

## Performance Measurement and Management in Oil and Gas Maintenance – Item Development

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### Abstract

The oil and gas industry faces challenges such as volatile prices, political instability, and competition from renewables, underscoring the need for a robust maintenance performance measurement framework to enhance efficiency and cost management. This research focuses on determining maintenance performance measurement items by means of a systematic literature review (SLR). From 21 articles found using SLR, 14 possible performance measurement items were identified: including cost, safety, equipment reliability, and productivity. These items will be used as the input to the quantitative survey in determining the key performance measurement index for oil and gas maintenance in Malaysia. This framework then aims to support Malaysian oil and gas companies in achieving sustainable operations and enhanced performance amid market uncertainties.

## 1. Introduction

Oil and gas had been used in some form for thousands of years before the modern era, such as lamps or as a building material, with the first reported oil wells being drilled in China in 347 AD. The modern era of the oil and gas industry commenced in 1847 with the discovery of James Young, a Scottish scientist (Ali, 2019). By the end of the century, it had become a widely traded commodity. This was due to the invention of the petroleum-powered engine and the discovery of crude oil kerosene production (Samsun *et al.*, 2015). Key oil firms were founded in the late 18th and early 19th centuries, and they still dominate the oil and gas business today. Despite competition from renewable energy sources, the oil and gas industries are, however, growing today but in a more volatile position than ever due to global events. Completely replacing oil and gas will necessitate a massive rise in alternative energy output (PETRONAS Gas Berhad, 2020). Oil and gas have numerous distinctive characteristics compared to other industries, including larger project sizes, higher technical complexities, the inclusion of diversified skills, and expensive transportation and machinery expenses (Bertocco & McCreery, 2014; Menhat, 2017). As a result, oil and gas operations frequently enlist the help of many companies to execute their projects. Due to variations in world oil prices, the oil and gas industry has seen an alternating economic boom and decline

since its inception. External factors such as oil and price shocks and political instability are unpredictable and difficult to regulate in the oil and gas industry. Furthermore, oil and gas businesses' end products have very little differentiation, making it difficult for them to gain a competitive advantage through it. As a result, to differentiate themselves from their competition, businesses must focus on internal factors. Resources and capabilities are two examples of such aspects that must be adequately studied and handled to improve a company's competitive edge. In keeping with this, a method for assessing and managing a company's internal resources and skills is required. As a result, performance measurement is seen as a "resource" in achieving competitive advantages in this research. On the other hand, the organizational fit theory claims that an organization can be divided into four basic strategies: prospector, analyser, defender, and reactor (Park, 2015). Each strategy has an impact on how a company handles its operations and can lead to varied results. In line with this theory, this research intends to study the effect of the critical factors' classification on oil and gas performance measures. According to Akma *et al.* (2010), a performance measurement framework can be a valuable instrument for describing the organizational strategy. According to the author, an organization's choice of performance measurements is heavily influenced by the type of strategy it employs. This research is also driven by the fact that less research on maintenance performance measurement in the oil and gas industry has been undertaken. Available research is focused on the performance measure in the supply chain in the oil and gas industry. Previous research focused on the health industry (Çiçek *et al.*, 2005), manufacturing industry (Ahmad & Zabri, 2016; Planuch & Erina, 2016), and retail industry (Staudt *et al.*, 2015). Therefore, this research explores the nature of the performance measurement framework from the maintenance perspectives. Thus, this paper will aid in the development of the maintenance performance measurement framework for the oil and gas industry in Malaysia. It will also look at how the performance measurement framework can be used to determine organizational success.

