

American Journal of Economics and Business Management

Vol. 8 Issue 9 | **pp.** 4314-4324 | **ISSN:** 2576-5973
Available online @ https://www.globalresearchnetwork.us/index.php/ajebm

Article

The Role of The Auditor In Identifying The Risks of Climate Change Facing Economic Units A Survey Study of The Opinions of A Sample of Auditors And Accountants

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Abstract: This paper is aimed at the objective of identifying the function of internal auditors regarding the risks of climate change when facing economic units. Direct and indirect threats to these units come from climate change. But many struggle to understand how these changes affect their businesses and lead them strategically. This research aims to, in examining to what extent does internal auditors play a significant role in the identification and assessment of climate-change risks affecting the economi c units performance. The main results of the research are that internal auditors play a crucial role in the formulation of mature risk management policies, and especially of policies related to climate change risk. This engagement provides increased resilience to future risks, increased confidence among current and future investors, and our team will continue to innovate in the face of climate change and the risks that stem from it. The study suggests that internal auditors should appreciate the responsibilities of contemporary internal auditing in enhancement of the challenges of global warming risk and its impact on economic entities.

Keywords: Auditor, Climate Change Risks, Economic Units

Citation: Thanoon, T. I & Shlash, W. H. The Role of The Auditor In Identifying The Risks of Climate Change Facing Economic Units A Survey Study of The Opinions of A Sample of Auditors And Accountants. American Journal of Economics and Business Management, 8(9), 4314-4324

Received: 10th Jun 2025
Revised: 16th Jul 2025
Accepted: 24th Aug 2025
Published: 01th Sept 2025

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1. Introduction

Today, the phenomenon of climate change increasingly unfolds in an accelerated manner on the world stage with substantive impacts on a variety of sectors of the economy, both directly and indirectly [1]. These changes bring new sustainability requirements and require economic agents to improve their environmental risk management. The significance of auditors and financial controllers' involvement in assessing the consequences of these changes for organizations' financial and operational performance are becoming increasingly important [2].

As a result, it is necessary to further develop auditing techniques to meet the new challenges. The research is divided into following four main parts: Part I - Research Methodology; Part II - Theoretical Framework; Part III – Data Analysis; and Part IV – Conclusion and Recommendation.

2. Materials and Methods

Research Problem

The current era is threatened by unprecedented climate change, affecting various activities of our lives, including the economy and business. Climate change is not a threat in an abstract future -- it is a reality today, with material risks to businesses of any size,

and in any sector. Thereby, the research problem was expressed through the questions that followed.

How aware are the auditors of climate-related risks and possible impact on economic entities? How are auditors currently analyzing and evaluating climate-related risks at such entities (i.e., what are the methodologies and tools that they use)?

Research Significance

The increase in global temperatures and the growing frequency and intensity of extreme weather events, such as floods, droughts, and storms, have caused substantial physical damage and economic loss to organizations. These developments highlight the need to evaluate and manage climate-related risks effectively.

Research Objectives

1. Assess auditors' roles and effectiveness in identifying and evaluating climate risks confronting economic entities.
2. Identify the challenges auditors face in this task, including knowledge gaps, resource constraints, forecasting difficulties, and absence of clear standards.

Development of new tools and methodologies that enable auditors to identify and assess climate risk more efficiently.

Research Hypotheses

Greater auditor knowledge and experience in climate change issues enhance their ability to identify and evaluate climate risks effectively.

The adoption of modern tools and techniques for climate risk assessment has increased the precision and effectiveness of the evaluation process.

Increased managerial awareness of climate-related risks heightens auditors' attention to evaluating such risks within economic entities.

Theoretical Component The conceptual foundation of this study is grounded in the seminal contributions of scholars and practitioners as documented in Arabic and internationally refereed journals, conference proceedings, and recent theses and dissertations. Particular attention has been paid to the literature examining auditors' roles in identifying climate-related risks confronting economic entities. To evaluate the research hypotheses and support theoretical arguments, a structured questionnaire was distributed to a targeted sample of auditors and financial controllers. The responses serve as empirical evidence that underpins the conclusions of this study.

