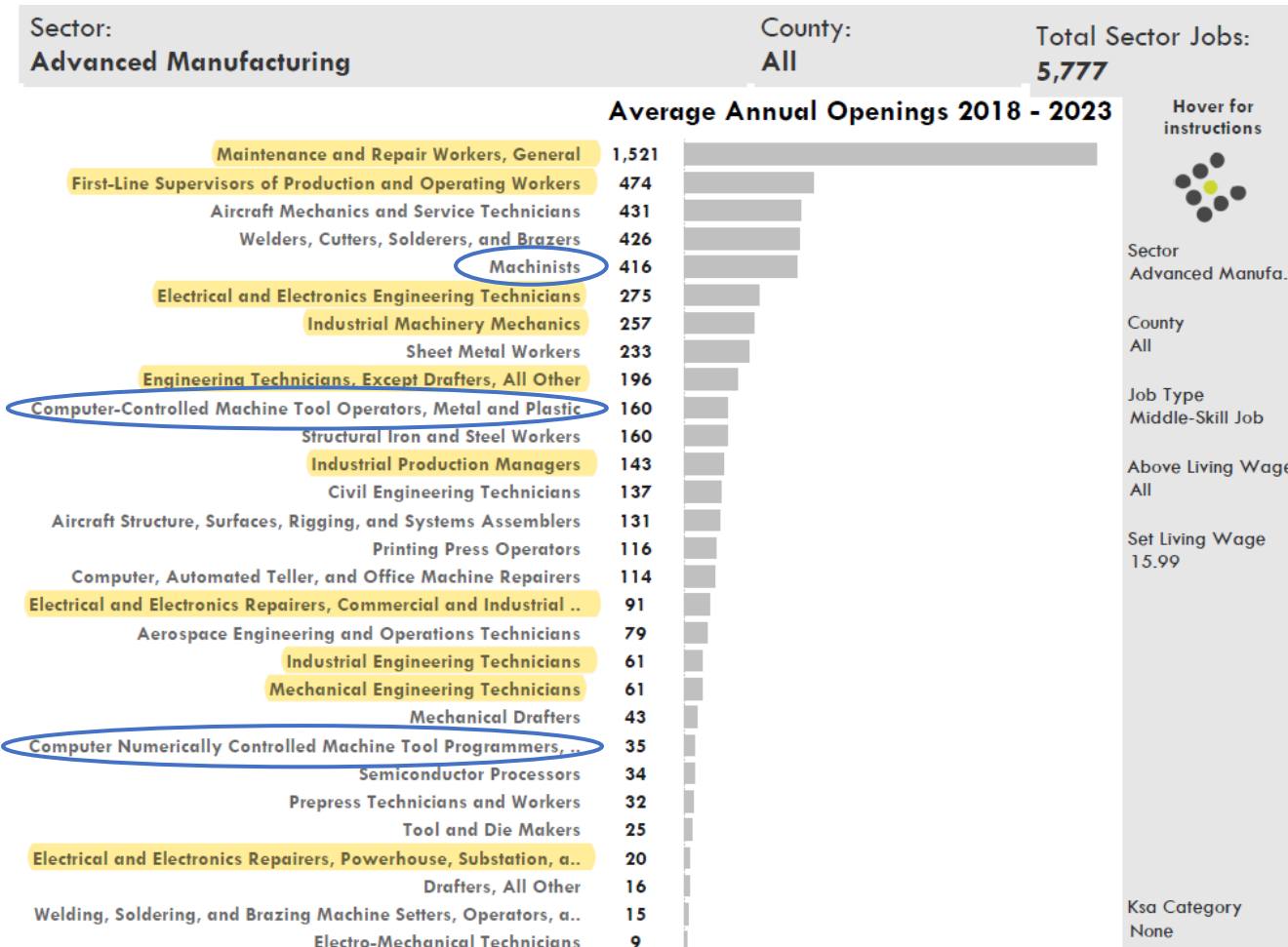
Occupational Title	2019 Jobs	2024 Jobs	2019 - 2024 Net Jobs Change	2019-2024 % Net Jobs Change	Annual Openings (Demand)
Maintenance and Repair Workers, General	480	505	25	5%	53
Installation, Maintenance, and Repair Workers, All Other	87	92	5	6%	9
Electrical and Electronics Engineering Technicians	45	49	4	9%	6
Industrial Machinery Mechanics	25	25	0	0%	3
Electrical and Electronics Repairers, Commercial and Industrial Equipment	<10	<10	Insf. Data	Insf. Data	Insf. Data
Industrial Engineering Technicians	<10	<10	Insf. Data	Insf. Data	Insf. Data

