

POSITIONING MALAYSIA'S NATIONAL BIM E-SUBMISSION (NBeS) WITHIN GLOBAL BIM-BASED BUILDING PERMITTING: A COMPARATIVE REVIEW

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Article history

Received date : 15-8-2026

Revised date : 16-8-2026

Accepted date : 15-10-2026

Published date : 20-10-2026

To cite this document:

Abdul Shukor, S. K., Ahmad, N. H., & Azmi, A. (2026). Positioning Malaysia's National BIM e-Submission (NBeS) within Global BIM-Based Building Permitting: A Comparative Review. *Journal of Islamic, Social, Economics and Development (JISED)*, 11 (87), 395 -411.

Abstract: *Comparative studies of BIM-based permitting often conflate electronic submission, model exchange, automated checking and statutory approval, obscuring differences in implementation evidence. This qualitative documentary review positions Malaysia's National BIM e-Submission (NBeS) alongside ten purposively selected international jurisdictions. Eighteen attributable evidence records were examined through directed content analysis across technical-information, organisational, regulatory-legal and administrative dimensions, followed by non-ordinal cross-case synthesis. Findings distinguish Singapore's phased CORENET X requirements, South Korea's prototype, Estonia's semi-automated checking and Germany's authority-level survey from Malaysia's NBeS pilots and technical guidance. CIDB Malaysia (2020) reported a simulated approval-time reduction from 50 to 15 days (70%) and a separate 92% pilot-evaluation score, while Husam et al. (2026) reported a reduction from 58 to 39 days, 35% improved error detection and seven model-checking examples. These findings reflect distinct evaluation contexts rather than verified nationwide outcomes. The review positions Malaysia's NBeS within international BIM-based permitting through a source-traceable comparison of four non-ordinal evidence categories: development, pilot validation, reported operational use and institutional/legal provisions. It highlights CIDB Malaysia's documented efforts and identifies evidence needs for NBeS assessment and One Stop Centre (OSC) procedures without implying a validated maturity model.*

Keywords: *BIM e-submission; National BIM e-Submission; digital building permit; automated compliance checking; building plan approval*

Introduction

Building Information Modelling (BIM) supports exchange of geometric and semantic information for regulatory review. However, electronic filing, Industry Foundation Classes (IFC) model acceptance, automated code compliance checking (ACCC) and use of a model in a statutory decision are distinct functions. Conflating policy announcements, prototypes and approved applications can overstate implementation (Noardo et al., 2022; Fauth et al., 2023).

International records illustrate contrasting evidence: South Korea's openBIM prototype (Kim et al., 2020), Estonia's selected semi-automated checks (Raitviir et al., 2026), Germany's authority survey (Hartmann et al., 2026) and Singapore's project-specific CORENET X mandate (Building and Construction Authority & Urban Redevelopment Authority, 2026). Different reporting units and functions preclude a common national maturity ranking.

Malaysia's National BIM e-Submission (NBeS) provides the focal case. Construction Industry Development Board (CIDB) Malaysia (2020) documented four 2019 pilots and a proposed NBeS integration scenario; the NBeS Guidebook specifies model data and exchange requirements (CIDB e-Construct Services, 2024). Husam et al. (2026) subsequently published pilot-related checking and efficiency findings. This review examines what each dated document substantiates rather than treating distinct or repeated figures as independent national measurements.

The article positions NBeS as a Malaysian case within eleven selected jurisdictions by tracing public documentary claims to their sources, permitting functions and inference limits. As an independent review rather than an internal CIDB programme audit, it seeks to clarify documented progress and remaining verification needs, not to rank countries or certify national approval performance.

Literature Review

Digital building permitting involves technologies, institutions and statutory administration. Prior comparative work identifies fragmentation among model submission, rule checking and approval workflows (Noardo et al., 2022), as well as organisational and regulatory constraints (Ataide et al., 2023; Fauth et al., 2023).

