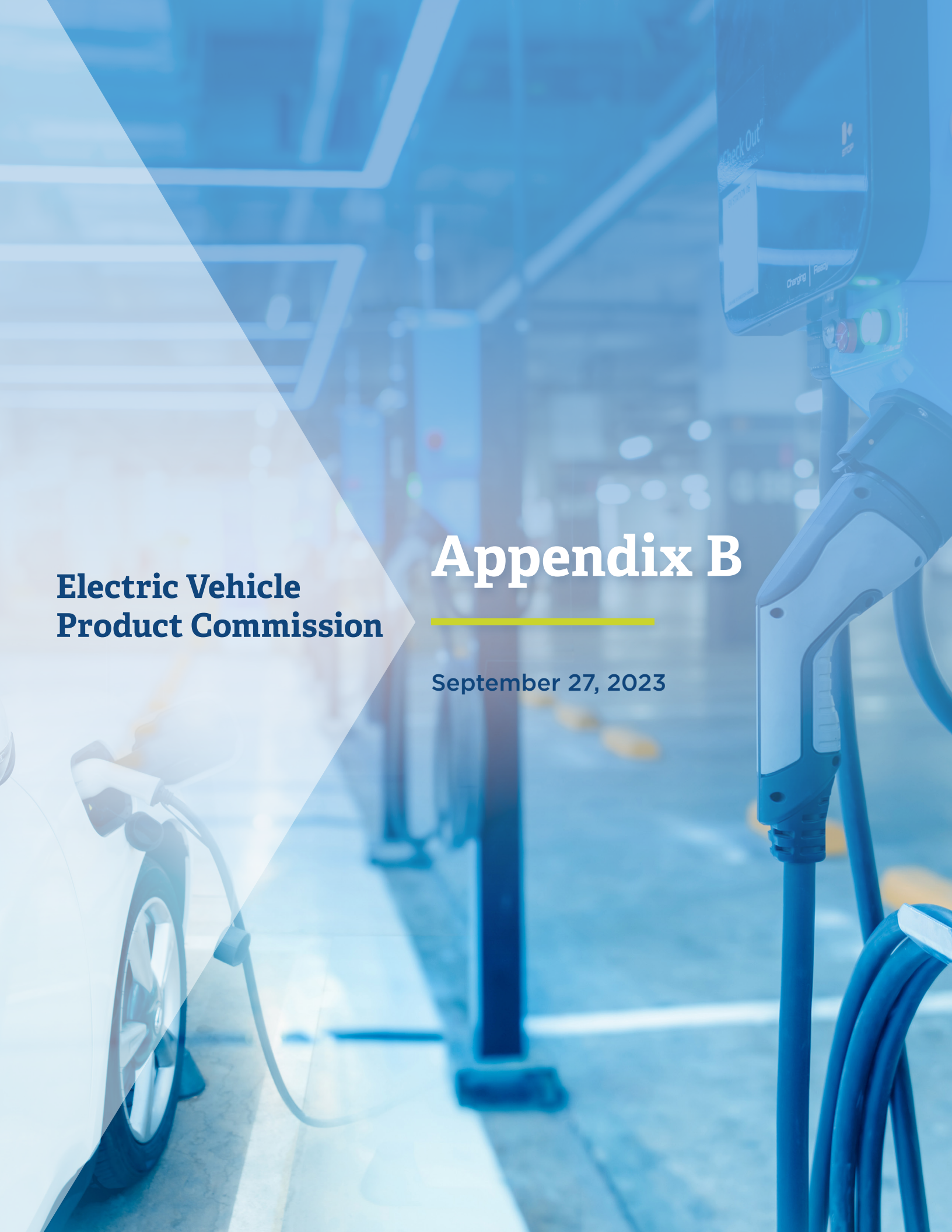

Electric Vehicle Product Commission

Appendix B

September 27, 2023

Task 2 – Shifts in the Worker Paradigm in the Automotive Industry in Indiana

Table of Contents

1 Automobile statistics

According to Alternative Fuels Data Center, administered by U.S. Department of Energy, in 2022 a total of 2.44M electric vehicles have been registered in the U.S. out of which 17,700 were registered in Indiana. This is up from 280,300 and 1,300 respectively in 2016. The count of EV per 10,000 people has risen from 9 to 73 in the U.S. during the same period while it has increased from 2 to 26 in Indiana. This translates to a growth of 711.11% in the U.S. while Indiana saw an astounding increase of 1,200%.[1]

1.1 Production and Non-production Workers

According to the BLS, production workers are categorized as employees who are directly involved in manufacturing, assembling, and processing goods. This can include workers involved in the production of everything from clothing to automobiles, as well as those working in industries such as food processing, chemical manufacturing, and electronics assembly.

Non-production workers, on the other hand, are employees who are not directly involved in manufacturing or assembling goods, but who are still important to the overall operation of a business. This can include workers in fields such as management, administration, sales, marketing, and finance.

The BLS provides detailed data on employment and wages for both production and non-production workers in a variety of industries and occupations. This information is used by policymakers, businesses, and researchers to better understand trends in the labor market and to inform decisions about labor policies, training programs, and other workforce development initiatives.

As detailed in an article published on INcontext,[2] the US Department of Labor characterizes production worker as a category encompassing individuals with elevated educational attainments and specialized technical proficiencies garnered through formal training, certifications, or degrees. These adept workers typically harbor expert insights within particular fields or industries and can adeptly tackle intricate tasks demanding advanced knowledge and adept problem-solving acumen. Esteemed by employers for their prowess in maneuvring sophisticated machinery, harnessing cutting-edge technologies, and catalyzing innovation and efficiency within their respective domains, production workers frequently command higher remuneration due to the remarkable value they bestow upon their employers, coupled with the distinctive nature of their honed skills.

Contrastingly, non-production workers are denoted as personnel who possess either modest or negligible formal education and lack specialized technical acumen. Such individuals typically engage in manual or repetitive assignments that necessitate minimal training or specialized qualifications. Often found in sectors like agriculture, basic manufacturing, and hospitality, where tasks can be swiftly acquired without substantial formal instruction, non-production workers are remunerated at a lower scale compared to their skilled counterparts, reflecting the more routine and less intricate nature of their job responsibilities.

[1] https://afdc.energy.gov/transatlas/#/?state=IN&view=per_capita, FHWA
[2] https://www.incontext.indiana.edu/2006/january/1.asp

2 Industry output (billions of dollars) share of the automotive sector

The automotive sector is crucial to the U.S. economy, contributing significantly to employment, technological innovation, and economic growth. Today, the sector remains a major player in the global automotive market, producing millions of vehicles and generating billions of dollars in revenue each year. In this context, examining the industry output of the automotive sector in the U.S. is critical to understanding its impact on the economy and society at large. The U.S. Bureau of Labor Statistics (BLS) provides employment and output by industry data.[3] The total for the automotive sector is determined based on NAICS codes that would be associated with auto industry. Table 2.1 represents the employment in thousands of jobs and Table 2.2 represents output in billions of chained 2012 dollars. The automotive sector accounted for roughly 5.92% of the total employment across all industries in the U.S., while contributing 9.23% of the total industry output amounting to approximately 3.2 trillion USD of the economy in 2021. The employment contribution of the automotive industry is expected to reduce to 5.63%, however, the output contribution is expected to increase to 9.45% over the next decade. Over the next decade, while the employment is expected to reduce in the automotive sector in line with the average across all industries, the output of automotive industry is expected to increase despite an average decrease across all industries. The factors responsible for this reduction in the employment and output are explored in depth in this report.

Table 2.1: Automotive Manufacturing Sector Employment

Industry	Employment 2011	Employment 2021	Employment 2031	Employment change 2011-21	Employment change 2021-31	Employment, Compound annual rate of change 2011-21	Employment, Compound annual rate of change 2021-31
Total Automotive	8,721.3	9,355.3	9,365.7	634	10.5	0.32%	-0.17%
Total	143,326.8	158,134.9	166,452.1	14,808.1	8,317.2	1%	0.5%
% Share of automotive Industry	6.08%	5.92%	5.63%	4.28%	0.13%	31.86%	-33.49%

Table 2.2: Automotive Manufacturing Sector Output (GDP)

Industry	Output 2011	Output 2021	Output 2031	Output, Compound annual rate of change 2011-21	Output, Compound annual rate of change 2021-31
Total Automotive	2,944	3,219.3	4,034.8	-0.10%	1.81%
Total	28,475.0	34,893.3	42,696	2.1%	2%
Share of automotive industry	10.34%	9.23%	9.45%	-4.65%	90.58%

[3] https://www.bls.gov/emp/tables/industry-employment-and-output.htm)

3 Employment trends in the industry

According to economists at Indiana University, labor shortages and supply chain issues continued to challenge Indiana's economy in 2022. However, they also expected to see continued growth in employment and job creation of around 2%, which is similar to the national growth rate. While the US labor participation rate is around 61%, Indiana has a rate hovering around 63%. Unfortunately, roughly 60,000 Hoosiers have dropped out of the labor force over the past year, indicating that fewer people are actively looking for jobs. Although the state's unemployment rate was expected to fall from about 4.2% now to as low as 3.6% by the end of 2022, Indiana's slower population growth may lead to slightly lower growth in employment and job creation relative to the national level. Additionally, the manufacturing sector was expected to experience slower growth in 2022, with economists predicting a growth rate of only 0.44%. One possible explanation for this is the possibility of higher worker productivity or an increased focus on automation and technology by employers as a means of coping with the ongoing labor shortage. Overall, the challenges faced by Indiana's economy in 2022 were reflective of broader economic trends affecting the United States. [4,5]

3.1 Wage changes

According to data from the Bureau of Labor Statistics (BLS), the hourly wage for workers in the automotive industry (Motor vehicles and parts manufacturing) in the U.S.[6] has increased over the past few years, with a high fluctuation throughout the year as seen in Figure 3.1. As of 2022, the median hourly wage for production workers in the motor vehicle manufacturing industry was $27.18, which was up from $22.02 in 2010. The tabulated values are represented in It is evident from Figure 3.1, that the data follows a linear trend with R^2 = 51% (the equation explains 51% of the data), with the auto industry seeing decreased wages between 2012-14. After 2017, the wages saw a drastic increment and this coincided with a dramatic public interest in EVs. The auto industry started seeing transitions around 2017 as Tesla's market cap surpassed Ford and Fiat Chrysler Automobiles. It should be noted that this data is only for production and non-supervisory employees.

Table 3.1.

[4] https://www.indystar.com/story/money/2021/11/05/indiana-economy-2022-what-to-expect-indiana-university-economists-iu/6270734001/

[5] http://www.ibrc.indiana.edu/ibr/2020/fall/article1.html

[6] https://www.bls.gov/iag/tgs/iagauto.htm#earnings

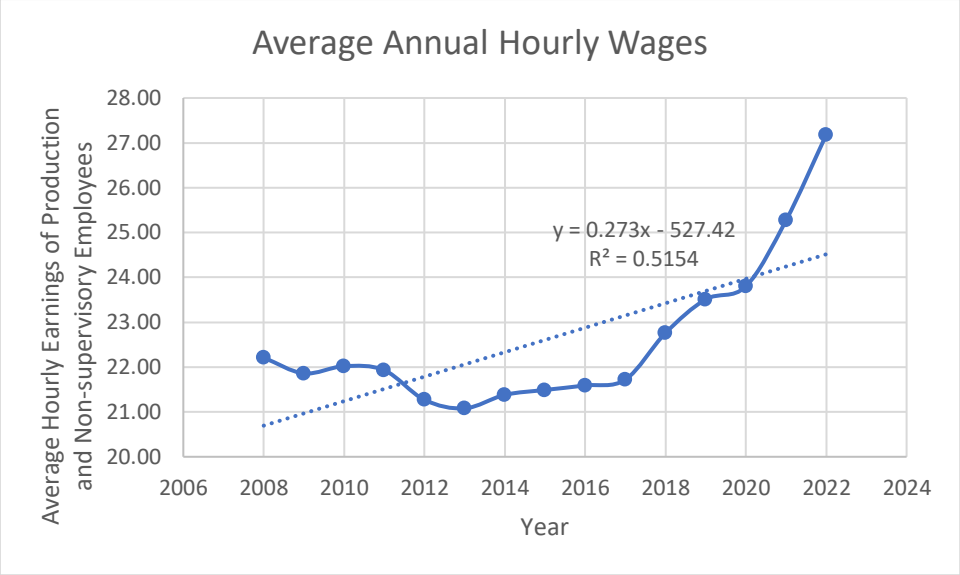

Figure 3.1: Hourly wages of Automotive workers (Production and Non-supervisory) in the U.S.

