The Impact of Strategic Monitoring on the Activation of Lean Manufacturing System

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Article Info

ISSN (online): 2583-6641
Volume: 04
Issue: 01
January-February 2025
Received: 09-10-2024
Accepted: 13-11-2024
Page No: 137-142

Abstract
In light of industrial organizations' increasing challenges, adopting effective managerial strategies that enhance competitiveness and improve organizational performance has become essential. Strategic monitoring is one of the most crucial strategies, as it contributes to forecasting the future and analyzing the internal and external environment, aiding in decision-making at the managerial level. On the other hand, lean manufacturing represents a modern approach aimed at reducing waste and improving production efficiency through principles and managerial techniques. This study aims to analyze the impact of strategic monitoring on lean manufacturing by examining the influence of strategic monitoring dimensions (strategic thinking, strategic intelligence, and strategic vigilance) on the dimensions of lean manufacturing (workplace organization, total productive maintenance, just-in-time production, and continuous improvement). The research employs a quantitative analytical methodology, collecting data through a structured questionnaire distributed to 113 administrative leaders in the Northern Cement Subsidiary. The collected data were analyzed using advanced statistical techniques, including regression and path analysis. The results indicate a significant and positive effect of strategic monitoring on lean manufacturing. Specifically, strategic intelligence and thinking have the most significant impact on adopting lean manufacturing practices. Additionally, the findings highlight the importance of strategic vigilance in enhancing responsiveness to external changes, thereby increasing operational efficiency and reducing waste.

DOI: https://doi.org/10.54660/IJMOR.2025.4.1.137-142

Keywords: Strategic monitoring; lean manufacturing; strategic vigilance; Northern Cement Subsidiary; impact analysis

1. Introduction

In an era of rapid industrial transformation and intense competition, organizations must adopt strategic approaches that enhance efficiency, adaptability, and competitive advantage (Barney & Hesterly, 2019) [4]. Strategic monitoring is a key managerial tool that enables organizations to analyze their internal and external environments, anticipate changes, and make data-driven decisions. It consists of three main dimensions: strategic thinking, intelligence, and vigilance, each crucial in guiding organizations toward sustainable growth (Choo, 1996) [5], (Al-Tanayeeb, 2020) [2].

At the same time, lean manufacturing has become a prevailing approach for industrial organizations to minimize waste and maximize resources to boost productivity (Womack *et al*., 2007) [16]. Based on core principles of workplace organization, total productive maintenance, just-in-time production, and continuous improvement, the processes are streamlined, and operational performance is improved (Sundar *et al*., 2014) [14].

While previous studies have explored the relationship between strategic monitoring and lean manufacturing, most have focused on correlation analysis rather than investigating causal relationships (Maware & Parsley, 2022) [10] (White, 2004) [15] (Dziyaba, 2016) [6]. Research suggests that strategic thinking improves decision-making and resource allocation, while strategic intelligence enhances data-driven efficiency (Choo, 1996) [5], (Al-Tanayeeb, 2020) [2], (Muhayimana & Kamuhanda, 2020) [11]. Additionally, strategic vigilance has been linked to quick adaptation to industrial and technological shifts, supporting lean practices such as just-in-time production and total productive maintenance (Henao *et al*., 2019) [8], (Okafor, 2021) [13],

(Amare, 2023) [3]. However, the direct effects of each dimension of strategic monitoring on lean manufacturing principles are still not explored. In gap, this paper attempts to address this through an in-depth quantitative analysis of regression, and path modeling, in order to assess the causal influence of strategic monitoring on lean manufacturing in the Northern Cement Company (NCA, 2016).

This study seeks to answer the following key question:

"To what extent does strategic monitoring influence the activation of lean manufacturing in the Northern Cement Subsidiary?"

From this, three sub-questions emerge

1. How does strategic thinking contribute to lean manufacturing implementation?
2. What is the role of strategic intelligence in enhancing lean manufacturing practices?
3. How does strategic vigilance improve the adoption of lean manufacturing principles?

The study aims to

1. Analyze the causal impact of strategic monitoring on lean manufacturing.
2. Evaluate the effect of each dimension of strategic monitoring on different aspects of lean manufacturing.
3. Provide practical recommendations for integrating strategic monitoring into industrial decision-making to optimize lean manufacturing practices.