Section II – Theoretical Framework 2.1

In recent years, global concerns regarding climate change risks have intensified owing to their direct impact on business sustainability and the financial standing of economic units. And these risks are not now seen only as environmental; they have substantial implications for performance assessment, investment, and the raising of funds. Auditing firms perform the important task of assessing the extent of reporting on climate-related risks by organizations in their accounts and non-accounts-based reporting.

The Concept of Climate Change Risks

Climate Change Risks The concept of climate change risk is described as the range of activities and policies developed by economic actors to shield themselves from the potential risks of climate change. Such risks motivate economic organizations to intensify investments in technologies which help these risks. From the above definitions, it is clear that climate change risks in auditing operations are the risks which are caused by climate change or its related policies and directly or indirectly affect the financial positions and cash flows of economic entities. Auditors, therefore, needs to take such risk into account when assessing material risk and providing professional opinions on the accuracy of financial statements.

3. Results and Discussion

Types of Climate Change Risks

Various environmental risks facing economic actors can be classified under two main categories; Physical Risks: These relate to direct risks due to climatic changes, such as damage from cyclones/hurricanes, wildfires, floods, droughts, as well as an increase in average high temperature [3], [4]. Subsequently, they result in raw material availability

for production of the goods and services, which further lead to increasing of the production cost.Transition Risks: These risks arise from the transition toward a low-carbon economy aimed at mitigating climate change. This transition is driven by societal responses and changes in international and local policies or technologies designed to mitigate or adapt to climate change. 3.2. Challenges Facing Auditors in Light of Climate Change Economic entities may encounter difficulties in fully assessing the economic impact of their climate obligations [5], [6]. The prevailing uncertainty and the long-term horizon of climate risk affect the impact of climate change on financial statements. Climate change influences the risk profile of economic entities through resultant physical and transitional climate risks.

The Relationship between Climate Change Disclosure and the Auditor's Opinion

The auditor's opinion represents the final work, which is a statement of fair and truthful judgment of the financial reports of economic entities. This is done to enhance the reports and reliability of accounting information. International auditing standards define the content of auditor reports and audit quality from a theoretical perspective, whereas adherence to linguistic principles improves the structure of audit reports in practice [7].

The relationship between climate change disclosure and auditors' opinions aims to raise awareness among economic entities and clarify their responsibilities regarding climate change. Economic entities always receive favorable opinions on climate change disclosure, which can lead to increased costs and enhanced public trust, particularly concerning environmental preservation and improving living standards [8], [9].

An auditor's opinion of climate change risk is a regulatory framework. It not only collects data on environmental and climate issues such as carbon emissions, but also detects material errors and omissions in prepared environmental information, including information related to climate change. This, in turn, increases the amount of information disclosed [10]. Therefore, understanding auditors' opinions on climate change risks depends on their efforts to identify appropriate audit evidence and perform audit procedures with high efficiency.

The Auditor's Role in Identifying Climate Change Risks

Because the recent rapid changes in auditing firms, the profession is typified by constant change and renewal and the competitive environment has become fierce among practitioners [11], [12]. This means that such firms have to follow the current developments, including the issues related to changes in the environmental activities, to enhance the performance and efficiency of auditors and conduct more effective and efficient audits. This contributes to information users' confidence in the audit report and fulfils stakeholder demands.

Since auditors have been entrusted with the prime responsibility to enhance the credibility of financial statements, as well as to exercise due diligence with respect to climate-related risks and their effects on financial reporting, in fact they also can consider climate-driven risks, for instance possible influence on financial reports. And in this space in between auditors and businesses, is there a critically important role for auditors acting as advisors, assuming a role of 'trusted business advisors' in helping businesses to understand and mitigate the risks of climate change – a role that can deliver real value to businesses, and assurance over the identification, mitigation and management of risk? As of now, corporate boards may not always be fully educated about all of the implications of weather risks, they said. (a) Full perception of risk in internal audit is of vital significance it presents the stakeholders with assurance [13], [14]. One of these is transition risks: we understand that businesses will be, in one way or another, exposed to the effects of transitioning to a low carbon economy – through changes in regulation, policy, new technology, new markets and by the way they are perceived to respond. Furthermore, it draws them closer to threatening to take economic actors and governments to court for having failed to even attempt to address dimensions of climate change which apparently undermine the security and existence of its workers and citizens [15].

