Applied Mathematics and Computational Intelligence
Volume 14, No. 3, 2025 [1-12]

Clustering Shariah-Compliant Stocks in the Construction Sector on Bursa Malaysia

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Received: 24 February 2025
Revised: 27 March 2025
Accepted: 30 April 2025

ABSTRACT

The complexity and volatility of stocks have made it difficult for investors to screen ethical and profitable options. Finding the ideal portfolio requires navigation through market uncertainties, fluctuations and fundamentals. Hence, this paper explores strategies to develop a risk-category portfolio to suit investors while adhering to Shariah guidelines. The main goals are to determine distinct clusters of Shariah-compliant stocks for construction companies in Bursa Malaysia and to categorize the cluster of stocks using selected stock indicators. K-Means Cluster analysis was employed to segment the construction stocks. Data on indicators were assessed from a finance portal from 2022 to 2024. The findings revealed three different clusters. Cluster 1 has the highest stock price and market capitalization, making it the most stable and lucrative option for long-term investors. Cluster 2, which exhibited moderate risk investment, is ideal for investors prioritizing capital preservation. Cluster 3, with 56 stocks, displayed high volatility and lower prices, appealing to risk-tolerant investors seeking growth opportunities. Based on these findings, the study aims to support investors in making informed, ethical, and strategically sound decisions in line with Shariah principles.

Keywords: K-Means analysis, shariah-compliant stocks, stock portfolio

1 INTRODUCTION

Stocks represent market share in the financial sector and signify ownership in a company [1]. Investment in the stock market involves purchasing ownership stakes in publicly traded companies through the acquisition of stocks or shares with the expectation of generating profit or income in the future. Investing in stocks offers the potential for both dividends and capital appreciation, contingent on the company's growth and value increase over time.

In Malaysia, Bursa Malaysia serves as the principal stock exchange, providing a platform for businesses to raise capital by trading stocks and other financial instruments. It operates under the regulatory oversight of the Securities Commission Malaysia, which ensures that Bursa Malaysia complies with laws and regulations governing capital markets in Malaysia. The exchange lists

companies that allow investors to participate in capital markets while offering online trading systems that simplify stock trading.

As of January 2025, Bursa has listed over 1000 stocks across three markets (Main, ACE and LEAP). However, not all stock investments align with Islamic principles. To address this, Bursa Malaysia offers Shariah-compliant stocks to ensure Muslim investors can participate in the stock market without compromising their faith, contributing to their financial empowerment and broader economic inclusion. For Muslim investors, choosing Shariah-compliant stocks is not merely a preference but a necessity to ensure adherence to Islamic principles. These principles emphasize earning income through 'halal' means, which exclude interest-based transactions (riba'), speculative activities (maisir), and investments in sectors considered harmful (haram) [2][3]. Choosing Shariah-compliant stocks allows investors to tap into industries aligned with the growing global halal economy, such as halal food, healthcare, and Islamic finance.

Investors have access to a wide variety of sectoral stocks, enabling the creation of well-diversified portfolios. The Securities Commission Malaysia provides access to 12 market sectors, with 820 companies adhering to Islamic finance regulations. The construction sector stands out as a compelling area for portfolio diversification and risk management due to its consistent performance. The construction sector encompasses companies involved in the construction of commercial and residential buildings, infrastructure projects such as railways, highways, and roads, as well as construction-related services, including architecture and interior design. Bursa Malaysia lists 64 Shariah-compliant construction companies with diverse return profiles, risk levels, and price values, providing a unique landscape for portfolio diversification and risk management. This sector is pivotal in Malaysia's infrastructure development and nation-building efforts, supported by ongoing government initiatives and public-private partnerships, ensuring steady demand even during economic uncertainties.

