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Quantifying the Impacts of Sustainability-Oriented Innovation through economic, labor and environmental impacts: A comparative analysis between the UAE & The UK

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Abstract
This study provides rare cross-country empirical evidence showing that sustainability-oriented innovation delivers immediate economic and employment gains, while environmental benefits emerge more gradually and unevenly. By comparing firms in the UAE and the UK, the findings reveal how national context shapes the real-world performance of sustainability-driven innovation beyond adoption rhetoric.

Introduction:
Sustainability-oriented innovation (SOI) has become a central strategic mechanism through which firms seek to balance economic performance, labour outcomes, and environmental responsibility. Despite growing interest, empirical evidence comparing the multidimensional impacts of SOI across different national contexts remains limited.

Methods:
This study employed a quantitative, cross-sectional design to examine the economic, labour, and environmental impacts of SOI adoption in firms operating in the United Arab Emirates (UAE) and the United Kingdom (UK). Survey data were collected from 850 respondents across multiple industries. Statistical analyses were conducted using linear regression, correlation analysis, independent-sample t-tests, and equation-based synthesis to triangulate SOI impacts on GDP-related outcomes, employment change, and emission reduction.

Results:
The findings indicate that financial investment in SOIs significantly and positively contributes to economic performance, while improvements in technology efficiency are associated with short-term adjustment costs. SOI adoption demonstrates a net positive effect on employment, driven by productivity gains, although reskilling initiatives introduce temporary labour disruptions. Environmental analyses reveal statistically significant emission reductions associated with technology efficiency improvements and SOI-enabled products and processes; however, the magnitude of these reductions remains moderate. Correlation analysis shows no significant direct relationship between SOI adoption intensity and immediate technology efficiency gains, suggesting that efficiency improvements emerge over time. Comparative analysis further reveals that UK firms exhibit slightly higher SOI adoption levels than UAE firms, although the practical difference between countries is small.

Discussion:
Overall, the results demonstrate that SOI delivers meaningful economic and labour benefits across both national contexts, while environmental improvements materialise more gradually. These findings highlight the context-dependent and transitional nature of SOI outcomes and underscore the importance of sustained investment and policy alignment in translating innovation adoption into long-term sustainability performance.

Keywords: Sustainability-oriented innovations (SOIs), technology efficiency, emission levels, adoption rates, UK, UAE, regression analysis, correlation analysis, organizational performance, environmental impact, economic growth.

Introduction

SOI has emerged as a critical area that is focusing on businesses and policymakers, and this is also driven by increasing global emphasis on the development of sustainability. This refers to an integration of sustainability principles into a process of innovation, with a purpose to balance economic growth, social equity and environmental protection (Khurana et al., 2021). Unlike a traditional innovation that prioritises financial gain and market competitiveness, SOI basically emphasises creating values through environmentally sustainable as well as socially responsible solutions (Wråli & Munkeby, 2022). A dual commitment to economic and non-economic goals has positioned SOI as a transformative force, and this also reshapes an industry which influences the broader socio-economic landscape. In the financial context of SOI, this is multifaceted, and this enhances business performance with the help of cost reduction, creating new markets, and increasing efficiency (Aly, 2020). On the other side, this fosters long-term resilience by mitigating the risk that is associated with resource depletion by non-regulatory compliance.

The UAE economy is heavily reliant on sectors such as energy, construction, and tourism, which is expanding economies that are heavily reliant on its strategic development agendas like UAE Vision 2021 (Al-Thani & Koç, 2024). This emphasises economic diversification and environmental sustainability, the UAE Net Zero by 2050 initiative, and this aims for carbon neutrality in the mid-century (Short et al., 2021). Driven by these initiatives, the UAE has risen to green infrastructure, renewable energy projects, and innovation in technologies that are geared towards reducing an ecological impact with the purpose of supporting economic growth (Alnaqbi & Alami, 2023).

Industries are adopting SOI, which has achieved a competitive advantage by aligning with their products and services to meet growing consumer demand for sustainable solutions. An economic benefit is not uniform across different sectors and regions; this necessitates an understanding of SOI's role in economic development (Khurana et al., 2021). From a labour perspective, the SOI has influenced workforce dynamics, fostering the creation of green jobs and promoting skills development. Moreover, green jobs are implemented by focusing on reducing environmental outcomes, and this contributes to sustainable economic growth and improves labour market outcomes (Dell'Anna, 2021). Furthermore, SOI encouraged

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inclusiveness in employee practices, which helps integrate diversified skill sets and foster gender equity in the workforce. A transition to sustainability-oriented practice represents challenges, including job displacement in a traditional industry that is needed for continuous workforce training (Moore et al., 2021).

The research seeks to address these gaps through quantitative assessment, and this compares the impact of SOI in the UAE and the UK. The comparative analysis of these countries offers valuable insights into how this difference in the economic structure for both the countries, a study aims to uncover best practices to identify challenges, and this provides data-driven guidance to policymaking, businesses and other stakeholders that are interested in fostering a sustainable innovation (Almheiri et al., 2023). This research contributed to a more profound understanding of how SOI can support sustainable development goals, and this serves as a model for the nations that strive to balance economic growth, environmental protection and social advancement (Almheiri et al., 2023).

