The Role and Implications of Big Data on Strategic Management Accounting Practices: A Case Study in a Malaysian Manufacturing Company

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ABSTRACT

This research aimed to analyze the role and implications of big data on strategic management accounting practices in the manufacturing industry. The research was conducted in Shah Alam, Selangor, Malaysia. This research used a qualitative approach, with data being gathered through in-depth interviews, observations, and the review of documents. The interviews revealed that big data facilitates and improves the implementation of strategic management accounting practices on competitors' and customers' analyses and costing by streamlining the analysis process, decreasing time spent searching for data, increasing data accuracy, and assisting in the decision-making process, which leads to better forecasts and improved company profitability. This conclusion was further confirmed by content analysis of the documents reviewed. The study contributes to the literature on strategic management accounting and big data, with a focus on the manufacturing industry. Additionally, the findings of this study indicate that strategic management accounting is the key source of acceptable and pertinent information for management at all levels. The implications arising from this research affect both practitioners and researchers concerning the importance of incorporating big data into strategic management accounting processes in order to enhance analysis and provide a better outcome.

Keywords: Big Data, Content Analysis, Costing, Manufacturing Industry, Strategic Management Accounting

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INTRODUCTION

Strategic management accounting (SMA) practices play an important role in management decision-making to develop, communicate, and implement companies' strategies. It is essential for SMA practices to furnish accurate, updated, and relevant management accounting information to support these decisions. With SMA, an organisation will be able to fulfil the companies' goals, gain competitive advantage, sustain economic growth, and market positioning that secures long-term performance (Abdullah et al., 2020). Thus, there are challenges for SMA as a primary provider of information to ensure that appropriate information is always available. There is very limited evidence of technical developments within SMA despite major changes taking place in manufacturing technology (Appelbaum et al., 2017; Abdel-Kader & Luther, 2006). CGMA (2014) stated that management accountants should be prepared for big data since it is part of a wave of digital technology that has the potential to threaten a variety of highly skilled jobs. Developing a thorough grasp of big data, may improve analytics and machine-assisted manufacturing capabilities in the manufacturing industry. A study by McKinsey (2014) revealed that in the United States, there is a lack of between 140,000 and 190,000 employees with analytical knowledge and 1.5 million managers and analysts with the ability to comprehend and perform big data analysis.

The market for big data applications is growing rapidly and it has grown from a mere US$7.6 billion in 2011 to US$37.34 billion in 2018 (Research and Market Report, 2020). Big data technology allows firms to collect and integrate detailed data on existing customers, potential customers, and competitors which help firms form a better strategy. A case study conducted by Zhang et al. (2018) on the application of big data in manufacturing companies discovered that there is a cost saving of energy around 4% when a company uses big data. This demonstrates the benefits of big data that improves energy efficiency in the manufacturing industry through realistic and appealing decisions, as it enables manufacturers to cut manufacturing costs, hence increasing their sustainable competitive edge in the market. Based on the discussion above, it is expected that with big data, companies are able to facilitate the implementation of SMA practices to improve the process of analysing by reducing time in searching for data, the accuracy of the data, rich data on competitors and customers, and

assist in the decision-making process. In the meantime, there are limited studies that secure a deeper understanding on how big data influences the implementation of SMA practices. As such, the main objective of this research was to investigate the role of big data and its impact on SMA practices, specifically in the Malaysian manufacturing industry.

LITERATURE REVIEW

Strategic Management Accounting Practices

Over the last few decades, management accounting has achieved significant steps forward into new areas and dimensions via various innovative techniques. These techniques have directly contributed to an organization's success, including innovations in product and process design, reducing costs and lead times, improving quality, and enhancing performance (Alsoboa et al., 2015). The expansion of management accounting practices has moved into the new area towards the formulation of strategic elements within SMA which includes most of the advanced management accounting tools (Turner et al., 2017). According to Simmonds (1981), conventional accounting is incapable of providing indicators for business strategy and only focuses on period profit. This was when SMA was introduced to meet the strategic needs by providing a measurement of costs, sales volumes, and prices against those competitors. Based on empirical studies that are often cited in the literature, this study used the SMA techniques studied by Cadez and Guilding (2008). The selection of SMA techniques identified by Cadez and Guilding is the most comprehensive set of SMA techniques as compared to other most cited studies. There are 16 SMA techniques that are classified into five categories, namely: 1) costing; 2) planning, control, and performance measurements; 3) strategic decision-making; 4) competitor accounting; and 5) customer accounting. The explanation for each category is given below.

