The Digital Supply Chain

Creating skills for the future

January 2018

Canadian Supply Chain Sector Council | Conseil canadien sectoriel de la chaîne d'approvisionnement

Canada

Alberta

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Our Partners

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Our Research Team

Triskele Logistics is a supply chain consulting company that enables its customers to achieve cost reduction and efficiency in their supply chain. In addition, we manage projects and complete supply chain research using our industry knowledge, connections and expertise. Founded in 2013 by Corrie Banks and with current President Steve Banks, Triskele applies simple, efficient change methodologies to work with you to achieve your vision and execute your projects. From strategy to project execution to sustainment, Triskele Logistics brings it all together. The Triskele Team (Corrie Banks, Steve Banks, William Merrill, Eric Rasmussen) enjoyed working with the CSCSC on this project to produce a product that we are proud of. For more information on Triskele Logistics, please visit www.triskelogi.com.

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The Province of Alberta is working in partnership with the Government of Canada to provide employment support programs and services.

Canada Alberta

EXECUTIVE SUMMARY

The Canadian supply chain is a critical part of the Canadian economy, enabling $1 trillion worth of goods movement, generating $66 billion in gross domestic product (GDP), and employing more than 878,000 people (excluding truck drivers) across Canada.

The sector is growing, creating new jobs at an average of 1.5% annually, and is faced with labour force challenges in filling vacancies due to retirement and workforce turnover.

In addition to the labour force challenges, the *Canadian Transportation Act Review 2016* report identified that all Canadian industries and transportation have a less than 41% use of advanced communication technologies, with the majority below 30%. Canada is ranked 14th among nations in the World Bank's Logistics Performance Index.

The Organisation for Economic Co-operation and Development (OECD) forecasts that, over the next 30 years, the Canadian economy will grow at a slower rate than those of many of our key competitors.

Considering the need for experienced and skilled labour, the late adoption of technology, the current ranking of Canada's logistics performance, and the possibility of its slowed economic growth, it is imperative that Canada seek to accelerate improvement through the use of digital technology in the supply chain sector.

Many technological advancements, particularly the internet of things, big data analytics, mobility internet, robotics, and blockchain will transform the supply chain sector by providing greater visibility, data, analytics, and opportunity for improvement.

However, as industry leaders adopt new technologies, they may have difficulty finding employees who have the required skill sets. The factor with the greatest impact on the talent shortage is changing job requirements. Today, the ideal employee has both tactical/ operational expertise and professional competencies such as analytical skills. Tomorrow's talent must also excel at leadership, cross- functional business unit collaboration, global team management, strategic thinking, innovation, and high-level analytics.

The global adoption rate for all of these technologies is within the next 1 to 5 years, and it is anticipated that they will be widely adopted (i.e., they will become the way we do business) by 2025.

According to research by the Canadian Supply Chain Sector Council (CSCSC), industry leaders and supply chain experts believe that the labour force will be impacted by technology within the next 3 to 5 years. These industry leaders expect that the increased use of autonomous vehicles, robotics and automation, blockchain, and drones will have a moderate to very high impact on the labour force. They also believe adopting technologies such as the internet of things (IoT), mobile internet, and big data analysis will lead to higher job creation than losses.

This document discusses six new technologies (autonomous vehicles, robotics and automation, big data analytics, drones, mobility internet and the internet of things, and blockchain) and the impact that they will have on job skills and labour requirements. It also highlights a number of innovative companies in Alberta that have already adopted new technologies. And finally, a labour skills report provides examples of the changing skill set required in the near future for a number of supply chain occupations.

In conclusion, Canadian companies adopting new technologies must also actively develop the corresponding skills and capabilities. Technological advancements and the growth of the supply chain sector are creating a demand for new skills, and smart companies must work to build those skills before the technology advancements reach a critical adoption rate.

SUPPLY CHAIN OVERVIEW

The supply chain is one of the most essential sectors of the Canadian economy. The success of this sector in meeting its human resources and labour market challenges has the potential to positively influence the future of Canada and the quality of life that we all enjoy.[1]

The transportation and logistics sector is itself a critical part of Canada's economic base. This sector:

- accounts for nearly $66 billion in gross domestic product
- represents more than 4% of Canada's total gross domestic product[2]
- employed 878,264 Canadians in 2016[3]

Additionally, the transportation system moves more than $1°trillion worth of goods each year; its efficiency is an important competitive factor across the economy.[4]

From 2010 to 2016, the supply chain sector added an average of 10,721 new jobs per year, representing an estimated annual labour force growth rate of 1.5%. In the future, the sector is expected to see similar growth, potentially adding over 50,700 jobs between 2016 and 2021[5].

It is also expected that over the next few years, the sector will face challenges in filling jobs created by this growth, as well as vacancies caused by retirement and job turnover.

In Alberta, the supply chain system is a critical part of the province's economic growth, accounting for $20 billion in gross domestic product (6.6% of Alberta's total GDP) and enabling $62.6 billion dollars in manufacturing shipments. Despite slower economic growth from weak oil prices, Alberta is still growing faster, at 2.9%, than all of the other Canadian provinces.[6]

Alberta is also diversifying and has a rapidly growing information and technology sector that is contributing $16°billion in gross domestic product (5.1% of total GDP across all industries).[7] Growth in this sector allows innovation and creativity to be cornerstones of the Alberta marketplace, driving change and improving Alberta's productivity and competitiveness in the marketplace. This is important because productivity levels in Canada have been a longstanding concern of governments and industry, since productivity affects the country's competitiveness in the global economy.

The Conference Board of Canada's International Ranking of Labour Productivity Growth notes that, as of March 2013, Canada's productivity is negatively affected by "weaker inward and outward foreign direct investment, low R&D intensity, a weak innovation record, and the relatively small percentage of Canadians with advanced degrees in science and technology." [8]

If this characterization applies to transportation, which has a major input across sectors, competitive problems could be compounded. Over time, such a competitiveness gap could negatively impact Canadians' prosperity relative to the rest of the world. The Organisation for Economic Co-operation and Development (OECD) forecasts that, over the next 30 years, the Canadian economy will grow at a slower rate than the economies of many of our key competitors. According to

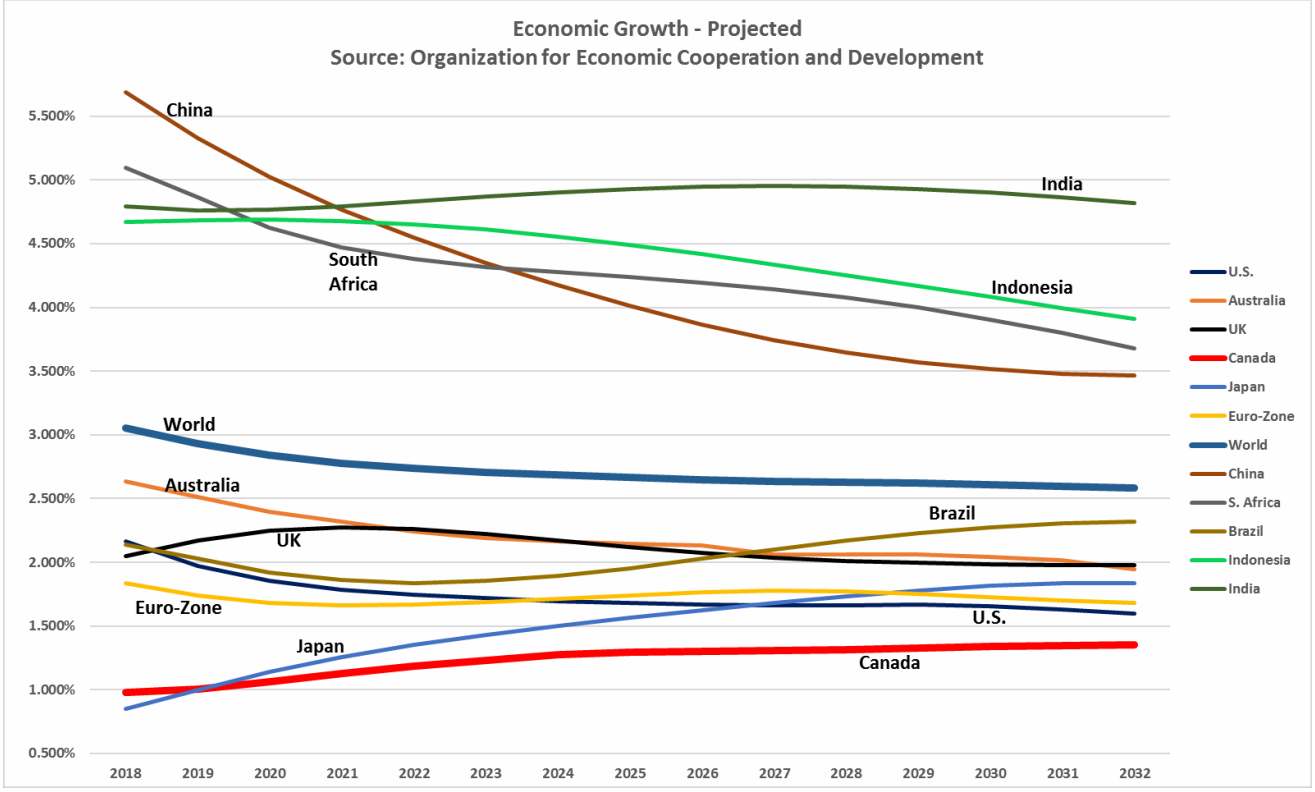


Figure 1 Projected Worldwide Economic Growth **Source: Canadian Transportation Act Review 2016 report**

the OECD forecast, the gross domestic product per person of countries such as the United Kingdom and Australia will surpass that of Canada.[9]

The *Canadian Transportation Act Review 2016* report identified that all Canadian industries and transportation have a less than 41% use of advanced communication technologies, with the majority below 30%. Canada is ranked 14th among nations in the World Bank's Logistics Performance Index. [10]

The World Economic Forum highlights that, if all countries reduce supply chain barriers halfway to global best practice, then global GDP could increase by 4.7% and world trade would increase by 14.5%.

