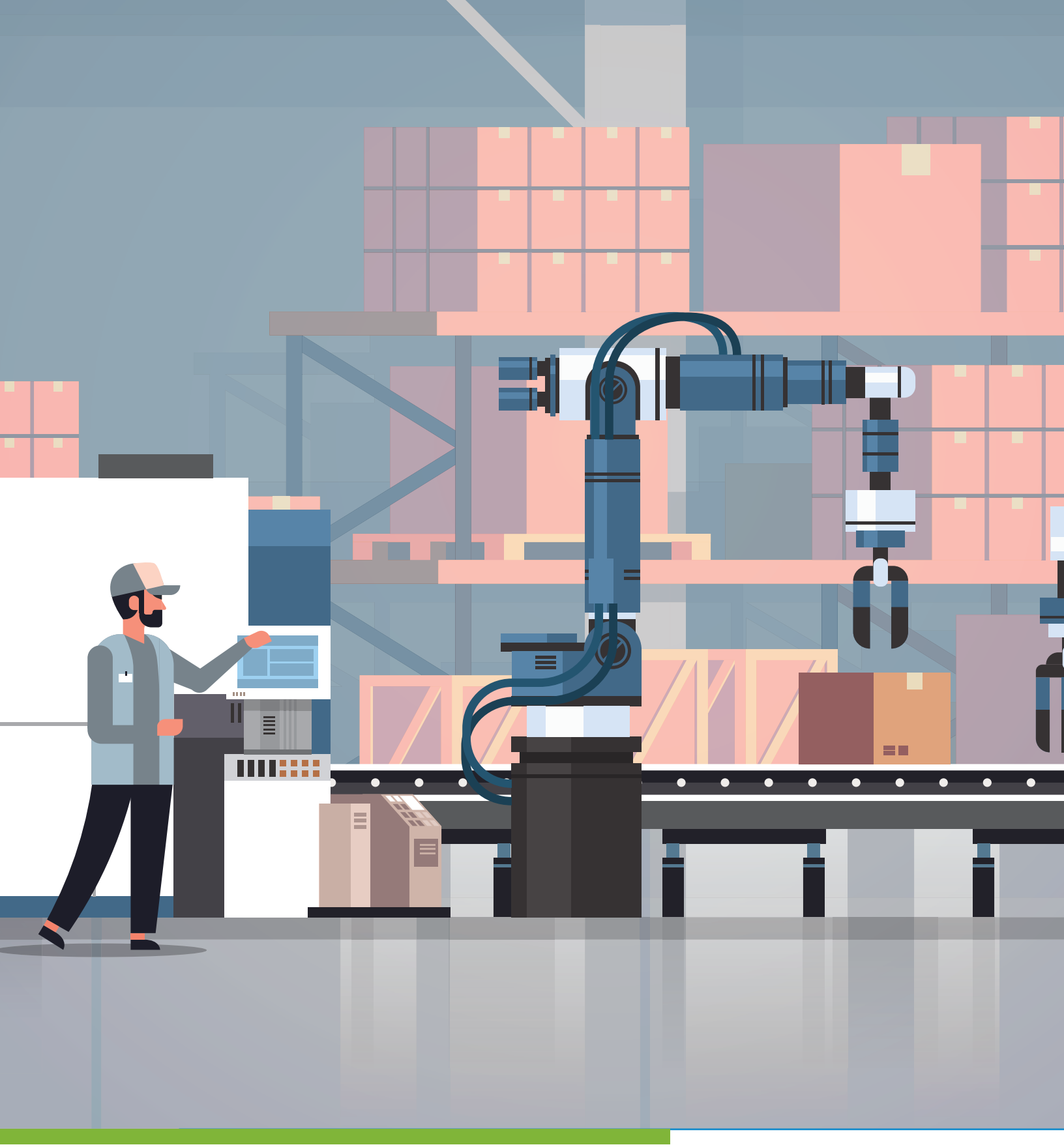


Warehousing and Distribution Industry

Determining emerging trends in technology and its possible impact on the industry workforce

TWIG TORONTO WORKFORCE INNOVATION GROUP

About the Toronto Workforce Innovation Group

Toronto Workforce Innovation Group (TWIG) is a leading-edge research and partnership organization responding to the diverse needs of local communities and businesses in the area of workforce development. It is one of the 26 similar planning groups tasked by the Ministry of Labour, Training and Skills Development to work closely with our local economies. As Toronto's Workforce Planning Board, we conduct dynamic labour market research, disseminate information and convene stakeholders to address workforce development trends, gaps and opportunities. Among similar organizations in Toronto, our multi-stakeholder approach is unique; we work on issues across many sectors and engage stakeholders from a wide range of perspectives including federal government departments, provincial government departments, industry, training institutes, labour groups, and special interest groups to address skills and labour market information needs. Our research is an on-going and continuous process that includes our numerous consultations and focus groups with employment/training service providers and job seekers in addition to the deep data dive that informs our publications. We work to ensure that Toronto's workforce has the skills and talent it needs to meet the demands of a changing economy. TWIG achieves its goals through:

- Researching, analyzing and reporting on workforce development trends, gaps and opportunities in Toronto
- Acting as a resource to inform our stakeholders (community groups, educators and trainers, employers, governments, labour groups and media) about Toronto's workforce development issues

Acknowledgements

This report was researched and written by TWIG's Lead Research Analyst Mahjabeen Mamoon. For this report, we are grateful for the support of TWIG's Executive Director, Tinashe Mafukidze, the Ministry of Labour, Training and Skills Development, ACE POS Solutions Ltd, Nexus Commerce, TSI Group Inc, Lock Search Group and Wilfrid Laurier University. Representatives from these departments and groups provided invaluable insights and understanding of both the needs and challenges facing the warehousing and distribution industry and its workforce due to the emergence of new technologies.

Table of Contents

1.0 Executive Summary

Toronto Workforce Innovation Group (TWIG) initiated an analysis of the warehousing and distribution industry to develop an in-depth understanding of emerging industry trends and practices in the Greater Toronto Area (GTA) and their possible impact on the industry's workforce in the next five to ten years. With rapid growth in e-commerce, businesses often consider warehousing and distribution center operations as an integral part of the company's business strategy. Findings suggest that this industry is likely to be transformed radically by technology. For this reason, industry businesses/employers and their workforce must be well informed about the changes and practices so that, as key stakeholders, they can strategically prepare themselves with corresponding skills and capabilities.

By reviewing existing literature and conducting semi-structured interviews of employers, recruiting agencies and subject matter experts, this report explored the following: the skills and scope of work requirements within existing and forthcoming occupations in the warehousing and distribution industry; the impact of accelerated technology in the industry processes and how that might change the future employment needs within the industry; any existing recruitment and retention challenges business face; and to what extent upskilling and retraining of the workforce is a business priority.

Based on a thorough analysis of the industry and through conversations with primary stakeholders, like employers, and external stakeholders, such as recruiting agencies and subject matter experts, a number of insights were put forward:

- Warehousing and distribution center operators need to better understand the possible complexities of new innovations and identify the specialized skills that will be needed to support such innovation.
- The impact of big data and predictive analytics on the supply chain workforce is a positive one. It is likely to create jobs for engineers, computer science majors, data managers, and analysts. Experts speculated that there could be a potential skills gap for the requisite skills needed to fill in managerial level positions in the industry.
- Demand-focused strategies that engage employers in partnership with educators, employment service providers and other labour market stakeholders can resolve skill gaps better.
- There is a need to increase employers' awareness of industry-related education, training and employment services and government training funds or knowledge-based resources offered to support businesses. Creating a critical pathway to connect these businesses with government funding resources can foster innovation and workforce development.
- Some promising technologies are yet to be reliably deployed in a live warehouse setting. As human intuition is still an important element needed to complete a task, businesses must support workers to transition into emerging roles. Training infrastructure is required, either through government-funded workforce development systems or within a business/company.
- Given that every warehousing and distribution center is at a different stage of its technology-development strategy, the impact on the workforce will vary across different warehousing facilities in the industry.
- Employers must use some new technologies with caution. For example, wearable technologies that monitor and track the movement of workers must be used carefully as they can pose serious concerns around the workers' privacy.

2.0 Introduction

In today's day and age, where the new normal is customer's ease, convenience and flexibility around omni-channel shopping, the benefits of an efficient warehouse and distribution center exceed beyond the store boundaries. An efficient facility plays a critical role to guaranteeing that customer orders are readily available and completed in exact accordance with consumer's preference without delay.

In order to deliver the best to the customers and at the same time to minimize operational costs, a lot is changing in this industry space. To be ahead of the game, every business now needs a smarter warehousing facility than it owned traditionally. So, many companies are building a roadmap on how the warehousing and distribution center will look like in the coming years and what will be the specialized workforce needs to complement such facilities.

In a latest report[1] by Zebra Technologies Corporation, 1,403 warehouse professionals and IT operators from North-America, Europe, Asia-Pacific and Latin America were surveyed to understand the current and planned experiences and processes related to the respondents' warehouse and/or distribution centers. This was done by analyzing the trends and challenges transforming the operations in the industry. Findings showed that 80 per cent of the respondents (decision makers of the businesses) planned to transition to a more modern, full-featured warehouse management system.

