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THE EFFECT OF STRATEGIC MONITORING ON LEAN MANUFACTURING SYSTEM: A CASE STUDY OF NORTHERN CEMENT COMPANY, IRAQ

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ABSTRACT

Organizations facing increasing industry challenges and competitive pressures must adopt strategic administrative approaches to enhance performance and sustainability. Lean manufacturing, a critical strategy for improving productivity and minimizing waste, enhances process efficiency but poses challenges such as integration with strategic processes and adaptability requirements. This study investigates the relationship between strategic monitoring and lean manufacturing system implementation at Northern Cement Company in Iraq. Data collected from a sample of 115 employees via a structured questionnaire was analyzed using SPSS and AMOS software, revealing a statistically significant positive correlation between strategic monitoring practices and lean manufacturing outcomes. High-impact areas include operational efficiency and waste reduction. The findings underscore the importance of strategic monitoring, particularly in its dimensions of strategic thinking, intelligence, and vigilance, as a catalyst for enhancing lean processes. The study recommends strengthening strategic control systems and equipping administrative leadership with enhanced environmental analysis and decision-making tools. A comprehensive integration of lean principles organization-wide is also encouraged to maximize resource utilization, reduce waste, and improve adaptability, positioning Northern Cement Company for sustained competitive advantage.

Keywords: Administrative leadership, Strategic monitoring, Lean manufacturing system, Northern cement company, Waste reduction.

1. INTRODUCTION

In response to rapid advancements and increasing competition within the industrial sector, contemporary organizations must adopt strategies that maintain efficiency, enhance institutional performance, and ensure sustainable operations (Al-Soufi & Mohammed, 2023; Barney & Hesterly, 2019). The cement industry is characterized by high energy consumption, significant environmental impact, and complex logistical demands, making operational efficiency a top priority (Biernacki et al., 2017). Consequently, lean manufacturing has emerged as a prominent approach, focusing on waste reduction, enhanced productivity, and streamlined processes. However, lean manufacturing is not without challenges; it requires organizations to adopt a continuous improvement mindset and adaptability to dynamic environments (Womack et al., 2007). In regions like Iraq, where the industrial landscape is influenced by economic fluctuations, regulatory challenges, and resource

constraints, companies such as Northern Cement Company face the dual challenge of maintaining operational efficiency while adhering to sustainable practices.

Lean manufacturing principles, focusing on reducing waste and optimizing resources, align well with these goals but are often challenging to implement in rapidly changing environments. Key pillars of lean manufacturing, such as just-in-time (JIT) production, total productive maintenance (TPM), and continuous improvement, rely on precise coordination and adaptability, which are difficult to achieve without comprehensive situational awareness (Sundar et al., 2014). Thus, strategic monitoring is deemed as one of the crucial factors, helping to facilitate lean pursuits by providing organizations with up-to-date information about internal and external conditions to pursue strategic coordination with lean goals (Bhasin & Burcher, 2006; Henao et al., 2019; Maware & Parsley, 2022a).

Strategic monitoring, an essential component of strategic management, empowers organizations to collect and interpret data on internal operations, competitor actions, and broader market trends (Elenkov et al., 2005). Through strategic thinking, intelligence, and vigilance, strategic monitoring provides a framework for administrative leadership to anticipate challenges, identify opportunities, and make informed decisions (Al-Tanayeeb, 2020; Choo, 1996). Each dimension plays a distinct role in supporting lean manufacturing: strategic thinking allows leaders to set a vision aligned with lean principles, strategic intelligence aids in data-driven decision-making, and strategic vigilance ensures that organizations can swiftly adapt to external pressures. These dimensions help maintain the flexibility and responsiveness needed to implement lean practices, especially in volatile industries, successfully.

The Iraqi cement industry is crucial to the nation's economic development by providing infrastructure and construction projects. There are too many hurdles to overcome: Outdated facilities, high energy consumption, and inadequate supply chain efficiencies (NCA, 2016). However, despite a production capacity that surpasses 25 million metric tons per year, actual volume is not constant because of operational limitations.

On the other hand, local and foreign producers compete, and lower-cost imports and multinational investments exert efficiency pressures (Biernacki et al., 2017). Additionally, regulatory challenges, such as what Womack et al. (2007) refer to as environmental policies and variations in fuel prices, make the adoption of lean manufacturing even more complicated (Womack et al., 2007).

With these set of challenges, strategic monitoring integration into lean manufacturing can improve efficiency, decrease waste, and improve competitiveness. At Northern Cement Company, strategy is defined as strategic monitoring made up of strategic thinking, intelligence, and vigilance, which this study examines to optimize lean practices.

This study explores the relationship between strategic monitoring and lean manufacturing within Northern Cement Company, Iraq, focusing on how strategic monitoring influences the company's ability to implement lean practices effectively. By examining the correlation between strategic monitoring dimensions (Strategic Thinking (ST), Strategic Intelligence (SI), and Strategic Vigilance (SV) and lean manufacturing dimensions (Workplace Organization (WO), Total Productive Maintenance (TPM), Just-in-Time Production (JIT), and Continuous Improvement (CI), the research addresses critical questions on the effectiveness of strategic monitoring in lean environments:

1. What is the availability of strategic monitoring dimensions and lean manufacturing requirements in the organization?
2. How does strategic monitoring correlate with lean manufacturing principles?

