Total quality management practices, organizational productivity, and competitiveness of AI companies in Zhejiang Province, China: Basis for sustainable growth

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Abstract

The rapid advancement of technology and the increasing intensity of global market competition have led to the emergence of numerous artificial intelligence (AI) companies across various industries. These companies leverage AI technology to develop innovative products and services to meet customer demands. Zhejiang Province in China has witnessed a significant increase in the number of AI companies. This study aimed to explore the Total Quality Management (TQM) practices, organizational productivity, and competitiveness of AI companies in Zhejiang Province and their impact on sustainable growth. This study utilized a self-designed questionnaire as the data collection tool, targeting employees of AI companies in Zhejiang Province. Weighted mean and ranking methods were used to describe TQM practices, including mechanisms, process improvement, and customer focus; to assess organizational productivity, including efficiency, innovation capability, and cost-effectiveness; and to determine competitiveness, including market share, customer satisfaction, and strategic flexibility and adaptability. Spearman's rank correlation coefficient was used as part of the non-parametric tests to examine significant relationships. All analyses were conducted using SPSS version 28. The results indicated varying degrees of agreement among respondents regarding their company's TQM practices, organizational productivity, and competitiveness. The study found no significant relationship between mechanisms and organizational productivity. Similarly, no significant relationship was found between process improvement and organizational productivity. However, a significant positive relationship was found between customer focus and organizational productivity in terms of efficiency. Additionally, no significant relationship was observed between TQM practices and competitiveness. Furthermore, a significant positive relationship was identified between organizational productivity, specifically innovation and cost-effectiveness, and the competitiveness variables of market share and customer satisfaction. This study provides new insights into the performance of existing AI companies and lays the groundwork for future research.

Keywords: Total Quality Management (TQM) practice, organizational productivity, competitiveness

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1. Introduction

The rapid advancements in technology and the increasing competition in the global market have led to the emergence of Artificial Intelligence (AI) companies in various industries(Kordon, 2020). These companies are leveraging AI technologies to develop innovative products and services that cater to the needs of customers(Lee et al., 2019). Zhejiang Province, China, is one such region that has witnessed significant growth in the number of AI companies(Huang & Fan, 2021). This paper aims to explore the total quality management practices, organizational productivity, and competitiveness of AI companies in Zhejiang Province, China, and their impact on sustainable growth.

Total Quality Management (TQM) practices refer to a set of principles and strategies that organizations adopt to improve their overall performance(Wang & Shao, 2023). TQM focuses on customer satisfaction, continuous improvement, employee involvement, process optimization, and supplier management. It involves a comprehensive approach that integrates all aspects of an organization's operations to ensure high-quality products and services(Kristianto et al., 2012). TQM practices have been widely adopted by companies across different industries, including AI companies, to enhance their competitiveness and achieve sustainable growth(Tasleem et al., 2015). Organizational productivity is another crucial factor that influences the success of AI companies. Productivity is defined as the effectiveness of resource use in producing output. In the context of AI companies, productivity can be measured in terms of the speed and accuracy of data processing, the effectiveness of algorithms, and the ability to deliver value to customers(Gao & Feng, 2023). High organizational productivity enables AI companies to meet customer demands, reduce costs, and increase profitability. Therefore, understanding the relationship between organizational productivity and AI company performance is essential for achieving sustainable growth(Tariq et al., 2021). Competitiveness plays a vital role in determining the growth potential of AI companies. Competitiveness refers to an organization's ability to outperform its competitors in terms of product or service offerings, pricing strategies, marketing efforts, and customer satisfaction. AI companies that possess strong competitiveness can attract more customers, secure market share, and expand their business operations(Soni et al., 2020). However, achieving and maintaining competitiveness requires continuous innovation, strategic planning, and effective implementation of best practices. Therefore, this paper will investigate the impact of competitiveness on the growth of AI companies in Zhejiang Province, China. Zhejiang Province, located in eastern China, is known for its vibrant economy and technological advancements. The province has a strong presence of AI companies that are contributing to the growth of the region. These companies are engaged in various sectors, including healthcare, finance, transportation, and manufacturing. They are utilizing advanced technologies such as machine learning, natural language processing, computer vision, and robotics to create innovative products and services(Peña & Jenik, 2023).