⁴ Emsi 2020.01; QCEW, Non-QCEW, Self-Employed.

Occupational Title	2019 Jobs	2024 Jobs	2019 - 2024 Net Jobs Change	2019-2024 % Net Jobs Change	Annual Openings (Demand)
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	<10	<10	Insf. Data	Insf. Data	Insf. Data
Electro-Mechanical Technicians	0	0	0	0%	0
Electrical and Electronics Installers and Repairers, Transportation Equipment	0	0	0	0%	0
Total	653	689	36	6%	73

Source: Bartel, T. N. & Edwards, J. (2020). Center of Excellence for Labor Market Research. Industrial Automation Occupations.

Occupations related to Industrial Automation & Maintenance

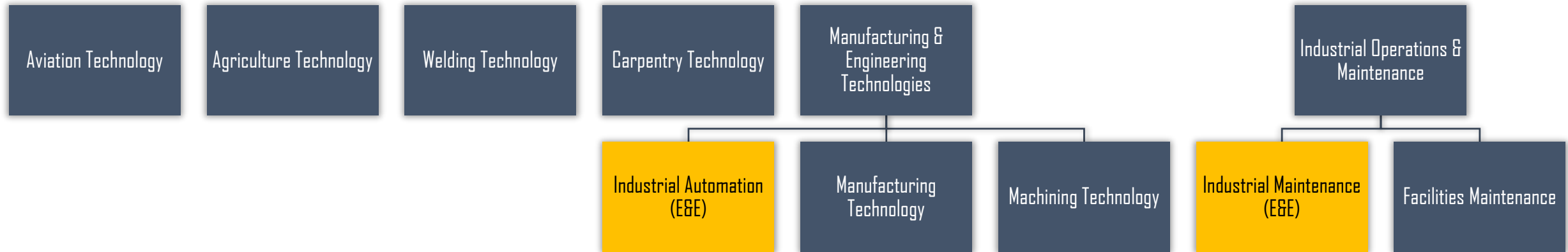


Additional Occupations:

- Mechatronics Technician
- Installation, Maintenance, and Repair Workers (371)
- Manufacturing Engineering Technologists

Source: Centers of Excellence for Labor Market Research. (2019). POC - San Diego-Imperial Regional KSA Analyzer v2.3

Proposed Programs: *Industrial Automation & Maintenance*



- Programs in yellow boxes do not currently exist in the San Diego-Imperial region
- Industrial Automation and Industrial Maintenance will include *Automation, Robotics & Mechatronics*
- E&E stands for *Electronics & Electrical*

Career Ladder - Production

Management Path

Technical Path

Bachelor's Degree

Bachelor's Degree +
Work Experience

Or

Bachelor's Degree

Middle Skills

Associate Degree +
Work Experience

or

Associate Degree

or

Post-secondary non-
degree award

or

High school Diploma +
Work experience

Operations Director/Plant Manager

Assistant Facilities/Industrial Maintenance Manager
or Middle Management

Production Manager
\$99,466/year

Assistant Production Manager/Superintendent

Production Supervisor
\$61,714/year

Production Team/Shift Lead
\$46,717/year

Engineering/Industrial Automation Technician or Machinist/Production Technician
\$36,046-\$41,600/year

