

Pertumbuhan penduduk dan urbanisasi di Indonesia meningkatkan kebutuhan hunian rumah tangga. Padahal, angka *backlog* kepemilikan rumah di Indonesia menyentuh sekitar 9,29 juta rumah tangga dan produksinya bertumpu pada metode konvensional dengan konstruksi di lokasi proyek yang masih relatif lambat. Kondisi ini mendorong adanya alternatif konstruksi modular yang berpotensi mempercepat waktu dan menekan biaya. Penelitian ini bertujuan membandingkan biaya, waktu, dan mutu struktur atas gedung modular volumetrik hibrida dengan gedung rangka baja konvensional untuk apartemen 15 lantai di Kota Palangka Raya, serta menetapkan alternatif terbaik melalui analisis multikriteria. Pemodelan tiga dimensi dan *quantity take-off* dilakukan menggunakan Autodesk Revit. Estimasi biaya disusun melalui analisis harga satuan pekerjaan yang mengacu pada Surat Edaran Direktur Jenderal Bina Konstruksi Nomor 47/Se/Dk/2026 dan Peraturan Menteri PUPR Nomor 8 Tahun 2023. Sedangkan, estimasi waktu dianalisis pada *Microsoft Project* berbasis *Precedence Diagram Method* beserta kurva-S. Pada perbandingan mutu, kriteria dinilai melalui studi literatur dengan poin perbandingan pada enam parameter. Hasil ketiga kriteria dianalisis menggunakan *Weighted Product Method* dengan bobot kriteria setara. Hasil penelitian menunjukkan konstruksi modular volumetrik hibrida memakan biaya sebesar Rp 89.173.140.000,00, lebih murah 17,75% daripada rangka baja konvensional sebesar Rp 108.409.040.000,00. Jika Pekerjaan MEP disertakan dalam konstruksi modular, biayanya menjadi Rp 99.411.510.000,00, tetap lebih murah dari metode konvensional dengan persentase 8,30%. Metode modular menyelesaikan pekerjaan dalam 169 hari, lebih cepat 39,86 % daripada durasi 281 hari pada metode konvensional. Dari aspek mutu, metode modular unggul pada parameter yang bergantung pada kendali pabrik, sedangkan rangka baja konvensional unggul pada aksesibilitas inspeksi dan keterpaduan sambungan antar-elemen. Secara agregat, poin mutu tiap metode modular dan konvensional masing-masing 1,587 dan 1,26. Analisis multikriteria menempatkan modular volumetrik hibrida sebagai alternatif terbaik dengan nilai preferensi 0,577 dibandingkan 0,423 pada rangka baja konvensional karena metode modular mengungguli ketiga kriteria sekaligus.

Kata kunci: modular volumetrik hibrida, biaya konstruksi, durasi pekerjaan, mutu, *weighted product method*

ABSTRACT

Population growth and urbanization in Indonesia have increased the demand for household housing. Meanwhile, the housing ownership backlog in Indonesia has reached approximately 9.29 million households, and its supply relies on conventional methods with on-site construction that remains relatively slow. This condition drives the need for an alternative modular construction method that has the potential to accelerate construction time and reduce costs. This study aims to compare the cost, time, and quality of the upper structure of a hybrid volumetric modular building with a conventional steel-frame building for a 15-story apartment in Palangka Raya City, and to determine the best alternative through a multi-criteria analysis. Three-dimensional modeling and quantity take-off were performed using Autodesk Revit. Cost estimation was prepared through unit-price analysis referring to Circular Letter of the Director General of Construction Development Number 47/Se/Dk/2026 and Regulation of the Minister of Public Works and Housing Number 8 of 2023. Meanwhile, time estimation was analyzed in Microsoft Project based on the Precedence Diagram Method with an S-curve. In the quality comparison, the criterion was assessed through a literature study with comparison points on six parameters. The three criteria were analyzed using the Weighted Product Method with equal criterion weights. The results show that hybrid volumetric modular construction costs Rp 89.173.140.000,00, 17,75% cheaper than the conventional steel frame at Rp 108.409.040.000,00. If MEP works are included in the modular construction, the cost becomes Rp 99.411.510.000,00, still cheaper than the conventional method by a percentage of 8,30%. The modular method completes the work in 169 days, 39,86% faster than the 281 days of the conventional method. In terms of quality, the modular method excels in parameters that depend on factory control, whereas the conventional steel frame excels in inspection accessibility and inter-element joint integration. In aggregate, the quality points of the modular and conventional methods are 1,587 and 1,26, respectively. The multi-criteria analysis ranks hybrid volumetric modular as the best alternative, with a preference value of 0,577 compared to 0,423 for the conventional steel frame, because the modular method outperforms all three criteria simultaneously.

Keywords: *hybrid volumetric modular, construction cost, task duration, quality, weighted product method*