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WELCOME SPEECH FROM THE CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

بسم الله الرحمن الرحيم السلام

عليكم ورحمة الله وبركاته

Greetings to all,

It is with great pleasure that I welcome you to the 17th RISM International Surveying Conference for Undergraduates (ISCU 2025), themed “*Embracing Construction Revolution 4.0: Transforming Malaysia’s Built Environment.*” On behalf of the Royal Institution of Surveyors Malaysia (RISM), I also wish to express our sincere appreciation to Universiti Teknologi MARA (UiTM), Perak Campus, for graciously hosting this significant event.

As we navigate the era of the Fourth Industrial Revolution (IR4.0)—or in our context, Construction Revolution 4.0 (CR4.0)—we are witnessing transformative advancements across the global construction sector. Technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), artificial intelligence (AI), robotics, big data analytics, and cloud computing are redefining the way we build, manage, and interact with our built environment. For Malaysia, embracing CR4.0 is a strategic imperative to achieve our socio-economic and environmental goals.

This conference serves as a vital platform to unite surveying undergraduates from various disciplines, fostering critical dialogue on industry challenges, enhancing professional networking, and preparing a new generation of talent for the rapidly evolving construction landscape. It is also an opportunity for employers to engage with and inspire our future professionals.

I would like to extend my heartfelt thanks to all industry speakers, paper presenters, judges, and participants for their time, contributions, and support in making ISCU 2025 a success. I also commend the organising committee for curating a meaningful and dynamic conference experience.

May the knowledge gained, connections formed, and ideas exchanged during this event inspire all participants to lead and innovate in their future endeavours.

Wishing everyone a productive and memorable conference.

Prof. Ts Sr Dr. Adi Irfan Bin Che Ani'

Chairman, Universities' Partnering Committee

RISM Session 2024/2025

May 2025

WELCOME SPEECH FROM CO-CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

Bismillahirrahmanirrahim.

السلام عليكم ورحمة الله وبركاته and greetings to all.

It is my great pleasure to welcome everyone to the 17th International Surveyor Conference for Undergraduates (ISCU 2025), proudly hosted by Universiti Teknologi MARA (UiTM) Perak Branch in collaboration with the Royal Institution of Surveyors Malaysia (RISM). This event is a meaningful platform for students in the built environment to share ideas, showcase innovations, and build professional networks. We are honoured by your presence and enthusiastic participation, with 135 accepted papers and 78 poster presentations this year.

UiTM Perak, home to the College of Built Environment, has long been a hub for academic excellence in architecture, planning, and surveying. Our commitment remains strong in nurturing competent graduates who meet industry demands and contribute to nation-building.

While you're here, we invite you to experience the heritage and culture of Perak Tengah from the architectural richness of Rumah Kutai to the historical towns of Pasir Salak, Bota, and Kampung Gajah.

To all presenters and winners, congratulations on your achievements. Let your work today be a catalyst for future success and academic growth. We hope this conference will inspire you to explore new ideas, foster collaboration, and make lasting memories.

My deepest thanks to the Royal Institution of Surveyors Malaysia (RISM) and the organising committee for making this event a success.

We hope your experience here will be rewarding and unforgettable.

Thank you. Selamat datang dan selamat berjaya.

Associates Professor Dr. Nur Hisham Ibrahim, *PMP*
Co-Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM THE PROJECT DIRECTOR

RISM 17th International Surveying Conference for Undergraduates 2025

Alhamdulillah, all praise to Allah S.W.T. for His guidance and blessings in making the RISM 17th International Surveying Conference for Undergraduates (ISCU) 2025 a reality.

It is with great honour and gratitude that I welcome all participants, guests, academicians, and industry professionals to this prestigious event, proudly organized under the Royal Institution of Surveyors Malaysia (RISM). This 17th edition of ISCU stands as a proud testament to our collective dedication toward academic excellence, professional collaboration, and youth empowerment in the field of surveying.

I extend my heartfelt appreciation to RISM for its unwavering support, to the hardworking ISCU 2025 Organising Committee, and to all 16 partnering universities across Malaysia for their commitment and contributions. Your efforts have shaped this conference into a dynamic platform for knowledge exchange, innovation, and professional growth.

To the academicians and practitioners present, your insights are invaluable in bridging the gap between academic theory and real-world practice. To our undergraduate participants, your passion, curiosity, and commitment are the very foundation of our future. May this conference not only deepen your academic journey but also ignite a spirit of leadership, integrity, and sustainable thinking.

