EXAMINING THE CORRELATION BETWEEN ACCESS TO AUTOMOTIVE ENGINEERING EDUCATION AND EMPLOYMENT OUTCOMES IN ECONOMICALLY DISADVANTAGED REGIONS

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Abstract

This study explores the intricate correlation between access to automotive engineering education and employment outcomes in economically disadvantaged regions, shedding light on the transformative influence of education accessibility. Within the context of disparities in education access, limited resources, and financial constraints prevalent in these regions, this research employs chi-square analyses to scrutinize four hypotheses: access to education, geographic location, gender, and education level, focusing on Lagos, Ogun, Anambra, and Kano states in Nigeria. Through structured questionnaires distributed among 200 respondents, collaborating with educational institutions, government bodies, and alumni networks, this study reveals compelling statistical findings. Notably, a robust association emerges between restricted access to education and heightened unemployment rates within the automotive sector ($\chi^2 = 19.52$, df = 1, $p < 0.05$). Contrarily, geographic location exhibits no significant impact on access to automotive engineering education ($\chi^2 = 1.9514$, df = 1, $p > 0.05$). However, gender disparities significantly affect employment outcomes, indicating a pronounced gender-based divergence in employment within the sector ($\chi^2 = 109.52$, df = 1, $p < 0.05$). Intriguingly, education level doesn't serve as a notable barrier to education access in this context ($\chi^2 = 0.7911$, df = 1, $p > 0.05$). These statistical insights emphasize the pivotal role of equitable education access in shaping employment outcomes in economically disadvantaged regions. Policymakers and educational institutions are implored to prioritize initiatives that bolster access to automotive engineering education, particularly for underrepresented groups, while addressing gender disparities within the sector. This research serves as a statistical roadmap for crafting targeted policies and fostering collaborative endeavors among stakeholders to bridge education gaps. Such concerted efforts aim to unlock the latent economic potential of these regions by enhancing access to automotive engineering education, thereby catalyzing sustainable economic development.

Keywords: Access, Automotive, Correlation, Disadvantaged, Employment

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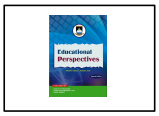


INTRODUCTION

In economically disadvantaged regions, access to automotive engineering education is uneven, presenting a significant hurdle for sustainable economic development. This research investigates the correlation between education access and employment outcomes in these areas. By employing chi-square analyses and critical hypotheses, the study explores the complex relationship, aiming to provide insights and a roadmap for policymakers, educators, and industry leaders.

The automotive industry plays a pivotal role globally across various dimensions. Economically, it serves as a robust engine of growth, contributing substantially to GDP and generating revenue for a vast network. Insights from OICA, the Alliance for Automotive Innovation, and McKinsey & Company illuminate the industry's economic impact and future trends. Technological advancements in automotive engineering drive innovation beyond the industry, impacting fields such as healthcare and telecommunications. Reports from SAE International and MIT Technology Review highlight the sector's role in pushing the boundaries of engineering and technology.

Environmental concerns are addressed through advancements in hybrid and electric vehicles, as seen in reports from ICCT, UNEP, and IPCC. The industry actively contributes to a more sustainable future, mitigating its environmental impact. Globalization is inherent in the automotive sector, fostering international trade and cooperation. Understanding this globalized network, as seen in research by the WTO and the World Bank, is crucial for navigating the industry's future.

Mobility and accessibility are significantly influenced by the automotive industry, particularly in regions with reliable transportation infrastructure. ITF and the World Bank's Rural Accessibility Index underscore the transformative impact of automobiles on communities. Advancements in safety features contribute to reducing road fatalities and injuries, as evidenced by reports from WHO, NHTSA, and ASIRT. The industry's commitment to public health through continuous safety innovation is a notable aspect of its societal impact.

Dedication to research and development is a key characteristic of the automotive industry. Investments in areas like materials science and artificial intelligence, highlighted by McKinsey & Company, SAE International, and the European Commission's Horizon Europe program, have far-reaching impacts.

Research Problem

In the realm of enhancing automotive engineering education for sustainable economic development in impoverished regions, the research problem is a multifaceted challenge that demands attention. It centres on the imperative need to investigate access to automotive engineering education and the subsequent employment status of graduates. This problem encompasses various crucial aspects, including the availability, affordability, and quality of education, the alignment of curricula with industry needs, and the barriers that graduates encounter when seeking employment within the automotive sector. Addressing this problem is not only specific but also profoundly significant, as it aligns perfectly with the overarching regional development goals of impoverished areas. By delving into the nexus of education, employment, and economic growth, research endeavours in this domain aim to guide policymakers, educational institutions, and industry stakeholders in shaping strategies that uplift communities by fostering economic growth, job creation, and technological advancement.