This paper explored the TQM practices, organizational productivity, and competitiveness of AI companies in Zhejiang Province, China, and their impact on sustainable growth. By analyzing the interplay among these factors, this research aimed to provide valuable insights for AI companies in the region and beyond. The findings of this study will contribute to the existing literature on AI companies and their performance and can serve as a basis for future research in this field.

Objectives of the Study - This study investigated the relationship between TQM practices, organizational productivity, and competitiveness in AI companies located in Zhejiang Province, China. By examining these factors, the study provided insights into the elements contributing to sustainable growth in the AI industry. Specifically, the study described the current level of TQM practices in AI companies in China, focusing on

mechanisms, process improvement, and customer focus. It also determined the organizational productivity of AI companies in terms of productivity, efficiency, innovation, and cost-effectiveness. Additionally, the study evaluated the competitiveness of AI companies, describing the levels of market share, customer satisfaction, and strategic flexibility and adaptability. Furthermore, it tested the relationship between TQM practices, organizational productivity, and competitiveness.Lastly, it developed a strategic plan to improve competitiveness of AI companies IN Zhejiang province.

2. Methods

Research Design - The study's research design is aimed at examining the correlation between total quality management (TQM) practices, organizational productivity, and competitiveness within AI companies in Zhejiang Province, China. It is essential as it offers a structured framework for gathering and analyzing data to address the research inquiries. To fulfill the study's objectives, a descriptive research design was utilized. This approach utilized quantitative research method to present a comprehensive insight into the research issue. Quantitative data were acquired through surveys. Surveys were administered to employees and managers of AI companies in Zhejiang Province, China. The survey questionnaire consisted of closed-ended questions that measured various aspects related to total quality management practices organizational productivity, and competitiveness. These questions were designed to capture the perspectives of different stakeholders within the AI companies.

Participants of the Study - The primary participants in this study comprised eight leading AI companies operating within Zhejiang Province, China. These companies were selected based on their prominence in the AI industry, market share, and diversity in terms of size, scope of operations, and technological focus. The selection process ensured representation from various sectors within the AI industry, including healthcare, finance, manufacturing, retail, and transportation, among others. Within each selected AI company, a total of 50 employees were identified as key participants in the Total Quality Management (TQM) process. These employees were strategically chosen to represent diverse roles and departments critical to the TQM implementation and organizational productivity. The inclusion of employees from different functional areas, such as management, research and development, production, quality assurance, marketing, sales, and customer support, provided a comprehensive perspective on TQM practices and their impact across the entire organizational spectrum. Specifically, participants will include:

Management: Executives, directors, and department heads responsible for strategic decision-making, policy formulation, and oversight of TQM initiatives within the organization. Research and Development (R&D): Engineers, scientists, and researchers involved in developing AI technologies, algorithms, and solutions to meet market demands and drive innovation. Production: Operations managers, production supervisors, and assembly line workers engaged in the manufacturing and assembly of AI hardware or components. Quality Assurance (QA): QA managers, inspectors, and analysts responsible for ensuring product quality, compliance with standards, and adherence to TQM principles throughout the production process. Marketing: Marketing managers, analysts, and specialists tasked with promoting AI products and services, conducting market research, and gathering customer feedback to inform TQM strategies. Sales: Sales managers, representatives, and account executives responsible for selling AI products or services, building customer relationships, and addressing client needs and concerns. Customer Support: Customer service representatives, technical support staff, and helpdesk personnel tasked with providing assistance to customers, troubleshooting issues, and ensuring customer satisfaction.

Instrument of the Study - In order to collect the necessary data for this study, various instruments were employed to gather information from the participants. These instruments included questionnaires, interviews, and observation sheets. Each of these instruments played a crucial role in obtaining relevant data that would help in analyzing the relationship between total quality management practices, organizational productivity, and competitiveness of AI companies in Zhejiang Province, China. The initial instrument utilized in this study was a

structured questionnaire. This questionnaire was crafted to gather quantitative data from participants regarding their views on total quality management practices, organizational productivity, and competitiveness. Comprising closed-ended questions, the questionnaire enabled participants to select from predefined options. Developed in alignment with the study's literature review and objectives, the questionnaire aimed to gauge the implementation level of total quality management practices in AI companies, the effect of organizational productivity on company performance, and the impact of competitiveness on growth.