3. How does strategic monitoring influence the effectiveness of a lean manufacturing system?

This study seeks to bridge the gap between strategic monitoring and lean manufacturing research by addressing these questions and providing insights into their combined impact on organizational performance in a high-demand industrial sector. The findings aim to equip Northern Cement Company and similar organizations with actionable strategies to enhance operational efficiency, minimize waste, and respond proactively to environmental changes.

The importance of this research is twofold. Theoretically, it contributes to the literature on lean manufacturing by positioning strategic monitoring as an enabler of lean success, particularly in resource-intensive industries. By detailing how strategic thinking, intelligence, and vigilance can support lean principles, the study adds to the understanding of strategic management's role in operational efficiency. Practically, the study provides Northern Cement Company with a framework to assess and refine its current lean practices. Insights from this research offer a pathway for companies facing similar challenges to use strategic monitoring for continuous improvement, better decision-making, and long-term adaptability in competitive industrial environments.

This paper is organized as follows: Section 2 presents a literature review of related work on strategic monitoring and lean manufacturing, outlining prior research and identifying gaps. Section 3 highlights details concerning research methods, data collection techniques, sample characteristics, and analysis techniques. The results and discussion are described in Section 4, which analyzes the collected data and its implications for strategic monitoring and lean manufacturing. Finally, the conclusion and recommendation are given in Section 5.

2. LITERATURE REVIEW

2.1. Strategic Monitoring and Institutional Performance

Strategic monitoring is essential in enhancing institutional performance, particularly in industries facing rapid technological changes, market competition, and complex operational environments (Choo, 1996). Defined by its key dimensions: strategic thinking, intelligence, and vigilance, strategic monitoring enables organizations to foresee trends, analyze data for informed decision-making, and respond swiftly to environmental changes (Al-Tanayeeb, 2020; White, 2004). These dimensions collectively support administrative leadership in optimizing resources, setting a long-term vision, and enhancing adaptability to market demands.

In Dziyaba (2016), the study on the Royal Bank in Ghana explains how M&E systems enhance transparency and accountability. The survey conducted with 120 clients and 60 bank workers showed that as useful as strategic monitoring is, it faces challenges, such as a lack of adequate staff participation in review processes. Branch staff were assured that decision-making authorities would be granted to them at branch levels to increase monitoring efficiency and, ultimately, total bank performance from Dziyaba.

The study by Muhayimana and Kamuhanda (2020) analyzed the relationship between monitoring and evaluation techniques and achieving public projects in Rwandalti. It focused on the Science and Technology Skills Development (STSD) project. To contribute to the development of the theoretical framework, the study employed a survey, including 146 participants encompassing project beneficiaries, coordinators, and managers, to reveal positive linear associations between the implementation of M&E activities, including the integration of M&E plans into strategic objectives, and the involvement of stakeholders and improved project performance, including time and cost optimization. The authors stressed that open monitoring and evaluation approaches are required for sustainable improvement of the public sector performance.

Okafor assessed the effect of M&E systems on the project performance in (2021) using the RANA project in Nigeria. By employing a sample of 32 participants, the study determined that an M&E plan, personnel, and an efficient information management system are critical to improving project performance. Okafor also noted the organizational M&E plan as having the closest relationship with project success, second to personnel skills and information systems. The study recommended a way forward to enhance M&E capacities to improve project performance.

Additional information is derived from Amare (2023), who also evaluated how M&E affected project performance in the T.E.T construction, particularly Tezetaw, Elias, and Tesfaye construction. This study, in which GPA's 51 project management and planning team members participated, established that performance measurement indicators are M&E's basic tools. However, the organization faces funding challenges and lacks a Monitoring Team. Amare also stated that there should be the establishment of specialized M&E teams as well as training to increase the efficiency of monitoring and develop the required skills needed for an organization.

Also, Ovcina and Arslanagic-Kalajdzic (2024) compared M&E systems and PIMS in non-profit sectors in the developing context, especially in Bosnia and Herzegovina. The study showed that better M&E and PIMS led to better organizational knowledge management practices, thus improving project performance. The authors recommended that nonprofits develop robust M&E and PIMS frameworks to optimize project execution, providing actionable insights for decision-makers and stakeholders in the nonprofit sector.

In Begum and Sumi (2024), a broad review of the integration of lean manufacturing to the principles of Industry 4.0 is presented, and the contribution of IoT, AI, and big data analytics to lean manufacturing techniques is studied.

These studies emphasize that effective strategic monitoring can support complex decision-making across various sectors by enhancing accountability, promoting resource optimization, and aligning operations with strategic objectives. This foundation underscores the importance of strategic monitoring in lean manufacturing, where adaptability and continuous improvement are crucial for success.

2.2. Lean Manufacturing In Industrial Sectors

Lean manufacturing is widely recognized as a cornerstone strategy for improving productivity and reducing waste by optimizing resource use and streamlining processes (Womack et al., 2007). Widely adopted in sectors ranging from automotive to manufacturing, lean principles aim to achieve higher output with fewer resources, making them especially relevant in resource-intensive industries like cement production (Sundar et al., 2014). However, the literature documents significant challenges in lean implementation, particularly in industries with fluctuating demand, resource limitations, and resistance to change.