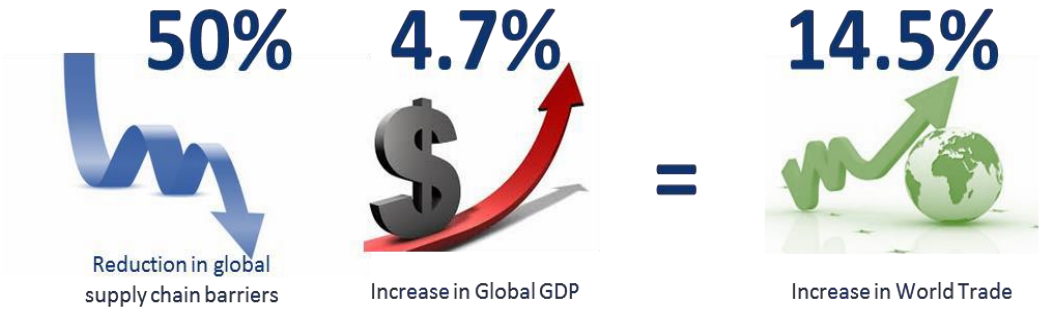


Figure 2 Impact of Efficient Supply Chains on the World

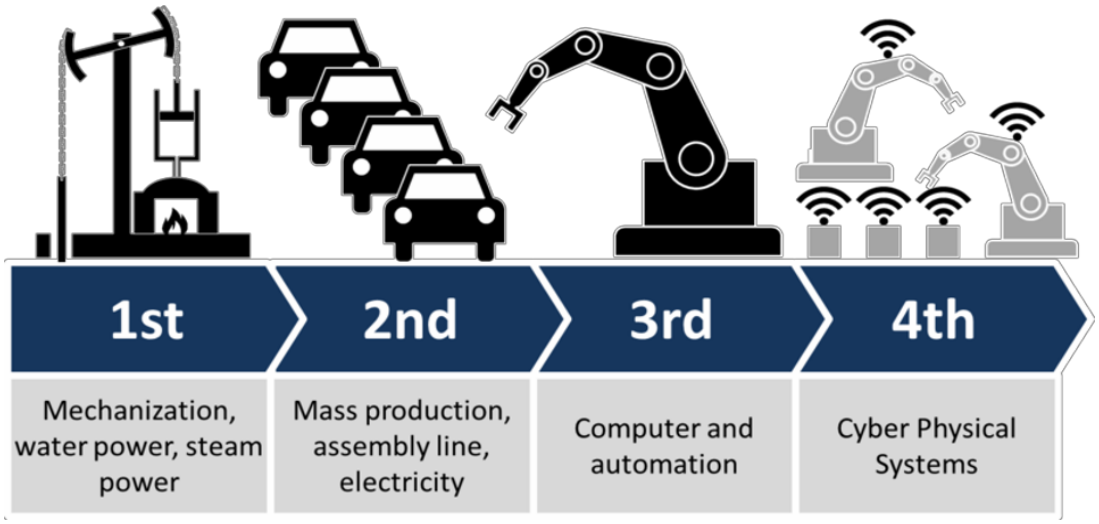


Figure 3 Industrial Revolutions over Time **Source: Google Images**

These benefits caused by changes in supply chain costs far outweigh those from the elimination of all import tariffs. It is estimated that eliminating tariffs could increase global GDP by 0.7% and world trade by 10.1%.[11]

Consulting firm PwC identified that companies that operate best-in-class supply chains have 50% higher sales growth and are 20% more profitable.[12] In other words, increasing innovation and productivity results in higher success and greater economic profitability.

Alberta's focus on innovation and technology is crucial to improving productivity and Canada's supply chain sector. We are in the midst of the fourth industrial revolution – a digital revolution – the speed of which has no historical precedent. The fourth industrial revolution is evolving at an exponential rather than linear pace, with unprecedented mobile devices, processing power, storage capacity, and access to knowledge. These advances are magnified by advances in artificial intelligence, drones, autonomous vehicles, robotics, the internet of things, blockchain, additive manufacturing, mixed reality tech, and renewable energy.[13]

The Canadian Supply Chain Sector Council (CSCSC) conducted two surveys of Alberta and international supply chain professionals and experts. The surveys were designed to

How Much Will Technology Impact Your Supply Chain in the Next 3 to 5 Years?

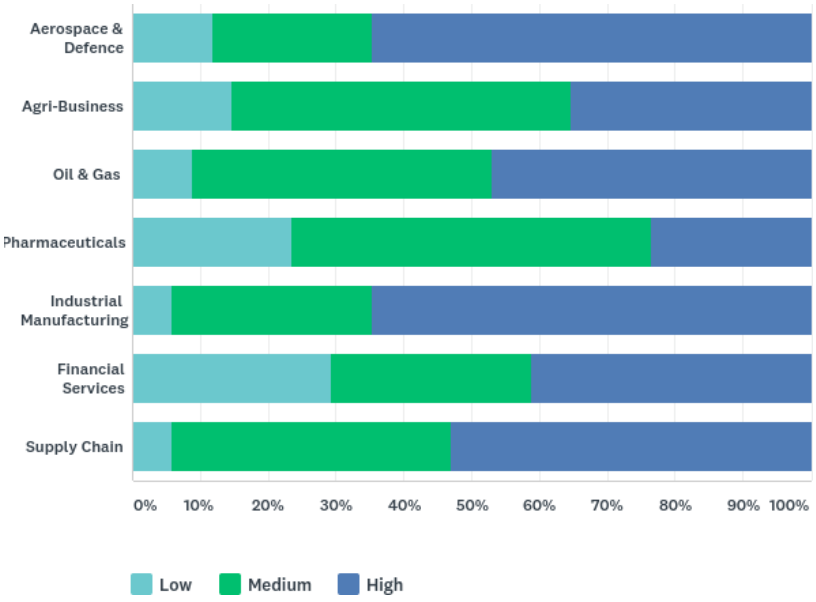


Figure 4 Survey of Canadian Supply Chain Professionals August 2017

attain industry feedback on the impact digital technologies will have on the supply chain workforce. The surveys highlighted that industry professionals believe that aerospace and defence, agri-business, natural resources, pharmaceuticals, industrial manufacturing, financial services, and supply chain will be highly impacted by technology within the next 3 to 5 years.

In October 2017, the CSCSC held two international web-based roundtables. These roundtables were attended by industry and supply chain professionals who discussed the rapid changes to the physical supply chain and labour force due to the adoption of digital technologies. Attendees of these roundtables reported that they believe that the labour force will also be impacted by technology within the next 3 to 5 years.

The technologies that are anticipated to impact supply chain most significantly are autonomous vehicles, robotics and automation, big data analytics, drones, mobility internet and the internet of things, and blockchain.

DIGITAL TECHNOLOGIES

AUTONOMOUS VEHICLES

An autonomous vehicle (also known as a driverless car, self-driving car, robotic car, and unmanned vehicle) is a vehicle that is capable of sensing its environment and navigating without human input.[14] This technology will have huge impacts on the supply chain sector, with a potential to automate forklifts, trucks, trains, and ships. Any vehicle currently requiring a driver can become semi- or fully autonomous.

Autonomous vehicles utilize many environment sensors such as LIDAR (light detection and ranging), radar, GPS, and cameras. Using these sensors, an autonomous vehicle has an enhanced ability to view its surroundings that far surpasses human capabilities. LIDAR, for example, washes its surroundings with lasers to create a digital image. This image can be very detailed and can even help an autonomous vehicle to "see" around objects.

Autonomous vehicles have superior ability to react and respond quickly to traffic flow. This allows them to drive closer to other vehicles, which should have the effect of easing congestion and increasing the flow of traffic.[15]

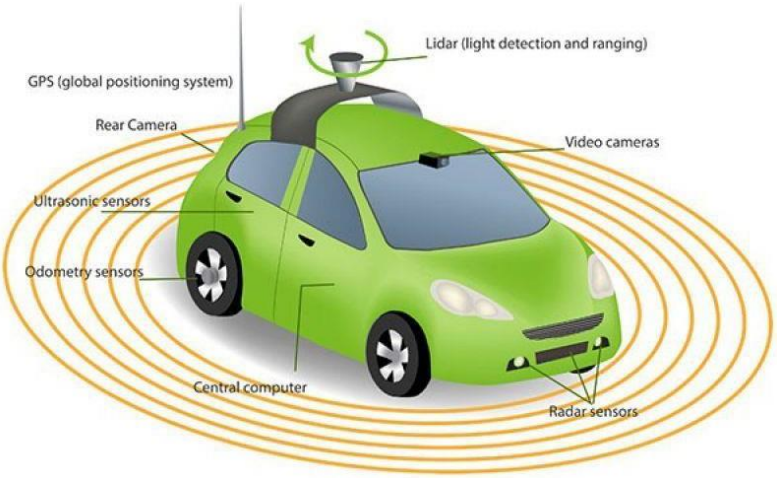


Figure 5 Technical Outline of an Automated Vehicle **Source: Google Images**

In 2015, 161,902 people were injured in collisions in Canada.[16] Autonomous-vehicle scientists believe that 75% to 95% of collisions will be avoided with autonomous vehicles.[17]

Supply chain nodes will be able to communicate with each other in real time through cloud applications between autonomous vehicles.

ADOPTION RATES

Currently, policies limit the use of self-driving vehicles in public spaces, so most are used in closed private environments. However, countries around the world are beginning to adopt policies that will enable autonomous vehicles to operate on public roads. For example, earlier this year the U.S. House of Representatives approved a new law that enables up to 100,000 self-driving cars per year to operate outside of current safety

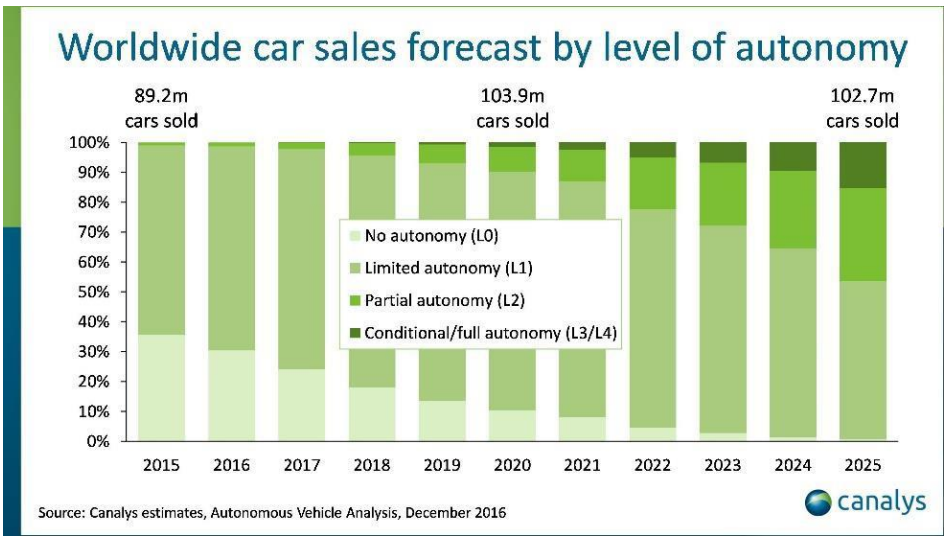


Figure 6 Projected Worldwide Car Sales by Level of Autonomy

standards, thus allowing companies to get self-driving cars on the road more quickly, which in turn will encourage development and innovation in the technology.[18]

In Canada, cities such as Ottawa, Edmonton, and Calgary are creating test zones to determine how well autonomous vehicles will operate in colder environments. Calgary is planning to have autonomous vehicles on its roads by 2021.[19]

ALBERTA EXAMPLE IN ACTION

Suncor Energy is currently utilizing autonomous heavy hauling trucks in its oil sands operations. After a test run, Suncor engaged in a contract with a Japanese manufacturer to eventually replace its entire fleet with autonomous vehicles. The initial test was for 12 vehicles, with the new contract adding more than 40 autonomous vehicles to its fleet.[20]

In 2015, while discussing the success of the program, a Suncor company spokesperson stated that a standard operator cost is about $200,000 per year. With 52 vehicles in the fleet, the annual labour cost reduction is thus greater than $10 million. Also, the use of autonomous vehicles has reduced tire wear, maintenance, and fuel consumption by 5% to 15%.[21]

Figure 7 Ford Lyft Autonomous Vehicle

IMPACT ON JOB SKILLS AND LABOUR REQUIREMENTS

A debate is on within the supply chain community regarding the need for an autonomous vehicle to have a driver. Many believe that we will always need a person present at the time of delivery – and they might be right. However, in confined spaces, such as yards, ports, and mining operations, there are other uses where the activities completed can be geo-fenced, predicted, planned, and automated. The Suncor case is an example of the early adoption of technology to improve productivity.

The use of autonomous vehicles will impact more than just drivers; the job skills and labour requirements in other areas of the labour force will be affected as well. Consider the impact of a connected vehicle (with or without a driver) that is capable of communicating its current location to other organizations. Currently, many of these communications are completed by dispatch and logistics analysts who track vehicles, couriers, and trucks, and let customers know where the assets are and how much work has been completed for the day. But, if an autonomous vehicle is connected to the cloud via electronic logging device (ELD), internal computer systems, or sensors, then it can communicate where it is, how much work it has done, and what its operating status is to a wide network without any human intervention.