Furthermore, the construction sector contributes significantly to Malaysia's GDP and employment, reflecting its stability as a core driver of economic growth [4]. Its projects typically span multiple years, providing long-term revenue visibility and reducing exposure to short-term market volatility. This characteristic makes construction stocks particularly attractive for investors seeking a balance between growth and risk mitigation. Additionally, the sector's diverse subcategories, such as residential, commercial, and infrastructure projects, offer opportunities to diversify within the industry, further enhancing its appeal for portfolio optimization and effective risk management.

The issue of stock selection has garnered widespread attention among researchers due to its strategic implications for the initial stages of constructing an optimal portfolio [5]. Although this issue has persisted for a significant period, it remains highly relevant today to consistently assisting investors in making more efficient stock selection decisions compared to random selection [6]. As a result, there is a growing demand for quantitative methods and analytical tools to guide investors in identifying the most suitable stock options that align with investors' financial goals and risk tolerance [7].

Stocks, including Shariah-compliant stocks, are often unpredictable since they are affected by internal and external factors [2]. Stocks in any sector exhibit wide variations in risk, return, and market behaviour, further complicating grouping them into meaningful categories. Effective categorization is critical to empower investors to navigate these complexities and align their portfolios with financial goals, risk tolerance, and ethical values. Categorizing such inherently diverse

stocks presents a significant challenge for investors, particularly in Shariah-compliant investments where adherence to Islamic principles limits the pool of eligible stocks. Stock portfolio management is crucial as it plays a significant role in achieving investors' goals, and its importance has been extensively studied by others, emphasizing that a well-diversified portfolio can effectively minimize risks [8].

Cluster analysis, a statistical method for grouping similar data points, has gained recognition for its effectiveness in market segmentation, pattern recognition, and portfolio optimization [9]. By identifying latent patterns and trends, clustering facilitates better decision-making for investors. Despite its versatility, clustering has been underexplored in the context of Shariah-compliant stocks, particularly in the construction sector of Bursa Malaysia. Existing research primarily focuses on clustering applications in broader financial markets, often overlooking the sector-specific challenges and ethical considerations unique to Islamic finance. Moreover, recent advancements in clustering applications to Islamic finance remain limited. This underscores the need for more targeted studies that address these limitations and apply clustering techniques to financial datasets within Shariah-compliant contexts.

This study addresses these gaps by applying K-Means clustering to categorize construction stocks listed on Bursa Malaysia based on variables such as closing price, volatility (standard deviation), and average price. Construction stocks tend to exhibit higher volatility due to project delays, cost overruns, and dependence on economic cycles. This makes them an interesting case for clustering, as volatility patterns can help segment companies by their risk profiles. The paper aims to enhance investors' understanding of market dynamics, optimize investment strategies, and support risk management, focusing on Shariah-compliant stocks. This study contributes to the growing discourse on socially responsible investing within Islamic finance by bridging the gap between ethical investment practices and advanced statistical techniques.

From an Islamic perspective, this research aligns with ethical investing principles, ensuring that Muslim investors can identify Shariah-compliant stocks. The study promotes socially responsible investment practices, fostering an ethically driven investment culture. The research's implications also extend to economic stability by encouraging informed investment behaviours that reduce market volatility and support sustainable development. Beyond practical benefits for investors, this study also contributes to the academic literature by demonstrating the efficacy of clustering techniques in financial analysis. Prior research has shown the versatility of clustering in stock categorization across various markets [10]. For instance, [1] demonstrated the utility of K-Means clustering in the Indonesia Stock Exchange, while [2] explored its application for Shariah-compliant stocks. However, the construction sector in Malaysia remains a relatively untapped area for such analyses despite its economic significance and investment potential.

In conclusion, this study bridges a critical gap by applying K-Means clustering to Shariah-compliant stocks within Malaysia's construction sector. By explicitly addressing the challenges of clustering in Shariah-compliant investments and focusing on the construction sector, this study aims to provide actionable insights for investors. The findings are expected to support informed decision-making, promote ethical investment practices, and contribute to the broader field of Islamic finance.

2 MATERIAL AND METHODS

The methodology section consisted of two main parts: the description of the data and the method of analysis. The first part outlined the data source, and the variables used in the study. The second part discussed the analysis method employed to group the construction stock market.