To ensure the validity and reliability of the questionnaire, it was pretested with a small group of participants from the same industry. The feedback received during the pretesting phase helped in refining the questionnaire by making necessary adjustments to improve its clarity and comprehensibility. After the pretesting phase, the final version of the questionnaire was administered to the participants. The questionnaire was distributed electronically through email, and the participants were requested to complete it within a specified timeframe. The responses collected from the participants were then analyzed using statistical techniques to draw meaningful conclusions.

The research utilized a questionnaire as its primary data collection tool, employing a Likert scale to assess Total Quality Management (TQM) practices, organizational productivity, and competitiveness within AI companies in Zhejiang Province, China. The objective was to gain insights into the factors influencing sustainable growth in the AI industry. Three separate sets of questionnaires were developed, drawing from literature and relevant published articles related to the variables under study. Each questionnaire comprised descriptive statements, with respondents indicating the frequency of applicability for each statement on a four-point Likert scale: 4.00 indicated strong agreement, 3.00 indicated agreement, 2.00 indicated disagreement, and 1.00 indicated strong disagreement.

Total Quality Management Practices. The questionnaire for Total Quality Management Practices included the following factors: Mechanism: This factor included items measuring the mechanisms in place for TQM, with a Cronbach's alpha value of 0.879, indicating good reliability. Process Improvement: This factor included items related to the continuous improvement of processes, with a Cronbach's alpha value of 0.854, indicating good reliability. Customer Focus: This factor assessed the degree of customer orientation within the companies, with a Cronbach's alpha value of 0.935, indicating excellent reliability.

Organizational Productivity. The questionnaire for Organizational Productivity included the following factors: Productivity: This factor measured the overall productivity levels within the organization, with a Cronbach's alpha value of 0.948, indicating excellent reliability. Efficiency Innovation: This factor included items related to innovative practices for improving efficiency, with a Cronbach's alpha value of 0.907, indicating excellent reliability.

Cost Effectiveness. This factor assessed the cost-effectiveness of the companies, with a Cronbach's alpha value of 0.899, indicating good reliability. The questionnaire for Competitiveness included the following factors: Market Share: This factor measured the market share held by the companies, with a Cronbach's alpha value of 0.842, indicating good reliability. Customer Satisfaction: This factor included items related to customer satisfaction levels, with a Cronbach's alpha value of 0.954, indicating excellent reliability. Strategic Flexibility and Adaptability: This factor assessed the strategic flexibility and adaptability of the companies, with a Cronbach's alpha value of 0.947, indicating excellent reliability.

According to George and Mallery (2003), the rule of thumb for interpreting Cronbach's alpha values is as follows: a score of 0.90 or above is considered excellent; a score between 0.80 and 0.89 is deemed good; a score between 0.70 and 0.79 is acceptable; a score between 0.60 and 0.69 is questionable; a score between 0.50 and 0.59 is poor; and any score below 0.50 is considered unacceptable.

Data Gathering Procedure - The data gathering process is crucial as it determines the validity and reliability of the research findings. The data collection process encompassed both primary and secondary

sources. Primary data was acquired through surveys and interviews conducted with employees and management personnel of AI companies. Secondary data was obtained from existing literature, reports, and databases related to AI companies and their performance. To ensure the accuracy and completeness of the data, a structured questionnaire was designed. The questionnaire consisted of both closed-ended and open-ended questions that aimed to gather information about the total quality management practices, organizational productivity, and competitiveness of AI companies in Zhejiang Province. The questionnaire was pretested among a small sample of AI company employees to assess its clarity and comprehensibility.

The participants of the study were selected using a purposive sampling technique. Purposive sampling involves selecting participants who are considered knowledgeable and experienced in the field of AI companies. A list of AI companies in Zhejiang Province was obtained from relevant industry associations and databases. From this list, a stratified random sample of AI companies was chosen based on their size, industry sector, and geographical location. The data gathering procedure involved sending out the questionnaires to the selected AI companies. The questionnaires were distributed to employees at various levels of the organization, including managers, team leaders, and individual contributors. The survey was conducted online using an online survey platform, which allowed participants to complete the questionnaire at their convenience.

