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Research Article

The Influence Of Agriculture Industry Characteristics Towards Management Accounting Practices (Maps)

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ARTICLE INFO | **ABSTRACT**

The agriculture industry in Malaysia holds a pivotal position, contributing significantly to the nation's GDP and serving as a fundamental source of sustenance through food production. This study explores the influence of the distinctive characteristics of the agriculture industry (perishability of the products, technological advancements, timing in handling the produce, vulnerability, and mechanization); which set it apart from other industries; on the several levels of Management Accounting Practices's (MAPs) adoption (i.e. for Cost Determination and Financial Control, Provision Of Information for Management Planning and Control, Reduction of Waste in Business Resources and; Creating value through the efficient use of resources) in their organizations. Using descriptive analysis and mean rank comparison, data from 129 agricultural companies are analysed to uncover insights into the relationship between industry characteristics and MAPs adoption. The findings reveal several significant correlations: 1) a positive correlation between the perishability of agricultural products and MAPs adoption; 2) a positive relationship between technology use in agriculture and MAPs adoption; 3) a positive relationship between the vulnerability of agricultural products and MAPs adoption; 4) a positive relationship between timing in handling agricultural products and MAPs adoption; 5) a positive relationship between mechanization in agriculture and MAPs adoption. Furthermore, it is observed that 6) agriculture companies dealing with perishable products, 7) high-tech companies, 8) companies dealing with vulnerable products, 9) companies requiring prompt handling, and 10) highly mechanized companies, tend to implement more advanced management accounting practices. These findings provide valuable insights into how agriculture companies utilize MAPs to optimize profitability, minimize losses, and facilitate effective decision-making, thereby contributing to the sustainable development of the agriculture industry in Malaysia. The study recommends that Malaysian agricultural firms tailor their MAPs to address the unique challenges and requirements of the industry. Continuous monitoring and evaluation of MAPs effectiveness are also emphasized to ensure sustained efficiency and competitiveness.

Keywords: accounting practices, agriculture industry, competitiveness, decision-making, industry characteristics, Management Accounting Practices (MAPs), profitability

1. INTRODUCTION

The realm of business competitiveness is ever evolving, necessitating the adoption of effective Management Accounting Practices (MAPs) in the pursuit of profit maximization and cost minimization (Rozlan & Hashim, 2018). In this dynamic landscape, information stands as a cornerstone of informed decision-making (Sunarni, 2014). MAPs: defined as a comprehensive process encompassing information identification, measurement, accumulation, analysis, and communication used for management planning and control (IMA, 1981); play a pivotal role in shaping business strategies.

The transformation of MAPs from a predominantly financial-centric approach to a fusion of financial and non-financial tools (Ahmad, 2017) has further underscored their significance as primary information systems facilitating efficient processing and decision-making (Reid & Smith, 2000; Nandan, 2010; Lucas et al., 2013). This evolution has made it increasingly imperative to explore how these practices adapt to various industries, which is the particular focus of this paper, i.e. the agriculture industry.

The agriculture industry holds a unique position in Malaysia's economic landscape, contributing a substantial 7.1% (RM101.5 billion) to the country's Gross Domestic Product (GDP) in the year 2022, and playing a pivotal role in ensuring a robust national food supply (Blandford, 2011) while its international agricultural trade reached $61.3 billion in 2022 with exports of $37.4 billion and imports of $23.9 billion (USDA, 2022). This industry comprises diverse sub-industries, including crops, livestock, fishery, forestry, and logging, each characterized by its distinct challenges (Girdžiūtė, 2012). The agriculture industry not only supports economic growth but also plays a crucial role in sustaining the nation's growing population and economic stability (Dethier & Effenberger, 2011).

Amidst this backdrop, the research delves into the intricate relationship between the characteristics of the agriculture industry and the adoption and effectiveness of MAPs. It is acknowledged that the agriculture industry's unique attributes, including the inherent risks associated with natural processes, differentiate it from other industries. Additionally, the handling and transportation of agricultural goods are instrumental in maintaining consistent quality and minimizing post-harvest losses, further distinguishing the industry from the manufacturing industrial domains. The industry's inherent risks, stemming from unpredictable environmental factors, necessitate comprehensive planning, continuous financial monitoring, and risk management (Zarda, 2009).

While much of the MAP literature has centred on manufacturing businesses due to their operational complexities (Al-Dhubaibi et al, 2015), other industries, such as healthcare and hospitality, have also been explored due to their distinct MAP requirements (Cylus et al., 2016; Hussey et al., 2009; Pavlatos & Paggios, 2009). The agriculture industry though possesses unique characteristics that necessitate specialized accounting practices, it is still an under-researched context with regard to its MAPs. Globally, traditional MAPs remain prevalent in the agriculture industry, with limited adoption of more advanced practices (Ahmad, 2012). Given these distinct attributes of the industry, the study aims to uncover how agriculture industry characteristics impact MAPs, offering valuable insights into industry-specific accounting practices within this unique context.

In summary, this research addresses the vital need to understand how the unique characteristics of the agriculture industry, including its inherent risks and dependence on natural processes, influence the effectiveness of MAPs. By shedding light on this relationship, the study contributes to the development of tailored management accounting practices that can enhance the competitiveness and sustainability of the agriculture industry in Malaysia.

2. LITERATURE REVIEW

Management Accounting Practices (MAPs) play a fundamental role in organizational decision-making and strategic processes. MAPs encompass the identification, measurement, accumulation, analysis, preparation, interpretation, and communication of information that supports managerial functions (Horngren et al., 2007). These practices offer valuable insights for effective decision-making (Alleyne & Weekes-Marshall, 2011). MAPs encompass five primary categories i.e. costing systems, budgeting, performance evaluation, decision-making, and strategic analysis (Abdul-Kader & Luther, 2008). Costing systems provide pricing and production choice information (Bromwich & Hong, 1999), while budgeting involves monetary planning and financial statement management (Sulaymonov, 2018). Performance evaluation assesses profitability and effectiveness across various levels (Caplan, 2006), while decision-making relies on MAPs to simplify complex information for managerial use (Reddi, 2023). Strategic analysis involves financial information interpretation and competitive market assessment (Alnoor et al, 2023).

The significance of MAPs in organizations is substantial, with their primary goal being to aid in planning, monitoring, and decision-making (Horngren et al., 2007; Bhimani, 2002). They are a vital component of management, supporting policies, decision-making, resource optimization, and asset security, among others (Briciu & Căpuşneanu, 2011). Furthermore, MAPs serve as the primary information system for efficient data processing, helping organizations adapt to changes and improve performance (Reid & Smith, 2000; Nandan, 2010; Lucas et al., 2013). MAPs also assist in sourcing inputs efficiently and minimizing waste within production operations (Rufino, 2014), while facilitating future decision-making through budgeting and project evaluation (Stefanou & Athanasaki, 2012). They are integral to a company's competitiveness and can significantly impact its success (Gichaaga, 2014; Tuan et al., 2022).