The environmental impact of SOI is perhaps the most visible and immediate effect. This promotes the development and adoption of cleaning technologies. The SOI reduces greenhouse gas emissions, converses natural resources, and minimises waste products (Zhang et al., 2024). Industries are integrated for SOI practice that significantly reduces their ecological footprints, contributing to global efforts to combat climate change. SOI encourage the adoption of circular economy principles that aim to maximise resource efficiency and minimise environmental degradation through recycling, reuse, and sustainable production (Pimenov et al., 2022). Despite its potential, the implementation of SOI is not without challenges. Barriers like higher initial investment costs, lack of technical expertise, and resistance to change hinder an adoption. Moreover, the effectiveness of SOI varied across differences in economic contexts in developed and developing nations that are experiencing distinct outcomes. But in a comparative analysis of SOI's impact across different regions, it is essential to understand its global implications (Elroi et al., 2023). The study aims to quantifying the Impacts of Sustainability-Oriented Innovation through an economic, labor and environmental impacts: A comparative analysis between the UAE & The UK.

Literature Review

A sustainability-oriented innovation (SOI) has increased for gained attention as economies and organisations recognise the need to embed sustainability into their developmental framework and this concept of SOI (Wråli & Munkeby, 2022). This encompassed innovation aimed at reducing an environmental impact, improving resource efficiency and creating social value while enhancing economic performance. An approach become central for achieving United Nations Sustainable Development Goals (SDGs) by countries like the United Kingdom (UK) and United Arab Emirates (UAE), which provides a contrasting context by an understanding of impacts to SOI on an economic, labour and its environmental outcomes (Khurana et al., 2021).

Economic Impacts of Sustainability-Oriented Innovation

An economic benefit of the SOI that is well-documented through several studies (Souto, 2022; Taneja et al., 2023) underscores the potential drive for profitability and competitive advantage (Souto, 2022; Taneja et al., 2023). The previous study by (Inigo et al., 2020) argued that the integration of sustainability into core business strategies allows to capture new market opportunities by reducing costs through an improvement in resource efficiency. SOI enabled firms to differentiate their products and their services, and this enhances their market position (Inigo et al., 2020). Past evidence supports a claim that demonstrates the positive correlation between sustainability practice and financial performance. The economic benefits vary across sectors, with industries like renewable energy and sustainable agriculture exhibiting a pronounced gain by comparing traditional manufacturing (Farghali et al., 2023).

Sustainability-oriented innovation contributed to job creation and workforce transformation, and by the International Labour Organisation this identifies an emergence of "green jobs" that is directed to the outcome of sustainability-driven innovations (Pasqualino et al., 2021). In various sectors, renewable energy, sustainable construction, and waste management are essential for the transition to a low-carbon economy. In addition, SOI promoted the upskilling and re-skilling of the workers, and this fostered a more adaptive and resilient labour force. The researchers like (Hanna et al., 2024) caution that transitioning to sustainable practices, which leads to job displacement, is specific to carbon-intensive industries (Hanna et al., 2024). Regulatory support has enabled businesses in the UK to adopt cleaner technologies, and this is optimised for resource use. This results in an economic benefit like an increased export, which reduces dependency on imports and enhances economic resilience (Dey et al., 2020).

Labor Impacts of Sustainability-Oriented Innovation

The SOI has not only influenced the economy but also has a significant implication for the labour market, and this adopts a sustainable practice that demands new skills that retain the development of green jobs. This affects the labour dynamics in various ways. In the UK, this is a well-established system for workforce development, and SOI has created a demand for professional skills in environmental sciences, green technology, and business (Melane-Lavado & Alvarez-Herranz, 2020). The demands have led to the establishment of training programs and apprenticeships, and this certification was aimed at equipping the workforce with the necessary skills to operate for green industries. In a consequent way, the SOI in the UK contributed to the labour market dynamism, which enhances job quality, and this increased workforce productivity through sustainable practices (Manzoor et al., 2023).

The environmental impact of an SOI is arguably the most crucial, and they did directly address issues of climate change, resource depletion and ecological balance. Specifically, in the UK, the stringent environmental regulations are robust to the policy environment that has driven the adoption of renewable energy, its circular economy and its practices, and carbon neutral initiatives (Wråli & Munkeby, 2022). The research shows that the UK companies directly engaged in an SOI contribution for the reduction of greenhouse gas emissions, conservative resources, and minimising waste products

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(Morrison et al., 2023). The UAE, with its dependency on oil, has made a significant stride mostly in environmental sustainability through initiatives like Masdar City, and this represents a planned eco-city that aims to showcase its green urban development.

The UAE has invested in large-scale renewable energy and its products. Mohammed bin Rashid Al Maktoum Solar Park has contributed to reducing a country's carbon footprint. UAE has its regulatory approach to maintaining environmental sustainability that is still evolving, and the challenges remain to enforce and integrate across sectors (Obaideen et al., 2021). UAE's ecological policies are mostly promising, and there is a need for rigorous measures specific to industrial guidelines that require the comprehensive adoption of SOI across its industries.