This wave of next generation, technology-enhanced warehousing facilities and distribution centers will have considerable impact on the way these businesses will make their labour decisions. For example, survey findings from the same report showed that 61 per cent of the respondents believed in partial automation. In order to increase productivity and enhance customer satisfaction, they planned to equip human labour with the necessary device and technology by 2024. On the contrary 27 per cent of the respondents plans to go for full automation with zero human involvement in the next five years. Net results revealed that 83 per cent of the respondents were currently increasing or planning to increase the number of workers by 2024.

In the last couple of years, the Greater Toronto Area (GTA) has already outperformed Canada's growth rate. With a larger and more diversified population, the region has a heftier consumption market, which is increasing the size and scale of warehousing and distribution centres in order to meet e-commerce demand. This report critically examined how local warehouses and distribution centers in the GTA may behave on the face of the possible technological transformation, what could be the potential challenges, emerging opportunities or skills gap in the industry, the value of bridging theses skills gap and to what extent businesses can create an optimal balance between human labour, machines, robotics and artificial intelligence.

Skills gap in any industry can hamper technological adoption and the growth of businesses in that industry. To ensure that technological innovation is not accompanied by talent shortages it is crucial to support the reskilling and upskilling of an existing industry workforce. Both government and businesses can work together to create an environment to facilitate these efforts.

3.0 Methodology

In order to understand the dimensions of the warehousing and distribution industry in Toronto, we adopted a mixed methodology using both quantitative and qualitative data. First, we analyzed available sets of labour force and industry data to develop a comprehensive understanding of the industry composition by size and location throughout Toronto. We also examined the industry's workforce demographics by age, gender, educational attainment, wages, range of occupations and job vacancy rates. Second, we conducted an extensive literature review. Finally, we conducted eight key informant interviews with the primary stakeholders like employers within the industry and external or secondary stakeholders like recruiting agencies and subject matter experts in supply chain management in the Greater Toronto Area.

4.0 Warehousing and Distribution Center Industry Background

A key function to the supply chain and logistic process is warehousing and distribution. Based on the North American Industrial Classification System (NAICS)[2], warehousing and storage is considered to be a key sub-sector of the transportation and warehousing sector.

This industry is becoming increasingly predominant on the face of the rise of e-commerce and omni-channel retailing at growth rates that have vastly exceeded the sales at brick and mortar stores. It comprises of establishments primarily engaged in operating general merchandise, refrigerated and other warehousing and storage facilities. It also includes third-party warehouses serving retail chains and wholesalers. Establishments in this industry also take the responsibility for storing the goods and keeping them secure. Other services offered ranges from logistics services, related to the distribution of a customer's goods like labelling, breaking bulk, inventory control and management, light assembly, order entry and fulfillment, packaging, pick and pack, price marking and ticketing and transportation arrangement.

Both public and contract warehousing are included in this subsector. Public warehousing generally provides short-term storage, typically for less than thirty days. Contract warehousing generally involves a longer-term contract, often including the provision of logistical services and dedicated facilities. The sub-sector is composed of the following:

- General warehousing and storage – handle goods in containers, such as boxes, barrels and drums, using equipment such as forklifts, pallets and racks and are not specialized in the handling of a particular type of good.
- Refrigerated warehousing and storage – provides warehouse and storage services, using equipment designed to keep goods frozen or refrigerated.
- Farm product warehousing and storage – primarily engaged in operating farm product warehousing and storage facilities, except refrigerated.
- Other warehousing and storage – establishments operate facilities and equipment that are designed to handle a particular type of good, for example, dead automobile storage, petroleum storage caverns and whisky warehousing.

Warehousing could entail different settings, starting from a retail warehouse to a manufacturing warehouse to a distribution centre. According to Davarzani and Norman (2015)[3]; the industry has a multi-faceted operational aspect due to a variety of requirements from different sales channels (e-commerce, retail, indirect channels, omni-channels), different production philosophies (e.g., lean or agile), different managerial perspectives (e.g., economic efficiency, green performance and social responsibility), different degrees of automation, warehouse management systems (WMS), etc. all of which imposes challenges and opportunities for the warehousing operations. The operational challenges combined with rising cost and higher consumer expectations from the dominant e-commerce trend can be considered as a major reason behind automation in warehousing and storage.

5.0 Warehousing Industry Labour Market

The Toronto economic region has the highest share (50 percent) of transportation and warehousing employment in the province and has registered an average industrial employment growth between the years 2017-19[4]. According to the 2019 Toronto Employment Survey[5], warehousing grew by 1,090 jobs or 7.1% in the last year. Also, the demand for industrial space is being driven by e-commerce and warehousing and distribution, as evidenced by the recent expansion of distribution centres for Amazon and Canada Post in Scarborough, and Purolator and Metro in Etobicoke. Canada Goose and the cosmetics company Deciem in Toronto have also expanded distribution employment over the last year. All these local companies combined, represent almost 2,400 existing or planned jobs in the warehousing industry.

In 2016, five Employment Monitoring Areas (EMAs) were created to analyze broader trends in Employment Area activity across the City of Toronto. Transportation and warehousing was in the top employment sectors in three of the five EMAs: West (approximates the former municipality of Etobicoke) – 10.4%, South (approximates the areas of the former municipalities of the City of Toronto, York, and East York) – 14.8%, East (approximates the former municipality of Scarborough) – 9.2%.

The warehousing and storage sub-industry is a critical component of the overall transportation and warehousing sector, employing a little less than 10% of the workforce[6]. However strong retail and wholesale sales growth in Ontario in the past couple of years along with higher inventory turnover supported employment gains in the sub-industry Material handlers (NOC 7452) and shippers and receivers (NOC 1471) make up 49% of employment in warehousing and storage[7]. As companies work to improve inventory management through technological innovation, this sub-industry is expected to see some significant changes in the near term. It is believed that the increased automation in the warehousing facilities is likely to engage more workers, especially in computer skills and safety.

5.0 Warehousing Industry Labour Market

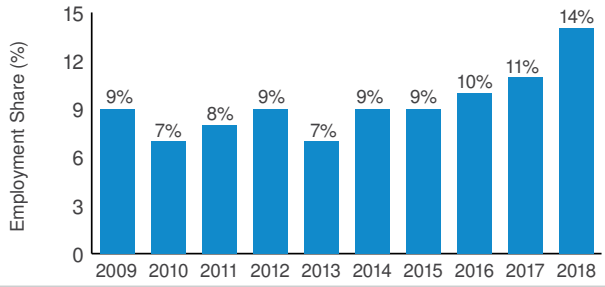
5.1 Labour Market Data Analysis

Using labour force survey data, figure-1 represents the share of employment in warehousing and storage as a share of the total employment in transportation and warehousing sector. Analysis suggested that over the past ten years, there has been an increasing trend in the share of employment in the warehousing and storage industry. In 2018, 14% of the employment in transportation and warehousing comprised of employment in warehousing and storage which was the highest in the past ten years.

Figure-2 shows a 10-year trend in total employment in warehousing and storage in Toronto, CMA. The figure reports rising levels of total employment in the industry in the past ten years. Between 2009 and 2018, there has been a 105% rise in the level of total employment. In 2018, the total employment in the industry in Toronto, CMA experienced a 41 per cent rise compared to 2017.

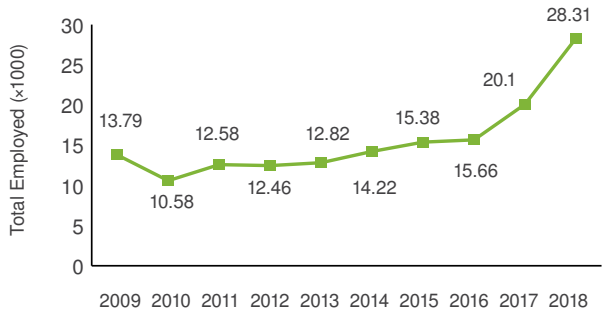
Figure-3 reports the number of establishments/ businesses in the warehousing and storage industry in the last ten years in Toronto, CMA and they have more than doubled. In 2009, there were 12,560 firms in this industry whereas in 2018 the number of firms operating under the industry increased to 28,090. Based on labour force survey data, this industry is dominated by firms that employed between 20-99 employees followed by those that employed 100-500 employees.

