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# Determinants of Assurance Management System for Critical Asset: A Literature Review

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**Abstract**
Several studies found that critical asset failure results in delays and downtimes in operation for most industries. One of the studies revealed that 272 of the 773 occurrences involved a critical asset breakdown. Thus, this study aimed to discuss the relevant factors of implementing the Assurance Management System for the industry's selected critical asset. Literature reviews play a significant role in this research through a content analysis review process from different review articles, google scholar, journals, and other social sciences. The result revealed that increasing the organization's knowledge of the processes and asset criticality in the assurance management system offers a high degree of openness to the activities carried out to ensure continued asset reliability and integrity. Relatively, it shows a clear long-term progress pattern of improved equipment reliability, leading to a significant increase in consumer trust due to introducing a system of reliability assurance management. Indeed, the study recommended that implementing an assurance management system is an integral part of the critical asset as it offers trust that the asset will perform as anticipated. Finally, it is an aid in understanding the asset and its relationship between expected and actual performance and efficiency in using a structured approach of the Assurance Management System for Critical Asset, the AMSCAF Framework. Therefore, industry stakeholders should consider the recommendations and best practices to ensure critical asset management systems need to generate value that maintains a competitive advantage in today's highly complicated and challenging market competition through the Assurance Management System.

**Keywords-** Assurance management system, Performance, Critical asset, Industry, Integrated maintenance.

## 1. Introduction

Leaders must understand and work out how to function efficiently under the given circumstances because the global economy is still struggling and in its final equilibrium following the recent global financial crisis (Dinçer & Hacioğlu, 2016; Viera & Kramer, 2020). It increases concern in the rapid growth of the sharing economy coming from both academicians and practitioners in the industry is very complex (Kumar et al., 2018). Consequently, the United Arab Emirates (UAE) strives for quality and efficiency in all industrial and business sectors (El Khatib & Ahmed, 2018). Accordingly, in a 2018 economic study published by the Ministry of Economic of the UAE, crude

oil and natural gas contribution to GDP in 2017 contributes to 29.5%, which rose by 0.8% (The UAE Government's official portal, 2018). On the one hand, public and private companies are exposed to dangerous incidents and risks crucial for their operations and development (Păunescu et al., 2018). On the other hand, Bourassa et al. (2016) study revealed that incidents in the industrial sector, construction of machinery, including operating methods, maintenance, and integrity, may be caused by various factors and lack of training. According to Păunescu et al. (2018), a malfunction of equipment occurs in 272 of the 773 cases, with 13 of them having immediate human consequences. Although, in construction aspects, building assets are recognized as critical, they also have issues due to the high rate of critical asset failure and accidents caused by unskilled operators (FitzPatrick et al., 2013; Manikandan et al., 2018). Corollary to this, the most crucial cause of equipment-related incidents with an operating cost of 23 percent and a maintenance and repair cost of 37 percent is the lack of equipment operators' training (Manikandan et al., 2018). In contrast, the supervisor is perceived safety support substantially links to safety enforcement (Beamond et al., 2016; Hu et al., 2018).

The study of Kian et al. (2019) found that critical asset failure results in delays and downtimes in marine industries, translating into additional costs and penalties imposed by the clients. Critical Assets should be identified and prioritized (Wittkop, 2016). Reasonably, the railway network industry used quantitative earthwork criticality to measure failure, combining two components for an individual earthwork (Power et al., 2016). When essential assets have been established, an evaluation of each asset's weaknesses must be conducted (Wittkop, 2016). Simultaneously, the asset criticality optimization model is implemented cost-effectively to maintain physical assets to increase their reliability in an economically optimum manner (Muganyi et al., 2018). The collective methodology for assessing the most critical asset's vulnerabilities can be demonstrated into confidentiality, integrity, and availability assessment, which will assess the entire assurance process (Wittkop, 2016). Hence, vulnerability rating gives an indication and opportunity to see the organization's information assets weakness inherent and residing (Kassa, 2017; Muganyi et al., 2018).

To reduce business risk due to critical asset loss, a well-functioning business model in the rising economy must establish a consumer and service provider (Kumara et al., 2018). It further describes that the decision-maker needs to align its asset strategy on how the critical asset's operational regime should be modified to sustain its operational requirement (Ameh, 2017). This was supported by Kumar et al. (2018)’s study that asset management strategy implementation is essential to the services and operation as enablers to retain the competitive advantage in the industry. Furthermore, it is elaborated that fitness for services helped eliminate unnecessary improvement maintenance and inspections that would have acquired cost and impacted business (Ameh, 2017). As a result, Kumar et al. (2018) discovered that gaps could be established through research and filled by implementing and carefully maintaining a strategic structure focused on catered segmentation strategies for asset management system implementation.

Higher customer loyalty or lower-cost operation is essential in today's increasingly competitive integrated markets (Maletič, et al., 2017). In terms of enforcement habits, conformity values anticipated them, but there was no proof of moderation by organizational formalization (Alexander & Van Knippenberg, 2014; Breuer & Lüdeke-Freund, 2015). Similarly, asset performance assessment is a complex problem involving several inputs and outputs and various stakeholders' dynamic requirements (Parida, 2012). Though top management commitment makes a difference to many failures, it is vital for a thriving global industry (Thornhill & Amit, 2003). A comprehensive

performance assessment system requires continuous improvement of asset management systems that will allow organizations to understand different elements' performance within the asset management system (Attwater et al., 2014). Relatively, proactive asset performance management, with decreased inventory, outsourcing with reduced downtime, and increased efficiency, retains assets at low costs (Parida, 2012). Deductively, when physical assets achieve high reliability within the operating boundary, efficiency improves significantly (Muganyi et al., 2018). According to the Asset Management Committees' management, an asset management model will give asset managers a succinct overview of basic asset management principles, concepts, and processes (Engineers, 2014). Undoubtedly, increasing the vital asset's reliability, availability, and maintainability, without a doubt, increases operational sustainability (Muganyi et al., 2018).

Arguably, failing companies capitalize on intangibles more aggressively than non-failing companies, especially in the five years leading up to their demise (Jones, 2011; Thornhill & Amit, 2003). The most recommended thing for a better manufacturing facility is performance, operating cost, and productivity (Agarwal et al., 2013; Dal et al., 2000; Vijayakumar & Gajendran, 2014). Tsarouhas (2013)'s study illustrated that components' efficiency and quality are immediately improved to optimize productivity and efficiency. Ideally, top management in the organization, including demand from organizations, faces numerous challenges (Maletič et al., 2017). A significant improvement has now been made in maintaining assets and production systems to reduce the waste of energy and resources (Vijayakumar & Gajendran, 2014). Hess & Rothaermel (2011)'s study expand on the significance of considering the variability of a company's intellectual human resources and the relationship between critical, creative activities along the information value chain. Undoubtedly, it is possible to preserve the necessary information for later safety assessments by providing a consistent documentation system for equipment failures and documenting accidents (Ghahramani et al., 2008).