It is evident from Figure 3.1, that the data follows a linear trend with R^2 = 51% (the equation explains 51% of the data), with the auto industry seeing decreased wages between 2012-14. After 2017, the wages saw a drastic increment and this coincided with a dramatic public interest in EVs. The auto industry started seeing transitions around 2017 as Tesla's market cap surpassed Ford and Fiat Chrysler Automobiles. [7] It should be noted that this data is only for production and non-supervisory employees.

Table 3.1: Hourly wages of Automotive workers in the U.S.

Year	Hourly wage (USD)
2008	22.21
2009	21.86
2010	22.02
2011	21.93
2012	21.27
2013	21.08
2014	21.38
2015	21.49
2016	21.59
2017	21.72
2018	22.76
2019	23.51
2020	23.80
2021	25.27
2022	27.18

The hourly wage for workers in the overall manufacturing industry (NAICS 31-33)[8] in the United States has also increased steadily over the past few years as shown in Figure 3.2, although at a slower pace

[7] https://www.businessinsider.com/biggest-auto-industry-disruptions-in-2017-1#for-real-teslas-market-cap-surge-1

[8] https://www.bls.gov/iag/tgs/iag31-33.htm#earnings

than in the automotive industry. Hourly earnings in overall manufacturing have seen an increase after 2021, with the wages increasing to more than $25 in 2022, up from about $18.6 in 2010. The tabulated values are represented in Table 3.2.

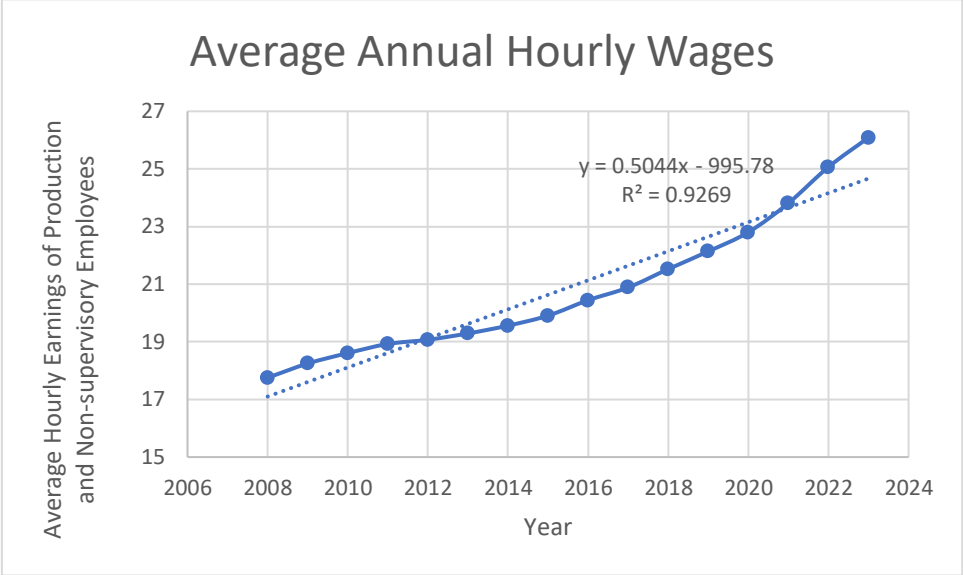

Figure 3.2: Hourly wages of Manufacturing workers (Production and Non-supervisory) in the U.S.

It is evident from, Figure 3.2, that the data follows a linear trend with a much better fit with R^2 = 92% (the equation explains 92% of the data). The wages have steadily increased through the years. However, the wages in auto industry have on an average always remained higher than overall manufacturing industry for production and non-supervisory employees.

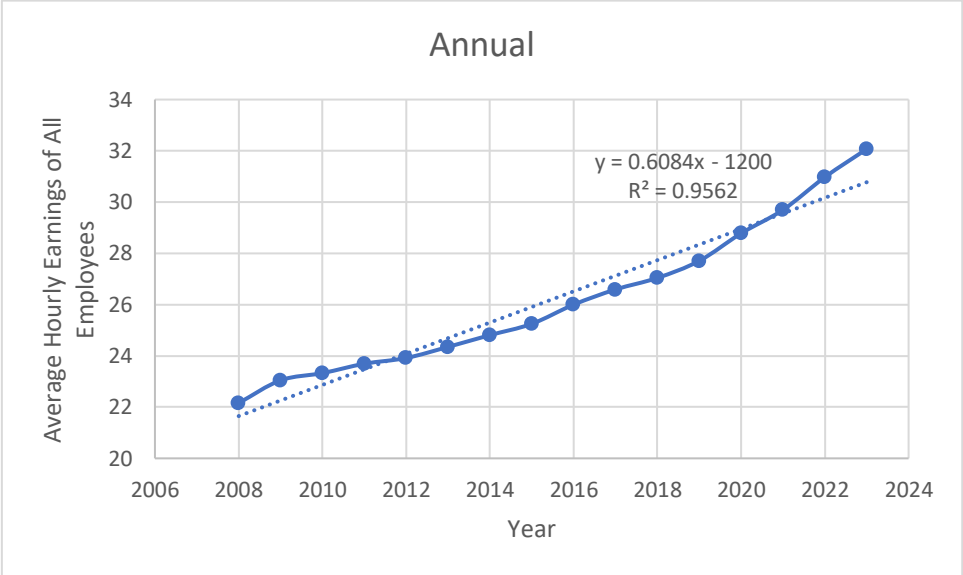

Figure 3.3: Hourly wages of Manufacturing workers (all) in the U.S.

As shown in Figure 3.3, for all the workers in the manufacturing industry too, the hourly wages follow a linear trend, with R^2 = 95% (the equation explains 95% of the data). The average annual wages are higher every year when considering all the workers in the industry compared to only the production and non-supervisory employees.

Table 3.2: Hourly wages of Manufacturing workers (all) in the US

Year	Hourly wage (USD)
2010	23.32
2011	23.69
2012	23.91
2013	24.34
2014	24.80
2015	25.24
2016	25.99
2017	26.59
2018	27.04
2019	27.70
2020	28.78
2021	29.69
2022	30.97

These figures reflect the median wage for all workers in the industry, and there may be variation in wages based on job type, geographic location, and other factors. Additionally, while wages have been increasing overall, the negative impact of industrial robots on employment and wages could still be affecting some workers in the automotive industry. This is discussed in the next section.

3.2 COVID-19 Pandemic effects

The impact of the COVID-19 pandemic on Indiana's manufacturing sector has been significant, with the transportation equipment industry being hit particularly hard. During the spring of 2020, employment in the manufacturing sector was down by 15% compared to the previous year. Indiana is the top manufacturing state in the U.S. in terms of percentage, with manufacturing employing over 530,000 workers, representing approximately 20% of the state's workforce. Unfortunately, Indiana's manufacturing sector suffered a loss that was 5% higher than the national rate, with the transportation equipment manufacturing industry experiencing the steepest job losses, with a 30% decrease in employment during the second quarter of 2020. Despite these challenges, Indiana's manufacturing sector continues to be a significant contributor to the state's economy, providing jobs and economic opportunities for a large number of workers.[9]

3.2.1 Education-wise breakdown

The involvement of highly educated workers having a bachelors or advanced degree has increased post pandemic for both male and female workers as observed in Figure 3.4. This can be attributed to several factors:

1. Technological advancements: The automotive industry is constantly evolving with new technologies, such as electric vehicles, autonomous driving systems, and advanced safety features. These technological advancements require workers with specialized skills and knowledge, which can only be gained through higher education.

[9] http://www.ibrc.indiana.edu/ibr/2022/spring/article1.html

2. Shift towards sustainable practices: With an increased focus on sustainability, the automotive industry is shifting towards producing more environmentally friendly vehicles, which require workers with expertise in fields such as battery technology and material science.
3. Data analytics: The automotive industry is increasingly relying on data analytics to improve efficiency and reduce costs. Workers with a strong background in data analytics and machine learning are in high demand, as they can help automotive companies make data-driven decisions.
4. Increased competition: The automotive industry is highly competitive, and companies are looking for workers who can help them gain a competitive edge. Workers with advanced degrees are often seen as more valuable and can help companies stay ahead of the competition.
5. Pandemic-related changes: The pandemic has forced the automotive industry to adapt to new ways of working, including remote work and increased use of digital technologies. Workers with advanced degrees are often better equipped to navigate these changes and can help companies stay productive and competitive in the face of uncertainty.
6. Automation: With the increase in use of automation in assembly lines and for manufacturing, the need for employees with knowledge and skills to operate the automated machinery has increased. The skill to efficiently work with automated machinery requires advanced degrees.

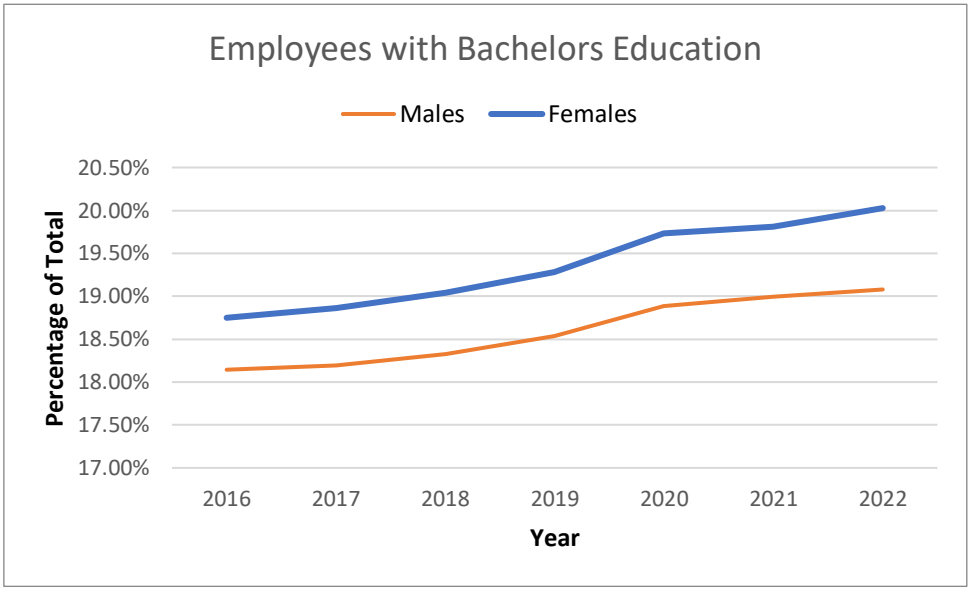

Figure 3.4: Trend of workers having a bachelors or advanced degree pre and post pandemic in the automotive industry

On the other hand, the requirement of blue-collar workers with an associate degree or less has fallen post pandemic. Some low-skilled jobs in the automotive industry have been automated or eliminated due to the pandemic, leading to a decreased demand for workers with just associate degree education. For example, in production lines, some tasks that were previously performed by manual workers may have been taken over by robots or automated systems. In these cases, the demand for blue-collar workers has fallen depicted in Figure 3.5 and Figure 3.6.