The rest of the paper is as follows: Section 2 describes the methodology in detail, including data collection and analysis. In Section 3, the findings are presented and discussed. Section 4 concludes with insight, managerial insight, an implication and a recommendation for relevant future research.

2. Methodology

This study adopts a descriptive-analytical approach, aiming to describe the nature of the variables under investigation and analyze their relationships through statistical methods. The methodology follows a structured process that includes data collection, sampling, and statistical analysis to ensure accurate and reliable findings.

2.1. Research method

The study uses A quantitative approach using a structured questionnaire as the main data collection tool. The questionnaire is based on validated measures from other research, and it is designed to assess the impact of strategic monitoring (strategic thinking, strategic intelligence, and strategic vigilance) on lean manufacturing (workplace organization, total productive maintenance, just-in-time production, and continuous improvement).

2.2. Data collection

Data was collected through two main methods

1. Conducted personal interviews with key personnel to understand strategic monitoring practices.
2. Distributed survey questionnaire containing set questions to gauge employees' perceptions of strategic monitoring and implementation of lean manufacturing at different managerial levels.

2.3. Sample and population

The study targeted employees of Northern Cement specifically depending on the subsidiary, as in administrative and production management. The random stratified sampling process was used to select the sample in order to ensure adequate representation across all the departments and hierarchical levels.

The distribution of the sample is as follows

- Age Groups: The majority (30%) belonged to the 31–40 age group, followed by 41–50 years (29%), 21–30 years (27%), and over 50 years (14%).
- Years of Experience: The most represented category was employees with 16–20 years of experience (30%), followed by those over 20 years (22%).
- Educational Level: The majority (82%) held a bachelor's degree, while others had higher diplomas (17%), master's degrees (10%), and PhDs (4%).
- Gender Distribution: 63% of the respondents were male, while 37% were female.

A total of 115 valid responses were collected and analyzed, ensuring a reliable dataset for statistical examination.

2.4. Questionnaire validity and reliability

The questionnaire assessed validity and reliability in two phases (Feldt & Brennan, 1989) [7]:

1. **Face Validity**: The items of the questionnaire were reviewed by a panel of 11 experts in order to ensure their clarity, relevance, and appropriateness.
2. **Reliability Analysis**: The items in the questionnaire were measured based on Cronbach's alpha coefficient. The internal consistency, overall reliability, was 0.94 meaning a high degree of reliability.

The reliability scores for individual constructions are detailed in Table 1:

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	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	

2.5. Internal consistency testing

Items within each dimension were assessed for the coherence of items by inter-item correlation analysis. As has been indicated by Wu *et al.* (Wu *et al*., 2016), an inter-item correlation of about 0.3 or higher will prove to be good consistency. All dimensions show very strong internal consistency, as shown in Figure 1.

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
Lean manufacturing	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		20	0.019	0.754	0.045	0.344

2.6. Study variables and measurement

The questionnaire was structured into two main sections:

1. Demographic Information: Includes age, gender, education level, and years of experience.
2. Study Variables:
   - Independent Variable: Strategic Monitoring
     - Strategic Thinking (X11-X15)
     - Strategic Intelligence (X21-X25)
     - Strategic Vigilance (X31-X35)
   - Dependent Variable: Lean Manufacturing
     - Workplace Organization (Y11-Y15)
     - Total Productive Maintenance (Y21-Y25)
     - Just-in-Time Production (Y31-Y35)
     - Continuous Improvement (Y41-Y45)

Responses were measured using a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

2.7. Conceptual Framework

The conceptual framework of the study, as shown in Figure 1, is used to depict the effect relationship between the independent variable, strategic monitoring and the dependent variable, lean manufacturing. Strategic monitoring, composed of strategic thinking, strategic intelligence, and strategic vigilance dimensions, is to be related to lean manufacturing, whose dimensions are workplace organization, total productive maintenance, just-in-time production, and continuous improvement.