Let this gathering serve as more than an academic milestone. May it foster lifelong networks, inspire transformative ideas, and chart new directions in our shared professional journey.

Wishing everyone a rewarding and inspiring conference experience.

Sr Dr. Nurul Fadzila Zahari

Project Director

RISM 17th ISCU 2025

ASSESSMENT ON THE ECONOMIC IMPACT OF INCREASING DIESEL FUEL PRICES ON THE OPERATION COST OF A CONSTRUCTION PROJECT AND THE MITIGATION STRATEGIES

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ABSTRACT

The construction industry relies heavily on diesel fuel for machinery operation, material transportation, and logistical management. However, rising diesel prices, driven by global market fluctuations and subsidy removals, have significantly increased operational costs, posing financial challenges for contractors. This study examines the economic impact of fuel price surges on project budgeting, contractor stability, and overall financial sustainability. The findings reveal that rising fuel costs lead to budget overruns, increased rental expenses, and financial instability, ultimately affecting project feasibility and profitability. Key challenges include price volatility, fluctuating material costs, and higher operational expenditure. To mitigate these challenges, the study explores strategic interventions such as price variation clauses, fuel cost escalation frameworks, and energy efficiency optimization. These measures aim to reduce financial risks and improve cost predictability. The study underscores the importance of proactive financial planning, contractual adjustments, and policy reforms to enhance industry resilience against fuel price instability. By adopting adaptive economic models and regulatory frameworks, the construction sector can better navigate future uncertainties and sustain long-term operational efficiency.

Keywords: Construction, Diesel Price, Impact, Strategies, Operational Cost

I. INTRODUCTION

Nowadays, construction is one of the main sectors of Malaysian economy (G Dehdasht, 2021). The construction sector's operations are heavily reliant on fuel. This energy source powers machinery, transports materials, and supports logistical processes. Consequently, fuel prices play a crucial role in determining the operational costs of construction activities. In addition, the obvious higher transportation and operating costs, rising fuel prices also affect other aspects of construction operations (Go Codes, 2023). The most direct effect of rising fuel prices is having to pay more to run equipment and transport people to construction sites. Since fuel prices are going up, materials processing companies may increase their prices (Custom Truck, 2022). However, the president of the Bumiputera Contractors Association of Malaysia (PKBM), Datuk Azman Yusoff has said the construction industry in Malaysia is facing unprecedented cost increases, with the price of construction goods surging by nearly 30% following a recent hike in diesel prices. Suppliers have begun setting new rates for construction materials. The impact of this price surge is most acutely felt by contractors classified from G1 to G7 (CIDB Malaysia, 2024). Therefore, this study focuses on the relationship between fuel price and operational cost of construction projects. Besides, effective ways to mitigate this impact will also be carried out in the study.

II. PROBLEM STATEMENT

The main obstacle is the recent removal of fuel subsidies and the subsequent rise in diesel prices of 55% has created significant challenges for the construction industry. Construction companies are now facing increased operational costs ranging from 15% to 35%, primarily due to their reliance on fuel for equipment operation,

material transportation, and on-site logistics. This cost increase threatens project financial stability and operational efficiency, potentially leading to project delays, financial losses, and even cancellations (Free Malaysia Today, 2024). According to MalayMail on 14th Jun 2024, Datuk Azman Yusoff, president of the Bumiputera Contractors Association of Malaysia (PKBM) has said, the price hike as the highest in the country history, like suppliers setting new rates for construction material and there has been an increase in the rental cost of machinery and raw materials. Based on The Edge Malaysia on 20th June 2024 by Suren Rajah, there is a serious problem which is after removal of subsidies, it can potentially to become an opportunity for the companies to raise prices while pretending that they are doing it to offset the increased cost of diesel. In addition, due to the fuel price following the global fuel price, there will be a risk which is uncertainty. This is so that a contractor is obligated to accept the bid price. If the contract does not contain a fluctuation clause, the contractor will be responsible for covering any price adjustments. The contractors find themselves in a challenging scenario when the price is uncertain and inconsistent. The tender price will increase if the risk of fluctuation is priced in. If the risk is not priced, the tender price could be too low to be used in the building phase. Even worse, fluctuating fuel prices might have an impact on other prices as well. Contractors are unable to commit to a set fee for an extended length of time in such a situation (Hamzah,2008).

III. RESEARCH AIM

The research aims to investigate the impact of increasing fuel prices on operation costs in the construction sector.