From Electronic Submission to Model-Based Approval

Moving from electronic documents to model-based assessment requires more than digitising intake. Permit services must accept structured data, execute defined checks and connect outputs to accountable review and approval steps (Noardo et al., 2022; Fauth et al., 2023). Figure 1 schematically differentiates these related functions; its arrows do not represent a universal implementation pathway or a measured maturity sequence.

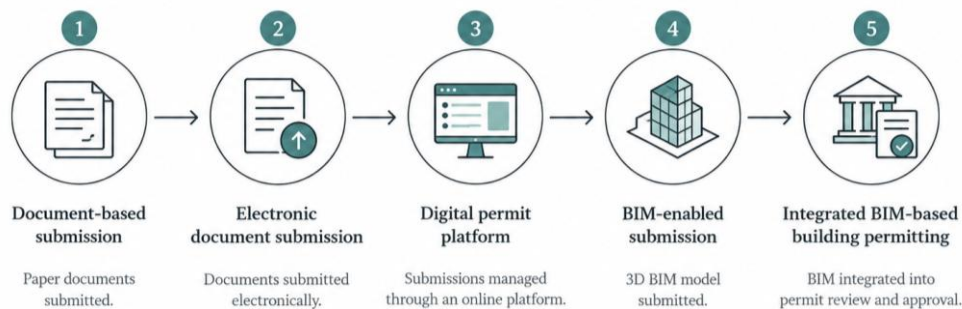


Figure 1: Conceptual progression from document-oriented submission to BIM-based regulatory assessment (authors' synthesis).

In Germany, Hartmann et al. (2026) analysed 399 completed survey responses covering 275 of 853 lower building supervisory authorities. Digital submissions were available at 130 of 275 respondent authorities (47.3%), but none reported BIM-based permit submission. Because participation was voluntary, the figures describe respondents rather than a national census. Thus, availability of an electronic portal cannot establish routine model-based regulatory assessment.

International Research and Differentiated Implementation Paths

International reviews identify policy direction, technical standardisation and institutional integration as interdependent concerns (Sun & Kim, 2026; Terzić et al., 2023). Nevertheless, evidence ranges from policy commitments to prototypes and operational cases, each supporting different claims. Research cases illustrate selected feasibility: K-BIM in South Korea (Kim et al., 2020), a South Tyrol permit-process application (Fauth et al., 2023), eight automated approval tasks in Austria (Battisti et al., 2023), structural e-permitting in Italy (Ciotta et al., 2021) and Brazilian municipal checking (Brito et al., 2022). None of these findings alone demonstrates universal routine adoption.

Estonia reports 47 semi-automated checks integrated into permitting infrastructure, while acknowledging governance and human-review requirements (Raitviir et al., 2026). Croatia's legal analysis addresses the recognition of BIM models in administrative proceedings, not measured permit throughput (Klasinc, 2026). These cases distinguish technical checking from legally effective decisions. Together, the studies indicate multiple, non-linear implementation paths. Comparison therefore requires explicit reporting units, functions and evidence boundaries rather than a single assumed progression.

OpenBIM, Information Specifications and Automated Checking

ACCC requires reliable information, computable rules and interpretable outputs (Ismail et al., 2017; Amor & Dimyadi, 2021). Translating legal prose into rules remains difficult even with natural language processing and AI (Zhang & El-Gohary, 2022; Zhang et al., 2022). IFC exchange requires suitable model views and information delivery requirements (Ciotta et al., 2021). De Mendonça and Ferreira (2024) show that poorly specified Information Delivery Specification (IDS) checks can produce false positives. The NBeS Guidebook v3.0 specifies LOD 300 and IFC2x3 Coordination View 2.0 for selected purpose groups (CIDB e-Construct Services, 2024); a technical specification is not proof of consistent live submissions. Even a technically valid check does not remove the need for professional judgement, exception handling and legal accountability.

