

## Research Article

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## Optimizing Intelligent Marketing with AI-Based DSS (Case Study: Sprout Social at University of Science and Technology, Aden, Yemen)

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Received: December 12, 2024

Accepted: January 02, 2025

Published: January 17, 2025

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**Cite this article as:** Yosra Abdullah Elewa, Nabil Mohammed Munassar, Mohammed Fadhl Abdullah. Optimizing Intelligent Marketing with AI-Based DSS (Case Study: Sprout Social at U.S.T Aden). Technological Applied Humanitarian Academic Journal (TAHAJ). 2025;1(1):1-10.

### Abstract:

The objective of this study was to explore the role of AI-driven decision support tools, specifically Sprout Social, in enhancing digital marketing strategies for higher education institutions. The research aimed to analyze social media performance metrics over a three-year period (2022–2024) at the University of Science and Technology, Aden, focusing on trends in engagement rates, followers, and content impact. The study used a descriptive and analytical approach, utilizing Sprout Social's analytics dashboard to track changes in metrics such as video views and impressions. Key findings include a significant increase in video content's impact on engagement (+2700% in 2023, +34.8% in 2024) and a shift towards deeper audience engagement despite a decline in net page likes. These results highlight the effectiveness of AI tools in refining marketing strategies, particularly through video content, and underscore the challenges faced by Yemeni universities in fully leveraging these technologies. The study provides actionable insights for higher education institutions to optimize their digital marketing strategies and suggests the need for continuous adaptation and investment in AI-driven tools to maintain competitiveness in the digital landscape.

**Keywords:** Sprout Social, Artificial Intelligence, Higher Education Marketing, Marketing AI Tools

## INTRODUCTION

The field of artificial intelligence (AI) is experiencing a resurgence akin to its emergence during the 1950s, driven by advancements that enable computer systems to learn and make data-driven decisions autonomously. In recent decades, AI has emerged as a transformative force in digital marketing, reshaping how businesses strategize, engage with customers, and optimize their operations [1]. By leveraging AI, marketers can process vast datasets, derive actionable insights, and create personalized campaigns. This evolution underscores AI's growing importance for businesses striving to remain competitive in an ever-changing market landscape [2].

Traditional marketing relied heavily on human intuition and effort, but AI introduced a paradigm shift with its efficiency and precision. For example, AI tools are revolutionizing social media by personalizing interactions, streamlining workflows, and enhancing marketing strategies. As AI technologies evolve, they unlock innovative applications, making them indispensable for modern marketing [3].

The increasing adoption of AI has also transformed performance measurement in marketing. AI tools collect and analyze consumer behavior data, identify trends, create user profiles, and deliver tailored content, thereby enhancing campaign effectiveness and user engagement [4]. Furthermore, the integration of AI into digital marketing facilitates the creation of dynamic and adaptive strategies that align with the fast-paced digital era.

Social Media Marketing is a very effective digital marketing tool [5] With the proliferation of social media, businesses generate and interact with massive datasets. This has led to the development of advanced AI-based tools, such as Sprout Social and Hootsuite, which analyze engagement metrics, track audience sentiment, and identify trends. These tools empower marketers with real-time insights, enabling them to optimize strategies and achieve higher ROI [3], [6].

Intelligent marketing a set of strategies that relies on collecting and analyzing deep data to understand consumer behavior. It aims to enhance marketing efficiency and achieve sustainable competitive advantages in today's dynamic business environment [7]. AI tools are software applications or systems that utilize artificial intelligence technologies, such as machine learning, natural language processing, and computer vision, to assist or enhance various tasks and functions [8]. Sprout Social is a global leader in social media management and analytics software. Sprout's intuitive platform puts powerful social data into the hands of more than 30,000 brands so they can deliver smarter, faster business impact. [9].

The significance of AI tools is also evident in higher education, where digital marketing plays a pivotal role in reaching and engaging target audiences. Recent studies highlight the effectiveness of tools like Sprout Social in optimizing marketing strategies. For instance, [10] emphasize the necessity of key performance indicators (KPIs) for enhancing campaign effectiveness, while [4] illustrate how AI enhances user experience through precise engagement analysis. Similarly, [11], [12], [13].underscore AI's potential in improving marketing strategies and measuring social media communication performance.

Despite the global adoption of artificial intelligence (AI) tools namely Sprout Social in enhancing marketing strategies, Yemeni universities, particularly the University of Science and Technology in Aden, face significant challenges in utilizing these technologies effectively. This gap arises from the limited understanding and application of AI-driven analytics to optimize digital marketing efforts, such as engagement rates, reach, and follower growth. Furthermore, while the integration of social media marketing is essential for positioning universities in a competitive educational market, there is a noticeable lack of studies addressing the role of AI-powered tools in this context within Yemen.