IV. RESEARCH OBJECTIVES

In achieving the aim of the research, the following objectives have been set out:

1. To identify the relationship between fuel price and construction operation cost.
2. To determine the impact faced by the construction sector due to the increase of fuel price.
3. To assess the potential strategies in mitigating the impacts.

V. RELATIONSHIP BETWEEN DIESEL PRICE AND CONSTRUCTION OPERATION COST

The construction sector's operations are heavily reliant on fuel. This energy source powers machinery, transports materials, and supports logistical processes. Consequently, fuel prices play a crucial role in determining the operational costs of construction activities.

Banlaw (2023) states that diesel is crucial for operating heavy machinery like excavators, bulldozers, cranes, and loaders. These machines are essential for construction tasks such as digging, leveling, lifting, and transporting materials. According to New Straits Times (2024), the removal of diesel subsidies for some industry suppliers will significantly increase project costs. With diesel prices rising from RM2.15 to RM3.35 per litre—an increase of over 50%—the cost of materials, particularly precast concrete, is expected to rise by 25% to 60%. Additionally, equipment and machinery costs may increase by more than 35%, ultimately driving overall project costs up by 30% to 65%.

Harapan Daily (2024) highlights that rising diesel prices will lead to higher construction costs. Contractors rely on tipper lorries to transport essential materials like stone, sand, and cement, making fuel price hikes a direct burden on the industry. MalaysiaNow (2024) reports that on the first day of the new diesel price implementation, several companies issued notices about upcoming price increases. After evaluating rising transport and product costs, Chuan Soon Heng Sdn Bhd announced adjustments to its product pricing and transportation charges.

Ririn et al. (2023) found that rising fuel prices significantly impact fleet operational costs, increasing fuel's share in total expenses. Since fuel is essential for operations, these price hikes directly affect businesses. Hitachi Construction Machinery (2024) emphasizes that fuel consumption is a major operational cost in the construction industry. Similarly, Hashem (2021) found that oil price fluctuations strongly impact construction costs, affecting building expenses, material transportation, and machinery costs. Willem Thorbecke (2019) also notes that the heavy construction sector is particularly vulnerable to oil price increases, further reflecting the influence of fuel costs on the industry.

VI. TYPES OF OPERATION COST IN THE CONSTRUCTION SECTOR

Running a construction business involves a lot of expenses, and these are called operational costs. These are the everyday costs of keeping the company going and getting projects done. Think of them as the necessary expenses for a project to succeed. These costs fall into different categories, and each one is important for managing the

overall budget of a construction project (ConstructConnect, 2022). According to Musarat (2020), one of the reasons for this is that the building materials, labour and machinery cost increase annually due to inflation. Inflation plays a vital role in the price increase of materials, labours and machinery which results in deviating the initial and final cost of the project.

a. Machinery cost

According to Muhammad Ali Musarat (2021), machinery has been used in the construction industry in both small and large-scale project for a long time. Machinery is one of the main resources of any construction projects. Machinery is an important resource of any construction project and with advancement, the demand for machinery is getting higher. All the products or materials being used in construction projects are transported by trucks and trains with diesel engines, and most construction equipment, plants and vehicles are also powered by diesel engines (Ajay et al, 2023). According to Sergey Prochorov (2018), the cost of machine and mechanisms operations in the production of construction and installation works takes a large part of the total cost for the construction of the facility.

b. Transportation cost

According to Adel Gohari et al (2018), transportation is one of the backbones of any industrial system and it is a major component of the supply chain to ensure the efficient movement and timely availability of raw materials and finished products in local and international markets. Transportation includes internal and external costs. Internal costs are the direct expenses incurred by providers of freight transportation. It includes operating costs and investment in capital facilities. Energy, wages, maintenance, user charges, depreciation, and insurance are parameters that can be considered as the total operating cost. Musarat, M.A, (2020), mentioned it can be observed that there are many factors involved in the deviating the material costs mainly; transport costs, crude oil prices and inflation that influence construction costs as well as the output of the construction industry. According to Eko Budi Satoto (2023), direct effects include changes in the prices of goods and services directly related to fuel, such as transportation. According to Hamradio (2024), as diesel prices rise, transportation companies will inevitably face higher operational expenses.

c. Material Cost

According to Musarat (2020), material costs influence inflation, but there is a huge change due to contractors and suppliers' margin. Inflation is causing an increase in the prices of materials. Building materials impact 35% to 60% of overall construction cost. The principle of how inflation affects building materials prices is the time lag behaviour of these components. It can be observed that there are many factors involved in deviating the material costs mainly; raw materials, crude oil prices and inflation that influence construction costs as well as the output of the construction industry. According to Renata et al, (2015), construction materials and equipment may constitute more than 70% of the total cost for a typical construction project. Therefore, the proper management of this single largest component can improve the productivity and cost efficiency of a project and help ensure its completion timely.