Operator
\$29,452/year

Technology Director

Technology Manager

Senior Industrial Maintenance Engineer

Engineer
\$61,000 – 111,000/year

Associate Engineer/Assistant Engineer
\$60,877 - \$83,971/year

Senior Engineering/Industrial Automation Technician
\$56,600 - \$77,860/year

Skills & Competencies

- Safety
- Programming
- Systems Engineering
- Electronics & Electrical
- Test Automation
- Manufacturing Processes
- Data Management
- Data Science
- Project Management
- Lean Six Sigma
- Leadership
- Supervision
- Teamwork
- People Skills
- Problem Solving

Skills & Competencies

- Safety
- Lean Six Sigma
- Leadership
- Supervision
- Teamwork
- People Skills
- Data Acquisition & Analytics
- Electronics & Electrical
- Automation Systems
- Manufacturing Processes
- Quality
- Machining
- Mechanical (Pneumatics & Hydraulics)
- Process Control
- Employability Skills
- Problem Solving

Career Ladder - Maintenance

Management Path

Technical Path

Bachelor's Degree

Bachelor's Degree +
Work Experience

Or

Bachelor's Degree

Middle Skills

Associate Degree +
Work Experience

or

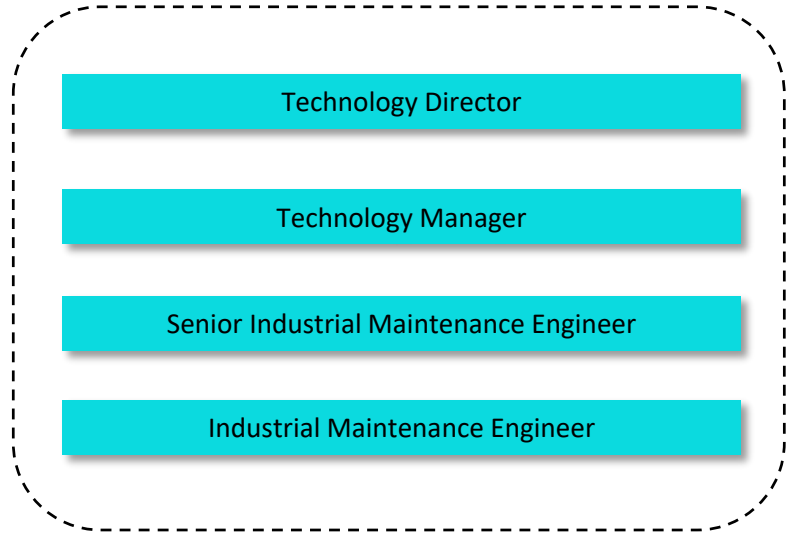
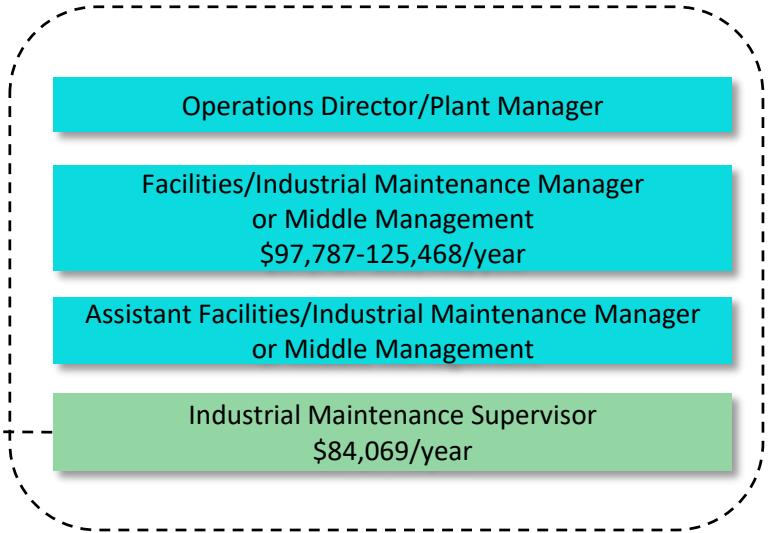
Associate Degree

or

Post-secondary non-
degree award

or

High school Diploma +
Work experience



Senior Industrial Maintenance Technician
\$79,407/year

Industrial Maintenance Technician
\$55,463/year

Installer, Maintenance and Repair Workers
\$42,827/year

Maintenance and Repair Workers
\$41,142/year

- Skills & Competencies**
- Safety
 - Programming
 - Systems Engineering
 - Electronics & Electrical
 - Test Automation
 - Manufacturing Processes
 - Data Management
 - Data Science
 - Project Management
 - Lean Six Sigma
 - Leadership
 - Supervision
 - Teamwork
 - People Skills
 - Problem Solving