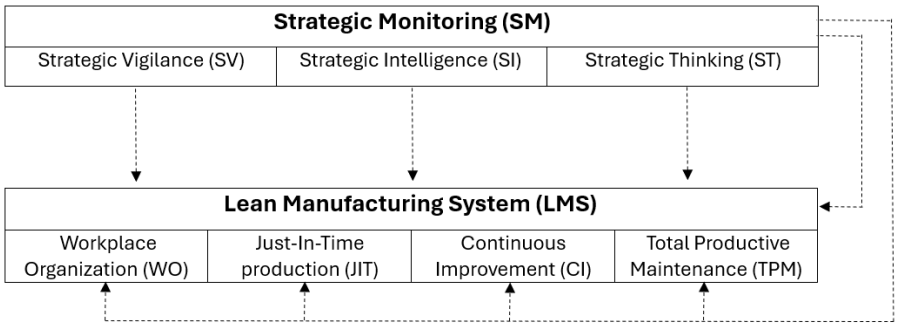

Fig 1: Conceptual Framework

2.8. Study hypotheses

This study is based on the following main hypotheses:

- **Main Hypothesis**

"There is no statistically significant impact of strategic monitoring on lean manufacturing at a significance level of ($\alpha \leq 0.05$) from the perspective of employees in the Northern Cement Subsidiary."

Two sub-hypotheses are derived from the main hypothesis:

1. There is no statistically significant impact between each dimension of strategic monitoring and lean manufacturing.
2. There is no statistically significant impact between each dimension of strategic monitoring and each dimension of lean manufacturing.

3. Results and Discussions

The purpose of this section is to describe, examine, and diagnose the study variables relative to the respective answers obtained from the Northern Cement Subsidiary employees. The analysis was done statistically using SPSS V.26 to calculate the percentages, means and SD, internal consistency, and reliability factor. In addition, AMOS V.24 was used in order to analyze all the correlations and all the impact relationships between the study variables.

3.1. Main Hypothesis

According to the results of the regression coefficient (Estimate β) (Marzocchi & Sandri, 2003) [9]equal to 0.72, presented in Table 3 and Figure 2, the results show that strategic monitoring positively impacts lean manufacturing. This is a statistically significant result with a P value of 0.000

less than the 0.05 threshold. More, the critical ratio (C.R.) of 4.43 was greater than the tabulated value of 1.96, thus reinforcing that the relationship was significant.

These findings lead to rejecting the null hypothesis and accepting the alternative hypothesis, which states that strategic monitoring significantly impacts lean manufacturing at a significance level of ($\alpha < 0.05$).

Additionally, the coefficient of determination (Akossou & Palm, 2013) [9] was 0.88 meaning 88 percent of variations for lean manufacturing is explained by strategic monitoring. The remaining 12 p.c is blamed on other variables not included on the regression model. This indicates that strategic monitoring is highly important in certain instances in making lean manufacturing practices in an organization studied.

Table 3: Impact of Strategic Monitoring on Lean Manufacturing

Independent variable	Dependent variable	Estimate (β)	SRW	R^2	Critical Ratio (C.R.)	P-value
Strategic monitoring	Lean manufacturing	0.72	0.940	0.88	4.43	0.000

***Source*:** Generated based on statistical analysis using AMOS V.24 (n=115)

The results show that strategic monitoring has a positive and statistically significant effect on lean manufacturing. This is highly significant (P-value 0.000 is less than 0.05). Moreover, the value of R^2 (0.88) means that there is 88% variability in lean manufacturing, explained by strategic monitoring, highlighting how vital this element is in ensuring optimal manufacturing processes.