Organisational, Information and Legal-Administrative Readiness

The literature relates adoption to process, organisation, technology and information (Ataide et al., 2023), competency and readiness (Ullah, 2022; Mohd Fuzi et al., 2024), and local workflow design (Fauth et al., 2023). Malaysian industry interoperability findings are relevant context but cannot substitute for authority-level NBeS records (Ahmed et al., 2024). Information continuity and legal-administrative recognition also matter. Digital permit and building-logbook studies foreground data requirements (Mêda et al., 2024; Lavikka et al., 2025), while Malaysian legal scholarship considers BIM liability and responsibility (Mastan et al., 2025). Croatia's BIM legislation illustrates the separate question of whether model-based evidence has administrative force (Klasinc, 2026).

Malaysia: OSC Procedures and the NBeS Development Record

Malaysia's One Stop Centre (OSC) 3.0 Plus manual defines procedural responsibilities but does not itself establish live NBeS integration (Jabatan Kerajaan Tempatan, 2019). Early Malaysian research investigated BIM e-submission potential (Abd Samad et al., 2018), while later research addressed practitioner competence and electronic submission practice (Mohd Fuzi et al., 2024; Zahimi et al., 2024). The original CIDB evaluation identifies the four Pihak Berkuasa Tempatan (PBT) in the 2019 pilot as Perbadanan Putrajaya (PPj), Majlis Bandaraya Petaling Jaya (MBPJ), Majlis Perbandaran Kangar (MPK) and Majlis Bandaraya Melaka Bersejarah (MBMB) (CIDB Malaysia, 2020). The NBeS Guidebook v3.0 also names Kangar (CIDB e-Construct Services, 2024, p. 13). Table 3 uses these primary institutional sources for the historical pilot cohort.

The guidebook specifies selected technical workflows, not verified recurring statutory approvals; likewise, programme engagement cannot be equated with an approved BIM-based permit transaction. The Guidebook lists Ar Husam Abdulfatah Haron as a co-author and BIM consultant (CIDB e-Construct Services, 2024, p. 8). His corresponding 2026 scholarly article is therefore an appropriately attributed practitioner-associated account of model-checking tests and performance; its findings are cited to Husam et al. (2026) with their reported scope, without inferring national outcomes.

Critical Research Gap

International comparison and thematic analysis are not new to digital building permitting research. Noardo et al. (2022) critically reviewed progress in digital permitting research and implementation, while Sun and Kim (2026) examined international BIM-based e-permit adoption and development. Building on these contributions, the present review addresses a more specific question: how Malaysia's publicly documented NBeS development can be positioned among international permitting practices when pilot evaluations, technical specifications, institutional announcements and statutory approvals offer different forms of evidence. The gap concerns a transparent, Malaysia-centred interpretation of these heterogeneous claims, not an absence of previous comparative research.

The article's distinctive contribution is an independent documentary synthesis that brings CIDB Malaysia's NBeS initiative into a structured international comparison. It connects official programme reports, technical guidance, local-authority records and attributed scholarly findings to their dates, functions, observation units and inference limits. This source-traceable positioning recognises documented NBeS progress while identifying what can and cannot yet be established from public records. The four-domain lens and non-ordinal evidence categories support the interpretation; neither is presented as a newly validated maturity model or an audit of CIDB's internal performance.

Research Questions, Objectives and Analytical Alignment

RQ1: What do documentary sources substantiate about digital filing, BIM exchange, ACCC and statutory workflow integration across the eleven jurisdictions? Objective: Compare documented functions and inference limits (Table 2).

RQ2: Which NBeS developments, PBT engagements and reported results can be established from dated Malaysian records? Objective: Reconstruct an attributable chronology and metric appraisal (Tables 3–4).

RQ3: Which technical, organisational, legal and administrative needs follow from the cross-case evidence? Objective: Derive justified implementation and verification implications (Discussion and Table 5).

Methodology

This qualitative, purposive comparative documentary review uses an attributable statement about a permitting function as its unit of analysis, rather than treating a country as one homogeneous case. Its analytical set comprises 18 evidence records: eleven jurisdiction anchors and seven additional Malaysian records. The wider bibliography is contextual literature, not the analytical sample. A source register records provenance and limitations; the study is not a PRISMA-style exhaustive systematic review (Morgan, 2022).