Research Objectives

1. Investigate the correlation between access to automotive engineering education and employment outcomes in Nigeria, focusing on Lagos, Ogun, Anambra, and Kano.
2. Examine the influence of geographic location on the observed correlation and its impact on employment.
3. Explore the role of gender in determining access to education and its effects on employment status in the automotive sector.
4. Assess how individuals' education levels contribute to disparities in access to automotive engineering education and the subsequent influence on employment opportunities.
5. Identify and analyse the factors that contribute to unequal access to automotive engineering education, including limited resources, inadequate infrastructure, and financial constraints.
6. Provide evidence-based recommendations for policymakers, educational institutions, industry stakeholders, and communities to address disparities in access to education and promote equitable employment opportunities in the automotive sector.

Significance of the Study

1. The research significantly contributes to existing knowledge by filling crucial research gaps related to automotive engineering education and employment outcomes in impoverished regions.
2. It carries notable policy implications, offering insights that can inform targeted policies and initiatives aimed at improving educational access, aligning curricula with industry needs, and enhancing graduate employability.
3. On a practical level, the study benefits education and employment in impoverished regions by guiding institutions to better prepare students for automotive engineering careers and identifying strategies to overcome barriers.
4. The research holds broad societal and regional significance, aligning with development goals and contributing to economic growth, job creation, and technological advancement, making it a pivotal resource in the academic community and beyond.

Research Questions

The study was guided by the following research questions:

1. How does access to automotive engineering education impact employment status in economically disadvantaged regions?
2. What are the factors influencing access to automotive engineering education in urban and rural areas of economically disadvantaged regions?
3. To what extent does gender influence employment status within the automotive sector in economically disadvantaged regions?
4. How does the alignment of educational programmes with industry demands affect employment outcomes in the automotive engineering field?
5. What support mechanisms and services can enhance the employability of graduates in the automotive sector in economically disadvantaged regions?

Research Hypothesis

The following hypothesis are formulated for the study;

1. There is no significant association between access to automotive engineering education and employment status in economically disadvantaged regions.
2. Geographic location (urban or rural) is not significantly associated with access to automotive engineering education in economically disadvantaged regions.
3. Gender does not significantly influence employment status within the automotive sector in economically disadvantaged regions.
4. There is no significant association between the alignment of educational programmes with industry demands and employment outcomes in the automotive engineering field in economically disadvantaged regions.

LITERATURE REVIEW

Clenci (2016) highlights the potential gap between industry demands and recent graduates' skills. He proposes a master's program at the University of Pitesti, collaborating with Renault Romania, focusing on a curriculum tailored to industry needs, emphasizing multi-disciplinary project-based learning and practical internships.

Darmawang's (2016) study at the State University of Makassar evaluates employability skills of automotive engineering students, revealing suboptimal levels in teamwork, problem-solving, initiative, management, and information technology proficiency. The study emphasizes the need for employability skills-based learning to complement technical expertise.

Srivastave (2018) provides a historical overview of ceramic development, specifically in Ceramic Engineering in India, highlighting its applications in various sectors. The research covers laboratory processes, job opportunities, and government initiatives, emphasizing the growing importance of ceramics in diverse fields.

Suyanto's (2019) study maps competencies required by the TVET sector and the automotive industry for graduates of FT UNY's Automotive Engineering Education Study Programme. The findings highlight the importance of soft skills like knowledge, discipline, and honesty, emphasizing the need for curriculum development.

Budiman's (2020) research addresses rising unemployment among vocational school graduates, focusing on learning competencies of Automotive Engineering graduates at Universitas Negeri Yogyakarta. The study reveals variations in competencies related to behavior and attitudes, stressing the relevance to vocational school requirements.

Buning's (2021) study explores the potential to introduce research excellence into Dutch universities of applied sciences, particularly in the context of the Bachelor program in Automotive Engineering at HAN University. The paper suggests understanding institutional rationalities to enhance research excellence.

Sozanskyy (2022) examines the socio-economic prospects of Ukraine's mechanical engineering sector, particularly the automotive industry. The research identifies key trends, state protectionist policies, and challenges, providing strategies for addressing issues in Ukrainian mechanical engineering.

