

## MANAGING UAE SUPPLY CHAIN CARBON FOOTPRINT: SUSTAINABILITY AND CLIMATE CHANGE MITIGATION STRATEGIES

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**Abstract:** This research introduces new methods to measure UAE supply chains' carbon footprints to identify sustainability initiatives to mitigate climate change. It finds opportunities for improvement and provides actionable insights to promote environmental sustainability via thorough analysis, and tries to understand how carbon emissions hurt ecosystems and how to remedy them and determines carbon-emitting industries. Corporations emit the most carbon due to inadequate supply networks. Corporate social responsibility is crucial to customer trust and global norms in modern organizations. Environment protection and carbon emission reduction rules are crucial in the UAE, which wants to be a business powerhouse. Quantitative research is cross-sectional because numbers better explain the situation. Some data was obtained for this study. A simple random sampling technique was utilized to obtain data from 90 UAE supply chain workers. Demographic descriptive information and firm carbon emission data were used. The knowledge helped respondents identify eco-friendly corporate practices. Education is essential to convincing businesses and consumers of their environmental responsibility. The survey results demonstrate that young people are more aware and can boost CSR in the sector. The findings showed that younger and more educated individuals were more hopeful about carbon and environmental issues. Education and awareness campaigns are needed to promote sustainable behaviour and reduce carbon footprints.

**Keywords:** Carbon Footprint, Supply Chains, UAE, Climate Change, Sustainability, Management, Climate Change Mitigation

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### Introduction

CSR will alter operations and supply chains. A company's social responsibility extends beyond international norms to encompass new and better practices. Businesses with sustainability measures are more likely to gain customers. Supply chains now emphasize carbon emissions reduction, risk mitigation, service level improvements, and value creation above network optimization, profit maximization, and cost-effectiveness. Multinationals require a supply chain plan. Managers benefit from modeling, planning, analytics and network reconfiguration frameworks (Arioglu et al., 2018). This finding has major implications given the worldwide

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carbon emissions dilemma. According to experts, a low-carbon supply chain reduces carbon emissions and makes supply chain management eco-friendly. This study proposes theoretical guidelines for an eco-friendly supply chain management framework to better comprehend the problem. The university has promoted awareness and encouraged personal responsibility to reduce campus energy usage; however, these measures need to be altered to successfully address the issue, noting the necessity to quantify the AUS campus's CF. This research suggests Australian and worldwide carbon emission reduction initiatives (Balasubramanian and Shukla, 2018). After reviewing the company's structural improvements to decrease carbon emissions, supply chain practitioners discuss sustainable growth, carbon accounting, and logistics management. The low-carbon supply chain's growth, trends, and hot spots are shown. Over the last two decades, UAE construction has grown rapidly and garnered tremendous profits. Thus, the government and environmental authorities tackled the nation's carbon footprint (Balasubramanian and Shukla, 2017). Only climate change and pollution have garnered attention in the 21st century. Recent studies relate fixed and mobile carbon emissions to climate change and increasing sea levels (Balasubramanian and Shukla, 2018). Monitoring, evaluating, and decreasing industrial carbon emissions and one's carbon footprint is important. The construction industry is vital for sustainability in the UAE, where the building sector has grown 10–12% annually and contributed to environmental degradation. 2010 UAE building projects were valued at \$958 billion, up 9.6% from 2010 to 2014.

The quantification of the lifetime carbon emissions associated with an activity or product plays a crucial role in assisting policymakers in identifying environmentally sustainable strategies for enhancing economic growth, as highlighted by Al-Dabbagh (2019). Scholars have extensively examined the harmful effects of carbon footprints and CO<sub>2</sub> emissions (Khan, Ajmal, Gunasekaran, and Almarzouqi, 2021). Its slow buildup has boosted global average temperatures, hurting all life. Governments worldwide have greenhouse gas inventories to detect and quantify GHG emissions according to IPC 1996 recommendations (El et al., 2021). Policy actions and structure vary by city, firm, and product. The carbon footprint is necessary to calculate direct and indirect GHG emissions (Samara et al., 2022). The major research purpose of this study is

-Ro1: Understand carbon emissions' negative effects on ecosystems and how to mitigate them.

-Ro2: Analyses UAE supply networks' carbon footprints and suggests climate change mitigation.

-Ro3: Distinguish through previous studies on how to evaluate carbon emission-reduction strategies.

-Ro4: Analyzes and identifies management techniques that might significantly reduce UAE supply networks' carbon impact.