Nordin et al. (2010) studied lean manufacturing in the Malaysian automotive industry. Based on surveys from 60 companies, the author determined that most firms were yet to fully adopt lean operations with prevalent changes addressing internal value chains rather than linkages with suppliers and consumers. Some of the main identified issues included lack of knowledge of lean ideas and employees' reluctance to change. Unfortunately, lean manufacturing is not fully optimized for most companies, and the authors suggested extending lean efforts to relationships with suppliers and customers.

Rahman et al. (2023) attempted to establish the effect of lean strategies on productivity and production line configuration in the ready-made garment industry, especially in a long-sleeve shirt

production line in Bangladesh. The conclusion was that lean tools enhanced productivity, reduced defects, and enhanced line efficiency. The study further advised that other production lines adopt lean tools with a view to improving efficiency and minimizing operational expenses.

Kassem et al. (2023) investigated this topic through an action research study using lean thinking at the strategic level within an Italian manufacturing company. The existence of continuous improvement and monitoring of the strategy is a crucial part of lean manufacturing, according to this study.

In Kenya, Joseph et al. (2023) assessed the effect of lean practices on operational performance in sugar factories. In the survey and development of an empirical multiple regression model of lean organizations, this study revealed that lean tools such as TPM, JIT, and continuous improvement significantly improved the efficiency and effectiveness of operations, thereby reducing costs. The authors stated that it is only when these practices are considered a strategic imperative that lasting advancements to operational performance may be realized.

Memari et al. (2024) conducted a study about lean manufacturing in a small local office supply company in Malaysia, where lean manufacturing principles focused on waste elimination with the help of Process Activity Mapping (PAM). In this study, it was established that, through implementing lean practices, the operating room showed enhanced efficiency by cutting down on waiting times and enhancing various processes. According to their research, the authors suggested that lean adoption should be gradual so that organizations, especially small and medium enterprises, can keep delivering performance improvement to them.

To increase the performance of Indian rolling mills, Rathi et al. (2024) attempted to practice lean initiatives comprising SMED and TPM. The research established that these methods enhanced equipment availability by 11.37%, productivity by 5%, and OEE by 30.3%. The authors suggested that lean implementation should be performed continuously to reduce the time products take in the line and provided useful suggestions to industries that seek to improve their outcomes within the steel industry.

These studies show the potential for increasing productivity and reducing waste using lean manufacturing. However, successful implementation usually involves a tailored approach for dealing with some challenges peculiar to certain industries. Not only that, lean adoption in cement production, for instance, may gain from complementary strategies, such as strategic monitoring, to overcome these barriers and fully reap lean benefits.

2.3. Strategic Monitoring's Role In Supporting Lean Manufacturing

Strategic monitoring in combination with lean manufacturing is a must to cope with the special problems of lean adoption in volatile situations. The strategic monitoring by its dimensions encompasses strategic thinking, intelligence, and vigilance, which can help lean manufacturing by providing insights on proactive adjustments in production processes. Studies also indicate that strategic monitoring ensures that an organization's internal activities correspond with external environmental pressures and improves the organization's capability to anticipate and prevent disruptions in supply or production systems. For example, strategic vigilance means that an organization can be on the lookout for signs that could indicate that some supplies are running low so that measures can be taken to reduce their impact on operations that have a lean inventory (Bhasin & Burcher, 2006; Maware & Parsley, 2022b).

Amare (2023), a recent study showed that organizations benefit from accurate monitoring approaches that could identify potential problems and reduce disruption in organizational project

environments. This is especially associated with the continuous improvement principle of lean manufacturing, that is, continuous monitoring of production lines and prompt response (if necessary). In addition, the literature reviewed also reveals a dearth of research investigating the relationship between strategic monitoring and lean outcomes. At the same time, the effects of the two factors or their lack of effects when integrated are not directly considered.

The reviewed literature shows that the direct effect of strategic monitoring on lean manufacturing has not been understood, particularly in the cement manufacturing sector, characterized by efficiency and resource optimization. A study has been conducted on the benefits of lean manufacturing and strategic monitoring separately, but little research has been done on their combined impact in a single organizational system. This study attempts to fill the gap by examining the role of strategic monitoring as a basis of support for lean manufacturing at Northern Cement Company and drawing on new insights into overcoming lean adoption failures and improving overall performance.

3. METHODOLOGY

This study adopts a descriptive-analytical methodology to explore the role of strategic monitoring in enhancing lean manufacturing practices within Northern Cement Company, Iraq. This approach combines descriptive techniques to summarize observed phenomena with analytical methods to investigate relationships among variables. This section outlines the data collection techniques, sampling strategies, measurement tools, and statistical analysis procedures used to address the study's research questions and hypotheses. By systematically examining the relationships among the variables, this approach provides a clear framework for assessing how strategic monitoring dimensions, strategic thinking, strategic intelligence, and strategic vigilance correlate with lean manufacturing elements such as workplace organization, total productive maintenance (TPM), just-in-time (JIT) production, and continuous improvement.

3.1. Data Collection

In this study, data was collected via personal interviews and the dissemination of questionnaires to a chosen sample of employees from the Northern Cement Company. The questionnaire included targeted questions to assess the availability of the strategic monitoring dimensions and the implications of using the lean manufacturing system.

