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The Influence of Material Price Fluctuations on Construction Project Budgeting in Johor Bahru

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Abstract

Construction sector especially in Johor Bahru has been intensely influenced by the variability and changes of notably crucial construction materials cost such as steel and cement. This phenomenon directly affects budgeting and profitability of the project. This has become an essential and challenging event for G7 contractors. Therefore, this research objectives are to identify the main factors contributing to the price fluctuations of materials in the Johor Bahru construction industry; to identify the effects of material price fluctuations in the Johor Bahru construction industry on financial budgeting in construction projects and to suggest the strategies that can be implemented to reduce the risks associated with material price fluctuations in the Johor Bahru construction industry. The research method of this study is quantitative method where a questionnaire survey was distributed to respondent which is G7 main contractor registered with Construction Industry Development Board (CIDB) in Johor Bahru. A total of 108 responses were obtained which represent a response rate of 17.6%. The collected data were analysed using descriptive statistics analysis with the aid of SPSS software. The results show that changes in government policies, a rise in demand, a shortage of materials, delayed procurement, and global disruptions in substitute supply chains impact most, thereby contributing towards fluctuation in material prices. It is also observed that fluctuation in material prices creates a negative impact upon accurate estimate calculations, budget deficits, financial strain upon project cash flow, decreased profit margins, and slowed down project completion. Lastly, the finding shows that techniques for accommodating price rises, risk-sharing, value engineering, early procurement, joint purchasing, and building long-term vendor ties impact most. However, approaches like the use of price escalation clauses, value engineering, bulk purchasing, and enhancing supplier relationships were identified as being effective in managing risks. In conclusion, the contributions of the proposed study would offer vital perspectives and knowledge for contractors, governments, and relevant stakeholders on improving and enhancing resilient budget and risk management practices in accordance with national transformations

within the construction sector.

1. Introduction

The construction industry is among the major economic growth drivers and pillars of competitiveness, urbanisation, and infrastructure investment in Malaysia, with materials cost accounting for up to 60% of construction cost (Construction Industry Development Board, 2023). Price fluctuations are caused by worldwide commodity volatility, inflation, market supply and demand discrepancies, and macroeconomic shocks like wars or epidemics, with post-pandemic supply chain disruptions causing over 25% surge in global building material prices during 2021-2023 (Musarat *et al*., 2020; World Bank, 2023). Johor, Malaysia's second biggest construction market, recorded RM7.4 billion construction sector output in Q4 2024 (17.7% of national value), with a 42.7% sector growth in 2024 driven by projects including the Johor Bahru-Singapore RTS Link and RM17 billion data centre investments (Department of Statistics Malaysia, 2024; The Edge Malaysia, 2025; Channel News Asia, 2024). This research examines raw material price fluctuations' impact on construction project budgets in Johor Bahru, aiming to identify determinants, quantify cost implications, and suggest risk management strategies tailored for this rapidly evolving cross-border economic environment.

The construction sector as of the fourth quarter of 2024 stood at RM31.4 billion, with Johor recording about RM7.4 billion, or 17.7% of the overall value, second only to Selangor (Department of Statistics Malaysia, 2024). Johor Bahru, the capital of Johor state, registered a GDP growth rate of 6.4% in 2024, with its construction sector increasing by 42.7% (The Edge Malaysia, 2025), driven by projects such as the Johor-Singapore RTS Link, the Pengerang Integrated Oil Complex (PIIPC), and the Johor-Singapore Special Economic Zone (JS-SEZ), which are expected to attract over 100 projects and create 20,000 skilled jobs (Malaysian Investment Development Authority, 2025).

Price fluctuations in construction materials like steel and cement have been significant, with steel bar prices increasing from RM2,400 per metric ton to RM3,910 per metric ton between 2020-2023 (Construction Industry Development Board, 2024), caused by global supply chain disruption, geopolitical strain, raw material scarcity, ringgit depreciation, and local factors such as logistics challenges at ports like Tanjung Pelepas (World Bank, 2023; Ministry of Investment, Trade and Industry, 2023; Business Today Malaysia, 2025). Despite mitigation measures such as price increase clauses, forward contracts, and bulk purchases, many contractors lack awareness or capacity to implement them effectively, exposing projects to uncontrollable risks (Dehdasht *et al*., 2022; Construction Industry Development Board, 2023). This research aims to explore the impact of price fluctuations on budgets in Johor Bahru and recommend adaptive strategies consistent with the Malaysia Construction Industry Transformation Plan (CITP) 2021-2025 (Construction Industry Development Board Malaysia, 2020).

Figure 1 *Percentage of construction sector output of major Malaysian states during the fourth quarter of 2024*

Price fluctuations of building materials represent a systemic risk that threatens the financial feasibility and timely completion of construction projects, specifically in Johor Bahru, a rapidly developing urban centre in Malaysia. In Johor Bahru, cost overruns caused by material price increases have become a common problem. The unpredictable fluctuations of core materials such as steel, cement and asphalt not only undermine the accuracy of bid pricing but also endanger the timely completion and profitability of the project (Musarat *et al*., 2020). Material costs usually account for 35-60% of the total project budget and are the main factor determining cost-effectiveness. The Department of Statistics Malaysia (2023) report shows that during the period from 2021 to 2023, the unit prices of concrete and steel bars rose by an average of 13% and 20%, respectively. In fixed-price contracts, contractors cannot demand additional payments, resulting in the compression of profits or losses. A

study by Khalef *et al*. (2021) emphasises that even as material costs rise, many contractors are legally required to complete projects, which forces them to reduce quality, delay execution or seek expensive legal recourse.