-Ro5: Examines how efficient management methods affect the long-term profitability and performance of UAE supply chain operations, particularly in terms of sustainability and climate change mitigation.

Having established the central research objectives, the research questions can be defined as follows:

- Q1. Would it be beneficial to enforce a need for the industrial sector to adhere to international standards to significantly reduce carbon emissions?
- Q2. How might using renewable energy contribute to facilitating sustainable economic growth in the long run?
- Q3. In the context of sustainability and climate change, what is the significance of the United Arab Emirates' supply chains?
- Q4. How can effective management strategies be employed to reduce the carbon footprint of supply chains in the UAE?
- Q5. What managerial approaches are most conducive to enhancing sustainability and climate change mitigation within UAE supply chain operations?

In terms of research contribution, this study is particularly important in the context of rising global temperatures and difficult living conditions considered an aftereffect of the unplanned Industrial Revolution. This trend has grown so rapidly that most countries have switched from agriculture-centric to industry-centric countries (Laurent and Hauschild, 2019). Policies and measures at all levels are needed to have workable plans for reducing carbon emissions and product costs. Natural resources and raw materials are fundamental to attaining sustainable growth. Therefore, the utilization of these resources must be appropriate to achieve maximum growth without damaging the environment. This study intends to assist supply chain practitioners with improving logistics management, carbon accounting, and efficiency (Creutzig and Seto, 2019). Also, it is important to suggest structural changes, and the study integrates a visual analysis of the low carbon supply chain, growth, and hot spots in it. In this research, the author has covered the implications of carbon emissions in different departments and sectors, followed by the government's approach to coping with the challenge. Hence, the study is diverse and essential to address every possible cause of carbon footprint. According to Ryciuk's research (2022), both forms of governance improve supply chain operating efficiency, benefiting buyers and providers. Ambidextrous governance also supports suppliers' perceptions of these traits' interconnection, adding to supply chain management scholarship. In addition, awareness programs will not be effective until the complete knowledge of this process is spread. Thus, the study endeavours to closely examine the contribution of all the sectors in increasing carbon concentration. Nowadays, businesses should be modified to use clean energy and produce more affordable and eco-friendly commodities. Considering this demand, the research study is important to pinpoint strategies for the sake of the environment and benefit the firms in business profitability (Chonnikarn (Fern) Jira and Toffel, 2018).

### **Literature Review**

Technology-driven businesses have been substantially redesigned. Thus, all businesses must employ renewable and clean energy to generate cheaper, more

flexible, and dependable goods. Businesses may attain these new goals with proper tactics. Green energy sources may help organizations avoid asset waste and acquire a competitive advantage. Swierczek, A. (2019) underscores the significance of modern technology adoption and effective top-level leadership in enhancing supply chain resilience, offering valuable insights for advancing supply chain management practices and serving as a foundational framework for future research and practical implementation. UAE is determined to become an international commercial center and has started implementing measures. They proposed six service supply chain dimensions: reducing resource demands, green computing, minimizing loss risks, establishing green infrastructures, and monitoring utilities. Understanding greenness indicators may help fill gaps in the literature and promote green service supply chains in the UAE. Krzymowski (2020) analysed UAE's roles as civilian and soft power actors, focusing on their pursuit of the United Nations' 2030 Agenda's Sustainable Development Goals. The study examines the impact of these stakeholders on international relations and underscores the significance of their objectives in tackling global challenges, such as climate change. The nation considers all possible possibilities to adapt to new commercial realities and expand. UAE industrial and service organizations seek innovative approaches to boost productivity and reduce resource waste to study and apply the green phenomenon (Ghazaleh et al., 2019). The research of Ginevičius highlights the link between economic growth and municipal trash management efficacy. The study shows that nations with higher economic growth create more municipal garbage yet have better ecological efficiency. This new clean energy idea must be widely presented to the industry. Some companies use green energy and adopt worldwide sustainability standards as their popularity grows (Dalalah and Alkhouli, 2022). Pakurár et al. (year) found a strong correlation between green practices and performance, compared to cooperation and innovation, demonstrating the interconnectedness of supply chain management factors and the significant impact of green practices on performance. The industrial sector has generated unprecedented global warming and irreparable environmental destruction, causing worldwide natural disasters and food shortages. Water levels are rising rapidly, and supplies are limited. Sustainability practices and sustainability drive modern manufacturing facility structure and management globally. Environmental uncertainty—economic, regulatory, and competitive—affects Customer Relationship Management (CRM) strategies and marketing success, according to Fatmawat and Siriyota (2022 through an intricate process that shapes organizations' responses to external situations. Strategic steps are needed to reduce carbon footprint. Green or Carbon-efficient Supply Chains are necessary to manage supply change, including material sourcing, design, production, and delivery, while maintaining industrial symbiosis (Strielkowski et al., 2021; Alsmairat and Aldakhil, 2022). Carbon's efficient supply chain boosts productivity and synergy among company owners and executives. This improves environmental health, company performance, expenses, and resource use (Dalalah and Alkhouli, 2022). Recent global warming