Therefore, this study aims to fill this critical gap by investigating the role of Sprout Social in enhancing digital marketing outcomes in Yemeni universities Providing valuable insights into both academic literature and practical strategies for higher education institutions in similar contexts.

The main objective of this research is to explore the impact of Sprout Social as an AI-driven tool on digital marketing strategies in Yemeni universities. sub-objectives are:

- Identify trends and fluctuations in key social media metrics such as engagement rates, reach, and follower growth.
- Explore the factors influencing these metrics and assess the effectiveness of current strategies.
- Provide actionable recommendations for optimizing digital marketing in higher education institutions. The research questions can be formatted as follows:
  1. How can AI-driven decision support tools like Sprout Social improve digital marketing strategies in the context of higher education at U.S.T Aden?
  2. What are the fluctuations in engagement rates, follower growth, and other key performance metrics in social media marketing at U.S.T Aden over three years (2022–2024)?
  3. What actionable recommendations can be made for optimizing digital marketing strategies based on the analysis of Sprout Social data?

This study focused on the University of Science and Technology in Aden, Yemen. The choice to concentrate on this university is rooted in its significance as a leading educational institution in the region. The sample consists of data collected from the university's official Facebook page, which includes interactions and metrics over a three-year period (2022–2024).

The significance of this research lies in its potential to provide valuable insights for the top administration of Yemeni universities. The results indicate that leveraging findings from AI-driven tools namely Sprout Social can empower university leaders to make informed decisions regarding their digital marketing strategies. The conclusions drawn from this study emphasize the importance of optimizing resource allocation to enhance engagement with prospective students. Additionally, the recommendations provided will guide universities in refining their marketing efforts and achieving better results in a competitive landscape.

## METHODS

### *Study Design*

This study employs a descriptive and analytical design to evaluate the effectiveness of AI-driven decision support tools, specifically Sprout Social, in optimizing digital marketing strategies at the University of Science and Technology, Aden. The descriptive approach focuses on observing and summarizing trends in social media performance over three years (2022–2024). This includes analyzing metrics such as engagement rates, follower growth, impressions, video views, and net page likes. The goal is to capture the dynamics of the university's social media presence and understand how specific strategies influence audience interaction. The analytical aspect involves interpreting these trends to assess the impact of various content formats and strategies, thereby identifying areas for improvement.

### *Sampling*

Data was analyzed from the official Facebook page of the University of Science and Technology, Aden, which was selected due to its significance as a primary digital marketing tool for the university. The sample comprises all posts, interactions, and performance metrics over the specified three-year period (2022–2024). Metrics analyzed included followers, engagement rates, impressions, video views, and net page likes. This approach ensures a comprehensive understanding of the university's social media dynamics and provides insights into how different content strategies affect audience engagement.

## *Procedures*

Data collection was carried out using Sprout Social's analytics dashboard, which offers detailed metrics and trends in social media performance. The process included the following steps:

1. **Data Extraction:** Metrics such as total followers, engagement counts (likes, shares, comments), impressions, and video views were retrieved for each year (2022, 2023, and 2024). This allowed for a detailed analysis of how these metrics fluctuated over time.
2. **Categorization:** Posts were categorized by content type (text, image, video) to evaluate the impact of different content formats on engagement metrics. This step helped in understanding which content types were most effective in driving interactions.
3. **Trend Analysis:** Comparative year-over-year analysis was conducted to identify significant shifts in performance metrics. This involved assessing changes in engagement rates, follower growth, and impressions to understand the effectiveness of marketing strategies across different years.
4. **Content Evaluation:** A systematic content analysis was used to determine the types of posts (e.g., video, image) that contributed most to audience engagement and reach. This analysis helped in identifying patterns in content that were successful in capturing audience attention and fostering interaction.