## 2. Literature Review

In Malaysia, the oil and gas industry facing the uncertainty of oil & gas prices for the past 10 years required the leading players and contractors to respond by minimizing and optimizing their capital and operational expenditure (CAPEX and OPEX) on asset and facilities. For example, the cost of revenue for PETRONAS Gas Berhad from 2016 to 2020 is that inclining from year to year resulted in a lower profit margin by comparing revenue vs cost of revenue, i.e. FY2019, MYR1,152.5 million vs MYR353 million and FY2020, MYR1,172.9 million vs MYR378 million. Customers are being impacted by unsustainable operational performance and non-competitive costs (PETRONAS Gas Berhad, 2020). Thus, by focusing on three main focus areas such as asset optimization, operating efficiencies and value-adding activities to existing assets responded to Malaysian gas supply and demand, consequently improving the annual cost of revenue. Improvement of cost of revenue can be achieved by looking at the current performance of day-to-day operations and maintenance activities such as productivity and efficiency and other relevant metrics in understanding and measuring their current performance. The lack of an oil and gas performance metric hampered performance and made it impossible to manage the assets and facility properly. Therefore, identifying critical factors, metrics and establishing the performance measures for the oil and gas industry is crucial and significantly impacts their financial and operating costs, contributing to annual profit and loss (P&L) financial performance. The research focused on operational reliability, delivery and efficiency at the Gas Transportation (GT) business from an operational and maintenance perspective. The differences of complexity in managing this asset and facility between regional operations (RO) facilities in Malaysia, i.e. Gurun, Sitiawan, Shah Alam, Seremban, Segamat, Pasir Gudang, Kuantan and Kerteh; due to factors such as the number of equipment, pipeline coverage, human capability, geography, location accessibility and many more is significant to study. As a result, it's critical to determine the relevant critical factors and create a performance measurement framework for GT and RO that supports important operational initiatives to attain and maintain a world-class standard that can be used to generate additional revenue. Furthermore, the need for this research stems from the fact that the type of industry in which companies operate has an impact on the performance measurement framework (Kumar, 2006; Mengistu & Panizzolo, 2021). As a result, the purpose of this research is to investigate the oil maintenance performance metrics and their impact on organizational performance.

The performance measurement and management (PMM) idea are well-known among international oil and gas companies. The PMM concept has been widely used. In recent years, classic financial PMMs have changed into a more advanced method, covering both the financial and non-financial elements of a company. Data Envelopment Analysis (DEA) is a model development technology using linear programming ideas to measure and decide if performance is monitored. Total assets and operating expenditures are determined using inputs, while three financial ratios and the oil reserve ratio are used as outputs to assess if inputs are appropriately employed to create outgoings and whether outputs value inputs (Abubakar *et al.*, 2016). Performance measurement has traditionally been described as an operational control metric derived from statutory financial reporting (Kuwaiti, 2004). The fundamental objective of performance evaluation, according to some writers, is to aid planning and ensure that operations are carried out in conformity with organisational goals. In today's world, performance measurement entails more than just determining a company's financial condition for external reporting purposes; it also includes a slew of measures that translate a company's prospects (both internally and internationally) into

its potential to stay in business. Maintenance is described as a collection of technical and administrative operations, including supervision, aimed at preserving or restoring an item's capacity to fulfill a needed function. Maintenance is essential for heavy and capital-intensive industries because it keeps machinery and equipment in safe working order. Maintenance is now widely recognized as an important function in maintaining an organization's long-term success (Al-Sultan & Duffuaa, 1995). Maintenance is an essential support function in businesses with large physical assets, and it aids in the achievement of organizational objectives (Tsang, 2002). According to Cross (1988), maintenance costs in the UK manufacturing industry range from 12-23% of total plant operating costs. Maintenance and operations departments at refineries are vast, with each employing up to 30% of the total workforce (Dekker, 1996). According to a study done by the Swedish mining sector, maintenance costs can account for 40-60% of overall operating costs in a fully automated mine (Danielson, 1987). Despite the numerous advantages of helpful PMM, as well as the fact that organizations that use integrated balanced performance management systems outperform those that do not (Parida & Kumar, 2006), studies have revealed that 70% of all system execution initiatives fail (Bourne *et al.*, 2000). Worse, according to a survey of industrial firms done by Cholasuke *et al.* (2004), only one-third of organisations with effective maintenance management procedures most likely to achieve the full advantages of their maintenance management activities. As a result, some academics have advocated for the use of more comprehensive and creative performance management tools, such as the Balance Scorecard and a new organizational development instrument (Garg & Deshmukh, 2006).