Costing

These costing techniques focus on costing analyses, which are useful for identifying and developing strategies. Costing analyses include costing on specific product attributes to customers, assessing product cost based on the product's life stages, identifying production costs, identifying,

repairing, and preventing defective products, determining an estimation of product cost, margin profit and price, and costing related to product design and distribution (Cadez & Guilding, 2008; Abdullah et al., 2020). These techniques are very important in every organization regardless of whether they provide service or products to customers, as they need to identify and estimate their product costs from the beginning costs involved in production until distribution to the marketplace. Besides, these techniques also allow firms to formulate their strategies according to costing information.

Planning, control, and performance measurement

This category focuses on elements of planning, control, and performance measurement, which are derived from the techniques of benchmarking and integrated performance measurement. Benchmarking techniques assist in identifying the best practices that can be adopted by a firm and provide a comparison of internal processes to an ideal standard, which acts as a performance measurement to improve firm performance (Turner et al., 2017). With benchmarking, the firm will be able to plan and control its strategic process to ensure it is according to the ideal standard. Besides, integrated performance measurement, which comprises financial and non-financial measurements, is useful to measure firm performance. Thus, planning, control, and performance measurement have a relationship with each other. As the firm plans and executes its strategy, it will need to control or monitor it by using performance measurement. Therefore, any strategic decision will be at its ideal standard.

Strategic decision making

The category of strategic decision-making allows firms to improve their decision-making skills while creating and sustaining competitive advantages by assisting in the strategy formulation process, pricing decision process, and assessing the value of their brand (Alsoboa et al., 2015). Therefore, this category comprises three components: strategic costing, strategic pricing, and brand valuation. A strategic decision-making method would allow a firm to develop and identify strategies effectively, assisting in pricing decisions and decisions on the allocation of resources to enhance brand value. This would benefit the firm's long-term performance and sustainability.

Competitor accounting

The competitor accounting method focuses on external orientation activities to contribute to a firm's competitive advantage by providing information related to the competitor's position in the market, evaluation and appraisal of the competitor, and assessment of the competitor's cost. As a result, these techniques are useful in planning, decision-making, and strategy monitoring. Competitor accounting consists of three techniques, namely: competitor's position monitoring, competitor's performance appraisal, and competitor's cost assessment. Therefore, with competitor accounting, firms are able to analyze their competitors and react based on their future goals, assumptions, capabilities, and current position (Abdullah et al., 2020). Besides, it allows a firm to monitor its competitive position through extensive analysis of the competition.

Customer Accounting

Customers constitute a unit of accounting analysis (Cadez & Guilding, 2008). As a result, customer accounting encompasses all practices designed to evaluate sales, costs, or profits based on customers or customer segments. This approach is considered an SMA technique as it is widely related to relational marketing. In this regard, it involves the conceptualization of the valuation of customers as assets, the analysis of customers' lifetime profitability, and the analysis of customer profitability.

Effectively, SMA can clearly provide a non-financial measurement or technique that can be used to analyze market competitors and customers. Although the implementation of the techniques was not widely used at the beginning, it has gradually become one of the important tools used in every organization. Consequently, the implementation of SMA techniques needs rich data or large data sets in order to provide accurate and meaningful analysis to develop strategies, such as strategies on pricing, technologies, and fulfilling customer needs. On that account, these data sets can be obtained by using big data.

Big Data

Big data is a term applied to data sets whose size or type is beyond the ability of traditional relational databases to capture, manage, and process the data with low latency in terms of time interval or delay (IBM, 2021).