In this case, the administration required to manage the business will be reduced. Analysts, dispatchers, and other employees who manage operations will have more network visibility and more data at a faster rate. Their role will change – instead of primarily operating the network, they will be managing the network. In

this new role, they will require more analytical, leadership and problem-solving skills. They will need to understand how the new technology communicates and what to do when it doesn't. Also, the issues they manage will become more technical in nature.

Based on the survey issued by the CSCSC, 30.3% of supply chain professionals believe that autonomous vehicles will have low to very low impact on the supply chain (Figure 7). However, as can be seen in Figure 9, over 80% of respondents feel that autonomous vehicles will have a moderate to very high impact on the labour force.

In summary, over the next three years, as personal and supply chain vehicles become increasingly automated, there will be impacts to the supply chain labour force. The most obvious change will be to the number of drivers required; however, the administrative and management functions within the supply chain sector will also be impacted.

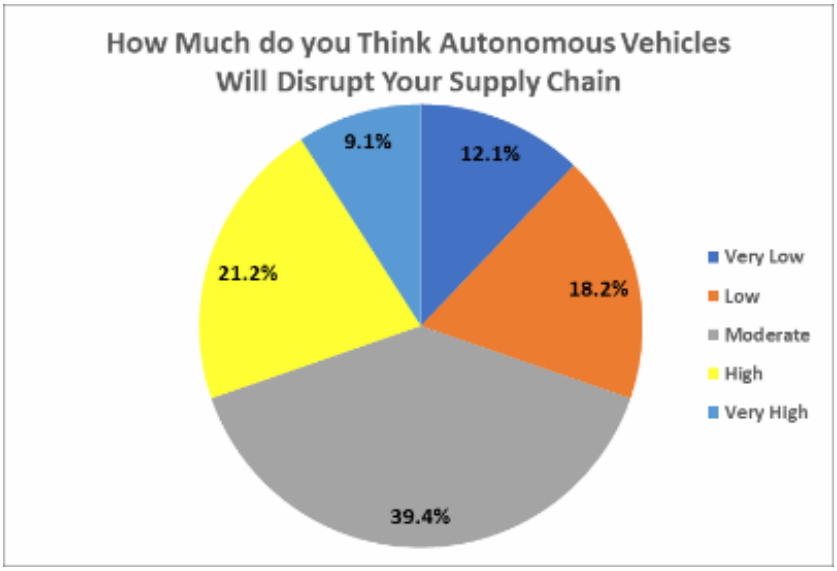


Figure 8 CSCSC Survey of International Supply Chain Professionals

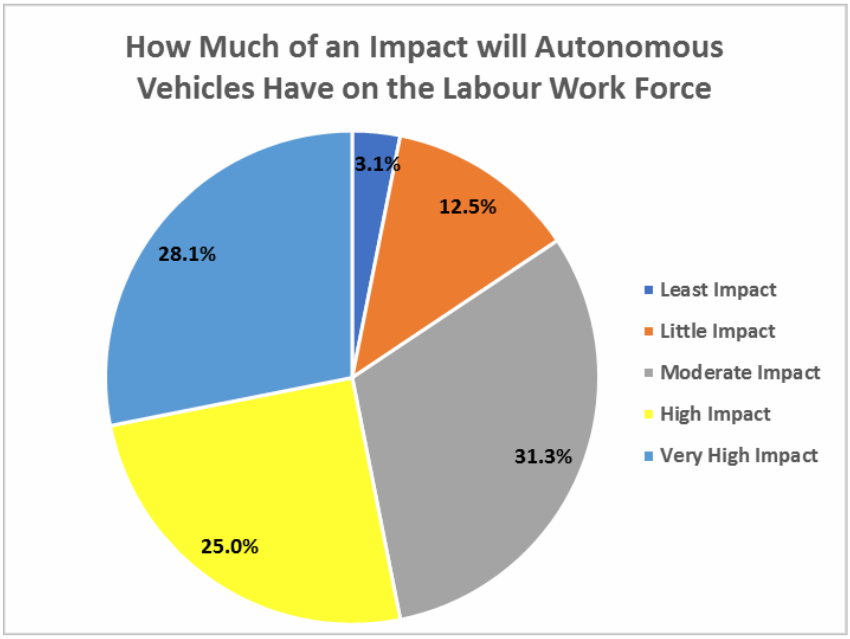


Figure 9 CSCSC Survey of International Supply Chain Professionals

ROBOTICS & AUTOMATION

Robots are machines capable of automatically carrying out a complex series of actions. Previously, robots were stationary, blind, and relatively unintelligent, which slowed down the adoption rate of robots in the supply chain sector. Today, next-generation robots are lighter, more flexible, and more affordable. They use cameras to "see" and have much better grip and sensor technologies. Robots equipped with high-resolution cameras and learning capabilities assist workers in warehouses with tasks such as picking, packing, and sorting. For example, DHL Global Supply Chain has the robot "Effi-BOT," which is a fully automated trolley that follows pickers through the warehouse and takes care of most of the physical work.[22]

ADOPTION RATES

According to a white paper from the University of Tennessee,[23] robotics is one of the most advanced technologies in supply chain today, in terms of its proliferation and application. With the dramatic rise and forecast continued growth in e-commerce, the demand for warehousing services will continue to increase. This will accelerate the need to find cost-reduction solutions through automation.

Many basic occupations face automation as the technical capabilities of robotics develop. In their 2013 study, Carl Benedikt Frey and Michael Osborne from the University of Oxford cited that an estimated 47% of occupations in the USA have a high risk of automation, while an additional 19% of occupations have a medium risk of automation.[24]

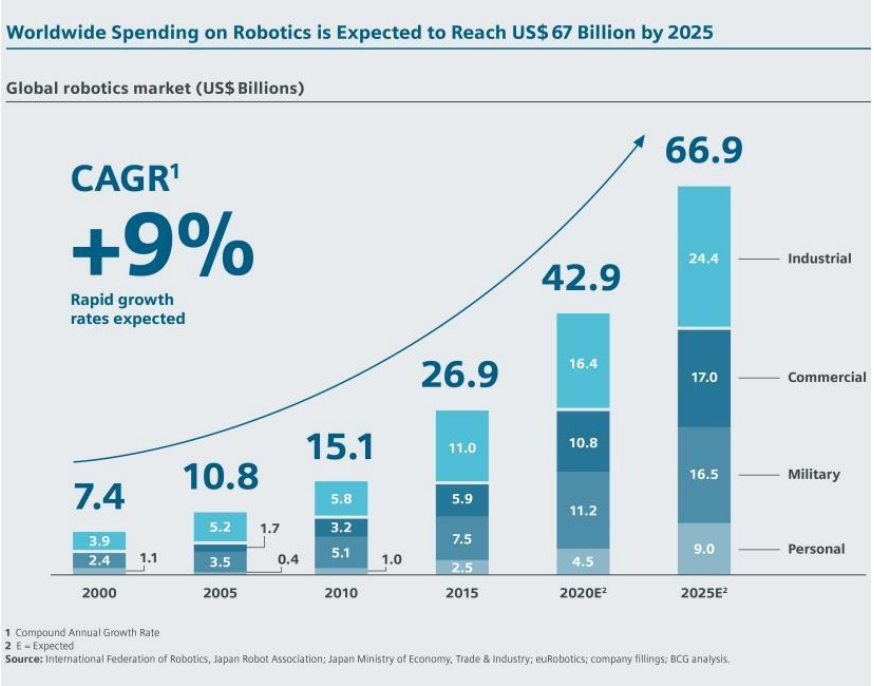


Figure 10 Projected Worldwide Spending on Robotics

ALBERTA EXAMPLE IN ACTION

In July of 2017, Sobeys Canada opened a highly automated warehouse in Balzac, Alberta.

Figure 11 Sobeys Vaughan Automated Warehouse

This warehouse permits one employee to complete work previously done by four. It is a replica of Sobey's Vaughan, Ontario facility, where the new Witron automated case picking and palletizing system, called OPM (order picking machinery), can receive 720 cases an hour (320,000 cases daily). In a conventional distribution centre, humans pick an average of 160 to 180 cases per hour. The new OPM system can pick 500 cases per hour.
Without humans, errors and damage to goods on pallets has been effectively eliminated.[25]

A typical warehouse can hold anywhere from 8,000 to 12,000 SKUs (stock keeping units). The Vaughan distribution centre can hold one and a half times more. Across Canada, Sobeys has reduced its labour force by 1,300 workers and, in Alberta, it has reduced its labour force by 400[26].

IMPACT ON JOB SKILLS AND LABOUR REQUIREMENTS

Robotics and automation will have one of the largest impacts on the labour force. By nature, the work that robots and automation will replace is manual, highly repetitive, and inefficient. As in the Sobeys example above, 75% of the warehouse workforce was removed. In our survey, 56.3% of responders expect robotics and automation to have a very high or high impact on the supply chain labour force.

As an additional example of the impacts on labour, Changing Precision Technology Company operates a factory in China. It replaced 90% of its employees in 2016 with robotics and automation, and saw a stunning 250% increase in productivity and an 80% decrease in defects.[27] These results bring a staggering difference to an organization's profitability.

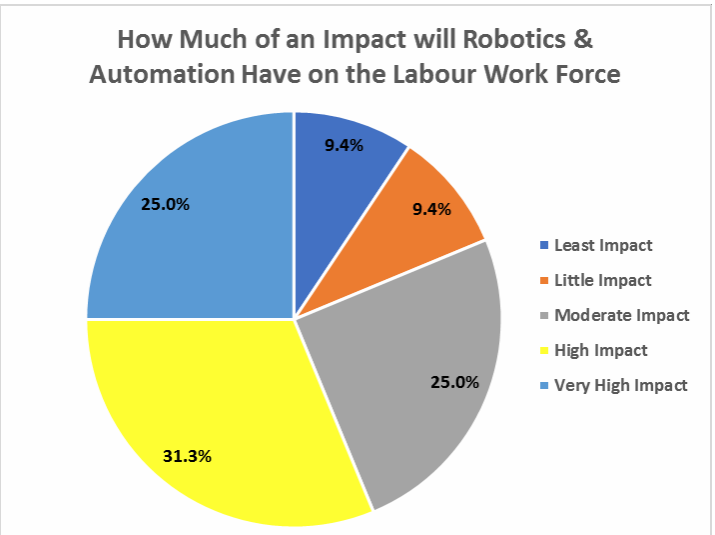


Figure 12 CSCSC Survey of International Supply Chain Professionals

BIG DATA ANALYTICS

Big data analytics is the process of examining large and varied data sets – i.e., big data – to uncover hidden patterns, unknown correlations, market trends, customer preferences and other useful information that can help organizations make more informed business decisions. Data is being created at an expansive rate and, when analyzed, useful information can be drawn from its results.

While this concept has always been true, the sheer amount of data that can be analyzed now adds new challenges and benefits. With big data analytics, the volume of data allows for organizations to get greater insights from their data, including higher accuracy when forecasting and monitoring operations. Ultimately this allows for data-enhanced business decisions.

ADOPTION RATES

There is a growing industry sentiment that "data is the new oil." Many industry leaders view data as a highly valuable asset and resource that can be leveraged to create beneficial results.

"Data are to this century what oil was to the last one: a driver of growth and change. Flows of data have created new infrastructure, new businesses, new monopolies, new politics and – crucially – new economics. Many a battle will be fought over who should own, and benefit from data."

