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UNVEILING RESEARCH PATTERNS IN CARBON ACCOUNTING: A BIBLIOMETRIC STUDY OF GRADUATE THESES IN TÜRKİYE

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ABSTRACT

Environmental issues such as global warming and climate change have heightened the importance of monitoring and reporting environmental performance and sustainability levels of businesses. As a result, environmental accounting has emerged as a critical tool for calculating and reporting carbon costs. Carbon accounting, a specialized branch of environmental accounting, helps businesses track, report, and reduce their carbon footprints. In the context of combating climate change, carbon accounting supports sustainability goals and helps companies comply with regulations that influence financial performance. This study uses bibliometric methods to analyze graduate theses on carbon accounting available in the Council of Higher Education (YÖK) database, focusing on terms such as carbon pricing and carbon accounting. A total of 15 theses were examined based on parameters including publication years, research methods, and keywords. Findings indicate that graduate research on carbon accounting started in 2014, with significant growth in 2022. The five most frequently used keywords were carbon, accounting, carbon accounting, sustainability and emissions. The majority of studies were conducted in the business administration field using quantitative methods. This research highlights trends and gaps in the literature, offering insights for future academic and practical work on carbon accounting.

Keywords: *Accounting, Carbon Accounting, Bibliometric Analysis, Sustainability, Environmental Performance.*

1. INTRODUCTION

Environmental degradation has become one of the most pressing challenges of the modern era, prompting an increasing global awareness of the need to reduce human impacts on the planet. As a result, businesses are under growing pressure to adopt strategies that minimize their environmental footprints and contribute to sustainability efforts (Çakıraslan & Öztürk, 2024). One such strategy is environmental accounting, which involves incorporating environmental data into the financial reporting systems of organizations. Environmental accounting is essential in measuring and managing the costs incurred by businesses to protect ecosystems and mitigate negative environmental impacts (Jasch, 2003). These costs, referred to as environmental costs, include expenditures related to pollution control, waste management, resource conservation, and sustainable practices (Kücüker, 2017). By providing a systematic approach to tracking environmental expenses, environmental accounting allows businesses to assess the financial implications of their environmental activities, helping them align their operations with sustainability goals (Yakhou & Dorweiler, 2004).

A critical component of environmental accounting is carbon accounting, which specifically focuses on the measurement and reporting of greenhouse gas (GHG) emissions in terms of carbon dioxide equivalents. With the growing urgency to combat climate change, carbon accounting has become a vital tool for businesses to evaluate their carbon footprints and take steps to mitigate their environmental impacts (Schaltegger & Csutora, 2012). This specialized form of accounting enables businesses to align their operations with international climate agreements such as the Kyoto Protocol and the Paris Agreement (Tang, 2017). Through transparent reporting of carbon emissions, businesses can track their progress toward sustainability goals, ensure compliance with environmental regulations, and communicate their

environmental performance to stakeholders (Tang & Demeritt, 2018).

In Türkiye, the academic interest in environmental accounting began in the 1990s as the country recognized the importance of integrating environmental considerations into business practices (Kaya & Akdeniz, 2016). The evolution of carbon accounting in Türkiye has followed global trends, gaining increasing attention in recent years as part of broader efforts to address climate change and sustainability challenges. Despite this growing interest, there remains limited research on the specific applications and challenges of carbon accounting in the Turkish context, highlighting the need for further academic exploration (Altınbay & Durak, 2022).

This study aims to address this gap by analyzing graduate theses on carbon accounting available in the YÖK Thesis Database. Through a bibliometric analysis, this research seeks to identify emerging trends, research methodologies, and potential gaps in the field of carbon accounting in Türkiye. The study's focus is to provide a comprehensive overview of the academic landscape of carbon accounting, offering insights into the evolution of the field, key thematic areas of interest, and the methodological approaches employed in existing research. By examining these trends, this paper also aims to highlight areas where future research could contribute to the development of more effective and regionally adapted carbon accounting practices.

Bibliometric analysis, as a research tool, offers a systematic method for evaluating the structure and dynamics of academic research. It allows researchers to analyze patterns of publication, identify key themes and topics, and assess the impact of various studies within a specific field. In this study, bibliometric analysis will provide valuable insights into the growth and development of carbon accounting research in Türkiye, shedding light on the methodological and thematic shifts that have taken place over time.

The paper is structured as follows: the first section provides an overview of bibliometric analysis as a tool for research, discussing its advantages and applications in assessing trends and methodologies within academic literature. The second section presents the findings of the bibliometric analysis, focusing on the key trends, thematic areas, and research methodologies identified in the selected graduate theses. Finally, the paper concludes with a discussion of the implications of these findings for both academia and practice, highlighting the areas that require further investigation and offering recommendations for future research on carbon accounting in Türkiye.