## *Statistical Analysis*

The data was analyzed using descriptive statistical methods to summarize key metrics, including averages, percentages, and changes over time. The following statistical techniques were used:

1. **Comparative Analysis:** Differences in performance metrics between consecutive years were assessed to understand changes in strategy effectiveness. This helped in identifying which strategies were successful in the short term and which needed adjustments.
2. **Trend Analysis:** Year-over-year comparisons were conducted to detect significant patterns or fluctuations in key metrics such as engagement rates, follower growth, and impressions. This approach provided insights into the impact of different content strategies over time.
3. **Rate of Change:** The percentage change between consecutive years was calculated for each key metric (e.g., engagement rates, impressions, and video views). This calculation quantified the magnitude and direction of performance shifts over the study period, providing a clear picture of how changes in strategies influenced outcomes.
4. **Excel:** Microsoft Excel was used for supplementary analysis, enabling detailed visualization of trends and easy comparison of metrics. Charts and graphs created in Excel helped to clearly illustrate the year-over-year changes in performance, providing a visual representation of the data.

### *Ethical Approval*

The study obtained ethical approval from the research ethics committee at the University of Science and Technology, Aden number MEC No. (MEC /AD054) . All data was anonymized and utilized solely for research purposes, ensuring strict adherence to confidentiality and ethical standards.

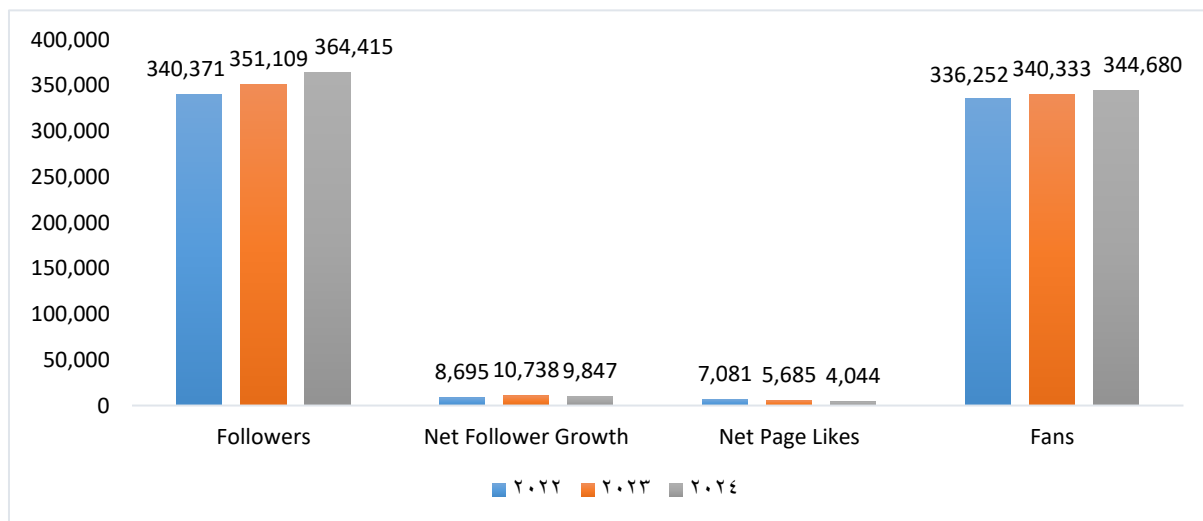
## **RESULTS**

### *Audience Growth*

As shown in Table 1 and Figure 1, the university's followers increased steadily over the years, growing by +3.2% in 2023 and +3.8% in 2024. This indicates a consistent ability to attract new followers. Net Follower Growth showed a sharp increase of +23.5% in 2023, followed by a decline of -8.3% in 2024, suggesting a strategic shift from rapid acquisition to deeper engagement with existing followers. However, Net Page Likes experienced continuous declines, with decreases of -19.7% in 2023 and -28.9% in 2024, reflecting a possible focus on engaging current followers rather than acquiring new likes. Fans showed steady growth, increasing by +1.2% in 2023 and +1.3% in 2024, demonstrating sustained audience interest.

**Table 1:** Audience Growth Metrics

Metric	2022	2023	2024	% Change 2023 vs. 2022	% Change 2024 vs. 2023
Followers	340,371	351,109	364,415	+3.2%	+3.8%
Net Follower Growth	8,695	10,738	9,847	+23.5%	-8.3%
Net Page Likes	7,081	5,685	4,044	-19.7%	-28.9%
Fans	336,252	340,333	344,680	+1.2%	+1.3%



