The Painful Necessity of Automation:

A Mixed-Methods Case Study of the Halton Region's Auto – Manufacturing Industry

Introduction

With its geographical advantage, neighboring the second largest automotive market, the United States, the Halton region in Southern Ontario, beside beautiful Lake Ontario as seen below, leads the Canadian auto-manufacturing industry.

Figure 1: Geographical Location of Halton Compared to North America

The landscape of Halton's auto-manufacturing industry has changed significantly in the past decade. These changes can be attributed to the increase in international trade, which has ultimately reduced the demand for Halton manufactured products. Ontario's extremely high product costs has caused parts made in Halton to cost considerably more than if the same part was to be made in Mexico where the minimum wage is approximately eight dollars less than Ontario's minimum wage (Guthrie, 2018, p. 3). This situation makes Halton-made products extremely unappealing to consumers and is further complicated by the emergence of automation in this sector, as nearly 35, 000 skill trade jobs involved in the Halton automotive industry are now at risk (*Government of Canada*, "Canadian Automotive Industry" 2018). To understand the full impact of advancing technology within this industry, a mixed-methods case study will be done on one of the most crucial the lines of automation in Halton known as the "ASF" line as seen in *Figure 2*.

Figure 2: The ASF line

This includes All Tool Manufacturing, Volestalpine Rotec Summo Corp (Summo), and the Ford plant. Information will be taken via short survey and interviews as well as statistical information from governmental sources. The trends found will likely lead to discovering what retraining processes are in place and the changes within these companies to allow them to compete internationally. A hypothesis can be made that these results will lead to a general trend of increasing unemployment and a heavier emphasis on automated processes within companies in the Halton region. This change will negatively impact skill trade workers in this sector and ultimately the economy. In this paper I will first be analyzing the current state of the automotive industry in North America, specifically America, and drawing a parallel to the state of the Halton industry. Then I will be discussing my methodology, which will explain how my data will be collected. The data will then be analyzed for trends and patterns. Finally, my conclusion will summarize my findings and illustrate the correlation between the data collected and my hypothesis.

Literature Review

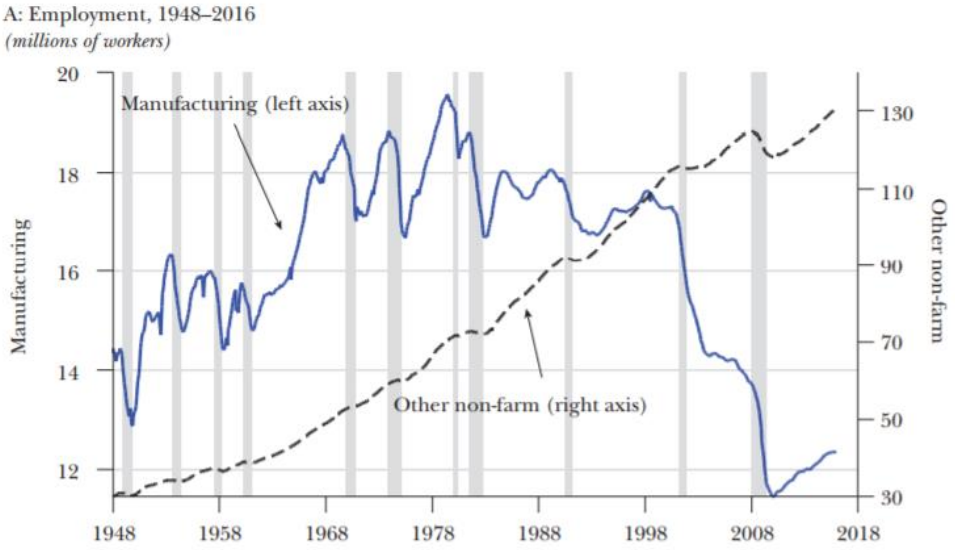
In the 1960s, during a time of rampant technological change similar to today, manufacturing companies strove to rid themselves of manually controlled operations (Hayes 2009, p. 12). However, unlike today as multipurposed machinery is more prevalent, “any change

in the process or product would cause a huge extensive overhaul of machinery" (p. 12). Although the past situation is different than the one today, the history of technological innovation in the automotive industry can further our understanding of current concerns (Akst, 2013, p. 4). In the United States, producers struggle to meet current demands for their products as worldwide competition grows (Fort et. al. 2018, p. 54; Guthrie, 2018, p. 2). Technological developments within manufacturing companies allows producers to maintain their position in the world economy and increased efficiency by optimizing processes and production, resembling past advancements with the key difference only being in the versatility of the machinery (Erffmeyer & Johnson, 2001, p. 172; Naitove, 2017, p. 46; Baily & Bosworth, 2014, p. 20). The consequences of these developments are seen in the American labor force, the manufacturing markets trajectory, and consequently, the Canadian economy due to the integration and interdependency of the two nation's manufacturing industries (*Government of Canada*, "Canadian Automotive Industry" 2018).

Automations Impact on Jobs

The growing use of robots and automation has "widen[ed] the gap between the rich and poor" through the replacement of positions previously held by skilled trade workers, opening the door to unemployment and a significant change in the "composition of the labor force" (Korane, 2015, p. 3). *Figure 3* illustrates the general decrease in employment in the manufacturing sector compared to other sectors of business within the United States (Fort et al, 2018, p. 48).

Figure 3: Employment in the US manufacturing industry between 1948 - 2016



In contrast, *Figure 4* shows an unexpected trend, where the value added to the GDP by the US manufacturing sector to the economy has equaled or totaled that of other sectors (Baily & Bosworth, 2014, p. 4; Fort et al, 2018, p. 48).

Figure 4: Manufacturing Industry's Real Value Added to the GDP Compared to Other Sectors

These trends are caused by technology's ability to drive down production costs and demand for workers. However, Ken Korane, a mechanical engineer who works as editor for *Machine Design*, notes these trends are not sustainable and that the discrepancy between them illustrate a trend of market instability, possibly leading to a market failure (2015, p. 2). To avoid an economic collapse, improved coordination is needed between governmentally funded and with the skills required by the market (Blakenhorn, 2015, p. 88).