2. CONCEPTUAL FRAMEWORK

Bibliometric analysis is a quantitative research methodology that employs mathematical and statistical techniques to examine the development, structure, and trends within academic disciplines (Zupic & Čater, 2015). First introduced by Alan Pritchard in 1969, the term "bibliometrics" pertains to the application of these methods to written communication, providing valuable insights into the state and progress of scientific domains (Lawani, 1981). Through bibliometric methods, researchers can analyze various parameters such as publication volume, citation networks, authorship patterns, and keyword frequencies, offering a comprehensive view of the academic landscape within a given field. These analyses enable scholars to track the evolution of academic knowledge, identify influential works, detect emerging themes, and uncover gaps in the literature. Moreover, bibliometric studies can help forecast future research directions by revealing patterns that might otherwise be difficult to discern (Lim & Kumar, 2024).

In the context of accounting, bibliometric methods have been widely applied to a variety of research topics, such as financial performance, digital transformation, and independent auditing. These studies play a pivotal role in identifying influential publications, understanding the trajectory of the field, and mapping key areas of interest. For example, Hotamışlı & Erem (2014) utilized bibliometric analysis to explore the academic output in accounting and finance journals, uncovering a focus on financial markets, public economics, and capital markets. Their study highlighted the concentration

of research within certain subfields and the publication trends over time.

The objective of the Katanalp (2024) study was to employ bibliometric techniques for the analysis of the status of scientific works by academics in Turkey, as identified in international databases. The study revealed that research on accounting education and professionals is continually evolving, with recent contributions emphasizing the field of accounting history.

In a recent study, Kaya (2024) analyzed papers published in the Journal of Accounting and Auditing Perspectives from 2017 to 2023 using bibliometric techniques. The research findings indicated that the articles in the journal predominantly addressed accounting standards, accounting professionals, and accounting education and independent auditing.

In a similar vein, Gök (2024) conducted a bibliometric analysis of theses on digitalization in accounting, revealing shifting trends, methodological preferences, and the increasing prominence of digital technologies within the discipline. This analysis contributed to a deeper understanding of how accounting is adapting to technological advancements and how these changes are reflected in academic research.

Carbon accounting, which is a specialized subset of environmental accounting, has gained considerable attention in recent years due to growing global concerns about climate change and environmental sustainability. Carbon accounting focuses specifically on tracking, measuring, and reporting greenhouse gas emissions, thereby helping businesses and organizations assess their environmental impact and reduce their carbon footprint (Schaltegger & Csutora, (2012). This field intersects multiple disciplines, including sustainability, economics, environmental policy, and regulatory compliance. As such, bibliometric analysis of carbon accounting allows for the exploration of its academic development, identification of key research themes, and the evaluation of its alignment with broader environmental goals (Stechemesser & Guenther, 2012).

Environmental accounting, the precursor to carbon accounting, emerged in the early 1970s as businesses and governments began to recognize the importance of environmental data in decision-making processes (Ding et al., 2014). The incorporation of environmental considerations into corporate financial reporting was influenced by international environmental agreements such as the Kyoto Protocol, the Basel Convention, and the Paris Agreement (Prieto, 2020). These agreements imposed stricter obligations on countries and corporations to reduce emissions and improve sustainability reporting. In Türkiye, environmental accounting research began gaining traction in the 1990s, providing a foundation for studies on carbon accounting in the subsequent decades. The early focus of these studies was on integrating environmental costs into financial reporting frameworks, thus creating an accounting mechanism for firms to evaluate their ecological impact (Çelik, 2018).

Building on environmental accounting principles, carbon accounting focuses specifically on the measurement, reporting, and reduction of greenhouse gas emissions. As corporations and governments recognized the urgent need to mitigate climate change, carbon accounting practices became a crucial tool for assessing and managing carbon liabilities. Studies such as Samaduzzaman et al. (2013) underscore the role of carbon accounting in promoting sustainability by helping organizations develop strategies to reduce their environmental footprint. Additionally, Tang (2017) provides a comprehensive framework for integrating carbon management within corporate structures, offering a blueprint for businesses to adopt carbon accounting practices.

Bibliometric analysis in carbon accounting is particularly valuable because it enables scholars to gain insights into the field's evolution over time, identify influential studies, and trace the impact of regulatory and technological advancements on research trends (Zheng, 2022). Parameters such as keyword frequencies, publication years, citation patterns, and authorship networks can help map the development of carbon accounting and identify

dominant themes, including the role of policy in shaping the field. Furthermore, bibliometric analyses can reveal emerging areas of research, such as the use of blockchain for carbon tracking or the integration of carbon accounting within broader corporate sustainability strategies.

