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Achieving Operational Excellence Through Strategic Asset Maintenance: A Business Perspective in China

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ABSTRACT: This study assessed the relationship between Strategic Asset Maintenance and Operational Excellence among 188 employee-respondents. Specifically, it examined the respondents' demographic profile, their assessment of Strategic Asset Maintenance and Operational Excellence, the significant differences in their assessments when grouped according to age, sex, and position, and the relationship between the two major constructs. The study used a quantitative descriptive-correlational design with a structured survey questionnaire as the primary data-gathering instrument. Data were analyzed using frequency and percentage distribution, weighted mean, standard deviation, t-test, one-way analysis of variance, and Pearson correlation. Findings showed that most respondents were aged 25-34, male, and employed as technicians, production staff, or engineers. Strategic Asset Maintenance was assessed as practiced, with an overall mean of 2.67, while Operational Excellence was also assessed as practiced, with an overall mean of 2.74. Among the Strategic Asset Maintenance dimensions, Governance and Strategic Alignment and Transformation Readiness obtained the highest ratings, while Digital Capability and Data Quality had the lowest rating. For Operational Excellence, People Capabilities and Culture received the highest assessment, while Measurement and Governance obtained the lowest. The results further revealed no significant differences in the assessments of Strategic Asset Maintenance and Operational Excellence when respondents were grouped according to age, sex, and position. However, a significant positive relationship was found between Strategic Asset Maintenance and Operational Excellence, with an overall computed r of 0.611 and a significance value of less than 0.001. These findings suggest that stronger asset maintenance practices are meaningfully associated with stronger operational performance. Based on the results, an Integrated Strategic Asset Maintenance Plan was proposed to strengthen digital capability, data quality, risk-based planning, resource utilization, and operational excellence integration.

KEYWORDS: strategic asset maintenance, operational excellence, asset management, maintenance planning, employee assessment, operational performance

1. INTRODUCTION

In today's highly competitive and technologically dynamic business environment, operational excellence has emerged as a core strategic objective for organizations seeking sustained performance, efficiency, and resilience. Traditionally understood as the pursuit of continuous improvement across all facets of operations, operational excellence represents a systematic approach to achieving superior performance through the alignment of people, processes, and technology with corporate strategy (Found et al., 2018). It is not merely about incremental gains in productivity or cost reduction but about building a culture of disciplined execution that supports strategic adaptability and value creation (Kovilage et al., 2022). In the context of China's rapidly modernizing industries, the implementation of operational excellence has gained renewed importance as firms face rising competition, regulatory pressures, and the global push toward digital transformation.

A growing body of literature suggests that the foundation of operational excellence lies in the strategic management of physical and digital assets—collectively referred to as strategic asset maintenance (Parra et al., 2019; Mehairjan, 2017). This concept extends beyond routine maintenance to encompass proactive lifecycle management, risk-based investment, and predictive technologies that ensure reliability, safety, and cost efficiency throughout an asset's operational life (Komljenovic et al., 2019). In the Chinese business landscape, where manufacturing, energy, and infrastructure sectors dominate economic growth, strategic asset maintenance has become a critical enabler of business continuity and operational stability. As Jung, Ray, and Salkuti (2019) note, the modernization of asset management systems—supported by data analytics and real-time monitoring—contributes directly to operational excellence by minimizing downtime, extending asset life, and improving decision-making accuracy.

Operational excellence (OE) is often conceptualized through frameworks such as Lean, Six Sigma, and the European Foundation for Quality Management (EFQM) model, which emphasize continuous improvement, value creation, and stakeholder satisfaction (Jaeger & Matyas, 2016; Shehadeh et al., 2016). Kovilage et al. (2022) redefine OE within the resource-based view (RBV) of the firm, emphasizing the deployment of valuable, rare, inimitable, and non-substitutable resources—such as knowledge, technology, and leadership—to consistently execute operational strategies and sustain competitive advantages. This theoretical orientation suggests that operational excellence functions as both an outcome and a process: it represents the result of effective resource integration while simultaneously requiring ongoing refinement through feedback and innovation (Sony, 2019).