3.2. Study Sampl

The participants in the study were purposefully selected based on certain demographic factors such as age, years of service, education level, and sex of the participants. Convenience sampling was used as the researcher targeted and selected participants who the researcher believed had adequate experience and knowledge of lean manufacturing practices relating to Northern Cement Company. The sample distribution is as follows:

1. Age group: The sample comprised four age groups, with the 21-30 age group representing 27%, the 31-40 age group at 30%, the 41-50 age group at 29%, and participants over 51 years at 14%.
2. Length of service: There were variations in service duration, with 19% of participants having less than 5 years of experience, while the largest proportion (30%) had 16-20 years of experience. Participants with over 20 years of experience comprised 22% of the sample.
3. Educational attainment: Most participants held a bachelor's degree (82%), while the remainder were distributed among those with higher diplomas (17%), master's degrees (10%), and doctoral degrees (4%).

4. Gender distribution: The sample comprised 63% male and 37% female participants.
5. A total of 115 valid questionnaires were collected and used for statistical analysis, enhancing the diversity of the sample and the accuracy of the derived results.

3.3. Questionnaire Validity

The validity of the questionnaire was tested in two stages:

1. The face validity of the questionnaire was assessed before distribution by presenting it to a panel of 11 specialized reviewers to ensure the questions' comprehensiveness, accuracy, and alignment with the study's objectives.
2. Reliability was measured using Cronbach's Alpha coefficient, as shown in Table 1. The table indicates that the composite alpha value (Feldt & Brennan, 1989) for the combined dimensions was 0.94, indicating a high level of reliability. The individual values for each dimension also demonstrated acceptable reliability, exceeding the minimum acceptable threshold of 0.70.

Table 1: Reliability Measurement For Study Dimensions

Variable	Dimension	Statements	Cronbach's Alpha for each dimension	Composite Alpha for combined dimensions
Strategic monitoring	Strategic thinking	X11-X15	0.77	0.94
	Strategic intelligence	X21-X25	0.79	
	Strategic vigilance	X31-X35	0.77	
Lean manufacturing system	Workplace organization	Y11-Y15	0.76	
	Total productive maintenance	Y21-Y25	0.80	
	Just-in-time production	Y31-Y35	0.75	
	Continuous improvement	Y41-Y45	0.87	

3.4. Internal Consistency

The internal consistency of the questionnaire items was assessed using the average inter-item correlations within each dimension to measure the correlation strength between items. Wu et al. (Wu et al., 2016) explain that the internal consistency value is 0.3 or more, which is good. Table 2 shows that all dimensions have good internal consistency, as most correlations exceed 0.3. These dimensions show this internal consistency that implies a strong relationship between the items of each dimension, that is, that the items measure the dimension correctly.

Table 2: Internal Consistency Values For Variables And Their Dimensions

Variables	Dimensions	No.	Var	Max	Min	Mean
Strategic monitoring	Strategic thinking	5	0.007	0.530	0.242	0.407
	Strategic intelligence	5	0.010	0.614	0.283	0.438
	Strategic vigilance	5	0.011	0.558	0.223	0.404

Variables	Dimensions	No.	Var	Max	Min	Mean
Lean manufacturing system	Workplace organization	5	0.007	0.568	0.273	0.388
	Total productive maintenance	5	0.011	0.674	0.317	0.438
	Just-in-time production	5	0.013	0.571	0.268	0.370
	Continuous improvement	5	0.006	0.754	0.440	0.584
Strategic monitoring		15	0.008	0.614	0.166	0.367
Lean manufacturing system		20	0.019	0.754	0.045	0.344

3.5. Data Description

The questionnaire consists of two main sections:

3.5.1 Part one: Personal information

Focuses on participants' personal information, such as age, gender, educational qualifications, and service duration.

3.5.2 Part two: Study dimensions

Addresses the dimensions related to the study's variables:

1. Independent variable dimensions (Strategic monitoring):

- Strategic thinking (X11-X15): This dimension includes questions that measure the use of analytical strategies within the organization, covering topics such as strategic thinking and evaluating internal and external environments.
- Strategic intelligence (X21-X25): This dimension assesses participants' ability to utilize available information intelligently to exploit opportunities and overcome challenges.
- Strategic vigilance (X31-X35): Focuses on measuring individuals' awareness and their rapid response to changes and developments in the internal and external environments.

2. Dependent variable dimensions (Lean manufacturing system):

- Workplace organization (Y11-Y15): This dimension examines how workplace organization and the arrangement of tools and equipment contribute to increased efficiency and reduced waste.
- Total productive maintenance (Y21-Y25): Includes practices to maintain equipment efficiency and ensure uninterrupted production processes.
- Just-in-time production (Y31-Y35): Focuses on the organization's ability to achieve production within specified times, minimizing time and resource waste.
- Continuous improvement (Y41-Y45): Emphasizes efforts to improve processes and reduce errors to enhance quality continuously.

Participants' responses to the questions were assessed using a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). All constructs were ensured to be valid through expert review and reliable through Cronbach's Alpha, which exceeds the 0.70 cut-off (Likert, 1932)

3.6. Conceptual Framework

The study's conceptual framework, as shown in Figure 1, illustrates the link between strategic monitoring (independent variable) and the lean manufacturing system (dependent variable). It aims to explain how the strategic monitoring dimensions, such as strategic thinking, strategic intelligence, and strategic vigilance, impact the dimensions of lean manufacturing, namely workplace organization, total productive maintenance, just–in–time, and continuous improvement.

