Advanced Manufacturing

lepc | Local Employment Planning Council

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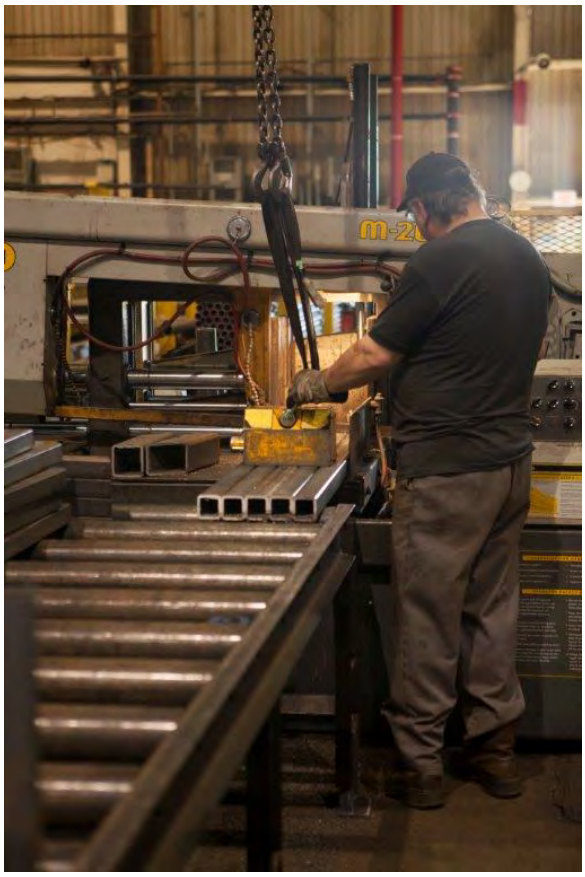


"….The strength of the region's manufacturing sector is the fact that there are a range of sub-sectors within it."

[Photos provided my Middlesex County- Economic Development]

Introduction

Since 2007, manufacturing in the London Economic Region has taken a wild and tumultuous ride. As the sector that was hit the hardest during the recession, our region saw soaring unemployment rates as companies were forced to cut costs, and, by result, the local workforce. Backed into a corner, local manufacturers found new ways to provide unique value propositions to the market, and are now leading the charge out of the recession with an extremely high amount of employer-driven innovation. Much of the manufacturing now requires skilled labour, as the region's local manufacturers have often shifted from a high-volume/low-cost product suite towards making one custom-built, highly complex solution per customer at a more premium price level.

Now, local manufacturers are finding new ways to increase production and efficiency in this environment thanks to the ever-evolving improvements in technology, and the skillsets of manufacturing workers are adapting to this trend as a result. Employers are hoping to find experienced labour with strong technical expertise in manufacturing, but are also seeking out candidates with an array of soft skills. Not only will job-seekers need the educational requirements for a local career in manufacturing, they will need to develop attitude, teamwork and problem solving skills as well.

We would like to thank local industry insiders for their insight into this sector, local economic development offices for their input and advice, the Excellence in Manufacturing Consortium and to the many anonymous contributors who graciously provided their time and input.

To help prepare people for employment, your Local Employment Planning Council has created a series of research reports to better prepare current and future job seekers for changing demands in occupations.

This is the third research report in a 5-part series that explores the evolution of skills required to be successful in key employment sectors. Each sector has been identified through discussion with local economic development offices and by examining the prominent sectors in our communities. Across Elgin, Middlesex, Oxford and London, it is clear that these five sectors play a significant role in our economy and our workforce:

- Agriculture
- Healthcare
- Manufacturing
- Supply Chain
- Retail

Studying the Manufacturing Workforce

In 2015, the manufacturing sector employed over 46,000 people within the London Economic Region. The sector is forecasted to grow its workforce by 0.9% in the region between 2015 and 2019, requiring over 8,000 workers within the next 10 years.

The Aging Manufacturing Workforce

- The average age of a manufacturing worker is 44
- 90% of new hires within the sector replace retirees
- 89% of manufacturing employers report recruitment challenges in the Southern Ontario Region (London and Windsor)
- 8,300 new workers required in the next 10 years
- 90% of total hiring requirement is to replace retiring workers
- The median age of a manufacturing worker is 44 years-old, whereas the median age of all workers is 41.