Figure 1: Trend in Share of Employment in Warehousing and Storage, Toronto CMA



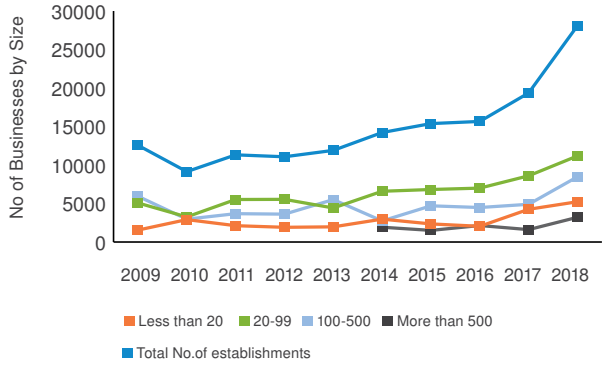
Source: Statistics Canada, Labour Force Survey

Figure 2: Trend in Total Employment in Warehousing and Storage, Toronto CMA



Source: Statistics Canada, Labour Force Survey

Figure 3: Trend in the Number of Warehousing and Storage Establishments by Size Toronto, CMA



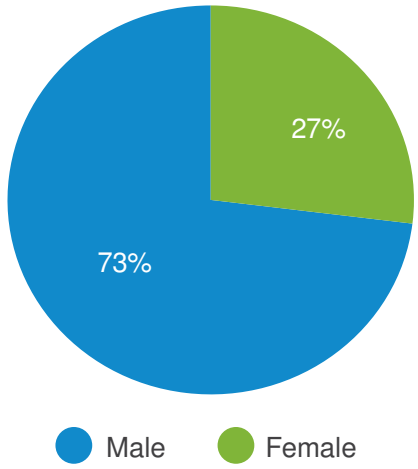
Source: Statistics Canada, Labour Force Survey

5.0 Warehousing Industry Labour Market

According to Figure-4, employment in warehousing and storage industry is overwhelmingly male dominated and this has been a common trend in the past ten years. This isn't a surprise as traditionally it's hard to escape the impression that many roles in the industry primarily involve moving and lifting heavy items for which reason it may seem daunting to most females.

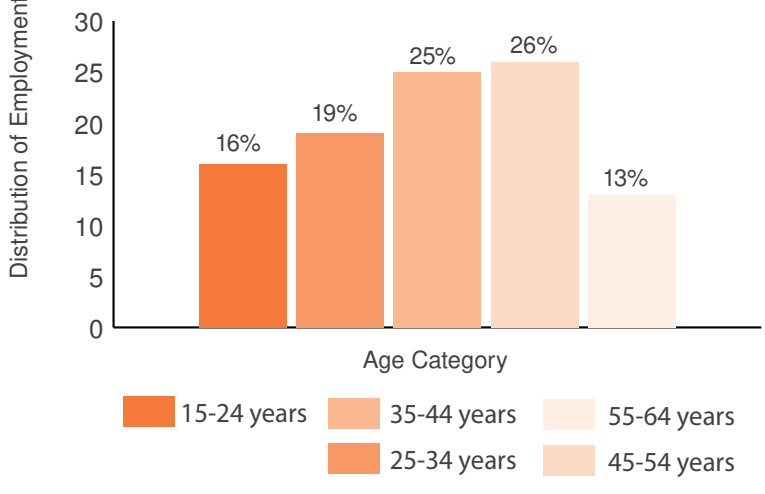
Figure-5 illustrates the distribution of the employment by broader age categories in warehousing and storage in Toronto CMA in the year 2018. It is evident from figure-5 that in 2018, the age profile is somewhat skewed as half of the employed workforce (51 per cent) in the industry in Toronto, CMA belonged to the prime working age categories 35-44 years (25 per cent) and 45-54 years (26 per cent). This means that in the next ten years, a large-scale exodus of workers could leave the industry causing employers to deal with stiff challenges in locating replacement employees. Given that the industry is heavily reliant on male workers, one way of addressing this talent deficits in the coming years could be to expand jobs to attract more female. Employers can also reconfigure work to potentially support valued older employees to stay in their jobs.

Figure 4: Distribution of Employment by Gender in Warehousing and Storage Toronto CMA, 2018



Source: Statistics Canada, Labour Force Survey

Figure 5: Distribution of Employment in Warehousing and Storage by Age Categories Toronto CMA, 2018



Source: Statistics Canada, Labour Force Survey

5.0 Warehousing Industry Labour Market

5.2 Careers in the Warehousing and Distribution Industry

Supply chain allows hundreds of career paths to follow and provide opportunities in both public and private sector. At present, more than 27,000 supply chain positions in Canada sit unfilled, and another 66,000 openings are anticipated each year for the next five years[8]. Careers in warehousing and distribution industry are varied and vast. However, the industry also suffers from poor perceptions of its career opportunities, which has led to a debate around skills gaps and a lack of gender diversity. Below is a list of some key career choices in the industry with a brief overview of the field. Click on the end notes to get details on alternative titles, job functions, position expectations and salary range.

Engineering Technician[9] – provides technical support and services in the development of production methods, facilities and systems, and the planning, estimating, measuring and scheduling of work.

Forklift Operator[10] – operates forklifts to move product or materials in warehouses or storage yards, including to and from transport trailers.

Freight Control Clerk[11] – receives and records the movement of parts, supplies, materials, equipment and stock to and from an establishment to ensure that priority appointments are expedited.

Loss Prevention and Safety Manager[12] – develops, communicates and implements loss-prevention programs, policies and procedures that reduce the company's exposure to loss of property and assets.

Material Handler[13] – loads, unloads and moves products and materials, and performs other activities such as counting, weighing, sorting, packing and unpacking.

Mechanical Engineer[14] – researches, designs and develops machinery and systems for transportation, processing and manufacturing. They also perform duties related to the evaluation, installation, operation and maintenance of mechanical systems.

Picker[15] – responsible for building pallets with cases of product, sorting and packing cans. Forklift experience is a plus. Safety-consciousness is critical.

Storekeeper and Parts Clerk[16] – store items in an orderly and accessible manner in a warehouse, tool room, supply room or other area.

Warehouse Inventory Auditor[17] – performs comprehensive procedural audits, provides reports on audits in written and verbal form, maintains audit tracking database, works with all departments to improve operations and quality-assurance.

Warehouse Manager[18] – responsible for directing a group of team leaders in the fulfillment of daily distribution centre (DC) operations. They develop, communicate and ensure the effective implementation of operational procedures in one of the following areas: receiving, order filling or shipping, and oversee all daily work activities to ensure customer quality, productivity, service, and delivery commitments are met.

Warehouse Worker[19] – performs material-handling, clean-up, packaging and other elemental activities in processing and manufacturing.

Given that e-commerce is booming unprecedently, consumer expectations continue to grow and are expected to drive continued investment in IT and operational functions in warehouses over the coming years. This will likely to create new positions and roles in this sub-sector.

6.0 Is the Warehousing Industry on the Brink of a Major Transformation?

6.1 Emerging Technologies in the Industry

The warehousing and distribution industry appear to be experiencing an unprecedented era of dynamism. With advancements in technology, the traditionally manually-operated, warehousing is now becoming automated, collaborative and cloud-based. Based on latest industry studies[20], below is a list of some of the trends and advanced technology that have started to significantly impact warehousing operations and workforce needs already and will do more so in the coming days.

Big Data: By analyzing big data, businesses can understand changes in customer needs and thereby make necessary improvements in the products and warehousing operations to meet customer expectations effectively. Given that data is the new oil, this aspect will lead to the creation of new and more job roles as engineers, computer science majors, data managers, and analysts.

Autonomous Vehicles and Equipment: Many warehousing facilities at present uses driverless vehicles like automatic guided vehicles (AGVs) that are generally controlled from outside the vehicle or are limited to a programmed path. For example,[21] robots equipped with high-resolution cameras and learning capabilities support workers in warehouses with tasks such as picking, packing, and sorting. Companies like DHL. Global Supply Chain uses the robot "Effi-BOT," which is a fully automated trolley that follows pickers through the warehouse and takes care of a significant part of the manual labour. Human intervention is partially required to navigate them around obstacles.

Drones: In larger warehouses, drones are becoming the new norm that large retailers can't do without. This includes parcel delivery, rural deliveries, surveillance, stocking shelves, and reading barcodes and RFID (radio frequency identification. According to supply chain specialists[22], at a given point in time, two drones can do the work of 100 humans. They can do unlimited warehouse tours, compare results, identify discrepancies, and report for a much more accurate and faster information than human. Although existing regulations in Canada limit drone use to within line of sight, as drone use increases, employees will need to be trained and licensed in drone operation. Existing limitations of this technology includes safety, payload capacity restrictions, and political acceptance.

6.0 Is the Warehousing Industry on the Brink of a Major Transformation?

Internet of Things (IoT): This is expected to be a critical emerging trend in warehousing facilities. Conveyors and other physical equipment will be attached to sensors and data-communication which in turn will be connected to the Internet. The objective is to manage the route (journey) of merchandise from the pick-up point to endpoint, including pickups, reception, quality control, reporting etc. within a warehouse and through a supply chain, up until it reaches the customers. Thus, IoT will support innumerable data collection and analysis. Gartner, Inc. forecasts[23] that there will be 7.55 billion connected devices by 2020 more than 200 percent increase compared to 2016. With sensors and devices providing information faster, it'll also allow for faster employee input and decision making. Humans will no longer need to enter, clean, and manage data and can instead focus on ways to be proactive with the data.