On the other hand, strategic asset maintenance focuses on optimizing the lifecycle value of assets through structured processes, governance, and analytics (Parra et al., 2019). Unlike conventional maintenance approaches that react to failures, SAM integrates planning, performance monitoring, and continuous improvement principles derived from ISO 55001 standards and predictive maintenance methodologies (Silva & de Souza, 2020). It encompasses dimensions such as asset reliability, cost efficiency, risk management, and digital enablement, aligning them with organizational objectives and sustainability goals (Crespo Márquez et al., 2020). Studies across industrial sectors highlight that strategic asset maintenance not only enhances operational reliability but also drives measurable financial and environmental performance (Judijanto et al., 2024; Alquraidi & Awad, 2024).

From a business perspective, the integration of operational excellence and strategic asset maintenance represents a convergence of strategic intent and technical execution. Both constructs are complementary: operational excellence provides the philosophical and managerial framework for continuous improvement, while strategic asset maintenance operationalizes that framework through tangible asset management practices that affect cost, quality, and productivity outcomes. As Biedermann and Kinz (2019) argue, maintenance is a strategic function and a value enabler, not a cost center. When organizations adopt a lifecycle approach to asset management, supported by intelligent systems and predictive analytics, they enhance their capacity for operational excellence and sustainable competitiveness (Teoh et al., 2021).

The relationship between these two variables may also be interpreted through the lens of organizational learning and digital transformation. Operational excellence requires accurate, timely feedback on performance, and strategic asset maintenance provides this through data-driven insights on equipment health, process stability, and risk exposure. The alignment of these systems allows organizations to optimize decision-making, reduce operational variance, and institutionalize best practices across business units (Tortorella et al., 2021). Empirical evidence from Chinese industries supports this synergy: firms that integrate predictive maintenance with continuous improvement methodologies demonstrate higher productivity and lower failure costs, leading to sustainable operational excellence (Iluore et al., 2020).

This study rationalizes the connection between operational excellence and strategic asset maintenance by positioning SAM as the mechanism through which operational excellence can be realized in business practice. Operational excellence defines the "what", a state of superior, sustainable performance, while strategic asset maintenance defines the "how"—the systematic and data-informed approach that ensures assets support strategic objectives. In the Chinese industrial context, this relationship gains salience due to the country's ongoing industrial modernization, energy transition, and digitalization agenda. Integrating the two not only enhances operational efficiency but also strengthens corporate resilience, regulatory compliance, and stakeholder confidence. The synergy between operational excellence and strategic asset maintenance thus represents a strategic pathway for Chinese enterprises seeking long-term business sustainability, competitiveness, and innovation readiness.

2. METHODS

Research Design

This study utilized a quantitative comparative-correlational research design. The quantitative approach was employed to gather measurable data from employee respondents using a researcher-made questionnaire. This design allowed the researcher to translate perceptions, experiences, and evaluations related to Strategic Asset Maintenance and Operational Excellence into quantifiable indicators that could be statistically analyzed.

The comparative component was used to determine whether significant differences existed in respondents' assessments of strategic asset maintenance and operational excellence when grouped according to their profile variables such as age, sex, tenure, position, and educational attainment. Comparing these groups revealed whether demographic or professional factors influenced perceptions and practices related to asset management and operational performance within Chinese organizations.

The correlational aspect examined the relationship between strategic asset maintenance and operational excellence. This was essential to determine the degree to which improvements in asset maintenance practices were associated with higher levels of operational excellence. Through correlation analysis, the study identified whether effective governance, lifecycle management, and digital capability significantly contributed to leadership alignment, process efficiency, and sustainability outcomes.

This design proved appropriate because the research aimed not to manipulate variables but to observe existing relationships and differences among naturally occurring groups within an organizational setting. The use of quantitative comparative-correlational design was justified as it provided empirical evidence that supported data-driven conclusions about how strategic

asset maintenance practices influenced operational excellence in the business sector in China. By doing so, the study contributed to the body of knowledge that guided managerial decisions on asset optimization and organizational performance enhancement.

Research Locale

The study was conducted in a textile manufacturing company located in Beijing, China, one of the country's leading industrial hubs known for its extensive textile and garment production. The province serves as a central node in China's textile value chain, housing numerous small-, medium-, and large-scale enterprises that specialize in spinning, weaving, dyeing, and fabric finishing. The chosen company operates as a vertically integrated textile manufacturer, producing yarns, fabrics, and finished garments for both domestic and international markets.