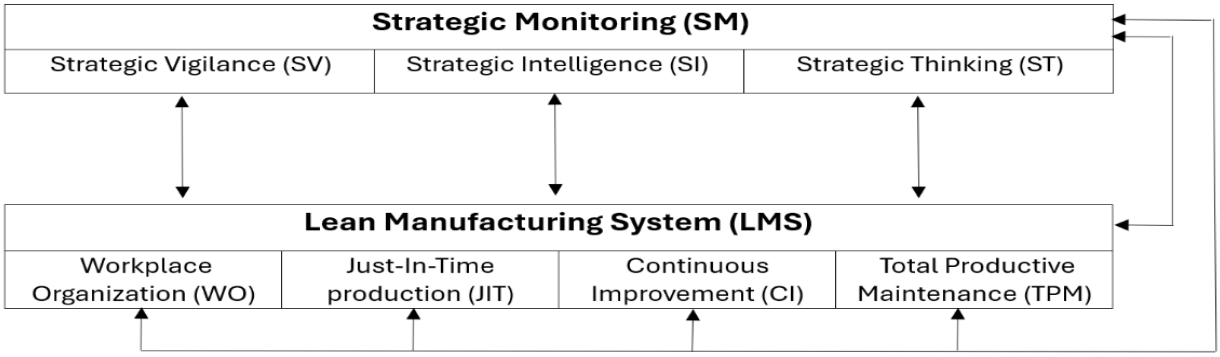

Figure 1: Conceptual Framework

3.7. Study Hypotheses

The study focuses on the following hypotheses:

- Main hypothesis: "There is no significant correlation between strategic monitoring and the lean manufacturing system at a statistical significance level ($\alpha \leq 0.05$) from the perspective of employees at the Northern Cement Company".
- Null hypothesis: "There is no significant correlation between strategic monitoring and the lean manufacturing system".
- Alternative hypothesis: "There is a significant correlation between strategic monitoring and the lean manufacturing system".

4. RESULTS AND DISCUSSION

In this section, an elaborate interpretation and analysis of the survey variables are derived from responses from employees of the Northern Cement Company. Data analysis was done using (SPSS V.26) to compute percentages, means, and standard deviations and to determine the reliability and internal consistency. Moreover, (AMOS V.24) was used to determine the correlations among the variables and measure the influence of strategic monitoring on the lean manufacturing system. One contribution of these analytical tools was that they consistently produced accurate and reliable insights that facilitated the achievement of the research objectives and testing of hypotheses.

4.1. Relationship Between Strategic Monitoring And Lean Manufacturing System

The analysis results in Table 3 and Figure 2 reveal a strong positive correlation between strategic monitoring and the lean manufacturing system, with a correlation coefficient of 0.940. This relationship is statistically significant, as indicated by the p-value (0.032), which is less than 0.05. Thus, the null hypothesis is rejected, and the alternative hypothesis is accepted, indicating a direct relationship between strategic monitoring and the application of the lean manufacturing system at a significance level of 0.05. This high positive correlation implies that strategic monitoring has the potential to ensure greatness in the application of lean manufacturing systems due to increased coordination, speed, and flexibility within an organization. Such studies are consistent with the preceding research by Bhasin and Burcher (2006), who highlighted the centrality of strategic monitoring in enhancing the conformity of organizational processes with lean goals.

Table 3: Relationship Between Strategic Monitoring And Lean Manufacturing System

Independent variable	Dependent variable	Correlation value	95% Confidence interval		P-value
			Upper	Lower	
Strategic monitoring	Lean manufacturing system	0.940	0.992	0.831	0.032