Cloud Technology: This technology allows updates to be made on an ongoing basis. In an increasingly complex distribution system, many warehouses are now using cloud technology. In fact, a latest study on warehousing management[24] found that 91.5% of businesses were considering a cloud-based WMS in their current selection project.

Block Chain: Blockchain as a technology is in the very early stages. It is a distributed ledger technology that exchanges record transactions between parties in a secure way. The data is stored on every computer, so that it is both decentralized and distributed. The collection of operational data mapped to financial rules and payment for services will fundamentally change processes related to proof of delivery, shipment management, accounting and finances. To support this technology, skills like leadership, negotiation, contract management and collaboration will be demanded by employers. A Canadian Supply Chain Sector Council (CSCSC)[25] survey highlighted that 71% of the respondents feel that blockchain will have a considerable impact on the industry labour force.

6.0 Is the Warehousing Industry on the Brink of a Major Transformation?

6.2 Technological Adaptation in Warehousing Industry: Latest Empirical Evidence

The Canadian Supply Chain Sector Council (CSCSC)[26] as a part of a latest study, conducted two surveys of Alberta and international supply chain professionals and experts. The surveys were designed to collect industry feedback on the impact of digital technologies on the supply chain workforce. The surveys highlighted that industry professionals believe that supply chain will be highly 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. 80% respondents in the survey reported that autonomous vehicles will have a moderate to very high impact on the labour force. For example, driverless car/robotic car, capable of sensing its environment and navigating without human input will have huge impacts on the supply chain sector, with a potential to automate forklifts used in the warehousing and distribution centres.

56.3% of respondents expect robotics and automation to have a very high or high impact on the supply chain labour force. According to the MIT Technology Review, a warehouse equipped with Kiva robots can process as many as four times the orders handled by a non-automated warehouse. These automated dollies crisscross the floor carrying shelves to humans, who pick, pack, and ship items without ever taking more than a couple of steps. Workers pick between 200 and 250 items hourly[27]. To speed up picking and avoid human error a red laser overhead flashes on the item that needs to be picked. Kiva's customers include[28] Amazon, Office Depot, Staples, Crate & Barrel, Toys "R" Us, and Saks Fifth Avenue.

In July of 2017, Sobeys Canada opened a highly automated warehouse in Balzac, Alberta similar to Sobey's Vaughan Ontario facility removing 75% of its warehouse manual, repetitive work. This warehouse takes one employee to complete task previously done by four. The new system can pick 500 cases per hour almost three times more than the average picking rates of human.

6.0 Is the Warehousing Industry on the Brink of a Major Transformation?

The impact of big data and predictive analytics on the supply chain workforce is a positive one. A key activity in this new digital age will be capturing, managing and transforming data into stories that can be used for predictive analytics. However, survey findings from the Canadian Supply Chain Sector Council[29] highlighted that almost half (48.5%) of supply chain professionals were not aware of these potential labour force changes and the increasing need for big data analysts. The growth of the supply chain sector along with rapid advancement in technology are creating a demand for new skills, and companies must work on to build those new skills sets. According to a Canadian Supply Chain Sector Council report[30], workforce should be prepared for the future with the following in mind:

There is going to be a decline in demand for repetitive tasks and digital literacy will be key. Together, they will have a critical impact on a wide range of workers in the industry. For example, at present, a key occupation in a warehousing facility is that of a material handler. This role involves a lot of manual and repetitive tasks and emerging technologies are expected to shift this role. Tasks like inventory counting can be done through IoT or a drone. Under this scenario, humans are speculated to use their analytical skills to understand the automatic process in order to fix things if there are any discrepancies and suggest improvements. According to a study by PwC[31], lack of digital culture and training is the biggest challenge facing supply chain.

While managers and analysts will use new methods of sharing data through blockchain, material handlers will increasingly work alongside robots and be aided by augmented reality or other IoT devices. To understand instructions and guidance, material handlers must have sound digital knowledge and the ability to adapt and change. They'll potentially engage on a daily basis working alongside robots, programing machines for specific tasks and oversee work. Instead of paper pick ticket or job sheet to pick an order, physically picking orders, material handlers are expected to receive instructions through an augmented reality set. Warehouse facilities already are using an augmented reality device called "pick-by-vision" that offers smart glasses for picking and sorting.

Like material handlers, storekeepers and parts clerks should also have digital literacy. While robots will be capable of organizing and storing items and tracking inventory, storekeepers and parts clerks should be able to use and monitor the systems to operate the machinery and identify discrepancies between the system and the inventory. Warehouse managers should also be able to use big data analytics for decision making. Creativity and critical thinking skills will be crucial to understanding how to work best with staff and technology.

6.0 Is the Warehousing Industry on the Brink of a Major Transformation?

6.3 When robots and humans are partners at work

According to a 2019 Forbes[32] article on supply chain trends, the demands of the e-commerce boom are making warehouse labor extremely tight. While warehouses are increasingly adopting automation to meet the requirements of direct-to-consumer fulfillment for example, shuttle system purchases and autonomous mobile robotics in the warehouse, automation is expected to only mitigate, not solve, the labor supply-demand imbalance.

Companies that uses collaborative warehouse robots (cobots) shows that automation solutions actually add stability to warehouse staffing needs. A cobot[33], or “collaborative robot” is specially designed to ease human-machine interface and enhance security. This kind of machine could be really helpful for routine tasks like loading pallets and packing. They can actually compliment humans and not replace them. These robots can calculate the fastest route from point A to B thereby letting staff solve for complex warehousing problems that require intuitive thought and human intelligence. It not just saves the business time and money but also improves the quality of employee’s work life.

Among many other distribution centres, by being in the forefront of automation, Amazon has more than 100,000 robots in action around the world, and plans to add more to its operation. These robots make the warehousing task less physically taxing while allowing the employees to engage in more intuitive jobs. According to a New York Times[34] interview, a top executive in charge of operations at Amazon, said that the company wanted the machines to perform the most monotonous tasks. According to Amazon, no people were laid off when robots were installed. Instead employees who were stacking and lifting plastic bins took courses at the company to become robot operators, troubleshooting them when necessary and making sure they have bins to load. Many others were transferred to receiving stations, where they manually sort big boxes of merchandise into bins.

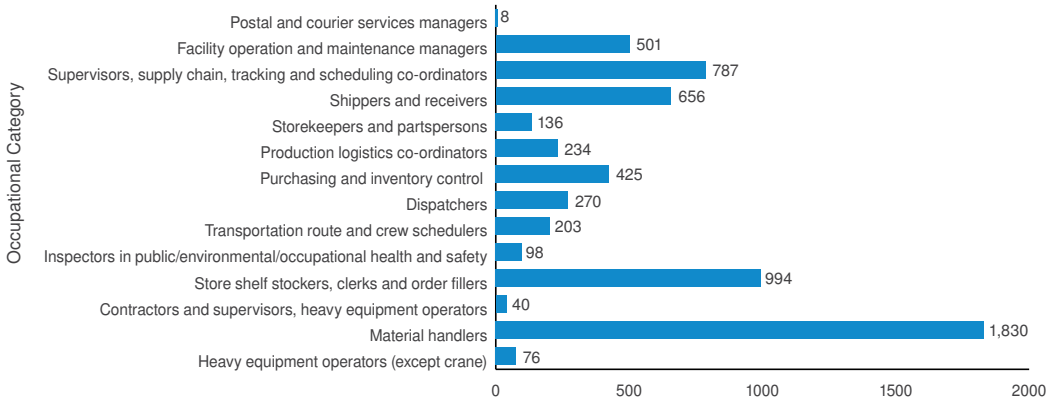
7.0 Hiring Demand in the Warehousing Industry

This report has used a web-based platform called Vicinity Jobs[35] to get some insights on the hiring demand of the warehousing industry in Toronto. It must be noted that this is not an exact reflection of the actual number of vacancies available in the industry as all employers may not advertise for a vacant position in these job portals. So, this data needs to be interpreted with caution as it only offers some ideas around the trends in hiring demand of the local industry.

Figure-6, represents the number of job postings by key occupational categories in the warehousing and storage industry in Toronto for a 12 months period from October 2018 to September 2019. There was a total of 6,258 jobs that were posted by this industry during this 12 months' time.

The hiring demand in the warehousing industry, in Toronto, during this period was the highest for material handlers that accounted for 29 per cent of the total job postings in the industry. However, it doesn't necessarily mean that there is a huge growth in the number of material handling positions. It could actually be a signal towards the increasing prevalence of job churn in this occupational category. To hire for roles where the hourly wage rate hovers around the minimum wage, employers often face a tough time retaining existing employees as a slight pay raise by a different employer may cause the worker to switch jobs, thereby leading to these increasing vacancies.