Literature on MAPs has argued that the MAPs shape and are reshaped by the environment in which they operate (Chapman et al., 2009; Chenhall 2012; Emsley, 2008; Abdel-Kader and Luther, 2008). Among others, research has looked at the interrelations among actors within the context (Ndemewah & Hiebl, 2022), the technological advances (Knudsen, 2020), culture - organisational and national culture (Choiriah & Sudibyo, 2020) and others. One of the important contextual factors that has been called several times for an in-depth examination to better understand the MAPs is the industrial context i.e. the core organisational characteristics of a particular industry and its specific industrial factors affiliated to it (Van der Stede, 2011; Gooneratne and Hoque, 2013; Messner, 2016). However, so far, only a handful of research papers in the MAPs literature explicitly discuss their empirical findings with regard to the industrial specifics' characteristics (Nama & Lowe, 2014; Dambrin and Robson, 2011). Therefore, since MAPs play an important role in the process of decision-making at the organisational level (strategic and otherwise) and the development of control at the industrial level, deliberate consideration of industry specifics is needed to understand and better explain the commonalities and differences in the MAPs of specific industry and its organizations.

Looking at the uniqueness and expansion of the agriculture industry which involves all kinds of sub-industries and activities throughout the supply chain, it is surprising that only limited research has investigated its MAPs (Jack, 2005; Jayasinghe & Thomas, 2009. And those that have been mentioned have studied the MAPs in this industry, either examined the overall historical context of the industry and its effects on the MAPs (Jack, 2005; Jayasinghe & Thomas, 2009), or only emphasis on the interactions of the actors within a context (Ahrens & Chapman, 2002, 2007). None or very little discussion was made directly to the MAPs and their industry-specific factors that correlate to the agriculture industry.

This research aims to investigate the relationship between the specific agriculture industry characteristics and the MAPs. The agriculture industry in Malaysia is one of the oldest industries in the country that has started to develop even before its independence. It has evolved over the years in terms of the sub-industries' variation, as well as the expansion throughout the supply chain of the agriculture industry itself. In Malaysia, the more traditional agriculture industries are the oil palm, rubber, cocoa, and paddy. Recently, the government has put more emphasis on the new sub-industries that have been identified to be of higher value such as swiftlet birds' nests, aquaculture, and herbs and spices. Besides the horizontal expansion, the agriculture industry also has seen the development of its value and supply chain of the many other sub-industries. The agriculture activities in the country not only focus on producing agricultural products but have also expanded in the upstream and downstream activities from producing inputs for agricultural production to producing food and beverages to be sold to customers. Given the unique nature of the agriculture industry, this research will explore the agricultural industry characteristics which include the perishability of agricultural products, advanced technology adoption, vulnerability to diseases, timeliness in handling products, and mechanization and its relationship to MAPs.

Perishability Of Agricultural Products

A significant distinction between the agriculture industry and manufacturing or services lies in the perishable nature of agricultural produce, requiring special care and monitoring (Behzadi et al., 2017). Proper handling, including storage and inventory control, is crucial, as any delay in transportation can result in significant brand value loss. Livestock and crop products fall into either perishable or long-life categories, encompassing items like fruits, vegetables, and meat (Behzadi et al., 2017). Perishable crops are further classified as respiratory or non-respiratory, and livestock products as fresh, chilled, or frozen. Decision-making for seasonal perishable agricultural products involves optimizing procurement and inventory recovery quantities, considering storage costs, future prices, demands, and commodity degradation (Liu et al., 2018). The perishability of products significantly influences organizational decision-making, affecting storage and inventory practices (Feng et al., 2017). Studies have been conducted to examine the evolving risk management strategies and insurance strategies in agriculture, with a particular emphasis on the adaptation of MAPs to mitigate risks associated with perishable items in the industry (Smith & Patel, 2022). Nguyen and Tran (2024) examine the significance of punctuality in agricultural supply chains and its influence on decision-making, emphasising the need for management accounting methods in handling perishable agricultural goods. Stage 1 of MAPs highlights the critical clearance of first-in stocks in physically controlling perishable inventory, with some agriculture companies adopting a first-in-first-out inventory approach. The perishability of products aligns with the usage of MAPs by agriculture companies.

Advanced Technology Adoption

Agricultural technology, emphasized by Ostaev et al. (2020) is a key driver of growth in the agricultural industry. National policies promoting a shift away from unskilled foreign labour incentivize the adoption of capital-intensive and management-intensive agricultural technologies, particularly in engineering and mechanization. The primary objective of incorporating advanced technology in agriculture is to boost productivity and ensure ample food production. Truong (2008) underscores the importance of aligning the implementation of technology with farmers' financial capacity. In the third stage of Management Accounting Practices (MAPs), IFAC (1998) notes that the latest technology enhances product quality and reduces costs. Advanced technology assesses the impact of innovation on fixed and variable costs, categorizing cost-effective technologies based on their effect on production inputs. The frequent utilization of MAPs, including modern practices like ABC and non-financial metrics, is anticipated to correlate with increased technology acceptance.

Abdel-Kader and Luther (2008) further establish a significant relationship between advanced production technology and MAPs, revealing that differences in management accounting sophistication are explained by production technology. Ahmad (2012) explores this correlation in SMEs, identifying a significant link between advanced technology and specific MAPs such as costing and performance evaluation. The study conducted by Wang and Li (2023) investigates the correlation between technology utilisation and performance assessment in the agricultural industry. Additionally, these studies shed light on the significance of management accounting procedures in maximising the effectiveness of modern agricultural technology.

Vulnerability To Diseases

The vulnerability in agricultural products refers to their susceptibility to various risks and threats that can negatively impact their production, quality, and availability. This vulnerability is a significant concern in managing plant and animal health, given the historical documentation of pathogenic microorganisms impacting hosts (Staskawicz et al., 2001). Philomena (2019) highlights the challenges in plant disease management, affecting various growth stages and the national agricultural economy. Risk management decisions by farmers, farm associations, and governments rely on subjective risk assessments, risk behaviour, and adaptive capacity to vulnerabilities (Chuku & Okoye, 2009). Vulnerability, integral to risk, encompasses the possibility of danger, loss, injury, or negative impacts (Crane et al., 2017). Risk management in agriculture involves practices like budgeting, cost-volume-profit analysis, and discounted cash flow. Effective Management Accounting Practices (MAPs) are crucial for agriculture businesses, aiding in managing production costs, assessing productivity, and collecting accurate information for decision-making (Doğan et al., 2013). Agriculture companies grappling with high vulnerability levels particularly benefit from well-designed MAPs.

Time In Handling Products

In agriculture, the timely handling of products distinguishes the industry from others, significantly impacting productivity. Delays in farm operations can lead to increased costs, reduced output, impact on farm productivity, and declining agricultural profits owing to low sales revenues (Nchanji et al., 2021). In aquaculture, timing is crucial for fish feeding, with specific periods like afternoon or evening recommended based on oxygen requirements (Hussan et al., 2016). Similarly, horticultural goods, being highly perishable, require precise timing in post-harvest handling to avoid significant losses (Antunes et al., 2007). Benchmarking in the agriculture industry is a valuable management accounting practice, especially since farmers often work closely with output, impacting decision-making and control in production timeliness within Management Accounting Practices (MAPs). This is supported by Sharma, Kamble, and Gunasekaran (2018) where they discussed the GIS analytics framework for agricultural supply chains, emphasizing the need for precision agriculture to overcome challenges in the current agricultural systems. They analyse the ways in which sophisticated MAPs enable the monitoring, tracking, and making of decisions in real time, thereby assuring the effective management of perishable goods. The importance of timeliness emerges as a significant factor influencing Management Accounting Practices (MAPs) in agriculture, impacting decision-making and overall control within agricultural companies.