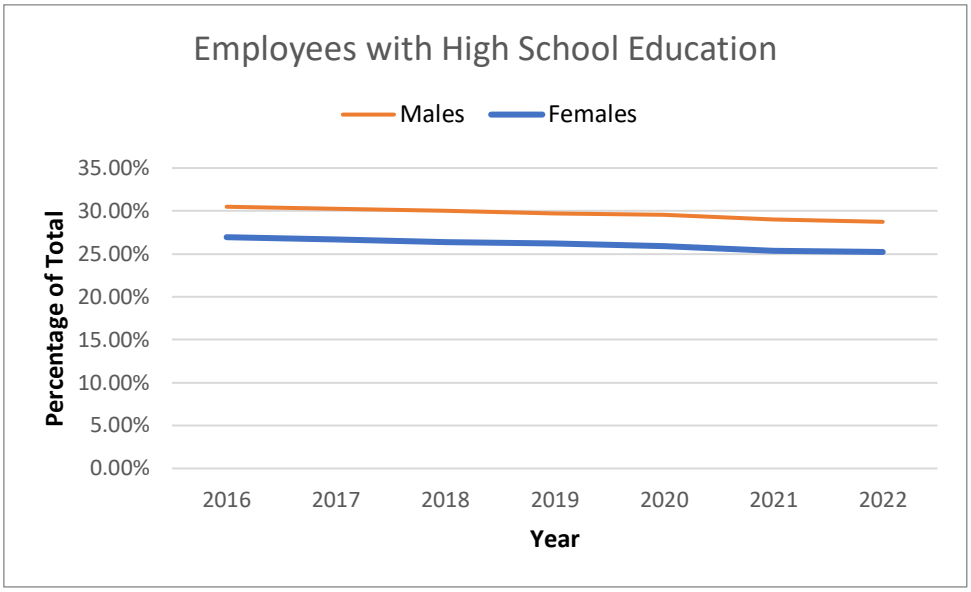

Figure 3.5: Trend of workers having a high school diploma pre and post pandemic in the automotive industry

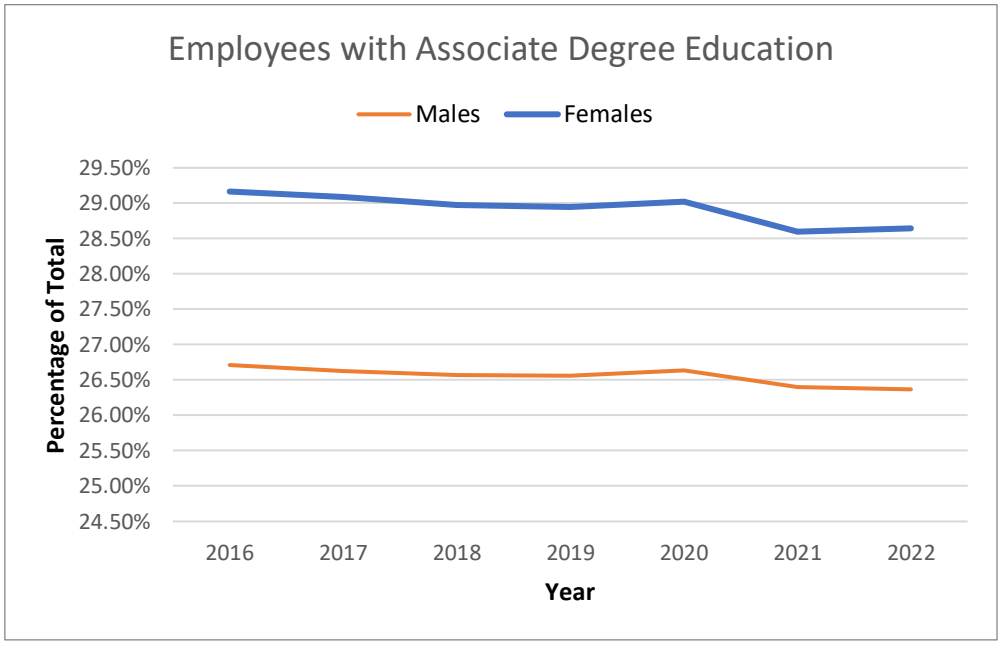

Figure 3.6: Trend of workers having an associate degree pre and post pandemic in the automotive industry

In addition to increase and decrease in employment across different education levels, the dynamics of gender can also be observed in employment across these education levels. It is evident that more females with higher degrees (Associate or Bachelors) are engaged in automotive manufacturing than males with the same education. More males with high school education are involved in auto manufacturing than females with same education.

3.3 Workforce Balance Sheet

The balance between workers joining and retiring from the workforce in the automotive industry is complex and influenced by a variety of factors. The COVID-19 pandemic has had a significant impact on the automotive industry, with many companies experiencing disruptions to their supply chains,

production schedules, and workforce planning. As a result, the trends around workers joining and leaving from the industry have shifted in recent years.

3.3.1 Pandemic

Prior to the pandemic, the automotive industry was already facing challenges related to an aging workforce and a shortage of skilled workers. Many companies were investing in training and development programs to help bridge the skills gap and attract new workers to the industry. However, the pandemic has accelerated some of these trends and created new challenges for the industry. Many workers in the automotive industry were laid off or furloughed during the pandemic, which may have led some to retire early or leave the industry altogether. At the same time, some companies may have slowed down their hiring efforts or shifted their focus to automation and digitalization, which could impact the number of workers joining the industry. This is evident from the drop in the share of workers in the 25-54 age groups as seen in Figure 3.7 and Figure 3.8. However, the industry has revived after 2021, with number of employees higher than before.

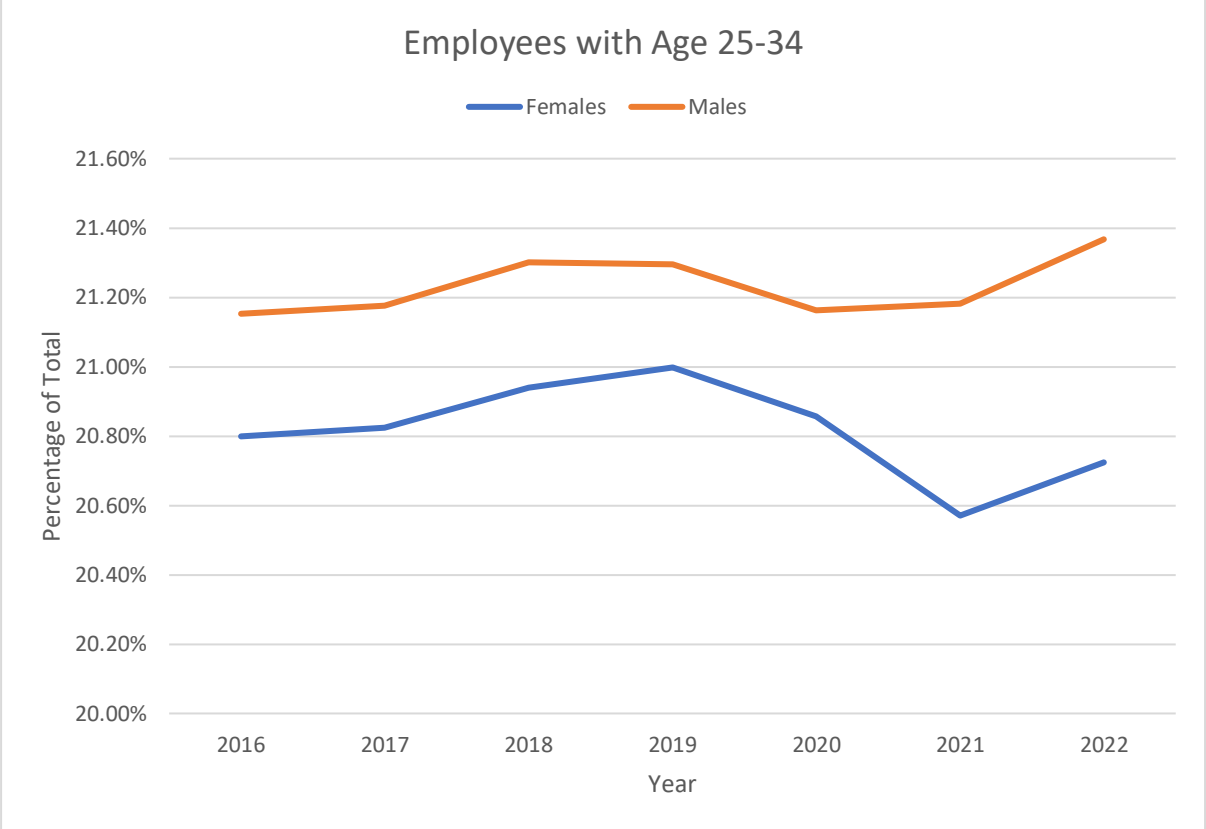

Figure 3.7: Workers in the 25-34 years age group in the automotive industry

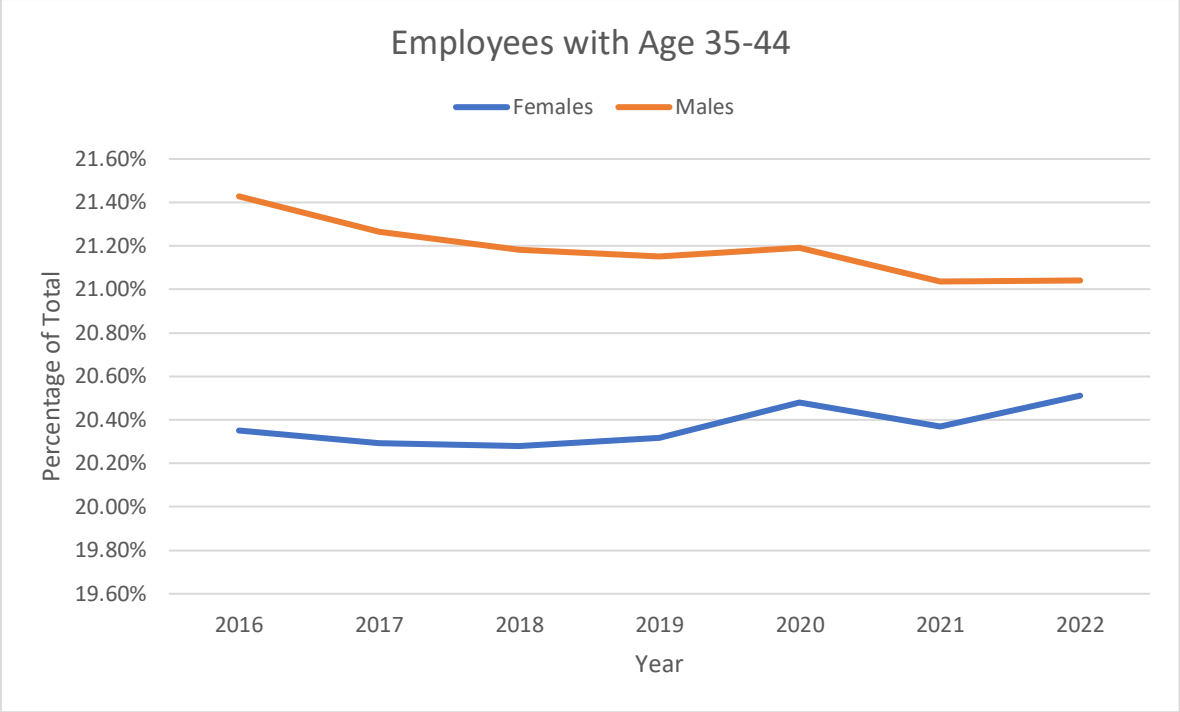

Figure 3.8: Workers in the 35-44 years age group in the automotive industry

As evident from Figure 3.9 and Figure 3.10, the percentage of employees in the age groups 45-54 and 55-64 decreases steadily over the years. While the percentage of employees in the 55-64 group increased until 2020 and then reduced to 2016 levels, the percentage of employees in 45-54 group decreased since 2016, with a minute spike in 2019.