Source: The Future of Manufacturing in London, Prism Economics & Analysis

Local and National Manufacturing Trends

In the local region, many people hear “manufacturing” and think of the large companies with hundreds of employees. In reality, small to medium sized businesses with less than 50 employees make up 85% of manufacturing companies in the region. The following information comes from the Prism Economics & Analysis presentation, "The Future of Manufacturing in London."

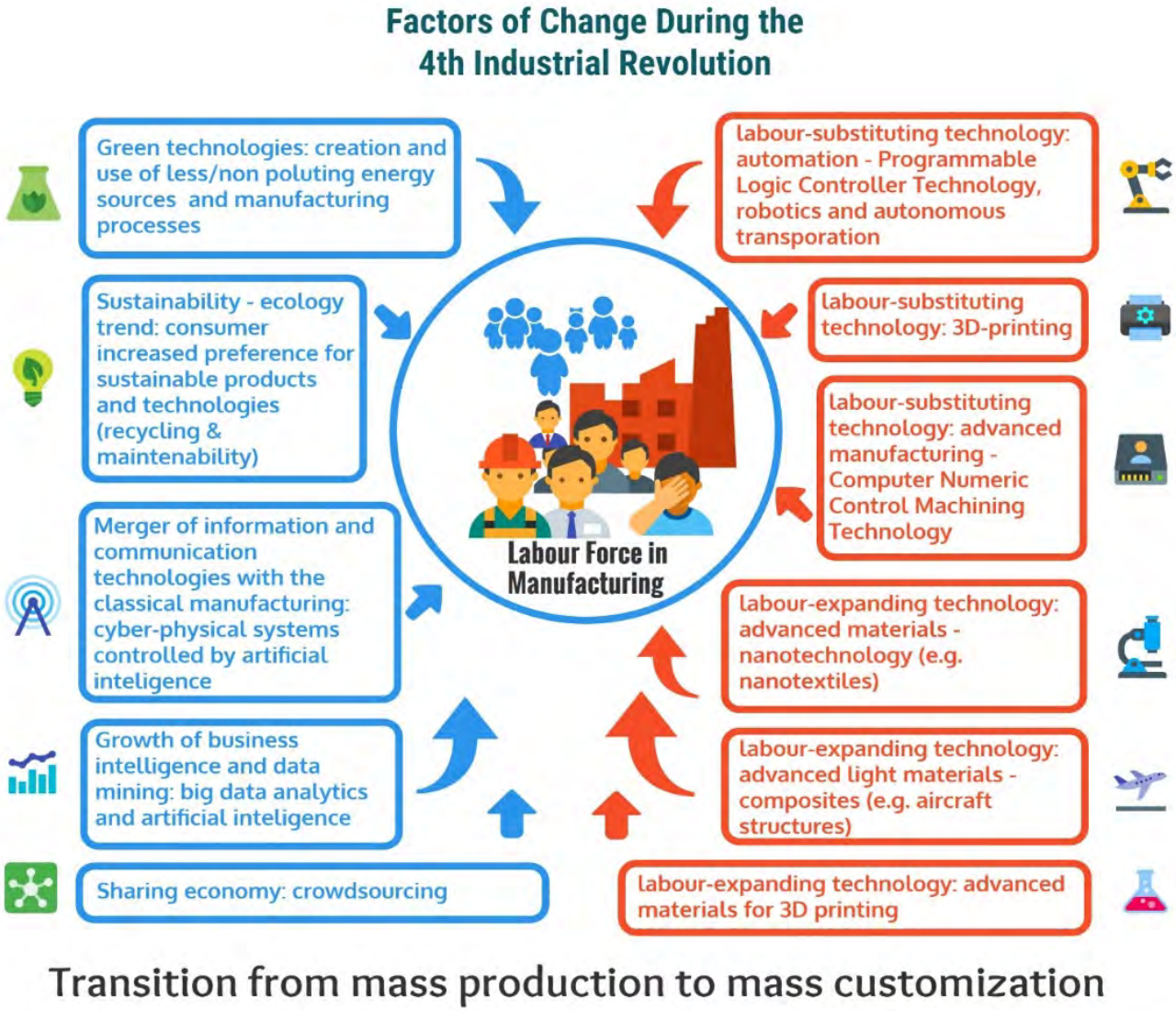
Manufacturing businesses are expanding, as 65% of Southern Ontario manufacturers reported that their business had grown last year. Additionally, 85% of local manufacturers expect that their business will grow over the next 3 years. With all of this business growth, the manufacturing workforce in the local region is forecasted to grow by 0.9% between 2015 and 2019. Hiring demands are expected to be greatest for senior managers, skilled trades, and technical occupations.