Performance depends on higher customer loyalty or lower-cost behavior in today's highly competitive, integrated markets (Maletič et al., 2017). While conformity values relatively expected compliance practices, but no proof of moderation by a formalization of organizations (Alexander & Van Knippenberg, 2014; Breuer & Lüdeke-Freund, 2015). As seen in the study by Badii et al. (2014), it can include fixed assets, such as specific sites or buildings, and temporary events that increase a specific facility's criticality. Furthermore, essential assets serve as the company's entry point, both organizationally and in terms of protection (Samimi et al., 2020; Wittkop, 2016). As a result, it is regarded as a critical component of services needed to ensure the long-term viability of products, infrastructure, and communications (Maliszewski et al., 2012). However, the productivity of critical assets in industrial and urban areas depends on network-based systems (Evazabadian et al., 2014). Specifically, the efficient positioning of critical assets will potentially occur within spatial optimization models dealing with protection, service, coverage, equity, and risk (Maliszewski et al., 2012). Effective assurance management implementation is more complicated than formulating strategies, which shows that only less than 10% of well-formulated policies are successfully implemented (Palladan et al., 2016). Consequently, failing firms invest more actively in intangibles than non-failing firms, especially in the five years leading up to a firm's failure (Jones, 2011; Thornhill & Amit, 2003). On the one hand, though management's performance makes a difference to a population of failures, it is vital for successful firms. On the other hand, according to Thornhill & Amit (2003), older companies are more likely to fail due to their incapability to respond to different changes, while younger companies struggle due to an absence of management experience and financial management skills. Therefore, the organization requires a strong understanding of the more extensive perception in which the information is created to turn the

company into a competitive advantage and recover its operational performance (Mawed & Al-Hajj, 2017).

Undoubtedly, in critical asset management, asset output assessment is critical to achieving the desired business goals (Maletič et al., 2017). Thus, the published literature and other publications applicable to the study, the researcher would like to discover the various factors in assurance management system implementation and related performance based on the discussions and observations from the literature review. Finally, it evaluates the relevant factors that affect industry performance regarding various assurance management systems and approach implementation, focusing on the critical asset associated with the implementation process.

Indeed, strategic leadership uses frameworks and various leadership engagement concepts into organizations' day-to-day life effective implementation (Jaradat & Mashhour, 2017; Palladan et al., 2016; Singh & Krishnan, 2014) through assurance practices organizational success. Leadership practices explicitly encapsulate the correct quantity of demand input from consumers by building relational confidence and constructive long-term support expectations (Birasnav & Bienstock, 2019). Finally, leaders who pursue a long-term sustainability mindset would 'naturally' model the embraced sustainability vision. Setting a vision and formulating a plan is critical in identifying potential external partners to extend current operations (Birasnav & Bienstock, 2019; Hallinger & Suriyankietkaew, 2018; Tubil et al., 2021). Therefore, there is a strong connection between leadership styles and employee engagement (Popli & Rizvi, 2016).

## 2. Objectives of the Study

This study aimed to address the crucial aspects of implementing an assurance management system for a specific industry's critical asset. It will go through all of the underlying characteristics of different assurance management implementations in various organizations in the United Arab Emirates.

## 3. Conceptual Framework

The five determinants of Assurance Management System (AMS) for the critical asset in industry performance which were identified in the systematic review of related literature are Leadership Engagement (LE), Operational Compliance (OC), Business Threat and Strategy (BTS), Human Capital Management (HCM), and Integrated Maintenance Management System (IMMS). Based on the researcher's analysis of relevant literature, this study is limited to the above determinants discussed in the succeeding sections. The conceptual framework was created using the combination of the three theories of El-Akruti et al. (2013)’s, Muganyi et al. (2018)’s, framework of asset management system operations, relationships, and mechanism, and Maletič et al. (2017)'s model of asset life cycle phases, the criticality optimization model.

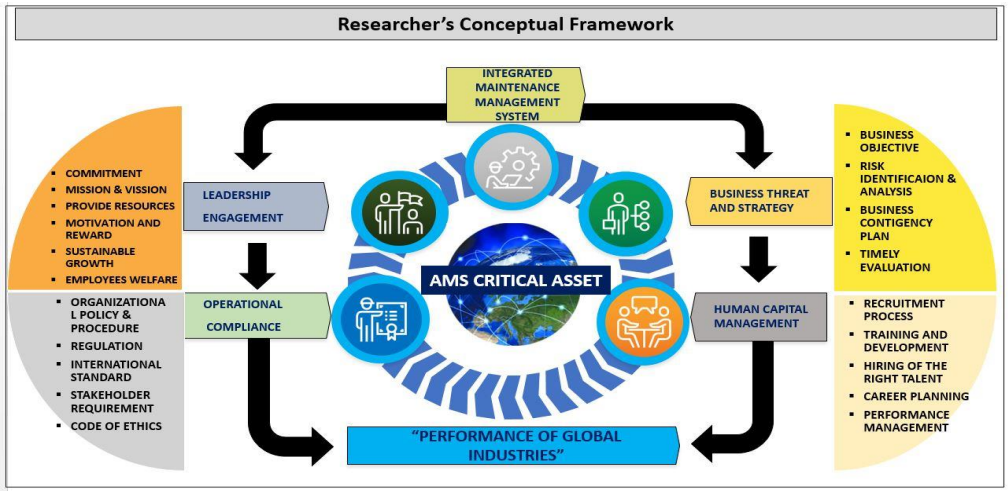


**Figure 1.** The assurance management system for critical asset model (AMSCAF framework).

## 4. Methodology

The study examines the scientific literature on applying the assurance management system for critical assets through literature analysis. Literature reviews serve as the baseline for all types of analysis (Snyder, 2019). A written paper defends a study by presenting a claim based on credible evidence from previous research (Machi & McEvoy, 2016).

According to Snyder (2019), the method for performing a literature review is as follows.

- *Designing the Review*. It's a good idea to start by searching the field to see if any other literature reviews have already been done, to figure out how many research studies need to be reviewed and to help formulate and clearly define the study's purpose, scope, and specific research question.
- *Conducting the Review*. The method of adding and removing particular papers should be appropriately documented during the course of the review process.
- *Analysis*. To do appropriate analysis, it is vital to understand how the articles can be used. Following the selection of a final sample, a systematic method of abstracting specific information from each article should be used.
- *Writing Up the Review*. Second, when writing the review, the inspiration and need for the review must be clearly expressed. Depending on the process, the final analysis article can be structured in various ways, with various information and levels of detail.