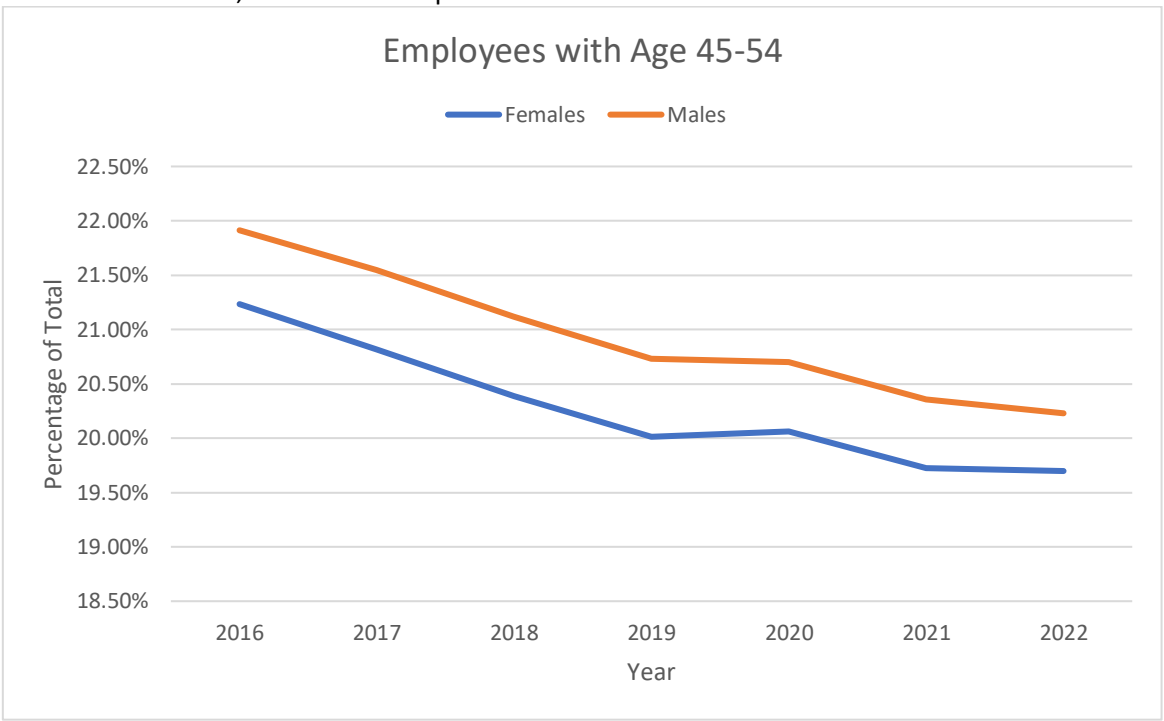

Figure 3.9: Workers in the 45-54 years age group in the automotive industry

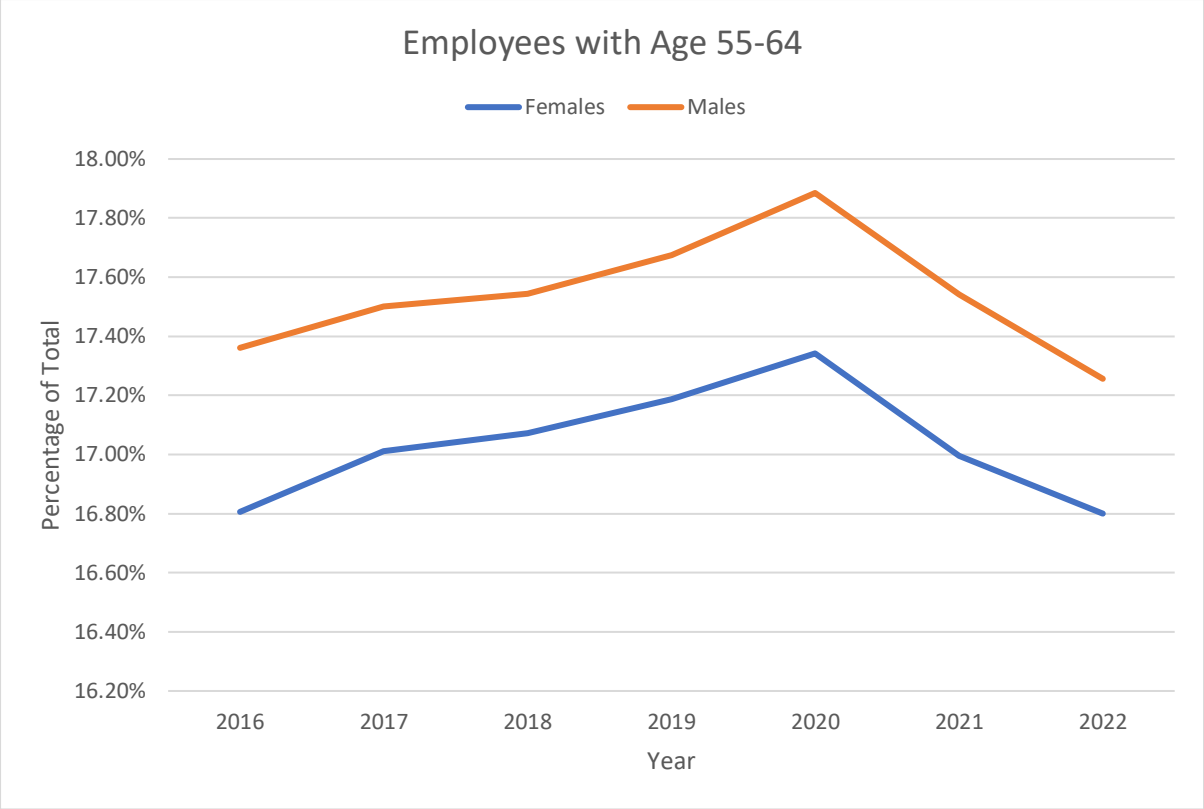

Figure 3.10: Workers in the 55-64 years age group in the automotive industry

At the same time, the automotive industry is also experiencing an aging workforce, with many experienced workers approaching retirement age. As these workers retire, they take their knowledge and expertise with them, which could create challenges for companies in terms of training new workers and maintaining production levels. However, due to the pandemic, a lot of the workers that would have retired have not retired due to the macroeconomic conditions in the county. This is clearly inferred through the spike in worker share in the retirement age of above 65 years during the pandemic and post pandemic period, as represented in Figure 3.11.

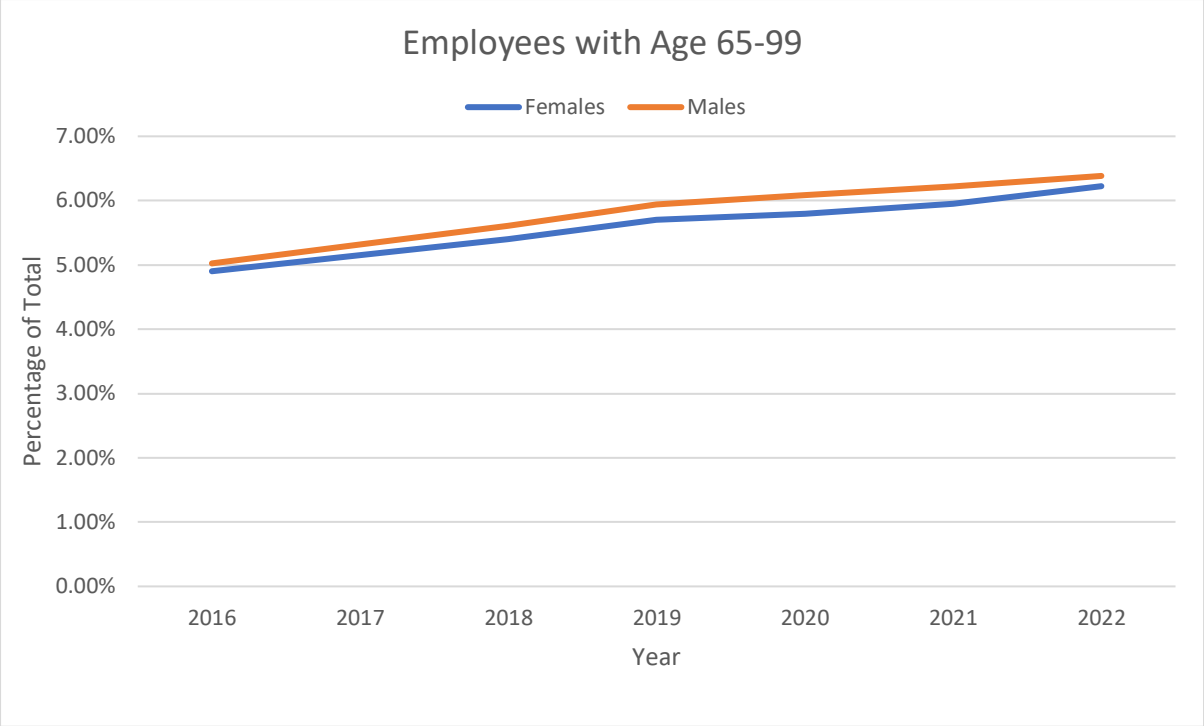

Figure 3.11: Workers in the 65 and over years age group in the automotive industry

3.3.2 Automation

Industrial robots are multipurpose machines that can perform a variety of tasks, such as welding, painting, and packaging. The use of industrial robots in the United States has a negative impact on employment and wages, according to a 2020 study. For every robot added per 1,000 workers, wages decrease by 0.42%, and the employment-to-population ratio declines by 0.2 percentage points, resulting in a loss of around 400,000 jobs to date.

The displacement effect occurs when robots or other forms of automation replace tasks formerly performed by workers, leading to a decline in employment and wages. The automotive industry employs the largest number of industrial robots, accounting for 38% of all robots employed (about 7.5 robots per thousand workers).

Both men and women are negatively affected by the adoption of robots, but men are impacted more significantly in manufacturing jobs, while women are more affected in non-manufacturing jobs. Furthermore, all education levels are impacted by the use of robots, but those without a college degree are affected more than those with a college degree or higher. The study also found that the adoption of robots does not have a positive impact on workers with advanced degrees, suggesting that industrial robots are not directly complementing high-skill workers.

The researchers estimate that there will be 5.25 more robots per thousand workers in the U.S. between 2015 and 2025. As a result, there will be a 1 percentage point lower employment-to-population ratio and a 2% lower wage growth during this period.[10]

Despite the negative effects of automation through robots, there are many positive impacts too. The introduction of robots and improvements in technology have made tasks easier, increased

[10] https://mitsloan.mit.edu/ideas-made-to-matter/a-new-study-measures-actual-impact-robots-jobs-its-significant

productivity, and increased profitability among many others. Therefore, it is important to weight the negative and positive impacts of automation on industries, especially automotive industry.

The effect of automation can be quantified through productivity indices[11] laid down by the U.S. BLS. The 4 main terms pertaining to automation impact are defined as:

- **Capital input**

The contribution to production from capital assets. Capital assets are the productive tools (equipment, structures, inventories, land, intellectual property, etc.) that can be re-used in future time periods after they are purchased.

- **Capital productivity**

The efficiency at which capital input is used to produce output of goods and services.

- **Labor productivity**

The efficiency with which goods and services are produced via labor hours; often referred to as output per hour.

- **Total factor productivity**

The efficiency at which combined inputs are used to produce output of goods and services.

The relationship between labor productivity, capital input, capital productivity, and total factor productivity can be used to quantify the effect of automation in the automotive industry. Automation can affect all these factors in different ways.

As evident from the data in Figure 3.12, the labor productivity has decreased from 99.47% in 2010 to 95.85% in 2020, with the lowest observed in 2019 at 95.4% during the decade. This decreased labor productivity can be one of the causes for the increased adoption of automation through manufacturing industry, especially auto manufacturing industry.

The capital productivity has increased from 91.61% in 2010 to 96.33% in 2020, with the productivity surpassing 100% in most of the years in between to a maximum of 104.69% in 2018. The investment of capital in manufacturing has steadily yielded better return. Since investment in automation increases efficiency of the process, the adoption of automation could be the potential driver of this increased capital productivity.

The total factor productivity decreases from 99.99% in 2010 to 97.77% in 2020. The productivity surpassed 100% and thereby 2010 levels across most years during the decade. The decreased productivity in 2020 could be attributed, potentially, to the pandemic.

The reduction in labor, capital, and total factor productivity in 2020 could be attributed to the pandemic during the period as the levels of capital and total factor productivity has stayed above the 2010 levels until 2020.