Research Design and Scope

Malaysia is the focal NBeS case. Ten jurisdictions were purposively selected to maximise observable contrast: Singapore (phased mandatory integrated submission), South Korea (prototype), Norway (IFC support), UK/USA/Australia (digital permitting at specified national, municipal or state levels), China (municipal BIM-assisted checking), Estonia (integrated checks), Germany (authority survey) and Croatia (legal recognition). These are analytical contrasts, not a representative sample of countries.

Document Selection, Extraction and Appraisal

Sources were identified from bibliographic chaining, scholarly publisher pages, the CIDB and NBeS programmes, regulator and local-authority portals and dated follow-up searches. Query concepts were ‘BIM-based building permit’, ‘digital permit’, ‘e-submission’, ‘automated compliance checking’, ‘IFC’, ‘NBeS’, ‘OSC’ and jurisdiction names. Records qualified if they provided a traceable issuer, identifiable jurisdiction, substantive permitting function and inspectable evidence at a declared access depth. Duplicate accounts, purely design-stage BIM studies and unattributed country rankings were excluded. Eighteen selected records have retrospective eligibility and claim-level decisions; historical search yields were not retained and are not retrospectively fabricated.

The CIDB Malaysia (2020) evaluation, NBeS Guidebook v3.0 and Husam et al. (2026) were read as full source documents; access to other items varied from official complete webpages to publisher abstracts or indexed notices, as recorded individually in the supplementary evidence trail. Abstract-only items support only the claims explicitly disclosed there. No raw search-result totals, unavailable full texts or retrospective exclusion counts are asserted.

Directed Content Analysis and Cross-Case Synthesis

Directed content analysis used four literature-informed dimensions: T (technical/model information), O (organisational roles), L (legal/regulatory recognition) and A (administrative

workflow) (Ataide et al., 2023; Fauth et al., 2023; Mohd Fuzi et al., 2024). Separately, each claim was tagged D (development/specification), P (pilot/testing), R (reported operational/service activity) or I (institutional/legal provision). Tags may overlap and are not ordinal: R denotes documented or reported service activity, not independent verification of completed statutory BIM approvals (Figure 2).



Figure 2: Four overlapping, non-ordinal forms of documentary implementation evidence (D, P, R and I); not a validated maturity model (authors' synthesis).

Analytical Procedure, Cross-Case Comparison and Auditability

The analytical procedure comprised five linked operations. First, the 18 included records were logged by source identity, date or retrieval date, selection rationale and access depth. Second, attributable claims were extracted together with their page or section locators, permitting functions and units of observation, such as checked models, eligible projects or respondent authorities. Third, each claim was assigned the relevant T-O-L-A domain codes and separate D-P-R-I evidence tags, allowing overlapping categories. Fourth, the claims were compared across jurisdictions according to the function actually documented, while retaining source disagreements, differing units and limits of access. Fifth, the observed contrasts were synthesised into conditional implications for Malaysian BIM e-submission rather than treated as confirmed national implementation outcomes.

Figure 3 summarises the audit route linking the purposively selected evidence records to coded comparisons and RQ-aligned findings. It illustrates the documented analysis of the included corpus; it does not imply an exhaustive systematic search or a validated sequence of implementation maturity.