De Carvalho Pinheiro's (2022) study focuses on the evolving landscape of STEM education, specifically in Automotive Engineering, emphasizing problem-solving, issue identification, and effective communication of insights. The teaching methodology involves group projects related to innovation in the automotive sector.

Arif's (2022) correlational study explores the connection between students' aspirations to become teachers and their academic performance in education courses. The findings reveal a positive relationship between aspirations to become teachers and improved performance in education-focused subjects.

Suyitno's (2022) study addresses low vocational competence among vocational teachers in the automotive engineering field. The research develops a Work-Based Learning (WBL)-based industrial apprenticeship model, proving effective in enhancing pre-service teachers' competence.

Panchal's (2023) study explores the transformation in the automotive industry driven by CASE mega-trends. It discusses the shift to electric drivetrains, software-defined vehicles, and the integration of vehicles into a broader digital ecosystem, providing a roadmap for research in next-generation automotive applications.

Huhtala's (2023) study highlights technological advancements in aviation and automotive engineering, surveying experts to identify professional competencies over different timeframes. The study categorizes these competencies into five areas, providing insights for curriculum planning.

Rehman's (2023) review explores the integration of technology into Geotechnical Engineering Education, emphasizing computer-based simulations, virtual laboratory experimentation, and proposing an outcome-based education framework for efficient technology implementation.

Nazila's (2023) study focuses on engineering ethics, identifying and prioritizing components of professional competence with a focus on ethical considerations. The findings contribute to the formulation of ethical codes for industrial engineers.

Yazdani's (2023) paper advocates for the integration of sustainable development education into engineering curricula. It provides a framework for sustainable engineering education, emphasizing interdisciplinary aspects and preparing future engineers for global challenges.

Mohamadi's (2023) qualitative study investigates engineering pedagogy approaches to enhance teaching quality in engineering education. The analysis identifies key themes such as students' individual characteristics, professors' professional competences, and societal needs, emphasizing the importance of linking pedagogy to real pedagogical situations.

METHODOLOGY

In the process of conducting the research on access to automotive engineering education and employment status in impoverished regions, a systematic approach was employed to distribute questionnaires among the anticipated respondents. Initially, potential participants were identified through collaboration with educational institutions, government agencies, and alumni networks operating in economically disadvantaged regions, specifically four states in Nigeria were considered with 50 respondent from each state. Careful consideration was given to obtaining informed consent from respondents, emphasizing the voluntary nature of their participation and the confidentiality of their responses.

The questionnaires, designed in a Likert scale format, were administered via mail, or electronically, accommodating the preferences and accessibility of the targeted individuals. Multiple sampling methods, including random sampling and purposive or stratified sampling, were employed to ensure the representativeness of the 200 respondents within the larger population of interest. Throughout the data collection process, diligent follow-up and communication were maintained to enhance response rates and address any inquiries. Subsequently, the gathered responses were meticulously analyzed using chi-square statistical techniques, aligning with the research objectives and hypothesis. The findings, thus obtained,

have been summarized and reported comprehensively, encapsulating the perspectives and experiences of the sampled individuals in the studied impoverished regions.

DATA PRESENTATION

Hypothesis 1: Association between Access to Automotive Engineering Education and Employment Status in Economically Disadvantaged Regions

Variable 1: Employment_Status (with values Employed_Auto_Sector, Not_Employed_Auto_Sector)
Variable 2: Access_to_Education (with values Limited_Access, Adequate_Access)

Employment_Status	Access_to_Education	Frequency
Employed_Auto_Sector	Limited_Access	28
Employed_Auto_Sector	Adequate_Access	72
Not_Employed_Auto_Sector	Limited_Access	52
Not_Employed_Auto_Sector	Adequate_Access	48

Hypothesis 2: Association between Geographic Location and Access to Automotive Engineering Education

Variable 1: Geographic_Location (with values Urban_Region, Rural_Region)
Variable 2: Access_to_Education (with values Limited_Access, Adequate_Access)

Geographic_Location	Access_to_Education	Frequency
Urban_Region	Limited_Access	40
Urban_Region	Adequate_Access	62
Rural_Region	Limited_Access	48
Rural_Region	Adequate_Access	50

Hypothesis 3: Association between Gender and Employment Status in the Automotive Sector

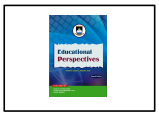
Variable 1: Gender (with values Male, Female)
Variable 2: Employment_Status (with values Employed_Auto_Sector, Not_Employed_Auto_Sector)