Research Conclusion

Climate change presents a challenge to commercial enterprises because it impacts on the sustainability of business activities and investor decisions. The auditors are increasingly under pressure to assess how much these entities recognise these risks and how well they disclose it.This necessitates the advancement of the professional and cognitive tools employed by auditors to adapt to such changes. This role is pivotal in enhancing transparency and accountability and supporting informed economic decision-making in a dynamic business environment.

Third Axis - Practical Aspect 1.3 Research Sample: To achieve the research objective concerning the auditor's role in identifying climate change risks faced by economic entities, a survey was conducted among a sample of auditors and accountants. To fulfil the research requirements, sixty (60) survey forms were distributed to the research sample. Table 1 Symbols Used to Express Research Questions

Table 1. Symbols Used to Express Research Questions:

Paragraph	Question	Symbol
Auditor's Knowledge of Climate Risks	I have sufficient knowledge of climate change risks and their impact on economic entities.	X1
	I follow regulatory and accounting updates related to climate disclosure.	X2
	The economic entity provides specialized training on climate risks and their auditing.	X3
	Some auditors lack specialized knowledge of climate risks and how they relate to accounting and financial aspects.	X4
Auditor's Assessment of Climate Change Risks	I assess the extent to which financial statements are affected by climate risks.	X5
	I verify accounting estimates affected by climate change (e.g., asset impairment).	X6
	I review the adequacy of environmental assumptions used by management.	X7
	I verify the sufficiency of climate-related disclosures in financial reports.	X8
	I examine and evaluate environmental and climate change risks.	X9
	I develop an audit plan and program and review audit reports on climate change.	X10
Auditor's Role in Improving Climate Disclosure	I recommend increasing climate risk disclosure in governance reports.	Y1
	I believe that the auditor has a strategic role in improving the transparency of climate disclosure.	Y2
	The auditor's report should include notes on material climate risks.	Y3
	The auditor verifies that disclosures related to climate risks and impacts are clear, sufficient, and relevant to financial information.	Y4
	The auditor can alert management to aspects of inadequacy or ambiguity in disclosure related to climate change risks.	Y5
	Ensuring that climate disclosure reflects the operational and financial reality of economic entities, not just theoretical obligations.	Y6

Paragraph	Question	Symbol
	Analyzing how climate change risks can affect financial statements and determining whether these risks require adjustments or disclosures.	Y7
	Contributing to raising management awareness of climate risks through continuous reports and dialogues with the audit committee and senior management.	Y8
Challenges Facing the Auditor	I face difficulty in assessing the financial impact of climate risks.	C1
	There is a gap in the accounting or auditing framework that addresses climate risks.	C2
	The lack of sufficient data from management hinders the auditing process.	C3
	Difficulty in obtaining accurate and reliable climate data that can be used to assess the impact of risks on financial statements.	C4
	Economic entities differ in their methods of disclosing climate impacts, which makes it difficult for the auditor to conduct a comprehensive comparison and analysis.	C5
	Many climate impacts appear in the long term or indirectly, making them difficult to quantify during the audit.	C6

The measurement instrument was developed in the form of a questionnaire encompassing four principal domains: auditors' knowledge of climate risk, their evaluation of climate change risk, their contribution to enhancing climate disclosure, and the challenges encountered by auditors. The following table presents the status of the questionnaires used in this analysis.

Table 2. Number of Distributed and Valid Questionnaires for Analysis

Status	Number	Percentage
Number of distributed questionnaires	60	100%
Number of unreturned questionnaires	3	5%
Number of invalid questionnaires for analysis	7	12%
Number of valid questionnaires for analysis	50	83%

A five-point Likert scale was used to formulate responses for the study variables. The objective was to assess the opinions of the sample group regarding the questionnaire items and ascertain their relative importance. The results are shown in the following table.