In Johor Bahru, G7 contractors face unique risks due to the scale and complexity of their projects. Commercial office development projects are characterised by high material strength and tight schedules, and thus are particularly vulnerable to shocks. Without sound risk-sharing clauses or dynamic budget models, even a 5-10% price deviation can lead to losses of millions of dollars (Zecchin, 2022). Many companies do not update their bid prices frequently, and standard contracts rarely include comprehensive clauses on price fluctuations. Furthermore, Malaysian primary building material prices have shown an obvious and steady rising trend from 2016 to 2023. Figure 2 shows that Rebar Y12 went up from RM2,300 per ton in 2016 to more than RM3,100 in 2023, and Clay Bricks from RM450 to RM600 (Construction Industry Development Board, 2023). This steady surge shows the urgent necessity for sound budgeting and risk management practices amongst Johor Bahru G7 contractors. Without empirical insights into the impact on the budget and an effective mitigation framework, the department will continue to face controversies, delays and a decline in investor confidence. This research addresses this gap by focusing on how G7 contractors in Johor Bahru experience and respond to fluctuations in material prices.

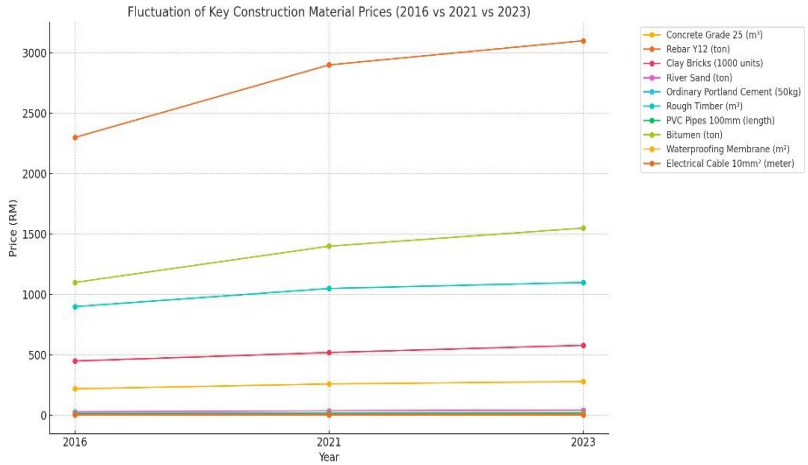

Figure 2 *Fluctuation of Key Construction Material Prices (2016, 2021, 2023)*

This study targets G7 contractors (the highest CIDB grade with unlimited tender capacity) (Construction Industry Development Board, 2023) in Johor Bahru, managing projects like RTS Link and Iskandar amid RM7 billion 2023 construction value (Department of Statistics Malaysia, 2024). Johor Bahru's Singapore proximity, rapid growth, and post-2020 supply chain volatility create unique material price-budgeting challenges during planning/execution (excluding unrelated labour/tax factors), distinguishing it from Selangor/Penang (Ministry of International Trade and Industry, 2023).

The Contractor Registry of CIDB in Johor, by Grade and District, presents the distribution of contractors registered with CIDB in Johor by grade and district. As shown, G7 contractors, the focus of this research, are present across all major districts in Johor Bahru, with a total of 614 registered companies. This comprehensive distribution further justifies the selection of G7 contractors as the research population, ensuring that the findings are representative of the highest tier of construction firms actively involved in large-scale projects throughout the state (Centralised Information Management System, 2025).

2. Literature Review

The construction industry is one of the most prominent sectors contributing immensely to the GDP of Malaysia, including all types of construction, such as residential, commercial, industrial, and infrastructure development. The growing development of the construction industry, fueled by developments such as the 12th Malaysia Plan and the National Construction Policy, has not only increased its growth but has also increased its challenges, such as changes in material prices, which significantly affect budgeting and financial planning for the fulfilment of projects (Musarat *et al*., 2021).

2.1 Background of Construction Project in Malaysia

Malaysia's construction industry drives growth across housing, infrastructure, and business sectors, with Q4 2023 activity up 34.1 billion ringgits (6.8% YoY) (Department of Statistics Malaysia,2024). Boosted by the Pan-Borneo Highway, ECRL, and urban project under RMke-12 and CITP 2021-2025, it targets better delivery,

sustainability, and Building 4.0 digitalisation (Construction Industry Development Board, 2023). CIDB ensures quality and safety, but cost overruns, labour shortages, and material price fluctuations challenge complex global supply chains.

(a) Overview of Construction Project in Johor

Johor, Malaysia's busiest construction hub due to its proximity to Singapore and the Iskandar Malaysia corridor, saw aggressive urbanisation from the government and foreign investments. It contributes 10.8% of the national G7 contractors (Construction Industry Development Board, 2023). Major projects include RTS Link, IIBD, PIPC, and Johor developments. The sector PR1MA and RMMJ affordable housing for the B40 or M40 group under the National Housing Policy. However, rising project costs from material inflation, land scarcity, and logistics congestion demand enhanced budget and procurement planning (KPMG, 2023).