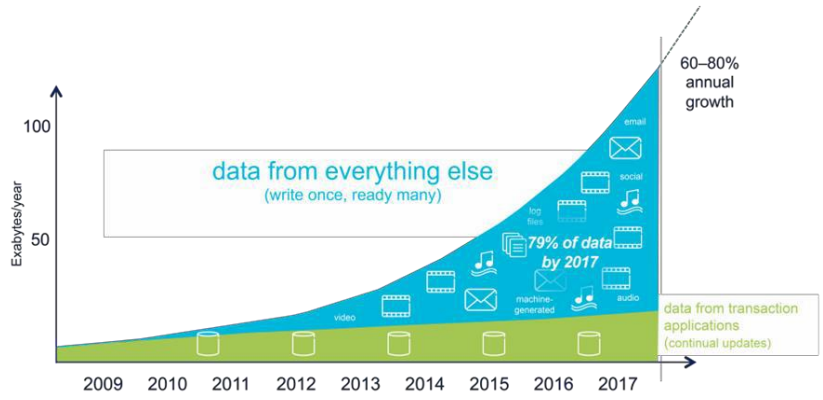
– The Economist

The Gartner group predicted a 60% to 80% growth in data from sources other than business transactions in 2017.[28]

ALBERTA EXAMPLE IN ACTION

Calgary-based start-up Chata.ai is building tools that allow users to ask the data a normal human-language question and receive an immediate response, complete with bar charts, graphs, analysis, or other information. This technology will eliminate the need to create queries and will provide the user with instantaneous answers to analytical questions. Its intelligent assistant can eliminate the human process of exporting data, mining spreadsheets, and performing complex data analysis. It does this by leveraging the latest advancements in computational linguistics and machine learning.

For example, a user could ask Chata, "What were the profit margins for each store in the last quarter?" and it would generate and present the data in a visual way that helps the user make decisions faster. This type of technology will enable anyone to analyze his or her business and profitability with little to no data expertise.[29]



Source: IDC, 2009-201700

Figure 13 Data Storage Growth from IoT Sensors

IMPACT ON JOB SKILLS AND LABOUR REQUIREMENTS

The labour impact of big data and predictive analytics is a positive one. Here we anticipate job creation for engineers, computer science majors, data managers, and analysts. Knowing how to capture, manage, and transform data into content that can be used for predictive analytics and decision making will be a cornerstone activity in this new digital age.

The Information and Communications Technology Council (ICTC) estimates that, in 2016, there were approximately 33,600 data analytics specialists directly employed across Canada, the majority of whose roles were an outgrowth of traditional database analysis and administration positions. A much smaller percentage were employed in more specialized roles that intersect with engineering, systems management, business analysis, and programming. When indirect and induced employment are factored in, in 2016, there was a total labour force of approximately 43,700. ICTC projects that, by 2020, 43,300 data analytics specialists will be directly employed in Canada, an increase of 33%. When indirect and induced employment are included, this will result in a total labour force of 56,000 by 2020.[30]

Our survey highlighted that almost half (48.5%) of supply chain professionals are not aware of these potential labour force changes and the increasing need for big data analysts. The results of the survey contrast significantly with ICTC's predicted increase in the number of data analytics specialists in the labour force.

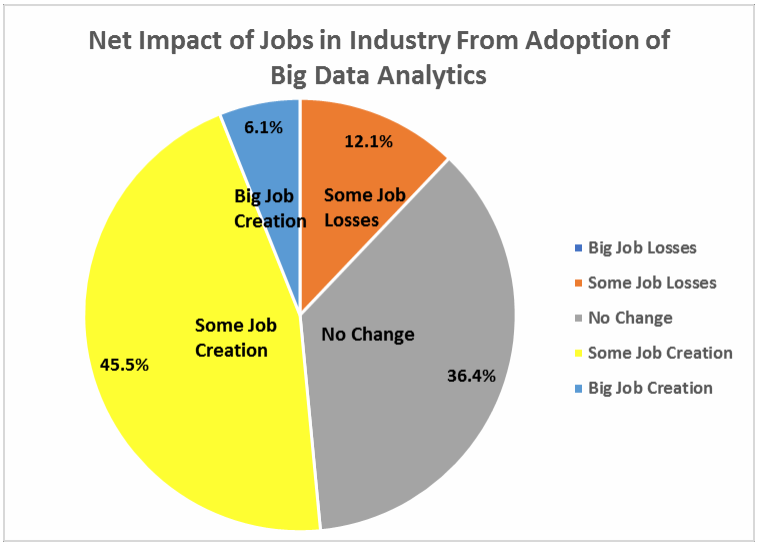


Figure 14 CSCSC Survey from International Supply Chain Professionals

DRONES

Often called unmanned aerial vehicles (UAVs), drones cross the benefits of advanced robotics with the versatility of small aerial craft. By adding sensors, cameras, scanners, hooks, and "hands" to small flying vehicles, drones can assist in accomplishing tasks with a new degree of efficiency, effectiveness, and versatility.

Drones have many designs, but in general their style is similar to that of airplanes or helicopters. Most drones are made in a helicopter style, which has the versatility of vertical takeoff and landing and so increases opportunity of use. These UAVs are typically electric with many rotors, and often they have autonomous features. Some drones are designed with combustion or hybrid engines, depending on the application.

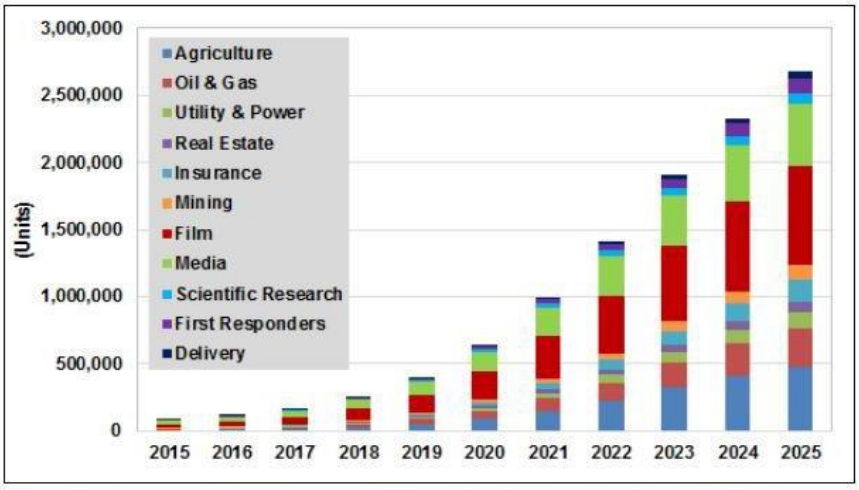
Uses for drones are widespread and include parcel delivery, rural deliveries, surveillance, surveying, and reading barcodes and RFID (radio frequency identification). Drones can have a variety of components added to them; this adaptability allows drone technology to benefit any industry. Business applications aside, drones are being produced as a consumer toy with sizeable markets and growing demand.

ADOPTION RATES

Based on a report from market analysis firm Tractica, worldwide sales of consumer drones reached $1.9 billion in 2015, and the market will continue to grow for the next few years. Tractica forecasts that worldwide consumer drone shipments will increase from 6.4 million units in 2015 to 67.7 million units annually by 2021.[31]

ALBERTA EXAMPLE IN ACTION

Calgary-based Aerium Analytics is providing unmanned aerial vehicle or drone services to industries such as airports and aerodromes, agriculture and livestock, construction and engineering, energy and renewables, forest resources, transportation, infrastructure and utilities, mining and aggregates, public safety, security and emergency response, lodging and remote accommodations. For these commodities, Aerium provides 3D modeling, videography, new vegetation spectography, orthophotogrammetry, and wildlife and environmental monitoring.[32]



IMPACT ON JOB SKILLS AND LABOUR REQUIREMENTS

Drones have the potential to enhance many different types of activities previously done by humans. Small-package delivery, land surveys, CAD analysis, videography, herd counting, forest growth measurement, stocking shelves, inspecting well sites, and inspecting rail tracks are just some examples where drone technology can enable employees to work faster and more efficiently.

As evidenced by the responses from the CSCSC surveys of supply chain professionals, 21.9% believe that drones will have a high or very high impact on the labour force, while 50% expect drones to have little impact on labour.

In the near term, regulatory challenges in Canada will limit drone use to within line of sight, which means the adoption rate of the technology in Canada will be slow and the overall impact low. However, as drone use increases, employees will need to be trained and licensed in drone operation and will need to understand how to operate, manage, and understand the data collected by drones.

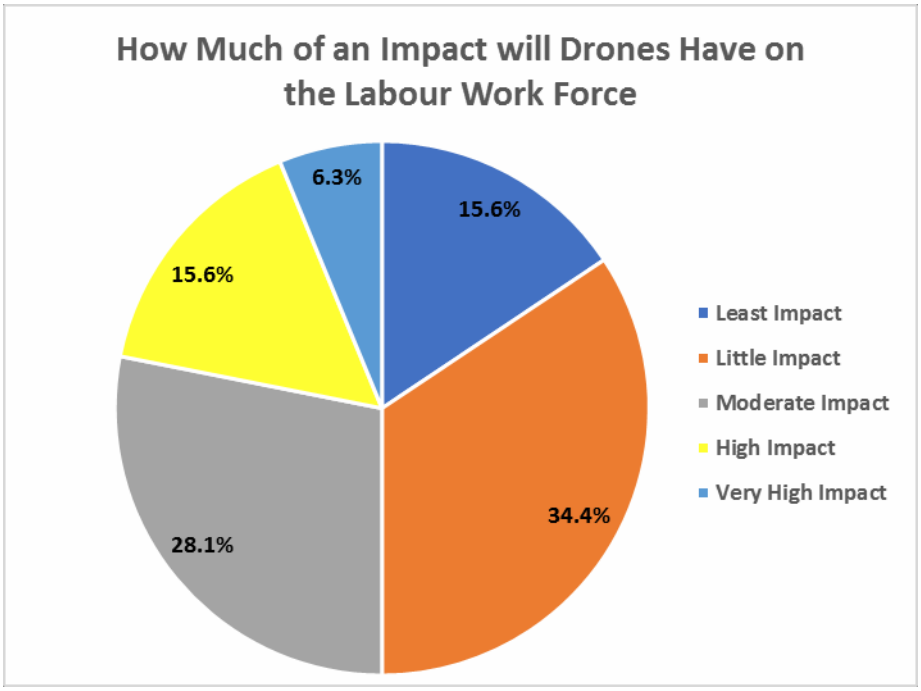


Figure 16 CSCSC Survey of International Supply Chain Professionals

MOBILITY INTERNET AND THE INTERNET OF THINGS

The internet of things (IoT) involves connecting devices to increase machine-to-machine communication via the internet. For example, the IoT enables communication between a truck and a warehouse to coordinate timing for deliveries. The IoT includes virtually any device or object that has a connection to the internet. Examples range from wearable technologies and smart phones, to connected household goods, to sensors found in equipment that automatically communicate data.

This connectivity is conducted by moving data through the cloud. By utilizing cloud computing, businesses and consumers have mobility of internet; i.e., there is easy access to devices anywhere. Additionally, devices can store significant amounts of data in the cloud, which reduces the size of required hardware.

The internet of things enables the remote sensing of anything, helping businesses to be more transparent and proactive. Sensors can be used to help track the location and qualities of products as they move through a supply chain. This will help to determine where products are, and if changes occur as products are handled and moved.