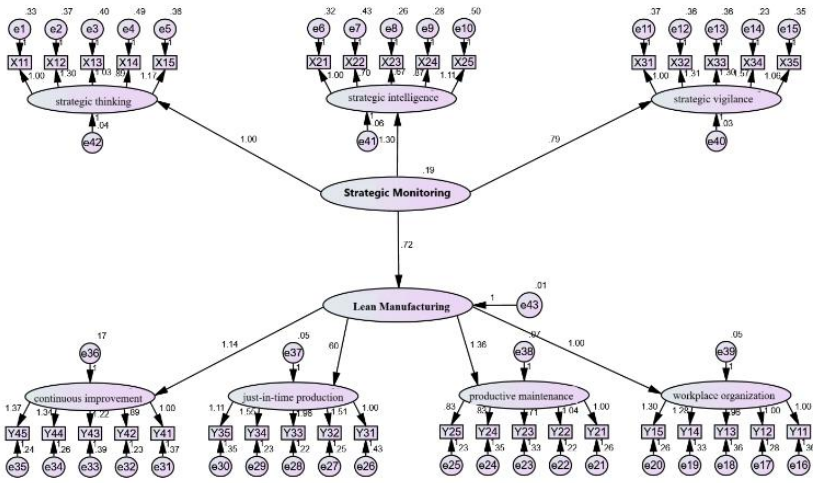

Fig 2: The Impact of Strategic Monitoring on Lean Manufacturing

3.2. Sub-Hypotheses Derived from the Main Hypothesis

1. The Strategic thinking has no statistically significant impact for lean manufacturing at a high level ($a \leq 0.05$) in the employees of Northern Cement Subsidiary.
2. The results indicate that strategic intelligence has no statistically significant impact on lean manufacturing at a substantive level of ($\alpha \leq 0.05$) as far as employees of the Northern Cement Subsidiary are concerned.
3. From the standpoint of the India Cortez Cement Subsidiary employees, lean manufacturing has no statistically significant effect of strategic vigilance at the level of ($\alpha \leq 0.05$).

3.3. Findings Based on Hypothesis

1. Positive Impact of Strategic Thinking on Lean Manufacturing

- The regression coefficient Estimate (β) = 0.14, indicating a positive impact.
- The P-value = 0.025, which is less than 0.05, confirming statistical significance.
- The critical ratio (C.R.) = 2.247, greater than the tabulated t-value (1.96), reinforcing significance.
- These results reject the null hypothesis and accept the alternative hypothesis, confirming that strategic thinking significantly and positively affects lean manufacturing at a significance level of ($\alpha < 0.05$).

2. Positive Impact of Strategic Intelligence on Lean Manufacturing

- The regression coefficient Estimate (β) = 0.22, indicates a positive effect.
- The P-value = 0.000, less than 0.05, confirms statistical significance.
- The critical ratio (C.R.) = 3.319, which exceeds the tabulated t-value (1.96), reinforcing the significance.
- These results lead to rejecting the null hypothesis and accepting the alternative hypothesis, confirming that strategic intelligence has a significant and positive impact on lean manufacturing at a significant level of ($\alpha < 0.05$).

3. Positive Impact of Strategic Vigilance on Lean Manufacturing

- The regression coefficient Estimate (β) = 0.52, indicating a strong positive impact.
- The P-value = 0.001, which is less than 0.05, confirming statistical significance.
- The critical ratio (C.R.) = 3.278, exceeding the tabulated t-value (1.96), further confirming significance.
- These results reject the null hypothesis and accept the alternative hypothesis, indicating that strategic vigilance significantly enhances lean manufacturing at a significance level of ($\alpha < 0.05$).

4. Variation in the Strength of Strategic Monitoring Dimensions on Lean Manufacturing

- Among the three dimensions of strategic monitoring, the most decisive influence was observed in strategic vigilance, with a standardized regression weight (SRW) of 0.688.
- Strategic intelligence ranked second, with SRW = 0.477.
- Strategic thinking had the least impact, with SRW = 0.251.
- This ranking suggests that quick adaptability (vigilance) and intelligence-based decision-making significantly influence lean manufacturing more than long-term strategic planning (thinking).

5. Overall Impact of Strategic Monitoring on Lean Manufacturing

- The coefficient of determination (R-Square) = 0.76, indicating that strategic monitoring dimensions explain 76% of variations in lean manufacturing.
- The remaining 24% is attributed to other external factors not included in the model.
- This finding confirms that strategic monitoring plays a major role in shaping lean manufacturing practices within the organization.

Table 4: Impact of Strategic Monitoring Dimensions on Lean Manufacturing

Independent variable	Dependent variable	Estimate (β)	SRW	R^2	Critical Ratio (C.R.)	P-value
Strategic thinking	Lean manufacturing	0.14	0.251	0.76	2.247	0.025
Strategic intelligence	Lean manufacturing	0.22	0.477	0.76	3.319	0.000
Strategic vigilance	Lean manufacturing	0.52	0.688	0.76	3.278	0.001

Source: Generated based on statistical analysis using AMOS V.24 (n=115).

