

# E-BOOK OF EXTENDED ABSTRACT

## THE 14<sup>TH</sup> INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025



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# ***SmartQS Prompt: A NEW BUILT-UP RATE GENERATOR***

Muhammad Iqbal Aqif Muhammed, Irfan Nazrul Amin, Nur Zulaika Fauzi, Sri Nurfilzah Ahmad Fadzil,  
Dr Nor Suzila Lop, Dr Izatul Farrita Mohd Kamar

Faculty of Built Environment, Universiti Teknologi MARA, Perak Branch,  
Seri Iskandar Campus, Seri Iskandar, 32610, Perak, Malaysia.

2024772065@student.uitm.edu.my

## **ABSTRACT**

The construction industry relies heavily on accurate and efficient cost estimation, with Quantity Surveyors (QS) playing a central role in generating reliable built-up rates (BUR). However, traditional rate-building methods remain time-consuming, prone to error, and lack integration with evolving digital tools. Thus, this research aims to introduce SmartQS Prompt, a novel AI-powered BUR generator designed to enhance the speed, consistency, and accuracy of rate compilation. A fully quantitative research methodology was adopted, comprising three sequential survey-based phases. Phase 1 preliminary conducted among Quantity Surveying's Students to identify prevailing challenges in traditional BUR preparation. Phase 2 involved the design and development of the SmartQS Prompt prototype using generative AI and natural language processing frameworks, incorporating standard cost databases and parametric inputs. Phase 3 involved a usability testing tool, where participants interacted with the SmartQS Prompt system and provided structured feedback through a Likert-scale-based survey. Finally, phase 4 expert validation reviews the SmartQS Prompt effectiveness by comparing user performance metrics, namely, accuracy, time efficiency, and satisfaction before and after using the system. The research signifies a paradigm shift towards semi-automated cost planning, supporting the digital transformation agenda within the built environment professions. SmartQS Prompt offers a scalable solution adaptable to varying project typologies, paving the way for further integration of intelligent systems in quantity surveying practice.

**Keywords:** Built-up Rates, Estimation, Prompt, generative AI

## **1.0 INTRODUCTION**

In the construction industry, cost estimation plays a crucial role in ensuring financial viability, value for money, and successful project delivery. Quantity Surveyors (QS) are responsible for preparing Built-Up Rates (BUR), which are detailed cost breakdowns of construction activities based on labor, materials, plant, profit and overheads. Despite advancements in construction technology, BUR preparation remains a labor-intensive and error-prone process when conducted manually or using traditional spreadsheet-based tools (Ashworth et al., 2013). These conventional methods lack integration with modern digital platforms and fail to capitalize on the capabilities of intelligent automation, leading to inefficiencies, inconsistencies, and limited adaptability in dynamic project environments (Perera et al., 2020). The process of obtaining these rates using traditional methods is usually slow, requires a lot of effort and is not very accurate, leading to issues in planning and cost management (Lin et al., 2024). However, following the traditional approach

results in slower response to the changing market and particular needs of the project (Smith & Zhang, 2022). The integration of generative AI is essential not only to modernize cost estimation practices but also to align QS roles with broader digital transformation trends in the built environment. Previous studies have highlighted the lack of tools that blend domain-specific knowledge with automation, especially for early-career QS professionals and students (Wu et al., 2021; Ofori, 2015).

Addressing this gap, the present study introduces SmartQS Prompt, an AI-powered BUR generator designed to streamline rate compilation. Developed using generative AI and real-time data analysis, this tool provides a faster, more consistent, and accurate method for generating BURs. SmartQS Prompt links essential cost components automatically, helping users to generate reliable rates quickly and with minimal manual input. Recent studies affirm the growing value of artificial intelligence in construction cost management, highlighting its ability to improve decision-making and accelerate project delivery (Lee & Park, 2023; Chen et al., 2020). By integrating computational intelligence with practical cost-planning workflows, SmartQS Prompt offers a scalable solution that not only enhances efficiency but also supports the broader digital transformation of the quantity surveying profession.

## 1.1 Problem Statement

The preparation of Built-Up Rates (BUR) is a critical task in construction cost estimation, yet many individuals particularly lower-grade contractors, construction professionals particularly quantity surveyors (QS) and students face significant challenges in performing it accurately. Lower-grade contractors often lack the necessary expertise, training, or digital literacy to handle modern BUR methods, and struggle to grasp rate calculation concepts. While most construction professionals may find it difficult to adapt to digital tools due to a lack of formal training or familiarity with software (Kumar & Singh, 2021). These issues are due to many contractors rely on outdated knowledge and do not have access to current information on labor, material, and equipment costs (Wang et al., 2022). Similarly, students pursuing construction-related education also face their own difficulties in preparing accurate BUR. Due to heavy academic workloads, limited time, and lack of practical site exposure, they often produce inaccurate or incomplete BURs for their assignments (Lee & Park, 2020; Patel et al., 2023). Without real-world experience or access to live market data, students' estimates may miss key cost components or reflect unrealistic figures. These issues highlight a critical gap in the ability of both early-career professionals and learners to prepare reliable BURs. Thus, there is a need to introduce an AI-powered generator, to produce fast, efficient and accurate BUR as a solution aimed at overcoming these barriers by simplifying the BUR process, improving accuracy, and bridging the skills gap in traditional quantity surveying practices.