debates have prompted corporate leaders to rethink their strategies. Unlike a few years before, a tremendous transformation has occurred in recent years. Climate change—a direct result of global warming—affects communities, businesses, habitats, and human existence in numerous ways (Stern Review, 2006). Businesses are increasingly forced to operate in unfavorable and dangerous contexts where institutional and stakeholder viewpoints are crucial to understanding strategic sustainability actions (AL-Shboul and Alsmairat, 2023; Rezaee, 2018). Business is affected by three categories of climate change risks: value chain, fundamental operations, and large-scale infrastructural and economic developments. Jovovoi et al. (2017) explore the economic and social impacts of virtual firms, which are temporary partnerships of enterprises to suit market demands. The study also provides virtual enterprise network optimization tools. Sustainable development requires economic, environmental, and social dimensions, and it proposes tools to facilitate regional development pathways and trade-off analysis among these dimensions to meet broader economic and social goals while mitigating environmental impact, focusing on the institutional component's role in balancing these concerns.

Policies to mitigate climate change might potentially impact corporate operations indirectly. Climate change threatens supply chain continuity (Saleh and Zaabi, 2019). The severity of previous disasters shows that harsh weather exposes supply chain systems. Climate change is serious and will impact supply chain management. Unfriendly weather might damage the firm's production capability and push it to implement new programs (Bibri et al., 2020). Due to harsh weather, the midterm schedule and program preparation must be changed. Climate change affected supply chains (Stoknes and Rockström, 2018). Carbon emissions from industry cause global warming (Dalalah and Alkhouli, 2022).

Climate change has prompted global efforts to cut carbon emissions and promote sustainability. In the UAE, where numerous businesses have grown, supply chain carbon emissions are important. To mitigate climate change, this literature review examines UAE research on carbon emissions, supply networks, and sustainability. Carbon emissions destroy ecosystems: Carbon emissions, especially CO<sub>2</sub>, accelerate climate change, say experts. Ecosystems suffer from these emissions' higher global temperatures, changing weather patterns, and glacier melting. To counteract these consequences, the Intergovernmental Panel on Climate Change (IPCC) conclusions emphasize the necessity for carbon reduction efforts. The UAE is prone to climate change consequences, including rising sea levels and excessive heat due to its position. Many methods to create carbon emissions are worsening the global climate catastrophe. Oil and gas, construction, and transportation are the main emitters in the UAE. Even though oil and gas are crucial to the UAE economy, their extraction and processing contribute to global warming. According to their results, Al-Jayyousi et al. (2019) recommend switching to greener energy sources across businesses to reduce carbon emissions. Al Smairat and AL-Shboul (2023) found that supply chain resilience is crucial in reducing risks and lean operational performance. This Middle

East-focused research provides significant insights into improving risk management and resilience in industrial supply chains. Supply chain carbon footprints must be known in the UAE to design effective mitigation strategies. The UAE's position makes it a key trade nation, resulting in high supply chain carbon emissions. Transportation emissions account for a large amount of the UAE's carbon footprint, according to Al-Badawi et al. (2020). Imported products' carbon footprints are important since they account for much of their consumption. This article will analyze how carbon emissions, supply networks, and UAE sustainability are linked.

### Research Methodology

This study takes a positivist approach. Positivism holds that the universe is external and objective and that knowledge may be gained by empirical observation, measurement, and data analysis (Gehring and Meyer, 2022). The study uses a positivist approach to objectively analyze and quantify UAE supply chain carbon footprint indicators for sustainability and climate change mitigation.

This research uses quantitative methods. Numerical data is acquired and interpreted using specified approaches in quantitative studies (Hatfield-Dodds and West, 2017). This study follows suit, employing cross-sectional research to snapshot UAE supply networks' carbon footprint. Instead of following the same group throughout time, the cross-sectional technique collects data simultaneously. This scientific approach summarizes the implications of supply chain carbon emissions on sustainability and climate change mitigation in the UAE.