### 4.1 Review Analysis Diagram

The scientific content review was used to examine the related literature sources. It is a repeatable, standardized method for condensing many terms into a smaller number of content categories based on basic coding principles (Stemler, 2000). Thus, the analysis provides a method for generating exciting and potentially valuable generalizations with minimal loss of original data knowledge (Downe-Wamboldt, 1992). Similarly, there are various capabilities for content interpretation, drawbacks, and challenges (Neuendorf & Kumar, 2015). Furthermore, content analysis is an extraordinarily versatile and commonly used tool for studying library and information science (LIS)

(Tubil et al., 2021; White & Marsh, 2006). Relatively, this is a tool designed to illustrate potentially misleading language from multiple sources such as academic databases, social sciences, google scholars, web archives, electronic journals, open-access websites, and other electronic access to draw textual inferences in a written statement (Shropshire & Kadlec, 2012; Smith, 2001).

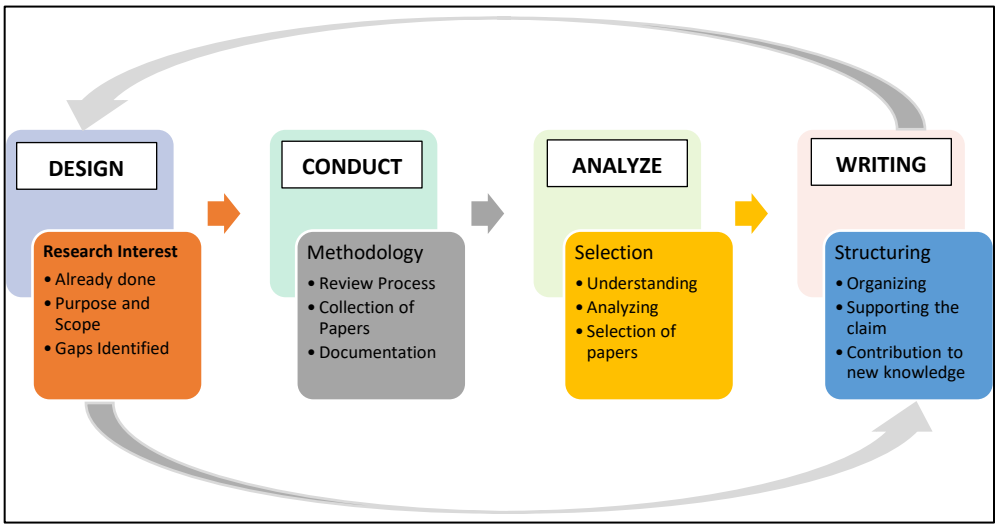


**Figure 2.** Review of literature analysis methodology (Adopted from Snyder, 2019).

In this method, the researcher searched related articles using "Assurance management system for critical assets and its performance" as a keyword. Initially, about 277,000 outcomes were found. After completing the initial process, 133 articles and other electronic journals were substantial contributors to the assurance management framework for critical assets, considered the sample during the review process. The following requirements were chosen for the websites: credibility, usability, availability of content, and bibliometric. Regarding content grouping of the assurance management framework's implementation, the papers were coded as leadership involvement, administrative enforcement, business danger and strategy, human resource management, and performance predictive integrated maintenance management system.

## 5. Result and Discussion

### 5.1 Assurance Management System

Asset assurance management is a vital part of assurance management practices as it provides the belief that the asset will work as planned and helps to understand the asset its relation between the expected and actual performance of an asset and efficiency (Modrouvanos, 2015). It is an essential requirement for consumer acceptance and marketing effectiveness, calculated in terms of protection and asset value management to achieve a high-performance level (Wren et al., 2002). The train organization has achieved a high standard of operational safety and service efficiency that is regarded as world-class with the robust platform of the operational assurance process and the spirit of continuous improvement (Cheng & Lam, 2012).

The use of these performance standards dramatically increases the organization's knowledge of the processes and asset criticality and offers a high degree of openness to the activities carried out to

ensure continued asset reliability and integrity. Incorporating into a single document (for each form of the barrier) of the entire lifecycle and function of critical asset is a best practice improvement from previous separate collections of design, maintenance, inspection, and audit requirements and documents (Cooke, 2012). Thus, ensuring that it is sufficient and operate on demand, a performance standard has been established for Health Safety and Environment HSE critical equipment and systems (Bell & Albusaeedi, 2014). The study shows a clear long-term progress pattern of improved equipment reliability, leading to a significant increase in consumer trust due to introducing a reliability assurance management system (Cowan et al., 2003).

### 5.2 Management of Physical Assets

The management of physical assets, such as machinery, vehicles, equipment, facilities, buildings, and utilities, is characterized as physical asset management. It provides a structured approach, from definition to disposal to the facilities' management (Hastings, 2010). Hence, to maximize the long-term output of assets at reduced lifecycle costs, the model proposed in Schuman & Brent (2005)'s study directs decisions taken during the early stages. Furthermore, Amadi-Echendu et al. (2010)'s study provides the basis for a highly integrated analysis of physical asset management's general problem, linking engineering potential to economic cost and value. Simultaneously, Hipkin (2001)'s study indicates that where the maintenance management information system resulted in higher knowledge levels, higher levels of benefits were achieved. Therefore, incorporating a theoretical framework brings together many management theories to understand the asset management activities found in the standards and guidelines (Alhazmi, 2018).

### 5.3 Life Cycle Management Practices

Emmanouilidis & Komonen (2013) defined optimal life cycle management of physical assets to reach the stated business objectives and targets. Asset management with a portfolio view of the asset's overall life cycle, including strategy and preparation, assessment and design, acquisition or development, maintenance of operations, adjustment, and disposal (Campbell & Jardine, 2001). The structural framework's goal is to secure the fitness for operation at any time during the plant life cycle (Kaiser, 2015; Kapur et al., 2019). Hence, operational reliability and systems engineering are identified as the means to achieve maximum value over a facility's lifespan from physical assets that should be performed at each point of the project's life cycle (Schuman & Brent, 2005). Haffejee & Brent (2008)'s findings show a reasonably clear understanding of the asset lifecycle management concept but find difficulties in full implementation.