(b) Significance of Material Costs in Construction Projects

Construction materials, 50-70% of project costs include structural steel or concrete, finishing paint or tiles, and infrastructure aggregates or pipes. Small price changes significantly impact profitability, especially in a long-term project. During the 2021-2023 COVID-19 recovery, Malaysian steel bar prices greater than 25% and cement costs increased by around 18%, causing budget revisions and delays (Construction Drive, 2023). Accurate material cost estimation is crucial for financial control; misestimation leads to cost overruns, cash flow issues, or abandonment. Understanding price drivers and mitigation strategies is essential for modern construction management (Musarat *et al*., 2021).

2.2 Concept Related to the Study

This section explores three fundamental concepts guiding research: fluctuations in construction prices, budget theory, and risk management theory. These frameworks not only determine the scope of the research but also serve as analytical perspectives through which the fluctuations in material prices and their effects are studied.

Table 1 *Key Concepts and Theories Related to Price Fluctuations in Construction*

Concept	Key Aspects	Source
(a) Price Fluctuations in Construction	Caused by supply-demand imbalance, global trade shocks, exchange rates, and external crises.	Chatterjee, S., & Chaudhuri, R.,2022
(b) Project Budgeting	Shift from static to dynamic budgeting using the CIDB MyPrices index and buffer funds.	Project Management Institute, 2021; Amran *et al*., 2023
(c) Risk Management	Guided by ISO 31000: Risk identification, analysis, treatment, and monitoring.	Hillson & Simon, 2020; Project Management Institute, 2021

2.3 Case Studies from the Johor Bahru Construction Project

The case study provides a glimpse into the actual impact of variation in material prices in the Johor construction industry. Based on a survey of public and private sector projects, it is possible to understand how variations in costs impact planning, execution and profitability. This section identifies three main points: projects that were negatively affected due to an increase in material prices, effective mitigation measures, and the most valuable lessons learned that can be applied across industries.

Table 2 *Case Studies for Price Fluctuations Impact on Johor Bahru Projects*

Project	Price Drivers	Affect	Source
(i) RTS Link	Global steel price surge, supply chain disruption, and exchange rate fluctuations.	Budget overrun due to a 28% price rise in imported materials.	National Audit Department, 2023
(ii) PIPC	Shortage of steel and petroleum-based insulation materials.	Procurement delays, higher costs due to the use of local substitutes.	Construction Industry Development Board, 2023

(iii) PR1MA Johor Bahru	Cement price increased 15–20% in 2022.	Redesign and delay due to cost spike, 15–20% over budget.	Amran *et al*., 2023

Table 3 *Mitigation Strategies in Johor Case Studies*

Project	Strategy	Outcome	Source
(i) RTS Link	Price escalation clause, Variation of Price (VoP) tied to CIDB MyPrices index.	Reduced disputes and ensured compensation.	Mostovaya & Dikareva, 2020
(ii) PR1MA Housing	Early procurement, use of local alternative materials.	Avoided import costs, maintained supply continuity.	Mohd Fateh *et al*., 2022
(iii) Medini CBD	Strategic supplier agreements lock in prices for core materials.	Budget control and better delivery reliability.	Jayamaha *et al*., 2024

2.4 Factors Contributing to Material Price Fluctuations in the Construction Project

Fluctuations in construction material prices are a complex phenomenon prompted by forces at the global, country, industry, and project levels. Cost setting is dictated by local infrastructural projects and international investment that fuels the construction sector. Addressing price fluctuations is critical in improving procurement planning, finance projections, and contract terms (Amran *et al*., 2023).

Table 4 *Factors Contributing to Material Price Fluctuations in the Construction Project*

Level	Factor	Source
(a) Global	Commodity shock (COVID, war), supply chain bottlenecks, USD-MYR depreciation.	World Bank, 2023; Department of Statistics Malaysia, 2023
(b) National	Inflation, diesel subsidy cuts, and mining restrictions.	Ministry of Finance, 2023
(c) Industry	Peak demand overlaps, a fragmented contractor network, and uncoordinated procurement.	Construction Industry Development Board, 2023
(d) Project	Fixed-price contracts without VoP; high-spec imports in design; late procurement.	Suresh & Nathan., 2020
(e) Regulatory / Government	Import tariffs, subsidy changes, environmental regulations, and local building code changes are impacting material prices and procurement.	ConExpo, 2025; Samsir *et al*., 2023

2.5 Effects of Material Price Fluctuations on Financial Budgeting in Construction Projects

Material cost variation has a significant contribution to the economic result of building construction contracts. It impacts the pre-construction planning, the project's mid-term cash flow, the contract's performance, and the long-term financial profits of the employer and the contractor. This section explores the multifaceted impacts of material price fluctuations on the budget.