The application of bibliometric methods in carbon accounting research can also shed light on interdisciplinary trends, as the field encompasses elements from accounting, environmental science, economics, and public policy. For instance, bibliometric analyses could uncover the increasing role of sustainability frameworks, such as the Global Reporting Initiative (GRI) or the Task Force on Climate-related Financial Disclosures (TCFD), in shaping carbon accounting practices. Additionally, by examining authorship patterns, citation networks, and thematic clusters, researchers can identify key collaborations between scholars from different disciplines and regions, offering insights into the globalization of carbon accounting research.

In this study, bibliometric analysis will serve as a tool to explore the key trends, emerging topics, and major influences in the field of carbon accounting. By examining factors such as publication volume, citation networks, and thematic focus, this research will contribute to a deeper understanding of how carbon accounting has evolved, its current state, and potential future directions. Furthermore, it will highlight critical gaps in the literature, providing guidance for future research efforts and offering recommendations for practitioners and policymakers seeking to improve their carbon accounting practices.

3. METHODOLOGY

The study analyzed 15 postgraduate theses from the YÖK Thesis Database. The selection criteria included theses containing the terms "carbon accounting" or "carbon pricing" in their titles or abstracts. The bibliometric analysis was conducted based on parameters such as:

- Languages of the theses
- Distribution of keywords
- Gender of authors
- Research methods
- Departments and institutes
- Universities and geographic distribution

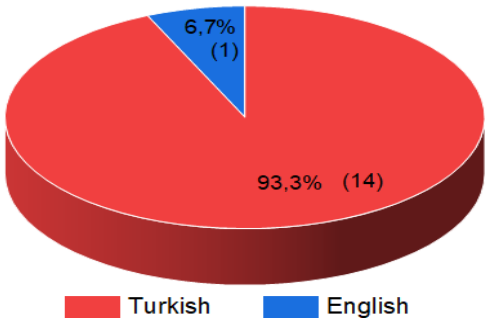
Data were analyzed using descriptive statistics and content analysis. Ethical standards were maintained throughout, ensuring transparency and accuracy in reporting.

4. FINDINGS

Language

Of the theses analyzed, 14 were written in Turkish, and only one in English (Figure 1). This demonstrates a clear preference for the Turkish language in academic research within this context. The scarcity of English theses may limit international visibility and collaboration, suggesting an opportunity to encourage bilingual research outputs.

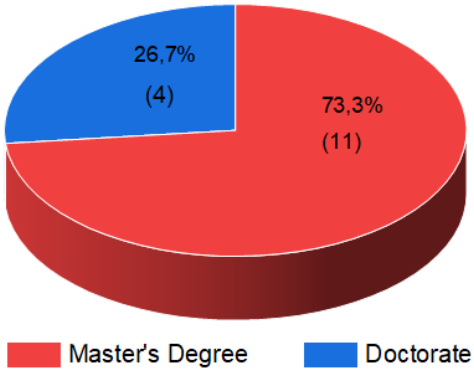
Figure 1. Languages of the Examined Theses



Graduate Level

As seen I Figure 2, among the theses, 73.3% were master's theses, and 26.7% were doctoral dissertations. This reflects a higher emphasis on graduate-level research at the master's level, potentially because it is more accessible or aligns with the academic demands of the field. The lower number of doctoral studies may highlight the need for more advanced research to deepen expertise.

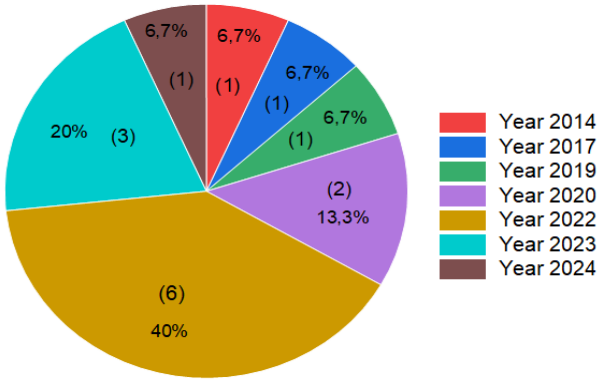
Figure 2. Graduate Levels of the Examined Theses



Publication Year

Figure 3 depicts that the theses were published between 2014 and 2024, with the majority (60%) appearing in 2022 and 2023. This clustering indicates growing interest or activity in recent years, possibly due to evolving academic priorities, emerging research areas, or funding incentives.