d. Labour Cost

Labour productivity is one of the most important factors that affect the physical progress of any construction project. Construction labourers are responsible for operating a variety of equipment, and their efficiency directly impacts the overall cost and schedule of a project. According to Musarat (2020), labour costs influence inflation, but there is a huge change due to contractors and suppliers' margin. The principle of how inflation affects labour wages is the time lag behaviour of these components. It can be observed that there are many factors involved in the deviating the material costs mainly; labour costs, crude oil prices and inflation that influence construction costs as well as the output of the construction industry. According to Nurulzatushima, (2013), construction projects are mostly labour based with basic hand tools and equipment, as labour costs comprise 30% to 50% of overall project costs.

VII. IMPACTS OF DIESEL PRICE RISING TO THE CONSTRUCTION OPERATION

According to the study by Oguche et al (2024), any increase in fuel prices directly impacts the prices of goods and services. However, the construction companies face numerous challenges, including subsidy removals and fluctuating fuel prices, which significantly affect operational costs and profitability. The persistent fluctuations

in fuel prices pose formidable challenges to the viability and sustainability of construction companies, impacting their profit margins, pricing strategies and supply chain operations. The rising fuel prices lead to increased operational costs for construction companies, affecting their competitiveness and financial stability.

a. Machinery cost

The construction sector, which depends heavily on heavy machinery and diesel-powered vehicles, will face rising costs. These increased expenses can lead to delays or escalations in project budgets, impacting infrastructure development and housing projects (Hamradio, 2024). According to MalayMail, (2024), there has been an increase in the rental costs of machinery, such as heavy machinery, excavators, and pavers for infrastructure projects as diesel price increases. As diesel is the primary fuel for operating heavy machinery. When diesel prices rise, the cost of running these machines increases. According to Willem Thorbecke (2019), heavy construction is exposed to oil price increases, reflecting the effect of oil prices on the cost of using construction machinery. According to Muhammad Ali Musarat, (2020), inflation is causing an increase in the prices of machinery and other inputs to construction project. The principle of how inflation affects machinery hire rates is the time lag behaviour of these components. This consists of three influential factors such as fuel cost, driver wage and maintenance cost of the vehicle.

b. Transportation and logistics cost

Based on Malaysia Now, 2024, the Johor sand and granite lorry operators' association, which represents more than 100 operators, said it had no choice but to raise prices to avoid losses due to the high cost of diesel, which rose from RM2.15 to a record RM3.35. The expected increase in tipper tariffs is just part of a series of price hikes in the logistics and transport sector, where almost all vehicles run on diesel. According to Willem Thorbecke (2019), heavy construction is exposed to oil price increases, reflecting the effect of oil prices on the cost of using transporting materials. This reflects the effect of higher oil prices on transporting goods. In both Thailand and Malaysia, the transportation sector is harmed by higher oil prices.

c. Material costs

According to Aftab et al, (2010), fluctuation in prices of materials is listed as one of the factors affecting construction cost, with a frequency of 9. This factor includes fluctuations in the cost of building materials, which can be influenced by changes in fuel prices, as fuel is a critical component in the transportation and production of construction materials. According to Nida Azhar et al, (2008), when projects exceed their budgets, it's often due to unpredictable energy costs. These costs affect the price of key materials like iron, steel, cement, and concrete. Since fuel is a major part of energy expenses, its ups and downs directly influence how much it costs to move materials and produce them, ultimately pushing construction projects over budget.

d. Lead to cost overrun

Eventually, a cost overrun will happen due to the increased cost of fuel. According to Jelena et al, (2019), cost overrun due to the increased cost of fuel has appeared in some development projects same mentioned in Musarat, (2020), cost overrun is a common problem for both developed and developing countries in the construction industry. According to Nor Haslinda et al, (2018), nd Ogun (2014), one of the affecting project's time and cost overruns will be price fluctuations. The major cost overrun distress is the rise in construction materials costs due to inflation.