Skills Sets Constantly Required in The Work Force

Increased worker wages within the United States have forced producers to resort to equipment, software, and outsourced jobs to increase efficiency and margins (Zucherman, 2010, p. 5). Aaron Cosbey, a development economist with over 25 years of experience in the areas of trade, investment, and sustainable development, and his associates, discern between the difference of semi – automation and full automation even though both "reduce the number of workers required" (2016, p. 13). However, semi – automation is much more present in the industry as more than half of all jobs can be at least partially automated" (Guthrie, 2018, p. 6). Teresa Fort and her associates, who are all principle economists, agree with this report's findings, stating that a "firm's technology and trade activities are correlated with subsequent changes in their employment and output," which can result in the automation of positions within companies (2018, p. 62). Furthermore, Korane is concerned about workers who "lack education and sophisticated skills to manage information" (2015, p. 3). While many of these studies have concluded that automation will cause a future decrease in employment, a few have investigated the possibility that the issue society is faced with is not a lack of jobs, but a new skill set, and principles demanded by the manufacturing market and its subsequent divisions (Guthrie, 2018, p. 5). This suggests that retraining is a potential solution (Wingo, 1963, p. 326; Akst, 2013, p. 10).

Daniel Akst, columnist of *The Wall Street Journal's* R&D section, states that with the rise of a "new work morality" the value of an employee would be derived from their success at "planning and organization" (2013, p. 12). Michael Pagano, the dean of Public Affairs at the University of Illinois, concludes that there may be a potential addition of jobs through the new "opportunities afforded by a new wave of advanced manufacturing," which would require a new set of skills (2015, p. 84). Looking at the outcome of the predicament facing the manufacturing industry in the 1960s, automation increased productivity and created different jobs that previously imagined (Korane, 2015, p. 3). Today, faced with a similar dilemma, researchers question if "automation [will] create more jobs than it replaces" (p. 3).

Market Failure

Data retrieved from the US Bureau of Labor Statistics in Fort's report (as seen in *Figure 3)* suggests a trend with a clear decrease in employment in the manufacturing sector from the 1980s onward. The American and Canadian economy today cannot adapt to the rapid changes in technology. If neglected, "companies eliminate workers, competition grows, wages drop, demand falls, deflation runs rampant, and the Great Depression will look like a picnic" (Korane, 2015, p. 2). On the other hand, Jeffrey Winters, political scientist and post-doctorate fellow at Northwestern University, emphasizes the role of resources in an economy driven on power demand as a result of automation. Analytics and automation will optimize energy and material use in manufacturing, making economies "less resource dependent that ever" (Winters, 2017, p. 29). Amy Guthrie, , takes a different angle on the issue than Korane and supports Winters in his belief that this change in technology will be beneficial for the Canadian market. The elimination of workers can be offset by ensuring a more stable trading relationship with other North American companies. Instead of "bickering over immigration, offshoring, and imports" and

putting a greater focus towards better finding a way for the three countries to work together in order to become more competitive on a global market, the demand for Canadian products will grow and the industry can stay alive (Guthrie, 2018, p. 3).

Educational Systems and Governmental Programs

Howard Wial, who is the former director of the Center for Urban Economic Development at the University of Illinois proposes that the educational system in place now, does not support the skills needed by the current job market and a change in these institutions will incite a positive change in unemployment. These systems are institutionalized and require a much larger long-term change that would not produce a shift immediately (Blankenhorn, 2015, p. 88; Wial, 2013, p. 22). Instead the introduction of governmental programs that "not only give workers a career path," but also provide "employers with confidence that the workers have acquired the necessary skills," can aid current unemployed workers to find employment (Blankenhorn, 2015, p. 88). At first glance, it may appear that these programs can regulate unemployment, on closer inspection, however, the number of jobs provided may not meet demand as seen in the United States, Canada, and the Halton region need to draw on the same competitive advantage that once fueled growth, economic innovation (*Government of Illinois*, 2018). As a technology goes from a "prototype to mass production" and the company expands, new positions within the company are created, increasing employment. However, this is lost in Canadian and American companies when they grow to a point where their processes can be outsourced for a fraction of the price. Without retaining the majority of the company's innovative properties, the American and Canadian "economy lose [their] hold on new technology" (Zuckerman, 2010, p. 6). In order to entice companies to stay local, Mortimer Zuckerman investigates the government's role, and concluded that by allowing for quicker approval processes and making it easier to build local

manufacturing plants, “startups can quickly transform into larger scale manufacturing companies,” positively impacting employment in the auto-manufacturing industry within the United States and Canada (2010, p. 6).

Gap Analysis

Automotive manufacturing is the largest sector of manufacturing within the United States (American Automotive Policy Council, 2018, p. 5). Any change in the American industry directly impacts Canada’s economy, since “Canada’s automotive industry is part of an integrated North American market” (*Government of Canada*, “Canadian Automotive Industry” 2018). These changes are crucial for Canada’s economy as the automotive industry contributes $19 billion to Canadas GDP and employs “nearly 700 parts suppliers” (p. 1). Within Canada, the “Halton region is the center of North America’s manufacturing heartlands” with over 1,150 manufacturers firms – employing 34,750 technical and general laborers’” as well as “an additional 125 engineering firms, employing 3,825 professionals” (*Government of Canada*, “Canadian Automotive Industry” 2018; *Halton Municipal Government*,” Halton’s Advanced Manufacturing & Engineering Clusters” 2018, p. 1). Halton also houses a large portion of Canadas research and development (R&D) automotive suppliers as seen in *Figure 5*.

Figure 5: Location of Automotive Manufacturing Firms and Professionals

With a large population of workers, automation in the Canadian automotive industry directly impacts the jobs of Halton workers. Even though Canada is one of the "world's top 10 producers of light vehicles," there is still a significant lack of research surrounding the Canadian manufacturing industry and the Halton region (*Government of Canada*, "Canadian Automotive Industry" 2018). Furthermore, this paper allows for relevant insight into a rapidly changing industry from the unique perspective of the ASF line. My research aims to address this gap by exploring the unfolding trends and phenomena within the auto – manufacturing industry in Canada and its impact on the skill-trade sector in the Halton Region.