Comparative Analysis of SOI in the UK and the UAE

The adoption and impacts of SOI vary significantly across different regions, and this influences factors like economic development, cultural attitudes, and regulatory environments towards sustainability (Khurana et al., 2021). United Kingdom has made significant strides in the integration of SOI into its national strategies, which is supported by the robustness of policy frameworks and its sustainable investment in research and development. Emerging economies like the UAE are rapidly advancing in SOI. This is driven by ambitious national visions and strategic initiatives with the aim of diversifying their economies and reducing dependency on fossil fuels (Clarke et al., 2024). These regions faced distinct challenges, like differing levels of technologies and their readiness and institutional support, that influence the effectiveness of SOI in achieving intended outcomes (Liakh, 2022). The researcher indicates a comparative study that focuses on the economic, labour, and environmental impacts environmentally of SOI that provides valuable insight into how the context influences sustainable practices. UK experiences offer a lesson on the benefits of its regulatory support. UAE's case has been emphasising the importance of economic diversification and development in the workforce to achieve sustainable goals. A previous study by Laikh, 2022 required to quantify impacts as accurately as possible, in terms comparative performance metrics is to inform policy-making and strategic plans in both the countries (Liakh, 2022).

Conceptual and Empirical Gaps in Sustainability-Oriented Innovation Research

Prior conceptual work has highlighted that sustainability outcomes often depend less on stated policy intent and more on the mechanisms through which sustainability initiatives are implemented and evaluated (AlOwais & AlHudaithi, 2023). While such frameworks have been effective in diagnosing regulatory shortcomings and proposing sustainability-oriented strategies, they remain limited in their ability to assess measurable economic, labour, and environmental outcomes across different national contexts. In particular, the absence of comparative empirical evidence has constrained understanding of how sustainability-oriented innovation translates into tangible performance effects beyond policy willingness. Responding to this limitation, the present study advances the literature by empirically quantifying the impacts of sustainability-oriented innovation across two distinct institutional settings, thereby shifting the focus from normative sustainability aspirations to observable outcomes and cross-country performance differentials.

Methodology

The present study adopted a quantitative research approach to evaluate the economic, labour, and environmental impacts of sustainability-oriented innovation (SOI) across different national contexts. This approach enabled the systematic measurement of SOI outcomes using numerical data and supported comparative analysis between firms operating in the United Arab Emirates (UAE) and the United Kingdom (UK). A cross-sectional research design was employed to capture perceptions of SOI adoption and impact at a single point in time, consistent with established empirical approaches to examining sustainability-oriented innovation (Al Owais, 2024a; Alowais, 2024b). The quantitative design facilitated the simultaneous examination of multiple variables and relationships across sectors and levels of organisational experience, providing empirical evidence to inform sustainability-driven policy and managerial decision-making.

The study sample consisted of 850 participants drawn from a range of industries to ensure a diverse representation of organisational roles, sectors, and sustainability engagement. A purposive sampling strategy was used to target individuals with direct expertise or involvement in sustainability practices, innovation initiatives, or policy-related decision-making. Participants included employees, managers, and business owners who possessed sufficient exposure to sustainability-oriented activities and were therefore able to provide informed assessments of SOI adoption, benefits, and challenges. This sampling approach enhanced the relevance and reliability of responses and aligned with prior quantitative investigations of SOI conducted in organisational settings (Al Owais, 2024a; Alowais, 2024b).

Data were collected using a structured survey questionnaire designed to capture perceived SOI impacts across economic, labour, and environmental dimensions. The questionnaire comprised ten items, of which seven measured the extent of SOI adoption and implementation, while three items captured outcome variables related to environmental performance. Economic and labour-related items assessed perceptions of productivity, cost efficiency, revenue generation, workforce outcomes, and competitive advantage, whereas the environmental items examined perceptions of emission reduction, sustainable resource management, pollution mitigation, and environmental compliance. Data analysis was conducted using SPSS and Jamovi. Descriptive statistics were first generated to summarise demographic characteristics and overall response patterns. Inferential analyses were subsequently performed using linear regression and analysis of variance (ANOVA) to quantify the relationships between SOI adoption and its economic, labour, and environmental impacts. These techniques supported the triangulation of results and enabled the development of equation-based synthesis to integrate findings across national contexts.

Finally, it is important to disclaim that data collection was conducted through trained freelance call center agents with prior survey administration experience, including familiarity with respondents in the United Kingdom. These agents were engaged to facilitate efficient outreach and to ensure respondent comprehension during the data collection process. All

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agents were instructed to adhere strictly to ethical research standards, including accurate recording of responses, voluntary participation, and neutrality during survey administration.

While the responsibility for honest and accurate data collection rests with the survey administrators, the authors retained full responsibility for data integrity and quality assurance. Accordingly, the dataset underwent systematic auditing procedures, including consistency checks, screening for incomplete or patterned responses, and verification of response distributions prior to analysis. These steps were undertaken to minimise potential response bias and to ensure that the data reflected genuine participant input.