Figure 6: Job Postings by Key Occupational Categories in Warehousing Toronto, October 2018- September 2019



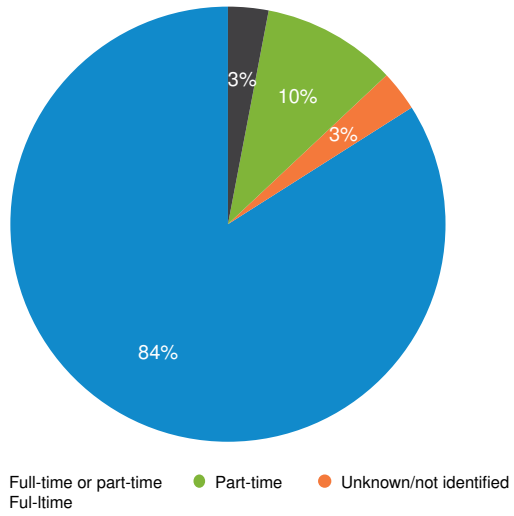
Source: Vicinity Jobs

7.0 Hiring Demand in the Warehousing Industry

Figure-7 illustrates the number of job postings for key occupations in the industry in Toronto by the job type/ job status. For the given period analyzed, majority of the job postings were for full-time positions (84 per cent) versus part-time (10 per cent).

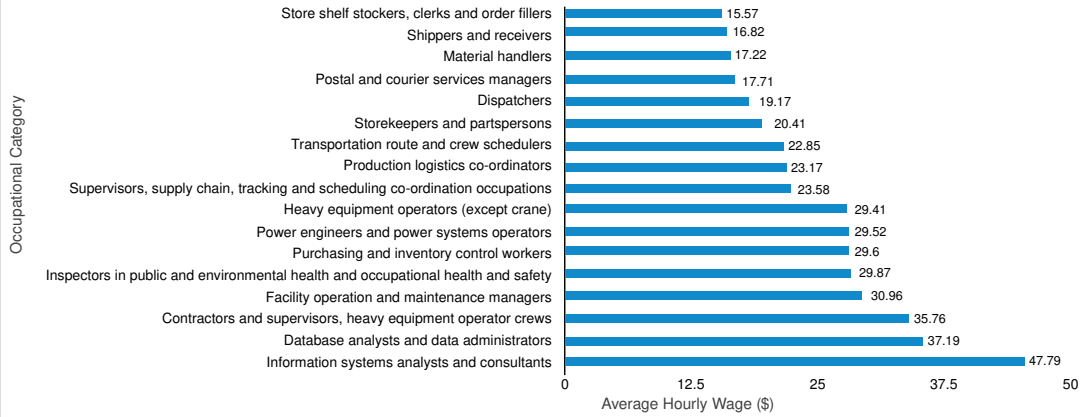
Figure-8 displays the average hourly wage rate offered for the job openings in the industry in Toronto between October 2018 and September 2019. In this analysis three more occupational categories were added: information system analysts and consultants, database analysts and data administrators and Inspectors in public health and environmental health and safety. Analysis in figure-6 and figure-7 didn't include these occupations because they don't exclusively belong to the warehousing and distribution industry. However, given that average wage rate for an occupation may not be vastly different across industries, it was worth including these occupational categories for average wage analysis of the warehousing and distribution.

Figure 7: Job Postings by Job Type in Key Occupations in Warehousing Toronto, October 2018-September 2019



Source: Vicinity Jobs

Figure 8: Average Hourly Wage by Job Postings in Key Occupations in Warehousing, Toronto, October 2018 and September 2019



Source: Vicinity Jobs

7.0 Hiring Demand in the Warehousing Industry

In today's day and age where data is the new oil, warehousing facilities and distribution centers in Toronto also offer database and system analysts positions that has the highest hourly wages compared to other occupations in the industry.

The top three highest paying occupational categories in the industry in Toronto (apart from the information/data analyst positions) based on job postings between October 2018 and September 2019 were:

1. Contractors and supervisors, heavy equipment operator crews ($ 35.76)
2. Facility operators and maintenance managers ($35.76)
3. Purchasing and Inventory Control workers ($29.6)

Table-1 below reports the top-10 employability skills by four broader categories based on the published job postings in the warehousing businesses in Toronto between October 2018 and September 2019.

Table 1: In-Demand Employability Skills in the Warehousing Industry

Employability Soft skills	Employability Specialized skills	Employability Technology skills	Employability Tools and Equipment skills
1. Communication skills	1. Analytical Skills	1. Microsoft Office	1. Forklifts
2. Teamwork	2. Budgeting	2. SAP	2. Lift trucks, hand trucks, reach trucks
3. Ability to Operate in a Fast-paced Setting	3. Continuous Improvement	3. Inventory Control Software	3. Pallet Jacks
4. English language	4. Project Management	4. Enterprise resource planning ERP system and software	4. Power Tools
5. Attention to Detail	5. Inventory Management	5. Inventory control systems	5. Computer terminals
6. Organizational Skills	6. Accounting	6. HVAC	6. Hoists
7. Flexibility	7. Key Performance Indicators	7. Warehouse Management System	7. Material Safety Data Sheets (MSDS)
8. Interpersonal Skills	8. Quality Assurance	8. Computerized maintenance management system CMMS	8. Conveyors
9. Self-motivated	9. Supply Chain Management	9. Oracle	9. Generators
10. Time-Management	10. Vendor management	10. Yardi	10. Wrapping Machines

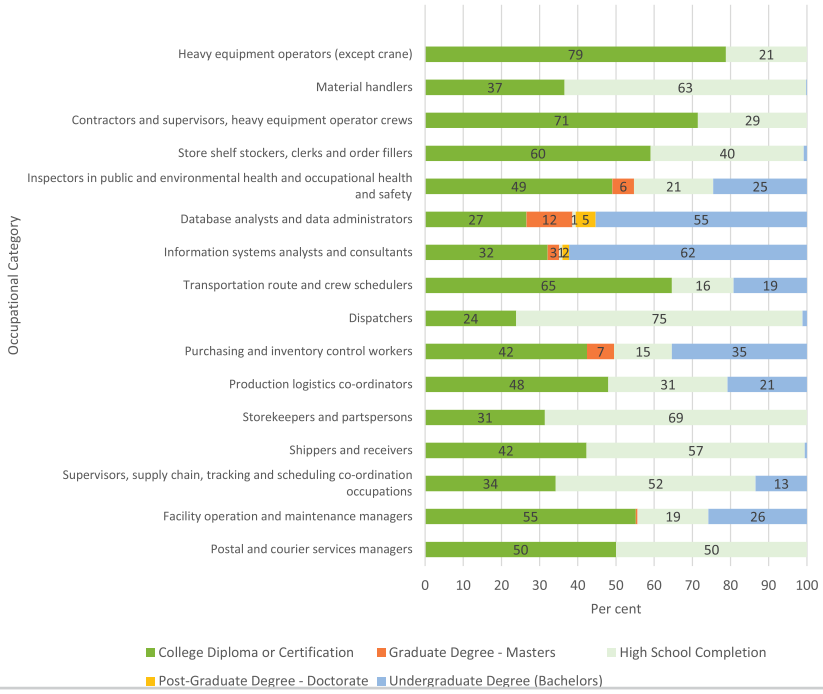
Source: Vicinity Jobs

7.0 Hiring Demand in the Warehousing Industry

Figure-9 highlights the educational requirements and certifications needed for the jobs posted for various occupational categories in the industry in Toronto for the period of October 2018 and September 2019. Analysis suggested that the share of job vacancies that required a college diploma or certification is the most cited educational requirement for key job occupations in the industry.

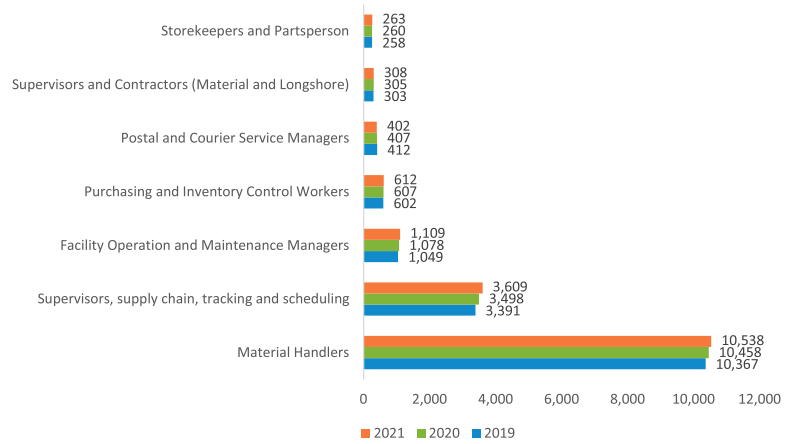
Out of the 16 occupations reported in Figure-9, vacancies in nine of the occupational categories had mostly asked for a college diploma as a standard educational requirement. For example, 79% of the job postings for heavy equipment operators cited college diploma or certification as an educational requirement. 71 per cent of job postings for contractors and supervisors, heavy equipment operator crews were also looking at applicants with the same educational credentials. On the other hand, job postings for occupations like material handlers, dispatchers, store keepers or parts person cited high school completion as the educational criteria. Vacancies for the positions of database analysts/administrators and information/ system analysts, purchasing and inventory control workers mostly asked applicants to have an undergraduate degree (bachelors) with some job postings in these categories seeking a graduate degree/masters or post graduate degree/ doctorate in some cases.