Methodology

This study implements a mixed methods case study design: the quantitative data collection method complements the qualitative inquiry and is best described as a case study, which is a focused analysis on a specific phenomenon in its local and real-world context (Creswell, 2013, p. 97). Case studied are particularly useful to employ when "there is a need to obtain an in-depth" understanding of an issue (Crowe et. al., 2011), which in this study is the

under researched Halton automotive industry. Similarly, in Robert Stake's *The Art of Case Study Research,* investigators can consider a specific case to consist of certain demographics of individuals, an organization, or a location when exploring trends within the entity.

Approach

The case examined is the 'line of production' for automotive goods within the Halton region as referenced in *figure 1*. There is limited research discussing automation with context to Canada and further exploration of the topic allowed for the discovery of possible trends and themes in the auto-manufacturing industry.

A mixed-methods approach was adopted because this design allows the quantitative statistical data to validate and compliment the qualitative interview and survey data. While a case study allowed for a focused look into one geographical location, a mixed methods approach allowed me to use complimentary statistical information about the Halton region specifically and support it with trends and phenomena found in the interviews and open-ended surveys conducted. The design of this study is replicable, which means that similar data can be found in different geological locations.

Sampling and Collection Methods

Upon approval from my institution's internal ethics review board data was collected from all three companies: All Tool, Volestalpine Rotec Summo Corp., and Ford in Halton. Within this, interviews were held with the managers of the companies and with the engineers at Summo in order to find the future plans of the company, the change in products produced, and the unemployment statistics of the company within the past 10 years. Interviews were most effective here as they allowed me to understand the company from a managerial perspective and to ask in-

depth qualitative questions. Moreover, open-ended qualitative survey questions directed towards engineering teams at Summo and ground floor employees at All Tool and Ford, allowed for an in-depth exploration of similar information found from interviews done with the managers of these companies, but from a different internal perspective and from a larger audience, which would not be as plausible with interviews. Lastly, statistical quantitative data was collected on unemployment and the rate of expansion of the automotive industry within Halton, in order to compliment previously found quantitative data. This led to a better understanding of the issue and provided useful information in order to describe trends within the industry found within the qualitative portion of the data collection (Green & Caracelli, 1997, p. 7).

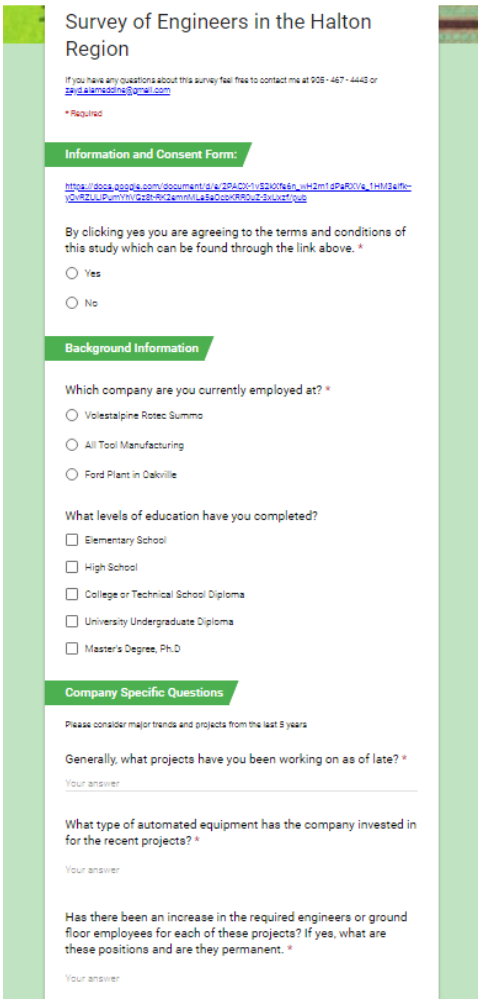
Limitations

This study is limited by the number of factors that are being examined in the automotive industry. This specified approach to the issue may lead to shortsightedness in the analysis of the data collected. For example, external factors could have caused the qualitative information collected in the ASF chain to not reflect the quantitative statistical data of the entire industry (Creswell, 2017. However, since the ASF chain is heavily integrated within the Halton automotive industry, the data collected can be considered generalizable throughout the entire local industry and the replicability of the methods and methodology used can allow a similar study to be done elsewhere, which would allow for an analysis of impact that those external factors could have on the data collected, if at all. Moreover, this study was limited by the sensitivity of the topic. Since this study discusses elements of job security, some individuals can be unwilling to come forth for data collection. To mitigate the impact that is limitation may have on the data collected, the questions asked were phrased with this sensitivity in mind.

Introduction to Findings

Overall, interviews were held with executives within each of the three companies within the ASF line. In addition to this, I was referred to 2 other executives within the Halton region who work in the field. Each of these interviews led to information surrounding the development of the industry as well as their specific company and how automation has impacted their process in Halton. In addition to this, open-ended surveys were sent to engineers, using *Survey 1*, or toolmakers/operators, using *Survey 2*, where applicable in the ASF line.

Figure 6: Survey 1



Survey of Engineers in the Halton Region

If you have any questions about this survey feel free to contact me at 905 - 467 - 4443 or zayd.alameddine@gmail.com

* Required

Information and Consent Form:

https://docs.google.com/document/d/e/2PACX-1vS2lOXfs6n_wH2m1dPaRXVg_1HM3eIfk-yOvRZuUiPumYhVGzBt-RK2emnMLeSaOcbKRR0uZ-3xUxXf/pub

By clicking yes you are agreeing to the terms and conditions of this study which can be found through the link above. *

- Yes
- No

Background Information

Which company are you currently employed at? *

- Volestalpine Rotec Summo
- All Tool Manufacturing
- Ford Plant in Oakville

What levels of education have you completed?