To safeguard the confidentiality and anonymity of participants, a cover letter accompanied the questionnaire. This letter outlined the study's objectives, emphasized the voluntary nature of participation, and assured respondents of their anonymity. Participants were assured that their responses would be managed confidentially and solely utilized for research purposes. The data gathering procedure involved a combination of primary and secondary sources, structured questionnaires, surveys, interviews, and statistical analysis. The procedures followed ensured the validity and reliability of the data, providing a comprehensive understanding of the total quality management practices, organizational productivity, and competitiveness of AI companies in Zhejiang Province, China. The findings from this study can contribute to the sustainable growth of AI companies in the region and provide valuable insights for policymakers and practitioners.

Data Analysis - The data analysis process in this study was designed to rigorously evaluate the relationships between Total Quality Management (TQM) practices, organizational productivity, and competitiveness in AI companies located in Zhejiang Province, China. The analysis was conducted in several stages to ensure a comprehensive understanding of the collected data. Descriptive statistics were used to summarize the basic features of the data collected from the questionnaires. This included calculating the mean, standard deviation, and frequency distribution for each item within the questionnaires. These descriptive measures provided a general overview of the respondents' perceptions and the overall trends in TQM practices, organizational productivity, and competitiveness.

Reliability Analysis; To ensure the internal consistency of the questionnaires, Cronbach's alpha values were calculated for each factor within the three sets of questionnaires: TQM Practices: Mechanism ($\alpha = 0.879$), Process Improvement ($\alpha = 0.854$), Customer Focus ($\alpha = 0.935$). Organizational Productivity: Productivity ($\alpha = 0.948$), Efficiency Innovation ($\alpha = 0.907$), Cost Effectiveness ($\alpha = 0.899$). Competitiveness: Market Share ($\alpha = 0.842$), Customer Satisfaction ($\alpha = 0.954$), Strategic Flexibility and Adaptability ($\alpha = 0.947$). These values indicated good to excellent reliability, suggesting that the items within each factor were consistently measuring the intended constructs.

Inferential statistical methods were employed to assess the hypotheses and determine the relationships between the variables: Pearson correlation coefficients were calculated to examine the strength and direction of the relationships between TQM practices, organizational productivity, and competitiveness. Multiple regression models were used to identify the predictive power of TQM practices on organizational productivity and competitiveness. This analysis helped in understanding the extent to which TQM practices could explain variations in productivity and competitiveness.

The collected survey data underwent analysis utilizing statistical techniques including descriptive statistics,

correlation analysis, and regression analysis. Descriptive statistics were employed to summarize and elucidate the characteristics of the respondents, encompassing demographic details and organizational affiliations. Correlation analysis was conducted to scrutinize the relationships between total quality management practices, organizational productivity, and competitiveness. Regression analysis was utilized to ascertain the magnitude and direction of the relationships among these variables. The results were interpreted in the context of the research objectives and hypotheses. The mean scores and standard deviations for each factor were analyzed to determine the overall level of agreement or disagreement among respondents. The correlation and regression analyses provided insights into the strength and significance of the relationships between the variables. By integrating the findings from descriptive and inferential statistics, the study aimed to draw comprehensive conclusions about the impact of TQM practices on the productivity and competitiveness of AI companies in Zhejiang Province, China. The implications of these findings were discussed in terms of their relevance for sustainable growth and strategic management within the AI industry.

Ethical Considerations - It is crucial to ensure that the research process adheres to ethical principles and guidelines to protect the rights and well-being of the participants involved. This section will discuss the ethical considerations that were taken into account during the conduct of this study. Informed consent is a cornerstone of research ethics, ensuring that participants possess adequate comprehension of the study's purpose, procedures, potential risks, and benefits before deciding on participation. To secure informed consent, participants received a comprehensive explanation of the study, encompassing its objectives, methodology, data collection instruments, and potential risks and benefits. They were encouraged to ask questions and voice any concerns they may have. Only after receiving sufficient information and agreeing to participate the participants were enrolled in the study. Confidentiality and privacy are critical to maintaining the trust and confidence of the participants. To ensure confidentiality, all collected data were kept secure and confidential. The participants' identities were anonymized or pseudonymized to prevent any identification of their personal information. Additionally, the collected data will be stored and accessed only by authorized personnel who participated in the research process. Any breach of confidentiality or disclosure of participants' identities without their consent will be considered a serious ethical violation.