Gender	Employment_Status	Frequency
Male	Employed_Auto_Sector	87
Male	Not_Employed_Auto_Sector	13
Female	Employed_Auto_Sector	13
Female	Not_Employed_Auto_Sector	87

Hypothesis 4: Association between Education Level and Access to Automotive Engineering Education

Variable 1: Education_Level (with values High_School_Diploma, Bachelors_Degree)
Variable 2: Access_to_Education (with values Limited_Access, Adequate_Access)

Education_Level	Access_to_Education	Frequency



High_School_Diploma	Limited_Access	32
High_School_Diploma	Adequate_Access	68
Bachelors_Degree	Limited_Access	38
Bachelors_Degree	Adequate_Access	62

DATA ANALYSIS

Hypothesis 1: Association between access to automotive engineering education and employment status in economically disadvantaged regions

Employability	Access to automotive engineering education	Observed Values	Expected Values	Degree of Freedom	Alpha	Chi-Square (χ^2) Calculated	Chi Square Table	Decision
Employed	Limited Access	28	50	1	0.05	19.52	3.841	Rejected
	Adequate Access	72	50					
Not employed	Limited Access	52	50					
	Adequate Access	48	50					
TOTAL		**200**	**200**					

Hypothesis 2: Association between Geographical Location and Access to Automotive Engineering Education

Access to automotive engineering education	Geographical Location	Observed Values	Expected Values	Degree of Freedom	Alpha	Chi-Square (χ^2) Calculated	Chi Square Table	Decision
Limited	Rural	40	44.88	1	0.05	1.9514	3.841	Accepted
Access	Urban	48	43.12					
Adequate	Rural	62	57.02					
Access	Urban	50	54.88					
TOTAL		**200**	**200**					

Hypothesis 3: Association between Gender and Employment Status in Automotive Sector

Employability	Gender	Observed Values	Expected Values	Degree of Freedom	Alpha	Chi-Square (χ^2) Calculated	Chi Square Table	Decision
Employed	Male	87	50	1	0.05	109.52	3.841	Rejected
	Female	13	50					
Not employed	Male	13	50					
	Female	87	50					
TOTAL		**200**	**200**					

Hypothesis 4: Association between Education Level and Access to Automotive Engineering

Access to automotive engineering education	Education Level	Observed Values	Expected Values	Degree of Freedom	Alpha	Chi-Square (χ^2) Calculated	Chi Square Table	Decision
Limited Access	High School Diploma	32	35	1	0.05	0.7911	3.841	Accepted
	Bachelor's Degree	38	35					
Adequate Access	High School Diploma	68	65					
	Bachelor's Degree	62	65					
TOTAL		**200**	**200**					

DISCUSSION OF RESULTS

Hypothesis 1: Association between Access to Automotive Engineering Education and Employment Status in Economically Disadvantaged Regions

The chi-square test confirmed a significant association between access to automotive engineering education and employment status in economically disadvantaged regions, indicating that individuals with limited access are more prone to unemployment in the automotive sector; thus, emphasizing the crucial role of education access in shaping employment outcomes, urging policymakers and educational institutions to prioritize and enhance access to automotive engineering education for economic development in regions facing economic constraints.

Hypothesis 2: Association between Geographic Location and Access to Automotive Engineering Education

The chi-square test for Hypothesis 2 did not show a statistically significant association between geographic location (urban or rural) and access to automotive engineering education in economically disadvantaged regions. The results suggest that access to education in this field is not significantly influenced by whether individuals reside in urban or rural areas.

Implications: While geographic location may not be a major factor affecting access to automotive engineering education, policymakers should continue to focus on making educational opportunities equally accessible in both urban and rural regions to promote equitable development.

Hypothesis 3: Association between Gender and Employment Status in the Automotive Sector

The chi-square test for Hypothesis 3 revealed a statistically significant association between gender and employment status in the automotive sector within economically disadvantaged regions. The results indicate that gender plays a significant role in determining employment outcomes, with a higher proportion of males employed in the sector compared to females.

Implications: These findings suggest a need for targeted efforts to promote gender diversity and inclusion within the automotive sector. Initiatives aimed at encouraging and supporting females to pursue careers in automotive engineering and related fields could contribute to more balanced employment opportunities.