- Elementary School
- High School
- College or Technical School Diploma
- University Undergraduate Diploma
- Master's Degree, Ph.D

Company Specific Questions

Please consider major trends and projects from the last 5 years

Generally, what projects have you been working on as of late? *

Your answer

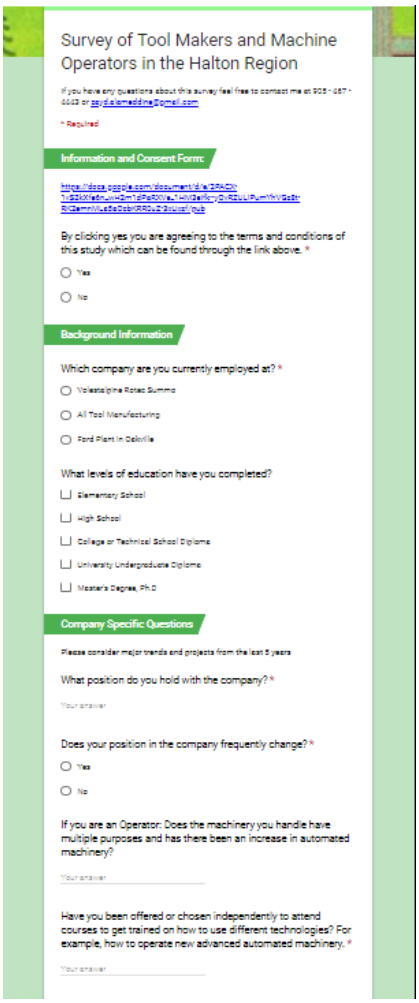
What type of automated equipment has the company invested in for the recent projects? *

Your answer

Has there been an increase in the required engineers or ground floor employees for each of these projects? If yes, what are these positions and are they permanent. *

Your answer

Figure 7: Survey 2



Survey of Tool Makers and Machine Operators in the Halton Region

If you have any questions about this survey feel free to contact me at 905 - 467 - 4443 or zayd.alameddine@gmail.com

* Required

Information and Consent Form:

https://docs.google.com/document/d/e/2PACX-1vS2lOXfs6n_wH2m1dPaRXVg_1HM3eIfkrYyOiRZuUiPumYhVGzBt-RK2emnMLeSaOcbKRR0uZ-3xUxXf/pub

By clicking yes you are agreeing to the terms and conditions of this study which can be found through the link above. *

- Yes
- No

Background Information

Which company are you currently employed at? *

- Volestalpine Rotec Summo
- All Tool Manufacturing
- Ford Plant in Oakville

What levels of education have you completed?

- Elementary School
- High School
- College or Technical School Diploma
- University Undergraduate Diploma
- Master's Degree, Ph.D

Company Specific Questions

Please consider major trends and projects from the last 5 years

What position do you hold with the company? *

Your answer

Does your position in the company frequently change? *

- Yes
- No

If you are an Operator: Does the machinery you handle have multiple purposes and has there been an increase in automated machinery?

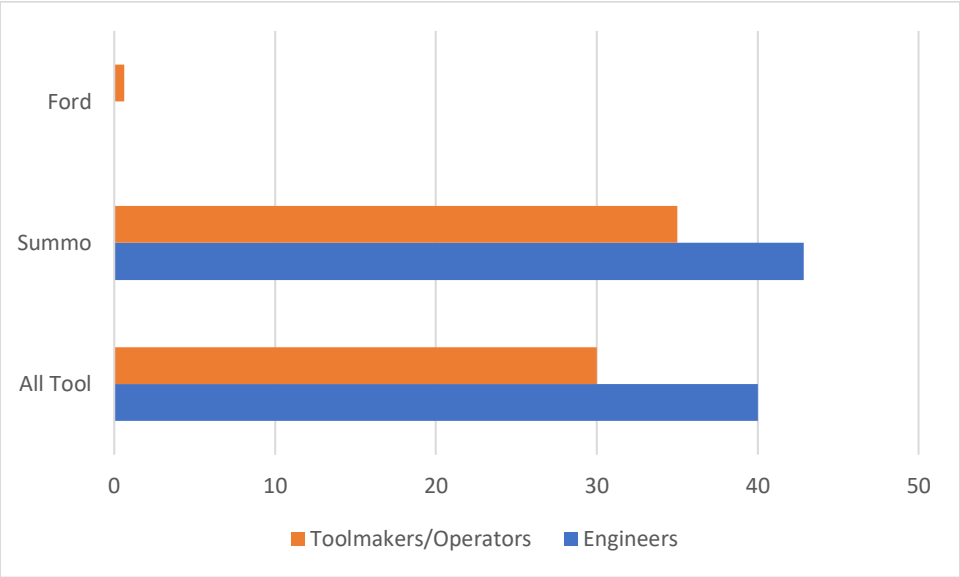
Your answer

Have you been offered or chosen independently to attend courses to get trained on how to use different technologies? For example, how to operate new advanced automated machinery. *

Your answer

At All Tool, 2 out of 5 engineers were surveyed along with 5 out of 15 toolmakers and operators on the ground floor. Similarly, at Summo, 3 out of 7 engineers were surveyed along with 7 out of 20 operators. Finally, at Ford, 63 out of the 1000 operators were surveyed. This information is represented in *figure 8.*

Figure 8: Participants Surveyed as a Percentage of their Company

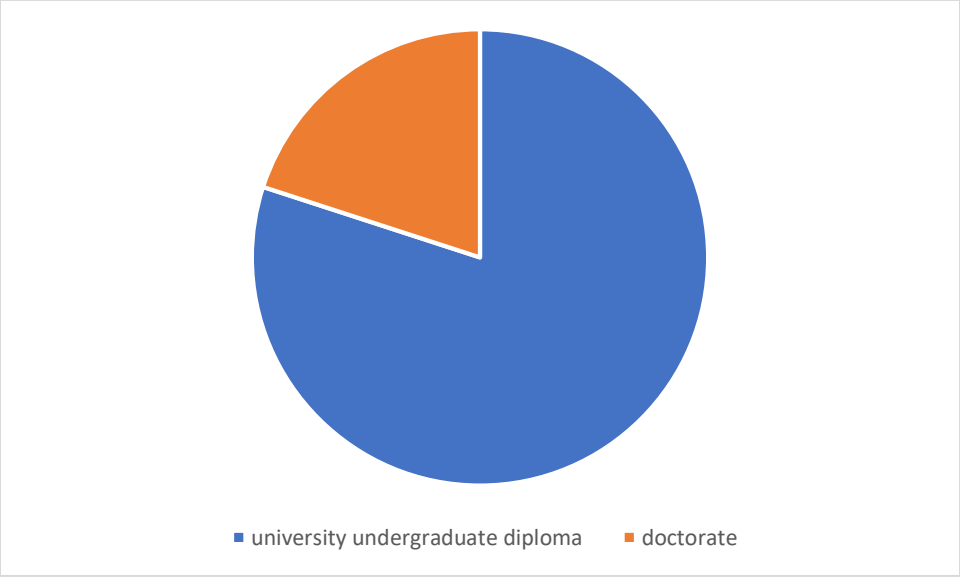


Survey 1 Results

Response to "What levels of education have you completed?"