Big data is a combination of structured, semi-structured, and unstructured data collected by organizations that can be mined for information and used in machine learning projects, predictive modeling, and other advanced analytic applications. Big Data has three important characteristics: volume, variety, and velocity from sensors, devices, video/audio, networks, log files, transactional applications, the web, and social media (IBM, 2021). In 2018, the market for big data applications was US$48 billion, with a value of US$169 billion. As of November 2018, 45 percent of market research professionals reported using big data analytics as a research method (Mlitz, 2021). According to Ghane (2020), system designs such as Lambda and Kappa deal with both real-time and batch data processing. Businesses can use sophisticated analytical techniques, such as text analysis, data mining, machine learning, and statistics, to obtain new insights from previously unused data sources, independently or in conjunction with existing enterprise data. Despite the examples of the use of big data in businesses, they still lack interdisciplinary studies. For instance, how big data helps the implementation of accounting techniques, such as SMA techniques, which can maximize a firm's profitability and create competitive advantages for the survival and sustainability of the business.

Big Data and Strategic Management Accounting

Abdel-Kader and Luther (2006) mentioned that the challenge for management accounting, as one of the primary providers of information, is to ensure that appropriate information was available to support management at all levels. Consequently, it is important for SMA techniques to remain relevant in this new era by providing a robust analysis for decision-making, and this could be achieved by using big data. Big data is a collection of data whose size or type exceeds the ability of traditional relational databases to capture, manage, and process data with low latency. It allows firms to collect and integrate detailed data about their customers, offerings, and the circumstances in which the purchases are made, which is important for performing SMA techniques. According to Dahal (2019), management accounting, which includes SMA techniques, provides both financial and non-financial data. As shown in Figure 1, the pyramid shows management accounting information highly depends on the collection and organizing of the data to generate processed information that is used for decision making. Thus, decision-making involves both quantitative and qualitative

information. Here, the unprocessed data can be provided by big data, which streamlines the data processing, summarizing, and generating relevant information.

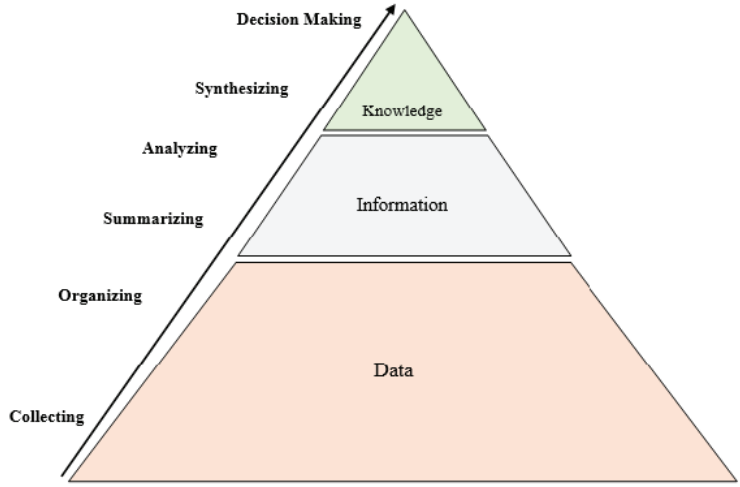

Figure 1: Need for management accounting information
(Source: Dahal, 2019)

The use of big data also allows firms to obtain information about their competitors, such as pricing and demand for their products or services. This will help firms to implement SMA techniques accurately and effectively, which could lead to a better forecast and improved profitability (Tanaka et al., 2018). It is crucial for management accounting not to lose its relevancy and to keep up with the evolution of products and process technologies, as well as cost management in the digital world.

METHODOLOGY

Research Design

The aim of this research was to analyze the role and implications of big data through SMA techniques for manufacturing companies. This research used a qualitative case study approach with multiple sources through in-depth interviews, observations, and content analysis. A case study was chosen as it is relevant in a situation where a particular phenomenon

is studied extensively and in depth with "how" and "why" questions. The interview aimed to obtain unpublished information, such as internal information and practices in the company. An in-depth interview with the key personnel at the company helps the researcher obtain detailed and thorough information on a topic that is being investigated (Sekaran & Bougie, 2016). Respondents for in-depth interviews were selected based on the characteristics of the respondents, their positions, and the responsibilities they held in the company related to accounting practices. Respondents included senior managers who supervised the organization's financials, and it has a direct impact on all accounting staff, who are involved with accounting decisions and more knowledgeable regarding the company's management accounting techniques and decision-making process (Spraakman, et al., 2018). In addition, the selection of respondents for the interviews was also based on their characteristics as experts, which is a qualified individual who is on top of their field and poses not only technical knowledge in the field but also a wide range of knowledge outside of it. Based on a study by Yusoff and Amrstrong (2012), this study used the justification for the selection of the key personnel for interview, who fulfilled the following minimum requirements: 1) at least seven years of management experience; and 2) membership in the Malaysian Institute of Accountants (MIA). Hence, based on the justification above, this study proceeded to have in-depth interviews with two key personal namely respondents A and B from the accounting department who fulfilled the minimum criteria.