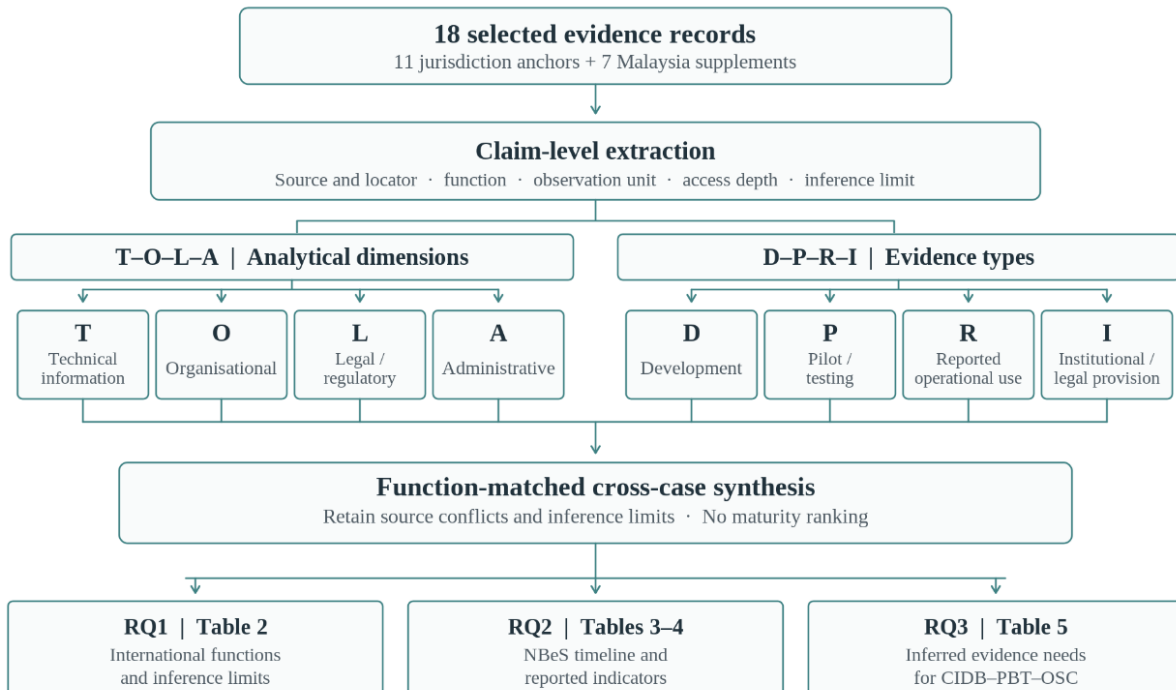


Figure 3: Audit route from selected documentary evidence to comparative findings and Malaysian implementation requirements (authors' synthesis).

This process addresses RQ1 by distinguishing comparable permitting functions and inference limits across the eleven jurisdictions (Table 2), and RQ2 by separating the NBeS development record and PBT engagement from the reported performance measures (Tables 3-4). For RQ3, the coded contrasts informed five evidence needs in Table 5: checkable model information requirements (T), verification beyond prototype tests (T/A), recurring transaction and outcome records (O/A), traceable institutional responsibilities and OSC hand-offs (O/A/L), and legal recognition and retention of model-based evidence (L/A). Table 1 illustrates six source-to-code decisions, while the supplementary register itemises the complete 18-record corpus. The DBKK news report provides contextual information outside that analytical corpus; historical search-hit and rejection counts were not retained and are not reconstructed.

Table 1: Worked coding illustration: six directly attributable claims

Evidence locator	Extracted statement (paraphrased)	Codes	Use / inference boundary
CIBD Malaysia (2020), pp. 1-2	Four named 2019 PBT pilots, including MPK (Kangar).	O; A / P	Table 3 / RQ2 - Historical participation; not approval throughput
CIBD Malaysia (2020), pp. 5, 55-59	50→15 days is a simulated NBeS-OSC workflow; 92% scores 24 appraisal items.	A / P	Table 4 / RQ2 - Proposed workflow and appraisal; not observed national rates
CIBD e-Construct Services (2024), p. 13	LOD 300, IFC model exchange and declared purpose groups for submissions.	T / D	Tables 3-4 / RQ2 - Technical input specification, not a count of approvals
Husam et al. (2026), PDF pp. 5-6	Seven model checks (4-48h) and reported 58→39 days and 35% improvement.	T; A / P	Table 4 / RQ2 - Author-reported pilot findings; hours differ from approval days

