

PEMBANGUNAN INSTRUMEN PENILAIAN PASCA PENGHUNIAN BAGI
PERUMAHAN BERTINGKAT YANG DIBINA MENGGUNAKAN KAEDAH
SISTEM BINAAN INDUSTRI

MOHD KAMARUZAMAN BIN MUSA

Tesis ini dikemukakan sebagai
memenuhi syarat penganugerahan
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ABSTRAK

Penilaian Pasca Penghunian (PPP) adalah penting bagi menilai bangunan yang telah siap dan diduduki bertujuan mengenalpasti kelemahan serta potensi untuk penambahbaikan pada masa akan datang. Maka, kajian ini bermatlamat untuk membangunkan dan menentusahkan instrumen PPP dari aspek kualiti, prestasi serta ekonomi perumahan bertingkat bukan kos rendah menggunakan Sistem Binaan Berindustri (IBS) berdasarkan kepada persepsi dan pengalaman penghuni. Sejumlah 10 konstruk dan 108 sub-konstruk awal telah dikenalpasti melalui kajian literatur. Rekabentuk kajian ini menggabungkan dua kaedah kajian iaitu kualitatif dan kuantitatif. Bagi kajian kualitatif, temubual berstruktur ke atas 15 pakar rujuk menggunakan teknik Delphi 3 pusingan bagi mengenalpasti konstruk dan sub-konstruk yang sangat penting. Kaedah yang sama turut digunapakai dalam Proses Analitik Hirarki (AHP) bagi menentukan pemberat relatifnya. Selanjutnya, kaedah kuantitatif melibatkan 399 responden yang dipilih secara persampelan rawak berkelompok terdiri dari kalangan pemilik serta penghuni perumahan ini di tiga buah negeri iaitu Negeri Sembilan, Melaka dan Johor. Hasil analisis melalui Perisian Winstep V.3.69.1.11 telah mengenalpasti lima konstruk PPP di bawah aspek kualiti (spatial ruang, rekabentuk dan estetika, fizikal, bahan binaan dan mutu kerja), tiga konstruk di bawah aspek prestasi (keselesaian dan keselamatan, persekitaran dan kesihatan serta kebolehselenggaraan) dan dua konstruk di bawah aspek ekonomi (nilai dan kos) serta 73 sub-konstruk penting. Seterusnya, Instrumen PPP ini ditentusahkan melalui Analisis Komponen Utama (PCA) dengan nilai Eigen yang baik iaitu 1.6 - 2.9 (maksima 6.172) dan nilai varians mentah antara 44.7% - 74.3% (melebihi 40%) diterima baik dalam membentuk kerangka PPP yang berkesan. Oleh itu, hasil kajian ini mampu menyumbang kepada pemeraksanaan Dasar Perumahan Negara ke arah penyediaan perumahan IBS bukan kos rendah yang selesa dan berkualiti kepada penghuninya.

ABSTRACT

Post Occupancy Evaluation (POE) is important to assess buildings that have been completed and occupied to identify weaknesses and potential for improvement in the future. This study aims to construct and produce a post occupancy evaluation (POE) instrument by developing and validating an instrument to measure the quality, performance and economics of non-low-cost multi-storey housing built using Industrial Building System (IBS) based on perceptions and occupant experience. A total of 10 initial constructs and 108 sub-constructs were identified through the literature review. The design of this study applies a combination method that is a combination of qualitative and quantitative methods. For the qualitative study, a structured interview method on 15 reference experts was conducted using a 3-round Delphi technique in identifying the most important constructs and sub-constructs. The interview method of the same reference experts were also used in the Analytical Hierarchical Process (AHP) to determine the relative weights. Meanwhile, the quantitative study involved 399 respondents who were selected by group random sampling from the owners and occupants of non -low cost IBS multi -storey housing in three states in the south of the country, namely Negeri Sembilan, Melaka and Johor. The results was analysed using Winstep V.3.69.1.11 have identified five POE constructs under quality aspects (spatial space, design and aesthetics, physical, building materials and workmanship), three constructs under performance aspects (comfort and safety, environment and health and maintainability) and two constructs in under economic aspects (value and cost) as well as 73 sub-constructs. Next, this POE instrument has been verified through Principal Component Analysis (PCA), which shows that it has a good Eigen value of 1.6 - 2.9 (maximum 6.172) and a crude variance value of 44.7 % - 74.3 % (above 40%) and is well accepted in forming an effective PPP framework. As a consequence, the findings of this study have the potential to contribute to the National Housing Policy towards the supply of comfortable and high-quality non-low-cost multi-storey IBS housing to its citizens.