When compared to the national average, local manufacturers are doing better. Nationwide, manufacturing is still not at pre-recession levels. In the last 10 years, manufacturing’s share of GDP fell from 20% to 15% in 2016, and manufacturing’s share of employment fell from 16% to 11% over the same time period. Currently, only 76% of manufacturers across Canada believe they are expanding in the next three years.

Locally, compensation and wages play an important role in recruitment in the manufacturing industry. Manufacturers who pay below average (or around minimum wage) are having a harder time recruiting than business in other industries who pay below average.

Future Occupations In Manufacturing

EXPLORING EXPECTED CHANGES



Transition from mass production to mass customization

New
MANUFACTURING SKILLS

Complex bundles of technical skills in demand

High-speed, high-tech, high-productivity, environmentally conscious, highly-flexible

IT, STATISTICAL & ANALYTICAL SKILLS

"As manufacturing is becoming increasingly high-tech on the factory floor and also in back offices, **the data from machinery is analyzed**, these skills deficiencies have a significant impact on the companies' ability to expand operations and improve productivity." (Imani, 2015)

HIGH TECHNOLOGY MAINTENANCE SKILLS

"As technology continues to grow at an exponential pace, the backbone hardware and software will need a larger workforce **to build and maintain these systems**. Some of these positions include system analysts, engineers, electricians, software developers and network security experts." (CBC TV, 2016)

PROGRAMMING AND OPERATING HIGH TECHNOLOGY SKILLS

"Those skills include **programming and operating computer-controlled tools**; maintaining and repairing sophisticated machinery, which require a deep understanding of both mechanics and electronics; and doing specialized types of welding." (Hagerty, 2015)

GREEN SKILLS - MAINTENABILITY, RECYCLING, & ENERGY SOURCES

As consumers and clients become more environmentally conscious, designing products and processes that minimize waste, facilitate recycling and use green energy sources become imperative. Knowledge of the green technologies, principles of product maintenability, recycling processes are a must in addition to the conventional technical skills.

ADVANCED MATERIALS AND 3-D PRINTING SKILLS

Skills and knowledge regarding advanced materials and their application to specific industries will be in high demand. This would be merged with the rising interest in 3-D printing production and the associated printing materials. Complex manufacturing processes are foreseen using 3-D printing and nanotechnology treatment processes to finish products.

DECISIONAL, CREATIVE AND MANAGERIAL SKILLS

Since most of the manufacturing technologies will be integrated in advanced systems governed by analytics and artificial intelligence most of the remaining tasks will involve situational decision making, creative design, and managing people. Searching for suppliers and putting together quick solutions requires creativity.

Examples of future occupations in manufacturing

Organic Voltaic Engineer - specialized on the development of highly efficient energy and light sources using natural resources (CST, 2016).

Recyclable Design Specialist - will design products by applying the principles of cost reduction and recycling. He or she will assist and advise industrial engineers and designers to create products and processes that are easier to recycle (CST, 2016).

Furniture Refurbishing Technician - focusing on "renew-reuse trend" will refurbish furniture. He or she will download and review the refurbishment specifications and adjust the assembly lines and robots to the task at hand. Furthermore, he or she will troubleshoot any difficulties during the process, maintain the quality of work and perform minor maintenance and resetting of the robots (CST, 2016).

Makeshift Structure Engineer - will work jointly with disaster relief workers to oversee the machinery used in 3-D printing construction. They will be assigned to developing different types of buildings - shelters, offices, public washrooms - associated to temporary camps (CST, 2016).

Agile Supply Chain Worker - has the role of adjusting the company's inputs and outputs. "Agile" refers to the project management approach of the work. Optimizing suppliers' prices requires creativity and searching skills (CST, 2016).