Out of the 5 engineers surveyed, 30% of the total engineers in the ASF line, 4 had achieved a university undergraduate diploma, while the fifth had achieved his doctorate as seen in *figure 9.*

Figure 9: Education Distribution of Engineers within the ASF Line



Response to the "Company Specific Questions"

The engineers at Summo briefly noted that there were two new projects that they were working on as of late, pretensioner line 1 and 2. The engineering team had been split to design and build both of these new multi-million-dollar production lines. These new lines differed from ones built in the past as one process, could have a multitude of different stations, whereas in the past, each station would have been separated and parts would be transferred from station to station to acquire the same result. Moreover, within the actual process, an investment has been made in automated robotic machinery, which assists in transporting parts from one station to the next within the process, and engineers, who design and customize the machinery for the task at hand. Only one operator is needed to check and move the part after it had been processed, instead of having an operator at every station.

Regarding the responses given by the engineers at All Tool, it is important to note that the projects that the company works on are designed based on the custom tooling needs of their

clients. However, the company still invests in automated equipment and machinery, as seen in, *figure 10*, in order to increase efficiency.

Figure 10: Example of an Automated Drill Bit Machinery

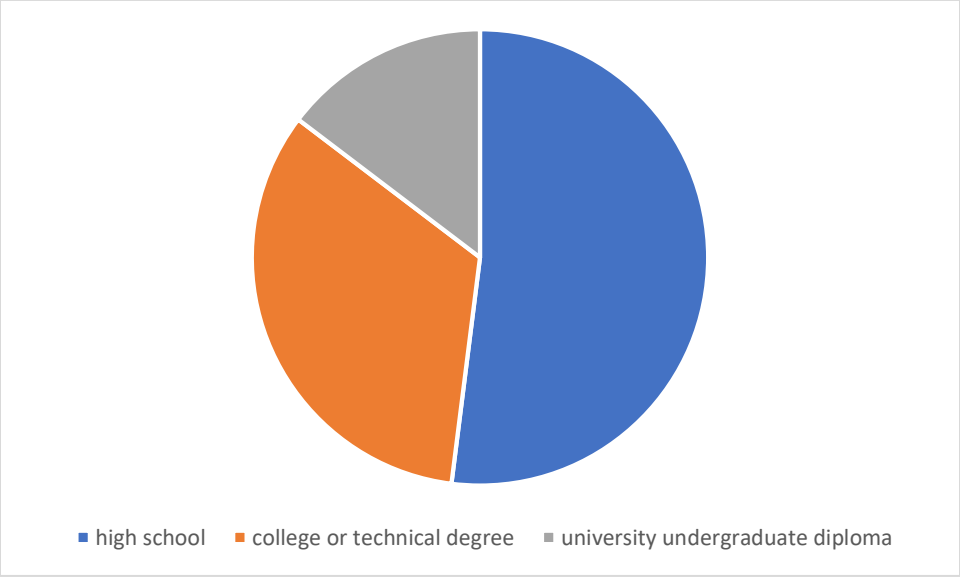
At All Tool, engineers are mostly needed to customized machinery and analyze what is the most efficient way to produce the parts they are requested to make. On account of this, the company has not seen a recent increase in the number of engineers but has seen an increase in the number of toolmakers.

Survey 2 Results

Responses to "What levels of education have you completed?"

Out of the 75 operators and toolmakers surveyed, 39 had finished their schooling after receiving their high school, 25 had gone on to a college or technical degree, and 11 had a university undergraduate diploma, as represented in *figure 11*.

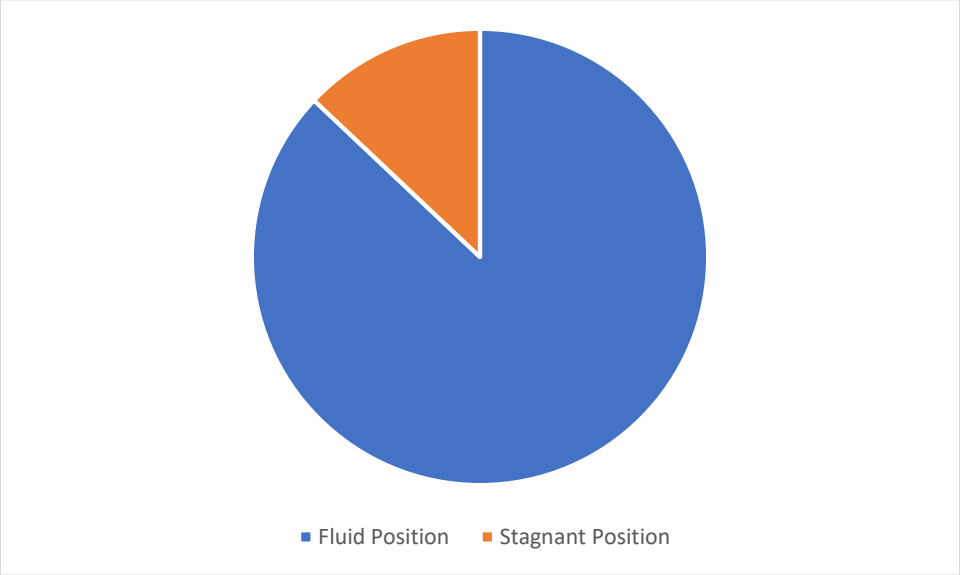
Figure 11: Education Distribution of Operators and Tool Makers within the ASF Line



Reponses to "Does your position in the company frequently change?"