Table 5 *Effects of Material Price Fluctuations on Financial Budgeting in Construction Projects*

Aspect	Effect	Source
(a) Cost Estimation	15% + deviation in estimates due to outdated indices and supplier assumptions.	Musarat *et al*., 2021; Liew *et al*., 2019
(b) Cost Overrun	10–18% material overrun in projects without VoP clauses.	Construction Industry Development Board, 2023
(c) Cash Flow	Upfront material cost rise squeezes other project areas like labour and logistics.	Jayamaha *et al*., 2024; Musarat *et al*., 2021
(d) Profit Margin	5% price increase can erase margins (common bid margin: 3%–8%).	Moshood *et al*., 2020; Musarat *et al*., 2021
(e) Contractual Dispute	Claims and EOTs increase due to rigid contracts lacking escalation clauses.	Yap & Lim, 2023; Algarvio, 2023

2.6 Strategies to Mitigate Risks Associated with Material Price Fluctuations

Due to the unpredictable fluctuations in the prices of building materials, a strong risk mitigation strategy must be adopted to ensure the stability of the budget and the feasibility of the project. Contractors, consultants and developers must work together to adopt financial, procurement, contractual and technical solutions to enhance the predictability of costs and reduce risks. This section explores the key mitigation strategies implemented in architectural practice in Malaysia.

Table 6 *Strategies to Mitigate Risks Associated with Material Price Fluctuations*

Strategy Type	Strategy/Description	Source
(a) Financial Risk Management Strategies	Hedging and financial derivatives can be used to lock in prices and reduce exposure to fluctuations.	Musarat *et al*., 2021
	Contingency budgeting approaches, such as setting aside reserve funds for unexpected price increases.	Construction Industry Development Board, 2023
	Financing and insurance options, including price fluctuation insurance and flexible financing arrangements.	Liew *et al*., 2019
(b) Procurement and Supply Chain Strategies	Early procurement and bulk purchasing to secure materials before anticipated price hikes.	Musarat *et al*., 2020
	Strategic supplier relationships to ensure priority access and negotiated rates.	Construction Industry Development Board, 2023
	Material storage and inventory management to buffer against short-term price spikes and supply disruptions.	Liew *et al*., 2019
(c) Contractual Strategies	Price escalation clauses in contracts allow for adjustment based on market indices.	Yap & Lim, 2023
	Risk sharing agreements between contractors, clients, and suppliers to distribute the impact of price changes.	Musarat *et al*., 2020
	Flexible contract structures that allow for renegotiation or adjustment in the event of significant price movements.	Construction Industry Development Board, 2023
(d) Design and Technical Strategies	Alternative materials and value engineering to substitute high-cost items with more stable or locally available alternatives.	Liew *et al*., 2019

3. Research Methodology

The research methodology is a systematic approach to solving the research problem, and it involves taking logical steps to achieve this goal. Not only that, Redman and Murray defined research as "a systematic effort to acquire new knowledge" (Patel *et al*., 2019).

3.1 Research Design

3.1.1 Research Design

The research design serves as a blueprint guiding the entire research process, ensuring that data is systematically collected, measured and analysed to achieve the research goals (Asenahabi & B. M., 2019). In this research, a quantitative approach will be adopted, using structured questionnaires distributed to G7 contractors in Johor Bahru to collect primary data on the influence of material price fluctuations on project budgeting. The sampling will involve key decision-makers, and the research flow will integrate research type, strategy, population, and data analysis methods to ensure validity and reliability.

Research designs are categorised into three primary types: quantitative research designs, qualitative research designs, and mixed-methods research designs. This research selected the first type, quantitative research design, because the data collection and analysis process adopted mathematical and statistical methods to analyse the results, which is more in line with this research. Quantitative research collects data through empirical observation and measurement, and it usually tends to come up with closed answers (Asenahabi, 2019).

3.1.2 Quantitative Research

This research uses quantitative methods to quantify variables and examine relationships through statistical analysis of numerical data (Creswell & Creswell, 2018). It identifies key factors causing material price fluctuations and assesses their effect on Johor Bahru construction project budgeting, and recommends risk mitigation strategies. Quantitative approaches provide objective, statistically reliable results with broader applicability (Fellows & Liu, 2021).

3.1.3 Research Process

The research process of this research would be carefully divided into five distinct stages, each of establishing research context, questions, aims, and a quantitative approach (Saunders *et al*., 2023). Second was the literature review from 2019 to 2025 on price fluctuation factors, budgeting effects, and mitigation strategies. Third was data collection via G7 contractor questionnaires and CIDB reports. Next, SPSS and Excel were used to analyse descriptive and inferential statistics (Pallant, 2020). Last, finding interpretation with evidence-based recommendations.