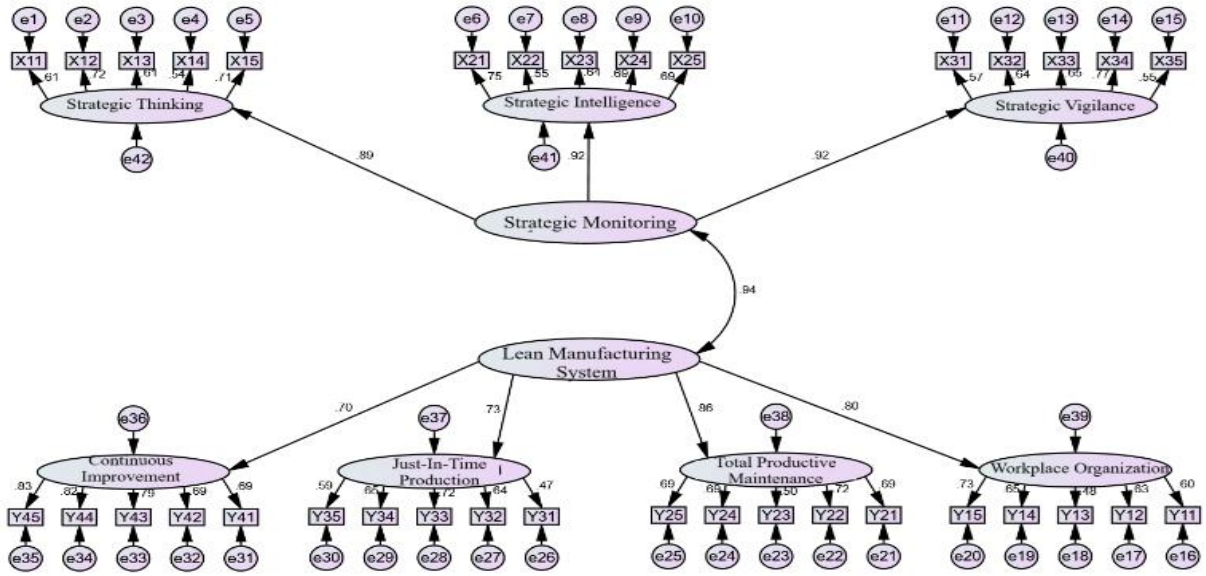

Figure 2: Correlation Between Strategic Monitoring And Lean Manufacturing System

4.2. Relationship Between Strategic Monitoring Dimensions And Lean Manufacturing Dimensions

The analysis of relationships between the dimensions of strategic monitoring (strategic thinking, strategic intelligence, strategic vigilance) and the lean manufacturing system is detailed in Table 4 and Figure 3, leading to the following results:

1. Strategic thinking and lean manufacturing: The results indicate a strong positive correlation between strategic thinking and lean manufacturing, with a correlation coefficient of 0.82 and a p-value of 0.030 below 0.05. This suggests that strategic thinking positively influences institutional performance through lean manufacturing.

Table 4: Relationship Between Strategic Monitoring Dimensions And Lean Manufacturing System

Strategic monitoring	Dependent variable	Correlation value	95% Confidence interval		P-value
			Upper	Lower	
Strategic thinking	Lean manufacturing system	0.820	0.909	0.666	0.030
Strategic intelligence		0.850	0.947	0.705	0.019
Strategic vigilance		0.900	0.986	0.777	0.021

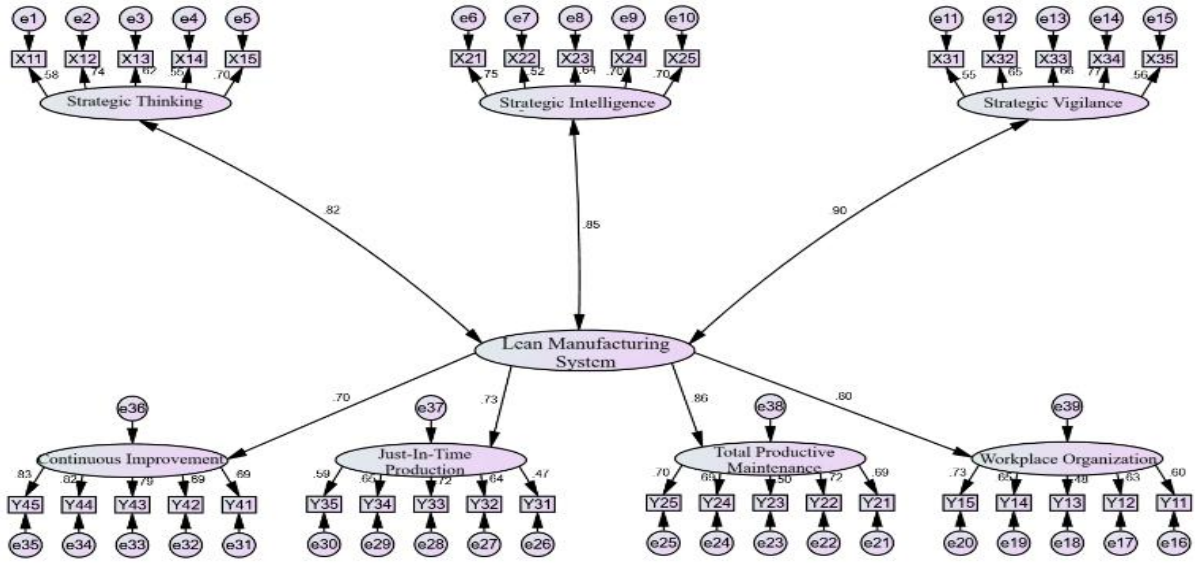

Figure 3: Correlation Between Strategic Monitoring Dimensions And Lean Manufacturing System

2. Strategic intelligence and lean manufacturing: A positive correlation was observed between strategic intelligence and lean manufacturing, with a correlation coefficient of 0.850 and a p-value of 0.0190. This indicates that effectively using and analyzing information enhances the organization's ability to implement lean manufacturing efficiently.
3. Strategic vigilance and lean manufacturing: The findings indicate that strategic vigilance has a high positive relationship with lean manufacturing, with a correlation coefficient of 0.900 and a p-value of 0.021. This means that quick organizational adaptation to the changes in the environment makes it easier to adopt lean manufacturing strategies.

The results of this study suggest that strategic monitoring dimensions are essential to facilitate the adoption of lean manufacturing systems and enhance the organizations' performance. Appreciation and application of these dimensions help businesses effectively control their resources and continuous improvements.