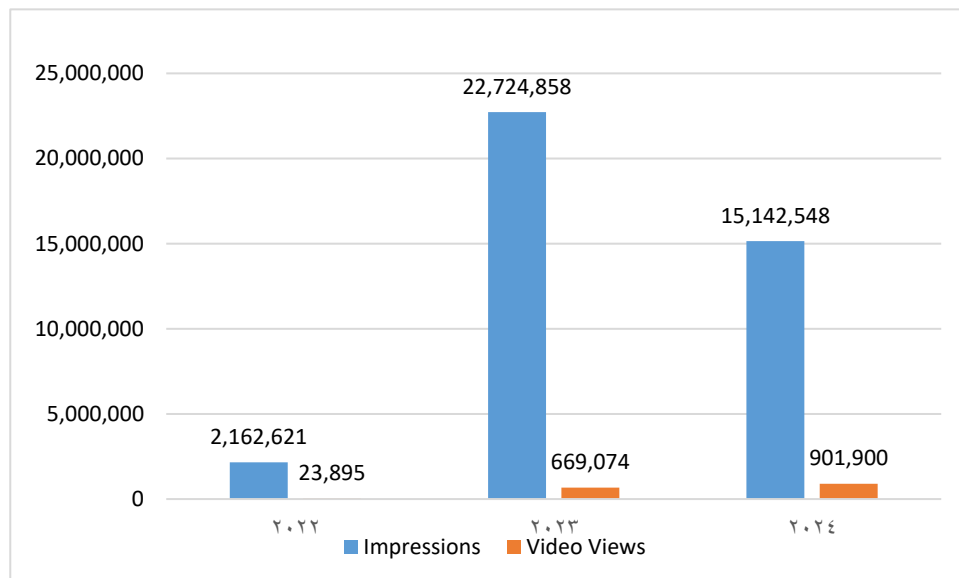
**Figure 1:** Audience Growth Metrics

## Reach and Views

As presented in Table 2 and Figure 2, impressions increased dramatically in 2023, being approximately +800% higher than in 2022. However, there was a subsequent decline of -33.4% in 2024, likely reflecting a shift to a more targeted audience approach. Similarly, video views rose significantly in 2023, showing an increase of about +2700% compared to 2022, and continued to grow by +34.8% in 2024. This highlights the effectiveness of video content in capturing audience attention.

**Table 2: Reach and View Metrics**

Metric	2022	2023	2024	% Change 2023 vs. 2022	% Change 2024 vs. 2023
Impressions	2,162,621	22,724,858	15,142,548	+800% higher	-33.4%
Video Views	23,895	669,074	901,900	+2700% higher	+34.8%



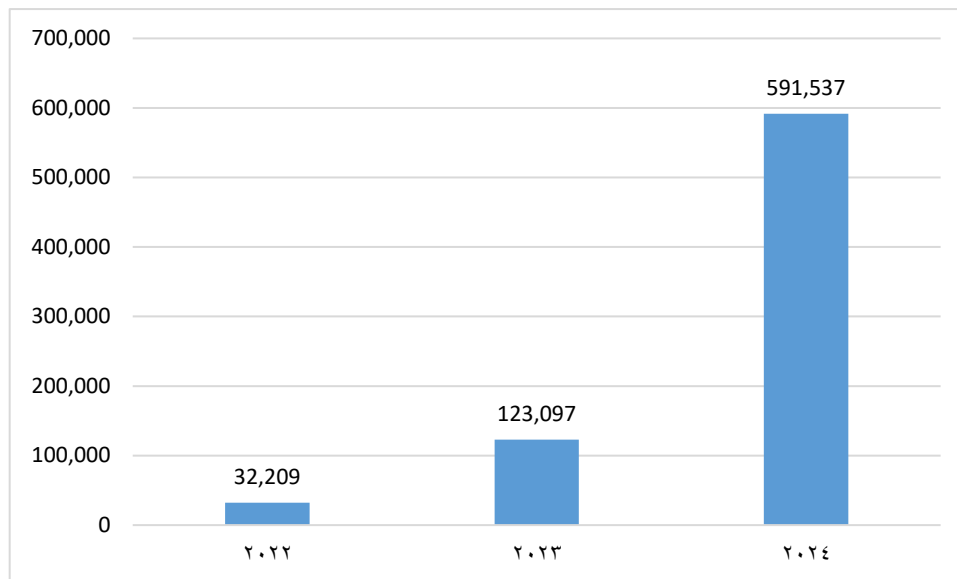
**Figure 2: Reach and View Metrics**

## Engagement Metrics:

As indicated in Table 3 and Figure 3, engagement rates showed significant improvement over the years. Engagements surged by +282% in 2023 and an impressive +380% in 2024, indicating that the content resonated well with the audience. Although the Engagement Rate per Impression dropped by -60.6% in 2023 due to the substantial rise in impressions, it rebounded sharply in 2024 with a +620% increase, suggesting better-targeted content and improved interaction quality.