The company was established in the early 2000s and has since expanded its operations to include advanced weaving technologies, automated dyeing systems, and digital quality-control platforms. It employs approximately 600 workers across multiple departments, including production, maintenance, quality assurance, logistics, and administration. Over the past decade, it has adopted lean production principles and invested in predictive maintenance systems to minimize equipment downtime and optimize energy efficiency. Its operations are certified under ISO 9001 for quality management and ISO 14001 for environmental management, reflecting its commitment to continuous improvement and sustainable industrial practices.

Despite its progress, the company continues to face challenges typical of China's textile sector—rising labor costs, equipment aging, and the need for digital transformation to maintain global competitiveness. These conditions make it an ideal setting for examining the relationship between Strategic Asset Maintenance and Operational Excellence. The textile industry's dependence on high-capacity machinery and production continuity underscores the importance of effective maintenance strategies. Moreover, as China transitions toward high-value manufacturing and sustainability-driven operations, textile firms like this one are under pressure to adopt integrated maintenance systems and quality-driven performance management to achieve operational excellence.

Participants/Respondents of the Study

The participants of the study consisted of employees of a textile manufacturing company in Jiangsu Province, China, who were purposefully selected based on their roles and relevance to the study variables. The respondents included individuals directly involved in the company's production, maintenance, quality assurance, logistics, and management departments. This selection ensured that participants possessed firsthand knowledge and experience related to asset maintenance practices and operational processes within the organization.

The study included approximately 188 employees, representing both technical and administrative positions. The inclusion criteria required that participants had at least one year of continuous service in the company to ensure adequate familiarity with its operational systems and maintenance routines. Employees who held supervisory, managerial, or maintenance-related roles were prioritized, as they were expected to provide more accurate insights into the implementation of maintenance strategies and their relationship with operational excellence.

Participants who were on probationary status, interns, or newly hired personnel were excluded from the study, as their limited exposure to company operations resulted in incomplete or unreliable responses. Participation was voluntary, and all respondents were informed of the study's purpose, confidentiality measures, and their right to withdraw at any time without penalty.

By purposefully selecting participants with relevant operational and maintenance responsibilities, the study gathered reliable data that accurately reflected the organizational dynamics between Strategic Asset Maintenance and Operational Excellence. This sampling approach ensured that the findings were grounded in practical workplace experience and contributed to developing a realistic and actionable Integrated Strategic Asset Maintenance Plan for the company.

Research Instrument

The primary research instrument of this study was a researcher-made questionnaire designed to gather quantitative data on employees' assessments of Strategic Asset Maintenance and Operational Excellence in a textile manufacturing company in Jiangsu Province, China. The instrument was carefully developed based on theoretical frameworks and empirical studies to ensure alignment with the research objectives. It was written in clear and concise English, with a translated Mandarin version made available to guarantee comprehension and response accuracy among respondents. The questionnaire employed a four-point Likert scale to quantify the degree of agreement or disagreement with each statement, ranging from Strongly Disagree (1) to Strongly Agree (4).

The first part of the instrument focused on the Profile of Respondents, gathering essential demographic and professional data such as age, sex, educational attainment, position or designation, department, and years of service. These variables helped describe the characteristics of the respondents and served as the basis for determining whether there were significant differences in their assessments when grouped according to profile categories. Understanding these background details aided in interpreting the influence of personal and occupational factors on perceptions of asset maintenance and operational performance. The second part measured Strategic Asset Maintenance, which represented the independent variable of the study. This section included nine key constructs that defined how maintenance strategies were planned and executed within the organization. These

constructs included: (1) Governance and Strategic Alignment, (2) Lifecycle Coverage and Economic Rationality, (3) Risk Integration and Criticality, (4) Reliability and Availability Performance, (5) Maintenance Strategy Design and Execution, (6) Digital Capability and Data Quality, (7) Resource Utilization and Capability Building, (8) Interoperability and Knowledge Structures, and (9) Transformation Readiness.