The general approach to qualitative data analysis was followed by Miles and Huberman (1994). All interviews were recorded using a Sony voice recorder. It will provide an objective basis for assessing the adequacy of the data and provide a rich source of verbatim materials. Validity in qualitative data will be increased when recorded data is available. All responses from respondents were categorized by using thematic analysis and according to the objectives of the research. It will be summarized the findings and discussion section of the article. At the same time, the research proceeded with content analysis by looking into available data on the company's website that can be accessed by the researcher. Findings from content analysis will provide a better understanding of the scenario in the case company and support the findings from the interview.

Background of the Case Company

The company selected (referred to hereafter as "Choco1") is a Malaysian manufacturing company located in an industrial area in Shah Alam, Selangor. Their core business is manufacturing chocolates, which falls under the food and beverage industry. The company's total employees were approximately 450 staff. Their market penetration for export was around 80%, while the local market was about 20%. Their products were exported to over 30 countries and territories, mainly in the Asia-Pacific and Middle East regions. The Headquarters is in Kuala Lumpur and the subsidiaries are in Malaysia, Singapore, and Hong Kong. The researcher sent an email about the research details to Choco1 before the interview sessions. The email explained the main purpose of the research, interview questions, possible involvement of organizational personnel, and research methods to be adopted. The email was sent to a senior manager in Choco1's Accounts Department, whose role was to oversee both the manufacturing and financial accounts divisions. Definitions of SMA, big data practices and participant requirements were clearly stated. At the same time, the interviewees were informed about the confidentiality of the research.

Data Collection and Analysis

Interviews with key personnel

The face-to-face interviews were conducted with two key personnel in the accounts department who held the positions of senior manager and manager for the manufacturing account division. The interviews were conducted to explore the role of big data in the implementation of SMA practices. The main advantages of this face-to-face interview are that the researcher can ensure that the responses are properly understood according to the questions and that the researcher can pick up nonverbal clues from the respondents (Sekaran & Bougie, 2016). These interviews used unstructured questions to bring up useful themes for further in-depth exploration and to gain a holistic understanding of the situation.

Table 1: Interviewee's Details

Details	Interviewee A	Interviewee B
Position	Senior Manager	Accounts Manager (Manufacturing Account)
Department	Accounts Department	Accounts Department
Professional membership	MIA	MIA
Years of experience in field	17 years	12 years
Interview method	Face-to-face	Face-to-face

All interviews were conducted in English at the premise of the respondents. The interviews were tape-recorded and transcribed with permission obtained from the participants and an average of two hours interview period was required for each participant. The details of the interviewees and department structure is shown in Table 1 and Figure 2, respectively. Among the questions being asked are the issues of SMA practices in Choco1 and how big data may facilitate and improve the implementation of SMA techniques in the company. The open-ended questions were formulated based on qualitative studies from past research on big data, such as Sumbal et al. (2017).

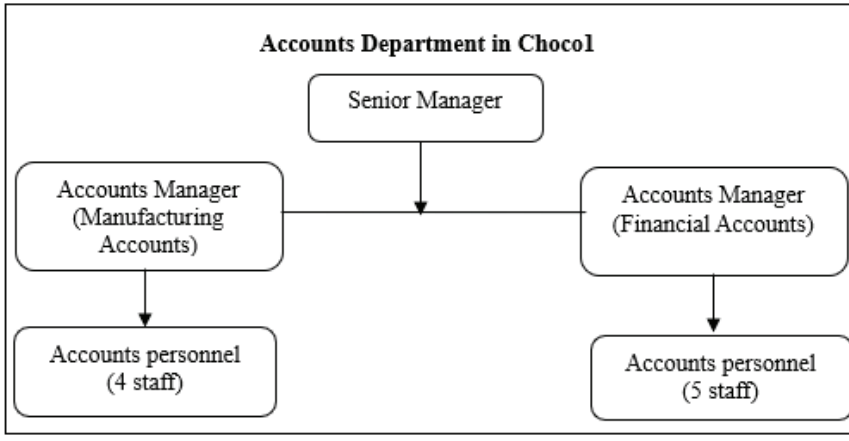

Figure 2: Accounts Department Structure in Choco1
(Source: Choco1)