Digital/Data Officers - has the role of adding value to the manufacturing through analyzing data collected from various processes. Furthermore, they have an important role in developing digital toolkits that will inform management and clients about products and manufacturing processes (Industrial Internet Now, 2016).

Garbage Designer - has the role to find creative ways to convert manufacturing process waste into high-quality materials for making entirely separate products. They must work towards waste free production (CST, 2016).

Energy Engineer - specialized on reducing energy consumption. Energy Engineers may recommend new air-conditioning equipment or solar powered streetlights, or they may design entire renewable energy systems such as harnessing methane from a landfil to generate electricity (Apparently Apparel, n.d.).

Fabricator of Carbon Fiber Spaceships and Planes - take design specifications from engineers and make them real using lightweight carbon composite materials (Apparently Apparel, n.d.).

Battery Engineer - designs, builds and tests batteries for hybrid electric cars (Apparently Apparel, n.d.).

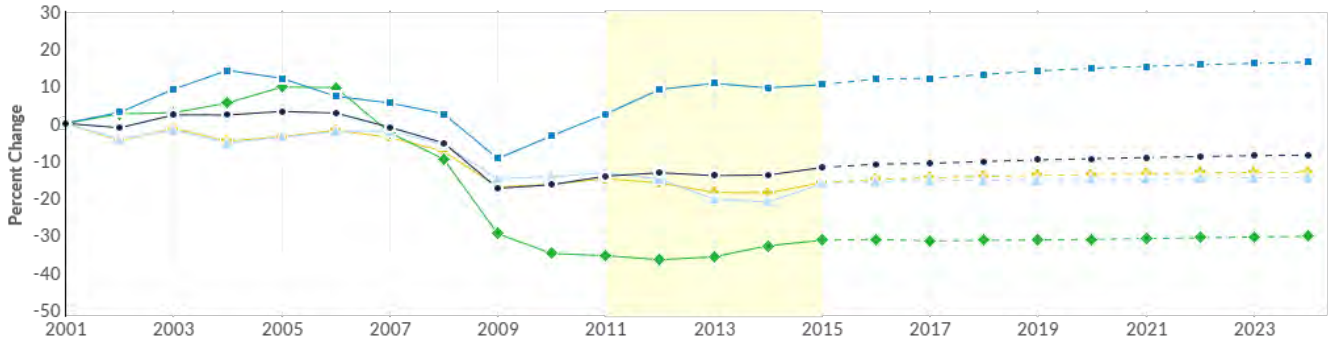
Waste Data Managers - insure data integrity in today's fast evolving information storage environment. He or she will be in charge of streamlining data storage by eliminating duplication (Frey, 2011).

Big Data Architect - will interpret data and design informational systems responsive to the new manufacturing realities. He or she will develop expert systems and artificial intelligence systems (REED.CO.UK, 2015).

3-D Printed Clothing Designer - will use 3D printing (additive manufacturing) technology to create fashion design clothing and jewelry (REED.CO.UK, 2015).

Regional Trends

- As of 2015, there were approximately 46,240 workers in the manufacturing labour force within the London Economic Region.
- Middlesex County employs the most number of people within manufacturing, however; the majority of the jobs are located within the City of London.
- While opportunities decreased within the City of London and Middlesex County, both Oxford and Elgin County's added over 1,500 positions within the manufacturing sector.



	Region	2011 Jobs	2015 Jobs	Change	% Change
●	Region	45,031	46,240	1,209	2.7%
●	Oxford	14,376	15,481	1,105	7.7%
●	London	20,832	20,128	-704	-3.4%
●	Elgin	6,515	6,931	416	6.4%
●	Middlesex	24,140	23,827	-313	-1.3%

Source: OMAFRA- Economic Modeling Specialists International (Emsi) Canadian Data set Q3 2016

Hiring requirements for top occupations

Hiring Requirements 2016 to 2025:

- **8,300** new workers required over the next 10 years; 30% of 2015 workforce.
- Demands greatest for senior managers, skilled trades and technical occupations
  - 950 Motor Vehicle Assemblers, Inspectors and Testers (23% of current workforce)
  - 420 Labourers in Food and Beverage products (33%)
  - 330 Manufacturing Managers (35%)
  - 290 Material Handlers (31%)
  - 220 Construction Millwrights and Industrial Mechanics (38%)
  - 210 Welders and Related Machine Operators (28%)
  - 179 Labourers in processing, manufacturing and utilities (30%)
  - 150 Machinists and machining and tooling inspectors (30%)

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PRISM ECONOMICS AND ANALYSIS

How many workers will be required?