4.3. Relationship Between Strategic Monitoring And Lean Manufacturing Dimensions

The analysis, as presented in Table 5 and Figure 4, demonstrates varying correlation strengths between strategic monitoring and the different dimensions of the lean manufacturing system:

Table 5: Relationship Between Strategic Monitoring And Lean Manufacturing Dimensions

Strategic monitoring	Dependent variable	Correlation value	95% Confidence interval		P-value
			Upper	Lower	
Strategic monitoring	Workplace organization	0.766	0.8730	0.6390	0.014
	Total productive maintenance	0.7720	0.8710	0.6180	0.021
	Just-in-time production	0.740	0.8570	0.521	0.053
	Continuous improvement	0.640	0.8260	0.3810	0.021

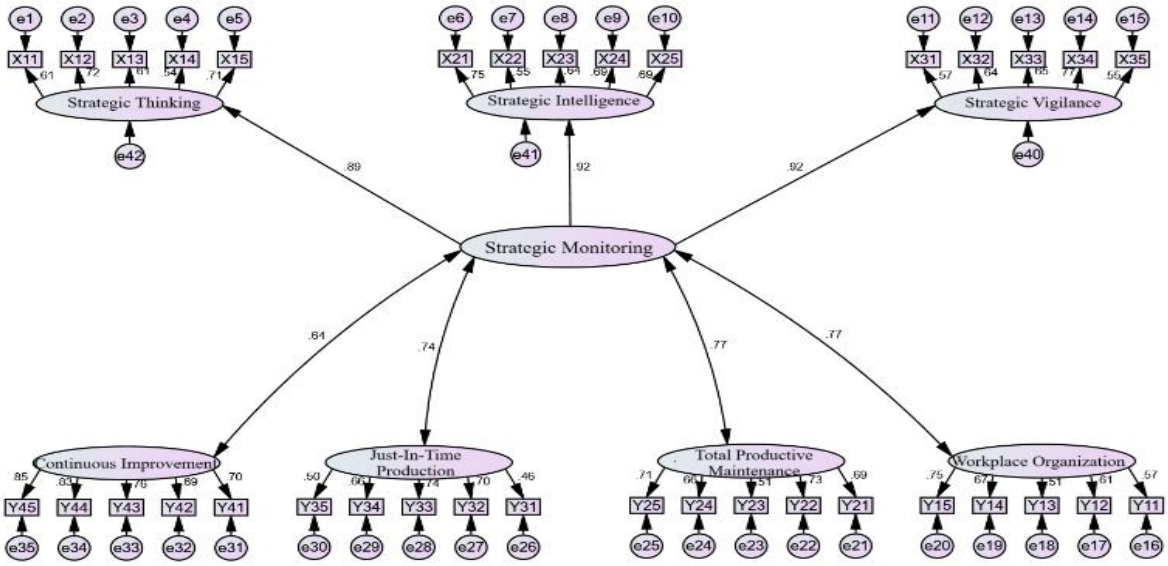

Figure 4: Correlation Between Strategic Monitoring And Lean Manufacturing Dimensions

1. Workplace organization and strategic monitoring: The analysis shows a positive and significant relationship, with a correlation coefficient of 0.766 and a p-value of 0.0140, indicating that strategic monitoring enhances the organization and arrangement of the workplace, contributing to reduced waste and increased efficiency.
2. Total productive maintenance and strategic monitoring: The results reveal a positive and significant relationship with a correlation value of 0.7720 and a p-value of 0.0210. This emphasizes the importance of strategic monitoring in ensuring effective maintenance and reducing downtime.
3. Just-in-time production and strategic monitoring: Although a positive correlation exists (0.740), the relationship is not statistically significant (P-value = 0.0530, greater than 0.05). This suggests that while strategic monitoring influences just-in-time production, it does not reach statistical significance.
4. Continuous improvement and strategic monitoring: The analysis reveals a positive and significant correlation, with a coefficient of 0.640 and a p-value of 0.0210, indicating that strategic monitoring supports continuous improvement efforts within the organization, contributing to higher quality outcomes.

4.4. Discussion Of Results

The results underscore the importance of strategic monitoring in supporting the application of lean manufacturing systems and enhancing the effectiveness of its various dimensions. The relationships between the dimensions suggest that strategic thinking and intelligence are pivotal in improving organizational performance, mainly through process organization and resource optimization. On the other hand, the insignificant relationship between strategic monitoring and just-in-time production stresses the need to continue efforts toward achieving optimal synchronization of monitoring processes with the need for production time.

These research results may indicate that strategic monitoring helps improve the decisions made by managers the flexibility of operations, and the potential for change. This paper supports combining strategic monitoring with Lean manufacturing, creating value for organizations and enhancing flexibility.

This supports its important role in improving operational efficiency through strategic monitoring at Northern Cement Company ($r = 0.940$; $p < 0.05$). This means practically that to improve predictive decision-making, this is a force multiplier to increase strategic intelligence; to drive continuous improvement, this is a force multiplier to increase strategic vigilance; and to manage and maintain workplace organization and work, this is a force multiplier to structured monitoring. Although there was a lack of statistical significance in the relationship with Just-in-Time (JIT) production, production planning might be aligned with strategic foresight, which could result in efficiency. NCC needs to invest in predictive analytics, real-time monitoring systems, and cross-functional teams to anticipate drawbacks in where they stand in the market and to deal with the challenges on the fly.

Finally, the study being done re-establishes the existence of strategic monitoring and lean manufacturing in organizations and, in the process, affirms that organizations should use monitoring tools to enhance production and create efficiency. They again emphasize the importance of thinking, knowing, and observing to attain positive lean manufacturing outcomes. From these insights, organizations can build on improving strategic monitoring for production performance and sustain lean manufacturing systems.