Figure 9: Job Postings by Educational Requirements for Key Occupational Categories in Warehousing, Toronto October 2018-September 2019



Source: Vicinity Jobs

Figure 10: Employment Forecast by Key Warehousing Occupations in Toronto



Source: Supply Chain Canada, LMI Portal

Figure-10 provides a hiring forecast by Supply Chain Canada, LMI Portal for the next two years in selected warehousing occupations in the Toronto region. Hiring in almost all broad occupational categories in the industry will stagnate over the next two years. The occupation that is forecasted to experience the highest increase in employment is supervisors, supply chain, tracking and scheduling (6 per cent).

8.0 Stakeholder Engagement

Stakeholder engagement efforts began by identifying warehousing and distribution industry stakeholders throughout the Greater Toronto Area. Stakeholder interview participants were identified by TWIG staff and were representative of key players in the industry. This included eight key informants including primary or economic stakeholders like employers in the industry and secondary or external stakeholders like the subject matter experts/academicians and recruiting consultants closely associated with the industry and who have extensive knowledge in supply chain management.

Semi-structured interviews were conducted with the intent to collect in-depth information that reflects the varied contexts and perspectives of different primary and secondary stakeholders in the warehousing and distribution center. The interviews were used to collect feedback on the needs and concerns of businesses in warehousing and distribution on the face of automation and solicit ideas on how the industry needs will look like in the next couple of years.

Interview responses were documented using a voice recorder and hand-written notes and then input for analysis and word processing. Analysis involved summarizing key information and reviewing all interview summaries to identify themes and observations. Upon request from the participants, TWIG also developed and distributed an online version of the interview questions. This was for stakeholders who were not able to schedule a telephone interview and instead wanted to fill out an online questionnaire at their convenience. Online responses were then collated and combined with the responses received from telephone interviews to generate a summary of the key discussion themes.

8.0 Stakeholder Engagement

8.1 Key Issues Addressed

Each stakeholder category (employers, recruiting agencies and subject matter experts) received a unique set of questionnaires. The questionnaire included a standard set of interview questions customized based on the key informants' knowledge of the critical industry needs and challenges. Questions were grouped into the following two broad categories:

- Recent and anticipated changes in the warehousing and distribution industry
- Emerging workforce and skills gaps, challenges and opportunities as a result of automation in the industry and possible solutions

8.0 Stakeholder Engagement

8.2 Major Themes Identified

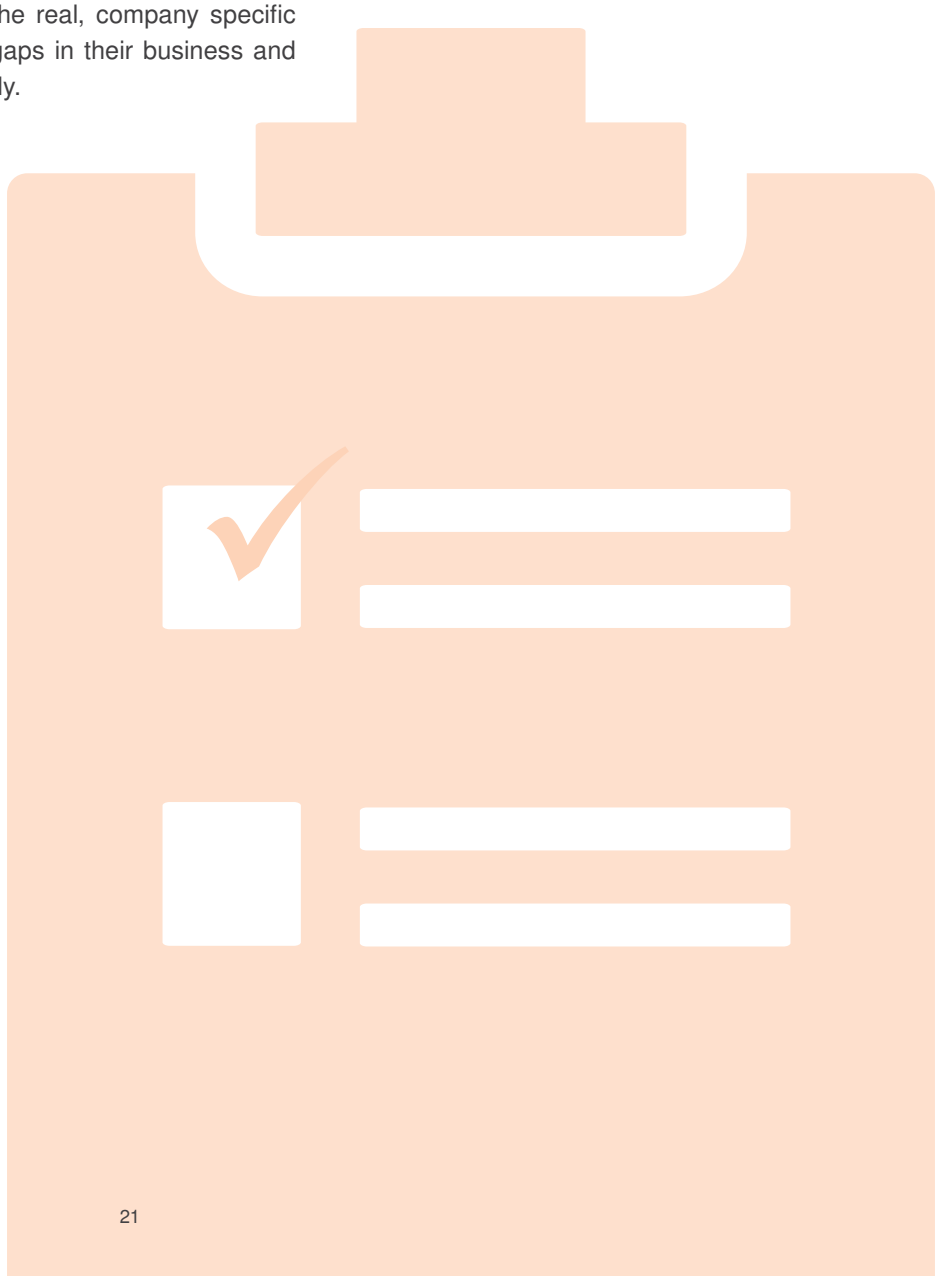
Major themes that emerged from conversations with key stakeholders included:

- Automation will play a critical role in shaping the labour need of the warehousing and distribution industry. If not in the immediate short or medium run, most certainly in the long-run.
- Recruiting agencies remarked that in many circumstances, employers were not actively voicing actual skills gap that may arise due to the rapid technological advancement. Rather employers were simply looking to fill ongoing vacancies to meet current consumer demand only.
- Experts and recruiting agencies speculated that as more and more facilities embrace technological advancement, there will be an increasing need for managerial level positions with holistic skills and interdisciplinary understanding needed to integrate the hardware and software of these facilities.
- Experts suggested that investing in upskilling/retraining of the existing workers should be an urgent business priority.
- Most often businesses were unaware of the government training fund or knowledge-based resources available to support innovation and workforce development.
- A critical way to help the industry workforce transition into new roles would be incentivizing managers for nurturing their subordinates and also creating a clear-cut career pathway for these roles.
- Experts suggested that warehousing and distribution centres must have the capacity to hire trained professionals who can manage the electronic data interchange (EDI) ensuring security enhancement by avoiding all kinds of fraud and misuse of information.

8.0 Stakeholder Engagement

8.3 Limitation

In order to generate demand-focused strategies, employer engagement is key. Employers feedback on what jobs are currently available, what skills will be needed in the industry in the next five years, whether or not there are potential skills gaps and how those skills can be resolved, developed and utilized is highly relevant to the labour market outcome of the employees. However, one of the significant challenges encountered in carrying out this research was that although it seemed that employers in the industry saw value in sharing their thoughts and experiences, participating in interviews was a low priority. A number of employers responded positively to initial requests for interviews, but were unable to fit interviews into their schedules. The employers who did participate were hesitant to share about the real, company specific challenges they were facing or potential skill gaps in their business and had a tendency to share general information only.



8.0 Stakeholder Engagement

8.4 Thematic Analysis of Qualitative Data

A thematic analysis was used as a foundational method of analyzing and interpreting the responses received by interviewing employers, recruiting agencies and subject matter experts.

Current In-demand Occupation and Basic Skill Requirement

Responses received from the recruiting agencies and employers in the industry suggested that the workforce in the industry was predominantly male and at present, the most in-demand roles in the warehousing and distribution industry were:

- Material Handler
- Powered Industrial Truck (PIT) Operator responsible for receiving, shipping and stocking products
- Warehouse Managers/Supervisors
- Inventory Control
- Data Analytics

Employers and recruiting agencies frequently cited the importance of the following as the common requirements and basic skills job seekers should be aware of when applying for in-demand positions in the industry:

- Licensing/Certification
- Ability to read and write english instructions
- Accustomed with radio frequency (RF) devices
- Physical ability to lift heavy items and an ability to stand/walk 10 hours a day.