Occupations	Total Hiring Requirement 2016 - 2025	Share of 2016 Employment
All Occupations in Manufacturing	**8,247**	**30.6%**
Motor vehicle assemblers, inspectors and testers	953	23%
Labourers in food, beverage and associated products processing	420	33%
Manufacturing managers	326	35%
Material handlers	287	31%
Construction millwrights and industrial mechanics	214	38%
Welders and related machine operators	209	28%
Other labourers in processing, manufacturing and utilities	170	30%
Shippers and receivers	165	31%
Machinists and machining and tooling inspectors	152	30%
Senior managers - construction, transportation, production and utilities	142	40%
Process control and machine operators, food, beverage and asso.	126	23%
Industrial electricians	116	34%
Mechanical engineers	115	21%
Transport truck drivers	78	51%
Industrial and manufacturing engineers	73	27%
Sheet metal workers	70	29%
Industrial engineering and manufacturing technologists and tec	60	21%
Contractors and supervisors, machining, metal forming, shaping and erecting trades	54	30%
Mechanical engineering technologists and technicians	52	24%
Electrical and electronics engineering technologists and technicians	45	23%
Industrial sewing machine operators	41	41%

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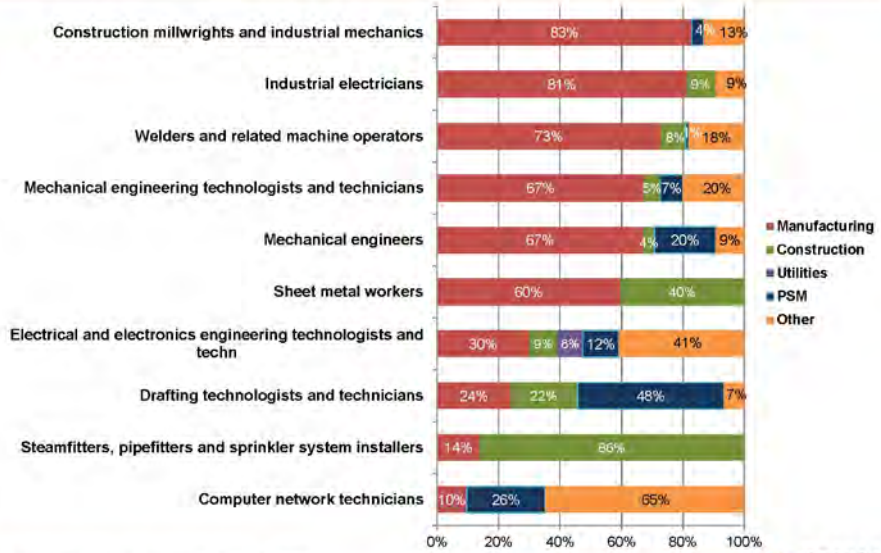
PRISM ECONOMICS AND ANALYSIS

Key Skilled Trades Occupations will be in strong demand from competing industries in the London Region



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*Source: Statistics Canada 2011 National Household Survey, 2006 Census

PRISM ECONOMICS AND ANALYSIS

Manufacturing Sub-sectors Employment and Expected Growth

Manufacturing Employment Growth Rates (Average Annual), London

NAICS	Sub-sectors	2015	2015-2020 Growth Rate	2020-2025 Growth Rate
31-33	Total Manufacturing	26,671	1.0%	-0.4%
311	Food	3,642	0.9%	-0.4%
322	Paper	1,516	1.3%	-0.3%
331	Primary Metal	1,273	1.4%	-0.2%
332	Fabricated Metal Products	2,921	0.7%	-1.1%
333	Machinery	1,948	0.7%	-0.6%
336	Transportation Equipment	8,389	0.6%	-0.4%
	Other Manufacturing	6,984	1.7%	-0.1%

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PRISM ECONOMICS AND ANALYSIS