Mechanization

The agricultural industry stands out for its widespread mechanization, offering opportunities in production, post-harvest management, and rural living (Alam, 2006). Mechanization is crucial for cost reduction, increased farm efficiency, and improved crop productivity (Benin, 2015; Kienzle et al., 2014; Pingali, 2007; Sims and Kienzle, 2006). Mehta et al. (2019) emphasize the societal impact, linking mechanized farming to improved living conditions for farmers. Goyal et al. (2014) stress the importance of mechanization in timely farm operations, cost reduction, and optimizing input productivity. Research by Yusuf et al., (2007) and Chen & Liu (2023) explores the relationship between mechanization and the third stage of management accounting practices related to Total Quality Management (TQM) in agriculture, emphasizing the role of TQM in improving productivity and quality. In summary, mechanization in agriculture extends beyond operational efficiency, influencing broader management strategies and accounting practices.

In conclusion, understanding the interplay between agricultural industry characteristics and MAPs is crucial for optimizing management practices in the agriculture industry. The perishability, technology adoption, vulnerability, timeliness, and mechanization aspects shape how MAPs are implemented and utilized in this unique industry, affecting decision-making, risk management, and overall efficiency. Further research in this area can provide valuable insights into enhancing MAPs tailored to the specific needs of the agriculture industry.

Research Framework

A theoretical framework is constructed to examine the perishability, advanced technology used, vulnerability, time in handling, and mechanization on management accounting practices in Malaysian agricultural goods or firms. The research examines these relationships through hypotheses H1 to H10 as follows as indicated in Figure 1:-

H1: There is a positive relationship between the perishability of agricultural products and the adoption of management accounting practices.

H2: There is a positive relationship between the technology used in the agricultural industry and the adoption of management accounting practices.

H3: There is a positive relationship between the vulnerability of agricultural products and the adoption of management accounting practices.
H4: There is a positive relationship between timing in handling agricultural products and the adoption of management accounting practices.
H5: There is a positive relationship between mechanization in agriculture and the adoption of management accounting practices.
H6: Agriculture companies dealing with perishable products implement more advanced management accounting practices.
H7: High-tech companies utilize more advanced management accounting practices.
H8: Companies dealing with vulnerable products implement more sophisticated management accounting practices.
H9: Companies dealing with agricultural goods requiring prompt handling utilize more advanced management accounting practices.
H10: Highly mechanized companies tend to utilize more advanced management accounting practices.

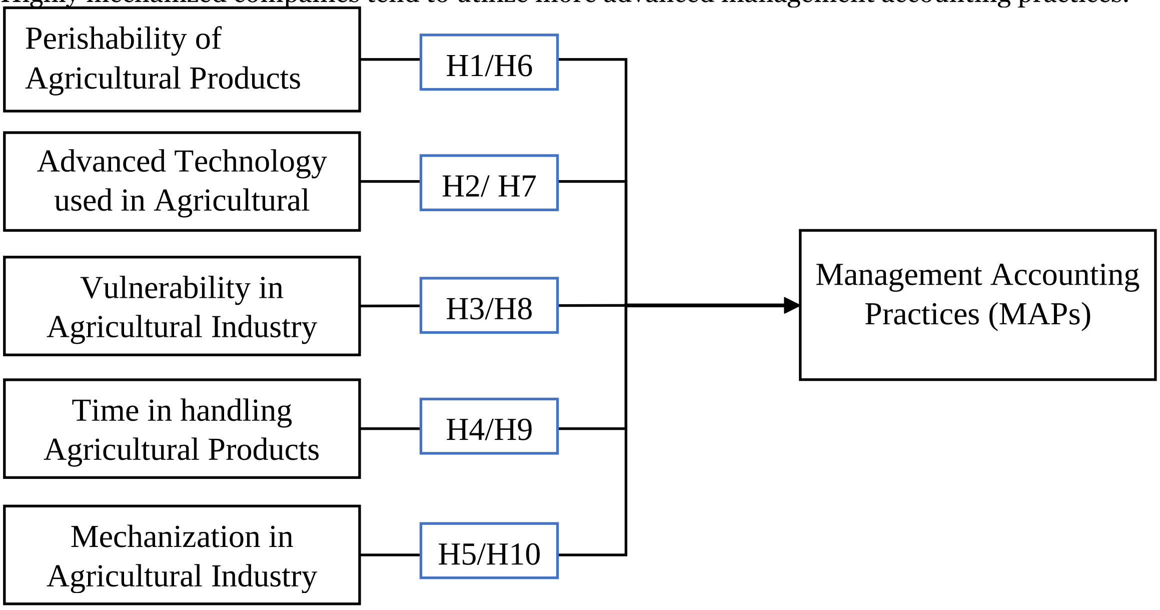

Figure 1. Theoretical Framework modified from Abdul-Kader and Luther (2008), Amara and Benelifa (2017), Nair and Nian (2017), Shahzadi, Khan and Toor (2018)

3. RESEARCH METHODOLOGY

This study adopts a purposive sampling method, which involves selecting individuals or groups with expertise, experience, availability, willingness to participate, and the ability to articulate their experiences and opinions related to the subject of interest (Etikan et al., 2015). In this research, a total of 129 agricultural companies with knowledge of Management Accounting Practices (MAPs) were purposively selected. Primary data is collected for this study where questionnaires were distributed to selected agricultural companies from September to November 2020 via face-to-face interactions and email. The use of email facilitated data collection when physical interactions were restricted.
The questionnaire used in this study consists of three sections:

- Section 1 - Demographics: This section collects demographic information about agricultural companies. It includes nominal and ordinal measures to identify company profiles. Example inquiries encompass duration of operation, industry categorization, hierarchical position within the company, headcount of full-time staff, annual revenue bracket, and geographical whereabouts of the enterprise.
- Section 2 - Agriculture Industry Characteristics: This section comprises eight questions categorized into sub-sections that assess various characteristics of the agriculture industry. These characteristics include perishability, technology usage, vulnerability, timeliness, and mechanization. Respondents in this study are asked to indicate their level of agreement on a scale of one to six, ranging from (1) strongly disagree to (6) strongly agree.
- Section 3 - Management Accounting Practices (MAPs): The third section assesses the usage of MAPs based on the stages defined by the International Federation of Accountants (IFAC, 1998), adapted from Abdul-Kader and Luther (2008). Stage 1 is on Cost Determination and Financial Control (CDFC), Stage 2 is Provision Of Information for Management Planning and Control (IPC), Stage 3 is related to the Reduction of Waste in Business Resources (RWR), and on Reduction of Waste In Business Resources (RWR). Respondents are required to indicate their level of agreement with statements using a Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree).

