

How Can SMEs Succeed in The Vuca World: The Role of Performance Measurement and Management in The Challenging Business Climate

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Abstract: *The world is changing. The changes are happening at an increasingly faster pace than ever. Organizations are facing significant impacts and must revisit their strategies outlined in the Performance Measurement and Management (PMM) System more often to ensure business sustainability. The primary objective of this conceptual research is to study how Small-Medium Enterprise (SME) industry operating in Penang is deploying PMM in the current high volatility, uncertainty, complexity, and ambiguity (VUCA) environment. This research applies a mixed mode research approach with a focus on in-depth case studies and group discussions with the managerial team in the organization as well as the employees in the selected company. A comprehensive literature review will be conducted as part of the analytical study to analyze the academic literature on the relevant topic that was published in the last 5 years. The goal of the analytical study is to gather statistical data and information on the approaches and models that were adopted in the industry. An empirical study will be carried out where the goal is to gain true insight into underlying reasons and motivations for the decision-making process associated with the PMM system within the organization in the SME industry. The overall objective of this research is to constitute several immense contributions, which include conceptual, empirical, and methodological contributions. This research is targeted to provide a reference to SME practitioners and managerial teams with strategic direction when developing PMM in challenging situations. The findings of this research can also be served contextually as a framework that provides another view of how the SME industry perceives PMM in the VUCA environment.*

Keywords: Performance Measurement and Management, Small and Medium Enterprises, VUCA

1. Introduction

As we entered the third decade of the twenty first century, the rate of change across the globe is undoubtedly to accelerate even more, especially with the unforeseen sources of disruption (Bailey et al., 2019; Sheng et al., 2019; Gunasekaran et al., 2019). We are experiencing more frequent than ever man-made and natural disasters. These have impacted individuals, society, businesses, and humanity as a whole. Covid-19 outbreak, for example, put a hard stop to all social and majority of economic activities in 2020. The recent tornado strike across eight states in America demolished thousands of houses and businesses in South and Midwest America. Companies of all sizes are carrying out Business Continuity Management (BCM) and ramping

up digital transformation to ensure the sustainability of their business operation. While technical advancements, rising globalization, changes in trade barriers, and social environmental issues are driving business transformations, making a swift decision and leading the organization to quickly excel in the challenging environment are becoming increasingly crucial. Research in utilizing Performance Measurement and Management (PMM) effectively and efficiently to bring improvements to organizations is not new. However, studies on PMM in the Small and Medium Enterprises (SME) industry was not carried out extensively to ensure its relevancy and effectiveness now and then as the world is going through unprecedented challenges.

SMEs are very vulnerable, and this is especially true in the highly competitive business environment. SMEs' capacity to predict or the ability to adapt promptly to external developments is crucial. The key component to keep SMEs strategized and leading the organization to survive and breakthrough in the highly competitive yet dynamic environment is keeping an effective PMM tailored to meet the objectives of the organization. This research aimed to provide an understanding of the role of PMM in helping SME organization to navigate through this challenging environment.

1.2 Background of the Research

Decades since PMM was published by H. Thomas Johnson & Kaplan (1987), organizations across industries have deployed PMM to measure and manage the performance of the organization. Since then, studies on PMM have been carried out extensively from a variety of angles (Franco-Santos et al., 2007). Bititci et al., (2011) conducted a study based on business models and suggested 10 big challenges for PMM research. Melnyk et al., (2014) studied the evolving landscape of PMM and recognized the significance of PMM to fit into an organization's mission to compete in an increasingly volatile situation. Though most of the research was conducted across multiple disciplines, their perspectives can be categorized into three broad research streams, namely the operations perspective, strategic control perspective, and management account perspective (U. Bititci et al., 2011).

Liu et al., (2021) introduced a new paradigm to estimate the performance of a construction company in a highly volatile, complex, and dynamic environment. The findings of this research were well received by the company as it demonstrated that prediction is critical for companies to prosper and survive. This research demonstrated the need to revisit PMM to meet the content of a specific industry, business trend, and external factors. In the context of the Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) environment, and coupled with the world embarking into digital transformation with the arrival of the Industry 4.0 revolution, the outcome of conventional PMM may not be meeting the expectations.

While there is a lot of research on the topic of PMM in recent years (Bourne et al., 2018; Modell, 2019; Striteska & Zapletal, 2020), there is not much research on how the present VUCA environment affects the adoption and implementation of PMM in the SME industry, particularly the industry in Malaysia.