### 3. Methodology

Systematic literature review (SLR) is a form of secondary study that uses a well-defined methodology to identify, analyze and interpret *all* available evidence related to a specific research question in a way that is unbiased and (to a degree) repeatable (Kitchenham, 2007). A systematic review protocol was developed to explore how developing academic literacy in undergraduate student nurses leads to the development of critical thinking and professional written literacy competence in their future professional practice. A systematic literature review (SLR) was conducted using the Scopus database to identify relevant studies on performance measurement in the maintenance of the oil and gas industry. The search employed the keywords "performance AND measurement AND maintenance AND oil AND gas" across article titles, abstracts, and keywords, resulting in the identification of 198 articles. To refine the selection, the search results were filtered by source type, focusing solely on journal articles, which reduced the count to 53. Further refinement was applied by limiting the publication timeframe to between 2006 and 2024, narrowing the results to 45 articles. Finally, articles specific to the engineering field were selected, leaving 21 articles for detailed analysis. The flow of the systematic review process is illustrated in Fig. 1. The selected articles were thoroughly reviewed and classified according to their respective industries and focus areas. Performance measurement items were systematically extracted from each article to assess their frequency of inclusion as key indices in maintenance performance evaluation. The frequency distribution of these items was analysed using a Pareto diagram, applying the 80:20 rule to prioritize the most critical performance measurement items. This approach ensured that the most impactful factors were highlighted for further study and application.

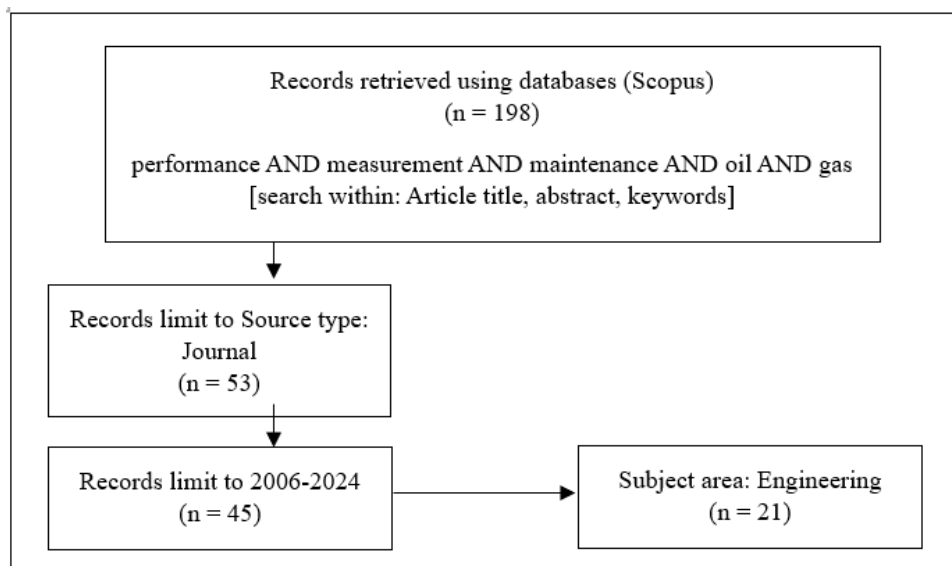


Fig. 1 Retrieval of articles

### 4. Results and Discussion

The following sections elaborate on the results obtained from the study. It starts with the narrowing down of scope from the articles to determination of items, and finally the definition of each item in the context of oil and gas maintenance.

#### 4.1 Retrieval of Articles

The 21 articles retrieved are used as a preliminary reading to determine the relevant information to the research. Table 1 shows the tabulated results of preliminary reading by identifying the related industry and focus area involved.