ADOPTION RATES

Of all the advancements in digital technology, few have more impact than the sensors used to create the internet of things. In a June 2016 Business Insider Intelligence report, it was predicted that there will be 34 billion devices connected to the internet by 2020, up from 10 billion in 2015. Internet of things devices will account for 24 billion, while traditional computing devices (e.g. smartphones, tablets, smartwatches, etc.) will comprise 10 billion.[33]

ALBERTA EXAMPLE IN ACTION

OPIsystems is a Calgary-based tech company and a global leader in optimizing grain quality for higher returns and

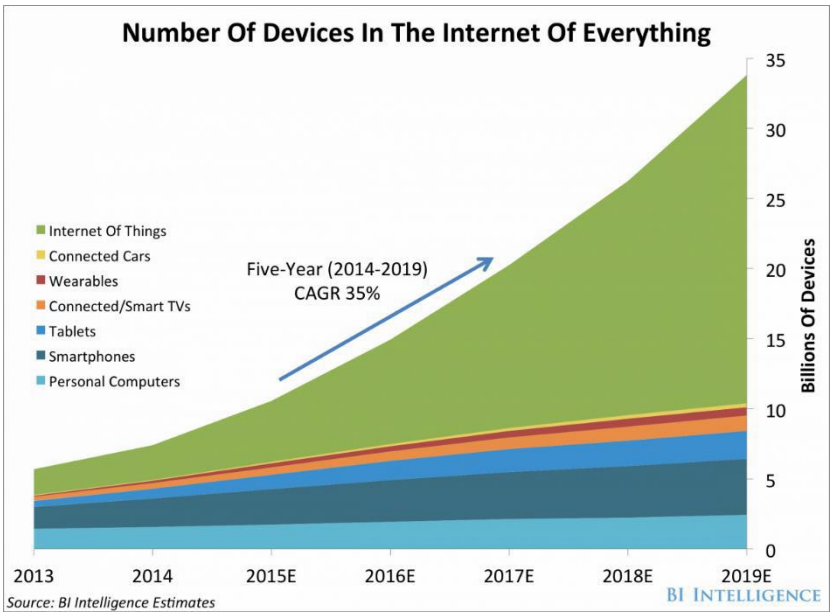


Figure 17 Number of Devices in the Internet of Everything

improved safety. OPIsystems' sensor-based technology measures the temperature and moisture content of stored grain, and through the use of processing algorithms and aeration fans, it automatically controls the condition of the grain to prevent shrinkage and spoilage. This technology works on all types of grain, including wheat, corn, oats, rice, and canola. Since grain is sold by weight, grain with higher moisture content has greater value and OPIsystems' technology keeps the grain at a constant moisture level.

If a hot spot is detected, indicating that the grain is beginning to spoil, the system automatically turns on the fans to cool the area to eliminate the problem, then turns the fans off when the job is done to prevent the grain from drying out and to save energy costs for the farmer. Having this control over grain drastically increases the length of time the grain can be stored, which gives farmers control over when they sell it. OPIsystems' technology also eliminates the need to enter the bin to manipulate the grain by hand, which can be very dangerous.[34]

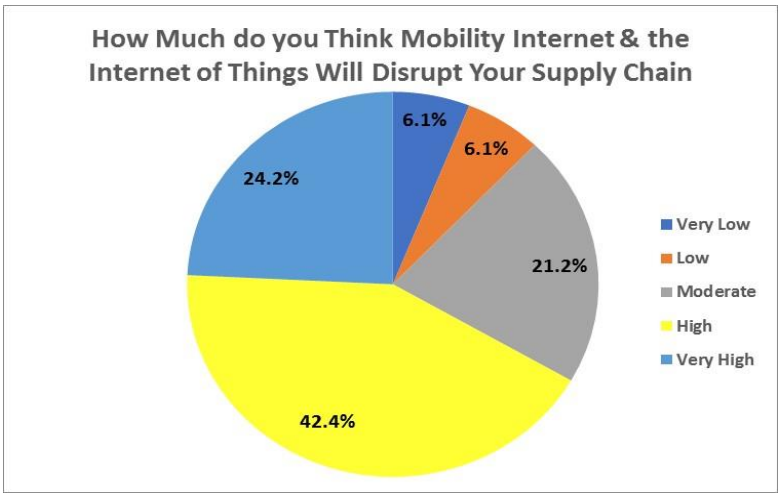


Figure 18 Survey of International Supply Chain Professionals

IMPACT ON JOB SKILLS AND LABOUR REQUIREMENTS

Sensors and devices will provide more information faster, enabling faster employee input and decision making. Sensors will collect, update, and manage data, eliminating the need for humans to enter, clean, and manage data. This shift will give employees time to focus on ways to be proactive with the data instead of spending time entering it.[35]

Sensors will also collect data on events and provide visibility to issues as they happen. For example, if a load shift in transit results in damages, load sensors will provide information to the customer service and claims analyst before the truck arrives at the destination. The claims analyst can start the paperwork on the claim, and customer service can divert the load for cleanup prior to delivery to the customer.

The majority of those surveyed by the CSCSC agree that IoT will have a significant impact on supply chain technology, with 87.8 of responses falling in the moderate to very high impact categories. However, survey results also indicated that over half of the supply chain professionals surveyed feel that IoT and mobility internet will cause no change to jobs.

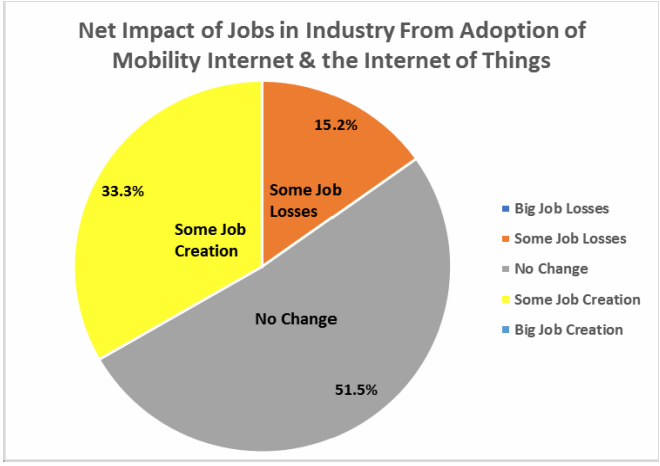


Figure 19 CSCSC Survey of International Supply Chain Professionals

BLOCKCHAIN

Blockchain is a technology that uses a general ledger for all participating parties to create a secure record of asset transfer. Due to its design, this general ledger is unchangeable, resulting in security and accessibility for the members of the chain. This creates transparency of the value of goods transferred from one party to another, ensuring partners in the chain have the same important information. A key component of blockchain is that there is no *one* owner of the information. The technology operates on a distributed network, instead of a traditional centralized network.

Blockchains are secure by design and are an example of a distributed computing system with very low opportunity for error (i.e., a high Byzantine fault tolerance). Decentralized agreement to a set of contractual conditions is therefore achieved through a blockchain. This makes blockchains potentially suitable for the recording of events, medical records, and other records management activities, such as identity management, transaction processing, documenting provenance, or food traceability.[36]

> "The societal power of blockchain to positively bring disparate—and even competitive—interests together can't be overstated…"
>
> *Bill Whitelaw - JWN Energy – June 23, 2017*

In the supply chain sector, blockchain has the capability of collecting operational data, rating the operational events (applying a cost), and then generating invoices for services rendered electronically. Considering the amount of paper currently used to track a shipment, legally accept or transfer liability of a shipment, and then pay for services pertaining to that shipment, blockchain (and the business process flows that are required to manage it) has the potential to bring together all of the other technologies and unify them under one platform. [37]

It is not without challenges. In order for blockchain to be effective, it requires collaboration, clear contract application, documented and agreed-upon rates for service, and "if this happens then what do we do" processes established. If the rigor required is achieved, then the reduction in administration, dispute resolution, claims, and other non-value-added activities within the supply chain are sizeable.

ADOPTION RATES

Blockchain as a technology is in the very early stages of creation. There are early leaders in the space, with Etherium (Microsoft) and Hyperledger (IBM) being two of the more visible solutions. There are hundreds, if not thousands, of companies entering the blockchain race and over 57% of the world's large companies surveyed by Juniper Research are considering their own blockchain solutions.[38]

ALBERTA EXAMPLE IN ACTION

ATB Financial, a commercial banking organization in Alberta, is leading the way in blockchain. In July 2016, ATB successfully transmitted $1,000 via Ripple. Ripple connects banks, payment providers, digital asset exchanges, and corporations via RippleNet to provide a frictionless way to send money.[39]

Ultimately, ATB wanted to see if it could use blockchain to move real money to a real financial institution, in real time. Traditional transactions currently take 3 to 6 business days; Ripple has the potential to reduce this to mere seconds.

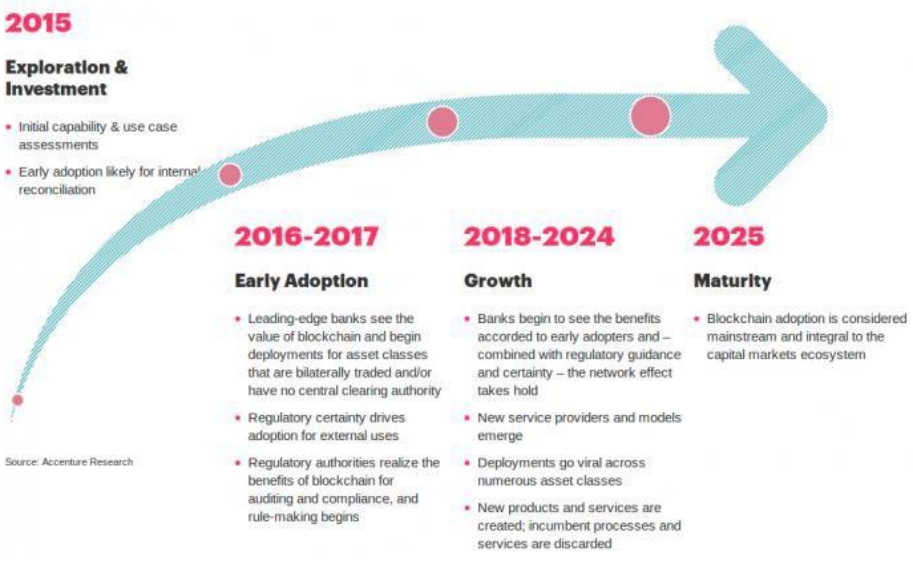


Figure 20 Projected Blockchain Growth and Adoption

ReiseBank has a unique core banking system for its special business needs, servicing its clients with the possibility of carrying out SEPA (Single Euro Payments Areas) transactions without an account. ReiseBank's deep knowledge of cash-based transfers that comply with both German and EU anti-money laundering regulations is now being implemented in the Ripple network. However, since ReiseBank lacked a customer-facing front end, an essential part of this project was to build a web-based user interface properly aligned with its business model.

When the decision was made to partner with ReiseBank, the ATB teams needed to adapt to work with the reality that there was an 11-time-zone difference.