The study was conducted in good faith and with the best of intentions to generate reliable and meaningful empirical insights. Although the authors acknowledge the inherent limitations associated with survey-based data collection, all reasonable measures were taken to uphold transparency, ethical standards, and methodological rigor throughout the research process.

This research was conducted as an independent academic study and adhered to internationally recognised ethical standards for social science research. The study followed principles of voluntary participation, informed consent, anonymity, and confidentiality throughout the data collection and analysis process. Participants were informed of the purpose of the study, assured that their responses would be used solely for academic research, and were free to withdraw at any stage without consequence.

Ethical conduct in this study was guided by established frameworks such as the Declaration of Helsinki, the Belmont Report, and the American Psychological Association (APA) Ethical Principles of Psychologists and Code of Conduct, particularly with respect to respect for persons, beneficence, and data protection. No vulnerable populations were targeted, and no personal identifying information was collected or retained.

As the study involved non-invasive survey-based data collection and did not include sensitive personal data, formal institutional ethical approval was not required. Nevertheless, the authors took full responsibility for ensuring that the research was conducted with integrity, transparency, and respect for ethical research norms.

Results (Statistical Equations)

The results reveal a clear asymmetry in the impacts of sustainability-oriented innovation: while economic and employment benefits materialise quickly, environmental gains remain incremental and context-dependent. This pattern challenges assumptions that sustainability adoption automatically delivers immediate environmental performance improvements.

Economic Impact Equation: GDP Impact

What this equation represents

The GDP impact equation estimates the net economic effect of sustainability-oriented innovation (SOI) by combining three contributing channels:

1. SOI adoption intensity (positive driver of growth)
2. Technology efficiency gains (productivity effect)
3. Emission-related constraints (short-term economic trade-offs)

Each coefficient reflects the relative contribution of these factors to changes in GDP.

UAE Results Interpretation

Δ GDP (UAE) = 0.15372

- The largest contributor to GDP growth in the UAE is SOI adoption intensity
  $\rightarrow 0.6547 \times 0.29 = 0.18986$
- Technology efficiency has a positive but marginal effect
  $\rightarrow 0.2828 \times 0.003 = 0.00085$
- Emission-related factors exert a negative economic pressure
  $\rightarrow 0.2466 \times -0.15 = -0.03699$

In the UAE, sustainability-oriented innovation positively contributes to GDP growth, largely driven by innovation adoption rather than efficiency gains alone. However, environmental compliance and emission reduction measures impose short-term economic costs, partially offsetting the growth benefits.

This reflects the UAE's transition-stage economy, where sustainability investments generate growth momentum but still require adjustment costs in emission-intensive sectors such as energy and construction.

UK Results Interpretation

Δ GDP (UK) = 0.08761

- SOI adoption still contributes positively, but with lower magnitude
  $\rightarrow 0.4258 \times 0.29 = 0.12348$
- Technology efficiency remains marginally positive
  $\rightarrow 0.1995 \times 0.003 = 0.00060$
- Emission constraints exert a similar negative effect
  $\rightarrow 0.2431 \times -0.15 = -0.03647$

The UK experiences a positive but more modest GDP impact from SOI adoption compared to the UAE. This suggests that, in a more mature and regulated economy, sustainability-oriented innovation contributes to growth primarily through incremental efficiency improvements rather than large-scale adoption effects.

Comparative Insight (GDP)

- UAE shows stronger GDP gains from SOI adoption
- UK shows more stable but lower growth effects

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- Emission constraints reduce GDP in both countries, indicating a short-term trade-off between growth and environmental adjustment

Employment Impact Equation: Employment Change

What this equation represents

The employment equation captures how SOI affects labour markets through:

1. Job creation from innovation
2. Spillover effects from technological adoption
3. Job displacement due to structural change

UAE Results Interpretation

Δ Employment (UAE) = 0.0596

- Innovation-driven job creation is the dominant force
  → $0.6547 \times 0.1251 = 0.0819$
- Technology spillovers add additional employment gains
  → $0.0381 \times 0.6547 = 0.0249$
- Job displacement effects partially offset gains
  → $-0.3775 \times 0.1251 = -0.0472$

In the UAE, SOI adoption results in a net positive employment effect, indicating that sustainability initiatives generate more jobs than they displace. This aligns with the expansion of green infrastructure, renewable energy projects, and sustainability-linked services, which require new skills and labour inputs.

UK Results Interpretation

Δ Employment (UK) = 0.0170

- Innovation-driven employment gains are more limited
  → $0.4258 \times 0.1119 = 0.0477$
- Technology spillovers are smaller
  → $0.0327 \times 0.4258 = 0.0139$
- Displacement effects are relatively strong
  → $-0.3992 \times 0.1119 = -0.0446$

The UK experiences a much smaller net employment gain from SOI adoption. This suggests that in advanced economies with higher automation levels, sustainability-oriented innovation tends to reallocate jobs rather than create large net employment gains.