Recruitment and Retention Challenges

There was consensus among employers and the recruiting agencies that recruitment and retention in the industry were challenging. The most challenging part of matching a job seeker to a vacancy in the industry was finding a talent with the right skills that understood people, processes and technology in the supply chain field and a qualified candidate who would stay in the job. Recruitment consultants highlighted that most job seekers didn't consider this industry as a fancy career choice and often were unaware of the upward mobility or opportunity for advancement in supply chain management career.

Some of the hardest to fill occupations mentioned by employers were material handlers and equipment operators as well as general labourer roles. Most employers found it difficult to hire qualified equipment operators. According to both the recruiting agencies and the employers, because of relatively low wages and a physically demanding working condition, businesses in the warehousing industry often faced continuous attrition of the workforce. Money was often the deal-breaker. Employees were ready to quit and switch elsewhere to a new facility for a slight pay increase.

8.0 Stakeholder Engagement

Emerging Skills Gaps on the Face of Transformation

Recruitment consultants highlighted leadership skills and technology skills as the potential skill gaps facing the industry. They remarked that in many circumstances, employers were not actively reaching out and voicing actual skills gap that may arise due to the rapid technological advancement changing the warehousing dynamics, rather they were simply looking to fill ongoing vacancies to meet current consumer demand only.

The tendency of employers to focus on current productivity only, also showed up in employers' responses. When asked about how they viewed potential skills gap related to automation in their facility, employers' feedback was very general and not far-sighted. While some said they didn't view any potential skill gap at the moment, others considered ability to work in a fast-paced environment and comfort level with computer as the potential skill gap.

Feedback received by interviewing the experts in supply chain management were more comprehensive. According to subject matter experts, automation is playing a critical role in shaping the labour need of the industry. Experts commented that against the backdrop of rising automation and artificial intelligence in the warehousing and distribution centers, there was likely to be skills shortage of specialized roles in warehousing and distribution. Perhaps not in the immediate short or medium run but most certainly in the long-run.

Subject matter experts in supply chain management referenced big players in the industry like Amazon and how it was driving to automate as many parts of its business as possible, whether pricing goods or transporting items in its warehouses. To compete and survive in the market, more and more logistic facilities are expected to follow Amazon and move towards automated specialized system. However, one concern raised by the experts during the interview were given the varying capacity of each facility, were facilities of every size being able to make better real time decisions because of automation? While innovation in a facility is supposed to increase the efficiency and reduce the cost, experts advised small and medium sized businesses to explore new technology with caution as the benefits of digital transformation will be different depending on the size and technology readiness of the company.

This view was supported by the recruiting agencies too. They too commented that larger the facilities, the more sophisticated the technology can be which will demand more complex and specialized skills of the people working in the environment. On the contrary, medium and small firms may lag behind the larger firms in terms of digitization.

8.0 Stakeholder Engagement

Experts also speculated that with the rise of robotics and automation, specialized labour will be expected to understand every operation more fully to coordinate activities between humans, robots and artificial intelligence, control the core panel of the robotics and manage the overall process better. Experts predicted that under such circumstances, there could be potential skills gap for the requisite skills needed to fill in managerial level positions in the industry. These managerial positions will require holistic skills and interdisciplinary understanding needed to integrate the hardware (radio-frequency scanners, conveyors/sortation systems, automated guided vehicles etc) and software (warehouse management systems) of these facilities.

Facilities can manage to have artificial intelligence and data analytics but businesses also need the right employees who have the knowledge and expertise to make use of that. Some rigid parameters that are best dealt with humans and seasonality issues may mean that no matter how much warehousing companies spend in technology and AI, they'll still be needing manual support.

Experts also expressed concerns around the limited security involved in the electronic data interchange (EDI) within the industry. In order to work with specific trading partners, vendors and/or suppliers, most businesses in the industry may be mandated to perform EDI. Such transactions were likely to increase more and more in the future. Therefore, experts suggested that warehousing and distribution centres must have the capacity to hire trained professionals who can manage the EDI ensuring security enhancement by avoiding all kinds of fraud and misuse of information.

Experts also highlighted the use of electronic monitoring of workers using newly available devices like "wearable" warehouse technologies and aired concerns on its impact on the health of the industry workforce. This technology allowed the tracking of workers' movements, bottlenecks, and break time but had the potential to lead to increased stress and anxiety among workers.

8.0 Stakeholder Engagement

Resolving Skill Gaps

Several existing studies on warehousing and distribution or supply chain management in general suggest that many employers identify that there are talents shortage/skills gap in the industry. TWIG asked stakeholders about the partners, either in the private, public or nongovernmental organization (NGO) sectors, that businesses feel could resolve skills gaps—and what roles could they respectively play in addressing these issues.

Not all employers responded to this question and those who did seemed to be focusing only on filling in current vacancies only. Employers appeared to seek support in hiring full-time material handler. Recruiters said that the academic training in supply chain management offered by the colleges, universities and continuous learning programs need to keep up with the changing dynamics of the industry. Skill gaps could be removed and taken care off in advance if employers and educational/ training institutions work closely. They suggested that it is important for both parties to understand the timing of when a new technology will flood the market and how that will change the skills needed in the supply chain sector.

According to expert's opinion, at a time of rapid digital transformation that requires multifaceted skill sets, many new job roles are emerging. To help employees' transition to new positions in the industry, businesses must offer continuous education and train staff internally when new systems are being implemented. Continuous training to embrace changes and pushing to be quick learners should be key to workforce development.

Experts also suggested that investing in upskilling/retraining of the existing workers should be an urgent business priority. While immediate considerations to investing in internal staff could be costly, the benefits can be definitely realized by businesses in the future. Demand-focused strategies that engage employers in partnership with educators, employment service providers and other labour market stakeholders can resolve skill gaps better. What looks like a disruption by technology today could actually be the beginning of the emergence of new roles in the industry.

Recruitment consultants suggested that with increasing technological advancement, the industry partners, shareholders/investors can contribute to the greater profitability of the industry by deferring immediate profit/dividend and instead invest it in the industry workforce so that they could have a smooth transition to new roles.

Experts spoke about how several innovation spaces/groups like MITACS supporting industrial and social innovation in Canada, funding groups working with these spaces can actually be the exact ingredient needed by the industry to resolve skill gaps. But most often businesses were unaware of these knowledge-based resources and failed to utilize them.

9.0 Key Insights and Guidance

Warehousing is often cited as an industry on the brink of transformation although it is difficult to predict how and when this will occur. The prevalence of routine manual tasks in a warehousing facility makes variety of roles in the industry a candidate of automation. This has become a pressing policy issue. After careful review of the existing literature and stakeholder feedback collected from the interviews, some key insights have been listed below:

1. Employers in warehousing and distribution centers need to address some crucial questions.

Warehousing and distribution center operators need to understand the possible complexities of new innovations and identify the specialized skills that will be needed to support such innovation. Innovating ideas on how humans can better work alongside machines should also be a priority. Employers need to recognize the skill base of its existing staff members and check if there is a match or a mis-match between an in-house skill and an emerging role. Addressing these issues are pivotal for employers and policy makers to begin planning today for programs that will prepare workers to develop skills for nonroutine tasks or newly created roles in the warehousing industry.

Given the negative image that hangs on in public perception, it is challenging to attract new talents in the industry. Recruiters should be able to come up with the right incentive tool to encourage more young people to consider a career in the industry. During telephone interviews, employers mentioned poor employee retention as an ongoing issue. This was mainly due to the physically demanding work environment coupled with low wages. Such systemic obstacles could be strategically addressed through optimal employer participation and backing of industry associations.

9.0 Key Insights and Guidance

2. Increase employers' awareness of industry-related education and training and employment services.

Employers mentioned that it would be helpful to have some support in screening potential applicants. The comments suggested that employers had limited knowledge on the existing government service providers in their community. Distributing information about available services might offer another avenue for employers to support recruitment efforts.

Most businesses were unaware of the available government training funds or knowledge-based resources that had the ability to foster innovation, raise productivity and profit, and as a result create new jobs and wealth in Canada. For example, government funding planners like Mentor Works offers funding consultancy, funding directories and webinars on government funding on workforce hiring and training grants. Then there are organizations like Mitacs that connects industry and post-secondary institutions to solve business/innovation challenges. It is critical to ensure connections between businesses and these available services.

3. Investment in training yields significant return

In 2019, Amazon[36] announced to offer one of the world's largest retraining effort of value $700 million to retrain about a third of its American workers to do more high-tech tasks. The program promised to cover company employees starting from corporate employees to warehouse workers, retraining about 100,000 by 2025. The objective was to help existing workers move up one or two rungs up the skills ladder.

Employees value employers that offer continuous learning and development opportunities. Employers are also likely to accrue benefit from training investments. A study completed for the American Society for Training and Development[37] showed that a training investment of $680 per person yields a six percent return on investment in total shareholder return the following year.