Content Analysis Publicly Available Information

The publicly available information was from Choco1's website. Information such as annual reports, background of the company, the list of product lines, market penetration (local and global), and compliance with relevant international food safety standards was available on the website. This approach was appropriate to find out about the company's information to tie with the interview data. General information about the company was obtained through content analysis. Content analysis is a technique derived from the systemic examination of communicative materials and from the mass media (Sekaran & Bougie, 2016).

RESULTS AND DISCUSSION

SMA Implementation

The interviewees were asked about the importance and issues of management accounting practices in Choco1. Prior to the adoption of the SMA, Choco1 implemented only some SMA techniques for the decision-making related to its manufacturing. The issues with current practice, which was not efficient due to being unable to retrieve real-time data and link to other departments and experiencing human error. The current practices were a management accounting system called "system X" and an Excel spreadsheet.

> *"Presently, we are using "system X" which is a 1990's is back dated by 20 years, so we going to upgrade. So, the important is when we upgrade, we want all the information to be linked, so less human error. And when we integrated all this kind of things, is less manpower."*
>
> (Interviewee A)

> *"Issues are examples like when we want to upgrade and update the information. For example, we want to update some information, such as posting information. We mostly use manuals and Excel spreadsheets these days. After that, we want to transfer*

to the system. It is quite difficult. What we want to do now is direct to the system so there is less human error. "

(Interviewee B)

The implementation of the previous practice was considered challenging as the system was not adequately reliable and the analyses were not accurate. Moreover, due to the dissatisfaction and misunderstanding concerning the old practice, Choco1 decided to change and consequently adopted a new system that was more comprehensive and reliable. Choco1 obtained the information about the new system through the information provided by big data on their competitor's new technologies and strategies.

The Role of Big Data on SMA Practices

The next question was about how big data facilitated and improved the implementation of SMA practices in Choco1. The discussions were provided based on the impact of each category of SMA techniques, namely (1) costing, (2) planning, control, and performance measurement, (3) strategic decision-making, (4) competitor accounting, and (5) customer accounting. Both interviewees agreed that costing techniques are essential in every organization. Big data provided costing and pricing information that allowed Choco1 to formulate their strategies. This information included pricing on similar products in the market, what price customers are willing to pay, customer reviews and expectations for the product, and raw material information from prospective suppliers. Thus, costing techniques focusing on costing analyses are beneficial for identifying and developing good strategies. By utilizing big data, Choco1 was able to identify, assess, and reduce its product costs, work on product design according to customers' feedback, reduce wastage, and determine its profit margin and pricing.

"Big data assists us in estimating the production cost, how much they fully utilize and bringing down the wastage. By identifying customer's needs, product demand and the best suppliers to supply quality raw materials, we are able to reduce our cost, determine the price and target profit margin. One more thing is the missing area. Now actually on our side, everything that we cannot find is considered waste and needs to be minimized."

(Interviewee A)

In terms of planning, control, and performance measurement, interviewee B stated that the use of big data allowed them to apply benchmarking techniques and integrated performance measurement. Information about competitors is very crucial to setting a benchmark, which is to identify best practices. For example, best practices in cost management related to new technologies. These techniques help to identify the best practices that can be adopted by the firm and offer an ideal standard of evaluation of internal processes. This will improve firm performance. Besides, integrated performance measurement consists of financial and non-financial measurements, which are useful for measuring firm performance. These techniques also enabled Choco1 to control or monitor it using performance measurements. Hence, the implementation of strategic decisions will be at its ideal standard.