The third part assessed Operational Excellence, which served as the dependent variable. This section evaluated the organization's ability to maintain superior performance, efficiency, and sustainability through six major constructs: (1) Leadership and Strategy Deployment, (2) People Capabilities and Culture, (3) Process Architecture and Methods, (4) Measurement and Governance, (5) Data and Technology, and (6) Sustainability and Stakeholder Value. Each construct consisted of eight statements designed to measure the consistency, agility, and quality of operations as perceived by the employees. The structure of this section emphasized how leadership direction, employee engagement, technological capability, and process integration collectively influenced the organization's pursuit of operational excellence.

To ensure the quality of the instrument, content validity was established through evaluation by a panel of experts in industrial management, quantitative research, and business operations. Their assessment ensured that the items accurately reflected the intended constructs, were free from ambiguity, and were relevant to the study context. The instrument underwent construct validity testing through exploratory factor analysis after pilot testing among thirty employees from a comparable manufacturing company. This process verified whether the items within each construct were appropriately grouped and measured the intended dimensions.

The reliability of the instrument was determined through Cronbach's alpha coefficient using data from the pilot test. A value of 0.80 or higher indicated strong internal consistency, suggesting that the questionnaire reliably measured each construct. Necessary revisions were made based on both statistical results and expert recommendations before the final administration. Ultimately, the results derived from this instrument formed the empirical foundation for developing an Integrated Strategic Asset Maintenance Plan that enhanced organizational performance in China's textile industry.

Data Analysis/Statistical Treatment

The collected data was statistically treated using both descriptive and inferential analyses to address the specific research questions stated in the study. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize the profile of respondents and to describe their level of assessment on the constructs of Strategic Asset Maintenance and Operational Excellence. The mean scores were interpreted using a four-point Likert scale to categorize the responses as Strongly Agree, Agree, Disagree, or Strongly Disagree, providing a clear understanding of the respondents' collective perceptions. To determine whether there were significant differences in the assessments of respondents when grouped according to their profile variables such as age, sex, educational attainment, position, and years of service, t-tests and one-way analysis of variance (ANOVA) were employed. For correlational analysis, Pearson's Product-Moment Correlation Coefficient (r) was applied to examine the relationship between Strategic Asset Maintenance and Operational Excellence. This analysis determined the strength and direction of association between the two major variables, allowing the researcher to assess whether improvements in asset maintenance practices were associated with higher levels of operational excellence. All statistical computations were performed using the Statistical Package for the Social Sciences (SPSS) software to ensure accuracy and efficiency in data processing. The significance level for all inferential tests was set at 0.05, which meant that findings were considered statistically significant if the computed p-value was less than 0.05. These statistical procedures provided empirical evidence to support the study's hypotheses and guided the formulation of an Integrated Strategic Asset Maintenance Plan for enhancing operational performance in the textile industry.

Ethical Considerations

Ethical standards were strictly upheld throughout the conduct of this study to ensure transparency, respect, and protection of participants' rights. Prior to data collection, the researcher secured official approval from the management of the textile manufacturing company and obtained informed consent from all employee-respondents. Each participant was informed about the study's objectives, procedures, and expected duration, as well as the voluntary nature of their participation. They were also assured that no form of coercion, pressure, or undue influence would be exercised at any stage of the research process. Confidentiality and anonymity were maintained at all times. Only aggregated data was reported, ensuring that no individual respondent or department could be personally identified. The researcher ensured that no harm—physical, psychological, or professional—was inflicted on any participant as a result of their participation. Moreover, the study complied with institutional research ethics guidelines and international standards for the ethical conduct of quantitative research. The researcher avoided any form of bias, data manipulation, or misrepresentation of findings. After the completion of the study, the textile company received a summary of the results and recommendations as a gesture of professional transparency and goodwill. These measures ensured that the entire research process upheld integrity, accountability, and respect for the dignity and welfare of all participants involved.

3. RESULTS

Profile of the Respondents. The respondents were composed of 188 employees, with the largest age group coming from the 25-34 bracket with 62 respondents or 33.0 percent, closely followed by the 35-44 bracket with 61 respondents or 32.4 percent. This suggests that most respondents were in their early to middle career stages, which may indicate adequate work exposure and familiarity with operational and maintenance-related practices. In terms of sex, male respondents comprised the majority with 111 or 59.0 percent, while female respondents accounted for 77 or 41.0 percent. For position, technicians formed the largest group with 55 respondents or 29.3 percent, followed by production staff with 44 or 23.4 percent and engineers with 43 or 22.9 percent. Supervisors and managers had equal representation with 23 respondents each or 12.2 percent. Overall, the profile indicates that the data were largely drawn from employees with direct technical and operational exposure, making their assessments relevant to Strategic Asset Maintenance and Operational Excellence.