4. RESULT AND FINDINGS

Descriptive Analysis of Company Background Profile

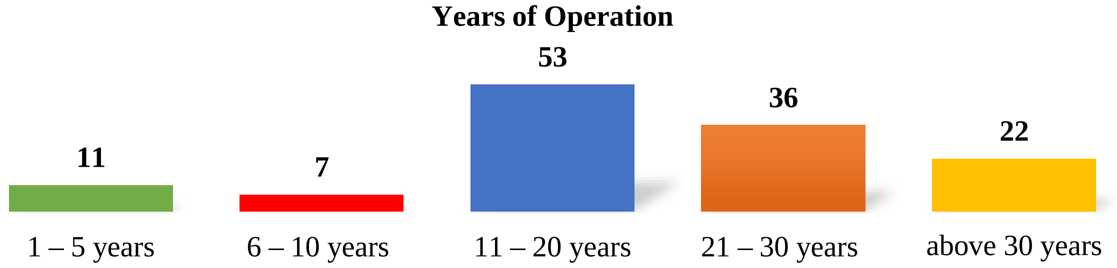

Figure 2. Years of Operation

The duration of operation in Figure 2 indicates that 129 agricultural firms were examined in this study. Out of the total, 11 companies (or 8.53%) had been operating for 1 to 5 years, 7 (or 5.43%) for 6 to 10 years, 53 (or 41.09%) for 11 to 20 years, 36 (or 27.91%) for 20 to 30 years, and 22 (or 17.05%) above 30 years. Years of operation between 11 and 20 are most prevalent.

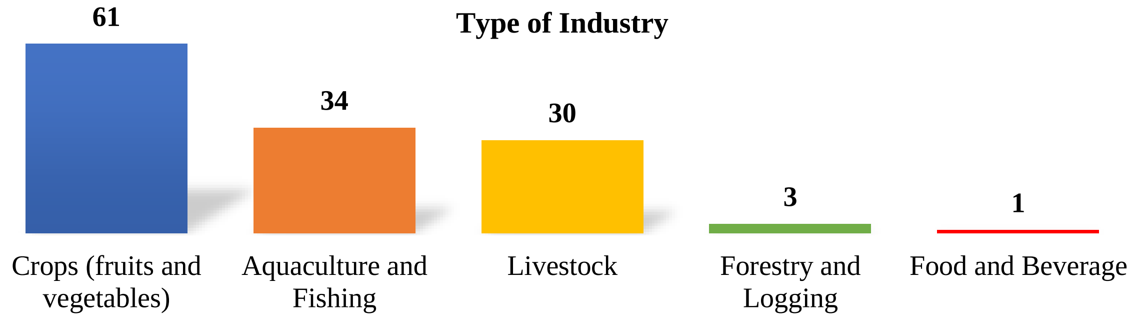

Figure 3. Type of Industry

As for the type of industry in Figure 3, out of 129 agriculture companies, 46.29% were involved in the crops (fruits and vegetables) industry, 26.36% were in the aquaculture and fishing industry, 23.26% were in the livestock industry, 2.33 percent were in the forestry and logging industry, and the lowest of the lot, 0.78%, was in the others category, which was the food and beverage industry.

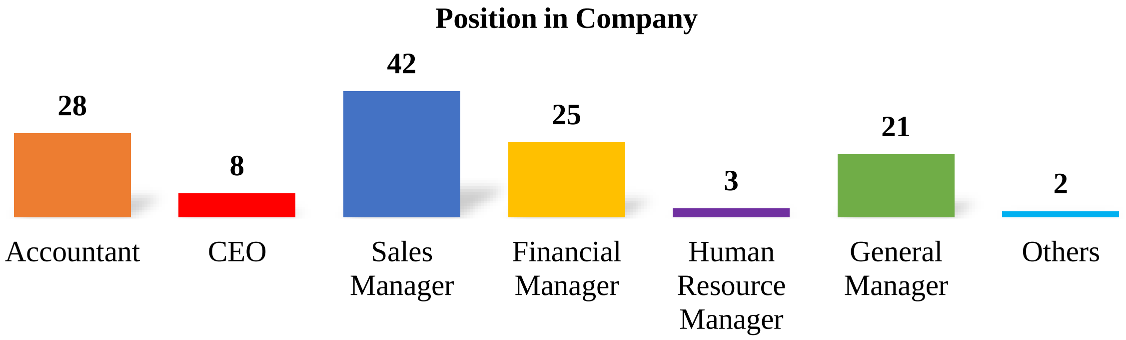

Figure 4. Position in Company

Figure 4 displays that 22% of those who answered were accountants (28 respondents), 6% were CEOs (8 respondents), 32.56% were sales managers (42 respondents), 19.38% were financial managers (25 respondents), 2.33% were human resource managers (three respondents), 16.28% were general managers (21 respondents), and finally, 1.55% were executives (two respondents).

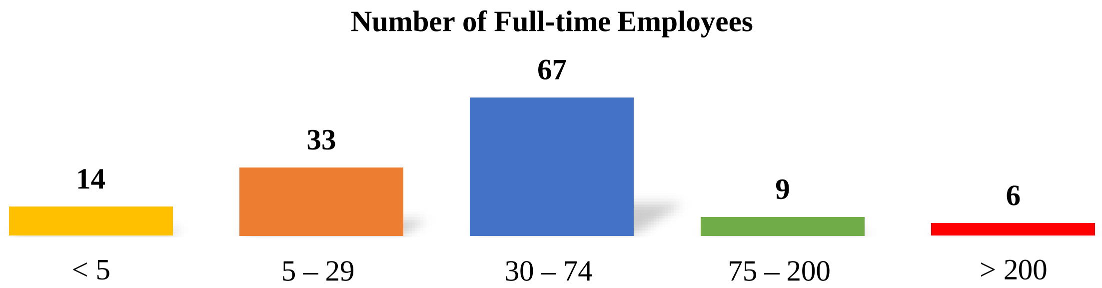

Figure 5. Number of Full-time Employees

For the number of full-time employees in Figure 5, 10.85% of 14 of the agriculture companies have fewer than 5 employees, 25.58% of 33 respondents have 5–29 employees, 51.94% of 67 have 30–74 employees, 6.98% of 9 have 75–200 employees, and 4.65% of 6 have more than 200.