Ultimately, the blockchain proof of concept was highly successful, with $1,000 being sent by ATB (in Canada) to ReiseBank (in Germany) in only eight seconds, using the Ripple protocol.[40]

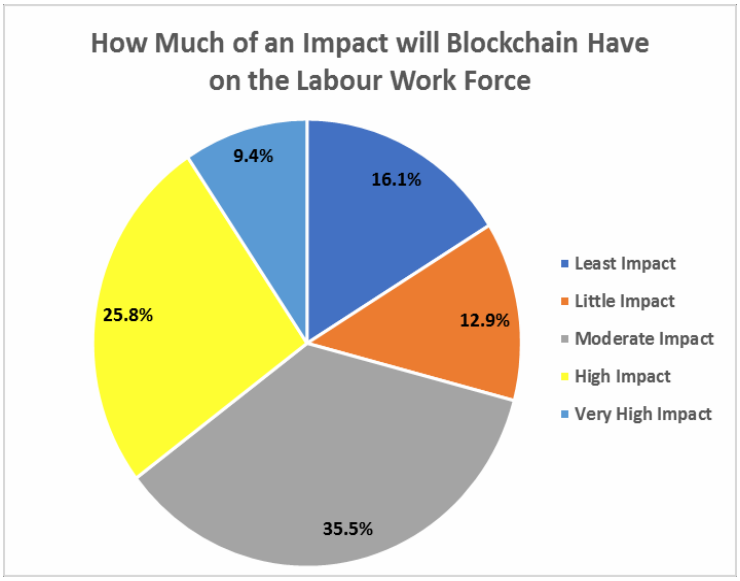


Figure 21 CSCSC Survey of International Supply Chain Professionals

IMPACT ON JOB SKILLS AND LABOUR REQUIREMENTS

Blockchain will significantly change how we manage a supply chain. The collection of operational data mapped to financial rules and payment for services will fundamentally change processes pertaining to proof of delivery, shipment management, and financial and accounting activities.

These changes will require advanced leadership, negotiation, contract management, business process, and collaboration skills. Of all the changes in supply chain, blockchain will result in the most fundamental changes to a wide array of roles within the sector.

The CSCSC survey highlighted that, while many (71%) of the responders feel that blockchain will have a sizeable impact on the supply chain labour force, there are still 29% who believe that blockchain will have little impact. This belief may be due to the fact that blockchain is a new technology and industry is still learning what it is and how it can be implemented within the sector.

JOB SKILLS IN A DIGITAL WORLD

Digital technologies are impacting supply chains around the world, transforming how we get goods to market, improving productivity and efficiency, and changing labour skills needed to perform many jobs in the sector. A report by MHI (Material Handling Institute) on the transformation to the digital supply chain identifies that, in this new era of digital technology, one of the top challenges for supply chain leaders will be hiring and retaining a skilled workforce. [41]

Based on projected digital and technical transformations in the supply chain sector, the top four new skills that will be required by supply chain professionals are likely to be:

- strategic thinking and problem solving
- ability to collaborate across different business units, customers, and functions
- leading and developing others
- ability to manage global and diverse teams

In Deloitte's *Third Annual Supply Chain Talent of the Future Report*, survey results highlight that not only are supply chain employers using advanced and digital technology, but they also expect their teams to be using digital technology in the near future. [42]

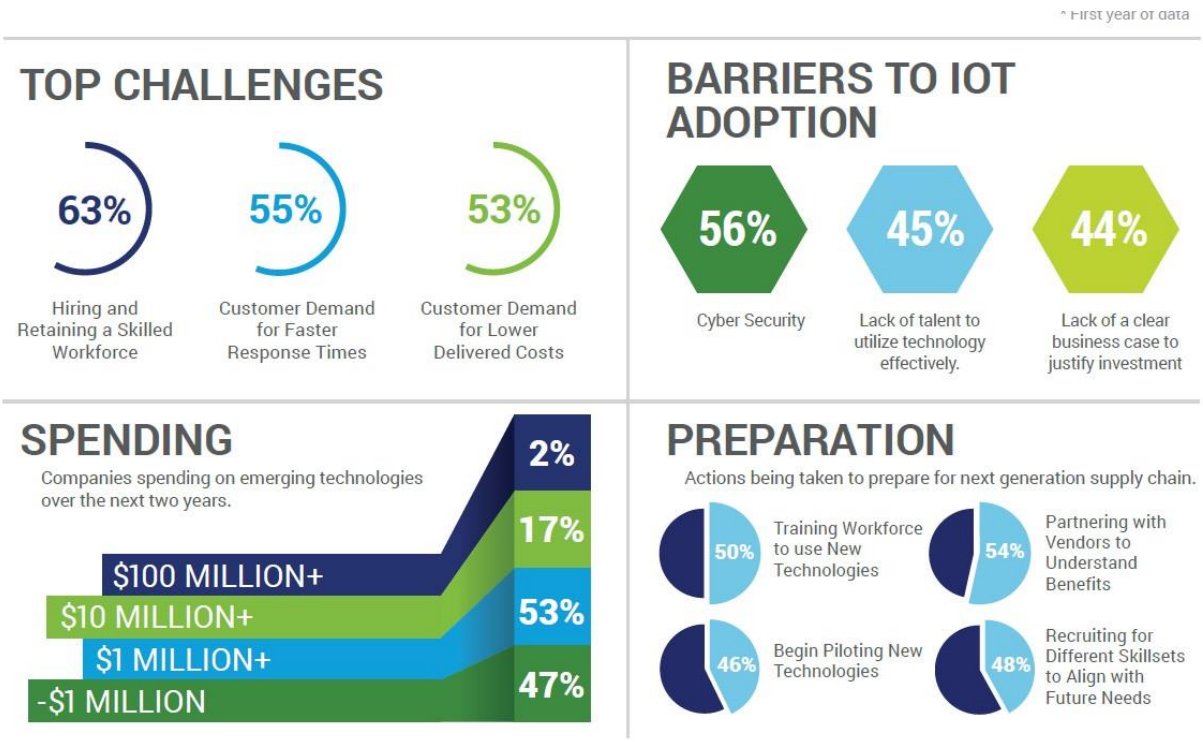


Figure 22 Source: The 2017 MHI Annual Industry Report Next-Generation Supply Chains: Digital, On-Demand and Always-On

NATIONAL OCCUPATIONAL STANDARDS

Currently, there are 48 supply chain occupations recognized by the CSCSC and the Canadian government.43 These occupations are coded to describe the roles involved in the industry and the details imperative to each occupation. The occupational standards should be considered the guideline for employers, employees, and institutions in understanding supply chain career paths.

Each occupational standard outlines the necessary skills to be successful in that occupation. Our analysis examined eight occupations from the list of 48:

- Procurement Officer
- Material Handler
- Supply Chain Manager
- Store Keeper and Parts Clerk
- Logistics Manager
- Transportation Manager
- Logistics Analyst
- Computer & Information Systems Manager

FUTURE SKILLS: AREAS OF FOCUS

From a future skills perspective, our research has found that there are specific areas of focus required for development as we prepare our workforce for future supply chains.

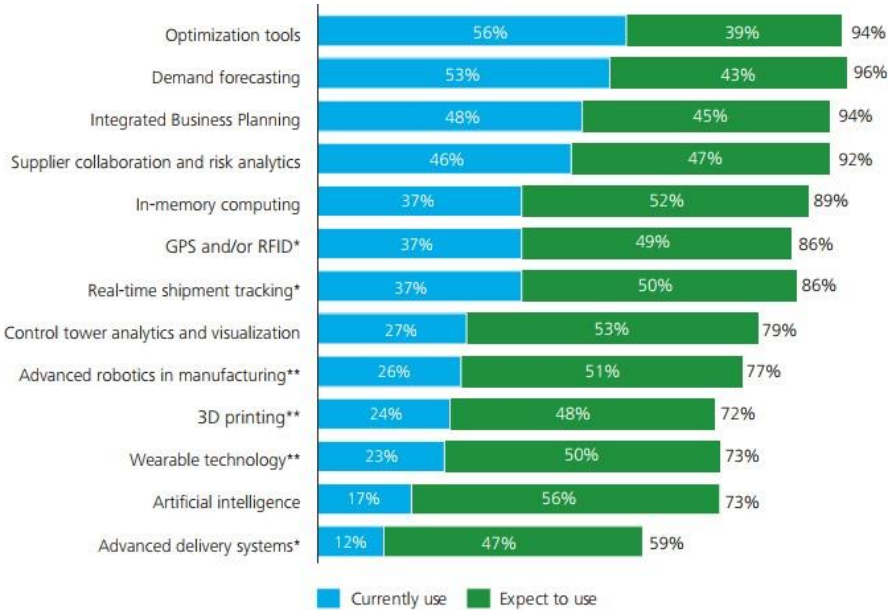


Figure 23 DHL Survey of Tools Currently Used vs. Expected to Use

Reduction of administrative tasks in favour of analysis and problem solving

With the proliferation of data and automation, many repetitive tasks are set to disappear. Weekly reports that had to be manually created can be automatically created if the correct infrastructure is in place. For example, an inventory count that requires a worker to count with a pen and paper could easily be done through IoT or by having a drone scan products as it moves through aisles.

Jobs where tasks become automated will require an increased capability for problem solving where discrepancies occur in the system. Although processes occur automatically, workers will still need to understand them in order to fix issues and propose improvements.

Increased need for leadership skills and strategic vision

As supply chain management becomes increasingly prominent in organizations, leadership and strategic thinking will be crucial for success. Harnessing technology to improve supply chains will help to improve efficiencies and potentially create entirely new business models.

Increased need for adaptability and understanding of new technologies

With many technological changes occurring at all levels of the organization, digital literacy will impact a wide range of workers. According to a study by PwC (a multinational professional services network), lack of digital culture and training is the biggest challenge facing transportation and logistics companies.[44] Managers and analysts will use new methods of sharing data through blockchain, while material handlers and store keepers will increasingly work alongside robots and be aided by augmented reality or other IoT devices.

As identified by the CSCSC LMI (labour market information) tool[45], the eight occupations we reviewed will have the highest growth rate over the next one to three years.

MATERIAL HANDLER

Occupational Standard: www.supplychaincanada.org/assets/u/CSCSCOSFinalMaterialHandler.pdf

Material handlers handle, move, load and unload materials by hand or using a variety of material-handling equipment. They are employed by transportation, storage and moving companies, and by a variety of manufacturing and processing companies, and retail and wholesale warehousing operations.

Many manual and repetitive tasks currently carried out by material handlers are expected to become automated. Aided by emerging technologies such as guidance and remote support through augmented reality sets, material handlers will be able to carry out more complex tasks. Working alongside robots, they will program machines for specific tasks, oversee work, and potentially handle day-to-day maintenance.

Examples of Changing Job Skills

Key Tasks	Examples of Changes	New Skills
Read work orders or receive oral instructions for work assignments.	Receive instructions through an augmented reality set. *Evolar sells a "pick-by-vision" augmented reality device for warehouse management. It also offers smart glasses (for picking or sorting) that direct employees and scan barcodes.*[46] Use a handheld device, computer on the forklift, or other computing device instead of a paper pick ticket or job sheet to pick an order.	**Digital literacy** to receive work instructions and guidance
Operate, navigate, or drive mechanized material-handling equipment.	Monitor, service, or manage more than one automated device or piece of equipment at a time. Take on greater responsibility to maintain equipment and manage the flow or network of goods in the warehouse instead of physically picking orders.	**Ability to use and monitor technology systems** to carry out daily activities
Pack containers and repack damaged containers.	Supervise tasks that are completed by robots. Ensure that robots are working effectively and that the packaging assembly line is working effectively. *Robots are being used for the inspection and packaging of pharmaceutical products in the manufacturing stage. One of the major advantages of robot use in this area is the reduction in risk of contamination generated by human contact.*	**Flexibility: ability to adapt and change**, as this role may require the ability to work alongside robots

PROCUREMENT OFFICER

Occupational Standard: www.supplychaincanada.org/assets/u/CSCSCOSFinalProcurementOfficer.pdf

Procurement officers process purchasing transactions for equipment, materials, supplies, capital goods, and services. They are employed by a wide range of establishments, such as manufacturing firms, utility companies, and the service sector, throughout the private and public sectors.