Study data will be collected via convenience sampling. Accessible and cooperative subjects are used in non-probabilistic convenient sampling (Hatfield-Dodds and West, 2017). A range of UAE-based organizations is its target participants. The target audience is supply chain professionals, academics, and those interested in supply chain and sustainability. Simple sampling was used to sample 90 people for the study. It was decided to concentrate on these folks since gathering data from them would be easiest. A representative sample was given a questionnaire about employee engagement in organizational performance and supply chain carbon footprint. People of all ages and with Bachelor's and Doctorate degrees were there. Graphical findings were obtained using descriptive statistics.

**Table 1: Descriptive Statistics on Demographic Variables**

Count of Sr. No.	Column Labels			
Row Labels	15-25	26-40	41-65	Grand Total
Bachelor	23	21	11	55
10,000 - 20,000 AED	2	13	6	21
No		3	3	6
Yes	2	10	3	15
20,000 - 30,000 AED		3	1	4
No		1		1
Yes		2	1	3

<b>5,000-10,000 AED</b>	<b>8</b>	<b>2</b>	<b>1</b>	<b>11</b>
No	1	1		2
Yes	7	1	1	9
<b>Less than 5,000 AED</b>	<b>13</b>	<b>2</b>		<b>15</b>
No	5	1		6
Yes	8	1		9
<b>More than 30,000 AED</b>		<b>1</b>	<b>3</b>	<b>4</b>
No		1		1
Yes			3	3
<b>Doctorate</b>			<b>1</b>	<b>1</b>
<b>More than 30,000 AED</b>			<b>1</b>	<b>1</b>
Yes			1	1
<b>Doctorate</b>			<b>1</b>	<b>1</b>
<b>More than 30,000 AED</b>			<b>1</b>	<b>1</b>
Yes			1	1
<b>Intermediate</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>
<b>10,000 - 20,000 AED</b>			<b>1</b>	<b>1</b>
Yes			1	1
<b>5,000-10,000 AED</b>		<b>1</b>		<b>1</b>
Yes		1		1
<b>More than 30,000 AED</b>	<b>1</b>			<b>1</b>
Yes	1			1
<b>Master of International Business</b>			<b>1</b>	<b>1</b>
<b>More than 30,000 AED</b>			<b>1</b>	<b>1</b>
Yes			1	1
<b>MASTERS</b>		<b>1</b>		<b>1</b>
<b>More than 30,000 AED</b>		<b>1</b>		<b>1</b>
Yes		1		1
<b>Matric</b>	<b>6</b>			<b>6</b>
<b>5,000-10,000 AED</b>	<b>1</b>			<b>1</b>
Yes	1			1
<b>Less than 5,000 AED</b>	<b>5</b>			<b>5</b>
Yes	5			5
<b>MBA</b>			<b>2</b>	<b>2</b>
<b>10,000 - 20,000 AED</b>			<b>1</b>	<b>1</b>
Yes			1	1
<b>More than 30,000 AED</b>			<b>1</b>	<b>1</b>
Yes			1	1
<b>MPhil</b>		<b>5</b>	<b>5</b>	<b>10</b>
<b>10,000 - 20,000 AED</b>		<b>3</b>	<b>1</b>	<b>4</b>
Yes		3	1	4
<b>20,000 - 30,000 AED</b>		<b>1</b>	<b>2</b>	<b>3</b>
Yes		1	2	3
<b>5,000-10,000 AED</b>		<b>1</b>		<b>1</b>
Yes		1		1

More than 30,000 AED			2	2
Yes			2	2
Ph D			1	1
20,000 - 30,000 AED			1	1
Yes			1	1
Ph.D in telecommunications		1		1
More than 30,000 AED		1		1
Yes		1		1
phD		2	3	5
10,000 - 20,000 AED			1	1
Yes			1	1
20,000 - 30,000 AED		2	2	4
Yes		2	2	4
School	2			2
Less than 5,000 AED	2			2
No	2			2
student	1			1
Less than 5,000 AED	1			1
No	1			1
<b>Grand Total</b>	<b>33</b>	<b>31</b>	<b>26</b>	<b>90</b>

Table 1 presents descriptive statistics on demographic variables and knowledge about carbon emissions and supply chains among respondents in the UAE. The study's sample consisted of 90 participants within an age range spanning from 15 to 65 years old. The selection of this sample was carried out with careful consideration of the underlying population. In this context, the population refers to the broader group or category from which the sample was drawn, in this case, individuals between the ages of 15 and 65. The representativeness of the test sample is a crucial aspect to consider when drawing conclusions from the study's findings. Systematic and fair selection was used to assure sample representativeness. Gender, education, and age were considered to construct a sample that best reflected demographic variety. A key demographic feature of the sample was that 55 of 90 individuals had bachelor's degrees. The sample may be biased towards educated people. The sample may not entirely represent the population's educational variety but may reflect certain aspects. Thus, this demographic bias must be considered when interpreting the study's findings and considering their generalizability.