2.1 Data

In this study, 64 Shariah-compliant stocks were identified from the Securities Commission Malaysia, and the stock trading data with company portfolio were extracted from the Yahoo Finance portal within the range 2022 to 2024. Yahoo Finance is widely recognized for providing reliable financial data and is commonly used in research [11]. For this study, a partial list of Shariah-compliant construction companies in Malaysia is provided in Table 1. In Table 2, four indicators were used to cluster the stock: closing price, market capitalization, average price, and standard deviation of price, which were derived from the closing price data.

Table 1: Partial List of Shariah-compliant stocks

	Stock Name	Name of Securities
1	AGESON	Ageson Bhd
2	AZRB	Ahmad Zaki Resources Bhd
3	AME	AME Elite Consortium Bhd
4	BPURI	Bina Puri Holdings Bhd
5	CRESBLD	Crest Builder Holdings Bhd
6	ECONBHD	Econpile Holdings Bhd
7	EKOVEST	Ekovest Bhd
8	SENDAI	Eversendai Corporation Bhd
9	GADANG	Gadang Holdings Bhd
10	GAMUDA	Gamuda Bhd

Table 2: Indicator Used in K-Means Analysis

Indicators	Description
Closing Price	Final trading price for a stock
Average Price	Average of closing price over the 2-year period of study
Standard Deviation of Price	The standard deviation of closing price over 2 years
Market Capitalization	The value of a publicly listed company

2.2 Model and Analysis

2.2.1 Scree Plot

The Scree plot is a graphical tool used to determine the optimal number of clusters in a dataset by analyzing the Within-Cluster Sum of Squares (WSS). It functions by plotting the WSS values against the number of clusters. As the number of clusters increases, the WSS decreases because the data points within each cluster are closer to their respective centroids. To determine the optimal number of clusters, the "elbow point" is observed where the rate of decrease in WSS significantly slows down. This point indicates the number of clusters that balance minimizing WSS and avoiding overfitting.

2.2.2 K-Means Algorithm

The K-Means clustering technique calculates the data into several groups using the average value as the cluster's centre [8]. Unsupervised K-Means analysis divided data points into discrete groups based on their similarities, with no established labels. Each cluster had a centre point, called a centroid, and data points within a cluster were closer to its centroid than to the centroids of other clusters. K-means clustering stands out among other clustering methods due to its ease of implementation, ability to handle large datasets efficiently, and effectiveness in producing compact and well-separated clusters. Unlike hierarchical methods, k-means is computationally less intensive, making it suitable for real-time applications. Furthermore, its computational efficiency makes it a popular choice for real-world applications, as it can easily handle high-dimensional data [12].

According to [13], the K-Means algorithm calculates the centroid of each cluster C_i and optimizes the cost function that can be defined as,

$$W(c_i) = \sum_{r=1}^{|C_i|} (d(x^i, x_r^i))^2 \quad (1)$$

where C_i is the i*th* cluster and $d(x^i, x^i_r)$ is the distance between a data point.

The K-Means algorithm consists of several steps:

1) Determine the number of clusters (K) in which objects are categorized, assigning them to one of these K groups.
2) Allocate each object to the group that has the closest centroid (mean) for Euclidean distance. The Euclidean distance can be defined as the distance between x_i and y_i in dimensional space.

$$d_E(x_i, y_i) = \sqrt{\sum_{i=1}^{n} (x_i - y_i)^2} \quad (2)$$

where n is the number of features.

3) Once all the objects have been assigned, recalculate the centroid for the clustering gaining the new object and adjust the centroid for the cluster losing the object.
4) Repeat steps 2 and 3 until some convergence is met. That is when centroids reach a state where they remain static. The convergence criteria are either no or minimal reassignment of data points to new cluster centres and a minimal decrease in squared error sum.