1.3 Problem Statement

Industries are facing great challenges with the explosion of the Covid-19 outbreak when it was first detected on 31 December 2019. Since then, many countries have closed their borders and restricted operations and movements. Many productions have been slowed as a result of supply chain disruptions and extensive shutdowns. Demand, on the other hand, appears to have suffered a heavier impact since the emergency shutdowns also left consumer purchasing

dropped, and company expenditure dried up. The Covid-19 endemic caused a huge impact. According to a recent report by Veem, a worldwide payments network operator, nearly eighty percent of small U.S. businesses are expecting the endemic to have an impact on their business over the next 16 months, and almost ninety percent foresee an economic downturn. In such a situation, SMEs may confront a serious problem because they lack the capacity and resources to deal with uncertainty, and they may experience severe capital shortages as a result (Zhu et al., 2020).

Millar et al., (2018) of McKinsey emphasized the significance of a fusion and integration of functions, as well as of people and data, in their article "The Most Perfect Union: Unlocking the Next Wave of Growth by Unifying Creativity and Analytics". They indicated that companies that harness creativity and data in tandem have growth rates twice as high as companies that do not. They also reflect that in marketing, ideas and facts have always had an uncomfortable alliance since creativity is an innate process for creative directors, designers, and copywriters of forging emotional relationships with customers. In a VUCA environment, SMEs are even more vulnerable as they usually do not have the relevance of this convergence of roles and processes across the organization.

According to Malaysia's GDP and SMEs GDP published by the Department of Statistics Malaysia, SMEs' GDP growth is often higher than Malaysia's GDP growth as shown in the time chart in Figure 1. However, in 2020, SMEs' GDP growth was negative 7.3 percent, which is weaker than Malaysia's GDP for the first time in 17 years since 2003. The contribution of SMEs to GDP dropped significantly to 38.2 percent in 2020. It was reported manufacturing and services sectors were the primary drivers of SMEs' GDP activities and they are accounting for over 80 percent of total SMEs' GDP. These facts provided signals that extra efforts must be taken to bring the SMEs' GDP and the country's GDP back on track.

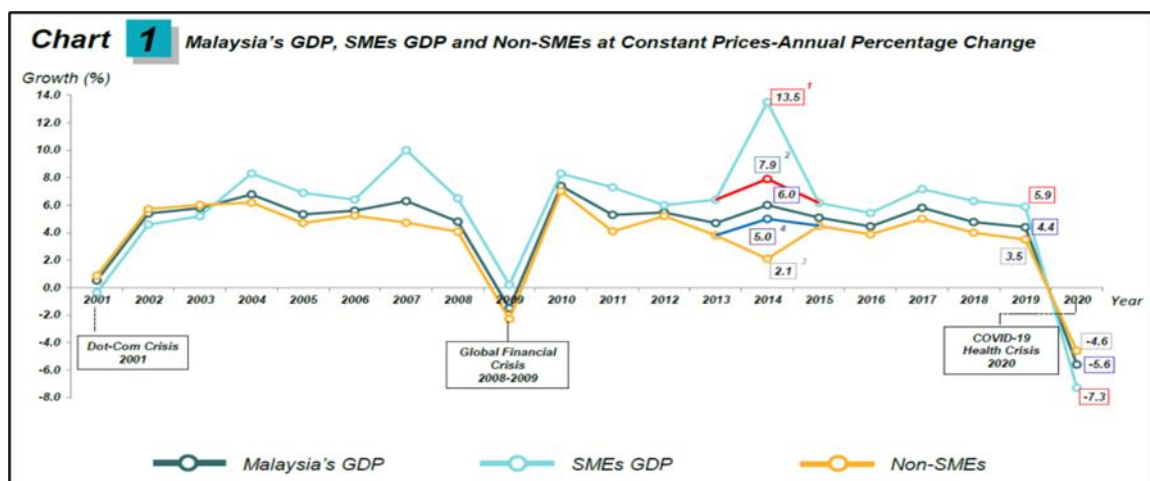


Figure 1: Malaysia's GDP, SMEs GDP and Non-SMEs GDP published by Department of Statistics Malaysia on 28-July 2021.