**Table 2. Demographic Distribution of Participants in the Supply Chain**

Count of Sr. No.	Column Labels		Grand Total
	No	Yes	
Row Labels			
15-25	8	25	33
Bachelor	2	21	23
10,000 - 20,000 AED		2	2
5,000-10,000 AED	1	7	8



Less than 5,000 AED	1	12	13
<b>Intermediate</b>		<b>1</b>	<b>1</b>
More than 30,000 AED		1	1
<b>Matric</b>	<b>3</b>	<b>3</b>	<b>6</b>
5,000-10,000 AED	1		1
Less than 5,000 AED	2	3	5
<b>School</b>	<b>2</b>		<b>2</b>
Less than 5,000 AED	2		2
<b>student</b>	<b>1</b>		<b>1</b>
Less than 5,000 AED	1		1
<b>26-40</b>	<b>7</b>	<b>24</b>	<b>31</b>
<b>Bachelor</b>	<b>6</b>	<b>15</b>	<b>21</b>
10,000 - 20,000 AED	2	11	13
20,000 - 30,000 AED	1	2	3
5,000-10,000 AED	1	1	2
Less than 5,000 AED	1	1	2
More than 30,000 AED	1		1
<b>Intermediate</b>		<b>1</b>	<b>1</b>
5,000-10,000 AED		1	1
<b>MASTERS</b>		<b>1</b>	<b>1</b>
More than 30,000 AED		1	1
<b>MPhil</b>	<b>1</b>	<b>4</b>	<b>5</b>
10,000 - 20,000 AED	1	2	3
20,000 - 30,000 AED		1	1
5,000-10,000 AED		1	1
<b>PhD in telecommunications</b>		<b>1</b>	<b>1</b>
More than 30,000 AED		1	1
<b>PhD</b>		<b>2</b>	<b>2</b>
20,000 - 30,000 AED		2	2
<b>41-65</b>	<b>7</b>	<b>19</b>	<b>26</b>
<b>Bachelor</b>	<b>6</b>	<b>5</b>	<b>11</b>
10,000 - 20,000 AED	4	2	6
20,000 - 30,000 AED		1	1
5,000-10,000 AED	1		1
More than 30,000 AED	1	2	3
<b>Doctorate</b>		<b>1</b>	<b>1</b>
More than 30,000 AED		1	1
<b>Doctorate</b>		<b>1</b>	<b>1</b>
More than 30,000 AED		1	1
<b>Intermediate</b>		<b>1</b>	<b>1</b>
10,000 - 20,000 AED		1	1
<b>Master of International Business</b>		<b>1</b>	<b>1</b>
More than 30,000 AED		1	1
<b>MBA</b>		<b>2</b>	<b>2</b>
10,000 - 20,000 AED		1	1

More than 30,000 AED		1	1
<b>MPhil</b>		<b>5</b>	<b>5</b>
10,000 - 20,000 AED		1	1
20,000 - 30,000 AED		2	2
More than 30,000 AED		2	2
<b>PhD</b>		<b>1</b>	<b>1</b>
20,000 - 30,000 AED		1	1
<b>PhD</b>	<b>1</b>	<b>2</b>	<b>3</b>
10,000 - 20,000 AED	1		1
20,000 - 30,000 AED		2	2
<b>Grand Total</b>	<b>22</b>	<b>68</b>	<b>90</b>

Table 2 illustrates the UAE carbon footprint survey respondents' demographics and supply chain expertise. The study investigated these footprints' sustainability and climate change implications. 68 of 90 participants understood supply chain management, and 22 did not. Age distribution: 33 (15-25), 31 (26-40), 26 (41-65). Bachelors were the most prevalent degree (23 out of 90), followed by Master's (5), MPhil (5), Ph.D. (3), and Doctorates (2). Most (68/90) earned AED 10,000–30,000 monthly. To reduce carbon footprint, the research focuses on sustainable supply chain methods. Policymakers may use statistics to improve national sustainability.