[11] Bureau of Labor Statistics, Office of Productivity and Technology

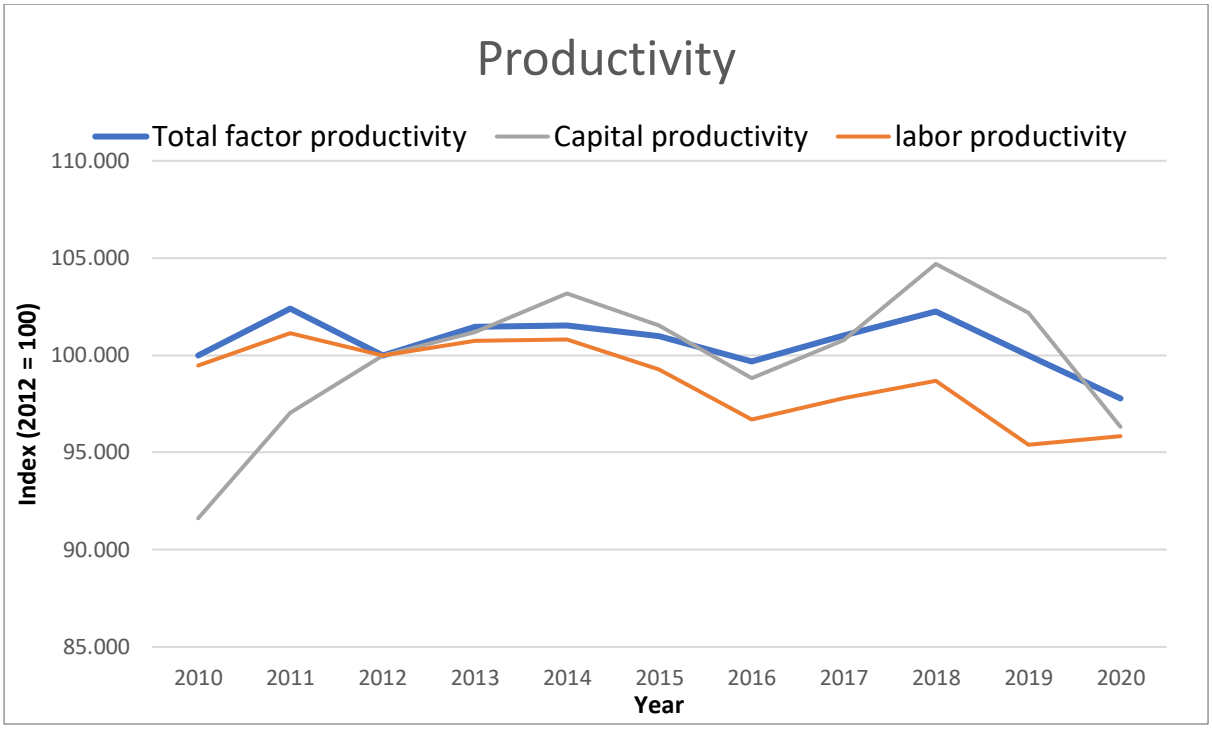

Figure 3.12: Comparison of labor, capital, and total factor productivity in the Automotive industry from 2010-22

3.3.3 Transition from ICE to EV

According to the American Automakers Policy Council (AAPC), the 15 major automakers in the U.S. employ about 388,000 workers. [12] According to the Congressional Research Service (CRS), it is estimated that there are nearly 590,000 employees engaged in motor vehicle parts manufacturing in U.S., out of which nearly one-quarter (150,000) are engaged in manufacturing components for internal combustion powertrains. [13] The impact on auto manufacturing and supplier jobs due to the transition to EV is very hard to determine. While EVs require new or retooled factories, requiring thousands of employees, EVs are said to need 30 percent less labor to produce ICE counterparts. On the other hand, a recent analysis by the Economic Policy Institute (EPI) estimates that auto industry related jobs could rise by 150,000 by 2030 given that battery electric sales reach 50% by 2030 and the vehicle market share of U.S.-assembled vehicles increases from current 50 to 60 percent. [14] According U.S. International Trade Commission (USITC) report, there are 80% fewer moving parts in EVs, making the EVs less complex than ICE vehicles. This suggests that a reduction in workforce would be observed in the automotive manufacturing industry and the related supply chain due to the transition from ICE to EV. [15] This is reflected in Ford's CEO Strategic Update of 2017, where Ford estimated a reduction of 30 percent in labor hours and 50 percent in capital investments per unit for EVs compared to ICEs. [16]

[12] https://www.americanautomakers.org/job-creation
[13] https://crsreports.congress.gov/product/pdf/IF/IF11101
[14] https://www.epi.org/publication/ev-policy-workers/
[15] https://www.usitc.gov/publications/332/executive_briefings/ebot_how_does_increased_ev_production_affect_employment.pdf
[16] http://s22.q4cdn.com/857684434/files/doc_presentations/2017/CEO-Strategic-Update-12.pdf (https://www.americanprogress.org/article/electric-vehicles-win-american-workers/)

4 EV supply chain

The EV supply chain involves several subsystems from a range of industries and NAICS codes. The breakdown of these components is consolidated in Table 4.1 as listed in the Seattle Jobs Initiative (SJI) report for the states of Oregon and Washington.[17]

Table 4.1: EV supply chain components and associated manufacturing NAICS codes

Component	**NAICS code**
Battery Cell	335911-Storage Battery Manufacturing 335912 - Primary Battery Manufacturing (for fuel cell technology)
Battery Management	
Battery Pack	
Battery Charger	335999 - AII Other Miscellaneous Electrical Equipment and Component Manufacturing
Electric Motor	335312 - Motor and Generator Manufacturing
Gearbox	336350 - Motor Vehicle Transmission and Power Train Parts Manufacturing
Power Distribution Module	336320 - Motor Vehicle Electrical and Electronic Equipment Manufacturing
Inverter	334419 - Other Electronic Component Manufacturing
DC/DC Converter	334413 - Semiconductor and Related Device Manufacturing 335999 - All other miscellaneous electrical equipment and component manufacturing
Thermal Management	336390 - Other Motor Vehicle Parts Manufacturing
Connections/Wiring	336390 - Other Motor Vehicle Parts Manufacturing

[17] Amping Up Electric Vehicle Manufacturing in the PNW - OPPORTUNITIES FOR BUSINESS, WORKFORCE, AND EDUCATION

5 Demographic Analysis of ICE and EV sectors

The makeup of the automotive industry workforce in Indiana is discussed in this section. The data for the workforce was sourced from the US Census Bureau, with 4-digit, 5-digit and 6-digit NAICS codes from 3219 to 4413 in relation to manufacturing motor vehicle components as obtained from the Dun and Bradstreet (D&B) datasets. These have been tabulated in the appendix. The analysis of the workforce data enables to assess the changes in the workforce traits over the past decade, and accordingly draw conclusions on the future trends and challenges that will be reshaping the workforce. A juxtaposition of ICE and EV manufacturing trends shows the shifts in the workforce towards a more EV-oriented future.

5.1 ICE sector trends

This section analysis the demographic trends in the ICE sector of auto manufacturing industry. The data for ICE sector is determined based on NAICS codes. The related NAICS codes for the sector are provided in the appendix.

5.1.1 Sex vs Education

Assessing the job growth by education level for females, the growth is observed to be decreasing the most in roles that do not necessitate a high educational requirement (31.14%) by roughly 18.3%. On the contrary, the occupational demand is predicted to grow in the occupations that require a bachelor's degree (17.5%) by nearly 9.7%. The demand for female workers with only an associate degree (29.94%) is predicted to shrink by 4.75%. However, the workers with lesser than high school education is predicted to increase by 37.15%. These observations imply an increase in jobs that require highly skilled workers or very young workers with lower education than high schools who may be underpaid for their jobs. Meanwhile high school and equivalent education blue collar workers would be left out of the workforce whose jobs may be taken over by automation. The associated trends can be seen in Figure 5.1.

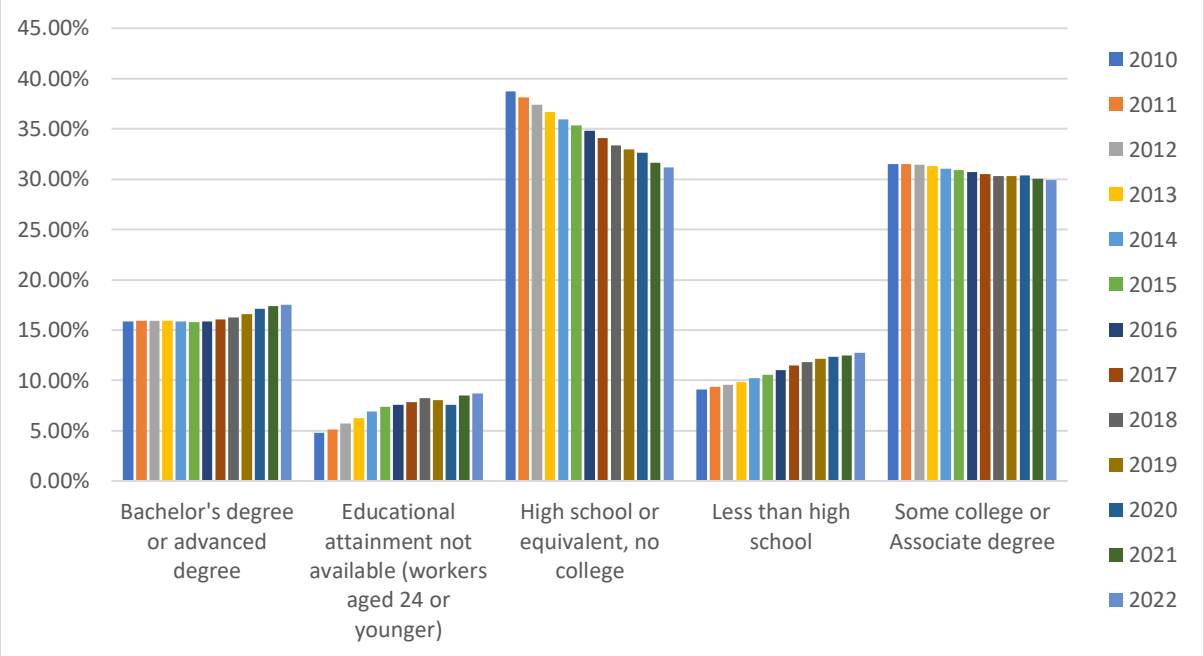

Figure 5.1: Education Distribution for ICE Related Occupations for Females from 2010-2022

The scenario for men shows certain differences. While a low educational attainment (lesser than high school) does account for the largest growing segment (26.54%), there is a decline in the other segments of educational attainment, with demand for male workers with only a high school (8.4%) or associate degree (6.8%) is predicted to contract. The key difference between males and females is the share of population with a bachelor's or advanced degree. For men, having an advanced education does not seem to be a driving factor from a job perspective, inferred from a decline in the share of the male population with an advanced degree (1.62%). Figure 5.2 illustrates these findings.

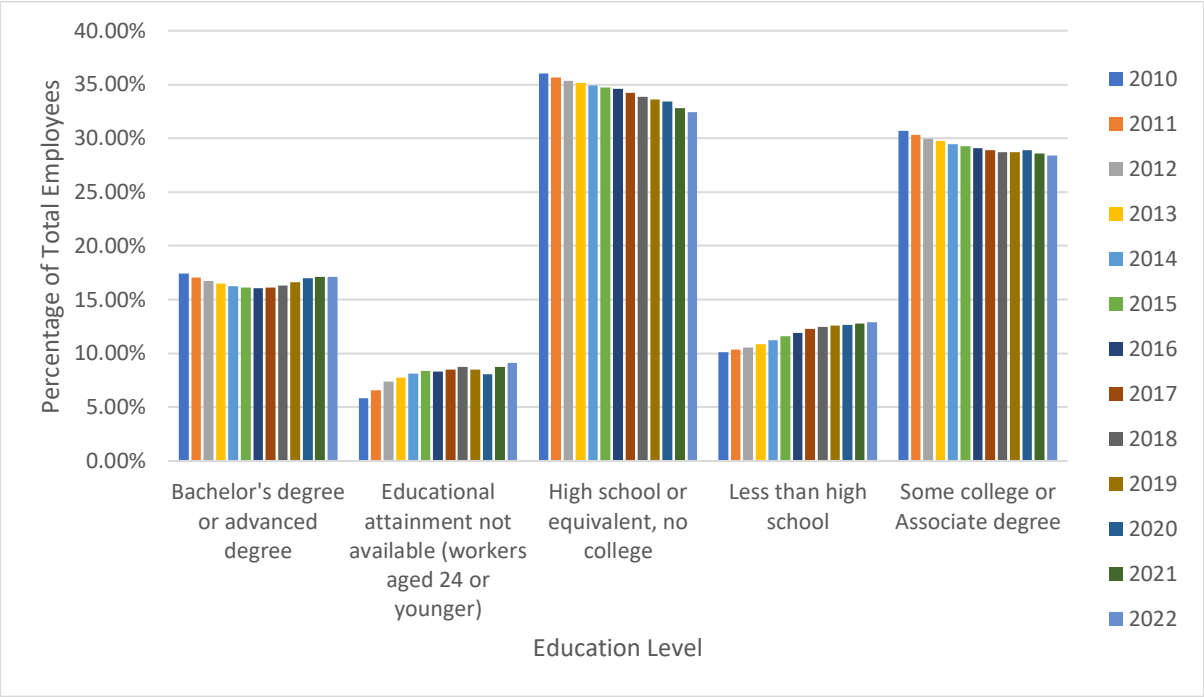

Figure 5.2: Education Distribution for ICE Related Occupations for Males from 2010-2022

5.1.2 Sex vs Age

There are several trends in the worker demographic of the automotive industry in Indiana when it comes to sex and age.