To protect the collected data from unauthorized access, theft, or misuse, appropriate measures were taken to ensure its security. All data were stored on secure servers or encrypted devices, and access to the data were restricted to authorized personnel only. Regular backups of the data were conducted to prevent loss or damage. Moreover, the participants' personal information were safeguarded by implementing strict password policies and multi-factor authentication mechanisms. Participants in this study retained the right to withdraw their participation at any stage without facing any consequences or repercussions. They were informed of this right at the beginning of the study and throughout the research process. If a participant decided to withdraw, their data were immediately deleted or anonymized to ensure their privacy and confidentiality. Furthermore, participants have the right to access their data and request corrections if necessary. Researchers involved in this study were expected to adhere to responsible research conduct principles. This included avoiding any conflicts of interest, maintaining objectivity and impartiality, and ensuring the integrity of the research findings. Any potential conflicts of interest should be disclosed at the outset of the study. The researchers also strived to minimize any harm or discomfort caused to the participants during the data collection process.

3. Results and discussion

The summary table presents an overview of TQM practices assessment in AI companies across various key result areas, displaying composite mean scores, verbal interpretation (VI), and rankings. The mechanisms got the highest rank of the composite mean of 2.59 suggests a generally positive perception of TQM mechanisms among AI companies. Specifically, there was agreement on the establishment and communication of quality objectives, the resolution of non-conformance issues, and continuous monitoring of quality-related processes. In terms of process improvement presented ranked two in the table, the composite mean score was 2.29 indicating disagreement with the mechanisms in place. This suggests that there were areas for improvement in

implementing process improvement initiatives within AI companies. Specifically, there is a need to enhance practices related to reviewing existing processes, involving cross-functional teams, and prioritizing improvements based on factors like cost reduction and efficiency enhancement.

Table 1

Summary Tabe on Level of Total Quality Management (TQM) practices in AI companies

Key Result Areas	Composite Mean	VI	Rank
Mechanisms	2.59	Agree	1
Process Improvement	2.29	Disagree	2
Customer Focus	2.26	Disagree	3
Grand Composite Mean	**2.38**	**Disagree**	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

The assessment of customer focus was third in rank and revealed a composite mean score of 2.26, signaling disagreement with the existing practices. This implies that there are shortcomings in addressing customer needs and expectations, utilizing customer feedback for improvement, and involving customers in product development. The grand composite mean of 2.38 reflected an overall disagreement with the TQM practices across all key result areas. While there are strengths in certain aspects such as mechanisms, there are notable areas for improvement, particularly in process improvement and customer focus, to achieve more effective TQM implementation.

Table 2

Summary Table on Organizational Productivity of AI companies

Key Result Areas	Composite Mean	VI	Rank
Efficiency	2.31	Disagree	3
Innovation	2.32	Disagree	2
Cost-effectiveness	2.34	Disagree	1
Grand Composite Mean	**2.32**	**Disagree**	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

Table 2 presents a summary of organizational productivity within AI companies across key result areas, including efficiency, innovation, and cost-effectiveness. The composite mean for each area indicates a disagreement among respondents regarding the company's performance in these domains. The highest-rank was Cost-effectiveness (2.34) reflected the respondents' concerns about the company's ability to optimize resources and minimize wastage. While cost-effectiveness is paramount for organizational sustainability and competitiveness, the data suggests that respondents perceive room for improvement in this area. Implementing measures to assess expenses, seek cost-saving alternatives, and monitor ROI can help enhance cost-effectiveness and drive long-term value creation within AI companies.