**Table 1** Summary of articles based on industry and focus area

No	Industry	Focus area					
		Maintenance	Operations	Supply Chain	HR	Finance	Others
1	Aerospace	3	1				
2	Manufacturing	8	3	4			15
3	Healthcare						2
4	Construction						4
5	Marketing						1
6	Tourism						2
7	Footwear						1
8	Railway construction	1					1
9	Power Generation	2	1				
10	Oil and Gas	2		1			1
11	General	4		3		1	7
12	Water	1					
13	Warehouse			1			
14	Transport						1
15	Software						1
16	Service						3
	Total	21	5	9	0	1	39

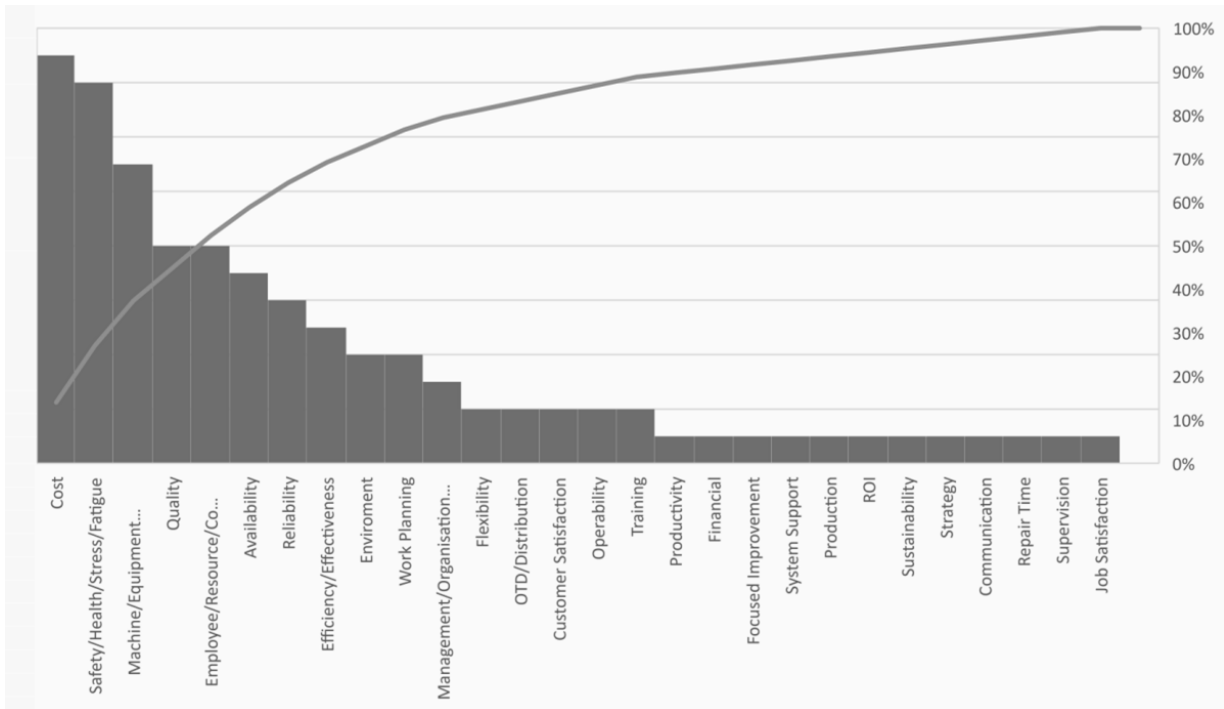
#### 4.2 Determination of Items

Thorough reading of the articles has brought into a summary of items' appearance with regards to performance measurement. There are 28 items identified in the 21 articles, with various sets of combinations, which are believed to represent the respective focus area and industry involved. A summary of those items is tabulated in Table 2.