Looking at the age distribution of workers in the ICE related occupations, the greatest share of regional labor force is in the age group of 45-54 for both males and females, indicating a significant concentration of middle-aged population. For females, this age group accounted for 23.91% and in males 22.86% in 2022. This age group is followed by the 25-34 and 35-44 age groups. Figure 5.3 and Figure 5.4 depict these details.

The trends observed from 2010 to 2022 portray a different picture. The share of female workers in the 45-54 and 35-44 age groups have dropped drastically by 24.6% and 11.7% in the past decade. On the other hand, the age group of 25-34 has seen an upward trend, growing by 18.7% suggesting a positive trend in a growing young workforce. This is coupled with a sharp increase in the retirement age population of 55-64 and above 65 years by 11.85% and 53.77% respectively. In conjunction, a drastic rise is observed in the female working population in the age group of 19-24 years has seen a significant rise of 58% indicating lesser educated workers wanting to join the workforce. Figure 5.3 illustrates the associated trends.

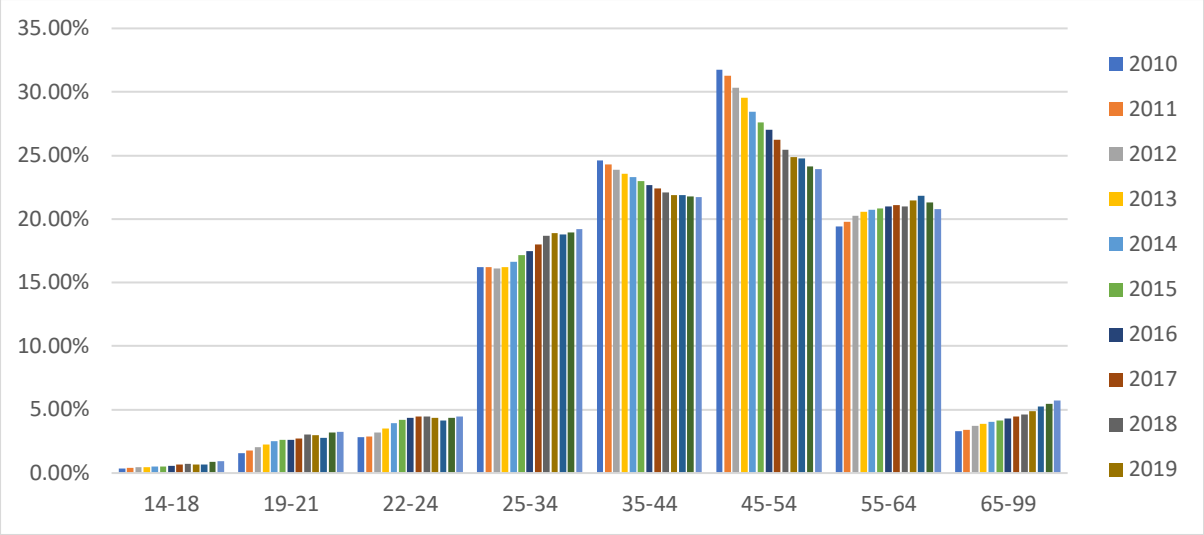

Figure 5.3: Age Group Distribution of ICE Related Occupations for Females from 2010-2022

In the case of male workers in the 25-34 age group, the share has grown by 11.4% in the past decade, a smaller increase as compared to the female worker population. Nonetheless, age groups of 35-44 and 45-54 have seen a decline, their contribution dropping by 13.82% and 20.93% respectively. In accordance with the female workforce, there is a sharp increase in the retirement age population of 55-64 and above 65 years by 8.3% and 92.4% respectively. Figure 5.4 illustrates the associated trends.

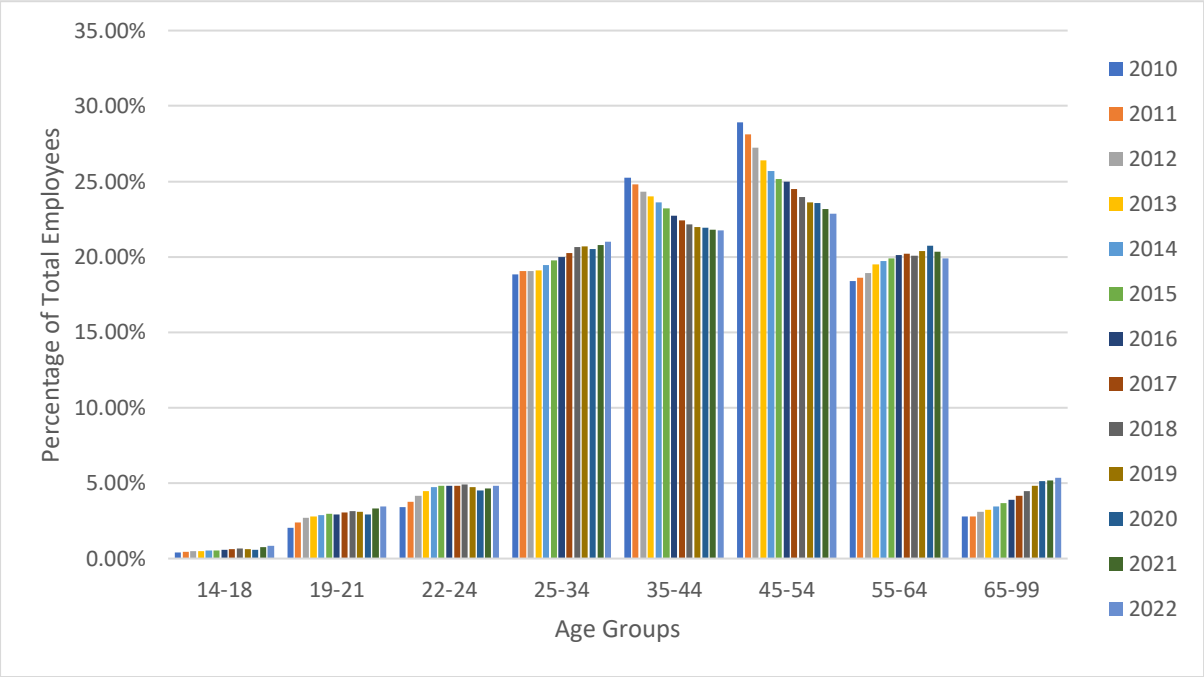

Figure 5.4: Age Group Distribution of ICE Related Occupations for Males from 2010-2022

5.1.3 Race

An overview of the data showed a lack of diversity in the workforce in the ICE automotive segment in Indiana. Figure 5.5 reveals the extent of this scarcity. As per Figure 5.5, in 2022, a staggering 88.08% of the workforce was comprised of white workers alone, more than 3 quarters of the total workforce.

The next largest group is the Black or African American group with an enormous gap of 81% (7.28%) from the largest group. This is followed by Asians (2.62%), mixed race (1.39%), American Indians (0.52%), and native Hawaiians (0.12%).

Although having the highest share, white workers experienced the highest drop of 3.78% in their share in the workforce over the past decade. The second largest group on the other hand witnessed a gain in their share of the workforce, a near 29.54% increase. Asians followed suit, with a 55.2% increase in their share respectively. The largest growth was observed in the mixed-race group with an 83.4% increase in their share. The contribution of American Indians and native Hawaiians also rose significantly, with a 47% and 70% increase respectively.

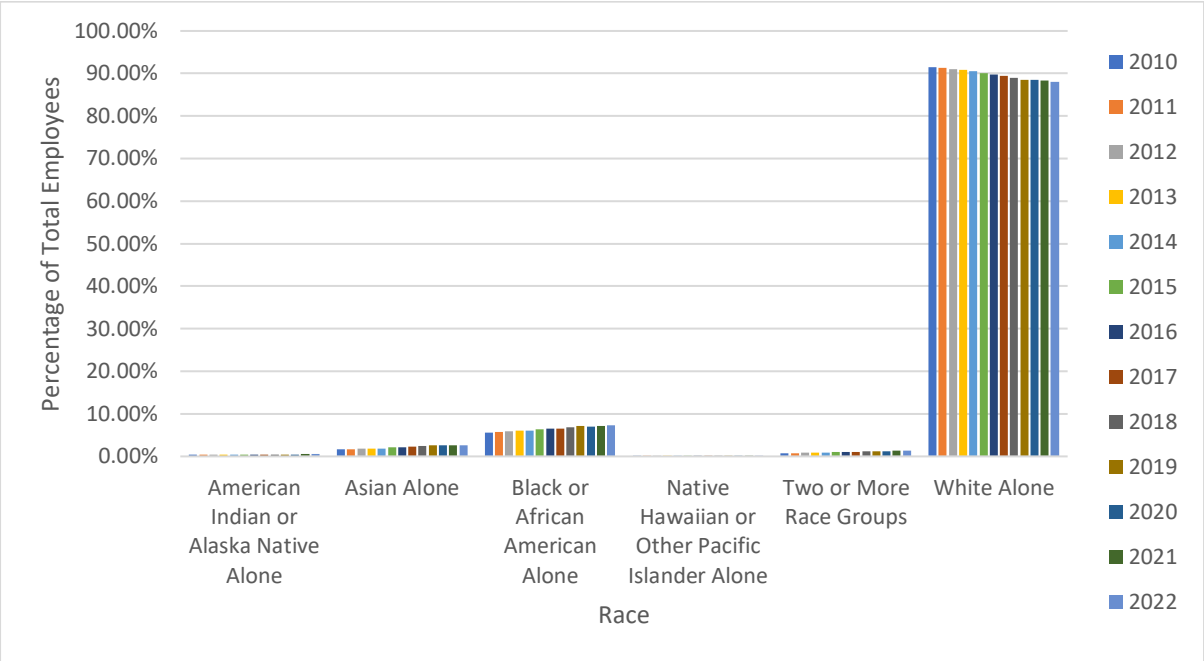

Figure 5.5: Race Distribution of ICE Related Occupations from 2010-2022

5.1.4 Ethnicity

As shown in Figure 5.6, the share of Hispanic or Latino workers has been relatively low at 9.94% in the overall workforce. On an optimistic note, there has been a steady increase of 69.5% in the share of Latino workers since 2010 with the numbers projected to continue rising over the next few years.