Criteria for Determining Opinion

The direction of opinion was determined based on the arithmetic mean for each item.

Weighted Mean	Opinion
1 - 1.80	Strongly Disagree
1.81 - 2.60	Disagree
2.61 - 3.40	Neutral
3.41 - 4.20	Agree
4.21 – 5	Strongly Agree

The degree of a respondent's opinion is determined by the weighted mean value, which falls between one and five.

Statistical Analysis of Research Questions

The analysis showed that the calculated means for all items fell within the "Agree" category, specifically between 2.61 and 4.20. The statistical results of the "auditor's knowledge of climate risk " are summarized below, see Table 3.

Table 3. Quantitative and Qualitative Analysis Statistics for the Auditor's Knowledge of Climate Risks

Section	Symbol	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Standard Deviation	t-test
		Count	%	Count	%	Count	%	Count	%
Auditor's knowledge of climate risks	X1	20	40	10	20	9	18	7	14
	X2	24	48	12	24	7	14	4	8
	X3	30	60	5	10	9	18	3	6
	X4	19	38	11	22	10	20	7	14
Average			47		19		18		11
Total		66	18	18					
Overall Mean									

Source: Prepared by the researchers, SPSS program outputs.

The table indicates several key findings:

Agreement on Concepts: All concepts presented in the "auditor's knowledge of climate risks" are considered valid and important for supporting the research's ideas. The overall mean of all items was 3.885, suggesting that respondents tended to agree with the concepts and opinions presented in this variable.

1. **Consistency of Opinions**: There respondents' opinions had a high degree of consistency, as indicated by the small standard deviation values (less than or close to one) for all items. This indicated the realism and reliability of the responses.
2. **Statistical Significance**: The Responses were statistically significant for all items within the variables. The calculated t-values showed a significance level of less than 0.05, indicating that the responses were important, logically sound, and could be relied upon for research conclusions.

Consequently, the variable "auditor's knowledge of climate risks" is well prepared for its intended scientific use.

Table 4. Quantitative and Qualitative Analysis Statistics for the Auditor's Role in Improving Climate Disclosure

Section	Code	Response Scale	Mean	Standard Deviation	t-test
		Strongly Agree	Agree	Neutral	Disagree
		Count (%)	Count (%)	Count (%)	Count (%)
Auditor's role in improving climate disclosure	Y1	17 (34%)	19 (38%)	10 (20%)	3 (6%)
	Y2	25 (50%)	10 (20%)	9 (18%)	4 (8%)
	Y3	23 (46%)	12 (24%)	7 (14%)	6 (12%)
	Y4	18 (36%)	19 (38%)	9 (18%)	3 (6%)
	Y5	20 (40%)	15 (30%)	10 (20%)	3 (6%)
	Y6	20 (40%)	15 (30%)	10 (20%)	3 (6%)

Section	Code	Response Scale	Mean	Standard Deviation	t-test
	Y7	17 (34%)	16 (32%)	8 (16%)	5 (10%)
	Y8	20 (40%)	10 (20%)	9 (18%)	7 (14%)
Average		40%	29%	18%	9%
Overall Mean					
Source: Prepared by the researchers, SPSS software output					

Analysis of Results

Table 4 shows that the calculated means for all research items fell within the "Agree" categories, ranging from 3.41 4.20. The following conclusions were drawn.

1. All ideas presented in the items for the studied variable (the auditor's role in improving climate disclosure) were valid and played an important role in proving the research hypotheses.
2. There was a high degree of consensus among the respondents, as indicated by the small standard deviation values (less than or close to one) for all items. This demonstrates a higher level of realism and reliability in the responses.
3. The responses for all the items were statistically significant, with the calculated t-values having a significance level of less than 0.05. This means that the responses are important, logically sound, and can be relied upon for research conclusions.
4. The overall approval rate for items in this section was **69%**, whereas the disapproval rate was only **14%**. This is supported by the fact that the arithmetic means for all questions were above 3.0, and the overall mean was **3.92**.