5. CONCLUSION

5.1. Conclusion

This study explored the role of strategic monitoring in supporting lean manufacturing practices within Northern Cement Company, Iraq. It addresses a critical gap in the literature by examining the integration of strategic monitoring with lean systems in resource-intensive industries. Through a detailed analysis of the dimensions of strategic monitoring, strategic thinking, strategic intelligence, and strategic vigilance, and their relationship with lean manufacturing principles such as workplace organization, total productive maintenance (TPM), just-in-time (JIT) production, and continuous improvement, several key findings emerged.

The implications of the research show that strategic monitoring has a highly positive relationship with lean manufacturing system implementation. This study confirmed that monitoring strategic activities raised lean practice indicators, facilitating better coordination, resource management, and flexibility. In detail, strategic vigilance indicated the most significant positive correlation with the lean manufacturing dimensions as a key factor supporting organizations' quick response to environmental conditions.

These findings are consistent with literature like Bhasin and Burcher (2006). They supported the implementation of strategic control tools for measuring and enhancing manufacturing processes. In addition, the clearly defined power options identified in this research for the measured construction, such as workplace organization ($r = 0.766$) and TPM ($r = 0.772$), support the notions and viability of improved monitoring as a significant enabler of strategic lean manufacturing.

Besides the theoretical significance, this study provides the following practical contributions to understanding cement manufacturing industries: Strategic monitoring frameworks can enhance business value and operational excellence by synchronizing internal and external goals, minimizing inefficiencies, and attaining superior and sustainable competitive advantages for an organization. It can also help other industries in other areas with similar challenges in lean manufacturing implementation.

Ultimately, strategic monitoring and lean manufacturing integration represent a pathway for organizations to enhance operational efficiency, adaptability, and sustainability. As industries

grapple with resource constraints and volatile market conditions, adopting these integrated approaches will be critical to achieving long-term success.

5.2. Recommendation

Based on the findings of the study, several recommendations are proposed to enhance the effectiveness of strategic monitoring and optimize lean manufacturing practices within Northern Cement Company:

1. Enhancing strategic monitoring mechanisms:

- Develop comprehensive monitoring systems: The company should invest in advanced strategic monitoring tools and systems that facilitate continuous data collection and analysis. This will allow leadership to detect emerging trends, assess potential threats, and identify opportunities in real-time, ensuring agile decision-making.
- Adopt modern technological tools: Implement predictive analytics and machine learning tools to strengthen monitoring capabilities. These tools can support proactive decision-making, improve production efficiency, and help the company adapt to rapidly changing industry conditions.

2. Building leadership capabilities in strategic monitoring:

- Training and development programs: Provide tailored training programs for leaders and managers to enhance their understanding of strategic monitoring principles. Emphasize skills in environmental analysis, strategic foresight, and data interpretation, equipping leadership with the competencies needed to support lean practices.
- Strengthening analytical skills: Develop workshops and continuous learning initiatives that enhance analytical skills, enabling leaders to interpret and translate environmental data into actionable strategies that improve organizational performance.

3. Adopting lean manufacturing as a long-term strategy:

- Integrate lean principles across all departments: Encourage departments across the company to adopt lean manufacturing principles as part of their core operational strategy. Comprehensive adoption will foster continuous improvement, maximize resource utilization, and reinforce a culture of efficiency.
- Embedded lean practices into the organizational culture: Position lean manufacturing as a key element of the company's mission and values, promoting a culture of waste reduction, efficiency, and continuous improvement across all levels of the organization.

4. Improving interdepartmental coordination:

- Enhance cross-functional communication: Facilitate better communication and collaboration between departments to ensure cohesive application of lean principles and strategic monitoring insights. Regular interdepartmental meetings to discuss data from monitoring systems and review lean performance can improve information flow and decision-making.
- Form cross-functional lean and monitoring teams: Establish specialized teams that bring together lean and strategic monitoring expertise to analyze real-time data, identify process inefficiencies, and initiate rapid interventions for improvement.

5. Establishing Key Performance Indicators (KPIs) and continuous performance measurement:

- Develop specific KPIs for monitoring and lean practices: Create KPIs to measure the effectiveness of strategic monitoring and its impact on lean manufacturing outcomes, such as waste reduction, production efficiency, and resource utilization. Regularly evaluating these KPIs will enable the company to track progress and identify areas for further improvement.
- Predictive analytics for future performance: Run predictive models to predict future performance trends, enabling the company to anticipate what to expect and be adaptable. Predictive analytics can give the company strategic foresight and do business with proactive management.

The goal here is to aid Northern Cement Company in its ability to implement effective integration of strategic monitoring into lean manufacturing processes. Through such an approach of strategic monitoring, the company can build its adaptability, raise resource efficiency, and achieve professional development in the cement industry.

5.3. Future Research Directions

This study provides strong evidence regarding the link between strategic monitoring and lean manufacturing. However, additional research should be conducted to understand how strategic monitoring practices alter lean manufacturing components. Future studies can focus on the contribution of real-time data analytics, AI monitoring, and digital transformation in improving lean practices. Furthermore, leadership and employee engagement, internal influences, and resistance to change may determine how to facilitate adopting strategic monitoring (e.g., investigating organizational culture). The generalization of these findings and the refinement of best practices for lean manufacturing implementation would be improved with comparative studies across different industries or geographical regions.

In conclusion, strategic monitoring represents a vital mechanism for supporting lean manufacturing in complex industries, and its integration into the operational framework of Northern Cement Company can drive substantial improvements in efficiency, adaptability, and sustainable competitive advantage.

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