- Skills & Competencies**
- Safety
 - Lean Six Sigma
 - Leadership
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 - Electronics & Electrical
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 - Mechanical (Pneumatics & Hydraulics)
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The Potentials

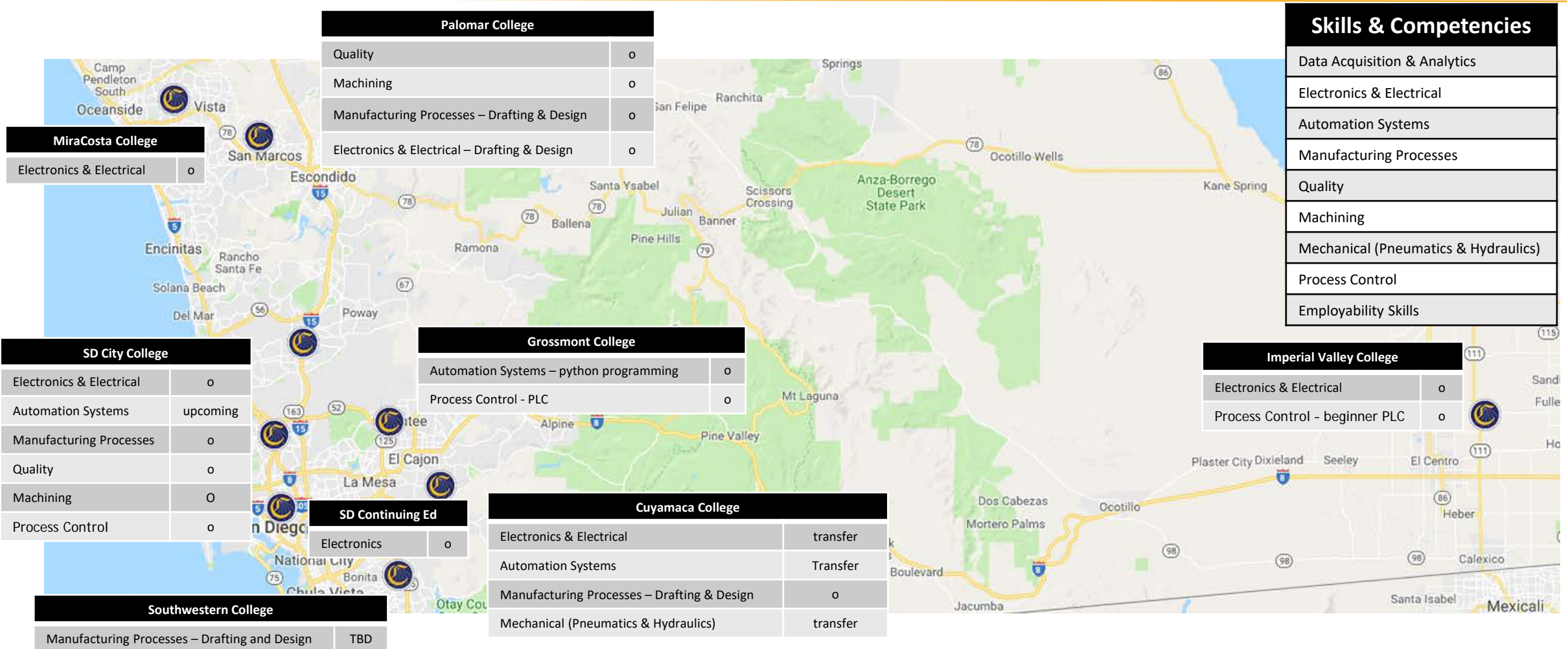
	North County		East County		Metro			South County	Imperial County
	Palomar	MiraCosta	Grossmont	Cuyamaca	City	Miramar	Mesa	Southwestern	Imperial Valley
Colleges with Proposed Program		TCI							
Colleges with Potential	Y	Y	Y	Y	Y			Y	Y