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SENARAI SIMBOL/SINGKATAN/ISTILAH

<i>AHP</i>	-	<i>Analytic Hierarchy Process</i>
<i>BB</i>	-	konstruk bahan binaan
<i>BREEAM</i>	-	<i>Building Research Establishment's Environmental Assessment Method</i>
<i>BS</i>	-	konstruk kebolehselenggaraan
<i>CI</i>	-	Indeks Ketekalan
<i>CIDB</i>	-	Lembaga Perindustrian Pembinaan Malaysia
<i>CONQUAS</i>	-	<i>Construction Quality Assessment System</i>
<i>COR</i>	-	Peringkat Komposit
<i>CR</i>	-	Nisbah Konsistensi
<i>DIF</i>	-	Kebezaan Fungsi Item
<i>FZ</i>	-	konstruk fizikal
<i>IBS</i>	-	Sistem Binaan Berindustri
<i>JMB</i>	-	Badan Pengurusan Bersama
<i>KK</i>	-	konstruk keselamatan dan kesejahteraan
<i>KPKT</i>	-	Kementerian Perumahan dan Kerajaan Tempatan
<i>KS</i>	-	konstruk kos
<i>LEED</i>	-	<i>Leadership in Energy and Environmental Design</i>
<i>MK</i>	-	konstruk mutu kerja
<i>MNSQ</i>	-	<i>Mean-square</i>

<i>NL</i>	-	konstruk nilai
<i>NW</i>	-	Berat dinormalisasi
<i>PAHP</i>	-	Instrumen Pakar AHP
<i>PCA</i>	-	Analisis Komponen Utama
<i>PK</i>	-	konstruk persekitaran dan kesihatan
<i>PKD1</i>	-	Pakar Kajian Delphi 1
<i>PKK</i>	-	Pusat Khidmat Kontraktor
<i>PPB</i>	-	Penilaian Prestasi Bangunan
<i>PPP</i>	-	Penilaian Pasca Penghunan
<i>PTMEA CORR.</i>	-	<i>Point-Measure Correlation</i>
<i>QLASSIC</i>	-	<i>Quality Assessment System In Construction</i>
<i>RE</i>	-	konstruk rekabentuk dan estetika
<i>RI</i>	-	Indeks Rawak
<i>RW</i>	-	Pemberat relatif
<i>SR</i>	-	konstruk spatial ruang
<i>TBP</i>	-	<i>Total Building Performance</i>
<i>UA</i>	-	Universiti Awam



SENARAI LAMPIRAN

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PTTA UTHM
PERPUSTAKAAN TUNKU TUN AMINAH

BAB 1

PENGENALAN

1.1 Pendahuluan bab

Bab satu ini merupakan bab pendahuluan yang membincangkan pengenalan kepada kajian yang dijalankan. Perbincangan meliputi latar belakang dan permasalahan kajian serta pernyataan masalah kajian. Selain daripada itu, bab satu ini juga mengemukakan objektif, persoalan dan skop kajian yang dibentuk selaras dengan matlamat kajian ini. Di akhir bab pula membincangkan kepentingan kajian dan struktur penulisan tesis yang terkandung dalam kajian ini.