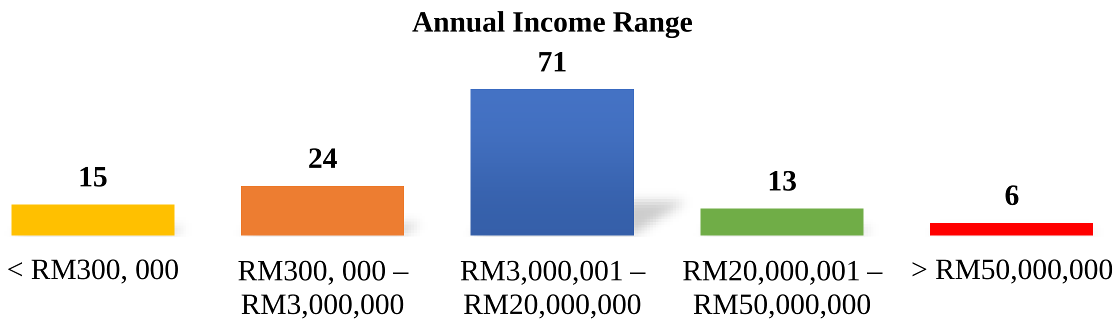

Figure 6. Annual Income Range

In terms of annual income as shown in Figure 6, among the 129 respondents, 11.63% make less than RM300,000 a year, 18.60% make between RM300,001 and RM3,000,000, 55.04% (71 respondents) make between RM3,000,000 and RM20,000,000, 10.08% (13 respondents) make between RM20,000,001 and RM50,000,000, and finally, only 4.65% (6 respondents) make more than RM50,000,000 a year.

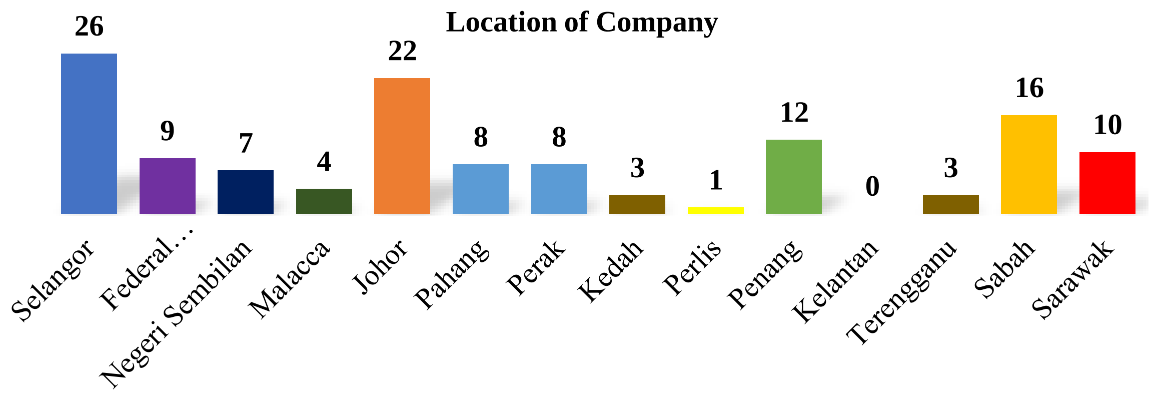

Figure 7. Location of the Company

As stated in Figure 7, the survey was collected throughout the 14 states in Malaysia. In terms of the location of respondents, 20.16% (26 companies) were located in Selangor, 6.98% (9) in the Federal Territory (Kuala Lumpur, Putrajaya, or Labuan), 5.43% (7) in Negeri Sembilan, 3.10% (4) in Malacca, 17.05% (22) in Johor, 6.20% (8) in Pahang and Perak, 2.33% (3) in Kedah and Terengganu, 0.78% (1) in Perlis, 9.30% (12 companies), 12.40% (16 companies) in Sabah, and 7.75% (10 companies) in Sarawak.

Table 1: Descriptive Analysis of Industry-Specific Traits of Respondents

Variable	N	Mean	Std. Dev.	Min.	Max.	Alpha
The Perishability of Agricultural Products	129	5.3663	1.08941	1.25	6	0.935
Technology used in the agricultural industry	129	5.2742	1.13806	1	6	0.971
Vulnerability in the agricultural industry	129	5.4971	0.90104	1	6	0.964
Timing in handling agricultural products	129	5.6444	0.66703	2.25	6	0.943
Mechanization in the agricultural industry	129	5.2481	1.18503	1	6	0.982

Table 1 on descriptive analysis of industry-specific traits of respondents shows that the mean values indicate that these industry-specific traits play a significant role in the respondent's day-to-day business activities. With mean scores ranging from 5.2481 to 5.6444, it is evident that respondents generally recognize the influence of these characteristics. The standard deviation values suggest that responses are closely clustered around the mean, indicating a degree of consensus among participants regarding the impact of agriculture industry characteristics. The low standard deviations, ranging from 0.66703 to 1.18503, highlight the limited variability in responses. The minimum and maximum values illustrate the range of responses, showcasing the diversity of opinions among surveyed agricultural companies. Despite this diversity, the minimum values for all variables are relatively close to the maximum score of 6, indicating unanimous acknowledgement of the significance of these characteristics. Lastly, the high alpha coefficients, ranging from 0.935 to 0.982, demonstrate the questionnaire's internal consistency and reliability, reinforcing the robustness of the descriptive analysis.

Agricultural Industry Characteristics

The Factor Analysis result of this study reveals nine extracted factors. Each factor includes various items, eigenvalues, the percentage of variance, and the cumulative percentage of variance, with a cutoff factor loading of 0.5 and above. The first factor, perishability, encompasses seven items. One item is excluded due to a factor loading below 0.5. Perishability accounts for 53.999% variance, with the highest loading item being 'Our product is generally refrigerated or frozen,' at 0.805, emphasizing the need for proper storage in agriculture companies. The second factor, advanced technology production, involves eight items, all with factor loadings above 0.5. Advanced production technology contributes to a 10.775% variance, emphasizing increased productivity in agriculture companies through technology use. The third factor, vulnerability, includes eight items, all with factor loadings above 0.5, accounting for a 7.996% variance. It highlights the potential productivity loss in agriculture products prone to diseases. The time of handling, as the fourth factor, consists of eight items, with three items excluded. The time of handling contributes to a 2.950% variance, emphasizing the impact of proper timing on product freshness. Mechanization, the fifth factor, involves eight items with factor loadings above 0.5, contributing to 2.515% variance. Mechanization enhances production productivity in agriculture companies.

The factor analysis conducted in this study has identified four critical stages within management accounting practices that significantly impact operational efficiency and resource management in business settings. Each stage, namely Cost determination and financial control (CDFC), Provision of information for management planning and control (IPC), and two instances focusing on the Reduction of waste in business resources (RWR), showcases distinct aspects of management accounting with specific items maintaining factor loadings above the 0.5 threshold, indicating their relevance and impact.

Stage 1 (CDFC) emphasizes the importance of evaluating major capital investments, highlighting the role of payback period and accounting rate of return as crucial determinants. This stage, accounting for a 2.082 percent variance with an eigenvalue of 1.437, underscores the significance of strategic financial planning and control in enhancing business sustainability and growth.

Stage 2 (IPC) focuses on the pivotal role of non-financial measures related to operations in management planning and control, reflecting a 1.984 percent variance and an eigenvalue of 1.369. This suggests that performance evaluation extends beyond financial metrics, incorporating operational efficiency and effectiveness as key indicators of success.

Stage 3 (RWR), with a variance of 1.640 percent and eigenvalues of 1.132, stresses the reduction of waste in business resources, where 'Cost of quality' emerges as a significant factor. This indicates the critical need for businesses to implement quality management practices that minimize waste and enhance value creation.