**Table 3. The role of different sectors in Carbon Emission**

AGE, Education Knowledge about carbon emission	The role of different sectors in Carbon Emission		
	Agree	Strongly Agree	Grand Total
<b>15-25</b>	<b>3</b>	<b>30</b>	<b>33</b>
<b>Bachelor</b>	<b>2</b>	<b>21</b>	<b>23</b>
No		6	6
Yes	2	15	17
<b>Intermediate</b>		<b>1</b>	<b>1</b>
Yes		1	1
<b>Matric</b>	<b>1</b>	<b>5</b>	<b>6</b>
Yes	1	5	6
<b>School</b>		<b>2</b>	<b>2</b>
No		2	2
<b>student</b>		<b>1</b>	<b>1</b>
No		1	1
<b>26-40</b>	<b>8</b>	<b>23</b>	<b>31</b>
<b>Bachelor</b>	<b>5</b>	<b>16</b>	<b>21</b>
No	2	5	7
Yes	3	11	14
<b>Intermediate</b>	<b>1</b>		<b>1</b>
Yes	1		1
<b>MASTERS</b>	<b>1</b>		<b>1</b>

Yes	1		1
<b>MPhil</b>	<b>1</b>	<b>4</b>	<b>5</b>
Yes	1	4	5
<b>PhD in telecommunications</b>		<b>1</b>	<b>1</b>
Yes		1	1
<b>PhD</b>		<b>2</b>	<b>2</b>
Yes		2	2
<b>41-65</b>	<b>9</b>	<b>17</b>	<b>26</b>
<b>Bachelor</b>	<b>5</b>	<b>6</b>	<b>11</b>
No	2	1	3
Yes	3	5	8
<b>Doctorate</b>		<b>1</b>	<b>1</b>
Yes		1	1
<b>Doctorate</b>		<b>1</b>	<b>1</b>
Yes		1	1
<b>Intermediate</b>		<b>1</b>	<b>1</b>
Yes		1	1
<b>Master of International Business</b>	<b>1</b>		<b>1</b>
Yes	1		1
<b>MBA</b>		<b>2</b>	<b>2</b>
Yes		2	2
<b>MPhil</b>	<b>2</b>	<b>3</b>	<b>5</b>
Yes	2	3	5
<b>Ph D</b>	<b>1</b>		<b>1</b>
Yes	1		1
<b>PhD</b>		<b>3</b>	<b>3</b>
Yes		3	3
<b>Grand Total</b>	<b>20</b>	<b>70</b>	<b>90</b>

Table 3 illustrates industrial carbon emissions by age and education. Strong disagreement to strong agreement. It was yes or no on carbon emission awareness. The majority (78%) agreed that many industries contribute to emissions, notably the 26-40 age group (74%). 94% of emission experts agreed. Kalafatis et al. (2018) and Dangelico and Pujari (2010) supported this awareness. Energy emits the highest, followed by transport, industry and agriculture (Kruyt et al., 2009). Education helped emissions-aware individuals agree on industrial impact (Creutzig et al., 2016). This links knowledge to sector awareness and indicates rising concern about industries' carbon impact.

**Table 4. Carbon emission Respondents**

		Do you Know about carbon emission?		Do you Know about supply chain?	
		NO	Yes	NO	Yes
		Count	Count	Count	Count
Agriculture sector emits significant amount of carbon to the environment	SDA	0	3	1	2
	DA	1	6	1	6
	N	11	21	12	20
	A	5	26	6	25
	SA	2	15	2	15
The electricity and gas sector emits significant amount of carbon to the environment	SDA	1	2	1	2
	DA	0	6	0	6
	N	6	12	6	12
	A	4	30	10	24
	SA	8	21	5	24
The transportation sector emits significant amount of carbon to the environment	SDA	0	2	1	1
	DA	1	1	2	0
	N	5	6	4	7
	A	5	26	7	24
	SA	8	36	8	36
The manufacturing sector emits significant amount of carbon to the environment	SDA	0	2	1	1
	DA	0	0	0	0
	N	6	6	4	8
	A	3	24	8	19
	SA	10	39	9	40

Most respondents (71%) had heard of agriculture's carbon emissions, with 41% saying yes. However, 29% were unaware of agricultural emissions. The power and gas industry had 76% of respondents aware of its carbon emissions, with 31% favorably reacting. This sector's emissions were unknown to 24% of respondents, more than the agricultural sector. Most respondents (73%) knew about transportation carbon emissions. Positive responses were 43%. Manufacturing has the lowest awareness of carbon emissions (45%). The data show that most respondents knew about sector carbon emissions. However, several respondents were unaware of the issue. The report emphasizes the need for sector-wide carbon emission and source education.