In a nutshell, the SME industry in Malaysia can be greatly impacted by the highly unprecedented business climate. SMEs may not be able to maximize organizational performance if they are not proactive in managing their organization to face new challenges.

1.4 Research Gap

Research conducted in the last decade has shed light on the importance of PMM in the VUCA world years (Bourne et al., 2018; Modell, 2019; Striteska & Zapletal, 2020). This literature revealed that changes in business climate have influenced how organizations conduct risk management to ensure business sustainability and business continuity in general. de Andrade et al., (2021) published a model for World Class Manufacturing to assess and adopt PMM in the VUCA world. However, research on how PMM should continue staying relevant to SME organizations in this challenging environment is rarely examined. As businesses undergo a transformation, the PMM approach should also be evolving to meet the new organizational strategies.

With all these research gaps, the objectives of this research are to gain a better understanding of the theoretical underpinnings of PMM literature by examining:

- i. The principal theories being used in the PMM studies.
- ii. The function of each theory and how multiple theories are implemented.
- iii. The relationship between theories and the research methodology used by researchers.
- iv. Unique hypotheses or philosophies in PMM applied by the SME companies in Penang Malaysia when business is facing new challenges or environment.

1.5 Research Objective

The objective of this research is to look at how contemporary SME business in Malaysia is keeping PMM as an effective approach to managing the organization. This research begins with a structural review of the published literature related to PMM, to analyze the present trends of research in this field. The author will then conduct individual interviews and focus group discussions with both the management team and employees of an SME company in Penang Malaysia to further understand the reality and practices of the company identified when deploying PMM in the unprecedented environment. Besides a series of questions and interaction sessions planned, observations will also be carried out to capture additional values of this research. This research is targeted to study the multidimensional impact of PMM on SME organization performance, as well as the effectiveness of the widely used assessment approach.

The findings of this research are aimed to contribute to making PMM efficient in the SME industry in a challenging environment. The author hopes the findings of this study could be leveraged in future studies to further improve PMM in ways to foster collaborative networks within the organizations to create value for the SME industry to excel in the turbulent environment.

1.6 Research Questions

The purpose of this research is to understand how the PMM adopted in the SME organization is changing in a highly unprecedented business environment. At the end of this research, the following research questions will explicitly be addressed:

- i. RQ1. How does PMM evolve to stay relevant in the new norm of the SME industry?
- ii. RQ2. Where are the performance management gaps in the business environment today that SME management is trying to address?
- iii. RQ3. How does performance measurement create values yet encourage innovation?

This research looks at how SME organization makes use of the PMM framework and create relational outcomes to lead the organization through a challenging situation. It contributes to the literature by expanding on the value-generation processes of various types of performance

information supplied by SME practitioners. In addition, this research looks at how both the data from performance measurement and the results of performance management are used strategically in the decision-making process.

2. Literature Review

From the earlier discussion, it has been found that PMM is a key factor in the success of organizations around the world. In this section, an extensive review of the literature concerning performance measurement and management, the SME industry in Malaysia, challenges in PMM research and implementation, impacts due to global sentiment, and strategic management will be presented. Details provided in this chapter are supported by references cited to offer readers additional details to gain a more in-depth understanding. At the end of this chapter, a summary will be presented to conclude the chapter.

2.1 Theoretical Principles of Performance Measurement and Management

PMM has been studied extensively from a variety of theoretical angles such as contingency theory, goal-setting theory, agency theory, and equity theory since it was advocated by Johnson and Kaplan (1987). Fast forward to the twenty-first century, Franco-Santos et al., (2012) looked into the impacts of modern PMM systems through these theories developed. Franco-Santos found out the shortages of theoretical underpinnings in PMM research and the necessity to apply theories to the design of PMM systems. The process of setting goals, constructing a set of performance measurements, acquiring data, evaluating, assessing, reviewing, reporting, and responding to the performance data was further defined as the PMM process (Bititci et al., 2015; Melnyk et al., 2014). These findings of the immaturity of PMM are coherent with previous studies from Neely (2005) and Taticchi et al., (2010). The entire process should include several other performance measurement principles, such as deploying organizational goals across the business to promote alignment and ensure that everyone is working toward the same goals. Feedback and feedforward controls should be included in the PMM, where feedback is associated with goal achievement and feedforward is associated with goal setting (Bititci, 2015). Poor integration of management theories is not a problem specific to the PMM area, but it is a problem that can be seen in several new and emerging research fields, such as sustainable supply chain management (Carter et al., 2015; Touboulic & Walker, 2015). Therefore, attention must be paid to its application and development when evaluating any academic field.