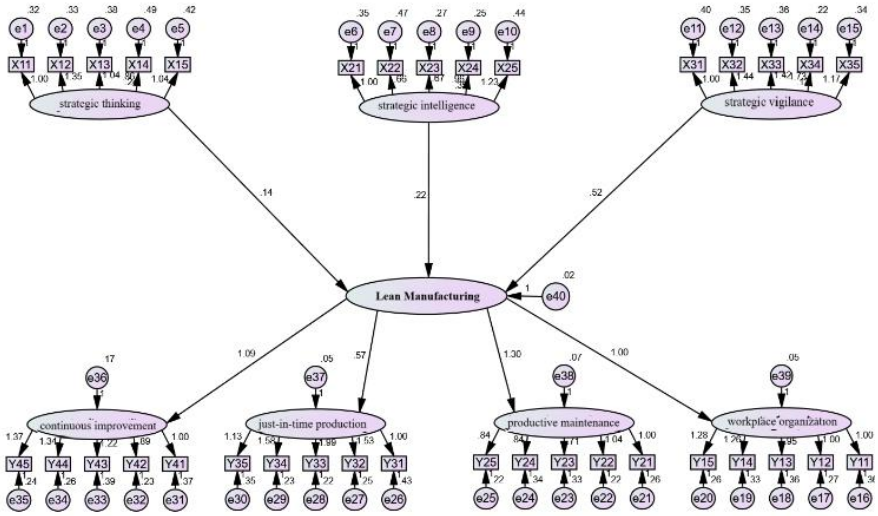

Fig 3: The Impact of Strategic Monitoring Dimensions on Lean Manufacturing

3.4. Discussion of Results

Statistical analysis supports that strategic monitoring has a critical positive role on lean manufacturing in the Northern Cement Subsidiary and that strategic monitoring needs to be practiced to increase manufacturing efficiency and reduce waste. Strategic vigilance had the greatest influence of the three dimensions of strategic monitoring, as it had a standardized regression weight (SRW) of 0.688. This finding offers the guidance that an organization's capability in the foreseeing of environmental changes as well as to respond quickly to such foreseeing is key for improvement in lean manufacturing practices within continuous improvement and just in time production.

Furthermore, strategic intelligence was proven to be an important driver of lean manufacturing with an SRW of 0.477. This implies that by properly using existing information as well as making data driven decisions, the total productive maintenance and the amount of operating waste can be greatly increased. Firms analyses the inside and outside surroundings in which they operate so as to improve production processes and also increase efficiency.

On the other hand, the impact of strategic thinking was relatively lower by an SRW of 0.251. It means that lean manufacturing requires long-term planning and setting of vision but plays a less important role than real-time adaptation and making intelligent decisions. In nature, Lean manufacturing calls for instant responses and expeditious decision-making, as opposed to strictly depending on long-term strategic planning.

They are consistent with previous work and suggest the need for strategic monitoring to boost production efficiency and flexibility to industrial change (Henao *et al*, 2019; Maware & Parsley, 2022) [8]. Lastly, the results also validated the studies that argue that operational tools and techniques play a crucial role in lean manufacturing success and that a strategic managerial approach is based on environmental foresight and analysis (Womack *et al*., 2007) [16] (Sundar *et al*., 2014) [14]. Overall, the study supports the crucial part of strategic monitoring, notably vigilance and intelligence, to maintain the fruits in lean manufacturing to preserve environmental effective sustainability.

4. Conclusions and Recommendations

4.1. Conclusions

Based on the statistical analysis and discussion of findings, the following conclusions can be drawn:

1. The strategic monitoring has a huge impact on the lean manufacturing and it can be proven through the fact that organizations that practice the strategic monitoring are better in adopting lean manufacturing principles and reaching the operational efficiency.
2. The most influential factor supporting lean manufacturing is strategic vigilance so as to anticipate environmental changes and take quick decision to improve industrial efficiency.
3. Understanding strategic intelligence assists in the better planning and use of resources, resulting in waste reduction. For organizations that rely on data analysis and environmental insights, this will improve productivity and ensure organizational sustainability.
4. Strategic thinking was relatively less important than other determinants. This implies that lean manufacturing is more nimble and flexible than heavily planned.
5. The results indicate that further progress in industrial organizations enhances the culture of strategic monitoring because of its determinative role in continuous improvement and process development in conjunction with market demands.