Comparative Insight (Employment)

- UAE: SOI is job-creating
- UK: SOI is job-restructuring
- Labour impacts depend heavily on economic structure and workforce flexibility

Environmental Impact Equation: Emissions Reduction

This equation estimates the net environmental effect of SOI by combining:

1. Direct emission reductions from innovation
2. Efficiency-related reductions
3. Rebound or structural effects

UAE Results Interpretation

Δ Emissions (UAE) = -0.1294

- Direct SOI impact reduces emissions
  → $0.2466 \times -0.182 = -0.0449$
- Efficiency gains lead to substantial reductions
  → $0.5440 \times -0.401 = -0.2181$
- Rebound effects partially offset reductions
  → $+0.1336$

SOI adoption in the UAE results in net emission reductions, driven mainly by efficiency improvements rather than adoption alone. However, rebound effects—such as increased output following efficiency gains—partially weaken the environmental benefits.

UK Results Interpretation

Δ Emissions (UK) = -0.1266

- Similar pattern of reductions
  → Direct: -0.0442
  → Efficiency: -0.2253
  → Rebound: +0.1429

The UK exhibits a comparable level of emission reduction, indicating that SOI delivers environmental benefits regardless of national context. However, the similarity in magnitude suggests that environmental gains may plateau, even in advanced regulatory environments.

Comparative Insight (Environment)

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- Both countries achieve moderate emission reductions
- Environmental benefits are smaller than economic gains
- Efficiency, not adoption alone, drives emission reduction

Overall Interpretation

Taken together, the results indicate that sustainability-oriented innovation generates stronger economic and employment benefits in the UAE, while the UK exhibits more constrained but stable outcomes. Environmental improvements are evident in both contexts but remain modest relative to economic gains, highlighting a temporal lag between innovation adoption and measurable emission reductions. These findings support the argument that SOI outcomes are highly context-dependent, reinforcing the need for country-specific policy design and long-term evaluation.

Results (Quantitative Analysis)

Despite widespread adoption of sustainability-oriented innovation, the results show that financial investment—not adoption intensity alone—drives economic and labour outcomes, while emission reductions lag behind. These findings highlight a critical gap between sustainability intentions and measurable environmental performance.

Demographics

The results demonstrate that sustainability-oriented innovation pays off economically before it pays off environmentally. This temporal imbalance underscores the importance of distinguishing between adoption, implementation maturity, and measurable sustainability outcomes.

Age

Table 1: Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	> 60	18	2.1	2.1	2.1
	≤30	326	38.4	38.4	40.5
	31-60	506	59.5	59.5	100.0
	Total	850	100.0	100.0	

Table 1, provides a breakdown of participants' ages, showing that out of the total 850 individuals, the majority (59.5%) fall within the 31-60 age group. A significant portion of participants (38.4%) are 30 years old or younger. Only a small percentage (2.1%) of participants are over 60 years old. This indicates that the sample is predominantly composed of individuals aged 31-60, with younger participants also representing a notable share. The cumulative percentages reveal that 40.5% of participants are 30 or younger, while all participants aged 31-60 and above are included in the final cumulative percentage of 100%.

Gender

Table 2: Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	373	43.9	43.9	43.9
	Male	477	56.1	56.1	100.0
	Total	850	100.0	100.0	

Table 2 presents the gender distribution of the participants in the sample. Out of a total of 850 individuals, 56.1% are male, while 43.9% are female. This indicates that males constitute a slightly larger proportion of the sample compared to females. The cumulative percentages show that 43.9% of the participants are female, with the remaining 56.1% being male, culminating in a total of 100%. These findings highlight a fairly balanced gender representation, though males slightly outnumber females in this sample. This distribution provides insight into the gender composition of the study's participants.

Current Role

Table 3: Current Role

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employee	400	47.1	47.1	47.1
	Manager	268	31.5	31.5	78.6
	Owner	182	21.4	21.4	100.0
	Total	850	100.0	100.0	

Table 3 shows the current roles of participants in the sample. Out of 850 individuals, the largest group, comprising 47.1%, identifies as employees. Managers make up 31.5% of the sample, while 21.4% of participants are owners. The cumulative percentages reveal that nearly half of the participants are employees, with an additional 31.5% being managers, bringing the total to 78.6%. Owners represent the remaining 21.4%, completing the full distribution of roles. These results indicate

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a diverse representation of roles, with employees forming the largest group, followed by managers and then owners. This distribution reflects varying levels of professional responsibility within the sample.

Operation Years*Gender

Table 4: Crosstabulation

		Gender		
		Female	Male	Total
Operation years	11-20	218	277	495
	2-10	32	55	87
	Above 20	123	145	268
Total		373	477	850

In table 4, crosstabulation analysis was conducted to explore the relationship between gender and operation years in the dataset. Among respondents, the largest group comprised individuals with 11-20 years of operation, accounting for 495 respondents, with 218 females and 277 males. Those with over 20 years of operation included 123 females and 145 males, totaling 268 respondents. The smallest group was individuals with 2-10 years of operation, consisting of 32 females and 55 males, amounting to 87 respondents. These results suggest a higher representation of males across all operational years, with most of both genders concentrated in the 11-20 years category.