Organizations operating in volatile and uncertain environment implies that how the organization measure and manages performance has a substantial impact on the organization (Melnyk et al., 2014). Recent research on PMM has made good progress in the correct direction. Okwir et al., (2018) identified sophisticated models as a useful tool for evaluating the efficacy of PMM systems, and they defined four system attributes, namely ontological, teleological, genetic, and functional, that could be deployed to comprehend the complexity of PMM. According to Smith and Bititci, (2017), the component of performance measurement reflects the technical aspect of the control element, and performance management reflects the social aspect of the control element, which is comprised of Simon's four levers of control (Shelleman & Shelleman, 1995):

- i. Belief systems give energy and direction by establishing a sense of purpose, ethics, and drive.
- ii. Boundary systems enable innovation within established parameters such as rules, processes, and standards of business conduct.
- iii. Interactive systems targeting engagement and participation in the decision making process.

- iv. Diagnostic systems use performance metrics, objectives, feedback, monitoring, and assessments to ensure that critical organizational purposes are met.

Several empirical studies have shown that PMM could assist companies in developing a strategic plan, encouraging positive practices, and strengthening performance over time (Micheli & Mura, 2017). However, the great majority of empirical research has been conducted in large corporations, and information on how PMM is applied in SMEs is relatively limited. This is critical not just because SMEs contribute positively to economic development and industry, but also because SMEs have unique features that set them apart from major corporations (Bititci et al., 2011). Smaller companies, for example, SMEs, are more adaptable and innovative, but they are constrained by human resource and budgetary limitations, and they rely on less formal managerial procedures and systems, such as PMM. They must, however, continue to encourage behaviors that are in line with the company's goals and values, as well as generate appropriate organizational synergy and gain a better understanding to improve overall performance (Massaro et al., 2019).

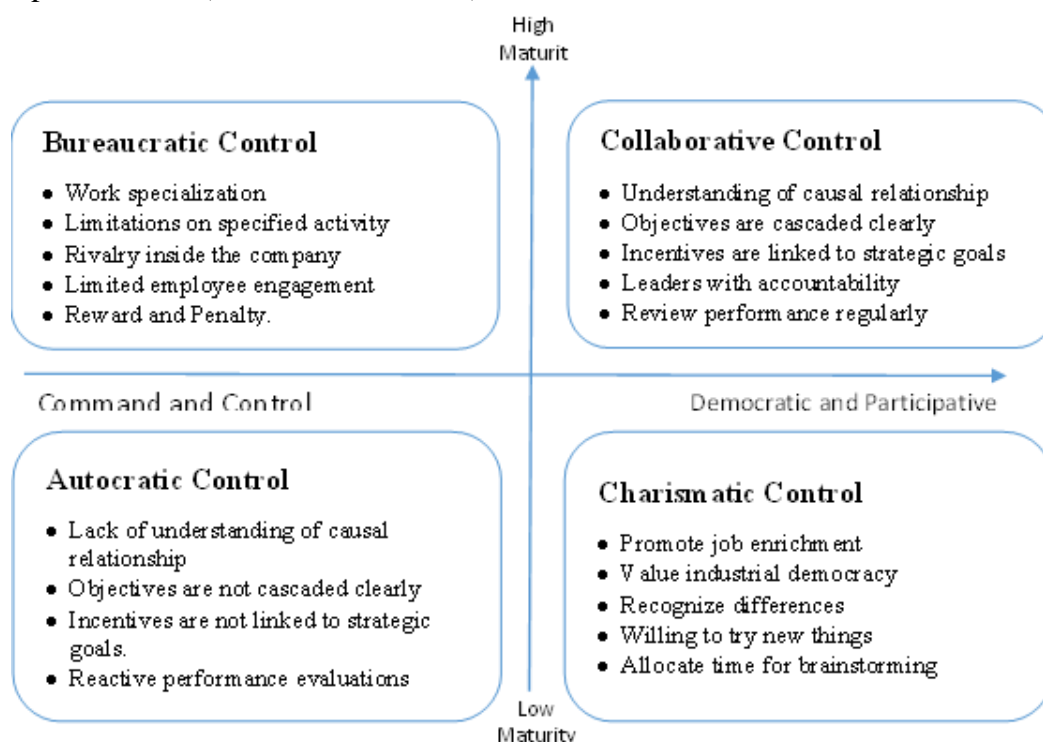


Figure 2: PMM in the framework of organization control based on Simon's lever of control. Source: (Nudurupati et al., 2021).