Table 1. Respondents' Demographic Profile

Indicators	Classification	Frequency	Percentage (%)
Age	Below 25	19	10.1%
Age	25-34	62	33.0%
Age	35-44	61	32.4%
Age	45 and above	46	24.5%
Sex	Male	111	59.0%
Sex	Female	77	41.0%
Position	Production Staff	44	23.4%
Position	Technician	55	29.3%
Position	Engineer	43	22.9%
Position	Supervisor	23	12.2%
Position	Manager	23	12.2%

Assessment of Strategic Asset Maintenance. The employee-respondents assessed Strategic Asset Maintenance as generally practiced, with an overall mean of 2.67 and a standard deviation of 0.68. Among its subconstructs, Governance and Strategic Alignment and Transformation Readiness both obtained the highest overall mean of 2.71, followed closely by Risk Integration and Criticality with 2.70. These results may suggest that the organization has existing maintenance governance mechanisms, risk-related practices, and readiness for transformation. However, Digital Capability and Data Quality obtained the lowest overall mean of 2.60, followed by Interoperability and Knowledge Structures with 2.61. These lower results appear to indicate that digital analytics, data use, system integration, and knowledge-sharing structures may still require improvement. While the overall interpretation remained Agree or Practiced, the findings suggest that Strategic Asset Maintenance is present but not yet highly mature.

Assessment of Operational Excellence. The employee-respondents assessed Operational Excellence as practiced with a mean of 2.74 and a standard deviation of 0.67. The highest subconstruct was People Capabilities and Culture with a mean of 2.80 which may suggest that accountability, recognition, collaboration and workplace culture are relatively stronger areas. Leadership and Strategy Deployment followed with a mean of 2.75 while Process Architecture and Methods obtained 2.74. The lowest subconstruct was Measurement and Governance with a mean of 2.70 although it was still interpreted as Agree or Practiced. Data and Technology registered 2.73 while Sustainability and Stakeholder Value obtained 2.72. Overall the findings suggest that Operational Excellence is moderately practiced, with ratings, in people-oriented and leadership-related areas while measurement, governance, information security and customer satisfaction practices may need closer attention.

Differences in the Assessment of Strategic Asset Maintenance. The results showed no significant difference in the assessment of Strategic Asset Maintenance when employee-respondents were grouped according to age, sex, and position. For age, the overall Strategic Asset Maintenance score produced an F-value of 0.32 with a significance value of 0.81. For sex, the t-value was 0.36 with a significance value of 0.72. For position, the F-value was 0.93 with a significance value of 0.45. Since all significance values were greater than 0.05, the null hypotheses were not rejected. Although supervisors recorded the highest descriptive overall mean by position at 2.90, while production staff had the lowest at 2.59, the difference was not statistically significant. This indicates that perceptions of Strategic Asset Maintenance were generally similar across different demographic and job groups.

Differences in the Assessment of Operational Excellence. The results also showed no significant difference in the assessment of Operational Excellence when respondents were grouped according to age, sex, and position. For age, the overall Operational Excellence score obtained an F-value of 0.06 with a significance value of 0.98. For sex, the t-value was -0.96 with a significance value of 0.34. For position, the F-value was 1.59 with a significance value of 0.18. Since all significance values exceeded 0.05, the

null hypotheses were not rejected. Descriptively, female respondents had a slightly higher overall mean of 2.79 compared with male respondents at 2.70, while supervisors posted the highest mean by position at 3.06. However, these differences were not statistically significant. The findings suggest that Operational Excellence practices were perceived in a broadly similar way across age groups, sex groups, and job positions.