> *"From competitors' information, we know our competitor used new machines to increase production and reduce costs, such as labor costs for foreign workers. Here, we are able to acquire the same new machine that is more high-tech, increase our production, cost saving and reduce human error. For example, when the XX powder the chocolate, they are supposed to put 2 piles, but they put less or more than 2 piles. And then when, until the QA is too late already. All these kinds of things are involved in human error. This issue was solved using the new sophisticated machine, and we managed to reduce waste."*
>
> (Interviewee B)

As for strategic decision making, Choco1's long-term performance and sustainability would benefit from strategic decision-making analysis. It would allow the company to develop and identify strategies effectively, assisting in the pricing decision process and decisions on the allocation of resources to enhance brand value. Thus, the use of big data in strategic decision-making occurs when big data analysis, which includes data mining, is fully utilized by businesses. Big data deals with raw, structured, semi-structured, and unstructured data that will improve the decision-making skills. This data also includes customers' and competitors' information, such as buying and selling behavior.

> *"The processed data, for example, business interactions record data combined with external information on customers and competitors, will help us to assess our brand value in the market and to exploit and acquire competitive advantage. The information is not only used for costing and pricing strategies but also marketing strategies."*
>
> (Interviewee A)

Competitor accounting permits firms to analyze their competitors so that it can be useful in planning, decision-making, and strategy monitoring. According to interviewee A, using big data, Choco1 was able to obtain information about their competitors, such as their market position, technologies adopted, pricing information, and their reaction to market changes. Therefore, competitor accounting focuses on external orientation activities to contribute towards the firm's competitive advantages. The information provided by big data assisted in competitor accounting techniques such as competitor position monitoring, competitor performance appraisal, and competitor cost assessment.

> *"Big data supports our competitor analysis by providing us with competitors' details. For example, their sales growth and new product line launched This data helps us to appraise and monitor our competitors' activities and cost assessments."*
>
> (Interviewee B)

According to interviewee B, customer accounting was one of the crucial techniques, especially for Choco1's retailers. Using the techniques, Choco1 was able to evaluate sales, costs, or profits made based on their retailers. Big data allowed Choco1 to obtain information needed about their retailers and implement analysis. The techniques focused on the financial measurement of customers, which helped to increase their value. It also supported the development of strategies that led to improved business performance. Based on the interviews, it is found that there was a significant role played by big data in improving the implementation of SMA techniques. Using big data, Choco1 was able to produce reliable and accurate analysis, which allows them to formulate business strategies. Hence, the advantages could be seen through the increase in production output, the reduction of costs such as labor and raw materials, and the decreasing waste.

> *"By having robust data about our customers and retailers, it helps us form a strategy to increase our sales growth, such as giving promotional offers or items and upgrading customer service."*
>
> (Interviewee B)

In addition, big data also reduced the time that is consumed to access the data and prepare the report, thereby reducing the workload. Although Choco1 was spending a large amount of money on new technologies, such as the purchase of sophisticated equipment for its production, based on cost benefit analysis, the expected benefit exceeds the cost incurred. Because of that, the strategies adopted by Choco1 created competitive advantages and built long-term business sustainability because during the pandemic, the company was still sustainably operating its business as usual. On top of the above discussion, this study also found that the management team, employees, and competitors were factors that influenced the use of big data in Choco1.

Content Analysis

This subsection presents findings from the content analysis which involved a review of the annual reports and company website of Choco1 to support the interview outcome above. This study analyzed the association between revenue and operating costs for the five years from 2017 to 2021 using data from annual reports, as shown in Table 2.

Table 2: Relationship between Revenue and Operating Cost

Year	Revenue (RM'000)	Operating Cost (RM'000)	Percentage Cost to Revenue
2017	70,800	2,108	3.0%
2018	65,300	1,802	2.8%
2019	71,700	1,285	1.8%
2020	55,300	734	1.3%
2021	34,800	700	2.0%

Table 2 demonstrates the percentage operating cost to revenue, which showed a decreasing pattern for 4 consecutive years from 2017 to 2020. This pattern resulted from cost reduction and improvement in both product

and operational efficiencies, as mentioned in the interview outcome and on the company website. In 2021, the percentage of operating costs to revenue showed an increase. This was because production costs had risen as a result of disruptions in the global supply chain triggered by the COVID-19 outbreak. Besides the increase in freight costs, the prices of direct raw materials, such as cocoa, milk powder, palm oil, and sugar, also increased dramatically compared to last year. As a result, the company implemented significant cost-cutting measures, such as restructuring operations through a reduced workforce and lower cost base.