Observations

Within the sector there is a growing need for soft skills, including communication skills, decision making skills, leadership skills, problem solving skills and time management skills. In addition to soft skills, employers say they are looking for skilled trades people. It is important to note, that it could take several years as an apprentice, to become a skilled trades person, depending on the trade. The following is a list of occupations that are most in demand within the region according to employers in the sector:

- Plant managers
- Payroll & Benefits administration
- HR Managers
- Health & Safety specialists
- Industrial Controls Automation
- Entry level general labourer
- Production workers
- Line associates
- Refrigeration Operators
- Automation specialists
- Electricians
- Millwrights
- Tool & Dye makers
- Coil winders
- Project managers
- Engineers
- Quality Assurance Technicians
- Welders
- Machinists & technologists
- Supply chain workers
- Customer Service representative

Top Occupations within the manufacturing sector in the London Economic Region

Description	Employed in Industry (2015)	% of Total Jobs in Industry (2015)
Other metal products machine operators	3,321	7.2%
Motor vehicle assemblers, inspectors and testers	3,023	6.5%
Welders and related machine operators	1,764	3.8%
Material handlers	1,748	3.8%
Manufacturing managers	1,576	3.4%
Source: OMAFRA- Economic Modeling Specialists International (Emsi) Canadian Data set Q3 2016		


Process
Engineer
exports
products
Technician
CNC
Operator
Tools
machine
Information
inspector
Electrician
labour
Millwright
Industrial
robotics
skills
technology
material
trades
Skilled
Motive
Welder
Power

Sources

Information from this report came from several sources, including a Manufacturing Roundtable Discussion held in November 2016, by the Local Employment Planning Council. We also spoke to employers within the manufacturing sector throughout the London Economic Region.

Apparently Apparel (n.d.). The 20 best jobs of the future. Retrieved June 23, 2016 from http://www.apparentlyapparel.com/news/the-20-best-jobs-of-the-future

CBC TV, (n.d.). Top 10 jobs of the future. Doc Zone with Ann-Marie McDonald. Retrieved June23, 2016 from http://www.cbc.ca/doczone/features/top-jobs

CST (2016). Inspired minds careers 2030. Canadian Scholarship Trust Plan. Retrieved June 23, 2016 from http://careers2030.cst.org/jobs/)

Frey, T. (2011, November 11). 55 Jobs of the future. Futurist Speaker, Thomas Frey. Retrieved from http://www.futuristspeaker.com/business-trends/55-jobs-of-the-future/

Ghituleasa, C. (2014, September). The textile and leather industry – promoter for smart products and cultural traditions. Nonconventional Technologies Review. Retrieved from http://www.revtn.ro/pdf3-2014/2_Ghituleasa_invited%20paper.pdf

Hagerty, J. (2015, June). Where the manufacturing jobs of the future will be. Wall Street Journal, June 2, 2015, Business Section, Journal Reports: Leadership. Retrieved from http://www.wsj.com/articles/where-the-manufacturing-jobs-of-the-future-will-be-1433301544

Imani, N. (2015). Tackling skill shortages in advanced manufacturing. German American Trade Quarterly, Quarter 1, 2015, Vol. 26, p. 7. Retrieved from http://www.festo-didactic.com/ov3/media/customers/1100/ga_trade_jan_feb_interactive_1.pdf

Industrial Internet Now (2016, May 18). New professions develop with new business opportunities. Interview with Martti Mantyla. People, Technology section. Retrieved from http://industrialinternetnow.com/new-professions-develop-with-new-business-opportunities/

Manyika, J., Sinclair, J., Dobbs, R., Strube, G., Rassey, L., Mischke, J., Remes, J., Roxburgh, C., George, K. Ohalloran, D., & Ramaswamy, S. (2012, November). Manufacturing the future: The next era of global growth and innovation. McKinsey Global Institute. Retrieved June, 23, 2016 from http://www.nist.gov/mep/data/upload/Manufacturing-the-Future.pdf

Prism Economics & Analysis – The Future of Manufacturing in London: http://prismeconomics.com/wp-content/uploads/2016/03/MANUFACTURING-PROFILE-London.pdf

REED.CO.UK (2015, October 5). 10 futuristic technology jobs you won't believe actually exist. Marshable. Retrieved June 23, 2016 from http://mashable.com/2015/10/05/tech-jobs-brandspeak/#sF3Ul1mDcuqo

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