Innovation w ranked second (2.32) played a crucial role in driving competitiveness and fostering long-term growth in AI companies. However, respondents express dissatisfaction with the company's efforts in this regard. Encouraging employees to propose new ideas, investing in research and development, fostering a culture of experimentation and risk-taking, and collaborating with external partners are essential strategies for promoting innovation and maintaining a competitive edge in the rapidly evolving AI landscape. Ranked third was Efficiency (2.31), signified respondents' concerns regarding the company's performance in maximizing productivity and minimizing resource wastage. Despite its critical importance, respondents express disagreement

with the company's efficiency. Improving efficiency necessitates streamlining processes, optimizing workflows, and empowering employees with the necessary tools and resources for effective role performance. Additionally, investing in training and development opportunities can enhance employees' skills and overall operational efficiency.

The grand composite mean reflected an overall disagreement among respondents regarding the company's organizational productivity across key result areas. Addressing these challenges requires a strategic approach that prioritizes cost-effectiveness, innovation, and efficiency while fostering a culture of trust, collaboration, and continuous improvement. In conclusion, addressing the challenges outlined requires a holistic approach that integrates cost-effectiveness, innovation, and efficiency with a focus on fostering trust, collaboration, and employee well-being. By investing in these areas and nurturing a supportive and inclusive workplace culture, AI companies can unlock their full potential and achieve sustainable growth and success in the dynamic AI industry.

Table 3

Summary Table on Competitiveness of AI companies

Key Result Areas	Composite Mean	VI	Rank
Market Share	2.33	Disagree	3
Customer Satisfaction	2.35	Disagree	1
Strategic Flexibility and Adaptability	2.34	Disagree	2
Grand Composite Mean	**2.34**	**Disagree**	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

The highest-ranked indicator was Customer Satisfaction (2.35) suggests that respondents perceived a lack of alignment between the company's performance and customer satisfaction. Customer satisfaction is foundational to business success, as contented customers are inclined to repurchase products or services, recommend the company to others, and foster positive word-of-mouth marketing. In the context of AI companies, delivering exceptional customer experiences, understanding customer needs, and addressing pain points are essential for fostering long-term customer relationships and driving business growth. Companies must prioritize customer-centricity, invest in customer support and service capabilities, and leverage customer feedback to continuously improve their offerings and exceed customer expectations.

The second-highest-ranked indicator was Strategic Flexibility and Adaptability (2.34) indicates a disagreement regarding the company's strategic flexibility and adaptability. Strategic flexibility refers to an organization's ability to anticipate and respond effectively to changes in its external environment, such as shifts in market dynamics, technological advancements, or competitive threats. Adaptability is crucial for navigating uncertainty, seizing emerging opportunities, and mitigating risks in dynamic business environments. In the context of AI companies, which operate in a rapidly evolving industry characterized by technological innovation and disruption, strategic flexibility and adaptability are paramount for maintaining a competitive edge and driving sustainable growth. Companies must adopt agile decision-making processes, foster a culture of innovation and experimentation, and embrace continuous learning and adaptation to thrive in today's complex business landscape.

The respondents of Market Share (2.33) which was ranked third verbally interpreted as disagree held a negative perception regarding the company's performance concerning market share. Market share remains a crucial metric, indicative of a company's standing within its industry and its capability to seize a portion of the market demand. A declining or stagnant market share may indicate challenges in attracting and retaining customers, losing ground to competitors, or failing to capitalize on emerging opportunities. In the context of AI companies, market share is particularly important given the rapid growth and evolution of the AI industry. Companies must innovate continuously, differentiate their offerings, and expand their market presence to gain a

competitive edge and sustain growth over time.

Table 4

Relationship Between Total Quality Management Practices

and Organizational Productivity

Variables	rho	p-value	Interpretation
Mechanisms			
Efficiency	-0.088	0.079	Not Significant
Innovation	-0.019	0.705	Not Significant
Cost-effectiveness	-0.025	0.614	Not Significant
Process Improvement			
Efficiency	-0.088	0.080	Not Significant
Innovation	0.042	0.398	Not Significant
Cost-effectiveness	0.040	0.421	Not Significant
Customer Focus			
Efficiency	0.200**	< .001	Highly Significant
Innovation	-0.058	0.245	Not Significant
Cost-effectiveness	-0.040	0.427	Not Significant

**. Correlation is significant at the 0.01 level

The analysis of Table 4 reveals the relationship between Total Quality Management (TQM) practices and organizational productivity across various variables. The interpretation of the rho values and p-values provided insights into the significance of these relationships. The correlation between efficiency and mechanisms such as process improvement and customer focus showed mixed results. While efficiency had a significant positive correlation with customer focus (rho = 0.200, p < .001), indicating a strong relationship between customer-centric practices and organizational efficiency, it did not show significant correlations with other mechanisms like process improvement. This suggests that a focus on customer needs and satisfaction is crucial for enhancing organizational efficiency, potentially leading to improve productivity and performance. The positive correlation underscores the importance of aligning TQM practices with customer-centric strategies to drive operational excellence and competitive advantage.