Lastly, the additional focus on RWR with a variance of 1.460 percent and an eigenvalue of 1.007, particularly on 'Target costing' and 'Product life cycle analysis', highlights the importance of strategic cost management and product development planning in achieving competitive advantage and sustainability.

The factor analysis above has identified nine key factors that significantly influence agricultural productivity and management accounting practices, with a focus on enhancing efficiency and sustainability in agriculture companies. In terms of management accounting practices, the study outlines four critical stages. It points out the importance of combining financial oversight, making operations more efficient, improving quality, and managing costs strategically. This comprehensive analysis provides valuable insights into the multifaceted aspects of agricultural production and financial management, offering a roadmap for agriculture companies to optimize their operations and strategic planning efforts.

Reliability Test

Table 2. Reliability Test

Variables	Items	Cronbach Alpha
Perishability	8	0.971
Technology	8	0.964
Vulnerability	8	0.943
Timing of Handling	8	0.949
Mechanization	8	0.982

MAPs Stage 1	5	0.953
MAPs Stage 2	10	0.97
MAPs Stage 3	7	0.956
MAPs Stage 4	14	0.948

The reliability of the questionnaire items was assessed using Cronbach's Alpha, a commonly employed measure of internal consistency (Bedford & Speklé, 2018) as shown in Table 2. Cronbach's Alpha evaluates the reliability and consistency of each variable within the questionnaire, indicating whether the questions are reliable measures. A Cronbach's Alpha coefficient above 0.60 is generally accepted as demonstrating reliability. The analysis included nine factors, each with its respective number of items: perishability (7 items), vulnerability (8 items), technology (8 items), vulnerability (8 items), time of handling (5 items), mechanization (8 items), MAPs Stage 1 (5 items), MAPs Stage 2 (10 items), MAPs Stage 3 (7 items), and MAPs Stage 4 (11 items), totalling 69 items. The results, as presented in Table 2, indicate that all variables in the questionnaire exhibited reliability, with Cronbach's Alpha coefficients exceeding the threshold of 0.60."

Practices Analysis

Table 3. Hierarchical Practices Analysis

	Clusters[a]			**F-test**	**P**
	1 (n=10)	**2 (n=81)**	**3 (n=38)**		
Stage 1: Cost determination and financial control (CDFC)	3.8556 -0.45258	2.42 -0.76274	4.9542 -0.13371	340.784	0
Stage 2: Provision of information for management planning and control (IPC)	3.7972 -0.36838	2.22 -0.72999	4.9072 -0.19493	407.731	0
Stage 3: Reduction of waste in business resources (RWR)	3.7063 -0.3967	2.6286 -0.70695	4.938 -0.17309	367.494	0
Stage 4: Creating value through the efficient use of resources (CV)	3.7659 -0.4068	2.0643 -0.57484	4.704 -0.38077	223.559	0
Labels attributed	97.20% Level 2 Moderate	100% Level 3 Least complicated	98.80% Level 1 Most complicated		

Note: Values reported above are the mean of variables within clusters (standard deviation).

The result of the Hierarchical Cluster Analysis in Table 3, which classified 129 agricultural companies into three distinct clusters based on their Management Accounting Practices (MAPs) application across four stages, indicates a significant differentiation in how these companies prioritize and implement MAPs. Stage 1 (Cost determination and financial control - CDFC), Stage 2 (Provision of information for management planning and control - IPC), Stage 3 (Reduction of waste in business resources - RWR), and Stage 4 (Creating value through the efficient use of resources - CV). The high accuracy rate of 95.5% in correctly classifying firms into their respective clusters through multiple discriminant analyses underscores the reliability of the clustering. Specifically, 97.2%, 100%, and 98.8% of companies were accurately classified into Clusters Level 1, Level 2, and Level 3, respectively.

The mean scores of the variables for each cluster reveal that 10 agricultural companies (7.75%) belong to Level 2, 81 companies (62.79%) fall into Level 3, and 38 companies (29.46%) are categorized under Level 1 in terms of their sophistication in Management Accounting Practices (MAPs). This robust validation process confirmed the reliability of the cluster solution and provided valuable insights into the varying emphases on different MAPs stages within each cluster.

Table 4. Relationships Between Agriculture Characteristics and MAPs

Variables	**T-Statistic**	**Significant**	**Decision**
Perishability of agricultural products	29.737	0.00	Significant
Advanced technology adaptation	39.327	0.00	Significant
Vulnerability in the agricultural industry	28.733	0.00	Significant
Timing in handling agricultural products	29.219	0.00	Significant
Mechanization in the agricultural industry	46.327	0.00	Significant

The T-statistics results in Table 4 reveal significant findings across multiple variables related to the agricultural industry as shown in Table 4. For the perishability of agricultural products, the T-statistic of 29.737 with a p-value of 0.00 indicates statistically significant relationships with MAPs. Similarly, advanced technology adaptation exhibits a T-statistic of 39.327 and a p-value of 0.00, leading to statistically significant relationships with MAPs, emphasizing the importance of technology adoption in the agricultural industry. Vulnerability in the agricultural industry, as indicated by a T-statistic of 28.733 and a p-value of 0.00, showcases a significant influence of MAPs. The timing in handling agricultural products, with a T-statistic of 29.219 and a p-value of 0.00, demonstrates a statistically significant relationship with MAPs. Finally, mechanization in the agricultural industry exhibits a statistically significant relationship with MAPs, with a T-statistic of 46.327 and a p-value of 0.00.

These findings collectively suggest that these characteristics such as perishability, technology adaptation, vulnerability, timing in handling, and mechanization are crucial factors in the agricultural industry, warranting attention and strategic considerations for effective management and decision-making.

Table 5: Agriculture Industry's Characteristics and The Different Levels of MAPs Adoption

	Level 1 (Most Complicated)	Level 2 (Moderate)	Level 3 (Least Complicated)	K-W Statistic (d.f. = 2)	Remarks
Perishability Mean rank	14.80	74.23	58.53	29.737***	Significant difference
Pairwise comparisons Level 1 (Most Complicated) Level 2 (Moderate) Level 3 (Least Complicated)		-59.435***	-43.726*** 15.708		Agriculture companies dealing with perishable products implement more advanced management accounting practices.
Technology Mean rank	17.20	78.69	48.39	39.327***	Significant difference
Pairwise comparisons Level 1 (Most Complicated) Level 2 (Moderate) Level 3 (Least Complicated)		-61.491***	-31.195** 30.297***		High-tech companies utilize more advanced management accounting practices.
Vulnerability Mean rank	18.00	74.56	57.00	28.733***	Significant difference
Pairwise comparisons Level 1 (Most Complicated) Level 2 (Moderate) Level 3 (Least Complicated)		-56.556***	-39.000** 17.556**		Companies dealing with vulnerable products implement more sophisticated management accounting practices.
Timing of Handling Mean rank	18.70	74.81	56.28	29.219***	Significant difference
Pairwise comparisons Level 1 (Most Complicated) Level 2 (Moderate) Level 3 (Least Complicated)		-56.109***	-37.576*** 18.532**		Companies dealing with agricultural goods requiring prompt handling utilize more advanced management accounting practices.
Mechanization Mean rank	10.05	79.69	48.14	46.327***	Significant difference
Pairwise comparisons Level 1 (Most Complicated) Level 2 (Moderate) Level 3 (Least Complicated)		-69.641***	-38.095*** 31.547***		Highly mechanized companies tend to utilize more advanced management accounting practices.