Asset Life Cycle Management techniques define an asset's current performance and forecast future performance, stressing that recognizing its life cycle is essential (Lei et al., 2012; Ruitenburg et al., 2014; Van der Lei et al., 2012). The decision framework should seek to define organizational, tactical, and strategic implications and effects to optimize an investment's value in any building facilities (Grussing, 2014). For all concepts, careful attention must be paid to improving environmental and social measurement mechanisms (Haffejee & Brent, 2008). Therefore, projects had to be assessed during the early life cycle stages regarding the sustainability implications of future assets and services introduced (Labuschagne & Brent, 2005).

### 5.4 Policy and Strategy Practices

Critical asset management is a comprehensive, fully integrated strategy process and culture directed at gaining the most significant lifetime effectiveness, value, profitability, and return from production and manufacturing equipment assets (Maletič et al., 2017). It is imperative to update the ramparts asset policy and standards to reflect the continuous improvement and ongoing

evaluation and feedback. As it is defined as a process model, an integrative strategic infrastructure asset management model is important (Power et al., 2016; Too et al., 2006). The study of Manlosa et al. (2019) highlights the utility of substituting capital assets to investigate interactions between various capital assets. Communication plays an essential role in delivering maintenance information. Work activities with all organizational members to ensure the value of facilities and properties every person understands maintenance (Sani et al., 2012).

An efficient asset management framework provides a reasonable basis for maximizing productivity and cost-effectiveness (Arif & Bayraktar, 2012). The study of Mardiasmo et al. (2008) highlighted problems in asset management and localized perception of management within various organizations' divisions as the main challenges in integrating asset management-asset governance. Consequently, the critical asset action plan must be aligned with the organization's strategic objectives (Copperleaf, 2017). In research by Cahyo et al. (2015) have developed a system dynamics model for maintenance resources provision optimization that support decision-makers in determining the required strategy.

### 5.5 Risk Management Practices

To maximize performance outcomes, the findings of Maletič et al. (2017) emphasized the importance of incorporating risk management activities into asset management processes. Though optimizing resilience by mitigating significant risk resulting from multiple economic, environmental, and social criteria, the study states a framework for prioritizing waterway infrastructure projects (Connelly et al., 2016). Schmit & Roth (1990)'s study includes the predicted lower cost effects associated with higher retention levels, larger scale, and less risky industries. The risk modeling exercise is designed to model the risk that exists at the present moment, and it is not intended to scheme to pertain to the risk (Wittkop, 2016). Accordingly, when a threat misuses a vulnerability, it increases the likelihood of attack and leads to risk. In this instance, the identified vulnerabilities could be a critical component of the risk modeling exercise (Kassa, 2017; Wittkop, 2016).

Ideally, organizational safety support was significantly associated with compliance via the risk-awareness procedure's perceived usefulness (Hu et al., 2018). According to Opara & Mahfouz (2016), small business owners are often likely to have the necessary tools for technology risk management in place but lack the procedures, policies, and training to secure their information resources. Specifically, in Kassa (2017) study, risk assessment contains the quantitative and qualitative assessment to measure individual risk, including the interrelationship of their effects. Thus, the consequence or impact of equipment failures is a critical aspect that always needs to be considered during the criticality optimization process (Muganyi et al., 2018). Each asset risk register presents the safety risk level determined by the combination of its likelihood and consequence of failure (Power et al., 2016). However, the degradation of critical components happens during utilization, and the gap between production and asset health poses a high risk of unexpected downtime (Lee et al., 2017). It is essential to consider that lifecycle cost and risk models for decision making to achieve a reliable and safe pipeline service life, optimized pipeline lifecycle cost, and satisfying business performance (El-Akruti et al., 2016; Sobral & Soares, 2016). Key to the risk and resilience process is quantifying asset risk related to a specified set of probable threats, deriving the consequences from asset design standards and maintenance practices (Dhutti et al., 2019; Herrera et al., 2017).

### 5.6 Performance Appraisal Practices

Asset Performance Management is fluctuating the landscape of how companies are managing their critical asset. When it is aging, critical assets' performance is expected to decline (Borges et al., 2017; Kolios & Luengo, 2016). The study of Kapur et al. (2019) stated that it is a well-known fact that supply chain management affects a firm's performance positively. According to Transportation (2017), performance measurement has repeatedly illustrated that achieving performance targets alone does not guarantee that an organization is making the best long-term decisions. Moreover, assessing asset performance is necessary to achieve the Physical Asset Management domain (Maletič et al., 2017). This involved overall equipment efficiency is an acceptable measure of industry performance (Eckhardt & Shane, 2011). While most people in the industry are unsatisfactory, performance evaluations serve various important organizational purposes (Wiese & Buckley, 1998). The study of Tahsildari & Shahnaei (2015) showed that recruitment, employee engagement, performance evaluation, and job description significantly affected organizational performance. Company strategies would be positively linked to organizations' success (Lee et al., 2017).

## 6. Determinants of Industry Performance

### 6.1 Leadership Engagement

Organizational theory and practice are some of the most hotly debated topics among contemporary organizational theorists and practitioners. According to Uhl-Bien & Arena (2018), leadership involvement is a dynamic situation in the form of excitement and interest that fully committed workers to bring to their work every day. In comparison, Shanafelt & Noseworthy (2017) describe engagement as the positive antithesis of burnout, defined as vigor, commitment, and immersion in work. According to To et al. (2015), for better performance, leaders to recognize the style that fits best in a particular situation and matches, employees' preferences must be engaged. The leader can antedate, envision, and maintain suppleness and empower others to create strategic transformation as necessary (Palladan et al., 2016).

Nonetheless, it is considered as one of the critical drivers of efficient strategy execution and a practical mechanism that can tie directly to a more integrated workplace culture, extra efforts, innovations, and ideas that make organizations thrive (Palladan et al., 2016; To et al., 2015; Tubil et al., 2021; Mahmood, et al., 2019). Many organizations that invest significant resources have a task to improve and partner with leaders to effectively deliver those strategies (Carasco et al., 2015). Strategic leaders form and maintain partnerships outside of the company and represent the company's brand to third parties (Samimi et al., 2020). Dinçer & Hacioğlu, (2016) found that the future leader's leadership model should prioritize behaviors that can respond rapidly to change and adapt to changes. As illuminated, any manufacturing company determined to combine supply chain partners with manufacturing processes to achieve a competitive edge must invest in top management support (Birasnav & Bienstock, 2019). On the one hand, Popli & Rizvi (2016) discovered a connection between leadership styles and employee engagement in their research. On the other hand, strategic leadership is described by Palladan et al. (2016) as the ability of a leader to anticipate, foresee, and maintain flexibility while motivating others to make strategic transformations as needed. They impact organizations by making strategic decisions and applying strategic leadership concepts to day-to-day operations (Jaradat & Mashhour, 2017; Samimi et al., 2020).