Correlation Between Strategic Asset Maintenance and Operational Excellence. The results revealed a significant positive relationship between Strategic Asset Maintenance and Operational Excellence. All correlation coefficients between the subconstructs were positive and significant at the 0.001 level. The computed correlation values ranged from 0.461 to 0.583 among the subvariable pairings, while the correlation between Overall Strategic Asset Maintenance and Overall Operational Excellence was 0.611. This indicates a moderate to strong positive relationship, suggesting that better Strategic Asset Maintenance practices are associated with stronger Operational Excellence. The highest subconstruct relationship was observed between Interoperability and Knowledge Structures and Measurement and Governance, with a computed r of 0.583, while the lowest was between Resource Utilization and Capability Building and Sustainability and Stakeholder Value, with a computed r of 0.461. Overall, the findings suggest that asset maintenance is not merely a technical function but is meaningfully connected with operational performance, governance, process improvement, technology use, and long-term organizational value.

Table 2. Correlation in the Assessment of Employee-Respondents on Strategic Asset Maintenance and Operational Excellence

Strategic Asset Maintenance	Operational Excellence	Computed r	Sig.	Decision	Interpretation
Overall Strategic Asset Maintenance	Overall Operational Excellence	0.611	<0.001	Reject Ho	Significant Positive Relationship

CONCLUSION

Profile of the Respondents. It may be concluded that the respondents were generally appropriate sources of information for the study because most of them came from age groups and job positions with likely exposure to operational and maintenance-related activities. The dominance of employees aged 25-34 and 35-44 suggests that the sample was largely composed of workers in their productive and professionally active years. Likewise, the high representation of technicians, production staff, and engineers indicates that the findings were grounded on the perceptions of employees who are likely to encounter asset maintenance concerns, production requirements, and operational processes in their actual work environment.

Assessment of Strategic Asset Maintenance. It may be concluded that Strategic Asset Maintenance is practiced in the organization, although its implementation appears to be moderate rather than highly established. The respondents agreed that governance, strategic alignment, risk integration, reliability, resource utilization, and transformation readiness are present. However, the relatively lower ratings in Digital Capability and Data Quality and Interoperability and Knowledge Structures suggest that the organization may still need to strengthen its use of digital tools, analytics, information systems, and knowledge-sharing mechanisms. Thus, asset maintenance appears to be functioning, but its strategic and data-driven maturity may still require further development.

Assessment of Operational Excellence. It may be concluded that Operational Excellence is also practiced in the organization. The respondents rated people capabilities, leadership, process methods, data and technology, sustainability, and measurement systems as generally practiced. Among these areas, People Capabilities and Culture emerged as the strongest, suggesting that accountability, recognition, collaboration, and workplace culture are relatively visible. However, the lower mean for Measurement and Governance may indicate that data validation, internal audit use, and performance-based decision-making can still be improved. Overall, the organization appears to have operational excellence practices in place, but these may need stronger consistency and deeper integration into daily operations.

Differences in the Assessment of Strategic Asset Maintenance. It may be concluded that the assessment of Strategic Asset Maintenance does not significantly differ when respondents are grouped according to age, sex, and position. This means that the respondents generally shared similar views regardless of demographic or job-related classification. Although some descriptive differences were observed, such as supervisors giving higher ratings than production staff and technicians, these differences were not statistically significant. This suggests that the organization's asset maintenance practices are experienced in a relatively similar manner across employee groups.

Differences in the Assessment of Operational Excellence. It may be concluded that the assessment of Operational Excellence likewise does not significantly differ when respondents are grouped according to age, sex, and position. The results indicate that perceptions of leadership, process improvement, workplace culture, technology use, measurement systems, and sustainability practices are generally consistent across respondent groups. While supervisors and female respondents recorded slightly higher

descriptive means in some areas, these differences were not statistically significant. This implies that operational excellence practices are perceived as organization-wide rather than limited to a particular age group, sex group, or job position.

Correlation Between Strategic Asset Maintenance and Operational Excellence. It may be concluded that Strategic Asset Maintenance is significantly and positively related to Operational Excellence. The overall correlation result indicates that stronger asset maintenance practices are associated with stronger operational excellence outcomes. This suggests that maintenance governance, lifecycle planning, risk integration, reliability management, digital capability, resource utilization, knowledge systems, and transformation readiness are meaningfully connected with leadership deployment, process discipline, people capability, measurement systems, technology use, and stakeholder value. The findings imply that asset maintenance should not be treated only as a technical or repair function, but as a strategic contributor to the organization's overall operational performance.

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