Agriculture product perishability

As indicated in Table 5, agricultural commodity perishability affects management accounting methods. All sample observations are ranked in the mean rank. The mean perishability rank is 29.737. A 0.05 significance level provides a 5% chance of finding a difference when there is none. The Kruskal-Wallis's test shows a perishability difference between the three groups. Pairwise analysis shows that Level 1 (Most Complicated), Level 2 (Moderate) (0.01) and Level 3 (Least Complicated) (0.000) are significantly different. However, Level 2 (Moderate) and Level 3 (Least Complicated) (0.53) are not significantly different. According to hypothesis 1, there is a positive relationship between the perishability of agricultural products and the adoption of

management accounting practices. This outcome also validates hypothesis 6, indicating that agriculture companies dealing with perishable products implement more advanced management accounting practices.
Agricultural technology
The result in Table 5 shows agricultural technology is unique and alters MAPs. The mean technology rank is 39.327. The Kruskal-Wallis test shows a technology-related significant difference between the three groups. Pairwise analysis shows that Level 1 (Most Complicated) and Level 2 (Moderate) (0.37), Level 1 and Level 3 (Least Complicated) (0.000), and Level 2 and Level 3 (0.00) are significantly different. These conclusions are supported by Abdul-Kader and Luther's (2008) empirical research. The finding supporting hypothesis 7 indicates that high-tech companies utilize more advanced management accounting practices. While also supporting hypothesis 2 that there is a positive relationship between the technology used in the agricultural industry and the adoption of management accounting practices.

Agricultural industry vulnerability
The mean rank for vulnerability is 28.733 in Table 5. The Kruskal-Wallis analysis indicates a significant discrepancy among the three groups regarding vulnerability. Further pairwise comparisons reveal noteworthy differences between Level 1 (Most Complicated) and Level 2 (Moderate) with a significance level of 0.003, between Level 1 (Most Complicated) and Level 3 (Least Complicated) with a significance level of 0.000, and between Level 2 (Moderate) and Level 3 (Least Complicated) with a significance level of 0.022. Hypothesis 3 posits that there is a positive relationship between the vulnerability of agricultural products and the adoption of management accounting practices. It is affirmed that companies dealing with vulnerable products implement more sophisticated management accounting practices, thereby validating hypothesis 8.
Agricultural product handling timing
The mean rank for timeliness is 29.219 in Table 5. Analysis via the Kruskal-Wallis test reveals a notable disparity in handling timing among the three groups. Upon pairwise examination, significant differences are observed between Level 1 (Most Complicated) and Level 2 (Moderate) with a p-value of 0.004, between Level 1 and Level 3 (Least Complicated) with a p-value of 0.000, and between Level 2 and Level 3 (Least Complicated) with a p-value of 0.013. Hypothesis 4 proposes that there is a positive relationship between timing in handling agricultural products and the adoption of management accounting practices. It also validates hypothesis 9 that companies dealing with agricultural goods requiring prompt handling utilize more advanced management accounting practices.
Agricultural mechanization
The mean rank for mechanization is 46.327. Results from the Kruskal-Wallis test in Table 5 indicate significant disparities in mechanization among the three groups. Further pairwise analysis reveals significant differences between Level 1 (Most Complicated) and Level 2 (Moderate) with a p-value of 0.008, between Level 1 and Level 3 (Least Complicated) with a p-value of 0.000, and between Level 2 and Level 3 with a p-value of 0.000. Hypothesis 5 is on a positive relationship between mechanization in agriculture and the adoption of management accounting practices is supported. The evidence also supports hypothesis 10 that highly mechanized companies tend to utilize more advanced management accounting practices.

5. DISCUSSION AND SUMMARY OF FINDINGS

The findings of this research shed light on the intricate relationship between various unique characteristics of the agriculture industry and their impact on the utilization of management accounting practices (MAPs) in Malaysia. In parallel with other industries, the agricultural businesses in Malaysia have integrated MAPs into their operations, marking their recognition of the significant role played by the MAPs. Within the context of this study, the agricultural industry's distinctive characteristics were examined as the independent variables of interest. These characteristics encompass perishability, the utilization of advanced production technology, susceptibility to various factors, the importance of timeliness, and the degree of mechanization. The research findings provide valuable insights into how the unique attributes of the agriculture industry in Malaysia shape the landscape of MAPs within this industry, underscoring the significance of adapting MAPs to suit the specific needs and challenges of agricultural businesses.
The analysis of mean ranks in this study has provided valuable insights into the relationship between the distinctive characteristics of the agriculture industry and the adoption of management accounting practices (MAPs). The findings indicate a statistically significant relationship between these variables, signifying that the unique attributes of the agriculture industry play a crucial role in shaping the utilization of MAPs within Malaysian agricultural companies. Notably, the results highlight that there is no significant difference between the various characteristics examined, namely perishability, technology usage, vulnerability, timeliness in handling, and mechanization, in relation to the implementation of MAPs. Additionally, the study discerns differences between different levels of MAPs, particularly between Level 1 and Level 2, as well as between Level 2 and Level 3. This suggests that while Malaysian agricultural firms have widely adopted fundamental management accounting practices, there may be variations in the extent to which they embrace more advanced techniques. In sum, these findings underscore the importance of tailoring management accounting practices

to the specific needs and circumstances of agricultural companies in Malaysia, taking into account their unique industry characteristics.

Recommendations

The research recommends that Malaysian agricultural companies tailor their management accounting practices (MAPs) to their specific needs and conditions. This recommendation is based on the understanding that the unique characteristics of Malaysia's agriculture industry greatly influence the adoption and utilization of MAPs within these businesses. Therefore, agricultural companies in Malaysia must prioritize the customization of MAPs to address their industry-specific challenges and requirements. This may involve evaluating their existing management accounting systems, identifying areas for enhancement or optimization, and incorporating more advanced practices where necessary. Additionally, continuous monitoring and evaluation of MAPs' effectiveness in meeting the evolving needs of agricultural businesses are essential to ensure sustained efficiency and competitiveness in the industry. In essence, aligning MAPs with the specific characteristics and demands of Malaysian agricultural companies is key to enhancing their operational efficiency, financial performance, and overall competitiveness.

6. CONCLUSION

In conclusion, this study affirms that industry characteristics exert a significant influence on management accounting practices (MAPs) within the agriculture industry. By shedding light on MAPs in an agricultural context, this research contributes valuable knowledge. Malaysia, as a developing nation, can benefit from this research by gaining insights that support efforts to enhance the performance of agricultural companies. Furthermore, this study lays a foundation for future investigations and in-depth analyses of MAPs among agricultural firms in Malaysia. It underscores the specific MAPs employed in the agriculture industry and highlights the substantial impact of industry characteristics on these practices, reinforcing the relationship between agriculture industry dynamics and effective management accounting practices.