Further to this, Pinto, (2019) proposed that Stakeholder and Paradox theories are to be used to develop PMM systems that would foster a more nuanced, long-term, comprehensive, and integrated management style. Nudurupati et al., (2021) also made another significant addition where the finding emphasized the necessity to design PMM frameworks that can swiftly adapt to environmental, and business trends and climate changes. Five main patterns that were identified as the most essential areas are:

- i. Emerging Technologies (in accordance with the notion of Industry 4.0)
- ii. Networking and Collaboration
- iii. Servitization and Value Creation
- iv. Innovation and Knowledge Work
- v. Environment and Sustainability

As the primary objective of all the PMM theory is leading toward organizational control, it is essential to consider the PMM principles outlined above for SMEs in the VUCA environment.

2.2 Challenges in PMM Research

With the rise of industrialization at the beginning of the 1900s, the goal of performance measurement is more focused on product management. However, the goal of performance measurement has evolved as more complex multi-plant organizations have emerged. In the area of financial control, researchers started to see the goal of performance measurement has changed towards budgetary control. With the increasing global competition and market complexity, the researcher is seeing more and more integrated performance measurement and then appreciating the value of integrated performance management without scarifying the goal of productivity management and budgetary control. (U. Bititci et al., 2011)

Even though researchers and practitioners have provided the PMM subject with significant attention, most PMMs are still not prudent and adaptable to the changes happening around the business, due to both internal and external factors (Melnik et al., 2014). As a consequence, those companies deploying a fixed PMM framework in a highly unprecedented market environment may lead to increasing complexity and inefficiency in resource planning and allocation.

Several frameworks and models have been created in response to concerns with standard backward-looking financial accounting systems (Bourne et al., 2000; Melnyk et al., 2014). However, few researchers have looked into the deployment of PMM, and Bourne et al., (2000)'s three-phase model has been broadly accepted in the community. The three-phase model started with designing performance measurements that are connected with the organization's strategy. The next phase is putting in place adequate structures and procedures for acquiring and processing data that will allow measurements to be carried out. The last phase involves ensuring that the metrics are used in the decision-making process and periodically evaluating the measures' validity. Many researchers from various disciplines have studied to discover the best business practices in various contexts since this three-phase model was introduced (Choong, 2013; Jääskeläinen & Sillanpää, 2013).

Bititci, (2015) recently compiled the majority of this research and categorized it into two main categories: which are social and technical controls. The cultural and behavioral controls are said to be achieved by personal attributes, organizations, administrative aspects, and connections. Some of these measures may be tacit and unexpressed. Good leadership, for example, may use performance measurements to empower individuals and foster a democratic and participatory culture. The technical controls contain objective and reasonable techniques that are used to achieve a certain goal. These are recognized to be professional, objective, and explicit in character, and comprise a wide range of metrics, information systems, data-gathering techniques, analyses, and visual communication (Kang et al., 2016).

Understanding the life cycle of PMM, the social-technical process for operating PMM, and the complexity theoretical lens through which PMM is considered are all very helpful in understanding the dynamics of complexity in PMM.

2.3 Global Sentiment and VUCA

VUCA is an abbreviation for Volatility, Uncertainty, Complexity, and Ambiguity. The word VUCA was first coined in 1987 by Warren Bennis and Burt Nanus (Bennis & Nanus, 1985). The term was then deployed to U.S. Army War College (Barber, 1992). Given the competitive

and dynamic business environment in the twenty-first century, corporate executives and organizations began to adopt this concept. Today, VUCA is no longer a buzzword anymore were senior-level strategists and leaders are using to lead their corporate to deliver greater values, VUCA is a new normal as the global sentiment is becoming highly unprecedented.

The market encounter new challenges every day as the world becomes more unpredictable. Uncertainly contributed various factors make the day-to-day business operations more challenging and complex for stakeholders to manage the business effectively. As a result, in the world of VUCA, ethical business practices are critical. In the absence of a more profound analysis and research.