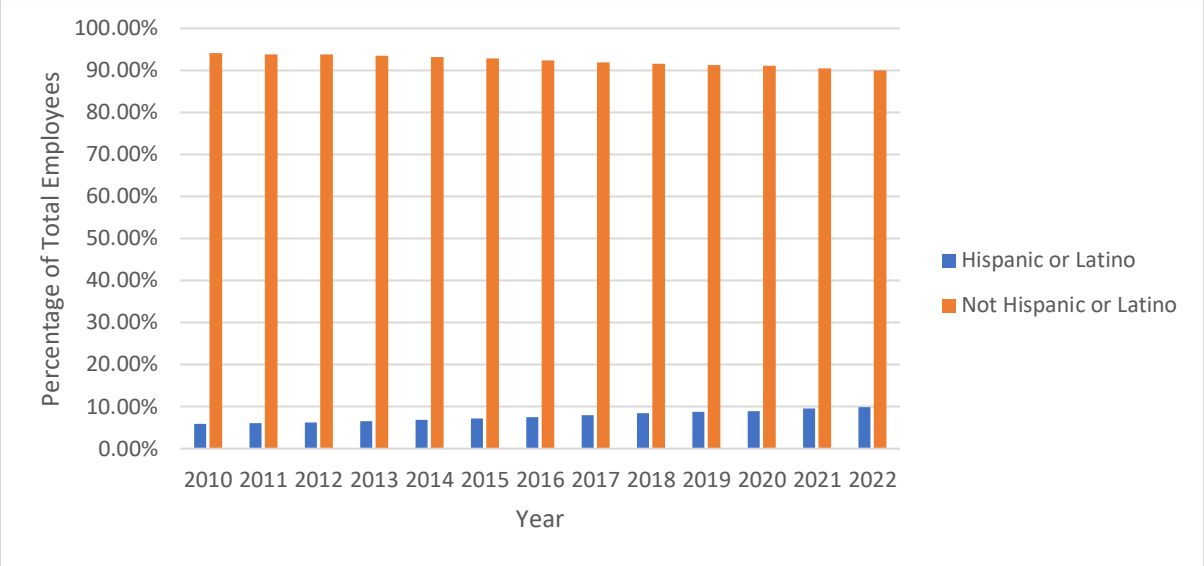

Figure 5.6: Ethnicity Distribution of ICE Related Occupations from 2010-2022

5.2 EV sector trends

This section analysis the demographic trends in the EV sector of auto manufacturing industry. The data for EV sector is determined based on NAICS codes. The related NAICS codes for the sector are provided in the appendix.

5.2.1 Sex vs Education

Figure 5.7 represents the trend of male workers in the EV sector by education. It is evident that the percentage of workers with high school or equivalent education is the highest. Despite contributing highest to the male workforce, this category has seen a decline from 2010 to 2022. A positive trend is observed for workers who have less than high school education and those with bachelors or advanced degrees. This could be attributed to the increased production of EVs and adoption of EVs by major auto companies. The increase in bachelors or advanced degree workers can be attributed to the need for improved technology in the industry sector. The labor force with associate or some college degree has decline from 2010 levels and this could be explained by the labor force advancing their education due to the need for advanced skillsets and the increasing opportunity in the sector.

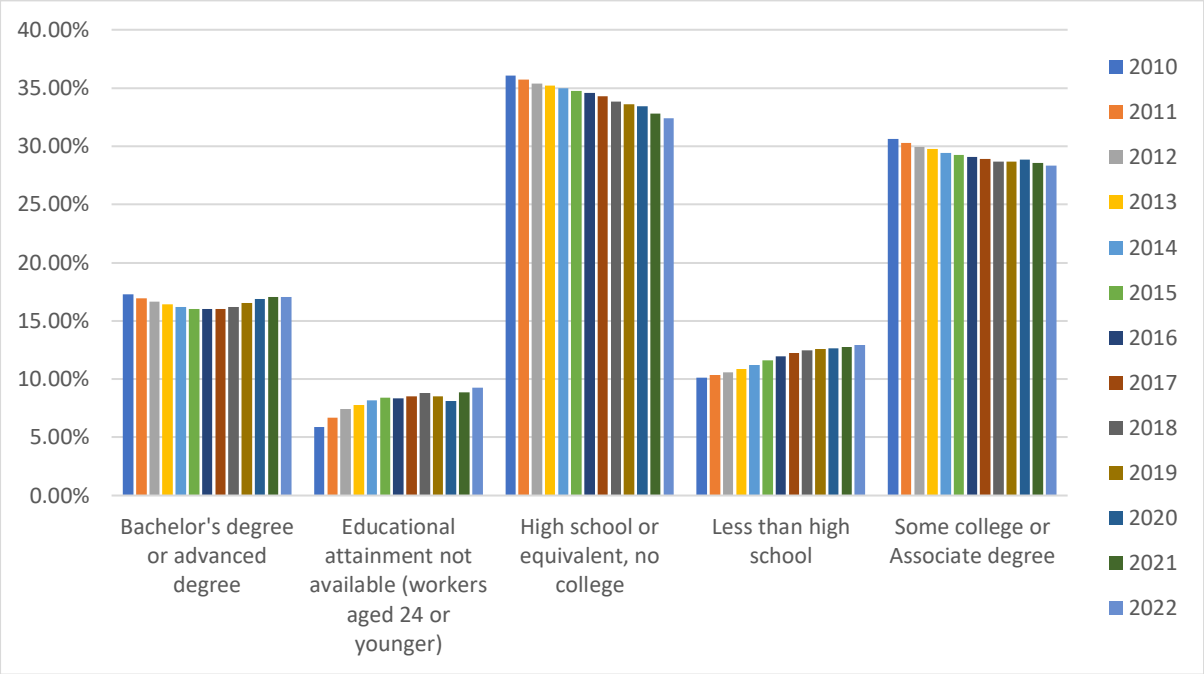

Figure 5.7: Education Distribution for EV Related Occupations for Males from 2010-2022

Figure 5.8 represents the trend of female workers in the EV sector by education. Similar trends are observed for the female workforce as for the male employees, with a decline in percentage of workers with high school or equivalent education and college or associate degree education while an increase in workers with less than high school education and bachelors or advanced degree education. However, the percentage of female workers with bachelors or advanced degrees has increased in 2022 compared to 2010, while the male workforce saw a decline in the middle of the decade but had strong presence in 2010 and now again in 2022. Compared to the male workforce, the decline in female workers with high school or equivalent education is steeper while the decline in female workers with college or associate degree is not as steep as that if male workers.

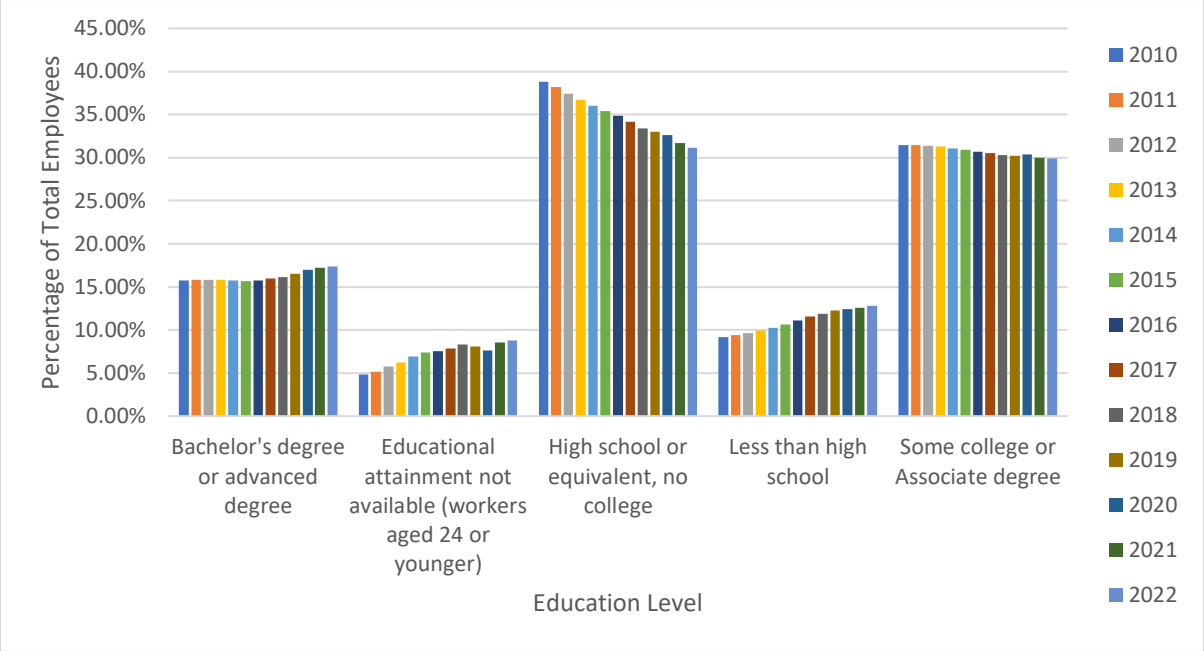

Figure 5.8: Education Distribution for EV Related Occupations for Females from 2010-2022

5.2.2 Sex vs Age

Figure 5.9 represents the age-wise data for males in the EV sector from 2010 to 2022. As seen, there is a steep decline in male workers for the age groups 35-44 and 45-54 while there is a positive trend across all other age groups, especially 14-18 and 65-99. It is evident that the positive trend plateaus for the 19-21, 22-24, 25-34, and 55-64 age groups.

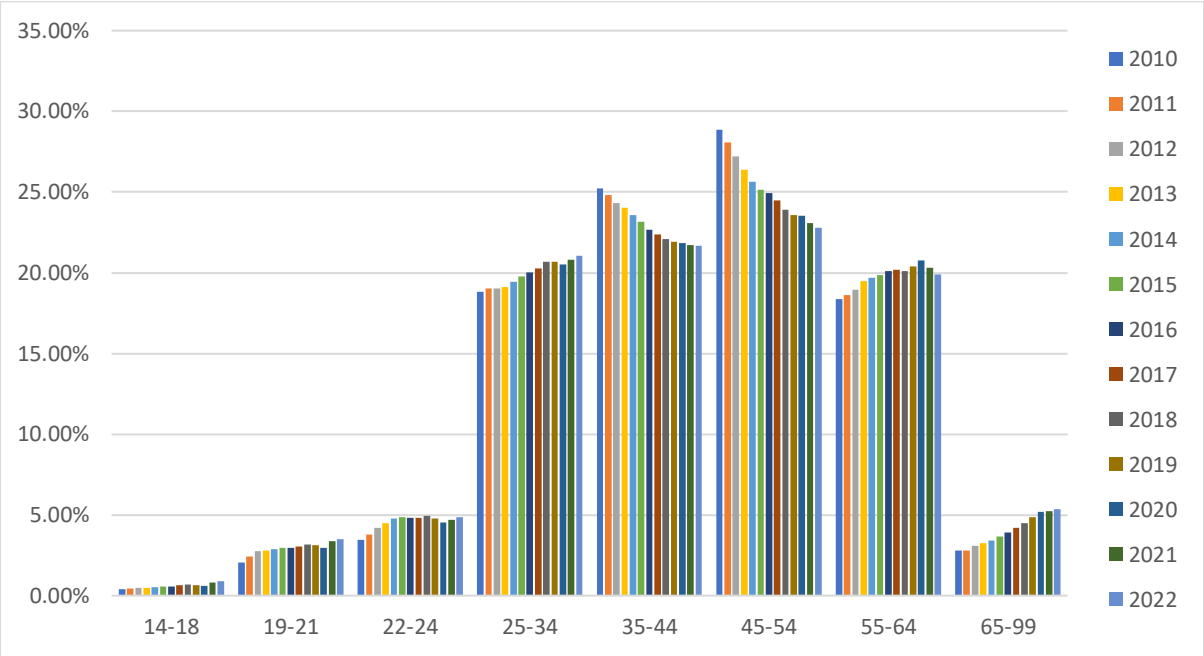

Figure 5.9: Age Group Distribution of EV Related Occupations for Males from 2010-2022

Figure 5.10 represents the age-wise data for female workers in EV sector from 2010 to 2022. A steep decline is observed for female workers in the age groups 35-44 and 45-54, while a positive trend is observed across all other age groups, especially 65-99. The positive trends seem to plateau for age groups 14-18, 19-21, 22-24, 25-34, and 55-64.