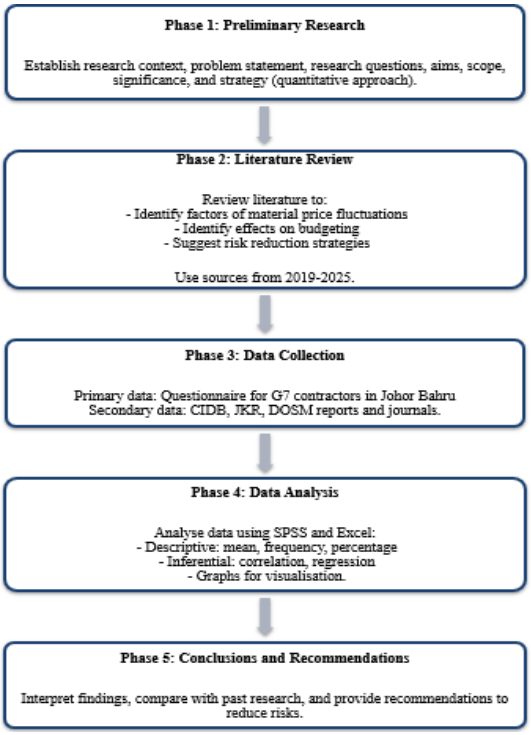

Figure 4 *Research process flow chart*

3.2 Data Collection

This section would describe the characteristics of the respondents who are expected to participate in this research. The focus of this research is on G7 contractors registered with the Construction Industry Development Board (CIDB) of Johor Bahru, Malaysia, as they are key stakeholders directly affected by the influence of material price fluctuations on construction project budgeting.

3.2.1 Primary Data

Primary data refers to the first-hand information collected directly from the survey subjects specifically for this research. In this research, the main data will be distributed to the research subjects within the study scope, namely G7 contractors in the construction industry, through structured questionnaires. The main data will be collected through an online platform (Google Sheets) and distributed via email to maximise the response rate. Meanwhile, the questionnaire design also followed best practices to ensure the clarity, relevance and reliability of the responses (Saunders *et al*., 2023). Most of the questionnaire was closed, consisting of Likert scale items measuring the mean scores using a five-point Likert scale, with 1 strongly disagree (SD), 2 disagree (D), 3 neutral (N), 4 agree (A), and 5 strongly agree (SA) (Saunders *et al*., 2023).

Table 7 *Reliability of the responses (Saunders et al., 2023)*

Reliability of the responses				
1=Strongly Disagree	2=Disagree	3=Neutral	4=Agree	5=Strongly Agree

3.2.2 Secondary Data

The background information on material price fluctuation factors, budget impact effects, and the measures that can be taken to overcome them would be obtained using secondary data in the form of systematic literature review journals on Google Scholar publications, construction reports of CIDB, as well as JKR & DOSM (2025-2019). The primary data on survey will also be complemented in this manner in creating an interpretation (Saunders *et al*., 2023).

3.3 Respondent

This section describes the characteristics of the respondents who participated in this research. The focus of this research is on G7 contractors registered with the Construction Industry Development Board (CIDB) of Johor

Bahru, Malaysia, as they are key stakeholders directly affected by fluctuations in material prices for commercial office building projects.

3.3.1 Population Size

The research aimed at 614 contractors belonging to the G7 group of contractors registered with CIDB Malaysia in Johor Bahru, categorised by 'Construction' (May 2025, Centralised Information Management System, 2025). They work with large/medium-scale commercial construction involving prices of construction materials, which can affect construction costs (CIDB Online Contractor Search portal).

3.3.2 Sample Size

For 614 G7 contractors in Johor Bahru, G*Power 3.1 calculation indicated that n=108 is required to obtain 90.1% power for medium effects with multiple regression (F tests and difference of R^2) to meet construction management standards (Memon *et al.*, 2020). Validation checks post-data collection include: Normality (Shapiro-Wilk Test: $p > 0.05$), multicollinearity (VIF value < 5), and homoscedasticity (Breusch-Pagan $p>0.05$).

F tests – Linear multiple regression: Fixed model, R^2 deviation from zero

Analysis:	A priori: Compute required sample size	
Input:	Effect size f^2	= 0.15
	α err prob	= 0.05
	Power (1−β err prob)	= 0.90
	Number of predictors	= 4
Output:	Noncentrality parameter λ	= 16.2000000
	Critical F	= 2.4599197
	Numerator df	= 4
	Denominator df	= 103
	Total sample size	= 108
	Actual power	= 0.9013736

Figure 5 *G*Power Analysis Parameters and Results*

3.4 Data Analysis Method

The data analysis stage is a key research component as it transforms raw data into meaningful insights that directly address the research objectives. In this research, two main tools were used for analysis: SPSS Statistics and Microsoft Excel. These tools were chosen because of their reliability, analytical capabilities and wide acceptance in academic research. The SPSS computer program would evaluate the questionnaire results with descriptive statistics such as mean, median, mode, SD, and frequency for demographics and research variables, as well as inferential statistics such as correlation and regression analyses to determine the correlation of material price variation with budget performance (Hair *et al.*, 2019). The computer program promotes data rigour and statistical significance, besides ensuring the reliability of research results (Pallant, 2020). This research would also use Microsoft Excel for preliminary data processing, cleaning (removing incomplete or incorrect responses), and basic descriptive statistics before SPSS analysis (Cleff, 2019), enhancing result clarity alongside SPSS capabilities.

4. Research Findings and Discussion

4.1 Respondents Background

This section contains data and background information regarding demographics for the 108 responses by G7 contractors registered with CIDB in Johor Bahru. The demographic data include gender, age, race, highest academic qualification and certificate, current position, work experience, and type of clients, specifically used to compare survey results with those of other studies.