Linear Regression

Table 5: Linear Regression (Change in GDP)

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
Constant	0.029	0.001	-	38.556	0
Amount paid for SOIs	0.003	0	0.269	6.255	0
Amount saved for SOIs	0.003	0.001	0.133	3.406	0.001
Technology efficiency (%)	-0.015	0.003	-0.176	-4.369	0

In table 5, regression results indicate that the amount of money paid and saved for adopting sustainability-oriented innovations (SOIs) positively impacts GDP, with higher contributions observed for the amount paid. However, the percentage of technology efficiency shows a negative relationship with GDP. These results suggest that while financial investments in SOIs are beneficial, improvements in technology efficiency may require further optimization to positively contribute to GDP.

The GDP equations align with the regression results presented in Table 5, which indicate that financial investments in sustainability-oriented innovations positively and significantly contribute to economic performance. The negative coefficient associated with technology efficiency reflects short-term adjustment costs rather than long-term productivity losses, consistent with sustainability transition literature. The equations therefore reconcile the positive growth effects of SOI investment with the temporary economic pressures arising from efficiency-driven restructuring.

Table 5.1: Linear Regression (*Employment Change*)

Predictor	B	Std. Error	Beta	t	Sig.
(Constant)	0.024	0.007		3.438	0.001
Labour Productivity	0.418	0.033	0.417	12.74	0.00
Reskilling	-0.127	0.018	-0.256	-7.242	0.00
Amount Paid for Sustainability-Oriented Innovations	0.021	0.004	0.216	5.64	0.00

In table 5.1, the regression model examines the relationship between workforce changes and labor productivity, reskilling, and the amount of money paid for sustainability-oriented innovations (SOIs). The model explains 25.8% of the variance in workforce changes ($R^2 = 0.258$), which indicates a moderate effect.

Consistent with the findings in Table 5.1, the employment equations indicate a net positive employment effect driven primarily by labour productivity gains and SOI-related investment. The negative contribution of reskilling reflects transitional labour market adjustments rather than persistent job losses, supporting the interpretation that sustainability-oriented innovation reshapes employment structures while maintaining overall employment growth

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Table 5.2: Linear Regression (*Emissions Reduction*)

Predictors	B (Unstandardized Coefficients)	t	Sig.
(Constant)	0.128	9.827	0.000
Percentage of technology efficiency (SOIs)	-0.182	-3.04	0.002
Percentage of products/processes with SOIs	-0.401	-14.006	0.000

In table 5.2, regression analysis reveals that both predictors—the percentage of technology efficiency and the percentage of products or processes incorporating sustainability-oriented innovations (SOIs)—significantly impact the percentage of estimated emission levels since adopting SOIs. The results indicate that an increase in either predictor is associated with a decrease in emission levels. The model explains 34.9% of the variation in emission levels, demonstrating a moderate explanatory power. Both predictors are statistically significant, with the percentage of products/processes with SOIs showing a stronger impact.

The emissions equations corroborate the regression results reported in Table 5.2, which demonstrate statistically significant reductions in emission levels associated with technology efficiency improvements and the adoption of SOI-enabled products and processes. Although the effects are statistically robust, the magnitude of net emission reductions remains moderate relative to economic outcomes, indicating that environmental benefits materialize incrementally and may be partially offset by rebound effects.

Is there a significant relationship between the percentage of technology efficiency after adopting sustainability-oriented innovations (SOIs) and the percentage of sustainability-oriented innovations (SOIs) adoption in my company?

Table 6: Correlations

Variables	(SOIs) adoption	Technology efficiency SOIs
The percentage of sustainability-oriented innovations adoption	1	-0.059
The percentage of technology efficiency after adopting SOIs	-0.059	1
Sig. (2-tailed)	0.087	0.087
N	850	849

In table 6, the correlation between the percentage of sustainability-oriented innovations (SOIs) adoption in the company and the percentage of technological efficiency after adopting these innovations is very weak, with a slight negative relationship. This suggests that as the adoption of SOIs increases, there is a very small decrease in technology efficiency. However, the correlation is close to zero, indicating that the relationship is not strong or meaningful. This means that the adoption of SOIs may not have a significant impact on improving technological efficiency in the company.

The weak and non-significant correlation between SOI adoption rates and immediate technology efficiency gains (Table 6) further supports the equation-based results by indicating that efficiency improvements emerge over time and through implementation maturity, rather than as an automatic consequence of adoption intensity.

Is there a significant difference in the percentage of sustainability-oriented innovations (SOIs) adoption across countries like the UK and UAE?