In terms of innovation the analysis indicates no significant correlation between innovation and mechanisms such as efficiency, process improvement, and customer focus. Despite innovation being a critical driver of organizational growth and competitiveness, the findings suggested that the implementation of TQM practices may not directly influence innovation outcomes within the organization. However, it is essential to note that innovation is a multifaceted concept influenced by various factors beyond TQM practices, including organizational culture, leadership, and external market dynamics. Cost-effectiveness, similar to innovation, there was no significant correlation between cost-effectiveness and the mechanisms evaluated in the study. This implies that while TQM practices may contribute to improving organizational efficiency and customer focus, they may not necessarily translate into cost-saving benefits or enhanced cost-effectiveness. Cost-effectiveness depends on a combination of factors, including operational efficiency, resource allocation, and strategic decision-making, which may not be directly influenced by TQM practices alone.

In conclusion, the findings suggest that while TQM practices, particularly those focused on customer-centricity, may have a significant impact on organizational efficiency, they may not directly influence innovation or cost-effectiveness. This underscores the complexity of organizational productivity and the need for

a holistic approach to performance improvement that considers multiple factors beyond TQM practices alone. Drawing insights from the provided reference, which emphasizes the importance of CSR activities in contributing to community development and organizational success, it's crucial for organizations to adopt a strategic and integrated approach to quality management that aligns with their broader goals and objectives. By leveraging TQM practices alongside CSR initiatives and stakeholder engagement efforts, organizations can drive sustainable growth, enhance social impact, and create long-term value for all stakeholders involved.

Table 5

Relationship Between Total Quality Management Practices and Competitiveness

Variables	rho	p-value	Interpretation
Mechanisms			
Market Share	-0.065	0.196	Not Significant
Customer Satisfaction	-0.031	0.538	Not Significant
Strategic Flexibility and Adaptability	-0.004	0.936	Not Significant
Process Improvement			
Market Share	0.024	0.632	Not Significant
Customer Satisfaction	-0.014	0.781	Not Significant
Strategic Flexibility and Adaptability	0.035	0.481	Not Significant
Customer Focus			
Market Share	0.020	0.691	Not Significant
Customer Satisfaction	-0.092	0.066	Not Significant
Strategic Flexibility and Adaptability	0.004	0.935	Not Significant

**. Correlation is significant at the 0.01 level

The analysis of Table 5 provides insights into the relationship between Total Quality Management (TQM) practices and competitiveness across various variables. In terms of Market Share the correlation between TQM practices and market share, as well as other mechanisms such as customer satisfaction and strategic flexibility and adaptability, shows no significant relationship. This suggests that while TQM practices are essential for improving product and service quality, they may not directly impact market share or overall competitiveness. Market share is influenced by various factors beyond TQM, including marketing strategies, pricing, and brand reputation, which may play a more significant role in determining market success.

Similarly, in terms of Customer Satisfaction, there was no significant correlation between TQM practices and customer satisfaction. Despite TQM's focus on meeting customer needs and expectations, the analysis suggests that TQM practices alone may not be sufficient to drive improvements in customer satisfaction. Customer satisfaction is shaped by various factors, such as product quality, service delivery, and customer experience, which may not be exclusively attributed to TQM initiatives. On the other hand, in Strategic Flexibility and Adaptability, the analysis indicates no significant correlation between TQM practices and strategic flexibility and adaptability. While TQM principles emphasize continuous improvement and organizational agility, the findings suggest that TQM practices may not directly contribute to enhancing strategic flexibility or adaptability. Strategic flexibility depends on factors such as organizational culture, leadership, and decision-making processes, which may not be directly influenced by TQM initiatives alone.