**Table 3: Engagement Metrics**

Metric	2022	2023	2024	% Change 2023 vs. 2022	% Change 2024 vs. 2023
Engagements	32,209	123,097	591,537	+282% increase	+380% increase
Engagement Rate per Impression	1.5%	0.6%	3.9%	-60.6% decrease	+620% increase



**Figure 3:** Engagement Metric

## DISCUSSION

The results of this study highlight the effectiveness of AI-driven decision support tools, such as Sprout Social, in enhancing digital marketing strategies. The consistent increase in followers (+3.2% in 2023 and +3.8% in 2024) suggests that the university successfully attracted new audiences through targeted strategies. Additionally, the significant growth in video views (+2700% in 2023 and +34.8% in 2024) underscores the role of video content as a key driver for audience interaction. These findings indicate that leveraging AI tools enables institutions to refine their strategies and improve audience engagement, aligning with the shift toward data-driven marketing approaches.

The findings align with those of [10], who emphasized the importance of KPIs in measuring and improving marketing effectiveness. Similarly, the focus on video content in this study reflects the conclusions of [6], which highlighted video as a highly engaging content format. Furthermore, the observed rebound in engagement rate per impression in 2024 (+620%) mirrors the trends identified by (Golab-Andrzejak, 2023), who demonstrated how AI tools enhance audience targeting and refine communication strategies. These comparisons validate the relevance of this study's results within the broader literature on AI-driven digital marketing.

## CONCLUSION

This study demonstrates the potential of AI-driven decision support tools, specifically Sprout Social, in enhancing digital marketing strategies for higher education institutions. By analyzing three years of social media performance data from the University of Science and Technology, Aden, the research highlights key trends such as the growing importance of video content, the need to prioritize audience engagement, and the effectiveness of AI in optimizing marketing efforts. The findings underscore the transformative role of AI tools in enabling data-driven decisions that improve engagement and brand awareness. By implementing the recommendations outlined, higher education institutions can leverage AI technologies to refine their strategies, achieve sustainable growth, and remain competitive in an increasingly digitalized world. This research contributes valuable insights for academic and practical applications, offering a foundation for future exploration in the field of AI-driven digital marketing.

## Limitations

Despite its contributions, this study has several limitations. Furthermore, while the data spans three years, the time frame was determined by the limitations of the free trial version of the Sprout Social software. Beyond this period, continued use of the platform would require subscription fees, which constrained the scope of this study. This limitation underscores the need for additional longitudinal studies, supported by institutional investment, to fully leverage AI-driven tools for long-term digital marketing optimization.

## Future Directions

Future research could expand the scope to include multiple social media platforms, providing a more comprehensive view of digital marketing performance. Additionally, qualitative methods, such as surveys or interviews with audience members, could offer deeper insights into their perceptions and engagement with the university's content. Exploring these perspectives would complement the quantitative findings of this study. Furthermore, future studies should consider longer timeframes, supported by sustained investment in AI-driven tools beyond free trial periods, to capture more nuanced trends and evaluate the long-term impact of such technologies. Lastly, investigating emerging AI technologies, such as generative AI, could provide a further understanding of their potential to revolutionize digital marketing strategies in higher education.

## Recommendations

Based on the findings and identified limitations, the following recommendations are proposed to optimize digital marketing strategies in higher education institutions:

- 1. Enhance Video Content Strategies:**  
Given the significant impact of video content on engagement rates and audience growth, universities should prioritize creating and promoting high-quality, visually engaging video content. This includes leveraging storytelling and interactive elements to captivate the audience.
- 2. Focus on Engagement Over Acquisition:**  
While attracting new followers is important, more attention should be given to deepening engagement with existing audiences. Tailoring content to audience preferences and fostering meaningful interactions can enhance loyalty and sustained interest.
- 3. Regularly Monitor and Adjust Strategies:**  
Utilize AI-driven analytics tools like Sprout Social to track key performance metrics in real-time. Regular monitoring enables institutions to adapt strategies quickly and respond effectively to emerging trends or challenges.
- 4. Invest in AI Training and Capacity Building:**  
Universities should allocate resources for training staff to use AI analytics tools effectively and understand the insights they generate. This will help integrate data-driven strategies into marketing efforts and maximize the benefits of AI technologies.



## Disclaimer

The paper has not been previously presented or published and is not part of a thesis project.

## Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

## Authors' Contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

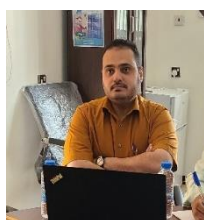
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