54 operators and toolmakers replied that their position within the company does change quite frequently. Of this 47 were operators and 7 were toolmakers, as illustrated in *figure 12*.

Figure 12: Fluidity of Operators and Toolmakers Positions Within the ASF Line



Reponses to "If you are an Operator: Does the machinery you handle have multiple purposes and has there been an increase in automated machinery?"

The operators at the companies within the ASF line noted that their position within the company fluctuated depending on where they were needed. The machinery that the operators worked with in some cases had multiple purposes but running these machines required a small amount of training meaning that the operators who ran those machines did not switch positions as frequently. Similarly, certain operators mentioned that they rarely moved from their position since the machinery they operated was not general and they had to be trained in how to use that piece of equipment.

Response to "Have you been or chosen independently to attend courses to get trained on how to use different technologies? For example, how to operate new advanced automated machinery."

5 tool makers and operators discussed that they had been offered by their respective companies to attend night school in order to learn how operate advanced automated machinery. The large majority of employees were not offered this opportunity. Furthermore, no respondents had chosen to independently attend courses to further their own knowledge and potentially better their positions within their companies.

Below is an analysis of the trends and phenomena found throughout my research supported by the data collected.

Discussion

Pseudonyms of Interview Participants

Interviews were conducted as part of the data collection for this paper. In order to keep the identity of the participants concealed, their names and specific of their credentials have been altered. Below are the five participants that I will be referencing throughout the discussion:

1. Mark holds a managerial position at All Tool Manufacturing
2. Khan is an executive at Volestalpine Rotec Summo Corp
3. Carol holds a managerial position within the Ford plant in Oakville
4. Daria manages economic development within the town of Oakville, which is in the Halton region.
5. Karl has worked within the Ontario Ministry of Labor and has sat on the auto caucus for Ontario

Importance and Development of Halton's Auto-Manufacturing Industry

30 years ago, Halton had a resource-based economy, says Karl. In Oakville alone, there was a chemical manufacturing and chrome refinery plant. As well, Royal Dutch Shell, commonly known as shell, and Beyond Petroleum, commonly known as BP, both had refineries throughout the Halton region. An analysis of the geographical location of the Halton region to one of the largest vehicle markets in the world, the United States, explains why the auto-manufacturing industry grew as well eventually becoming one of the largest contributors to Canadian GDP, seen in *figure 13*. This goes to show the deep-rooted manufacturing industry that Halton had within its borders.

Figure 13: Top 10 Contributors to the Canadian GDP

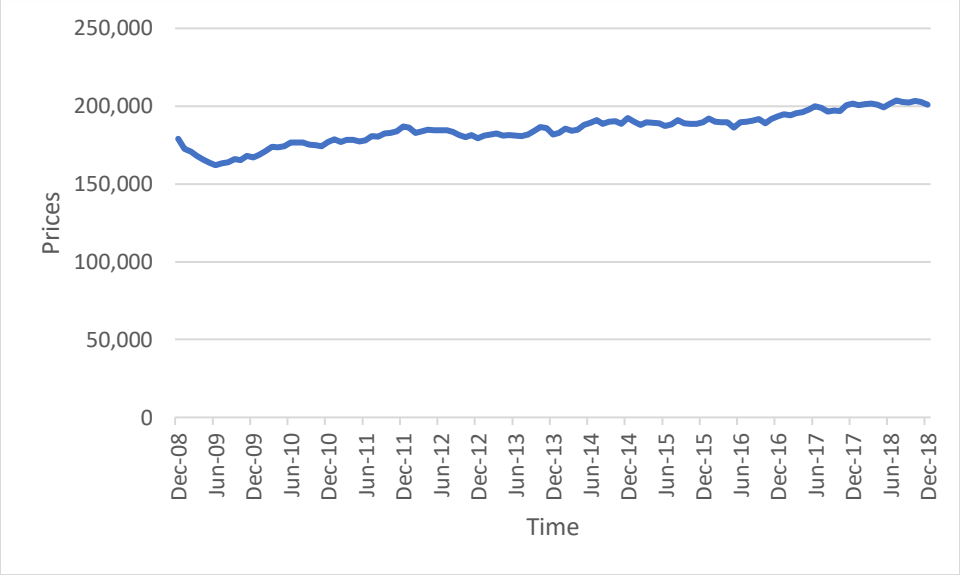
TOP 10 CONTRIBUTORS TO CANADIAN GDP	2014 (in $Bils)	% of GDP
1. Real estate and rental and leasing	206	13%
2. Manufacturing	**174**	**11%**
3. Mining, quarrying, oil & gas extraction	139	8%
4. Construction	124	8%
5. Finance and insurance	110	7%
6. Health care & social assistance	109	7%
7. Public Administration	106	6%
8. Wholesale trade	94	6%
9. Professional, scientific & tech. services	87	5%
10. Retail trade	87	5%

With the development of the industry, came long term relationships with suppliers and consumers. Carol mentions that this was, and still is, important for auto makers, as building and keeping this trust and reliability with suppliers in the region, allows for large companies such as Ford to know that the parts they need are going to show up on time. By doing this, logistics cost, shipping time, and risk can all be reduced. For Ford specifically, Carol mentions that internally, there are processes in place that describe "certain distance ranges for different parts" depending on importance and complexity. These processes tend to then favor Halton auto auppliers over others worldwide. However, in the past 10 years, there has been an immense change in the globalization of products, which drained the Halton region of its once geographical advantage as "it does boil down to price" (Mark).

Interestingly, Karl states that "Halton knew these days were coming" and instead of competing with the lower cost suppliers elsewhere, Halton focused on their strengths in education and training. This is supported by the numerous advanced manufacturing plants and

increase in the basic prices for products produced by the manufacturing industry, as seen in *figure 14* as more complex parts are more expensive to produce. This focus illustrates why the Halton region has been able to stay competitive in a global market.