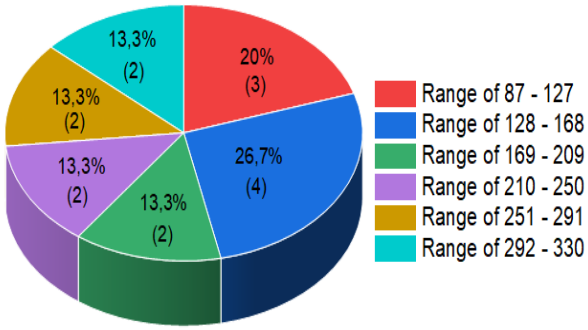
Figure 3. Publication Years of the Examined Theses



Page Range

As seen in Figure 4, the theses varied significantly in length, with the largest proportion (26.7%) falling within 128–168 pages. The spread across other page ranges shows diversity in research scope and depth. The variation might be attributed to the complexity of topics or differing institutional guidelines.

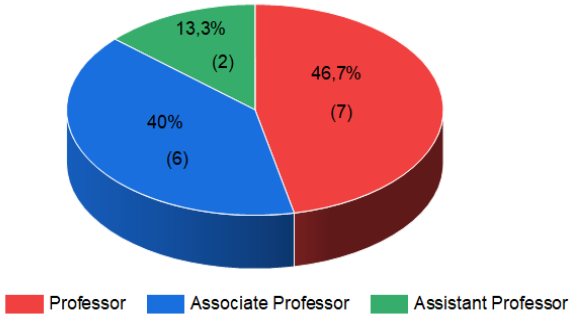
Figure 4. Number of Pages of the Examined Theses



Academic Titles of the Supervisors

The academic titles of the supervisors are as follows (Figure 5): 46.7% of the theses were supervised by Professors, 40% by Associate Professors, and 13.3% by Assistant Professors. This distribution indicates that experienced faculty members are primarily responsible for guiding graduate research, which reflects the crucial role of expertise in ensuring the quality and rigour of academic work.

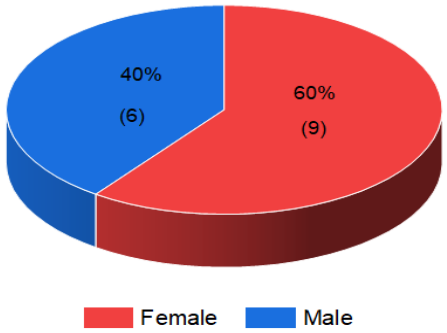
Figure 5. Academic Titles of the Supervisors of the Examined Theses



Gender

With regard to gender, the authors included 60% female and 40% male researchers (Figure 6). The higher proportion of female authors may be indicative of evolving dynamics in gender representation within the academic realm, potentially influenced by an increase in inclusion or support initiatives.

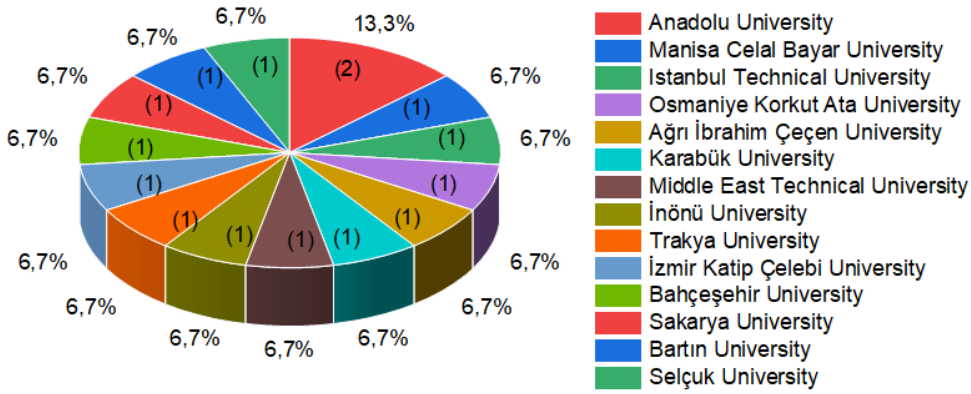
Figure 6. Genders of the Researchers



Universities

As seen in Figure 7, Anadolu University accounted for the highest number of theses (2), while other universities contributed one thesis each. Geographically, the Central Anatolia Region led with 4 theses, followed by the Marmara, Aegean, Black Sea, and Eastern Anatolia Regions, each contributing 2 theses, and the Mediterranean Region contributing 1. This uneven distribution may reflect regional variations in research infrastructure, focus, or opportunities.