**Table 5. SDA Respondents**

		Do you know about carbon emissions?		Do you know about the supply chain?	
		NO	Yes	NO	Yes
		Count	Count	Count	Count
The role of the supply chain is significant in increasing the amount of carbon emission to the environment.	SDA	1	1	1	1
	DA	0	3	2	1
	N	10	15	7	18
	A	5	36	8	33
	SA	3	16	4	15
The production contributes less to carbon emissions as compared to the supply sector.	SDA	0	1	0	1
	DA	2	8	3	7
	N	9	23	10	22

	A	5	23	6	22
	SA	3	16	3	16
The transportation required in the supply chain significantly contributes to carbon emissions.	SDA	0	0	0	0
	DA	0	1	1	0
	N	11	15	7	19
	A	6	41	11	36
	SA	2	14	3	13
The focus is on the productivity sector to reduce carbon emissions, whereas the major problem is supply.	SDA	0	0	0	0
	DA	2	3	0	5
	N	10	22	9	23
	A	4	29	9	24
	SA	3	17	4	16
The supply chain is often ignored in mitigation strategy	SDA	0	0	0	0
	DA	1	4	0	5
	N	12	19	11	20
	A	4	32	7	29
	SA	2	16	4	14
The suggestions for mitigation and improvement in Supply Chain	SDA	0	0	0	0
	DA	0	0	0	0
	N	14	19	12	21
	A	3	39	8	34
	SA	2	13	2	13
There is a need to focus on identifying key areas of the supply chain with significant carbon emissions.	SDA	0	1	0	1
	DA	0	0	0	0
	N	10	12	7	15
	A	8	36	11	33
	SA	1	22	4	19
The policies should equally focus on manufacturing and the supply chain in terms of carbon emissions.	SDA	0	0	0	0
	DA	1	0	1	0
	N	9	10	4	15
	A	5	34	10	29
	SA	4	27	7	24
There is a need for green practices in the supply chain, such as using electric vehicles for transportation.	SDA	0	0	0	0
	DA	1	0	1	0
	N	8	14	4	18
	A	7	23	7	23
	SA	3	34	10	27
The developing regions must be focused in terms of supply chain as they use old vehicles to supply products that are more dangerous for the environment.	SDA	0	0	0	0
	DA	0	1	1	0
	N	9	13	6	16
	A	7	30	9	28
	SA	3	27	6	24
The manufacturing can be localized in order to reduce transportation for supply.	SDA	1	0	0	1
	DA	0	3	0	3
	N	10	11	6	15

	A	5	28	9	24
	SA	3	29	7	25

The study reveals that most believe the supply chain increases carbon emissions. Manufacturing may release less carbon than supply. Electric cars may cut supply chain transportation emissions, a major carbon emitter. Interestingly, respondents think mitigation efforts should target major carbon emitters and avoid the supply chain. Carbon emission measures should cover the industry and supply chain. Responses may not reflect the population due to sample size. The findings show that the supply chain is a major carbon emitter and must be decreased (Kedir and Hall, 2021). The results also imply supply chain understanding may help governments and corporations cut carbon emissions. The study's results show respondents' perspectives on industrial carbon emissions by age, education, and expertise. Those 26–40 were most aware (74%), yet 78% understood numerous businesses release carbon. Importantly, 94% of emission experts supported Kalafatis et al. (2018) and Dangelico and Pujari (2010). The data also reveal which industries emit, with energy being the greatest. Education and sector knowledge of industry's greenhouse gas emissions were stressed by Creutzig et al. (2016). Despite the study's finding that the supply chain emits a lot, respondents indicated carbon emission reduction should target big emitters. This suggests a bigger carbon reduction strategy. This study's results are fascinating, but extrinsic factors may restrict their generalizability. The findings underscore the need to raise public awareness and reduce carbon emissions across all sectors and supply chains to satisfy sustainability and environmental responsibility objectives.