Employee engagement and leadership styles have been critical in establishing a culture of engagement and developing human resource strategies that drive organizational progress (Hewitt,

2015; Popli & Rizvi, 2016; Singh & Krishnan, 2014). Significantly, age and education positively affect the relationship between leadership styles and employee engagement (Hewitt, 2015). Hence, many organizations have substantial resource allocations and commitments that can have long-term consequences for their companies (Samimi et al., 2020). According to Yuan et al. (2018), through clarifying responsibilities and nurturing organizational culture, leadership participation becomes more successful in engaging employees. Companies that concentrate on developing engaging leaders see a significant increase in employee engagement, which may occur as transactional and transformational leadership styles are used (Hewitt, 2015; Mahmood, et al., 2019). Similarly, in recent decades, the external leadership role, which includes leaders' interactions with external parties who can impact the firm, has been highly beneficial (Jaradat & Mashhour, 2017; Samimi et al., 2020; Wittkop, 2016). Strategic leaders influence organizations through versatility and their decisions (Palladan et al., 2016; Samimi et al., 2020; Tubil et al., 2021).

## 6.2 Operational Compliance

The company faces many obstacles when dealing with emerging economies, including changing legislation and constant volatility in the global economy sector (Beamond et al., 2016). Individuals who fail to follow laws and procedures in dangerous conditions put themselves and others in danger (Hu et al., 2018). According to Tang et al. (2016), a culture that encourages workers to follow information policies improves information security. As a result, multi-asset entities need tools to help them determine which structuring standards are required to comply with the industry's regulatory structure (Lima & Costa, 2019; Power et al., 2016). Therefore, applying synergy principles to management entails that the management system meets the criteria, or indicators of social phenomena, that decide how the synergy effect manifests in a corporate social setting (Gaisina et al., 2017).

According to Eva et al. (2017), organizational formalization muddled the connection between self-direction values and creative behaviors. The corporate culture or organizational culture is thought to affect policy enforcement culture (Tang et al., 2016). Similarly, conformity values predicted compliance behaviors, but there was no evidence of organizational formalization moderating these behaviors (Alexander & Van Knippenberg, 2014; Breuer & Lüdeke-Freund, 2015). Undoubtedly, the study of Tubil et al. (2021) indicated that it is more critical for enterprises to identify the skills and level of knowledge required from staff to do the organization's critical activities. Significantly, it is crucial to recruit workers who value personality (Prajogo & McDermott, 2014). Organizations that involve low levels of creative action, on the other hand, must ensure that structured procedures are followed (Saraç et al., 2014). Miller (2018) concluded that Blockchain and IoT technologies would address regulatory, insurance, and legal requirements in the industrial sector. Thus, understanding the individual and organizational factors that affect enforcement is critical (Hu et al., 2018).

In addition to being dense in information, organizations must navigate an inherently complex process involving functionalities from various fields, specialized expertise, and various commitment levels (Beamond et al., 2016; Lima & Costa, 2019). Through multi-asset organizations need tools to assist them in determining which structuring standards are required to comply with the industry's regulatory structure (Lima & Costa, 2019; Power et al., 2016). However, the study of Desai (2016) suggested that regulatory collaborations are valuable in the intensity of compliance efforts and reduce performance problems. Finally, formalized procedures erode the relation between self-direction values and creative action (Eva et al., 2017).

### 6.3 Business Threat and Strategy

With the rapid development of available technologies and businesses' growing reliance on technology, small businesses' risks can only grow (Miller & Engemann, 2015). Hence, the implementation of the Business Intelligence System (IS) success literature contains many studies considering several factors that govern the success or failure (Yeoh & Popovic, 2016). Ideally, asset management is a brave new world amidst unprecedented economic turmoil and regulatory change. Consequently, process performance can be evaluated in terms of schedule and budgetary thoughts (Burns, 2010; Yeoh & Popovic, 2016). On the one hand, business models evolve as managers create new ones and respond to external developments regularly (Saebi et al., 2017). On the other hand, some businesses have discovered that they are more likely to change their business model (Achtenhagen et al., 2013; Andries & Debackere, 2013). Consequently, Kassa (2017) study illustrated the identification, categorization, and valuation of asset management system information, which is a critical task of the process. As a result, various techniques for developing equipment identification and analysis with powerful maintenance strategies (Muganyi et al., 2018).

The role of business threats in new environments and how it is controlled generated should be analyzed to develop different ways to support the business (Ibarra et al., 2018). Imperatively, in facility management, companies' financial decision-making played an important role (Rincon et al., 2017). The new data protection law establishes requirements for organizations to enforce controls (Diaz, 2016). According to Lopes et al. (2019), any company that has already applied to adopt ISO/IEC 27001 is in a great position to demonstrate risk in IT security enforcement (Dinçer & Hacioğlu, 2016). Hence, there is a solid need to highlight companies' benefits, and the added value of the business approach to resolving the deprivation of decision-making is understandable and feasible (Muganyi et al., 2018).

On the one hand, there is a measure of an asset's failure's safety concerns based on its location within the rail track asset and the particular characteristics (Power et al., 2016). On the other hand, Yeoh & Popovic (2016) study examined the process and the technology factors impacting business intelligence systems implementation in large organizations. Indeed, organizations must ensure high-level compliance with security processes and procedures to participate in the global information network in a safe, stable, and sensitive manner (Onumo et al., 2018). According to the current global market in their operations' analytical decisions, every organization searches for new methodologies that address their specific business needs (Rincon et al., 2017). The outcome of the study of Power et al. (2016) found a decision to improve the asset performance of the predicted hazard index of failure. Accordingly, organizations must focus on their main activities and ascertain opportunities for cost reductions with the market behavior changes (Rincon et al., 2017).

Furthermore, from Breier (2014)’s study, asset valuation is a technique of assessing the organization's asset's value about information system based on its confidentiality, integrity, and availability. The study of Power et al. (2016) explicit that a series of hazard registers for each type of asset is determined primarily through visual examinations. In like manner, the aspects considered for coming up with the overall criticality ranking time repair, degree of influence, probability of failure, and criticality of equipment (Muganyi et al., 2018). The study of Yeoh & Popovic (2016) concluded that the critical success factors do indeed have a direct, positive, and significant influence on the business intelligence systems implementation. Thus, the asset criticality optimization modeling should be used to ultimately select the maintenance strategies for the business's physical assets and ensure that they operate with high reliability (Desai, 2016; Muganyi et al., 2018). Therefore, applying the fuzzy theory for the asset criticality optimization technique

has proven to be a worthy key, which was reflected in the study of Muganyi et al. (2018).