Figure 7. Universities Where the Theses Submitted



The regional distribution of the universities where the examined theses were accepted is presented in Figure 8.

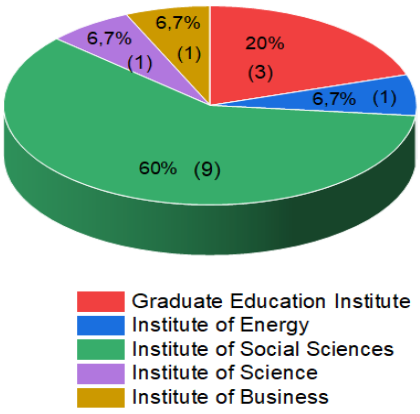
Figure 8. Locations the Universities that the Examined Theses Submitted

Types of Graduate Schools

The distribution of theses by type of graduate school is as follows (Figure 9): 60% were hosted by the Institute of Social Sciences, 20% by the Institute of Graduate Education, and smaller contributions from the Energy Institute (6.7%), the Institute of Science (6.7%), and the Institute of Business (6.7%). This suggests that the social sciences represent the dominant field of graduate research within the

dataset, with specialised areas of study contributing less frequently.

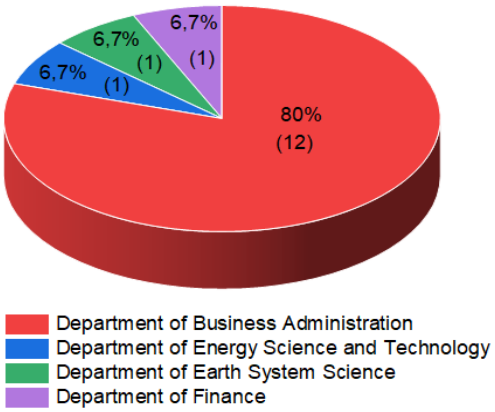
Figure 9. Graduate Schools of the Examined Theses Submitted



Major Disciplines

As highlighted in Figure 10, the majority of theses were within the field of business administration, which accounted for 80% of the total. This highlights the central role that this discipline plays in the research. The remaining disciplines accounted for a minor share (6.7% each), indicating a necessity to diversify research across disciplines in order to facilitate broader academic exploration.

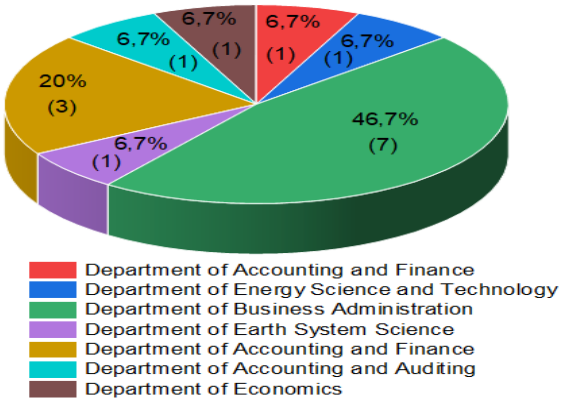
Figure 10. Major Disciplines of the Examined Theses



Scientific Fields

The results of the evaluation of the 15 theses revealed that 46.7% were accepted in the field of Business Administration, while 20% were accepted in the field of Accounting and Finance (Figure 11). The remaining fields contributed 6.7% each. The preponderance of business-related subjects indicates the primacy of these disciplines within the context of the study, suggesting a robust alignment with contemporary economic and managerial challenges.

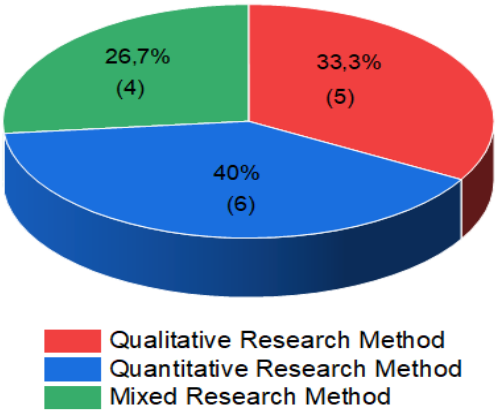
Figure 11. Scientific Fields of the Examined Theses



Research Methods

Figure 12 demonstrates that the most frequently employed research methods were quantitative (40%), followed by qualitative (33.3%) and mixed methods (26.7%). The preference for quantitative approaches indicates a focus on measurable, data-driven insights, while the notable use of qualitative and mixed methods suggests an interest in exploring nuanced, multifaceted phenomena.