1.2 Latar belakang dan permasalahan kajian

Revolusi Industri Ke-empat (IR 4.0) telah menjadi pemangkin kepada perubahan industri-industri utama di dunia (Zabidin *et al.*, 2019). Kebanyakan industri telah mula memanfaatkan penggunaan automasi, digitasi serta simulasi dalam skala yang lebih besar dari sebelumnya yang menyaksikan lebih banyak wang dan ruang dibelanjakan bagi menaiktaraf peralatan dan kemudahan yang lebih menjimatkan dari segi kos, masa dan kualiti (Alaloul *et al.*, 2018). Jika dibandingkan perkembangan semasa antara pelbagai sektor yang terlibat, sektor pembinaan dilihat tidak mendominasi perubahan ini secara besar-besaran meskipun pembangunan yang drastik telah diambil oleh industri-industri utama lain seperti makanan dan minuman, tekstil, automotif, elektronik dan kimia. Ini kerana industri pembinaan secara amnya masih giat menumpukan kepada kaedah konvensional yang banyak bergantung kepada manualisasi serta kemahiran manusia selain faktor mobilisasi dan lokasi tapak yang

sentiasa berubah-ubah (Maskuriy *et al.*, 2019). Namun demikian, itu tidak bermakna bahawa industri pembinaan tidak kompetitif dalam mengharungi abad ke 21. Ini kerana masih terdapat pembangunan dan perkembangan teknologi yang menyokong IR 4.0 ini khususnya dari aspek pengilangan pintar seperti komponen pasang siap serta modular yang juga dikenali sebagai Sistem Binaan Berindustri (IBS) (Arif *et al.*, 2020).

IBS secara umumnya menurut Lembaga Pembangunan Industri Pembinaan Malaysia (CIDB), dirujuk sebagai kaedah pembinaan di mana komponen dibina secara prasiap sama ada di tapak mahupun di kilang dan kemudiannya dipasang kepada struktur dengan kerja tambahan yang minimum (CIDB, 2003). Rahim dan Qureshi (2018) pula menyatakan bahawa IBS menyediakan kaedah pembinaan insentif teknologi yang mana setiap komponen dihasilkan dalam persekitaran terkawal dan dipasang terus pada kerja pembinaan. Melalui IBS, industri pembinaan disasarkan akan dapat menghasil dan menyampaikan produk yang berkualiti dan lebih nilai kepada pengguna (Mohd Nawi *et al.*, 2013).

Kaedah IBS ini memberi banyak kelebihan serta faedah secara langsung jika dibandingkan dengan kaedah konvensional khususnya dalam mengoptimumkan proses kerja serta meminimumkan kos buruh (Rashid *et al.*, 2019). Selain itu, Pozin *et al.*, (2019) berpendapat bahawa melalui kaedah IBS tempoh pembinaan juga lebih singkat di samping dapat mengurangkan bahan binaan di tapak serta dapat mengawal pembaziran bahan binaan. Menurut Abas *et al.*, (2020), pengaplikasian kaedah IBS dalam pembinaan juga dapat menjadikan tapak pembinaan lebih teratur dan bersih dan secara tidak langsung dapat menjamin keselamatan kerja di tapak.

IBS bukanlah perkara baharu dalam industri pembinaan negara malah sejak diperkenalkan oleh Kementerian Perumahan dan Kerajaan Tempatan (KPKT) pada tahun 1964, IBS telah mengalami evolusi perubahan yang memberangsangkan (Majid *et al.*, 2011). Menurut Abdul Rashid *et al.*, (2021), perkembangan teknologi telah banyak membantu kaedah IBS menjadi lebih produktif dan bersistematik selain berupaya menambahbaik kualiti komponen IBS yang dihasilkan. Kini, setelah empat dekad berlalu, kaedah IBS ini telah digunakan secara meluas di seluruh negara termasuk dalam pembinaan infrastruktur dan bangunan tinggi. Insentif dan inisiatif yang berterusan daripada kerajaan juga telah menyumbang kepada penggalakkan pengaplikasian kaedah IBS ini di kalangan penggiat industri pembinaan tanah air.

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