Figure 14: GDP at Basic Prices for the Manufacturing Industry



To compliment this change, auto makers in the Halton region have developed a large focus towards innovative processes, which Khan states is "supported by governmental programs". This illustrates the role of government in keeping the auto-manufacturing industry profitable and how dependent the government is in doing this. Daria explain that "if [a company] can take a task that is routine" and automate it, they can bring down costs significantly. Furthermore, the more labor intensive a task is the more cost effective it is to automate the process.

To contextual the situation, Khan illustrated a scenario where a company, such as Summo, would automate a process. An off the shelf robot costs approximately 30, 000 Canadian

dollars. This robot “can replace three operators, each costing 50, 000 Canadian dollars a year.” These robots do not have safety issues, never get hurt, are never absent, and always produce the same better-quality part all the time. An example of an automated canister development process within Summo is seen in *figure 15.*

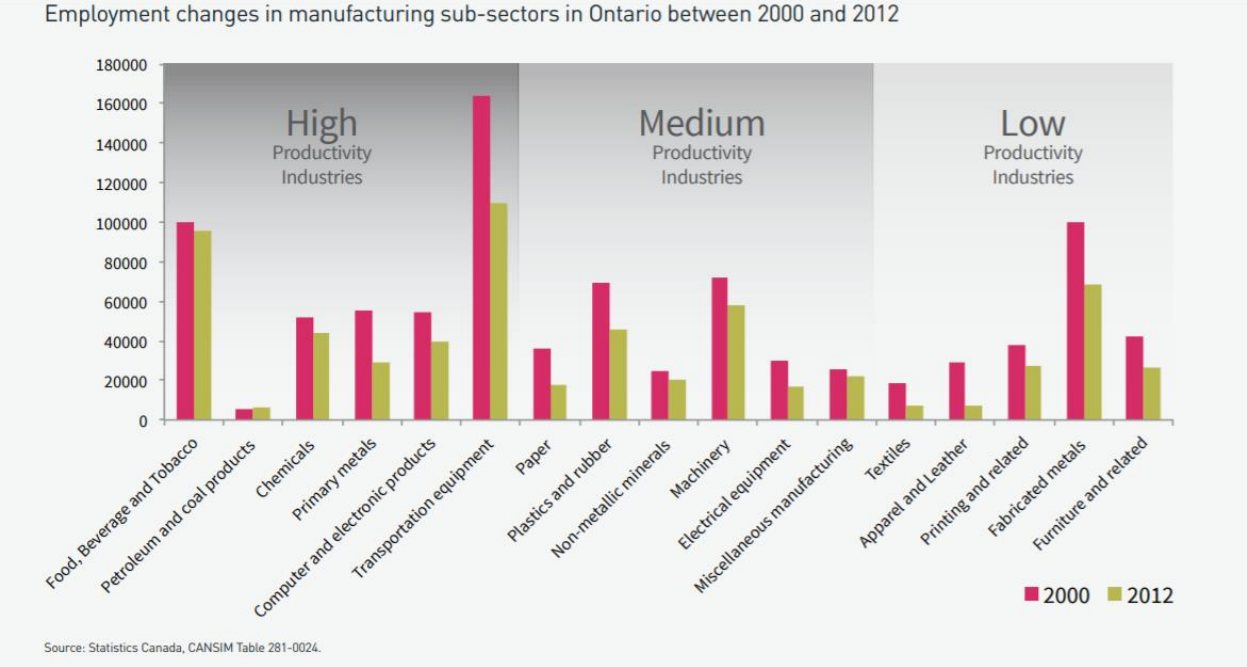
Figure 15: Automated Canister Development Process

The long stand relations of auto makers within the region is complimented by the Halton regions superior edge on automated processes. Its’ advanced manufacturing industry has also allowed the Halton region to stay competitive in a global market. Companies cannot afford to have part shortages and finding an operational pattern that can run 24 hours a day almost all week is associated with the least amount of risk and most amount of efficiency. The Halton region can provide that. However, this has fundamentally changed the kind of individual desired by the auto-manufacturing workforce.

Development of the Workforce Within the Auto-Manufacturing Industry

A rapid change is beginning to be seen throughout the auto-manufacturing industry as the skills possessed by the work force does not match the skills needed. Data collected from *Survey 2* illustrates that a multitude of skilled trade workers, classified as ground floor employees, have a low level of education with the majority receiving only their high school diploma. In addition, operators, a type of ground floor employee, are seeing a decrease in employment, as seen in *figure 16.*

Figure 16: Change in the Ontario Employment in the Manufacturing Industry (Relevancy: Transportation Equipment)



In *Survey* 2 participants noted the difference between work where their position within the company fluctuated significantly and where their position remained the same. Positions within the company that fluctuated significantly can be linked to routine work that does not require specialized training or a higher level of education, which relates to the education of

ground floor workers. Daria notes that routine tasks can easily be automated, which correlates with the decrease in employment in the manufacturing sector. Since not all routine tasks are automated, the Halton auto-manufacturing industry may be in a transitional period, which will result in a larger decrease in employment for ground floor employees over time. This change will also result in an increase in engineers hired within the company, which is seen in *Survey 1*, as engineers are hired to manage the increasingly complex machinery used. This goes to show that jobs that require higher levels of education are increasingly in demand in the automotive work force. Lastly, it can be seen in *Survey* 2 that ground floor employees are not independently pursuing training and only a very small portion of employees have actually been offered to be retrained in order to use more complex automated machinery. This phenomenon illustrates a workforce within Halton that is either not knowledgeable about their changing industry or is not worried about potentially losing their jobs. Further research would be required to discover the root cause of the phenomena.

Development of Robots in the Industry

Khan explains that at Summo, they design their own specialized Computer Numerical Control (CNC) equipment, which has 70 axes compared to an off the shelf robot, seen in *figure 14*, which has 3. This development allows for the automation of more complex and specialized processes within the company, but only to a certain extent. Moreover, these processes are extremely expensive and require a massive capital and intellectual investment, in terms of engineers, from the company. Therefore, lower volume complex parts do not require CNC equipment and it is more cost effective to have an operator instead. The data collected from *Survey 2* also illustrates that tool makers positions are not as fluid as those of operators. This can be attributed to the analytical skills that a tool maker must use when assembling the tooling

created by the operators. This illustrates that analytical skills are harder to automate and therefore needed in the automotive workforce.