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APPENDIX

Section 1: Socio-Demographic

1. Years of Operation (Year)

a.	1 - 5 years
b.	6 - 10 years
c.	11 - 20 years
d.	21 - 30 years
e.	Above 30 years

2. Type of Industry

a.	Crops (fruits, vegetables)
b.	Aquaculture and Fishing
c.	Livestock
d.	Forestry and Logging
e.	Food and Beverage

3. Position in Company

a.	Accountant
b.	CEO
c.	Sales manager
d.	Financial manager
e.	Human Resource manager
f.	General manager
g.	Others

4. Number of Full-Time Employees

a.	< 5
b.	5 – 29
c.	3 – 74
d.	75 – 200
e.	> 200

5. Annual Income Range:

a.	<RM300,000
b.	RM300,000 – RM3,000,000
c.	RM3,000,001 – RM20,000,000
d.	RM20,000,001 – RM50,000,000

e.	>RM50,000,000

6. Location of your company:

a.	Selangor
b.	Federal Territory (Kuala Lumpur, Putrajaya & Labuan)
c.	Negeri Sembilan
d.	Malacca
e.	Johor
f.	Pahang
g.	Perak
h.	Kedah
i.	Perlis
j.	Penang
k.	Kelantan
l.	Terengganu
m.	Sabah
n.	Sarawak

Section 2: Industry Characteristics

A. Perishability (ICP)

a.	Our product is highly perishable. (ICP1)
b.	Our product needs to be stored under a certain temperature. (ICP2)
c.	Our product needs a high standard of sanitary handling. (ICP3)
d.	We have a complex storage system because of our perishable products. (ICP4)
e.	Our product needs to be eaten as fresh as possible. (ICP5)
f.	Our product needs proper handling because it can easily be spoiled. (ICP6)
g.	Our product has a short storage life. (ICP7)
h.	Our product is generally refrigerated or frozen to preserve and keep it safe for a longer time. (ICP8)

B. Advanced Production Technology (ICAPT)

a.	We use advanced technology in producing our product. (ICAPT1)
b.	We use technology that enables us to be more productive. (ICAPT2)
c.	We use advanced production technology to ensure the quality of our product. (ICAPT3)
d.	We ensure our workers' safety with advanced production technology. (ICAPT4)
e.	Technology provides information about our product to help us make decisions. (ICAPT5)
f.	Technology helps to manage land for our farm. (ICAPT6)
g.	We have an automated system that monitors our production. (ICAPT7)
h.	Technology is making our production more efficient. (ICAPT8)

C. Vulnerability (ICV)

a.	Our product is prone to disease/contamination. (ICV1)
b.	Our product is easily polluted. (ICV2)
c.	Diseases can severely harm our product. (ICV3)
d.	There will be productivity loss when our product is prone to diseases. (ICV4)
e.	Once a disease outbreak occurs, it will be difficult to control. (ICV5)
f.	When an outbreak occurs, all our products will be affected. (ICV6)
g.	When an outbreak occurs, a huge monetary loss will occur. (ICV7)
h.	Our product can easily be infected with diseases. (ICV8)

D. Timing Of Handling (ICTOH)

a.	Our product needs to be handled in a timely manner. (ICTOH1)
b.	The productivity of our production will be affected by the timing of production activity of our product. (ICTOH2)
c.	The timing of handling reduces the stress of our product. (ICTOH3)
d.	The proper timing of handling will preserve our product. (ICTOH4)
e.	The proper timing of handling will determine the freshness of our product. (ICTOH5)
f.	Proper timing in handling will minimize the loss/damage of our product. (ICTOH6)
g.	The timing of handling determines the output of quality products. (ICTOH7)
h.	The timing of handling determines the shelf life of our product. (ICTOH8)

E. Mechanization (ICM)

a.	Our production system is fully mechanized. (ICM1)
b.	Mechanization enhances our production productivity. (ICM2)
c.	Mechanization in our production helps to produce consistent quality of our product output. (ICM3)
d.	Mechanization helps us reduce time and energy. (ICM4)
e.	Mechanization increases labour productivity. (ICM5)
f.	Mechanization improves the processing and packaging of our product. (ICM6)
g.	Mechanization helps reduce waste. (ICM7)
h.	Mechanization encourages timeliness of operation. (ICM8)

Section 3: Management Accounting Practices Used in Agriculture Companies

Stage 1: Cost Determination and Financial Control (CDFC) (MAPS1)	
1	Using a plant-wide overhead rate (MAPS11)
2	Budgeting for controlling costs (MAPS12)
3	Flexible budgeting (MAPS13)
4	Performance evaluation based on financial measures (MAPS14)
5	Evaluation of major capital investments based on payback period and/or accounting rate of return (MAPS15)

Stage 2: Provision Of Information for Management Planning and Control (IPC) (MAPS2)	
1.	Using a plant-wide overhead rate (MAPS11)
2.	Budgeting for controlling costs (MAPS12)
3.	Flexible budgeting (MAPS13)
4.	Performance evaluation based on financial measures (MAPS14)
5.	Evaluation of major capital investments based on payback period and/or accounting rate of return (MAPS15)
6.	Cost-volume-profit analysis for major products (MAPS26)
7.	Product profitability analysis (MAPS27)
8.	Stock control models (MAPS28)
9.	Evaluation of major capital investments based on discounted cash flow method(s) (MAPS29)
10.	Long-range forecasting (MAPS210)

Stage 3: Reduction of Waste in Business Resources (RWR) (MAPS3)	
1.	Activity-based costing (MAPS31)
2.	Activity-based budgeting (MAPS32)
3.	Cost of quality (MAPS33)
4.	Zero-based budgeting (MAPS34)
5.	Performance evaluation based on non-financial measure(s) related to employees (MAPS35)
6.	Evaluating the risk of major capital investment projects by using probability analysis or computer simulation (MAPS36)
7.	Performing sensitivity 'what if' analysis when evaluating major capital investment projects (MAPS37)

Stage 4: Creating value through the efficient use of resources (CV) (MAPS4)	
1.	Target costing (MAPS41)
2.	Performance evaluation based on non-financial measure(s) related to customers (MAPS42)
3.	Performance evaluation based on residual income or economic value added (MAPS43)
4.	Benchmarking (MAPS44)
5.	Customer profitability analysis (MAPS45)
6.	For the evaluation of major capital investments, non-financial aspects are documented and reported (MAPS46)
7.	Calculation and use of cost of capital in discounting cash flow for major capital investment evaluation (MAPS47)
8.	Shareholder value analysis (MAPS48)
9.	Industry analysis (MAPS49)
10.	Analysis of competitive position (MAPS410)
11.	Value chain analysis (MAPS411)
12.	Product life cycle analysis (MAPS412)
13.	The possibilities of integration with suppliers and/or customers' value chains (MAPS413)
14.	Analysis of competitors' strengths and weaknesses (MAPS414)