Table 8 *Respondents' Background*

No	Respondents' Background Information	Frequency	Precentage (%)
1	Gender		
	Male	64	59.3
	Female	44	40.7
2	Age		
	Below 30 years old	25	23.1
	31 to 40 year old	43	39.8
	41 to 50 year old	34	31.5
	50 years and above	6	5.6
3	Highest academic qualification		
	Certificate	0	0
	Diploma	16	14.8
	Bachelor Degree	59	54.6
	Master	24	22.2
	PhD	9	8.3
4	Current Position		
	Quantity Survey	69	64
	Project Manager	39	36
5	Working Experience		
	Less than 1 year	0	0
	1 - 5 years	23	21.3
	6 - 10 years	49	45.4
	11 years and above	36	33.3

Based on Table 8 above, a total of 108 respondents participated in this study. The majority of respondents who completed the questionnaire were male, comprising 64 individuals, which is 59.3%, while female respondents numbered 44, which is 40.7%. Regarding age distribution, 43 respondents, which is 39.8%, were 31-40 years old, followed by 34 aged 41-50 years, which is 31.5%, 25 below 30 years, which is 23.1%, and 6 above 50 years, which is 5.6%. In terms of highest academic qualification, 59 respondents held a Bachelor's degree, which is 54.6%, followed by 24 with a Master's, which is 22.2%, 16 with a Diploma, which is 14.8%, and 9 with a PhD, which is 8.3%.

For the current position, 69 respondents were Quantity Surveyors, which is 64% and followed by 39 Project Managers, which is 36%. Regarding working experience, 49 respondents had 6-10 years, which is 45.4%, followed by 36 with 11 years and above, which is 33.3%, and 23 with 1-5 years, which is 21.3%. The findings indicate that the majority of respondents possess strong educational backgrounds and substantial industry experience. Therefore, the feedback received from respondents can be considered reliable and accurate. Based on this data, most respondents can be said to have sufficient experience in the construction industry, making the feedback received for each study objective more valid (Othman, 2018).

4.2 Main Factors Contributing to the Price Fluctuations of Materials in the Johor Bahru Construction Industry

Table 9 shows the minimum index range for determining the agreement level. If the minimum index value falls between 1.00 and 2.49, the agreement level is low. If the value is between 2.50 and 3.79, the agreement level is moderate. Meanwhile, a high agreement level corresponds to values between 3.80 and 5.00.

Table 9 *Minimum Index Interpretation (Jamil, 2002)*

Index Range	Interpretation
1.00 – 2.49	Low
2.50 – 3.79	Medium
3.80 – 5.00	High

The following is a presentation of Table 10, highlighting the results of descriptive statistics for factors that cause fluctuations in construction material prices in Johor Bahru construction projects. According to Table 10, the study has discovered that the highest mean value for statement 3(a) and 3(e) is 4.278, indicating that respondents agreed that there is an increasing demand for construction materials, which causes market price

instability, and lack of early contractor involvement during project planning reduces the accuracy of material price forecasting.

Table 10 *Main Factors Contributing to the Price Fluctuations of Materials in the Johor Bahru Construction Industry*

No	Statement	Mean	Minimum Index Interpretation Level	Ranking
1	Global Economic Factors	4.169	High	4
(a)	Changes in global demand for construction materials significantly affect their prices in Johor Bahru.	4.176	High	7
(b)	Changes in global demand for construction materials significantly affect their prices in Johor Bahru.	4.148	High	9
(c)	Exchange rate instability creates uncertainty in estimating project budgets.	4.167	High	8
(d)	Inflation directly affects the pricing and affordability of construction materials.	4.167	High	8
(e)	Global supply chain disruptions, such as shipping delays or port congestion, contribute to sudden material price increases.	4.185	High	6
2	National and Local Economic Factors	4.187	High	3
(a)	National inflation leads to higher construction material prices.	4.167	High	8
(b)	Government taxation contributes to rising material costs.	4.167	High	8
(c)	Tariffs contribute to rising material costs.	4.185	High	6
(d)	Import duties contribute to rising material	4.185	High	6
(e)	costs.	4.204	High	5
(f)	Implementation of new environmental measures affects the cost of materials and logistics. Safety regulations affect the cost of materials and logistics.	4.213	High	4
3	Industry and Project Factors	4.209	High	2
(a)	Increasing demand for construction materials causes market price instability.	4.278	High	1
(b)	A limited supply of construction materials	4.231	High	2
	causes market price instability.	4.037	High	10
(c)	Transportation (e.g., fuel prices, delivery			
	delays) increases the overall cost of	4.222	High	3
(d)	materials.			
(e)	Delayed procurement due to cash flow limitations exposes contractors to price escalation. Lack of early contractor involvement during project planning reduces the accuracy of material price forecasting.	4.278	High	1
4	Regulatory and Government Policy Factors	4.222	High	1
(a)	Changes in government policies, such as subsidies or trade tariffs, directly impact material price fluctuations.	4.222	High	3

Next, statements 3(b) both documented the second-highest means at 4.231, respectively. The respondents strongly agree that a limited supply of construction materials causes market price instability. Additionally, several factors that reached a high level of agreement of around 4.20 to 4.22, and they were safety regulations

affecting material and logistics costs,2 (f) is 4.213, new environment measures,2 (e) is 4.204, government policy changes such as subsidies or tariffs,4 (a) is 4.222, delayed procurement due to cash flow limitations,3(d) is 4.222, and global supply chain disruptionsis,1(e) is 4.185. Scores for all factors were well within the high interpretation scale of 3.80 to 5.00, indicating a high level of consensus among G7 contractors for all given factors.