### 6.4 Human Capital Management

In the global financial crisis of 2008, organizations remain to face severe problems recruiting and retaining talent to sustain the global business (Beamond et al., 2016). It is a dynamic change in the industry, and human resources management is essential for any organization's success factors. It defined talent as the employees' skills, ability, and knowledge to do their job effectively to achieve the organization's objective (Pasha & Ahmed, 2017). Cahyo et al. (2015) found that maintenance resource management was crucial for achieving improved asset efficiency and maintaining physically engineered assets in an enterprise. As a result, the number of available resources, activities, and processes involved in the systematic identification of critical positions impacts making a policy or a decision in maintenance to achieve the necessary asset efficiency (Beamond et al., 2016; Cahyo et al., 2015). The complicated implicit social contract between employees and employers based on belief and commitment relationships is vital in most emerging economies. (Beamond et al., 2016; Pasha & Ahmed, 2017).

Thus, according to Woyessa (2015), successful performance management systems include practices and organizational contexts with unique characteristics. The lack of confidence between the two parties, the employer and the employee, in enforcing the order is an essential factor that can be expressed as a deficiency in achieving an effective performance management system (Pasha & Ahmed, 2017; Woyessa, 2015). Hence, the recruitment process is an integrated recruitment process, evaluation, and hiring of the business that conveys people into the organization (Pasha & Ahmed, 2017). Indeed, the study of Pasha & Ahmed (2017) deliberated that Performance Management can be achieved with the help of a business plan, and its impact of talent management strategies has notable effects on the output and productivity of organizations and employees.

The study of Beamond et al. (2016) explained that talent management had become one of the essential strategic issues for leaders nowadays. Whereas, the most pressing issues facing enterprise asset management in the short to medium term may be the need to develop a coherent knowledge base, as well as an organizational refocus on the asset, as well as a commitment to re-aligning education and training toward effective human resource development (Amadi-Echendu et al., 2010). Relatively, the study of Cahyo et al. (2015) elaborated that the research's future steps should include the complete human resources in the investigation of maintenance and related costs for all activities. It is supported by Jaradat & Mashhour, (2017)’s study, which emphasized that employees are most observed as a capital resource, with being the leading resource in gaining competitive advantages. Finally, effective and transparent human resource practices can be focused on through supervisors and leaders (To et al., 2015; Uhl-Bien & Arena, 2018).

### 6.5 Integrated Maintenance Management System

The developed framework is intended to demonstrate how the knowledge-based system can be applied for operations to support maintenance choices (Milana et al., 2017). This integrated operational and maintenance strategy has attracted attention as it is recognized as a primary driver for competitive advantage (Nahas & Nourelfath, 2018; Narayan, 2012). Hence, the study defined maintenance management as a process that coordinates and allocates resources to enhance maintenance performance. The maintenance function's role in achieving expected reliability and production equipment performance reflects the vital link between maintenance decisions and manufacturing (Gulati & Smith, 2009; Nahas & Nourelfath, 2018; Sankararaman, 2015). Consequently, the manufacturing and strategic business perspectives for maintenance strategy and

operations must be considered (Aldairi et al., 2016). Maintenance and mission plannings are two main interlinked tasks, which affect cost availability and ownership and play a crucial role in cost-saving and efficient use of the property (Camci et al., 2019; Xia et al., 2017). There are three major contributors to the management of spare parts in building maintenance: spare part quality, budget allocations for the procurement of spare pieces, and inventory level. Besides, selecting good quality replacement parts was the most important principle for building maintenance practitioners (Camci et al., 2019; Sankararaman, 2015; Xia et al., 2017).

Effective spare parts management is critical for keeping the manufacturing process running smoothly and preventing production and quality losses (Teixeira et al., 2017). Roda et al. (2014) defined spare parts management as an operation to support maintenance activities and provide real-time information on the amounts available to each spare part by adopting inventory policies that safeguard its availability when required and minimize costs. The equipment's efficiency and proper operation are essential to avoid production losses (Chen et al., 2015; Prakash & Chin, 2017; Teixeira et al., 2018). Due to capital accumulation and storage, high stock levels are expensive (Chen et al., 2015; Prakash & Chin, 2017). Ideally, some parameters must be monitored to monitor and forecast the possible time to fail and establish a preventive maintenance activity to prevent and concern the undesirable failure (Sobral & Soares, 2016). The holistic asset management approach offers a systematic view of the engineering asset management system (El-Akruti et al., 2016). Conditional monitoring is also a strategy that makes it possible to understand the asset's condition and its performance before failure. Relatively, the best techniques for using and predicting equipment failures are increasingly dependent on the maintenance activities' technological quality (Sobral & Soares, 2016). Indeed, life management is vital to reduce the life-cycle costs that can be functional for critical assets and related to the support function (El-Akruti et al., 2016; Sobral & Soares, 2016).

### 6.6 Performance for Assurance Management System

Asset assurance management is an evolving activity to integrate financial cost, planning, engineering, people, efficiency, and information management to support the organization in managing its critical assets cost-effectively (Ghobakhloo, 2018). It is vital to bring the organizational plan and ensure long-term financial sustainability (Jackson, 2019). It focuses on providing the correct information to the right people and needs a more organized approach (Jackson, 2019). According to Transportation (2017), it is a systemic process in which physical assets should be improved, operated, and maintained cost-effectively. The Gaarenstroom (2014) study showed that management systems are frameworks of procedures that ensure that an organization can fulfill all its tasks to achieve its goals.

In comparison, a real-time monitoring system supports the ultimate just-in-time maintenance (Gaarenstroom, 2014). However, barriers, such as reducing maintenance frequency, insufficient design standards, insufficient, overloaded, or unskilled personnel, can be too busy to check all or do not know what to find (Ebrahimipour & Yacout, 2015). Thus, the new sector changes focus on running the asset at a minimum cost that corresponds to the company's safe and efficient operations (Kaiser, 2015). Likewise, the escalation checks could include strict design standards or an inspection and maintenance schedule (Ebrahimipour & Yacout, 2015).

### 6.7 Spare Parts Acquisition Management

Eruguz et al. (2018) explained that maintenance and spare parts property costs are essential providers to numerous moving assets' overall operating costs. It was assumed to reduce the impacts

of equipment downtimes and play an essential role in achieving equipment availability at minimum cost (Eruguz et al., 2018; Hu et al., 2018). However, it is challenging to prepare replacement parts for the correct machine at the right time with the exact amount and minimum amount of work due to demand and supply insecurity (Zheng & Wu, 2017). Similarly, this issue arises in the maritime sector in which the failure of an engine part can be projected using a conditioning base monitoring system (Kian et al., 2019). In the Zheng & Wu (2017) study, they proposed an intelligent inventory management system that aims to produce the right machine replacement parts at the right time. Therefore, spare parts management was crucial in achieving the desired equipment availability at a minimum cost (Hu et al., 2018).