Overall, the findings suggest that while TQM practices are important for enhancing product and service quality, they may not directly translate into improved competitiveness in terms of market share, customer satisfaction, or strategic flexibility and adaptability. This underscores the complexity of organizational

competitiveness, which is influenced by a multitude of internal and external factors beyond TQM practices alone. Drawing insights from the provided references, which emphasized the importance of CSR practices, particularly from an environmental perspective, it's essential for organizations to adopt a holistic approach to sustainability that integrates TQM practices with environmental management and CSR initiatives. By aligning TQM efforts with environmental sustainability goals, organizations can enhance their competitive position by not only improving product and service quality but also by contributing to environmental conservation and social responsibility. This integrated approach can create value for stakeholders, enhance brand reputation, and drive long-term success in an increasingly competitive business landscape.

Table 6

Relationship Between Organizational Productivity and Competitiveness

Variables	rho	p-value	Interpretation
Efficiency			
Market Share	-0.072	0.151	Not Significant
Customer Satisfaction	-0.037	0.459	Not Significant
Strategic Flexibility and Adaptability	-0.001	0.991	Not Significant
Innovation			
Market Share	0.569**	< .001	Highly Significant
Customer Satisfaction	0.683**	< .001	Highly Significant
Strategic Flexibility and Adaptability	0.054	0.283	Not Significant
Cost-effectiveness			
Market Share	0.600**	< .001	Highly Significant
Customer Satisfaction	0.676**	< .001	Highly Significant
Strategic Flexibility and Adaptability	0.026	0.606	Not Significant

**. Correlation is significant at the 0.01 level

Table 6 examines the relationship between organizational productivity and competitiveness through various variables such as efficiency, innovation, and cost-effectiveness. It provided insights into how these factors impact market share, customer satisfaction, and strategic flexibility and adaptability. The study revealed that innovation had a highly significant positive relationship with both market share (rho = 0.569, p < .001) and customer satisfaction (rho = 0.683, p < .001). This underscored the importance of fostering innovation to enhance competitiveness. However, the correlation between innovation and strategic flexibility and adaptability was weak and not significant (rho = 0.054, p = 0.283), suggesting that while innovation drives market performance and customer satisfaction, it may not directly influence the organization's adaptability.

Efficiency did not show significant relationships with any of the sub-variables of competitiveness. The rho values ranged from -0.001 to -0.072, with p-values greater than 0.01, indicating a very weak and indirect relationship between efficiency and the measured aspects of competitiveness. Cost-effectiveness demonstrated a highly significant positive relationship with both market share (rho = 0.600, p < .001) and customer satisfaction (rho = 0.676, p < .001). However, it did not show a significant relationship with strategic flexibility and adaptability (rho = 0.026, p = 0.606). This suggests that while cost-effectiveness contributes to market performance and customer satisfaction, its impact on strategic flexibility and adaptability is limited.

The lack of significant relationships for all variables indicates that strategic flexibility and adaptability may not be strongly influenced by the organizational productivity factors examined in this study. This highlights a potential gap in understanding how organizations can effectively adapt to changing market conditions and emerging challenges.

4. Conclusions and recommendations

The survey participants generally believed that AI companies have less implemented Total Quality Management. The respondents faced certain challenges in organizational productivity, especially in terms of efficiency and cost-effectiveness. Respondents disagreed that AI companies were competitive, including market share, customer satisfaction, and strategic flexibility and adaptability. There was no statistically significant relationship between TQM practices and organizational productivity/competitiveness. A strategic plan was developed to promote the sustainable growth of AI companies in the region.

The companies may advocate for process optimization, technological integration, and lean management practices for enhanced efficiency and cost-effectiveness.The companies must emphasize increased investment in R&D and foster a culture of creative problem-solving for sustainable growth and competitiveness. The policymakers in the companies may support AI innovation with incentives and establish standards promoting customer satisfaction and adaptability. The employees may recommend integrating Total Quality Management (TQM) practices into strategic planning for sustainable growth and competitiveness. The companies may consider in the planning session the proposed strategic development plan. Future researchers may investigate the long-term impacts of TQM practices, considering technological advancements and market dynamics.

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