Figure 12. Research Methods of the Examined Theses

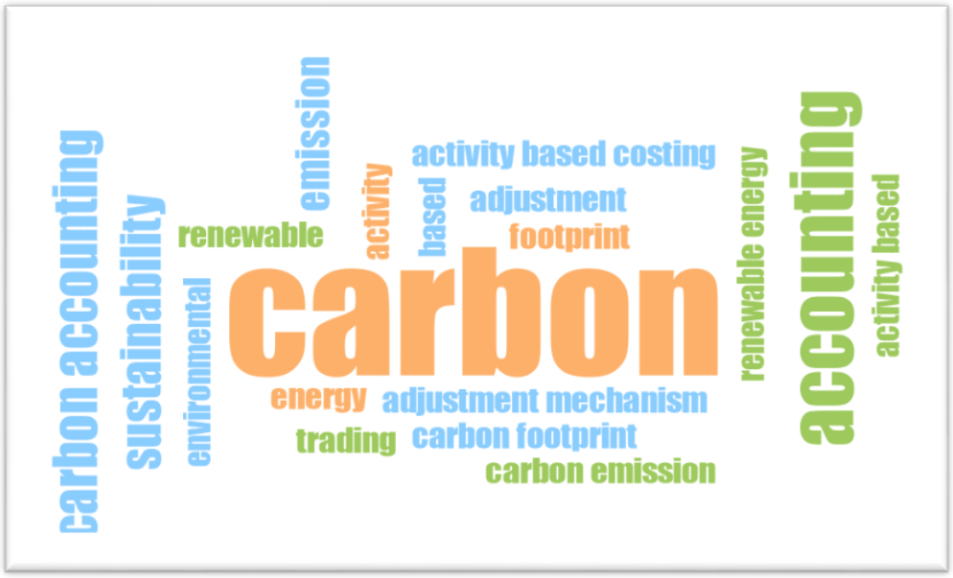


Keywords

The keyword analysis in Figure 13 revealed "carbon" as the most frequent term (25 repetitions), followed

by "accounting" (15), "carbon accounting" (11), "sustainability" (10), and "emissions" (7). This pattern highlights a strong focus on environmental and sustainability issues, particularly carbon-related topics, reflecting their increasing importance in contemporary research and policy discussions.

Figure 13. Keywords of the Examined Theses



Key Findings of the Theses

Aliusta (2014) investigated the influence of national and international economic measures targeting emission reductions on businesses' accounting and financial frameworks. The study concluded that controlling carbon costs is crucial for sustainable growth. It emphasized that a well-designed accounting system, which integrates carbon expenses, is indispensable for businesses to achieve this goal. This underscores the importance of adapting financial structures to address environmental objectives.

Küçüker (2017) analyzed the significant impact of business practices on energy consumption and carbon emissions. The findings revealed that a substantial portion of carbon emissions originates from natural gas consumption, highlighting the importance of energy-efficient strategies. This study provides critical insights into identifying and addressing major sources of carbon footprints in business operations.

Kara (2020) explored the accounting and reporting of carbon emission certificates under international accounting standards. Using a practical example, the study demonstrated the application of both cost and revaluation methods. This contribution is pivotal for enhancing transparency and consistency in reporting emission-related financial data.

Halaç (2020) evaluated a textile company's renewable energy investments and carbon emission credits. By presenting best practices for accounting in these areas, the study offered a financial perspective on integrating sustainability initiatives into business strategies, serving as a benchmark for other industries.

Kılıç (2022) conducted a historical analysis of Türkiye's progress in the green economy. The study concluded that environmental taxes implemented as policy tools have not fully achieved their objectives. This finding calls for a reassessment of policy effectiveness and the potential for more innovative green economy strategies.

Ünsal (2023) examined Türkiye's environmental policies and the role of carbon tax applications. The study highlighted the inefficiency of existing environmental taxes and emphasized the need for carbon pricing tools aligned with sustainable development goals. This work is a call to action for

policy reform aimed at achieving measurable environmental and economic benefits.

Şimşek (2019) focused on a thermal power plant's efforts to reduce carbon emissions. Through accounting records based on real data, the study demonstrated practical measures that businesses can adopt to minimize their environmental impact while ensuring compliance with environmental regulations.

Ulucenk (2022) proposed an alternative carbon accounting model for the maritime transport sector within the sustainability framework. This study broadens the scope of carbon accounting by addressing the unique challenges and opportunities in maritime operations.

Kılınç (2022) analyzed the impact of the Carbon Border Adjustment Mechanism (CBAM) on Türkiye's steel and cement sectors. The study concluded that carbon costs significantly reduce exports, GDP, and overall output, highlighting the economic challenges of adapting to international carbon regulations.