### 6.8 Real-Time Monitoring System

Cybersecurity is now one of the most pressing issues that businesses adopting the Industry 4.0 model must address to remain competitive (Corallo et al., 2020). Monitoring systems have become critical factors in management decisions as the volume of data collected during the production process has increased (Cheung et al., 2018; Mora et al., 2017). Moon et al. (2017) proposed a real-time detection method based on Internet of Things-based sensors, a hybrid, and a big data analysis prediction model in their research. Significantly, the recommended extensive data processing system and Internet of Things (IoT) based sensors are adequate and efficient for monitoring the entire operation (Manes et al., 2016). Furthermore, the device is supposed to assist management by enlightening decision-making and avoiding unintended losses incurred by specific manufacturing errors (Calderón Godoy & González Pérez, 2018; Lee et al., 2018; Salamone et al., 2017). In particular, the framework and gateway performance of an effective significant data platform architecture to handle IoT-generated sensors was evaluated and tested. According to the study by Syafrudin et al. (2018), current commercial smartphones are capable of mixing daily operations with simultaneous results. The proposed system can efficiently process the vast input-output of sensor data that helps improve the real-time monitoring system and incorporate crucial strategies as the number of sensor data and sensor devices grow (Alfian et al., 2017; Morón et al., 2014;). Disruptive technology in Industry 4.0 and the Internet of Things, according to Lee et al. (2017), progresses rapidly over industrial manufacturing. Therefore, inspections can now be performed without disrupting activities, resulting in increased protection and operational performance (Dhutti et al., 2019). Maglaras et al. (2018) found that SCADA systems are critical for controlling and handling industrial processes.

### 6.9 Integrity Assurance Management

Component lifetimes with unknown downtime, for example, may result in a non-linear maintenance resource requirement, as defined in Cahyo et al. (2015). This emphasizes the challenges and variables that may jeopardize asset management's credibility (Al-Sulaiman et al., 2013). It is intertwined with organizational honesty and must be handled in tandem (Al-Sulaiman et al., 2013; Kusumawardhani et al., 2016). Similarly, removing uncertainties is the most effective way to achieve a long-term result, consisting of an optimal balance between available capital and the planning of maintenance investments (Fuggini et al., 2016). Several sets of potential maintenance resource provision policies should be considered (Cahyo et al., 2015). Immature Asset Management activities on dynamic or sensitive asset bases, on the other hand, pose a significant risk to an enterprise (Davis, 2016). Additionally, the constant development of technology creates a constantly evolving scenario for data processing and utilization. Borges et al. (2017). However, for the energy sector to operate effectively without interruption, routine machinery and equipment maintenance are essential (Petrović et al., 2014). By performing preventative maintenance, the risk of failures and consequences could be reduced (Ghahramani et al., 2008). Ideally, condition-based

monitoring could be directed to the wrong equipment if failure systems are not analyzed and understood and achieve incorrect and costly results (Baglee & Jantunen, 2014). Indeed, there is an increasing and instead urge differentiation to establish according to the failure for each company's critical assets failure which is seen to be potentially disastrous, highly difficult to foresee, and increasingly likely to occur (Baglee & Jantunen, 2014; Van Eeten et al., 2011).

### 6.10 Asset Optimization Management

Strategic models shared with technology may be the tools used to safeguard that facility management performance measurement creates value for an organization's strategy (Rincon et al., 2017). The main objective of criticality optimization is to improve a system that optimizes maintenance activities (Muganyi et al., 2018). Whereas the practice of a benchmarking framework to achieve an uninterrupted innovation process may bring new ideas into practical use (Rincon et al., 2017). The decision-makers need a pronouncement support system to effectively assign funding and achieve the uppermost possible return on investment on their infrastructure (Shoghli & De La Garza, 2017). In contrast with the finding from the study of Rincon et al. (2017), it is vital for benchmarking to link the organizational objectives in tracking and measuring performance. Therefore, to manage assets in the most efficient, cost-effective manner while preserving their value, an integration method is needed (Alyami, 2017).

On the one hand, asset value can be interpreted as a shared performance practice for the added value process between competing asset management systems (Alyami, 2017). On the other hand, the risks to critical assets in companies must currently be assessed using methodologies that were established before the asset place into operation, which inherently adopts a single system that might be condemned and the potential for resulting risk connecting to the assets (Nurse et al., 2017). Therefore, strategic decision-making is more critical in the aging asset's maintenance system due to limited budget availability, as discussed in the study (Shoghli & De La Garza, 2017).

### 6.11 Program Assessment and Evaluation

It recognizes the higher level of competitiveness in managing assets in the industry and closely focuses on the operations' costing and efficiency (Burns, 2010; Maletič et al., 2017). Undoubtedly, Maletič et al. (2017) took a step toward understanding the importance of contingency factors in deploying asset management activities and applying KPIs in maintenance asset management. However, failure to prepare for unanticipated occurrences does not minimize their risk; instead, it raises negative consequences (Wittkop, 2016). The performance index is produced by the working behavior results, reflecting performance management's ultimate goal (Qu et al., 2015; Wittkop, 2016). According to Cahyo et al. (2015), auditors are becoming more relevant in offering independent confirmation to management that the information system's systems and data are maintained.

## 7. Synthesis

Businesses nowadays will remain challenging due to the recent global financial crisis (Dinçer & Hacioğlu, 2016). In all industrial and business activity regions, the United Arab Emirates is known to strive for quality and performance (El Khatib & Ahmed, 2018). More companies in the region implemented an innovative approach in critical asset management to increase their assets' lifetime with a lower operating cost. On the other hand, public and private companies expose to dangerous incidents and risks crucial for their operations and development (Păunescu et al., 2018). However, inadequacies in one task represented in the process can lead to poor and unsuccessful methods for other operations in asset management (El-Akruti et al., 2013). Thus, academicians and

professionals are becoming increasingly concerned about the sharing economy's exponential development (Kumar et al., 2018). The study of Kian et al. (2019) found out that critical asset failure results in delays and downtimes in marine industries, translating into additional costs and penalties imposed by the clients.