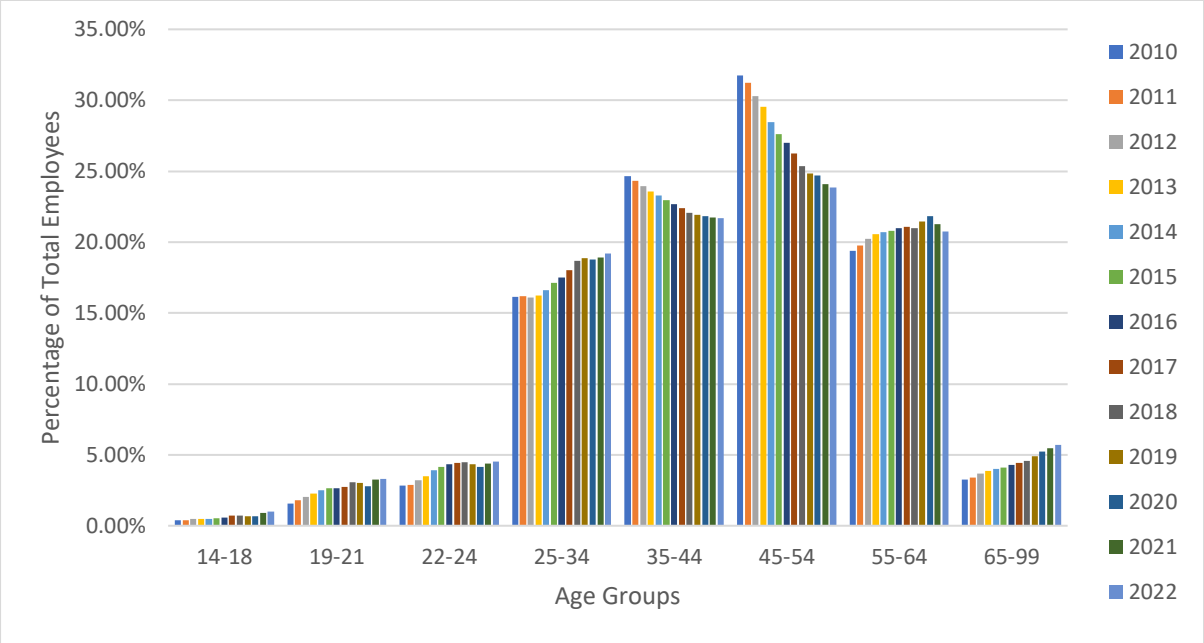

Figure 5.10: Age Group Distribution of EV Related Occupations for Females from 2010-2022

5.2.3 Race

As in the case of ICE vehicle manufacturing, the lack of diversity is evident. As per Figure 5.11, in 2022, a staggering 88.03% of the workforce was comprised of white workers alone, more than 3 quarters of the total workforce. The next largest group is the Black or African American group with an enormous gap of 81% (7.29%) from the largest group. This is followed by Asians (2.64%), mixed race (1.4%), American Indians (0.52%), and native Hawaiians (0.12%). These trends are consistent with the ICE manufacturing sector, indicating a need for improvement in the racial diversity and upliftment of other race groups for EV manufacturing.

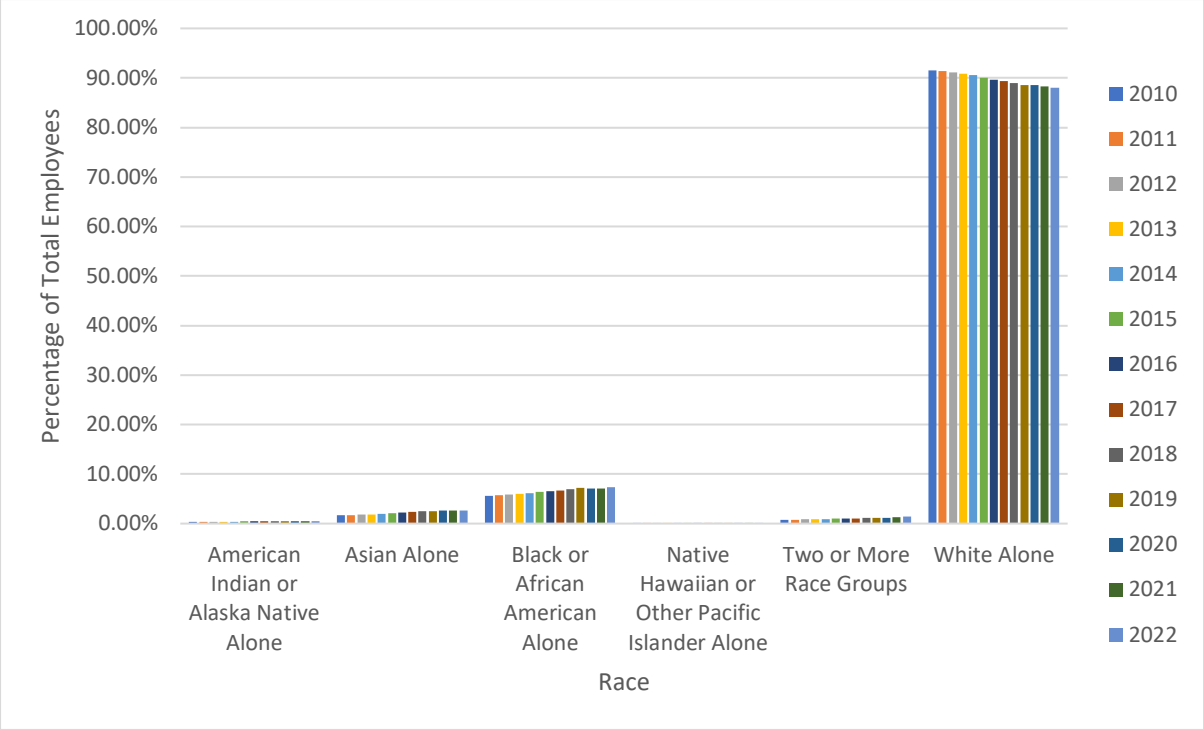

Figure 5.11: Race Distribution of EV Related Occupations from 2010-2022

5.2.4 Ethnicity

As shown in Figure 5.12, the share of Hispanic or Latino workers is significantly less than non-Hispanic or non-Latino. Although, the share has increased from that in 2010 to that in 2022, it is still under 10%. The share of Hispanic or Latino workers has been bleak at 9.89% in the EV workforce as in the case of ICE manufacturing.

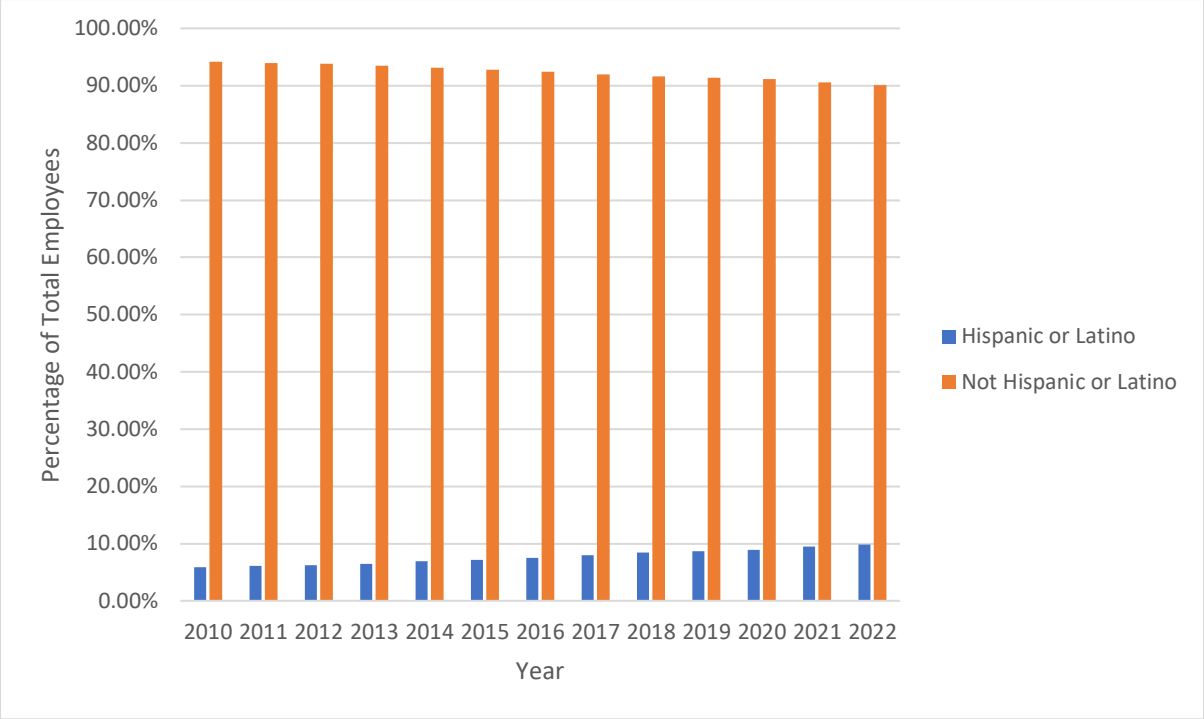

Figure 5.12: Ethnicity Distribution of EV Related Occupations from 2010-2022

Increasing racial and ethnic diversity in ICE (Internal Combustion Engine) and EV (Electric Vehicle) manufacturing in the U.S. and Indiana is important for several reasons. Firstly, a diverse workforce brings a range of perspectives and experiences to the table, which can help to identify and solve problems more effectively. When a company has employees from a variety of backgrounds, they are more likely to consider a broader range of perspectives when making decisions and developing products. Secondly, a more diverse workforce can help to attract and retain a wider range of customers. As the U.S. becomes increasingly diverse, companies that reflect and understand the needs of different communities will be better positioned to succeed. This is particularly relevant in the EV industry, where a diverse customer base is likely to be more interested in vehicles that align with their values and lifestyles. Thirdly, increasing diversity in the manufacturing sector can help to reduce inequalities and improve economic outcomes for underrepresented communities. By providing job opportunities for people from diverse backgrounds, companies can help to create more inclusive and equitable communities.

In Indiana specifically, increasing diversity in the manufacturing sector can help to address longstanding disparities in employment and income. Indiana ranks among the lowest states in the U.S. for African American economic equality, with a persistent wage gap and high rates of poverty. By prioritizing diversity in its manufacturing workforce, Indiana can help to address these disparities and create a more inclusive economy.

Overall, increasing racial and ethnic diversity in ICE and EV manufacturing in the U.S. and Indiana is not just a moral imperative, but also a strategic business decision that can help companies to better serve their customers, solve problems more effectively, and promote economic growth and equity.

6 Appendix

List of NAICS codes for ICE and EV manufacturing

ICE		EV
321991		321991
322211		322211
322219		325211
324199		325510
325211		326150
325510		326199
325520		326211
326122		326220
326130		326291
326140		326299
326150		327910
326191		327999
326199		331110
326211		331210
326220		331222
326291		331315
326299		331318
327910		331420
327999		331491
331110		331492
331210		331511
331221		331523
331222		331524
331315		332111
331318		332117
331410		332119
331420		332216
331491		332311
331492		332312
331511		332313
331512		332321
331513		332322
331523		332323
331524		332420

331529		332439
332111		332510
332112		332613
332117		332618
332119		332710
332216		332722
332311		332811
332312		332812
332313		332813
332321		332912
332322		332913
332323		332999
332410		333111
332420		333112
332431		333120
332439		333131
332510		333242
332613		333249
332618		333318
332710		333413
332721		333414
332722		333514
332811		333515
332812		333517
332813		333519
332911		333611
332912		333613
332913		333618
332919		333914
332991		333922
332999		333924
333111		333992
333112		333994
333120		333995
333131		333999
333132		334111
333242		334118
333243		334290
333249		334310

333318		334413
333413		334416
333414		334417
333415		334418
333511		334419
333514		334513
333515		334515
333517		334519
333519		335210
333611		335312
333612		335313
333613		335314
333618		335911
333912		335921
333914		335931
333921		335932
333922		335999
333923		336111
333924		336112
333991		336120
333992		336211
333993		336212
333994		336213
333995		336214
333997		336310
333999		336320
334111		336330
334112		336340
334118		336350
334290		336360
334310		336370
334413		336390
334416		336412
334417		336991
334418		336992
334419		336999
334511		339991
334513		423610
334514		

334515		
334519		
335110		
335129		
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Electric Vehicle Product Commission