**Table 2** The frequency of items in articles

Source of articles																								
No.	Performance item	Sabaghi <i>et al.</i> , 2016	Tsarouhas & Makrygianni, 2017	Park <i>et al.</i> , 2012	Behesti <i>et al.</i> , 2017	Schreiber <i>et al.</i> , 2020	Petrillo <i>et al.</i> , 2019	Parida & Kumar, 2006	Baiday <i>et al.</i> , 2018	Muchiri <i>et al.</i> , 2011	Van Horenbeek <i>et al.</i> , 2014	Garcia-Cascales & Lamata, 2011	Famurewa <i>et al.</i> , 2013	Kefalidou <i>et al.</i> , 2018	Gozalez <i>et al.</i> , 2017	Assaf <i>et al.</i> , 2015	Uyiomendo <i>et al.</i> , 2010	Purohit & Lad, 2016	Ighravwe & Oke, 2015	Muchiri <i>et al.</i> , 2010	Aju Kumar <i>et al.</i> , 2018	Trojan & Morais, 2015	Frequency	
1	Cost	/		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	15
2	Safety/ Health/ Stress/ Fatigue	/	/			/	/	/		/	/	/		/						/				10
3	Machine/ Equipment					/								/							/			3
4	Management/ Autonomous Quality					/				/		/												3
5	Employee/ Resource/ Co-worker/ Individual/ People Development		/			/	/							/		/	/							6
6	Availability							/									/	/	/				/	5
7	Reliability				/			/		/					/	/			/					6
8	Efficiency/ Effectiveness									/	/				/					/				4
9	Environment	/				/		/									/			/				5
10	Work planning								/					/						/	/			4
11	Management/ Organization performance	/	/						/										/		/			5
12	Flexibility				/			/																2
13	On time delivery/ Distribution		/		/								/		/				/					5
14	Customer satisfaction					/	/																	2
15	Operability							/	/											/	/	/		5
16	Training		/																					1
17	Productivity											/												1
18	Financial														/									1
19	Focused improvement					/																		1
20	System support											/												1
21	Production						/								/									2
22	Return on Investment (ROI)							/	/	/														3
23	Sustainability									/														1
24	Strategy													/										1
25	Communication													/			/							2
26	Repair time		/																					1
27	Supervision			/																				1
28	Job satisfaction		/														/							2

Utilizing the concept of Pareto, the items are sorted in descending order based on their frequencies, and 80-20 rules are applied, as illustrated in Fig. 2. Pareto rules stated that the 20% of the effort, or input, leads to 80% of the results or output, highlighting the unequal distribution of inputs and outcomes in various domains. From the pareto, there are 14 performance items identified as critical and will be considered in the next step.



**Fig. 2** Pareto analysis of the results

The items are listed in Table 3 and specific terms to be used further in this research with their definition within the context of this research is displayed in Table 4.

**Table 3** Summary of the frequency of items

No	Performance item	Frequency
1	Cost	15
2	Safety/ Health/ Stress/ Fatigue	10
3	Employee/ Resource/ Co-worker/ Individual/ People Development	6
4	Reliability	6
5	Availability	5
6	Environment	5
7	Operability	5
8	Management/ Organization performance	5
9	On time delivery/ Distribution	5
10	Efficiency/ Effectiveness	4
11	Work planning	4
12	Machine/ Equipment	3
13	Management/ Autonomous Quality	3
14	ROI	3

**Table 4** *The definition of items*

No	Performance item	Definition
1	Cost	The expenses associated with maintenance activities, including labor, materials, tools, and downtime costs, to ensure operations remain financially sustainable.
2	Safety and Health	Measures to ensure a safe working environment, minimize health risks, and address stress and fatigue levels in employees to maintain productivity and compliance with safety standards.
3	People Development	The efforts to enhance employee skills, teamwork, resource allocation, and professional growth to improve workforce competency and satisfaction in maintenance tasks.
4	Reliability	The probability that equipment or systems will perform their intended function without failure over a specific period under stated conditions.
5	Availability	The proportion of time equipment or systems are operational and accessible for use compared to the total time.
6	Environment	The impact of maintenance activities on the surrounding environment, including emissions, waste management, and adherence to environmental regulations.
7	Operability	The ease with which systems or equipment can be operated, maintained, and managed to achieve desired performance levels.
8	Organization	The efficiency and effectiveness of leadership, organizational processes, and resource coordination in achieving maintenance objectives.
9	Performance	
9	On-time Delivery	The ability to execute maintenance tasks or deliver maintenance outcomes within the scheduled timeframes, minimizing disruptions.
10	Efficiency & Effectiveness	The ratio of outputs achieved to the resources used (efficiency) and the degree to which maintenance objectives are achieved (effectiveness).
11	Work planning	The process of scheduling and organizing maintenance activities, including resource allocation, to ensure tasks are completed efficiently and effectively.
12	Equipment	The performance and condition of machinery and equipment, including uptime, maintenance needs, and long-term sustainability.
13	Autonomous Quality	The ability of management systems and autonomous technologies to maintain high standards in maintenance processes without compromising quality.
14	ROI	The financial return or benefits gained from maintenance activities compared to the costs invested in performing them.