Table 5. Therefore, the "auditor's role in improving climate disclosure" is well suited for the required scientific use.

Section	Code	Response Scale	Mean	Standard Deviation	t-test
		Strongly Agree	Agree	Neutral	Disagree
		Count (%)	Count (%)	Count (%)	Count (%)
Challenges facing the auditor	C1	15 (30%)	17 (34%)	9 (18%)	8 (16%)
	C2	19 (38%)	17 (34%)	10 (20%)	3 (6%)
	C3	12 (24%)	15 (30%)	12 (24%)	7 (14%)
	C4	16 (32%)	17 (34%)	8 (16%)	5 (10%)
	C5	20 (40%)	12 (24%)	8 (16%)	7 (14%)
	C6	14 (28%)	15 (30%)	10 (20%)	8 (16%)
Average		32%	31%	19%	13%
Overall Mean					
Source: Prepared by the researchers, SPSS software output					

Analysis of Results

Table 5 indicates that the calculated means for all items fell within the "Agree" category, ranging from 3.41 4.20. The key findings are:

1. The concepts in the "challenges faced by the auditor" variable are valid and play a significant role in supporting the research ideas.
2. There was good homogeneity in the respondents' opinions, as evidenced by the small standard deviation values, which were close to one. This indicated a higher degree of reliability of the answers.

3. The responses for all the items were statistically significant, with the calculated t-values having a significance level of less than 0.05. This means that the answers are important, logically sound, and can be relied upon for research conclusions.
4. The overall approval rate for this section was **63%**, while the disapproval rate was only **18%**. The overall mean was **3.72**, supporting the finding that the respondents tended to agree with the concepts presented.

Table 6. The variable challenges facing the auditor is also highly prepared for scientific use

#	Item	Item Mean	Ranking
1	I face difficulty in assessing the financial impact of climate risks.	3.74	3
2	There is a gap in the accounting or auditing framework that addresses climate risks.	4	1
3	Lack of sufficient data from management hinders the audit process.	3.48	6
4	Difficulty in obtaining accurate and reliable climate data that can be used to assess the impact of risks on financial statements.	3.72	4
5	Economic entities' varying methods of disclosing climate impacts make it difficult for the auditor to perform a comprehensive comparison and analysis.	3.78	2
6	Many climate impacts appear in the long term or indirectly, making quantitative estimation difficult during the audit.	3.58	5
	Source: Prepared by the researchers, SPSS software output		

Table 6 shows the importance ranking of the items for the challenges facing the auditor variable. The most important item is that there is a gap in the accounting or auditing framework that addresses climate risks, while the least important is the lack of sufficient data from management, which hinders the audit process.

Correlation Analysis Between Study Variables

Correlation analysis was performed to determine the strength and direction of the relationship between the study variables, see Table 7.

Table 7. Correlation Coefficients Between Research Variables

Primary Variable (Dependent Variable)	Secondary Variable (Independent Variables)	Correlation Coefficient	Significance Level	Result
The auditor's role in improving climate disclosure	The auditor's knowledge of climate risks	0.986**	0.000	Significant
	The auditor's assessment of climate change risks	0.982**	0.000	Significant

Source: Prepared by the researchers, SPSS software output

Note: ** denotes significance at the 0.01 level.

Table (10) indicates a significant positive correlation between the auditor's role in improving climate disclosure and both the auditor's knowledge of climate risks and their assessment of climate change risks. The correlation coefficients were 0.986 and 0.982, respectively, providing initial support for the hypothesis that auditors play a positive role in identifying climate change risks faced by economic entities.

Regression Analysis to Determine the Impact Relationship Between Variables

Regression analysis is a statistical technique that is widely used in scientific research to establish a relationship between one dependent variable and one or more independent variables. Multiple linear regression to model the relationship between two independent and dependent variables.