Table 1: Characteristics of VUCA and examples. Source: Based on van Tulder et al., (2019)

	General Characteristics	Examples
Volatility	Change happens are unpredictable and without known duration; the situation can be explained and understandable with the information available.	Price changes after a crisis, for instance, commodity pricing, which is quite volatile.
Uncertainty	The cause and effect are visible and can be explained, but the level of impact and duration are unknown.	Threat from an upcoming competitor's new product.
Complexity	Caused by many interrelated incidents and operations, usually multiform and convoluted, although not always requiring change.	Expanding a business to a new country usually entails compliance with new rules, regulations, logistics, and cultural values.
Ambiguity	Lack of understanding of the fundamental of the incident; cause and consequences are unknown; no precedence for making predictions.	Launching a product without a good grasp of the market needs.

The findings from the literature study related to VUCA show that the changes in the VUCA environment are becoming increasingly hard to predict. The implications for policy planning and strategic decision are taking more weight in such a situation.

2.4 Strategic Management and PMM in SME

Organizational success is often closely related to performance management strategies. The impact of strategic management practices on SMEs' performance has been studied by several researchers (Omsa, 2017; Rehman & Anwar, 2019). Omsa, (2017), for example, investigated how SMEs in Indonesia sustained and improved financial and operational performances. PMM elements deployed from the strategic planning stage to execution and from performance evaluation to performance management have led to very significant SME sales results and great profits for the organization. Deployment of PMM, if done strategically, had demonstrated a great impact on SME business.

Delving further into examples of PMM deployment in the SME industry, Audenaert et al., (2019) and U. Bititci et al., (2016) also advocated the importance of PMM in improving organization performance in their research. U. Bititci et al., (2016) looked into the impact of visual PMM on organizational performance management. He studied seven production facilities and developed this novel PMM approach. The findings of the study revealed that

PMM has a variety of positive impacts when the PMM was deployed strategically. Some of the key impacts on the overall SME performance are:

- i. Stimulate the development and deployment of strategies
- ii. Fostering performance measurement and review
- iii. Encouraging employee engagement
- iv. Improving internal and external information exchange
- v. Constantly improving business culture
- vi. Cultivate an innovative thinking environment

Audenaert et al., (2019) conducted research by looking into employee performance management in public companies and assessing its relationship with employee innovation. When an organization emphasizes employee performance management, it not only improves the performance of the organization but also employee innovation. The study also demonstrated that when individuals within the group have positive engagement with the leaders, the influence of employee performance management on innovation improves. These findings could contribute to empirical support for the role of PMM in enhancing the overall management of the company.

When it comes to improving organizational performance, PMM is one of the crucial components and it can be driven by the human resources (HR) team. HR management should incorporate high-performance workflow with PMM as part of the strategic HR management to further accelerate the outcomes expected (U. Bititci et al., 2016; Shin & Konrad, 2017). Findings from Smith & Bititci, (2017) suggested that aspects like employee engagement and performance review could boost the effectiveness of PMM. To further investigate this finding, the two researchers looked at two aspects of organizational control, namely the technical aspect and the social aspect. The study found that having an impactful performance monitoring system would greatly enhance employee engagement and overall performance significantly (Smith & Bititci, 2017).

PMM produces a variety of tangible and intangible benefits. In the context of competitive challenges, to gain an advantage in a competitive market, SMEs must implement PMM. Several research showed that SMEs reported strong returns and gain market share after the implementation of PMM (Forth & Bryson, 2021; Mustapha et al., 2016). Despite the common belief that SMEs do not require PMM because of their relatively small size in business, Forth & Bryson, (2021) suggested that deploying PMM in SMEs would result in quantifiable advantages, such as consistency in business growth, accelerated production capacity, and overall returns. Based on research from Forth & Bryson, (2021) claimed that HR directors and departments should focus on performance-focused management techniques, which would result in greater levels of productivity. On the other hand, the cause of failure in small-scale organizations like those in the SME industry could be attributed to the lack of PMM deployment (Mustapha et al., 2016). The findings of the research by Mustapha et al., (2016) revealed that it is crucial to equip SMEs with PMM information and deployment techniques to increase their management skills and improve their overall performance of the SMEs. A few other researchers shared the same findings as well (Forth & Bryson, 2021; Larsson et al., 2017). Larsson et al., (2017) did research on ways to enhance the communication of PMM for SMEs. It is believed that PMM has the potential to improve employee performance, and this ultimately improves the organization's performance. Larsson et al., (2017) conducted a case study and a survey to identify the SME organization's strengths and shortcomings in communicating PMM.