4.2. Recommendations

Based on the findings, the following recommendations are proposed for the administrative leadership of the Northern Cement Subsidiary and other industrial organizations:

1. To enhance strategic vigilance in order to develop specialized units in order to monitor changes by environmental practices such as market trends and technology improvement to support strategic decision making for lean manufacturing service.
2. Training managerial leaders in developing strategic intelligence such as data analysis and opportunity recognition capabilities for continuous improvement and minimizing production waste.
3. It includes integration of strategic thinking practices into production planning to develop long term visions and strategies and to ensure a lean manufacturing fits with the organizational objectives.
4. Implement advanced business intelligence systems for performance data collection and analysis for the use of data driven decision making for transition to Lean manufacturing.
5. The use of workshops, which include employees in regular workshops to promote a lean manufacturing culture among them through continuous improvement principles and waste reduction helps promote efficiency and productivity for the team.
6. They started further applied research to examine the relationship between strategic monitoring and lean manufacturing in other industrial environments in order to determine influencing factors and more effective institutional performance strategies.

5. References

1. Akossou AYJ, Palm R. Impact of data structure on the estimators R-square and adjusted R-square in linear regression. International Journal of Mathematics and Computation. 2013;20(3):84-93.
2. Al-Tanayeeb NAN. The impact of strategic vigilance in crisis management [dissertation]. Zarqa: Zarqa University; c2020.
3. Amare S. The role of monitoring and evaluation on project performance: The case of Tezetaw, Elias and Tesfaye (T.E.T) Construction Addis Ababa, Ethiopia [dissertation]. Addis Ababa: St. Mary's University; c2023.
4. Barney JB, Hesterly WS. Strategic management and competitive advantage: Concepts and cases. Pearson; c2019.
5. Choo CW. The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions. International Journal of Information Management. 1996;16(5):329-40. doi:10.1016/0268-4012(96)00020-5.
6. Dziyaba R. The role of monitoring and evaluation in promoting strategic management: A case study of the Royal Bank Ltd, Ghana [dissertation]. Kumasi: Kwame Nkrumah University of Science and Technology; c2016.
7. Feldt LS, Brennan RL. Reliability. In: Educational measurement, 3rd ed. American Council on Education; 1989:105-46.
8. Henao R, Sarache W, Gómez I. Lean manufacturing and sustainable performance: Trends and future challenges. Journal of Cleaner Production. 2019;208:99-116.
9. Marzocchi W, Sandri L. A review and new insights on the estimation of the b-value and its uncertainty. Annals of Geophysics.
10. Maware C, Parsley DM. The challenges of lean transformation and implementation in the manufacturing sector. Sustainability. 2022;14(10):6287. doi:10.3390/su14106287.
11. Muhayimana O, Kamuhanda JK. The relationship between monitoring and evaluation (M&E) practices and public projects performance in Rwanda with reference to Science and Technology Skills Development (STSD) project. International Journal of Advanced Scientific Research and Management. 2020;5(9). Available from: www.ijasrm.com
12. Northern Cement Associate. 2016. Available from: https://ncsciraq.gov.iq/
13. Okafor AE. Influence of monitoring and evaluation system on the performance of projects. IJRDO - Journal of Social Science and Humanities Research. 2021;6(8).
14. Sundar R, Balaji AN, Kumar RMS. A review on lean manufacturing implementation techniques. Procedia Engineering. 2014;97:1875-85.
15. White C. Monitoring strategic performance. In: Strategic Management. Macmillan Education UK; 2004. p. 651-97. doi:10.1007/978-0-230-55477-1_18.
16. Womack JP, Jones DT, Roos D. The machine that changed the world: The story of lean production—Toyota's secret weapon in the global car wars that is now revolutionizing world industry. Simon and Schuster; 2007.