While automation is associated with increased productivity, some promising technologies have not yet reached the point where they can be reliably deployed in a live warehouse setting. For this reason, in many activities human intuition is an important element needed to complete a task. As rising automation increases the reliance on data, businesses can train staff to manipulate complicated data to generate higher revenues.

However, in order for workers to move from less-skilled to more-skilled labor, training infrastructure is required, either through government funded workforce development systems or within a business/company. While large companies like Amazon has the capacity to propose and implement such retraining programs, small-medium sized warehouse operators may need external support to avail a sufficient training infrastructure.

9.0 Key Insights and Guidance

4. Make smart technology investment

Warehousing facilities and distribution centre, should not feel obligated to automate based on peer pressure and the excitement of the latest technology available. Businesses must remind themselves that the technical feasibility to automate depends largely on the size of the facility, the fixed architectures of warehouse facilities and their distribution systems. Not all facilities are compatible with some new technologies. It is also critical to evaluate the cost of developing and deploying both the hardware and the software for automation. The dynamics of the labour is also a key element. The pace of adopting a new technology may be slower if for a given activity, workers with the right skills are in abundant supply and significantly less expensive than automation.

Investing in a lot of robots makes more sense in a large million-square-foot Amazon facility than a small or mid-size operation. So, every business needs to remind themselves to cautiously explore new innovations. Given that every warehousing and distribution centers are in different stages of their technology-development strategy, the impact on the workforce will vary across different warehousing companies in the industry. While some workers may be more likely to be exposed to job change or job loss, for workers belonging to small-medium sized facilities, the change might not be immediate.

5. Effect of new technology on workers' health and safety and privacy

Amazon has recently received a patent that will allow it to track and monitor employee efficiency and inventory through wearable technology. Employers including Walmart, Toyota, and Heineken are also making warehouse workers wear biometric harnesses that track their every movement while on the job[38]. The biometric harness device has a feature that warns workers if their movements (lifting an object, bending too deep etc) were unsafe so that employers can track these data and use it to train workers who repeat unsafe movement. But employers weren't just using the technology for safety purposes — they were also using it to monitor worker productivity. Based on this, there are concerns that such technologies can exert a constant pressure on workers to work faster and harder and create mass anxiety. They can also affect workers privacy. There are also questions about whether these data are collected to improve workers safety and efficiency or are they being used to feed the AI behind new autonomous warehouse machines. This raises some serious concerns around data privacy. Employers must cautiously use these new electronic monitoring technologies and keep in mind that employees don't like to be micro-managed rather they like to be empowered.

Appendix A: Research Contributors

Michael A. Haughton, PhD, Professor of Operations & Decision Sciences and CN Fellow in Supply Chain Management, Wilfrid Laurier University.

Cornelius Wong, CCLP, Recruiter/Head-Hunter in Operations, Supply Chain and Logistics.

Stephen Tallevi, Supply Chain Management Expert, Nexus Commerce.

Karen Wong, Entrepreneur | Co-Founder & CEO | Retail Tech Enthusiast, ACE POS Solutions Ltd.

Pamela Ruebusch, CEO at TSI Group Inc.

End Notes

1 Zebra Technologies. (2019). Warehousing Vision study. Available at: https://www.zebra.com/content/dam/zebra_new_ia/en-us/solutions-verticals/vertical-solutions/warehouse-management/vision-study/2024/warehouse-vision-study-en-us.pdf

2 Statistics Canada, North American Industry Classification System (NAICS) Canada 2017 Version 1.0

3 Davarzani, H., & Norrman, A. Toward a relevant agenda for warehousing research: literature review and practitioners' input. Logist. Res. 8, 1 (2015) doi:10.1007/s12159-014-0120-1. Available at: https://link.springer.com/article/10.1007/s12159-014-0120-1

4 Service Canada, Ontario. (2017). Sector profile for Transportation and Warehousing 2017-19. Available at: http://www.edsc-esdc.gc.ca/img/edsc-esdc/jobbank/SectoralProfiles/ON/2018/20172019SectoralProfileTransportation_E.pdf

5 Toronto City Planning. (2020). Toronto Employment Survey 2019. Available at: https://www.toronto.ca/wp-content/uploads/2020/01/9453-Toronto-Employment-Survey-2019-Bulletin.pdf

6 Service Canada, Ontario. (2017). Sector profile for Transportation and Warehousing 2016-18. Available at: http://www.edsc-esdc.gc.ca/img/edsc-esdc/jobbank/SectoralProfiles/ON/2017/20162018SectoralProfile_ON_Transportation_EN.pdf

7 Service Canada, Ontario. (2017). Sector profile for Transportation and Warehousing 2016-18. Available at: http://www.edsc-esdc.gc.ca/img/edsc-esdc/jobbank/SectoralProfiles/ON/2017/20162018SectoralProfile_ON_Transportation_EN.pdf

8 Careers in the Supply Chain. Retrieved from: http://www.careersinsupplychain.ca/

9 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Engineering_Technician.pdf

10 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Forklift_Operator.pdf

11 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Freight_Control_Clerk.pdf

12 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Loss_Prevention_and_Safety_Manager.pdf

13 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Material_Handler.pdf

14 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Mechanical_Engineer.pdf

15 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Picker.pdf

16 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Storekeeper.pdf

17 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Warehouse_Inventory_Auditor.pdf

18 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Warehouse_Manager.pdf

19 Careers in the Supply Chain. Retrieved from: http://careersinsupplychain.ca/wp-content/pdf/Profile-WD-Warehouse_Worker.pdf

20 Hill, K. (2017, May 15). Trends Impacting Modern Warehouse Operations. Industrial Distribution. Retrieved from: https://www.inddist.com/business-technology/blog/13774044/5-trends-impacting-modern-warehouse-operations

21 Canadian Supply Chain Sector Council. (2018). The Digital Supply Chain-Creating skills for the future. Retrieved from: http://legacy.cscrf.ca/www.supplychaincanada.org/assets/u/The-Digital-Supply-Chain-Final-Report.pdf

22 Payne, T. 4th June 2018. The evolving warehouse and future trends. ExploreWMS. Retrieved from: https://www.explorewms.com/warehouse-future-trends.html

End Notes

23 Gartner, Inc. (2017). Retrieved from: https://www.gartner.com/en/newsroom/press-releases/2017-02-07-gartner-says-8-billion-connected-things-will-be-in-use-in-2017-up-31-percent-from-2016

24 Software Path. (2019). Retrieved from: https://softwarepath.com/guides/wms-report

25 Canadian Supply Chain Sector Council. (2018). The Digital Supply Chain-Creating skills for the future. Retrieved from: http://legacy.cscrf.ca/www.supplychaincanada.org/assets/u/The-Digital-Supply-Chain-Final-Report.pdf

26 ibid

27 Kopytoff, V. (2012, Juy 12). In Warehouses, Kiva's Robots Do the Heavy Lifting. MIT Technology Review. Retrieved from: https://www.technologyreview.com/s/428436/in-warehouses-kivas-robots-do-the-heavy-lifting/

28 ibid

29 Canadian Supply Chain Sector Council. (2018). The Digital Supply Chain-Creating skills for the future. Retrieved from: http://legacy.cscrf.ca/www.supplychaincanada.org/assets/u/The-Digital-Supply-Chain-Final-Report.pdf

30 ibid

31 Tipping, A., & Kauschke, P. (2016). Shifting Patterns-the future of logistics industry. Retrieved from PwC https://www.pwc.com/sg/en/publications/assets/future-of-the-logistics-industry.pdf

32 Banker, S. (2019, Jan 5). Supply Chain Trends to Watch In 2019. Forbes. Retrieved from: https://www.forbes.com/sites/stevebanker/2019/01/05/supply-chain-trends-to-watch-in-2019/#7b6d08ba323d

33 Geiger, R. (2018, March 1). Humans and Robots Collaborate in Today's Warehouses. Digitalist Magazine. Retrieved from: https://www.digitalistmag.com/digital-supply-networks/2018/03/01/humans-robots-collaborate-in-todays-warehouses-05922042

34 Wingfield, N. (2017, September 10). As Amazon Pushes Forward with Robots, Workers Find New Roles. The New York Times. Retrieved from: https://www.nytimes.com/2017/09/10/technology/amazon-robots-workers.html

35 Vicinity Jobs collects in-depth information from major job portals to offer demand and supply analytics of the labour market

36 Casselman, B., & Satariano, A. (2019, July 11). Amazon's Latest Experiment: Retraining Its Work Force. The New York Times. Retrieved from: https://www.nytimes.com/2019/07/11/technology/amazon-workers-retraining-automation.html?auth=login-google

37 Witt, C. (2004, October 24). Stop Training Your Warehouse Employees. Material Handling and Logistics News. Retrieved from: https://www.mhlnews.com/labor-management/article/22043879/stop-training-your-warehouse-employees

38 Holmes, A. (2019, November 6). Warehouses are making workers wear biometric harnesses that track their movements on the job. Business Insider. Retrieved from: https://www.businessinsider.com/warehouses-make-workers-wear-biometric-harnesses-that-track-movements-2019-11