The main trend that will shape the jobs of future procurement officers will be increased access to data and the capability that provides to make better decisions. Repetitive and administrative tasks will become automated, with time spent on value-added activities increasing. A strong understanding of data analysis will be key to success in this field.

Examples of Changing Job Skills

Key Tasks	Examples of Changes	New Skills
Establish and negotiate contract terms and conditions, and maintain supplier relationships.	Use analytics software to perform dynamic analysis of purchases and contracts. *EY expects procurement decision making to be significantly influenced by high-quality data analytics by 2025. As analytics becomes more powerful, procurement will become increasingly central to business decision making. This means that procurement officers will have more tools to effectively manage demand, costs, and risk.*[47]	**Ability to use and monitor technology systems** to aid in decision making
Process purchase requisitions/orders within purchasing authority and reconcile or resolve value discrepancies.	These tasks will become increasingly automated and streamlined as technologies such as blockchain become integrated into operations. *According to Accenture, blockchain technology has the potential to provide huge operational benefits in terms of speed, greater security, and decreased workload by facilitating the exchange of information.*[48]	**Digital literacy** as purchasing processes become automated
Prepare and maintain purchasing records, reports and price lists.	With greater availability of data, the load of administrative tasks decreases, as reports become easier to generate through software. *For example, IoT-connected devices in warehouses will be able to accurately track details of every delivery. The individual performance of suppliers can then be tracked with great accuracy. If specific suppliers are consistently late or inaccurate with deliveries, then changes to contracts can be made automatically.*[49]	**Technical/analytical knowledge** as administrative time is reduced and more time is spent on analysis for problem solving to increase organizational efficiency

SUPPLY CHAIN MANAGER

Occupational Standard: www.supplychaincanada.org/assets/u/CSCSCOSFinalSupplyChainManager.pdf

Supply chain managers plan, develop, optimize, organize, direct, manage, evaluate, and are accountable and/or responsible for some or all of the supply chains processes of organizations.

Supply chain is seeing a growing importance at a strategic level in many organizations. As problem solving for day-to-day issues is reduced through better data and automation, supply chain managers can spend more time problem solving for longer-term solutions. Supply chain managers will spend increased time on designing new solutions, finding new sources of competitive advantage and aligning the supply chain with business goals.

Examples of Changing Job Skills

Key Tasks	Examples of Changes	New Skills
Lead and manage production planning, customer service, purchasing, inventory control, forecasting, warehousing, transportation and other areas, as required.	Manage supply chains with high levels of innovation and technology adoption. *Business model innovations, such as Amazon Prime Shipping, require supply chain leadership to reinvent the network in order to create a competitive advantage.*[50]	**Leadership** to create vision for innovative supply chains and to assist with change management
Develop analytics, systems, and data management capabilities, including metrics and reports.	Increasingly use big data analytics for decision making. *Pratt & Whitney, an aerospace manufacturer, is using big data to help prevent inflight engine shutdowns and related delays and cancellations. 5,000 parameters are used to monitor in-flight engine activity. This data is then used to create predictive models for when an engine needs to be scheduled for maintenance.*[51]	**Technical/analytical knowledge** to understand impact to organization
Direct, coordinate, assign, monitor, and review the work of individuals engaged in supply chain related duties.	Make increasingly more strategic decisions. *A survey by DHL found that the top three skills that will be required by supply chain professionals are: leadership; strategic and critical thinking; and problem-solving skills, creativity and imagination.*[52]	**Holistic solution thinking** to create alignment with vision of the organization

TRANSPORTATION MANAGER

Occupational Standard: www.supplychaincanada.org/assets/u/CSCSCOSFinalTransportationManager.pdf

Transportation managers plan, organize, direct, manage, and evaluate the operations and budget of transportation departments responsible for the transportation and movement of goods or companies involved in supply chain services. This position includes the identification of opportunities for transportation operation improvements.

Transportation management will be exposed to significant change with the adoption of automation and increased supply chain visibility.

Examples of Changing Job Skills

Key Tasks	Examples of Changes	New / Increased Need for Skills
Direct the activities of staff in relation to transportation operations, including dispatching, routing, and tracking transportation vehicles.	Dynamic analysis of transportation operations using big data, reports and predictive analytics to enable better business decision making faster. *Reduced time on administrative tasks will free up transportation managers to focus on process improvement and understanding customer needs.*[53]	**Ability to use and monitor technology systems** to aid in decision making in real-time
Direct the effectiveness of private, third-party, and contract carriage systems.	Adopt new technologies to manage operations effectively through improved access to data. *A 3PL study describes blockchain as having the potential to make significant improvements in security, transparency, and governance in the transportation sector.*[54]	**Digital literacy** as data transactions become automated
Monitor operations to ensure that staff comply with administrative policies and procedures, safety rules, union contracts, and government regulations.	Oversee a fleet of machines/robotics and understand corresponding key supply chain metrics. *Suncor Energy is currently utilizing autonomous heavy hauling trucks in their oil sands operations. After testing 12 Japanese-made autonomous vehicles, the company has contracted the manufacturer to produce 40 more autonomous vehicles for their fleet.*[55]	**Planning and problem solving** for developing optimal solutions for network efficiency

LOGISTICS ANALYST

Occupational Standard: www.supplychaincanada.org/assets/u/CSCSCOSFinalLogisticsAnalyst.pdf

Logistics analysts collect, evaluate, and analyze product delivery or supply chain processes and operations to identify and recommend changes to upper management.

Daily repetitive tasks, including manually searching for freight/carriers and providing status updates, will be automated. Increased focus will be placed on analysis and optimization of the supply chain network.

Examples of Changing Job Skills

Key Tasks	Examples of Changes	New Skills
Interpret data on logistics elements, such as availability, maintainability, reliability, supply chain management, and transportation.	Evaluate and analyze data/metrics from sensors and from a fleet of machines/robotics.	**Planning and problem solving** for developing optimal solutions for network efficiency
Track product flow from origin to final delivery.	Spend less time on tracking, as IoT devices automatically update on location and trip status. *Although asset tracking is already used today, manual updates are often required due to the capabilities of current devices. Future versions will be more accurate, secure and predictive.*[56]	**Critical and creative thinking** skills, as more time will be spent on problem solving for continuous improvement
Communicate with service providers, such as ocean carriers, air freight forwarders, global consolidators, customs brokers, or trucking companies.	Increase the use of software to manage transportation needs. *There will be an increased use of chat windows, text messages, and online computer messaging systems.*	**Digital literacy** to effectively use dedicated brokering software

STORE KEEPER AND PARTS CLERK

Occupational Standard:

www.supplychaincanada.org/assets/u/CSCSCOSFinalStoreKeeperandPartsClerk.pdf

Storekeepers and parts clerks sort, store, and issue parts and supplies and may use a variety of material-handling equipment (equipment that does not require certification to operate). They are employed by a variety of manufacturing companies, business establishments, and warehouses.

The focus of this role moves away from physically moving inventory to overseeing machinery and ensuring tasks are done correctly. Operating 3D printers and completing associated tasks may become a large portion of the role.

Examples of Changing Job Skills

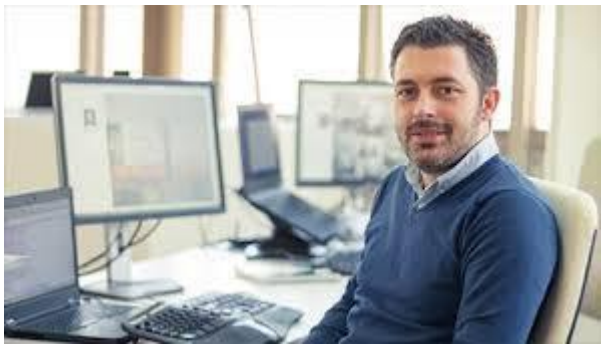
Key Tasks	Examples of Changes	New Skills
Store items in an orderly and accessible manner in a warehouse, tool room, supply room, or other area.	Robotics and automation will be capable of effectively organizing and storing items, reducing the need for human assistance. *Rethink Robotics has two models of robots that are designed to work in unstructured environments, giving them the flexibility to carry out a wide range of tasks.*[57]	**Planning and problem solving** for identifying discrepancies between the system and the inventory
Process incoming requisitions and issue or distribute parts and supplies for internal usage.	Use 3D printing to produce parts and tools on demand according to business needs. *DHL envisions "spare parts on demand" as a major area where 3D printing will proliferate. There are currently hundreds of millions of parts stored in warehouses with a significant proportion rarely used.*[58]	**Ability to use and monitor technology systems** for operating machinery
Maintain records of orders and the amount, kind, and location of parts and supplies on hand using a manual or computerized inventory system.	Inventory will be tracked automatically through dedicated software. *An example of this is the Amazon Go store, which has no cashiers or checkout lines. Instead, all products are tracked through RFID technology.*[59]	**Digital literacy** for using software and identifying discrepancies

COMPUTER AND INFORMATION SYSTEMS MANAGER

Occupational Standard:

www.supplychaincanada.org/assets/u/CSCSCOSFinalComputerandInformationSystemsManager.pdf

Computer and information systems managers plan, organize, direct, manage, and evaluate activities related to the analysis, design, development, implementation, operation, and administration of computer and telecommunications software, networks, and information systems.



The computer and information systems manager will play an increasingly important role in organizations as the capability of technology increases. In a quickly changing environment, successful managers will need the ability to identify technologies and systems that work for the needs of their organization.

Examples of Changing Job Skills

Key Tasks	Examples of Changes	New Skills
Work with other departments and senior management to manage information system priorities and workload, align information system resources, and ensure successful delivery of services.	The manufacturing industry will see significant changes as smaller autonomous vehicles further proliferate into facilities. *Companies such as Otto Motors are creating smaller autonomous movers to shuttle material around a facility*.[60]	**Technical/analytical knowledge to** manage increased levels of automation and artificial intelligence systems
Develop analytics, systems, and data management, including metrics and reports. Establish key performance indicators, monitor ongoing performance, and improve performance against set goals.	New manufacturing equipment will increasingly have IoT capabilities incorporated into the design. This enables increased productivity in manufacturing operations, as every process can be accurately tracked and analyzed to micro details[61]	**End-to-end supply chain understanding** to effectively find ways to leverage technology to improve operational performance
Collaborate with staff, other departments, senior management, decision makers, and other professionals and associates (external to the organization) to share or provide information, problem solve, and clarify management objectives.	Leadership will be required to manage increasingly larger projects. As technology advances, greater reliance will be placed on leadership with a technical background. Having leaders with technical backgrounds may help other organizations find new sources of competitive advantage through technology.[62]	**Leadership** skills to manage larger projects as automation takes a more prevalent role in organizations

LOGISTICS MANAGER

Occupational Standard: www.supplychaincanada.org/assets/u/CSCSCOSFinalLogisticsManager.pdf

Logistics managers plan, organize, direct, manage, evaluate, and are responsible for the operations and budget of departments or companies involved in supply chain services, including customer service, warehousing, inventory control, transportation, materials handling, and strategic planning. This position includes the identification of opportunities for logistics operation improvements.

Logistics managers will need to have the ability to adapt in rapidly changing environments. This will require continuous learning, as well as a good understanding of how technologies can shape supply chains. Logistics managers will have to evaluate new modes of transport (e.g., drones) and ways of tracking shipments to design efficient supply chains.