Ok (2022) provided a detailed cost comparison of products in a company using both traditional and activity-based costing systems. By illustrating the share of production costs linked to carbon emissions, this study highlighted the need for businesses to adopt more accurate and environmentally conscious costing methods.

Ergün (2022) demonstrated the growing significance of carbon costs as a business expense through an example application using developed software. The study highlighted the operational adjustments required for companies to manage these rising costs effectively.

İbaçoğlu (2023) conducted a bibliometric analysis and found the USA and China leading in carbon accounting publications, with Türkiye ranking 25th. This study emphasized the need for increased academic contributions from Türkiye to elevate its position in global research.

Altay (2022) calculated the carbon footprint of a steel company using emission-causing input data. The study suggested that renewable energy sources could significantly enhance energy management, providing actionable recommendations for companies in heavy industries.

Şutaşdemir (2023) compared the emission trading system with carbon taxes in Türkiye, concluding that the trading system offers greater benefits in reducing the economic burden of emissions and the CBAM. This study contributes to the ongoing debate on the effectiveness of different carbon reduction mechanisms.

Tüjümet (2024) focused on developing a carbon accounting application for a chemical company. This practical tool demonstrates how businesses can financially approach carbon reduction projects and align them with accounting standards, paving the way for innovative solutions in this area.

A common theme across these studies is the critical role of carbon accounting in aligning business operations with sustainability goals. Most studies emphasized the financial implications of carbon costs, highlighting the necessity of integrating sustainability into accounting frameworks. For instance, Aliusta (2014) and Kara (2020) focused on foundational accounting practices, while studies like Küçüker (2017) and Altay (2022) addressed sector-specific challenges. Meanwhile, policy-focused studies such as Kılıç (2022) and Ünsal (2023) provided insights into the broader economic and regulatory landscape.

Sectoral diversity in the studies—ranging from steel and textile industries to maritime transport—demonstrates the multifaceted challenges and solutions in carbon accounting. Furthermore, the emphasis on policy mechanisms, such as the CBAM and carbon taxes, highlights the intersection of accounting practices with international regulations.

Overall, while the studies collectively stress the need for robust carbon accounting frameworks, they also reveal gaps in policy effectiveness and international competitiveness, particularly in Türkiye. Bridging these gaps will require coordinated efforts among policymakers, businesses, and academic researchers to develop innovative tools and frameworks that align with global standards.

5. CONCLUSION

This study provides valuable insights into the evolution of carbon accounting research in Türkiye, highlighting its increasing significance as a tool for addressing climate change and achieving sustainability goals. As nations strive to meet their international climate commitments, carbon accounting is emerging as a key practice in tracking and reducing carbon emissions, helping both businesses and governments meet the mandates set by international frameworks such as the Paris Agreement. Through a bibliometric analysis of 15 graduate theses, this study uncovers the trends in the research methods, thematic focuses, and geographical scope of carbon accounting studies in Türkiye, contributing to the growing body of literature on the subject.

The findings reveal significant growth in carbon accounting research, particularly in response to regulatory pressures and sustainability objectives. The uptick in studies during 2022 aligns with global momentum around climate agreements and national policies advocating for stricter emissions reporting. This highlights a growing recognition of the importance of carbon accounting in driving effective climate action.

Carbon accounting, as a rapidly evolving field, plays an essential role in managing greenhouse gas emissions and ensuring that businesses, governments, and other stakeholders are transparent and accountable in their sustainability efforts. In line with global calls for more rigorous carbon reporting, the Turkish context shows an increasing focus on emissions reduction, sustainability, and regulatory compliance. This alignment with global climate goals reflects a growing recognition of the importance of carbon accounting in driving effective climate action. While much of the focus has been on global strategies, this study places emphasis on the regional and national dimensions, offering new insights into the Turkish research landscape.

From a methodological perspective, the predominance of quantitative methods underscores the field's reliance on empirical and financial data, reflecting its technical and regulatory orientation. However, the limited use of qualitative and mixed methods suggests an opportunity to explore more nuanced, contextual analyses of how organizations implement carbon accounting. For example, qualitative studies could examine decision-making processes behind adopting carbon management tools or the cultural shifts required within organizations. Expanding the range of methodologies will enrich the field and offer a more comprehensive understanding of carbon accounting practices.

The bibliometric analysis reveals several key trends that are of particular importance for both academia and practice. First, the thematic trends indicate that regulatory compliance, sustainability, and emissions reduction are central concerns in the research on carbon accounting. These themes mirror the priorities of global environmental policies that focus on emission reductions, such as the Kyoto Protocol and the more recent Paris Agreement.