It is believed that the deployment of PMM would bring numerous benefits to the organization. Research showed that PMM may lead to improvement in the area of creativity and innovation and it creates an environment for continuous improvement (Mahmood et al., 2018; Saunila, 2017). Saunila, (2017) gathered and analyzed data from several SMEs in Finland to measure innovation concerning the size, operational and financial performance of the SME. The result of the research showed that enterprises that used various forms of innovation demonstrated better performance in terms of financial and operational than SME organizations that did not utilize innovation measures as part of their PMM metrics.

Mahmood et al., (2018) also acknowledged and emphasized the importance of PMM to foster innovation and create a culture of continual improvement in the organization. Mahmood et al., (2018) advocated that the performance levels of employees within the SME organization must be known and visible throughout the system. It is crucial for successful teamwork, ongoing improvement and innovation, and competitiveness. These insights will be very useful in identifying different approaches for improving performance outcomes and measurements in SMEs. Implementation of PMM will lead to higher productivity, innovation, and competitiveness ((Mahmood et al., 2018; Saunila, 2017)

2.5 Summary

In line with papers discovered from the literature review in another field (Nudurupati et al., 2021; Okwir et al., 2018; Pinto, 2019), this research on the SME industry is deemed necessary to explore and understand how PMM is deployed in the SME industry in the VUCA environment. The findings from this research will be able to provide future researchers and SME practitioners to reconsider and revise traditional PMM before deploying it in the VUCA environment. After all, SMEs will need to establish more flexibility and dynamic in managing the organization in the ever-changing VUCA environment.

3. Research Methodology

This research will be divided into two macro sections. The first section is the analytical study, and the second section is the empirical study. The analytical study is to go through related literature in the past 5 years in the context of PMM. This section provides SME practitioners and future researchers with a good landscape of how PMM has been adopted and evolved in various business trends and environments. The second section is the empirical study, where the author will identify several SME companies in Penang Malaysia to conduct a case study associated with the interest of this research.

3.1 The Analytical Study

In the analytical study, two data sets with different scopes will be used. The first data set to be utilized in this research will be called “Dataset 1: Comprehensive Dataset”, which was established by researchers. Scopus, which is one of the most reliable archives of commercial and scientific information, will be the data source where the analytical study is to be conducted. Research articles published in the past 5 years with the terms “Performance Measurement” appearing in the title, keywords, or abstract will be used to populate the data collection. Further to this, the following filters will be applied during the search:

- i. Language: English
- ii. Type: Article
- iii. Scopus search areas: Business Management and Accounting.

Initial findings showed that there were 1,198 articles found that were published between 2018 to 2020. Following this initial finding, the next step is to start conducting a granular analysis with bibliometric tools to find out additional details like the top article where PMM research is published, the most influential researcher, and the most cited article. This provides more insights into the focus of the PMM body of knowledge in recent years. With this background understanding as the foundation, the focus will be shifting to articles related to the SME industry. It was found that 43 out of the 1,198 articles were studies with a focus on the SME industry. Reviewing these 43 articles is believed to be able to further strengthen the empirical study to be conducted in the second section of this research.

3.2 The Empirical Study

To understand and evaluate the impact of changes to the SME business in the VUCA world today on the implementation of PMM, an empirical study must be conducted. A case study was determined to be conducted as it involves more than just observation and interviews. A case study usually has one single sample. The author chose to undertake a multi-case study with three to four distinct cases to represent a wide spread of industries in Penang Malaysia.

It is important that the SME companies to be selected for the case study have well-developed PMM processes in place. These selected companies should meet the criteria to represent a diversity of manufacturing contexts in Penang, including industry, size, and operating environments. For the sake of reliability and data generalization of this research, companies of the same size and serving the same industry will not be selected. At this point, the case study companies will be selected based on:

- i. Size or headcount: small, medium, or large.
- ii. Nature of business: engineering, medical, food technology, etc.
- iii. Industry: Manufacturing or service.
- iv. Years of implementing PMM: 3 years and above.
- v. Environment: stable, changing, or turbulent.