Examples of Changing Job Skills

Key Tasks	Examples of Changes	New Skills
Direct, coordinate, assign, monitor, and review the work of individuals engaged in the following duties: shipping, receiving, storing, distributing materials, parts and products, dispatching crews, scheduling transportation crews and routes, and other related activities.	In addition to existing duties, oversee a fleet of machines/robotics, while having a good understanding of new technologies for adoption. *For example, DHL envisions drone use for several purposes in supply chains, including first- and last-mile deliveries, rural deliveries, and surveillance of infrastructure.* [63]	**Continuous learning** to understand the capabilities of rapidly evolving technologies, such as autonomous vehicles
Establish key performance indicators, monitor ongoing performance, and improve performance against set goals.	Through IoT sensors and big data analysis, monitor supply chain performance in real time. *With improved visibility to assets, responsiveness and flexibility will be highly improved. For example, IoT could be used to identify capacity on certain lanes allowing for consolidation on LTL (less than truckload) shipments.*[64]	Increased **critical and creative thinking**, as innovative solutions are needed in quickly changing supply chains
Manage contractor and subcontractor activities, reviewing proposals, developing performance specifications, and serving as a liaison with the organizations.	Transactional communication will be reduced through increased use of brokerage software and blockchain. *Blockchain technology is set to enter the logistics industry, as it helps to create transparency among stakeholders along the supply chain.*[65]	**Digital literacy** to communicate effectively through new interfaces

IN CONCLUSION

As we continue to advance and enhance digital supply chains, it becomes increasingly important that we have the right skills and are planning career pathways that meet the changing skills needs. Digital literacy, leadership, and critical and creative thinking will be skills in high demand in the future. The DHL report *The Supply Chain Talent Shortage: From Gap to Crisis* [66] highlights just how difficult skilling our supply chain will be.

This report states the following: "The U.S. Bureau of Labor Statistics reports that jobs in logistics are estimated to grow by 26% between 2010 and 2020 while one global study estimates that demand for supply chain professionals exceeds supply by a ratio of six to one."

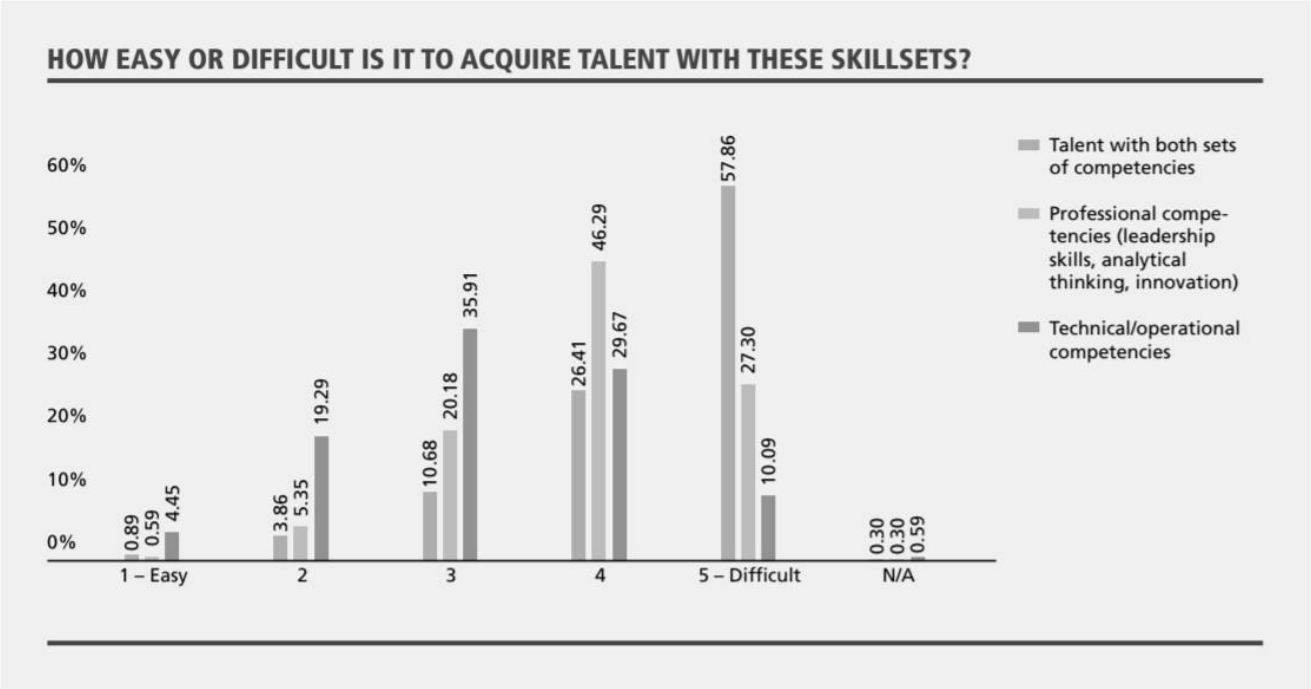


Figure 24 Source: DHL Research Brief: The Supply Chain Talent Shortage

According to DHL, the factor with the greatest impact on the talent shortage is changing job requirements. Today, the ideal employee has both tactical/operational expertise and professional competencies such as analytical skills. Tomorrow's talent must also excel at leadership, strategic thinking, innovation, and high-level analysis. Of the companies surveyed, 58% say that this kind of talent is hard to find, and yet over 30% of the companies have no plans to develop the talent that they require.

To accelerate efficiency and competitiveness in the supply chain sector, Canadian companies adopting new technology must also actively develop the skills and capabilities that these technologies require. Technological advancements and the growth of the supply chain sector are creating a demand for new skills, and smart companies are working to build those skills before the technology advancements reach a critical adoption rate.

RESEARCH METHODOLOGY

For the purposes of generating this report, the Canadian Supply Chain Sector Council contracted Triskele Logistics (Calgary, Alberta) to conduct research, collect data, and prepare a final document. The following is an explanation of their research methodology.

OUTCOMES

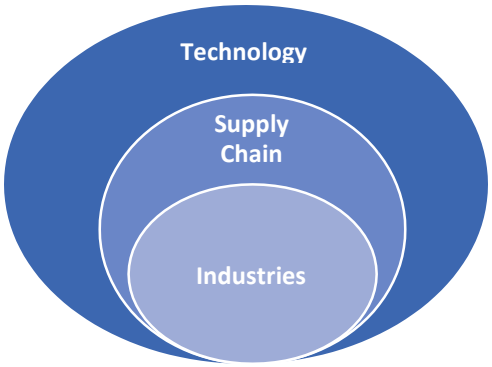
The purpose of this report was to achieve the following outcomes:

- Explain the current role of technology in supply chain and how this differs regionally
- Identify key characteristics of emerging technologies and the ways they will be implemented into supply chains
- Summarize the adoption rates of emerging technology within industry
- Analyze the labour skill changes that are projected to occur in eight selected supply chain occupations
- Identify the projected impacts to the skill sets that are required across the supply chain roles recognized in Canada
- Provide an overview of research findings, including analysis of survey results and highlights

TECHNOLOGY REVIEW

The purpose of this section of the report was to examine the adoption of emerging technologies by the supply chain sector across potential growth industries in Alberta. While technology and innovation will bring large-scale changes to the supply chain sector and its labour force, it ultimately affects every industry and all levels of society.

The following table outlines the examples from technology, the supply chain sector, and industries that were considered for inclusion.



TECHNOLOGY	SUPPLY CHAIN SECTOR	INDUSTRIES
• Autonomous Vehicles • Additive Manufacturing • Robotics & Automation • Mixed Reality Tech • Big Data Analytics • Drones • Mobility Internet & Internet of Things • Fintech & Blockchain • Renewable Energy • Artificial Intelligence	• Truck • Rail • Ocean • Air • Warehouse • Manufacturer • Producers • Retail • Port • Pipeline	• Aerospace & Defence • Agribusiness • Oil & Gas • Pharmaceuticals • Industrial Manufacturing • Mining • Financial Services

RESEARCH

To identify the effects of emerging technologies on the supply chain sector, Triskele Logistics researched the following:

- The emerging technologies that will shift the supply chain sector
- The current use of emerging technology and future expectations
- The level of industry awareness and understanding of technology and labour shifts

CONNECTIONS

Using social media, surveys, and networking events such as roundtables, connections were made with key stakeholders in the supply chain sector in order to achieve the following:

- Identify current technology trends, where they are occurring in the world, what the adoption rates have been for Alberta companies, and what experts are predicting for future adoption rates
- Conduct a survey with the roundtable participants and other stakeholders to confirm the research findings

EMPLOYMENT AND SKILLS TRENDS REVIEW

Currently, there are 48 supply chain occupations recognized by the Canadian Supply Chain Sector Council (CSCSC) and the Canadian government.

Triskele Logistics' research examined eight occupations from the list of 48 to cross reference the impacts that new technology will have on the tasks currently performed in these roles. The occupations examined included the following:

- Procurement Officer
- Material Handler
- Supply Chain Manager
- Store Keeper and Parts Clerk
- Logistics Manager
- Transportation Manager
- Logistics Analyst
- Computer & Information Systems Manager

HEAT MAP

Taking the approach that the tasks and roles of these job functions will remain the same but the ways the tasks are performed will shift, the research identified the top 3 to 5 most-impacted tasks for each job function. Triskele Logistics outlined the key tasks performed today, and highlighted how they might be performed in the future. Using this as the base, a heat map was drawn to visualize the estimated impact technology will have on the tasks and skills sets on the eight supply chain occupations.

The heat map examining shifts in all the recognized occupations was pooled by supply chain subsectors. The supply chain subsectors recognized by the CSCSC include:

- Inventory/Material Control
- Management
- Marketing & Sales
- Purchasing
- Senior Management
- Transportation
- Warehousing
- Logistics
- Information Systems

SURVEYS, ROUNDTABLES AND REVIEWS

To validate current and projected labour market skills trends, Triskele Logistics performed the following tasks:

- Held two international roundtables with 10 technology companies and 10 supply chain companies from India, France, Canada (Alberta and other locations), Africa, The Netherlands, and the United States. The purpose of these roundtables was to discuss the companies' major technology projects and to identify the impact that these projects have on the labour force
- Conducted surveys with industry, technology, and recruiting firms to assess the level of skill changes to the workforce
- Reviewed the CSCSC National Occupational Standards, Connector Tool and LMI Tool, and using the CSCSC supply chain sub-sectors and National Occupational Classification (NOC) codes, identified the changes in skills

To fully develop a comprehensive action plan pertaining to employment and skills, interviews were conducted with 10 Alberta companies that are currently developing and using new technology. These companies were then surveyed to confirm the interview findings. The survey included a review of the current skills shortages and what, if any, effects the implementation of new technology will have on labour requirements.

Finally, the skills needed to meet the demands of future technology were identified by:

- Determining the tasks most likely to change as a result of technology
- Conducting research to determine expected required future skills
- Creating a detailed matrix by role of the expected tasks/skills requirements in jobs affected by disruptive technology

TASK ASSESSMENT

The task assessment was completed using the Canadian Supply Chain Sector Council National Occupational Standards found at www.supplychaincanada.org/en/NOS.

CONNECTOR TOOL ASSESSMENT

The skill sets that were assessed within each occupational standard were identified using the CSCSC's Connector Tool (www.supplychaincanada.org/en/Connector). Specific skills required for each role were expanded upon using the skills listed in the occupational standard. Each occupation was analyzed for changes in the following general areas:

- Document Use
- Communication
- Numeracy
- Reading
- Thinking Skills
- Writing

This analysis provided a view into the labour skill changes that are projected to occur in the eight selected occupations, and a larger view of the projected impacts to skill sets that are expected across the supply chain roles recognized in Canada.

APPENDIX A: RESEARCH CONTRIBUTORS

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