## 2.0 METHODOLOGY

Generally, this research adopted four phases, namely: literature review and preliminary survey, design and development of the SmartQS Prompt, usability testing tool and expert validation review to evaluate the appropriateness and applicability of SmartQS Prompt in supporting cost estimation tasks in construction.

Firstly, in *Phase 1*, a literature review and preliminary survey on the implementation of conventional built-up rate and its challenges. Followed by conducting preliminary survey to quantity surveying's students to identify prevailing challenges in traditional built-up rates preparation. These groups were selected due to

their direct involvement with Built-Up Rates (BUR) processes, which strengthen the usability and effectiveness of SmartQS Prompt. A purposive sampling technique was used to select samples according to predetermined criteria. The sample includes 30 students, 15 contractors, and 15 consultants, making a total of 60 participants. The data obtained was then analysed by using descriptive statistics via SPSS software.

In *Phase 2*, the SmartQS Prompt prototype was developed to improve the speed and accuracy of generating built-up rates (BUR) for pricing the Bill of Quantities. The system was designed using generative AI and natural language processing, allowing users to input key parameters such as item description, quantity, and location. It incorporated standard cost databases covering materials, labor, machinery, overheads, and profit. A user-friendly interface was built to generate structured BUR outputs. Prompt templates were created to guide AI in assembling complete rate breakdowns, and initial testing ensured logical consistency, usability, and relevance to real-world quantity surveying needs.

In *Phase 3*, usability testing will be conducted to evaluate the effectiveness and user-friendliness of the SmartQS Prompt system. A group of Quantity Surveying students and junior professionals will be asked to complete BUR tasks manually and then use the SmartQS Prompt. After using the system, participants will complete a Likert-scale questionnaire to rate ease of use, speed, accuracy, and satisfaction. The results will be analyzed to compare manual and AI-assisted performance, helping to identify areas for improvement and validate the system's overall usability.

In the *final phase*, a validation process will be carried out by industry experts to assess the effectiveness and reliability of the SmartQS Prompt system. A selected group of expert Quantity Surveyors will review the AI-generated BUR and compare them with traditional manual outputs. Experts will provide feedback through structured evaluation forms and interviews. Their insights will help confirm whether the tool is appropriate and meets professional requirements, supports real-world application, and is ready for broader adoption in quantity surveying practices.

## **3.0 FINDINGS**

### **3.1 Product Description**

SmartQS Prompt is an easy-to-use AI tool that helps users create Build-Up Rates (BUR) by developing prompt templates. It calculates materials, labor, machinery, overhead, and profit using industry standards, then provides a full cost breakdown in Ringgit Malaysia. This product is perfect for fast, accurate pricing without needing complex software or experience.

### **3.2 Novelty and Uniqueness**

SmartQS Prompt is unique in its ability to simplify complex Build-Up Rate (BUR) preparation using just three user-friendly inputs, namely, components, unit, and cost. This AI-powered tool uses natural language processing and standard industry assumptions to instantly generate detailed cost breakdowns. There's no need for special software, Excel spreadsheets, or complicated manuals. It transforms the AI into a virtual QS calculating labor outputs, applying wastage, and adding profit margins automatically. The system's

adaptability across various construction materials and tasks, combined with its speed and accuracy, marks a significant innovation in digital quantity surveying and cost estimation.

### 3.3 Potential for Commercialization

There are real opportunities to turn SmartQS Prompt into something bigger. For example, it could be developed into (i) a web or mobile app for contractors and small construction firms, (ii) a learning tool for universities or colleges teaching Quantity Surveying and (iii) a plugin for existing QS or construction management software. It could be offered as a subscription, a one-time purchase, or bundled into professional training programs.

## 4.0 CONCLUSION

This research shows that SmartQS Prompt is a useful AI tool that can improve how Built-Up Rates (BUR) are prepared in construction. It solves common problems like slow, error-prone, and complicated manual calculations by using artificial intelligence to make the process faster, more accurate, and easier to use. The tool was tested with students, professionals, and experts, who found it helpful and reliable. SmartQS Prompt is simple to use, even for beginners, and helps users save time while producing consistent cost estimates. It also supports learning by making complex cost calculations easier to understand. Overall, SmartQS Prompt offers a smart, practical way to modernize cost estimation in construction, supporting digital transformation and improving how quantity surveyor's work. It also has good potential to be developed into apps or software for wider use in the industry and education.

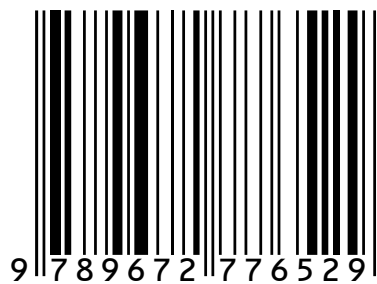
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