2.2.3 Validity Measures

Internal validity in clustering refers to the ability of a clustering method to produce meaningful and accurate groupings based solely on the data's inherent characteristics. This validity is assessed using various internal indices, which evaluate the quality of the clusters without relying on external criteria or pre-existing labels. These indices typically consider factors such as compactness (how close the data points within a cluster are to each other) and separation (how distinct the clusters are from one another). Commonly used distance functions, like the Euclidean distance, help quantify the similarity between data points. Internal indices provide a metric for determining how well a clustering algorithm has partitioned the data, guiding researchers in selecting the most appropriate clustering solution. A total of 23 indices, including the Ball-Hall index, Calinski-Harabasz, Silhouette, Dunn, and Davies-Bouldin, were used to determine the optimal cluster.

3 RESULTS AND DISCUSSION

The optimal number of clusters for K-Means analysis was determined using the Scree plot and was validated using the validity measures. The Scree plot in Figure 1 suggests that the optimal number of clusters for the 64 Shariah-compliant stocks is three, as indicated by the point where the Total Within Sum of Squares (WSS) shows a significant reduction in its rate of decrease. This result suggests that the stocks can be grouped into three clusters, highlighting their similarities based on the selected variables.

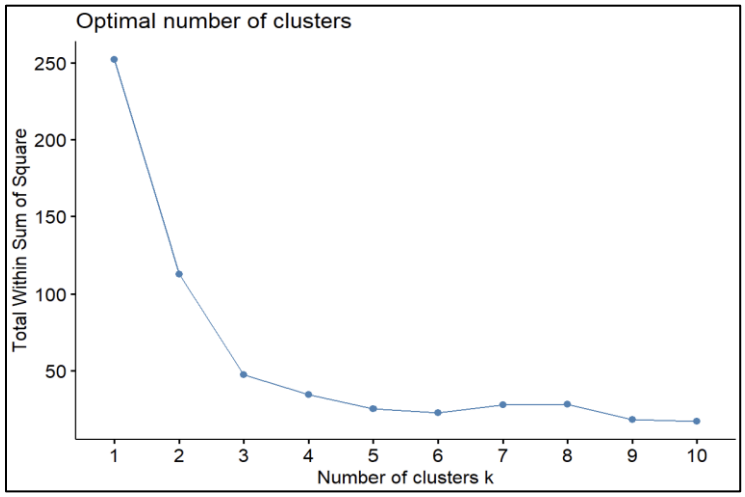

Figure 1: Optimal cluster number using Scree Plot.

Table 3 presents the indices used in validity measures and their suggested cluster number. According to the majority rule, the best number of clusters is 3, affirming that the scree plot produces the optimal number of clusters.

Table 3: Result of validity measures

Cluster Number	Number of Indices used	Indices Name
2	6	DB, Silhouette, PtBiserial, McClain, Dunn, SDIndex
3	13	KL, CH, Hartigan, Marriot, TrCovW, TraceW, Duda, PseudoT2, Beale, Ratkowsky, Ball, Rubin, CIndex
5	4	CCC, Friedman, SDbw, Scott

The 2D clustering plot in Figure 2 resulted from the K-Means analysis. It shows how 64 Shariah-compliant stocks in the construction sector are grouped based on similar characteristics. The stocks are divided into three unique clusters, marked by different colours: red circles for Cluster 1, green triangles for Cluster 2, and blue squares for Cluster 3. It's important to understand that the numbers and colours of the clusters do not imply that any cluster or stock is better or worse than another. Instead, the clusters show how the stocks are related to each other based on variables under study. Cluster 1 contains one stock, which is GAMUDA. Cluster 2 includes seven stocks: AME, PTARAS, DKLS, SUNCON, IJM, BNASTRA, and KERJAYA. The remaining 56 stocks are grouped into Cluster 3.