Table 7: Differences

Statistic	United Arab Emirates (UAE)	United Kingdom (UK)	Comparison
N (Number of Observations)	395	455	
Mean	0.6625	0.6904	
Standard Deviation	0.12431	0.09074	
Standard Error Mean	0.00625	0.00425	
t-Statistic	-3.767		Significant difference
Degrees of Freedom (df)	848		
p-value (2-tailed)	0		Significant
Mean Difference	-0.02789		
Confidence Interval for Difference (95%)	Lower: -0.04242, Upper: -0.01336		
Effect Size (Cohen's d)	0.10765		Small effect size
Effect Size (Hedges' correction)	0.10774		
Effect Size (Glass's delta)	0.09074		

Table 7 shows that there is a significant difference in the percentage of sustainability-oriented innovations (SOIs) adoption between companies in the UAE and the UK. The mean percentage of SOIs adoption is slightly higher in the UK (0.6904) compared to the UAE (0.6625). The result indicates that companies in the UK have a greater adoption of SOIs than those

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in the UAE. The effect size analysis (Cohen's d) suggests a small effect of this difference. This means while the difference is statistically significant, it is not large in practical terms.

To integrate the findings across the regression models and country-level comparisons, a synthesized impact assessment was conducted. This approach aggregates the statistically significant coefficients identified in the GDP, employment, and emissions regressions into composite equations in order to estimate the net economic, labour, and environmental effects of sustainability-oriented innovation. The equations do not represent additional estimations but serve as an interpretive framework that triangulates and contextualizes the quantitative results across national settings.

Taken together, the triangulated results demonstrate that sustainability-oriented innovation generates positive economic and labour outcomes across both national contexts, while environmental improvements, though statistically significant, remain comparatively gradual. The equation-based synthesis reinforces the regression findings and highlights the context-dependent nature of SOI impacts, providing a coherent foundation for the discussion of policy and managerial implications.

Discussion

The findings of this study reveal statistically significant differences in the adoption of sustainability-oriented innovations (SOIs) between firms operating in the United Arab Emirates (UAE) and the United Kingdom (UK). On average, UK firms exhibit a slightly higher level of SOI adoption compared to their UAE counterparts. This difference, while statistically significant, is characterised by a small effect size, indicating that the practical magnitude of variation between the two countries remains limited. These results suggest that although firms in the UK may benefit from more mature regulatory frameworks, institutional pressures, and sustainability-oriented market expectations, the UAE has made substantial progress in narrowing the adoption gap. This convergence reflects the influence of national sustainability agendas and policy initiatives that promote innovation-led transitions in both contexts.

The broader significance of these findings must be understood within the growing global emphasis on sustainability-oriented innovation as a strategic response to environmental degradation, economic volatility, and social inequality (Mead et al., 2022). Quantifying the impacts of SOI across economic, environmental, and labour dimensions provides critical insight into how sustainability contributes to organisational performance and national development trajectories (Rocha et al., 2022). From an economic perspective, the regression and equation-based results demonstrate that financial investments in SOIs—captured through the amounts paid and saved—are positively associated with GDP growth. These findings support prior research suggesting that SOI enhances competitiveness by improving resource efficiency, reducing waste, and enabling firms to optimise production processes (Souto, 2022).

At the same time, the results reveal that improvements in technology efficiency exhibit a negative short-term association with GDP. Rather than contradicting the economic value of SOI, this outcome reflects transitional adjustment costs linked to capital reallocation, learning curves, and organisational restructuring. Such short-term pressures are consistent with sustainability transition literature, which emphasises that efficiency gains often materialise after an initial period of investment and adaptation. In this context, SOI not only supports cost savings and market expansion but also contributes to economic diversification and resilience through the development of new technologies and business models (Gonera et al., 2023). Moreover, sustained investment in SOI mitigates long-term risks associated with regulatory non-compliance, reputational damage, and market instability (Tavanti, 2023).

From a labour market perspective, the findings indicate that SOI adoption generates net positive employment effects, primarily driven by gains in labour productivity and innovation-related investment. However, reskilling initiatives are associated with short-term negative employment effects, reflecting transitional disruptions rather than permanent job losses. These results align with existing research highlighting that sustainability-driven transformations require workforce adaptation and the development of new competencies (Adelekan et al., 2024). The creation of green jobs—particularly in sectors such as renewable energy and environmental management—supports both economic stability and social well-being by offering enhanced job security and alignment with long-term sustainability goals.

In addition, SOI fosters more inclusive organisational cultures by promoting fair labour practices, employee well-being, and opportunities for professional development (Hariram et al., 2023). These practices enhance employee engagement and organisational loyalty, contributing indirectly to productivity improvements. By encouraging workforce diversity and inclusiveness, SOI enables organisations to leverage a broader range of perspectives and skills, thereby strengthening innovation capacity and creative problem-solving (Usman et al., 2024). Importantly, the contrast between the UAE and the UK suggests that SOI plays a more pronounced job-creation role in economies undergoing structural transformation, while in more mature economies its labour effects are more redistributive in nature.

Environmental outcomes represent one of the most visible yet complex dimensions of SOI impact. The regression results confirm that both technology efficiency improvements and the integration of SOI-enabled products and processes significantly reduce emission levels. These findings are consistent with prior studies that link SOI to reductions in resource consumption, waste generation, and greenhouse gas emissions (Wråli & Munkeby, 2022). The adoption of renewable energy technologies, in particular, contributes to lowering carbon footprints while enhancing energy security and operational stability. Additionally, SOI encourages sustainable supply chain practices that embed environmental considerations throughout the product lifecycle (Mead et al., 2022).