Consequently, using and carefully managing the strategic framework based on catered segmentation techniques for asset management system implementation, some holes are found through the study, which can be filled by utilizing and carefully managing the strategic framework (Kumar et al., 2018). Whereas, according to the Kolios & Luengo (2016) report, these critical assets are subject to various harsh operating and environmental conditions, particularly for those installed offshore, leading to the deterioration of their performance and structural ability over time. Nonetheless, in a rising economy, a well-functioning business model must establish a consumer and service provider to reduce business risk due to critical asset failure (Kumara et al., 2018).

In recent years, the industry has experienced more critical changes (Vijayakumar & Gajendran, 2014). The study of Eckhardt & Shane (2011) revealed that technological advancement is a significant determinant of growth behavior. Significantly, online monitoring technologies today offer an opportunity for predictive and proactive asset management in many different industries. The most recommended factor for a better production facility is performance, productivity, and operating costs (Agarwal et al., 2013; Dal et al., 2000; Tubil et al., 2021; Vijayakumar & Gajendran, 2014). It further illustrated that components' efficiency and quality are immediately improved to optimize productivity and efficiency (Tsarouhas, 2013). Similarly, Egbu, (2004)'s study pointed out that innovation is observed as a significant competitive advantage source. It is a view as a requirement for organizational performance and survival. The evolving symbiotic innovation model emphasizes innovation collaborations to produce quality services in a cost-effective framework (Egbu, 2004; Khanna, 2012).

Moreover, top management in the organization, including demand from organizations, faces numerous challenges (Maletič et al., 2017). The study by Hess & Rothaermel (2011) expands on the significance of considering the variability of a company's intellectual human resources and the relationship between critical, creative activities along the information value chain. Undoubtedly, it is possible to preserve the necessary information for later safety assessments by providing a consistent documentation system for equipment failures and documenting accidents (Ghahramani et al., 2008). A significant improvement has now been made in maintaining assets and production systems to reduce the waste of energy and resources (Vijayakumar & Gajendran, 2014).

Challenging changes across industries are more attractive to the asset owner (Roy & Cohen, 2017). The study of Eckhardt & Shane (2011) revealed that technological advancement is a significant determinant of growth behavior. Simultaneously, the manufacturing industry has experienced more significant changes (Vijayakumar & Gajendran, 2014). Furthermore, essential assets serve as the company's entry point, both organizationally and in terms of protection (Samimi et al., 2020; Wittkop, 2016). It can include fixed assets, such as specific sites or facilities, and temporary events that increase a facility's criticality, as shown by Badii et al. (2014) study. Thus, it is regarded as a critical component of services that ensures the long-term viability of products, utilities, and communications (Maliszewski et al., 2012). However, the productivity of critical assets in industrial and urban areas depends on network-based systems (Evazabadian et al., 2014). Hence, critical assets' efficient positioning can potentially happen within spatial optimization models that deal with security, activity, coverage, equity, and risk (Maliszewski et al., 2012). Consequently,

effective assurance management implementation is more complicated than formulating strategies, which shows that only less than 10% of well-formulated policies are successfully implemented (Palladan et al., 2016). Indeed, to turn the company into a competitive advantage and enhance its operational efficiency, the company needs to consider the broader context in which the data were produced (Mawed & Al-Hajj, 2017).

The decision-maker needs to align its asset strategy on how the critical asset's operational regime should be modified to sustain its operational requirement (Ameh, 2017). Kumar et al. (2018)'s study supported this claim that asset management system strategy is significant to the services and operation as enablers to retain their competitive advantage in the industry. Further elaborated that fitness for services helped eliminate unnecessary improvement maintenance and inspections that would have acquired cost and impacted business (Ameh, 2017). Otherwise, the asset Management system can be a primary framework to be implemented for the critical assets of industrial plants, manufacturing companies, logistics operations, oil and gas, and other services providers globally (Transportation, 2017). The study of Rahman et al. (2018) has projected that strategic competitiveness would provide companies an edge to survive in an uncertain and stormy era. On the left hand, by framing and executing the required strategies effectively, modern asset management revolves around the four key elements: leadership, value, alignment, and assurance (Copperleaf, 2017). On the other hand, older companies are more likely to fail due to their inability to respond to environmental change, while younger companies struggle due to a lack of management experience and financial management skills (Thornhill & Amit, 2003). Therefore, innovativeness is vital for organizations to generate value and maintain a competitive advantage in today's highly complicated and changing environment (Palladan et al., 2016).

## 8. Contributions of Study and Emphasis to the New Knowledge

Though few researchers have taken a bold approach in utilizing the systematic review process, this research attempts contributes to strengthen the dearth of the reference materials and provide meaningful impact in research as an alternative design in conducting a research study in the field of both the business and engineering industries where the *Assurance Management System for Critical Asset Framework (AMSCAF)* is recommended as the newest contribution to the critical assurance management system. The review of related literature proved that once it undergoes a tedious and rigorous process, it can emphasize an example shift in building confidence in today's research process. The study contributes to the asset management process in redefining the assurance management system of critical assets in the industry. It uncovers the latest contribution in critical asset management by reviewing the reference published materials in critical asset management implementation as additional reference materials. The study would like to reinforce the industry performance through the availability of reference materials in coping up the dearth of knowledge the review of related literature. The systematic approach presented in the methodology will help to guide the new researcher in presenting the review materials. The industry will reveal new insight as an approach to guide different stakeholders to achieve high performance in the assurance management as support literature revealed as the outcome from the different studies.

## 9. Conclusions

In recent years, more significant changes have occurred in the industry. The asset owner is more interested in these challenging changes across industries. Thus, this study's goal was to discuss the crucial aspects of implementing an assurance management system in a specific industry dealing with critical assets. In this study, a systematic overview of the literature and content analysis played a significant role in analyzing various review papers, Google Scholar, journals, and other social

sciences. The result revealed that increasing the organization's knowledge of the processes and asset criticality in the assurance management system offers a high degree of openness to the activities carried out to ensure continued asset reliability and integrity. Relatively, it demonstrates a strong long-term trend of increased equipment reliability, leading to a substantial increase in customer confidence due to implementing a reliability assurance management system. The study recommended that implementing an assurance management system for critical assets is essential because it provides confidence that the asset will perform as anticipated, as well as aids in understanding the asset and its relationship between expected and actual results, as well as efficiency in following the Assurance Management System for Critical Asset Framework's (AMSCAF) structured approach. Therefore, top management in the different industries should consider the recommendations and best practices to ensure essential asset management through the Assurance Management System considerations. In today's highly complex and evolving world, businesses must generate value and retain a competitive edge, as the role to be considered by most top management of every implementing industry to secure the desired success of the organization.

**Conflict of Interest**

There is no conflict of interest to declare for this research.

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