## 5. Conclusion

Upon thorough literature reviews from 21 relevant articles in the field of research, 14 items are selected to be the basis of research in determining the factors that influence the performance measurement of oil and gas maintenance, particularly for gas transmission sections. These items will be the input for a questionnaire development that will be used to gather data through a survey methodology. Further research activities and analysis will then be directed towards identifying the key performance measures for oil and gas maintenance, which will be beneficial to the oil and gas industry to have a standard and common understanding on the performance measurement.

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## Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

## Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** Mohd Hafiz Mohd Idris, Tengku Nur Azila Raja Mamat, Nurazwa Ahmad; **data collection:** Mohd Hafiz Mohd Idris; Nur Afiqah Roslan; **analysis and interpretation of results:** Nur Afiqah Roslan; Muhammad Farid Shaari; **draft manuscript preparation:** Tengku Nur Azila Raja Mamat; Nurazwa Ahmad; Nur Afiqah Roslan; Tuan Noor Hasanah Tuan Ismail. All authors reviewed the results and approved the final version of the manuscript.

## References

- Abubakar, M. Y., Ahmad, S. S., Kaoje, N. A., & Abdulazeez, M. (2016). Performance Measurement and Management in the Upstream Oil and Gas Sector. *IOSR Journal of Business and Management*, 18(08), 26–33. <https://doi.org/10.9790/487x-1808042633>
- Ahmad, K., & Zabri, S. M. (2016). The Application of Non-Financial Performance Measurement in Malaysian Manufacturing Firms. *Procedia Economics and Finance*, 35, 476–484. <https://doi.org/10.1016/s2212>
- Aju Kumar, V. N., Gupta, P., & Gandhi, O. P. (2018). Maintenance performance evaluation using an integrated approach of graph theory, ISM, and matrix method. Retrieved from <https://link.springer.com/article/10.1007/s13198-0180753-6>
- Akma Mohd Salleh, N., Jusoh, R., & Ruhana Isa, C. (2010). Relationship between information systems sophistication and performance measurement. *Industrial Management & Data Systems*, 110(7), 993–1017.
- Ali, U. (2019). *The history of the oil and gas industry from 347 AD to today*.
- Al-Sultan, K. S., & Duffuaa, S. O. (1995). Maintenance control via mathematical programming. *Journal of Quality in Maintenance Engineering*, 1(3), 36–46. <https://doi.org/10.1108/13552519510096341>
- Assaf, S. A., Hadidi, L. A., Hassanain, M. A., & Rezaq, M. F. (2015). Performance evaluation and benchmarking for maintenance decision making units at petrochemical corporation using a DEA model. *International Journal of Advanced Manufacturing Technology*, 76(9–12), 1957–1967. <https://doi.org/10.1007/s00170-014-6422-2>
- Baidya, R., Dey, P. K., Ghosh, S. K., & Petridis, K. (2018). Strategic maintenance technique selection using combined quality function deployment, the analytic hierarchy process and the benefit of doubt approach. *International Journal of Advanced Manufacturing Technology*, 94, 31–44. <https://doi.org/10.1007/s00170-016-9540-1>