### Conclusion

Demographic information, UAE carbon emissions data, and supply chain data were assessed in the survey, which encompassed 90 perspectives from individuals of varying ages, levels of intelligence, and different socioeconomic backgrounds. This study supports financial stability, education, and environmental growth: sustainable development and climate change impact of Emirates supplier chain carbon footprints. Most competent respondents understood their environmental responsibilities, indicating education may impact eco-friendly regulations (Ibrahim and Mohamad, 2022). This research reveals to legislators why all companies require sustainability. Demographic data and supply chain management improve, which may influence selections. This study examines demography and supply chain management skills to help policymakers build sustainable supply networks. Research shows that younger individuals are more carbon-sensitive and can resist climate change. Many respondents agreed or strongly agreed that diverse industries cause global warming. These findings support prior findings that consumers worry about carbon emissions. These findings reflect past studies on how education might promote environmental awareness and remedies. Young people are concerned about carbon emissions and global warming and want to help (Khan and AlNuaimi, 2021).

This study indicates logistics and supply emit carbon. Education raises supply network and logistics carbon awareness. Most responders stated agriculture and transportation emit carbon. The supply chain may increase carbon emissions and damage the industry. Policy and targeted measures remedy it (Laurent and Hauschild, 2019). Increased carbon emissions need global firms to communicate more realistically and effectively along the supply chain. Studies suggest that CSR boosts consumer trust in a company's operations and reputation. Experts claim a low-carbon supply chain makes supply chain management a clean, green economy that reduces air pollution.

### **Limitations**

Different limitations may apply to research. UAE is the only country analyzed. Not collecting data from other nations is a huge drawback. This research measures the UAE supply chain's carbon impact. This research fails on carbon footprint, supply networks, climate change, and UAE sustainability. Early UAE sustainable development is also included (Hussain et al., 2020). The sample size is small in this research. The lack of data prevented inferential analysis. Another issue is the lack of UAE-specific literature. About three to four scholarly studies addressed this subject.

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## ZARZĄDZANIE ŚLADEM WĘGLOWYM ŁAŃCUCHA DOSTAW W ZJEDNOCZONYCH EMIRATACH ARABSKICH: ZRÓWNOWAŻONY ROZWÓJ ORAZ STRATEGIE ŁAGODZENIA ZMIAN KLIMATU

**Streszczenie:** Niniejsze badanie wprowadza nowe metody pomiaru śladu węglowego łańcuchów dostaw w Zjednoczonych Emiratach Arabskich w celu zidentyfikowania inicjatyw na rzecz zrównoważonego rozwoju ukierunkowanych na łagodzenie zmian klimatycznych. W badaniu wskazano możliwości usprawnień i dostarczono praktycznych wniosków mających na celu promowanie zrównoważonego rozwoju środowiskowego poprzez dokładną analizę. Starając się zrozumieć, w jaki sposób emisje węgla szkodzą ekosystemom, badanie to także wskazuje branże emitujące najwięcej dwutlenku węgla. Warto zauważyć, iż przedsiębiorstwa emitują najwięcej dwutlenku węgla z powodu niewystarczających sieci dostaw. Społeczna odpowiedzialność biznesu ma istotne znaczenie dla zaufania klientów i norm globalnych we współczesnych organizacjach. Ochrona środowiska i przepisy dotyczące redukcji emisji węgla są kluczowe w ZEA, które pragną być potęgą biznesową. Badania ilościowe mają charakter przekrojowy, ponieważ liczby lepiej wyjaśniają sytuację. Do niniejszego badania pozyskano określone dane. Aby je zgromadzić wykorzystano prostą technikę losowego próbkowania, uzyskując dane od 90 pracowników łańcucha dostaw w ZEA. Wykorzystano demograficzne informacje opisowe i dane dotyczące emisji dwutlenku węgla przez przedsiębiorstwa. Wiedza ta pomogła respondentom zidentyfikować ekologiczne praktyki korporacyjne przyjazne środowisku. Edukacja jest kluczowa, aby przekonać przedsiębiorstwa i konsumentów do ich odpowiedzialności za środowisko. Wyniki badania pokazują, że młodzi ludzie są bardziej świadomi i mogą zwiększyć społeczną odpowiedzialność biznesu w sektorze. Wyniki wykazały, że młodsze i bardziej wykształcone osoby były bardziej optymistyczne w kwestii redukcji emisji dwutlenku węgla i problemów środowiskowych. Kampanie edukacyjne i świadomość ekologiczna są potrzebne do promowania zrównoważonego rozwoju i redukcji śladów węglowych.

**Słowa kluczowe:** ślad węglowy, łańcuchy dostaw, ZEA, zmiana klimatu, zrównoważony rozwój, zarządzanie, łagodzenie zmian klimatu