There are 3 categories defined under criteria number 5 (Pathak, 2010). A stable environment has no unexpected changes, and it is highly predictable, whereas a changing environment has gradual change, but it is still predictable. Lastly, a turbulent environment is one in which change occurs quickly and it happens without expectation. In the unprecedented environment today, it is almost impossible to find a perfectly stable environment. Therefore, this research will omit stable environments but focus on changing and turbulent environments. Up to four SME companies in Penang will be selected based on this combination of criteria outlined above for this research. The background of each selected company with justifications will be provided in a separate section in the final report of this research.

Ideally, this research should be conducted across a span of 3 years or more to observe the interconnection between business trends and PMM. But this may not be practical due to the length of the study and observations. Hence, this research may be conducted as cross-sectional research for a period of 18 months, with the key stakeholders from the chosen organizations participating. To ensure this research captures a broad spectrum of inputs, these stakeholders are among those in the management role, leaders in the middle management group, and employees in the organization. They must have worked in the organization for at least 3 years to be able to empathize with the situation clearly and contribute constructively to this research.

3.3 Potential Case Study Questions

The research questions for this case study comprise both quantitative and qualitative questions. Overall, the questions are designed to address the substance of this case study. These are some of the general questions:

- i. What improvements in PMM are required for SMEs to account for emerging technologies in the Industry 4.0 era like the Internet of Things, Cloud-based Computing, Smart Manufacturing, Digitization, etc.?
- ii. What are the key measures and indexes in the SME to cultivate an innovative thinking process in this new yet challenging environment?
- iii. How is the management measure value-added ideas, momentum, and synergy created to lead the organization to thrive through the environment?
- iv. More and more outsourcing activities are happening. How does SME cope with the trend in terms of managing the deliverables of the supplier?
- v. Is lean management the way to go when the market is facing uncertainty? What are the procedures or approaches conducted by the management to keep the SME organization savvy?
- vi. Is there any emerging philosophy other than PMM in measuring and managing the organization?
- vii. In the era of Industry 4.0, how do SME organizations develop leadership and practice adaptability to lead the company to achieve economic sustainability?
- viii. How are employees motivated to fulfill the company goal in this challenging environment?
- ix. Is there a way to reduce the chances of making poor-quality management decisions with the aid of big data analytics in Industry 4.0 for the SME industry?

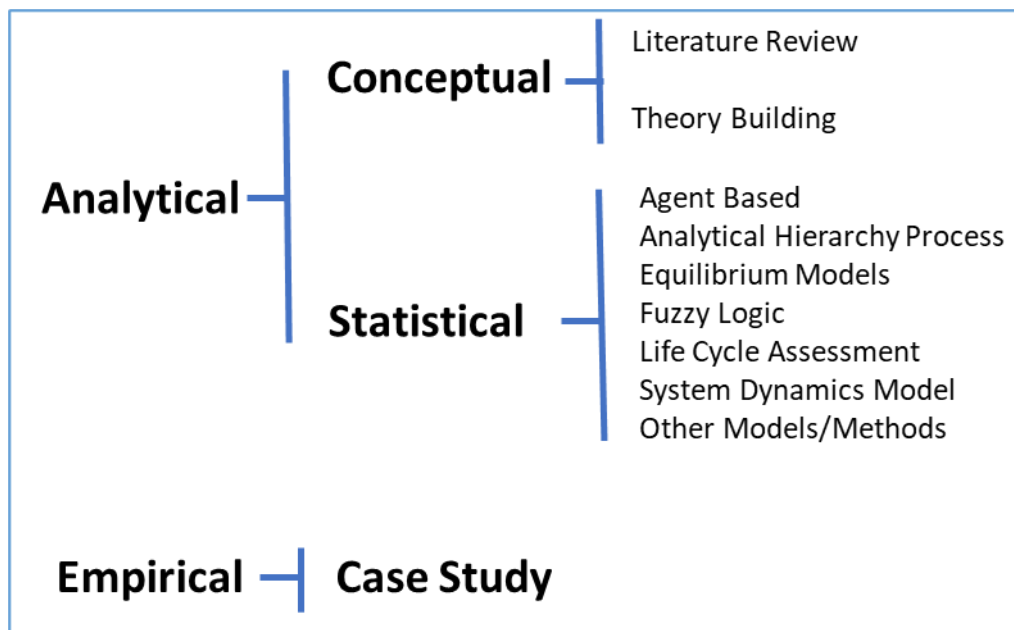


Figure 1: A proposed framework is to be used in this research.

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