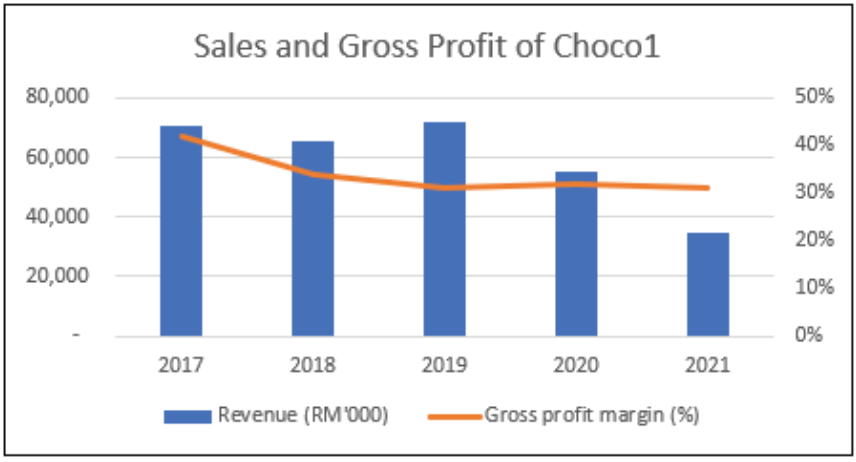

Figure 3: Sales and gross profit of Choco1
(Source: Choco1 annual reports)

Figure 3 presents sales in Ringgit Malaysia and percentage of gross profit for 5 years from 2017 to 2021. Although the sales dropped but the percentage of gross profit were maintained from 2018 to 2021 at around 31% to 32%. This shows the evidence of the use of SMA practices such as costing techniques for cost reduction and reduce waste. During the financial year, Choco1 embarked on many marketing activities throughout the fiscal year on product innovation to meet consumers' need and to stay in trend in order to preserve brand visibility. However, the revenue of Choco1 in 2021 declined 37.1% to RM34.8 million due to a slowdown in offtake in important export markets due to lockdowns enacted to contain the spread of COVID-19. For the domestic market, sales were impacted by the government's enforcement of various Movement Control Order (MCO), which resulted in a decrease in

foot traffic at supermarkets and hypermarkets. Thus, there was no increase in the selling price of Choco1 products across all markets in 2021. In addition to reviewing financial reports, based on the observation, Choco1 had acquired sophisticated equipment for its research and production. This supports the statement by the interviewees that by using big data, the company can identify competitors' strategies. Hence, Choco1 could reduce labor costs, avoid waste of resources, and reduce production time. Thus, the content analysis in this study supported the interview outcome.

CONCLUSION

The case study indicated several significant findings. Firstly, the evidence from Choco1 showed that the company had implemented SMA practices throughout the organization. The findings proved that big data does facilitate and improve the implementation of SMA techniques related to new technologies and strategies of the company, such as competitor and customer analyses and benchmarking. Big data technology assisted in SMA practices by allowing firms to collect and integrate detailed data about customers' preferences, buying patterns, cost reduction, and competitor strategies such as technologies. This conclusion was confirmed by content analysis of the documents reviewed, which provides an indication of cost reduction in operating and gross profit margin. Using big data, management accounting will stay relevant and provide appropriate information to support the management decision-making process. Accordingly, the influence of big data usage on SMA practices will enable companies to face challenges in the global market and ensure their sustainability.

This research is subject to limitations which leads to future research. The case study was limited to a single manufacturing company; hence, the findings are not conclusive in representing manufacturing companies. Thus, future research should increase the number of manufacturing companies as case companies for richer findings. In summary, this research provides insights on the association between big data and SMA practices in the context of Malaysian manufacturing companies. It is hoped that the findings of this research can add to the corpus of literature in the fields of accounting and information technologies related to manufacturing companies as a reference for future research.

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