Limitations

While all three companies within the ASF line are heavily integrated within the Halton region, which should allow for the data collected to be generalizable to the entire region, it is important to note that different companies have different processes and because of that a bias may form, tainting the information collected. Furthermore, this study is limited by the time period that is examined as reliable statistical data of the industry is not readily available. This is on account of the slow processes that are in place to analyze the state of the industry at any given time. The auto-manufacturing industry develops very quickly as technology is rampantly changing. While this paper is still relevant, it may not be an exact reflection of the industry currently. Lastly, this paper did not account for the uncertain growing tension between political groups within the United States and Canada. Changes to the North American Free Trade Agreement (NAFTA), as well as the tariffs on commodities, such as aluminum, directly impact the cost of products produced and in Canada and the profit made on those products as the US is out largest trading partner and the second largest automotive industry in the world. This was not mentioned to retain focus on automations' impact on the industry.

Suggestions for Further Research

An interesting phenomenon appeared from the data collected, relating to the displacement of workers, which did not directly relate to automations impact on the automotive industry. Even though there is a clear decrease in employment within the automotive industry and this decrease is largely within ground floor employees, workers did not seem to be worried about their

occupations. Out of the 75 toolmakers and operators surveyed only five responded that they had been offered to be retrained by their company or had independently attended retraining courses. An analysis of the false sense of security felt by workers and what this means for the industry could be of interest. Furthermore, as the design of this study is reproduceable, research could be on a region similar to Halton. A potentially interesting region to study would be Guangzhou, China, on account of the regions massive auto-manufacturing industry. China has also recently surpassed the United States as the largest automotive industry in the world and studying the industries development could be of interest (Clarke & Cheng, 2005, p. 64).

Conclusion

The results from this study suggest that automation detrimentally impacts skilled trade workers within the Halton region. However, automating processes is more efficient and is vital for companies within Halton to compete on a global scale. Auto makers continue to rely on the Halton auto-manufacturing industry because of the long-standing relationships between the companies, geographical location to the manufacturing plants as well as the United States, and because of the quality of advanced parts.

Word Count: 5,206

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Appendix

Interview questions from discussion with Khan, an executive at Summo

1. Why do auto-makers buy from parts manufactures in Halton when there are lower cost providers elsewhere?
2. What makes a part worthwhile manufacturing at Summo versus other lower cost alternatives in other parts of the world?
3. How has automation played a role in allowing auto industry suppliers to stay competitive?
4. Have you been investing in more automation equipment recently as a result of that?
    a. To what extent did their impact help the company's margins?
    b. If so what was their purpose and what roles are they intended to replace?
    c. Are there any jobs that are being created because of automation?
5. Is there any references or articles that you can recommend that have statistical data on Summo showing the impact that automation has had on its revenues?

Interview questions from discussion with Mark, who holds a managerial position at All Tool

1. Why do auto-makers buy from parts manufactures in Halton when there are lower cost providers elsewhere?
2. What makes a part worthwhile manufacturing at All Tool versus other lower cost alternatives in other parts of the world?
3. How has automation played a role in allowing auto industry suppliers to stay competitive?
4. Have you been investing in more automation equipment recently as a result of that?

    a. To what extent did their impact help the company's margins?
    b. If so what was their purpose and what roles are they intended to replace?
    c. Are there any jobs that are being created because of automation?
5. Is there any references or articles that you can recommend that have statistical data on All Tool showing the impact that automation has had on its revenues?

Interview questions from discussion with Carol, who holds a managerial position at Ford

1. Why do auto-makers buy from parts manufactures in Halton when there are lower cost providers elsewhere?
2. What makes a part worthwhile manufacturing at Ford versus other lower cost alternatives in other parts of the world?
3. How has automation played a role in allowing auto industry suppliers to stay competitive?
4. Have you been investing in more automation equipment recently as a result of that?
    a. To what extent did their impact help the company's margins?
    b. If so what was their purpose and what roles are they intended to replace?
    c. Are there any jobs that are being created because of automation?
5. Is there any references or articles that you can recommend that have statistical data on Ford showing the impact that automation has had on its revenues?

Interview questions from discussion with Daria, who manages economic development within the town of Oakville

1. Why do auto-makers buy from parts manufactures in Oakville when there are lower cost providers elsewhere?

2. How has automation played a role in allowing auto industry suppliers to stay competitive?
    a. Has the impact of automation displaced jobs within the Halton auto-manufacturing industry?
3. Are there any governmental retraining programs to help those who have lost their jobs?
    a. If so, have they been effective?
4. Is there any references or articles that you can recommend that have statistical data on the changing state of the auto-manufacturing industry in Halton?

Interview questions from discussion with Karl, who worked within the Ontario Ministry of Labor and has sat on the auto caucus for Ontario

1. Why do auto-makers buy from parts manufactures in Halton when there are lower cost providers elsewhere?
2. How has automation played a role in allowing auto industry suppliers to stay competitive?
3. Are there any governmental retraining programs to help those who have lost their jobs?
    a. If so, have they been effective?
4. Is there any references or articles that you can recommend that have statistical data on the changing state of the auto-manufacturing industry in Halton?

Consent Form

Every participant was given this sheet of paper. Those who participated in the survey clicked a button giving their consent to the survey and those who were interviewed either signed the sheet or gave verbal consent through a recording device.

Zayd Alameddine
540 Lakeshore Road
(905) - 467 - 4443

Information and Consent Form

Overview

This study focuses on the exploring the changing landscape of Halton's auto-manufacturing industry due to the impact of globalization. The purpose of this form is to gain preliminary qualitative information for the primary research phase of this project. Feel free to contact me if you have any questions.

Risks Associated With The Study

There are no known risks associated with this study.

Confidentiality

Any and all information shared in this form is confidential and will not be linked to any individuals directly. Once an analysis of the data is done, the results will be permanently deleted.

Right to Refuse Participation

If at any time you feel uncomfortable with the questions in the survey, you are free to leave the questions blank as this study is completely voluntary. However, once submitted, results cannot be withdrawn.