VIII. STRATEGIES TO MITIGATE THE IMPACTS

A. Adopting Fuel-Efficient Machinery

Modern construction equipment is designed to be more fuel-efficient, helping to reduce diesel consumption. Newer models of excavators, bulldozers, and cranes use advanced engine technology that maximizes fuel efficiency (Hitachi Construction Machinery, 2024). Additionally, hybrid and electric-powered machinery, while requiring higher initial investment, offers long-term savings by reducing reliance on diesel and lowering maintenance costs (Hashem, 2021). These machines also contribute to sustainability efforts by reducing carbon emissions.

B. Optimizing Logistics & Transportation

Fuel costs in construction are heavily influenced by transportation expenses. Efficient route planning for transporting materials and equipment helps reduce fuel consumption and operating costs (Ririn et al., 2023). GPS tracking and fleet management systems can optimize vehicle routes, minimize idle time, and prevent

unnecessary trips, ensuring that fuel is used efficiently (MalaysiaNow, 2024). Bulk transportation, where materials are delivered in larger quantities at once, reduces the number of trips required, further cutting fuel expenses.

C. Contractual strategies

To manage fuel price fluctuations in construction projects, contractual mechanisms such as Variation of Price (VOP) clauses and escalation clauses play a crucial role in distributing financial risks between contractors and project owners. According to The Edge Malaysia (2022), VOP clauses allow for project cost adjustments when material prices, including fuel, increase or decrease. The Construction Industry Development Board (CIDB), Malaysia and Minsoo Choi et al., (2006) recommends incorporating these clauses to ensure a fair distribution of financial risks between project owners and contractors and the inclusion of fuel price escalation clauses, ensuring contractors are not disproportionately affected by rising costs. Bahaa Chammout (2024) highlights that under the AIA A201 contract, price escalation related to materials, equipment, and taxes must be acknowledged before contract formation. Price increases beyond the stipulated allowances can trigger contract amendments through changing orders, ensuring that unexpected fuel price hikes do not unfairly burden the contractors. Unlike AIA contracts, EJCDC contracts hold contractors fully responsible for all costs, including labor, materials, and equipment. This implies that any fuel price increase is absorbed by the contractor unless a separate escalation clause is included in the agreement.

d. Alternative Energy Sources

The construction industry can explore alternative energy sources to reduce dependence on diesel. Renewable energy solutions, such as solar-powered lighting, on-site solar panels for energy needs, and battery-powered equipment, provide cost-effective alternatives (Willem Thorbecke, 2019). Additionally, biofuels, derived from organic sources, can serve as a substitute for traditional diesel, reducing both fuel costs and environmental impact (Hashem, 2021). These alternatives are becoming more accessible and can help offset the financial burden of fluctuating diesel prices.

e. Diesel Procurement & Cost Management

One way to manage rising fuel costs is by securing long-term contracts with fuel suppliers. Such contracts can provide stability in pricing and help businesses plan their budgets effectively (Harapan Daily, 2024). Additionally, monitoring fuel price trends and purchasing in bulk during periods of lower prices can help construction companies control costs (New Straits Times, 2024). Companies can also explore partnerships with fuel suppliers for discounts or rebates based on long-term purchases.

f. Workforce Training & Awareness

A well-trained workforce plays a crucial role in improving fuel efficiency. Operators should be trained in fuel-saving techniques such as smooth acceleration, reducing idling time, and maintaining optimal engine performance (Hitachi Construction Machinery, 2024). Regular maintenance of machinery, such as timely oil changes and air filter replacements, ensures that equipment operates efficiently and consumes less fuel (Banlaw, 2023). Educating employees on fuel-conscious practices can lead to significant cost savings in the long run.

g. Fuel hedging strategy

According to Mohammad Ammar Al-Zarrad, (2015), a hedge is an investment position projected to offset potential losses that may be incurred by a companion investment. Although it is known that using hedging as a risk management tool adds value to a financial firm, limited knowledge has been established about using hedging for construction material price risk mitigation. Hedging has also been a practice applied in the airline industry for a long time, and substantive research has been completed in the field of airline fuel hedging.

CONCLUSION

With the fuel price strikes and removal of fuel subsidies, construction firms face rising costs in machinery operation, material transportation, and logistics, leading to financial instability and potential project delays. The study further identifies mitigation strategies such as fuel efficiency measures, contractual adjustments like price variation clauses, and the adoption of alternative energy sources. By implementing these approaches, construction firms can better manage cost uncertainties and maintain project viability. The findings aim to provide valuable insights for industry stakeholders, enabling them to develop strategic responses to rising operational costs. Future studies may also consider a broader scope, incorporating additional variables such as government policies and

technological advancements in fuel efficiency to further enhance cost management in the construction sector.

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