Table 8. ANOVA Table for the Regression Analysis

F-value	**Mean Square**	**Sum of Squares**	**Degrees of Freedom**	**Source of Variance**
954.581	30.048	60.097	2	Between Variables
	0.031	1.479	47	Within Variables
		61.576	49	Total Variance
Source: Prepared by the researchers, SPSS software output				

Table 8 shows that the calculated F-value (954.581) was greater than the table value (5.09). This confirms that the proposed linear model is valid and effective for explaining the relationship between the auditor's knowledge of climate risks and their assessment of these risks on the one hand, and the auditor's role in improving climate disclosure.

Table 9. Regression Coefficients

Significance Level	t-test	Regression Coefficient
0.000	5.931	0.491
0.000	4.808	0.580
0.014	2.566	0.317

Source: Prepared by the researchers, SPSS software output

Table 9 presents the regression coefficients and their significance, tested using t-tests. Because all the calculated t-values exceeded the table value of 1.96 the regression coefficients were highly significant.

The resulting regression equation is:

$Y = 0.491 + 0.580 X1 + 0.317 X2$

Where:

Y represents the auditor's role in improving climate disclosure.

X1 represents the auditor's knowledge of climate risks.

X2 represents the auditor's assessment of climate change risks.

This equation indicates that a one-unit change in both the auditor's knowledge of climate risks (X1) and their assessment of climate change risks (X2) leads to a positive increase of 1.388 units in the auditor's role in improving climate disclosure (Y).This supports the main research hypothesis that there is a statistically significant impact of auditors' knowledge of climate risks and their assessment of these risks on their role in improving climate disclosure.

The model's explanatory power of the model, as represented by the coefficient of determination, was 98%. This means that 98% of the changes in the auditor's role in improving climate disclosure can be attributed to their knowledge and assessment of climate risks, with the remaining percentage attributed to other unstudied variables.

4. Conclusion

Empirical Conclusions

The questionnaire items were highly effective in eliciting transparent, evidence-based responses, attributable to the survey's scientific rigor and its sound, logical structure. All items yielded statistically significant results across the three study variables—auditor knowledge of climate risk, auditor assessment of climate change risk, and the auditor's role in enhancing climate disclosure—except for the item "Establishing an audit plan and program and reviewing audit reports on climate change." A statistically significant positive correlation was identified between auditors' knowledge of climate risk, their

assessment of climate change risk, and their role in enhancing climate-related disclosure. Auditor knowledge of climate risk (X_1) and auditor assessment of climate change risk (X_2) exert a statistically significant influence on auditors' role in improving climate change disclosure (Y). The estimated regression equation is as follows: $Y = 0.491 + 0.580 X_1 + 0.317 X_2$. The model's coefficient of determination (R^2) was 0.98, indicating that 98% of the variance in Y was explained by the two independent variables, demonstrating strong explanatory power.

Theoretical Conclusions

Disclosing climate-related risks provides investors with critical information that aids in understanding the threats facing economic entities and strategies adopted to confront and adapt to these risks.

Climate risk disclosure assists auditors in evaluating client business risk, detecting earnings management practices, and reducing information asymmetry between management and stakeholders, thereby lowering auditor litigation risk. Auditors must implement specified substantive procedures and exercise professional judgment when performing auditing work related to climate change issues. The auditor's opinion on climate-related risks is a part of the entity's control architecture. Beyond gathering data on environmental matters, such as carbon emissions, the auditor detects material errors and omissions in reported environmental information. As climate-related data increases the volume of disclosed information, an informed audit opinion on climate risk necessitates additional effort to obtain appropriate audit evidence and execute audit procedures with a high level of proficiency.

Recommendations

Commit to climate-related financial disclosure and integrate it with the overall strategy so that users can understand how the organization manages climate change risks and opportunities.

Economic entities should describe climate-related risks and opportunities that could affect their outlook, explain the nature of each risk, and clarify whether they represent physical or transitional risks. Governance mechanisms within economic entities should be strengthened to effectively and efficiently protect them from emerging crises and risks, including those associated with climate change.

Identify and assess climate change risks confronting economic entities, take measures to mitigate and manage those risks, and recognize both current and future climate-related obligations undertaken by the entity. Increased disclosure and transparency concerning the impact of climate change on related financial statement items require auditors to highlight climate-related risks in their audit reports.

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