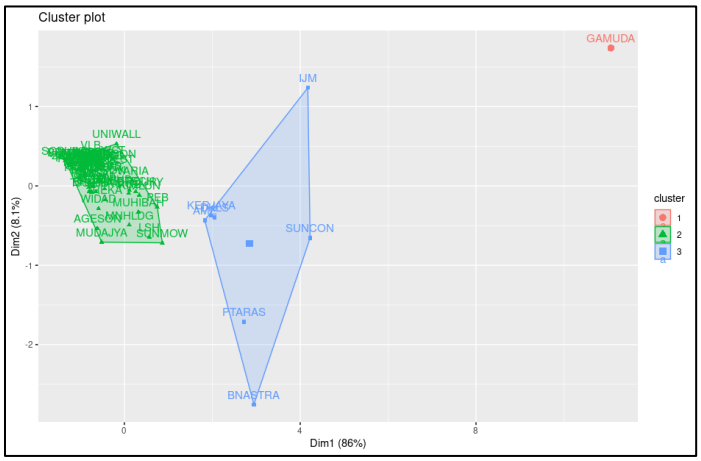

Figure 2: Cluster of Shariah-compliant stocks in the construction sector.

Table 4: Descriptive statistics of stock clusters

Variable	Statistics	Cluster		
		1	2	3
Stock Name		GAMUDA	AME, PTARAS, DKLS, SUNCON, IJM, BNASTRA, KERJAYA	AGESON, AZRB, BENALEC, BPURI, CRESBLD, ECONBHD, EKOVEST, SENDAI, FAJAR, GBGAQRS, GADANG, GDB, GKENT, HOHUP, IHB, INTA, IREKA, JAKS, KIMLUN, KITACON, LEBTECH, MELATI, MERCURY, MGB, MITRA, MUDAJYA, MUHIBAH, OCR, PESONA, PEB, PRTASCO, PUNCAK, TRC, TSRCAP, TJSETIA, VARIA, VIZIONE, WCT, ZECON, ZELAN, ANEKA, BVLH, HAILY, JTGROUP, LSH, MNHLDG, NADIBHD, NESTCON, SCBUILD, SIAB, SSB8, SUNMOW, TCS, UNIWALL, VLB, WIDAD
Closing Price (RM)	Mean	5.1000	2.0014	0.3975
	Std. Dev	NA	0.4178	0.2817
	Minimum	5.1000	1.5900	0.0100
	Maximum	5.1000	2.7600	1.0600
	CV	NA	20.87%	70.86%
Average Price (RM)	Mean	4.1064	1.5923	0.3811
	Std. Dev	NA	0.4592	0.2678
	Minimum	4.1064	0.7394	0.0216
	Maximum	4.1064	2.0458	1.2940
Standard Deviation of Price (RM)	Mean	0.6292	0.3085	0.0622
	Std. Dev	NA	0.1481	0.0480
	Minimum	0.6292	0.1550	0.0000
	Maximum	0.6292	0.5750	0.1980
Market Capitalization (RM million)	Mean	23017	3180.57	277.8393
	Std. Dev	NA	3912.3915	287.0316
	Minimum	23017	177	26
	Maximum	23017	10906	1386

Cluster 1, consisting solely of GAMUDA stock owned by Gamuda Berhad, represents a well-established construction stock listed on the Main Market of Bursa Malaysia [14]. The Main market is a premier platform for well-established companies that meet the required quality standards, scale, and operations [15]. Additionally, GAMUDA is recognized as one of Malaysia's blue-chip companies. Blue-chip companies are widely acknowledged as being well-established and financially stable. With the highest closing price of RM 5.10 and a large market capitalization of RM 23,017 million, GAMUDA demonstrates significant financial stability, solidifying its position as a blue-chip stock.

In Malaysia, a company earns the blue-chip designation when its market capitalization exceeds RM10 billion [16]. While other factors, such as profitability, liquidity, and the company's maturity, are considered in determining blue-chip status, market capitalization is often the primary indicator. This is because it reflects the company's value in the stock market, with higher market capitalization indicating a more valuable and resilient company during the market downturn. GAMUDA's high market capitalization, consistent performance, and established reputation highlight its low-risk profile, appealing to risk-averse investors who prioritise stability and reliability over rapid growth.