- Beheshti Fakher, H., Nourelfath, M., & Gendreau, M. (2017). A cost minimization model for joint production and maintenance planning under quality constraints. *International Journal of Production Research*, 55(8), 2163–2176. <https://doi.org/10.1080/00207543.2016.1201605>
- Bertocco, R., & McCreery, J. (2014). Operational Excellence: Managing performance in the oil and gas industry. *Bain & Company*, 5–7.
- Bourne, M., Mills, J., Wilcox, M., Neely, A., & Platts, K. (2000). Designing, implementing and updating performance measurement systems. *International Journal of Operations & Production Management*, 20(7), 754–771. <https://doi.org/10.1108/01443570010330739>
- Cholasuke, C., Bhardwa, R., & Antony, J. (2004). The status of maintenance management in UK manufacturing organisations: results from a pilot survey. *Journal of Quality in Maintenance Engineering*, 10(1), 5–15. <https://doi.org/10.1108/13552510410526820>
- Çiçek, M. C., Köksal, G., & Özdemirel, N. E. (2005). A team performance measurement model for continuous improvement. *Total Quality Management and Business Excellence*, 16(3), 331–349. <https://doi.org/10.1080/14783360500054129>
- Cross, M. (1988). Raising the value of maintenance in the corporate environment. *Management Research News*, 11(3), 8–11. <https://doi.org/10.1108/eb027976>
- Danielson, B. (1987). A study of maintenance problems in Swedish mines. *Status Report, Idhammar Konsultant AB, Sweden*.
- Dekker, R. (1996). Applications of maintenance optimization models: a review and analysis. *Reliability Engineering & System Safety*, 51(3), 229–240. [https://doi.org/10.1016/0951-8320\(95\)00076-3](https://doi.org/10.1016/0951-8320(95)00076-3)
- Famurewa, S.M., Asplund, M., Galar, D.P., & Kumar, U. (2013). Implementation of performance-based maintenance contracting in railway industries. *International Journal of System Assurance Engineering and Management*, 4, 231–240.
- Garcia-Cascales, M. S., & Lamata, M. T. (2011). Multi-criteria analysis for a maintenance management problem in an engine factory: Rational choice.
- Garg, A., & Deshmukh, S. G. (2006). Maintenance management: Literature review and directions. *Journal of Quality in Maintenance Engineering*, 12(3), 205–238. <https://doi.org/10.1108/13552510610685075>
- Gonzalez, E., Nanos, E. M., Seyr, H., Valldecabres, L., Yürüşen, N. Y., Smolka, U., Muskulus, M., & Melero, J. J. (2017). Key Performance Indicators for Wind Farm Operation and Maintenance. <https://doi.org/10.1016/j.egypro.2017.10.385>
- Ighravwe, D. E., & Oke, S. A. (2015). Maintenance workforce performance enhancement in a fuzzy environment with multiplicity of criteria in manufacturing system.
- Kefalidou, G., Golightly, D., & Sharples, S. (2018). Identifying rail asset maintenance processes: A human-centric and sensemaking approach. <https://doi.org/10.1007/s10111-017-0452-0>
- Kitchenham, B. (2007). Guidelines for performing Systematic Literature Reviews in Software Engineering. *EBSE Technical Report*, 1(2), 1–44.
- Kumar, U. (2006). Development and Implementation of Maintenance Performance Measurement System: Issues and Challenges.