4.3 Effects of Material Price Fluctuations in the Johor Bahru Construction Industry on Financial Budgeting in Construction Projects

Table 11 below shows the results of descriptive analysis on the effects of Material Price Fluctuations in the Johor Bahru Construction Industry on Financial Budgeting in Construction Projects. Based on Table 11, the study findings indicate the highest mean value of 4.25 for statement 1(a), showing that the majority of respondents strongly agree that frequent changes in material prices make it difficult to produce accurate cost estimations during project planning. This highlights the primary challenge in early-stage financial planning due to price Fluctuations.

Table 11 *Effects of Material Price Fluctuations in the Johor Bahru Construction Industry on Financial Budgeting in Construction Projects*

No	Statement	Mean	Minimum Index Interpretation Level	Ranking
1	Impact on Cost Estimation and Project	4.213	High	1
(a)	Planning	4.25	High	1
(b)	Frequent changes in material prices make it difficult to produce accurate cost estimations during project planning.	4.176	High	6
	Outdated supplier quotations or price indices result in underestimated project budgets.			
2	Financial and Cash Flow Implications	4.133	High	4
(a)	Material price increases during project execution often lead to significant budget	4.139	High	9
(b)	overruns.	4.093	High	10
(c)	Escalating material prices strain project cash flow and delay payment to subcontractors.	4.167	High	7
	Slow approval for budget revisions in government projects worsens the financial impact of price escalation.			
3	Profit Margin and Business Viability	4.207	High	2
(a)	Rising material costs create cash flow challenges that disrupt other aspects of project execution, such as labour or	4.204	High	3
(b)	equipment expenses.	4.231	High	2
(c)	Continuous price escalation increases the risk of business closure or insolvency among contractors.	4.185	High	5
	Escalating material costs reduce project profit margins, sometimes eliminating expected profits.			
4	Contractual and Legal Consequences	4.171	High	3
(a)	Material price fluctuations increase the	4.148	High	8
(b)	likelihood of contractual disputes.	4.194	High	4
	Material price fluctuations increase the likelihood of project delays.			

Next, continuous price escalation, increasing the risk of business closure or insolvency among contractors, recorded the second-highest mean value of 4.231 of 3 (b). Respondents strongly agree that continuous price escalation increases the risk of business closure or insolvency among contractors. Additionally, rising material costs create cash flow challenges that disrupt other aspects of project execution, such as labour or equipment expenses, 3(a) is 4.204. Material price fluctuations increase the likelihood of project delays, 4(b) is 4.194, and outdated supplier quotations or price indices result in underestimated project budgets,1 (b) is 4.176; all

achieved high agreement levels. All mean scores fall within the high interpretation range (3.80-5.00), confirming strong consensus among respondents regarding the severe financial budgeting impacts of material price fluctuations across cost estimation, cash flow, profitability, and contractual domains.

4.4 Strategies That Can Be Implemented to Reduce the Risks Associated with Material Price Fluctuations in the Johor Bahru Construction Industry

Table 12 below presents the descriptive analysis of statements showing strategies that can be implemented to reduce the risks associated with material price fluctuations in the Johor Bahru construction industry. Based on Table 12, the study findings present the highest mean value of 4.407 for statement 3(a), which means that a significant proportion of the respondents agree that including price escalation clauses in contracts can effectively distribute the financial risks of material cost changes. This also signifies a primary contractual strategy preferred by G7 contractors.

Table 12 *Strategies That Can Be Implemented to Reduce the Risks Associated with Material Price Fluctuations in the Johor Bahru Construction Industry*

No	Statement	Mean	Minimum Index Interpretation Level	Ranking
1	Financial Risk Management Strategies	4.232	High	3
(a)	Early procurement of materials helps reduce the impact of price fluctuations.	4.352	High	3
(b)	Using financial tools, such as hedging or insurance, can mitigate the risks associated with price fluctuations.	4.111	High	8
2	Procurement and Supply Chain Strategies	4.188	High	4
(a)	Material price increases during project execution often lead to significant budget	4.176	High	6
(b)	overruns.	4.213	High	5
(c)	Bulk purchasing of materials helps reduce the impact of price fluctuations.	4.148	High	7
(d)	Building strong relationships with strategic suppliers improves price stability and material availability. Building long-term relationships with strategic suppliers improves price stability and material availability.	4.213	High	5
3	Contractual	4.347	High	1
(a)	Including price escalation clauses in contracts can effectively distribute the financial risks of material cost changes.	4.407	High	1
(b)	Risk-sharing agreements in contracts can effectively distribute the financial risks of material cost changes.	4.287	High	4
4	Technical Strategies	4.220	High	3
(a)	Using alternative materials helps control costs when standard material prices rise.	4.06	High	9
(b)	Applying value engineering helps control costs when standard material prices rise.	4.379	High	2

Next, applying value construction to control costs when standard material prices rise recorded the second highest mean value of 4.379, 4(b). Respondents strongly agree that applying value engineering helps control costs when standard material prices rise. Additionally, Early procurement of materials helps reduce the impact of price fluctuations, 1(a) is 4.352 and Risk-sharing agreements in contracts can effectively distribute the financial risks of material cost changes, 3(b) is 4.287, achieving high agreement levels. Several procurement strategies, including Bulk purchasing of materials helps reduce the impact of price fluctuations, and building long-term relationships with strategic suppliers improves price stability and material availability, 2 (b) and (d), which are 4.213, and strong strategic Material price increases during project execution often lead to significant budget overruns, 2(a) is 4.176, also received strong endorsement. All mean scores fall within the high

interpretation range (3.80-5.00), confirming strong consensus among respondents regarding these multifaceted risk mitigation strategies.