Skills & Competencies

- Data Acquisition & Analytics
- Electronics & Electrical
- Automation Systems
- Manufacturing Processes
- Quality
- Machining
- Mechanical (Pneumatics & Hydraulics)
- Process Control
- 21st Century Employability Skills

Source: Amatrol. (2020). Advanced Manufacturing | Industrial Careers Hands-on Skills Training. Retrieved from: <https://amatrol.com/wp-content/uploads/2020/02/CH-23-H-Advanced-Manufacturing-Chart-Interactive-PDF.pdf>

Current State



Recommendations

North

MiraCosta

Cross-departmental collaboration between Design, Computer Studies & Information Technology and Biomanufacturing departments. Provide offerings in Quality control and Data Acquisition and Analytics.

Palomar

Cross-departmental collaboration between Drafting, Drone Applications and Technologies, Industrial Technology/Machining, Engineering and Physics and HVAC departments. Provide offerings in Data Acquisition and Analytics.

East

Cuyamaca

Cross-departmental collaboration between CADD, Electrical Engineering, and Computer and Information Science (Mechatronics) departments. Provide offerings in Data Acquisition and Analytics.

Grossmont

Invest in more course offerings or consider partnering with another college such as Cuyamaca to provide a comprehensive Industrial Automation & Maintenance program

Recommendations

Metro

San Diego City

Its MACT, MFET and Electronics programs combined along with more expansion of course offerings in automation and mechanical systems will position the college well. Provide offerings in Data Acquisition and Analytics.

San Diego Continuing Education

Provide certifications in Maintenance and Repair, Leadership and Management, Sales and Lean Six Sigma

South

Southwestern

Industry 4.0 Fundamentals and the Digital Connectivity in Supply Chain and Logistics (Deloitte, 2016)

Recommendations

Imperial Valley

Imperial Valley

Create an industrial automation and maintenance program focusing on industries in agricultural, sustainable technologies such as bio-fuel and solar energy. Sensors, automation and communication technologies are needed for efficient use of energy calls for system-wide, integrated approaches to minimize the socio-economic-environmental impacts of energy systems. (Motlagh, N. H. et al., 2019)

Other Considerations

- K-12 Pipeline
- Alignment & Marketing
- Curriculum to include industry insights and how an organization is ran
- Regional Certifications
- Mesa and Miramar Colleges - Short-term programs or certifications

Industrial Automation & Maintenance Programs

(Example)

Class Size: 24-30 students

Instructors: 2 Full-time, 1-2 Part-time (depends on which level)

Curriculum: All AS and above courses to include aspects of Business Communications, Project Management, Ethics, Management Science, Technical writing and Technical math

Equipment & Training Provider	Costs			Space Requirement (Level 3 In-Person)
	Level 1	Level 2	Level 3	
Amatrol (USA) FESTO (Germany) SMC (Japan)	\$30K	\$150K	\$1-2M	10,000 - 20,000 sq. ft (15,000 sq. ft)

Note: Costs does not include training costs

Thank You

References

Amatrol. (2020). Advanced Manufacturing | Industrial Careers Hands-on Skills Training. Retrieved from: <https://amatrol.com/wp-content/uploads/2020/02/CH-23-H-Advanced-Manufacturing-Chart-Interactive-PDF.pdf>

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Centers of Excellence for Labor Market Research. (2019). POC - San Diego-Imperial Regional KSA Analyzer v2.3

Daborn, C. (2018). Behance. Industry 4.0 Infographics. Retrieved from: <https://www.behance.net/gallery/61690915/Industry-40-Infographics>

Motlagh, N. H. et al. (2020). Internet of Things (IoT) and the Energy Sector. *Energies*. 2020,13, 494

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