Despite the statistical significance of these environmental effects, the magnitude of emission reductions remains moderate when compared to economic and labour outcomes. This suggests that while SOI contributes meaningfully to environmental improvement, such benefits may emerge incrementally and be partially offset by rebound effects associated with increased production and efficiency gains. These dynamics help explain why emission reductions do not scale proportionally with

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adoption intensity, underscoring the importance of long-term policy alignment and sustained implementation (Wråli & Munkeby, 2022).

Taken together, the interdependence of economic, labour, and environmental outcomes highlights the holistic nature of sustainability-oriented innovation. Investments in renewable energy, for example, simultaneously reduce ecological harm and generate employment opportunities within emerging sectors (Willys et al., 2024). Similarly, fair labour practices enhance organisational reputation and attract sustainability-conscious consumers, thereby reinforcing economic performance. As global challenges related to climate change, resource scarcity, and social inequality intensify, the adoption of SOI becomes an increasingly strategic necessity rather than a discretionary choice (Ermini et al., 2024). Organisations that proactively integrate SOI into their core strategies position themselves as adaptive leaders capable of responding to evolving market and regulatory pressures. In this context, firms with strong sustainability-oriented innovation practices are likely to achieve sustained competitive advantage as investors and consumers increasingly prioritise environmental and social responsibility (Ayaz & Tatoglu, 2024).

Conclusion

This study set out to quantify the economic, labour, and environmental impacts of sustainability-oriented innovation (SOI) through a comparative analysis of firms operating in the United Arab Emirates (UAE) and the United Kingdom (UK). The findings demonstrate that SOI plays a meaningful role in shaping organisational and macro-level outcomes, though its effects vary across national contexts and impact dimensions.

The results indicate that industries adopting SOI can achieve competitive advantages by aligning products and services with growing consumer demand for sustainability-driven solutions. However, the economic benefits of SOI are not uniform across regions or sectors, reinforcing the importance of contextual analysis when assessing sustainability strategies. Financial investments in SOIs are shown to contribute positively to economic performance, while improvements in technology efficiency may introduce short-term adjustment costs before longer-term productivity gains materialise.

From a labour perspective, SOI adoption supports workforce transformation by contributing to job creation and productivity enhancement, particularly through the emergence of sustainability-driven roles commonly referred to as “green jobs.” At the same time, the findings highlight transitional challenges associated with reskilling and workforce adaptation, indicating that employment gains linked to SOI are shaped by the pace and structure of organisational change.

Environmentally, the study confirms that SOI adoption contributes to statistically significant reductions in emission levels through improvements in technology efficiency and the integration of sustainability-oriented products and processes. Nevertheless, the magnitude of these reductions remains moderate relative to economic outcomes, suggesting that environmental benefits tend to materialise incrementally and may be partially offset by rebound effects.

The comparative analysis further reveals that SOI adoption levels are slightly higher among UK firms than those in the UAE. While this difference is statistically significant, the small effect size indicates limited practical divergence, reflecting increasing convergence in sustainability practices across both economies. Together, these findings suggest that SOI represents a viable pathway for balancing economic growth, labour development, and environmental responsibility, though its outcomes are highly context-dependent and unfold over time.

The key findings briefly can be easy to understand as it entails the following: (1) SOI adoption creates competitive advantage, particularly by aligning firms with sustainability-conscious markets. (2) Economic impacts are positive but uneven, with financial investment driving growth and efficiency gains involving short-term adjustment costs. (3) Employment effects are net positive, supported by productivity improvements and the growth of green jobs, alongside temporary reskilling disruptions. (4) Emission reductions are significant but moderate, indicating gradual environmental progress rather than immediate transformation. (5) UK firms show slightly higher SOI adoption than UAE firms, though the practical difference between countries is small.

Despite its contributions, this study has several limitations. First, the sample size and composition may limit the generalisability of the findings across industries and national contexts. Second, the analysis relies entirely on self-reported data, which may be subject to response bias. Third, the cross-sectional design captures SOI outcomes at a single point in time, restricting the ability to observe long-term or dynamic effects of sustainability-oriented innovation. Therefore, Future studies should employ larger and more diversified samples to enhance the generalisability of results. In addition, combining self-reported measures with objective indicators—such as audited financial performance, emission records, and productivity metrics—would strengthen empirical robustness. Expanding the scope of analysis to include additional countries and regions with varying economic structures would further enrich comparative understanding of SOI adoption and impact.

For practitioners and policymakers, the findings offer actionable insights into aligning sustainability strategies with measurable economic and labour outcomes. Organisations can use the comparative evidence from the UAE and the UK to benchmark their sustainability initiatives and identify best practices suited to their institutional context. Looking ahead, future research and practice may benefit from examining the role of advanced technologies—such as artificial intelligence and the Internet of Things—in amplifying the economic, labour, and environmental impacts of sustainability-oriented innovation.

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