Cluster 2 comprises seven stocks from the Bursa Main market, including AME, DKLS, IJM, KERJAYA, PTARAS, SUNCON, and BNASTRA, which are priced moderately between RM1.5900 and RM2.7600, making them appealing to both retail and institutional investors seeking value-driven opportunities. With a mean market capitalization of RM3,180.57 million, these mid-cap stocks offer a balanced combination of growth potential and stability. Mid-cap companies, with a market value between RM2 billion and RM10 billion, are generally less susceptible to volatility than small-cap companies, making them a more consistent investment option [17]. This cluster is characterized by its low standard deviation in the last price, indicating consistency across the companies. Such consistency demonstrates that the companies in Cluster 2 are less risky, offering stable performance among stocks. For example, the IJM is a blue-chip stock leader in Malaysia's construction and infrastructure sectors. Despite its blue-chip status, its price aligns with the cluster's range, reflecting consistent performance and a strong presence in large-scale projects [18]. Similarly, KERJAYA specializes in high-end construction and property development, focusing on premium projects. The company's steady growth and strong market positioning contribute to its appeal within this cluster. Both companies represent the traits of Cluster 2, offering stability, growth potential, and moderate risk for investors seeking long-term capital appreciation.

The large, moderate and small market capitalization companies are all included in Cluster 3, which is considered the riskiest as reflected in the coefficient of variation (CV) value. The value of 70.86% is the highest compared to other clusters, indicating a more significant dispersion between stock prices within the same clusters. As stated by [19], high volatility often signals that supply and demand dynamics are abnormal, leading to unpredictable stock price movements. Despite these risks, companies in Cluster 3 are attractive to speculative or risk-tolerant investors who seek to capitalize on potential profit opportunities. Investors in this cluster need to be selective, have a proactive strategy and be ready for significant changes in market performance. Price increases can be unpredictable and short-lived. Because of this, investors must stay alert and flexible to make the most of their returns and manage the risks involved.

4 CONCLUSION

In this research, three clusters of the construction sector were obtained from Shariah-compliant stocks in Bursa Malaysia. Cluster 1, with a single stock named Gamuda, was characterized by the highest stock price and market capitalization. Cluster 2 comprises seven stocks with consistent yet moderate performance and risk levels, making it suitable for conservative investors seeking stable and secure returns. Cluster 3 includes 56 companies with moderate to low stock prices and high dispersion among stock prices, catering to risk-tolerant investors pursuing high-growth opportunities. The classification of stocks according to risk, price fluctuations, and overall market capitalization enables investors to create portfolios that align with their financial objectives and improve risk management. This effort highlights the utility of clustering analysis as a tool to classify Shariah-compliant stocks and support investors in making educated decisions.

From the perspective of Islamic finance, Cluster 1's emphasis on stability and resilience aligns closely with the principle of avoiding excessive uncertainty (gharar). The predictable performance of blue-chip stocks like GAMUDA fits the Islamic preference for investments that offer ethical, stable, and transparent returns, minimizing potential financial risks. Cluster 2's stability and moderate growth potential align well with the Islamic finance principle of promoting ethical and sustainable investments. These stocks balance risk and return, aligning with the preference for investments that offer predictable and transparent growth without exposing investors to excessive uncertainty or speculative behaviours. However, the high volatility of Cluster 3 underscores the need for investors to utilize additional tools, such as technical analysis, to manage better the risks associated with excessive uncertainty (gharar) in Islamic finance. This study primarily focuses on categorizing stocks, offering a foundation for more informed decision-making, while technical analysis can further assist investors in navigating these complexities.

ACKNOWLEDGEMENT

We want to thank our colleagues from Universiti Teknologi MARA Negeri Sembilan Branch and Seremban Campus, who provided insight and expertise that greatly assisted the research. Furthermore, we would like to express our deep appreciation to our campus for the facilities and support for this research. All the support has significantly contributed to the successful completion of this research.

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