4.5 Discussion of Research Findings

(a) Main Factors of Material Price Fluctuations

The results indicated that the factor of regulatory and government policy had the highest mean score amongst the factors, which means that the changes made to government policies, subsidies, taxes, tariffs, and import duties have been identified to have the most dramatic impact on the fluctuation of material prices within the construction industry of Johor Bahru. In fact, this corroborates the views of earlier research, which identified the profound effects of macroeconomic factors, inflation, and trade regulations on the cost of construction materials, leading to dramatic cost increments (Musarat *et al*., 2024).

Industry and project factors that were more risky included growing demand, constricted supply, procurement delays, and limited early contractor involvement, which also had high mean values to confirm that internal dynamics within the market and project management practices greatly contribute to instability in prices. These findings are consistent with empirical evidence that rapid development, supply chain constraints, and poor planning at the early stages increase material price risks in developing urban regions. National and local economic issues, along with global economic pressures such as fluctuating exchange rates and commodity prices on the international market, further uphold the volatility of material costs; however, their mean scores were a little lower when compared with the drivers linked to regulatory and project-related factors (Shahbaz *et al*., 2020).

(b) Effects of Price Fluctuations on Project Budgeting

Results revealed that the effects of material price fluctuations are more significant on cost estimation and project planning in terms of accurate cost forecasts, affected by the changing prices and outdated prices submitted by the suppliers. This result corroborates the existing theory that the cost estimation process in an uncertain market environment tends to have higher risks of underestimation and cost overrun (Musarat *et al*., 2024).

The results also indicated that strong negative impacts of price fluctuations on financial and cash flow management existed, which were budget overrun, cash flow strain, and delays in payments to subcontractors and suppliers. These results align with previous studies that indicated material price fluctuations as one of the major sources of cost overrun and liquidity pressure in construction projects, especially when the contract sums are fixed, and input prices are increased during implementation.

Moreover, it was mentioned in the study that the threat to the profitability and survival of the contractor business by perpetual escalation could result in a risk of business closure due to a loss in profits and a decrease in profits corresponding to the increase in the cost of construction contracts. The last area it touched was legal implications related to cost escalation in contracts and construction projects (Rudi *et al*., 2025).

(c) Strategies to Reduce the Risks of Price Fluctuations

The findings showed that the highest overall mean score was achieved by the use of contract strategies, especially the use of price escalation and risk-sharing agreements within the contract agreements, which the respondents strongly agreed played an effective role in managing the financial risk associated with material prices between clients and contractors. This is in line with best international practice, which suggests the use of escalation and risk-sharing agreements to manage cost fluctuations (Musarat *et al*., 2024).

Technical methods, in particular the application of value engineering and the use of alternative materials, were rated very high as a practical approach to manage the increases in the cost of standard materials. The same observation has been observed in studies on the application of value engineering, in which the method has been shown to yield significant cost savings without affecting the functionality of the materials, thereby making it an efficient way of dealing with fluctuating material prices. Third, while the application of financial risk management methods, in particular the utilisation of contingency budgets and financial instruments, has been considered as a supportive approach, its application may be affected by the financial resources of the company. Another method identified in the study was the application of purchase power or the effect of the size of the company (Chammout *et al*., 2024).

5. Conclusion

For this study, the findings from the respondents were collected through the data findings obtained from the online questionnaire that was distributed. Generally, this study has been able to effectively present the findings from the data to address the research questions. All three research objectives were met through the analyses that were conducted. There is an important purpose for conducting this study, focusing on addressing the significant problem of the effect of the fluctuation of prices of materials on the budgeting of construction projects in Johor Bahru. Furthermore, contractors are also able to use the issues and problems identified in connection with the fluctuation of prices appropriately. Finally, the purpose of conducting this study is to be able

to provide benefits and references to the stakeholders, particularly the academia, contractors in Malaysia, and the government agencies. Relevant academic experts can refer to the related topics, which are expected to support future academic studies in construction management and economics.

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Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this paper.

Author Contribution

The authors confirm contribution to the paper as follows: study conception and design: Song Mei Xin, Norliana binti Sarpin; data collection: : Song Mei Xin; analysis and interpretation of results: Song Mei Xin, Norliana binti Sarpin; draft manuscript preparation: Song Mei Xin, Norliana binti Sarpin, Md. Asrul Nasid bin Masrom, Seow Ta Wee, Goh Kai ChenAuthor Y, Author Z. All authors reviewed the results and approved the final version of the manuscript.

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