Regulatory compliance in the context of carbon accounting refers to the adherence to national and international climate policies that require entities to report and reduce their carbon emissions. Research on this topic is vital for ensuring that carbon accounting practices align with evolving legislation and help organizations track their contributions to climate goals. The research also reveals that the regulatory environment in Türkiye is becoming more supportive of carbon accounting as a tool for emissions tracking, which may prompt future studies to explore the implications of specific policies on carbon practices in Turkish industries.

Thematic trends identified in this study reveal a focus on regulatory compliance, sustainability, and emissions reduction, aligning closely with global climate priorities. The dominance of keywords such as "carbon," "accounting," and "sustainability" reflects the alignment of research with international climate goals. However, the underrepresentation of advanced topics like digital carbon tracking and blockchain integration indicates potential research gaps. Exploring these emerging technologies could enhance transparency, precision, and efficiency in emissions reporting and tracking.

A significant finding of this study is the identification of emerging sectoral applications, such as renewable energy investments and industry-specific carbon tracking. Carbon accounting is not just a universal framework but also one that requires sector-specific adaptation. Renewable energy investments are a key component of Türkiye's national climate strategies, as the country has been actively pursuing goals to transition to a more sustainable energy mix.

The integration of renewable energy sources such as wind, solar, and hydropower into the national grid has profound implications for carbon accounting systems, as these investments impact emissions profiles and carbon offset strategies. By incorporating renewable energy projects into carbon accounting systems, organizations can better track the reductions in carbon emissions and the potential for achieving net-zero emissions. Further research could delve deeper into the effectiveness of carbon accounting in assessing the true environmental impact of renewable energy projects and whether current methodologies are equipped to handle this.

Sector-specific findings demonstrate that carbon accounting research has begun addressing industry-specific challenges, such as those faced by the textiles and steel sectors. These findings highlight opportunities for cross-sectoral comparisons to identify best practices and innovative solutions. For instance, renewable energy investments in industries can significantly influence carbon profiles and sustainability strategies. Future research should delve deeper into the effectiveness of carbon accounting in assessing the environmental impact of renewable energy projects and addressing the unique needs of carbon-intensive sectors.

The bibliometric analysis also reveals that sector-specific applications involve industry-specific carbon tracking, which is becoming increasingly important as companies and governments seek tailored solutions to their unique challenges in achieving sustainability. Industries such as manufacturing, transportation, and agriculture are particularly carbon-intensive and therefore require specialized approaches to effectively measure and mitigate emissions. The existing body of literature highlights that the carbon accounting methods in these industries have significant room for development, particularly in terms of methodological integration and accuracy in emissions reporting (Cames et al., 2016). The research in Türkiye, while still nascent, is pointing toward a growing interest in developing such specialized tools that can accommodate the diverse needs of these sectors.

The geographical concentration of carbon accounting research in certain regions of Türkiye, as highlighted by this study, points to a need for a broader exploration of the institutional and economic contexts across the country. While large urban centers, such as Istanbul and Ankara, have been the focal points of academic research, other regions with varying economic structures and environmental conditions could offer valuable insights into the diverse challenges and opportunities in carbon accounting.

Regional disparities in economic development, industrial activity, and environmental vulnerability make it important to consider the diversity of contexts when developing carbon accounting systems. A more inclusive approach to research, which examines rural and less economically developed areas, would not only enrich the academic discourse but also ensure that the practices of carbon accounting are accessible and applicable across different socio-economic settings.

In terms of future research directions, there is considerable potential for expanding the scope of carbon accounting studies to incorporate global perspectives, as well as cross-cultural comparisons. The expanding body of literature on global carbon accounting practices highlights the importance of adapting accounting systems to regional variations in climate policies, industrial practices, and societal needs (Pereira et al., 2021).

Expanding the linguistic and geographic diversity of research in Türkiye would allow for richer discussions and contribute to the broader global dialogue on climate action. It is important for scholars in Türkiye to not only examine domestic practices but also engage with international research

to understand best practices, the challenges faced in other contexts, and innovative solutions that could be adapted to the Turkish context.

In conclusion, this bibliometric study on carbon accounting research in Türkiye offers valuable insights into the field's development and highlights several key trends and opportunities for future research. Policymakers, educators, and industry leaders can leverage these insights to promote innovative practices and further advance the sustainability agenda. As the field of carbon accounting evolves, it is critical for researchers to explore new methodologies, integrate interdisciplinary approaches, and expand the geographical and sectoral scope of their studies. By doing so, they can help advance carbon management strategies that are both effective and adaptable to the dynamic challenges posed by climate change.

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