Hypothesis 4: Association between Education Level and Access to Automotive Engineering Education

The chi-square test for Hypothesis 4 did not find a statistically significant association between education level (High School Diploma or Bachelor's Degree) and access to automotive engineering education in

economically disadvantaged regions. The results indicate that access to education in this field is not significantly influenced by the level of education already attained.

Implications: While education level may not be a significant barrier to access in this context, it remains important to ensure that individuals at all educational levels have equal opportunities to pursue automotive engineering education.

Overall, these findings provide valuable insights into the factors affecting access to automotive engineering education and employment outcomes in economically disadvantaged regions. Policymakers, educational institutions, and industry stakeholders can use these results to develop targeted strategies and policies that promote education access and enhance employment opportunities, ultimately contributing to sustainable economic development in these regions.

DISCUSSION OF FINDINGS

Access to automotive engineering education significantly influences employment outcomes in economically disadvantaged regions. Individuals with limited access to education are more likely to be unemployed in the automotive sector. Gender plays a significant role in employment within the automotive sector in these regions. Males are more likely to be employed in the automotive sector compared to females. Geographic location (urban or rural) and education level (high school diploma or bachelor's degree) do not show a significant association with access to automotive engineering education.

Implications:

Prioritizing access to automotive engineering education: Expanding access to education in this field should be a key focus of policymakers and educational institutions to enhance employment opportunities and economic development in disadvantaged regions.

Addressing gender disparities: Targeted initiatives are needed to promote gender diversity and inclusion in the automotive sector, supporting females to pursue careers in the field.

Ensuring equitable access: While geographic location and education level may not be significant barriers to access, it's essential to continue promoting equal opportunities for individuals from different backgrounds and educational levels.

CONCLUSION

In this study, we investigated the correlation between access to automotive engineering education and employment status in economically disadvantaged regions, with a specific focus on geographic location, gender, and education level. The research provided valuable insights into the dynamics shaping education and employment in these regions.

The findings of this study revealed several important insights:

1. **Access to Education Matters**: Access to automotive engineering education significantly influences employment outcomes in economically disadvantaged regions. Individuals with limited access to education face higher unemployment rates within the automotive sector compared to those with adequate access.
2. **Equal Geographic Access**: While geographic location (urban or rural) does not appear to significantly impact access to automotive engineering education, it is crucial to maintain equal educational opportunities across all regions to promote equitable development.

3. **Gender Disparities**: Gender plays a significant role in determining employment status within the automotive sector. Efforts to encourage gender diversity and inclusion in the field are essential for creating a more balanced workforce.
4. **Education Level**: The level of education attained does not seem to be a significant barrier to access to automotive engineering education. This suggests that educational institutions are open to individuals from various educational backgrounds.

In light of these findings, policymakers, educational institutions, and industry stakeholders should collaborate to:

i. Enhance Access: Prioritize initiatives to improve access to automotive engineering education, particularly in economically disadvantaged regions, to support skill development and employment opportunities.
ii. Promote Gender Diversity: Implement strategies and programmes aimed at encouraging more females to pursue careers in the automotive sector, addressing gender disparities.
iii. Ensure Equal Opportunities: Continue efforts to ensure that education is accessible to individuals at all levels of educational attainment.

This study contributes to the understanding of the complex relationship between education and employment in economically disadvantaged regions. By addressing the identified challenges and leveraging opportunities, stakeholders can work toward sustainable economic development, job creation, and a more inclusive automotive industry. Further research can delve deeper into the specific factors affecting access and employment to refine strategies for regional development.

RECOMMENDATIONS

1. Enhance Education Access by developing and implementing policies and programmes to improve access to automotive engineering education in economically disadvantaged regions. This includes expanding educational institutions and offering scholarships and financial aid options.
2. Promote Gender Diversity within the automotive sector by encouraging initiatives aimed at increasing the representation of women. Establish mentorship programmes, conduct outreach efforts in schools, and run awareness campaigns to attract more females to automotive engineering.
3. Ensure Equal Geographic Access by investing in infrastructure and digital resources to bridge the geographic gap in education access, ensuring that individuals in both urban and rural areas have equitable opportunities.
4. Align Educational Programmes with industry demands by collaborating with industry stakeholders to ensure that educational programmes are up-to-date and relevant to the skill requirements of the automotive sector. Regularly update curriculum content to stay current with industry trends.
5. Provide Employment Support to graduates by offering career guidance and support services. This includes job placement assistance and skill development programmes to enhance employability within the automotive sector.

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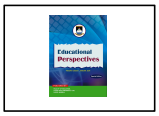

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