- Kuwaiti, M. E. (2004). Performance measurement process: definition and ownership. *International Journal of Operations & Production Management*, 24(1), 55–78. <https://doi.org/10.1108/01443570410510997>
- Mengistu, A. T., & Panizzolo, R. (2021). Indicators and Framework for Measuring Industrial Sustainability in Italian Footwear Small and Medium Enterprises. *Sustainability*, 13(10), 5472. <https://doi.org/10.3390/su13105472>
- Menhat, M. N. S. (2017). *Performance measurement framework for the oil and gas supply chain*.
- Muchiri, P. N., Pintelon, L., Martin, H., & De Meyer, A. (2010). Empirical analysis of maintenance performance measurement in Belgian industries. *International Journal of Production Research*, 48(20), 5905–5924.
- Muchiri, P.N., Pintelon, L., Gelders, L.F., & Martin, H. (2011). Development of maintenance function performance measurement framework and indicators. *International Journal of Production Economics*, 131, 295-302.
- Parida, A. and Kumar, U. (2006) Maintenance Performance Measurement (MPM): Issues and Challenges. *Journal of Quality in Maintenance Engineering*, 12, 239-251. <http://dx.doi.org/10.1108/13552510610685084>
- Parida, A., & Kumar, U. (2006). Maintenance performance measurement (MPM): Issues and challenges. *Journal of Quality in Maintenance Engineering*, 12(3), 239–251. <https://doi.org/10.1108/13552510610685084>
- Park, H., Kang, M. J., & Son, S. (2012). Factors affecting quality and performance - a case study of Korean aircraft maintenance unit. *Total Quality Management and Business Excellence*, 23(2), 197–219. <https://doi.org/10.1080/14783363.2011.639560>
- Park, R. (2015). Employee participation and outcomes: organizational strategy does matter. *Employee Relations*, 37(5), 604–622. <http://10.0.4.84/ER-09-2014-0107>
- Petrillo, A., De Felice, F., & Zomparelli, F. (2019). Performance measurement for world-class manufacturing: A model for the Italian automotive industry. *Total Quality Management & Business Excellence*, 30(7-8), 908-935. <https://doi.org/10.1080/14783363.2017.1408402>
- PETRONAS Gas Berhad. (2020). *Integrated Report 2020 PETRONAS gas berhad*.
- Planuch, E. T., & Erina, J. (2016). *Performance Management Model for Manufacturing Companies*.
- Purohit, B. S., & Lad, B. K. (2016). Production and maintenance planning: An integrated approach under uncertainties.
- Sabaghi, M, Mascle, C. & Baptiste, P. (2016). Evaluation of products at design phase for an efficient disassembly at end-of-life. *Journal of Cleaner Production*, 116 (177-186). <https://doi.org/10.1016/j.jclepro.2016.01.007>.
- Samsun, R. C., Pasel, J., Peters, R., & Stolten, D. (2015). Fuel cell systems with reforming of petroleum-based and synthetic-based diesel and kerosene fuels for APU applications. *International Journal of Hydrogen Energy*, 40(19), 6405–6421. <http://10.0.3.248/j.ijhydene.2015.03.091>
- Schreiber, M. A., Schutte, C. S. L., Braunreuther, S., & Reinhart, G. (2020). A performance measurement system for integrated production and maintenance planning.
- Staudt, F. H., Alpan, G., Di Mascolo, M., & Rodriguez, C. M. T. (2015). Warehouse performance measurement: A literature review. <https://doi.org/10.1080/00207543.2015.1030466>
- Trojan, F., & Morais, D. C. (2015). Maintenance management decision model for reduction of losses in water distribution networks. *Water Resources Management*, 29(10), 3459-3479.
- Tsang, A. H. C. (2002). Strategic dimensions of maintenance management. *Journal of Quality in Maintenance Engineering*, 8(1), <https://doi.org/https://doi.org/10.1108/13552510210420577>
- Tsarouhas, P., & Makrygianni, M. (2017). A framework for maintenance and combat readiness management of a jet fighter aircraft. *International Journal of System Assurance Engineering and Management*, 8, 1895-1909. <https://link.springer.com/article/10.1007/s13198-016-0481-8>
- Uyiomendo, E. E., Markeset, T., & Subsea Maintenance Service Delivery: Mapping Factors Influencing Scheduled Service Duration. (2010). <https://doi.org/10.1007/s11633-010-0167-7>
- Van Horenbeek, A., Pintelon, L., & Muchiri, P. (2014). Economic and Environmental Aware Maintenance Optimization. Retrieved from <https://doi.org/10.1016/j.procir.2014.06.048>