BCA & URA (2026), 23 July circular	CORENET X applies to defined project classes under phased mandating.	L; A / I; R	Table 2 / RQ1 - Bounded classes; not nationwide audited approval outcomes
Hartmann et al. (2026), Results / survey	130 of 275 responding authorities reported digital filing; zero BIM submissions.	O; A / R	Table 2 / RQ1 - Respondent sample; not national census

Findings

The 18-record purposive set spans eleven jurisdiction anchors and seven further Malaysian evidence records. Table 2 compares functions and limitations; Tables 3-4 reconstruct and appraise Malaysian NBeS evidence. Coding combines T-O-L-A themes with non-ordinal D-P-R-I evidence tags.

Cross-Case Implementation Evidence

Table 2 demonstrates that electronic filing, IFC model support, prototype checking, statutory provisions and reported integrated submissions are not equivalent. Singapore's CORENET X records refer to covered projects; Norway's guidance addresses IFC submission; the German survey counts responding authorities. These cannot be converted into a common national maturity score.

Table 2: Documented permitting functions, attributable sources and inference boundaries across eleven selected jurisdictions

Jurisdiction	Documented function	Source, evidence type and D/P/R/I tags	Inference limit
Singapore	CORENET X phased gateway; covered new projects $\geq 5,000$ m ² from 1 Oct 2026; >140 earlier-tier submissions reported.	BCA & URA (2026), joint circular. [R, I]	Covered project submissions $\neq$ audited approval outcomes.
South Korea	K-BIM openBIM rule-checking and e-submission prototype.	Kim et al. (2020), technical evaluation. [P]	Prototype $\neq$ nationwide service.
Norway	IFC4 supporting models accepted with building applications.	Norwegian Directorate for Building Quality (2026), official guidance. [D, I]	No national automated-approval volume.
United Kingdom	Online planning/building-control filing.	Planning Portal (n.d.); Building Safety Regulator (2025). [R]	Electronic filing $\neq$ IFC checking.
United States	NYC DOB NOW electronic permits and records.	NYC Department of Buildings (n.d.), municipal portal. [R]	City-level portal; not national BIM permit use.
China	Shanghai BIM-assisted review subsystem announced.	Shanghai Municipal Commission of Housing and Urban-Rural Development (2023), notice. [D]	Announcement $\neq$ national sustained use.
Australia	NSW Planning Portal mandatory digital lodgement.	NSW Government (2020); Audit Office of New South Wales (2022). [R]	State planning submissions $\neq$ BIM statutory checking.

Jurisdiction	Documented function	Source, evidence type and D/P/R/I tags	Inference limit
Estonia	47 semi-automated checks within permitting infrastructure.	Raitviir et al. (2026), developer-involved case. [R]	Limited check domains; no national outcome series.
Germany	130/275 surveyed authorities (47.3%) digital filing; none reported BIM permit submission.	Hartmann et al. (2026), authority survey. [R]	Voluntary sample, not census.
Croatia	BIM provisions and model evidentiary questions.	Klasinc (2026), legal analysis. [I]	Legal provision ≠ live platform.
Malaysia	NBeS LOD 300/IFC2x3 guidance; pilots and model-checking examples.	CIDB Malaysia (2020); CIDB e-Construct Services (2024); Husam et al. (2026). [D, P, R]	Pilot and specification ≠ national approval volumes.

For RQ1, three contrasts are especially informative: a Singaporean mandate with a defined project threshold, Norwegian guidance on IFC4 submission and a German respondent-level survey. Estonia documents selected operational checking; Croatia analyses legal recognition. Each supports a specific regulatory proposition rather than general national approval efficiency. The primary result is unequal evidence scope, not a global league table. RQ1 answer: across cases, different functions are demonstrated at project, system, municipal, state or authority-survey level; national BIM permit adoption cannot be inferred uniformly.

NBeS Development, Local Authority Engagement and Reported Outcomes

CIDB Malaysia (2020) identifies PPj, MBPJ, MPK (Majlis Perbandaran Kangar) and MBMB as the 2019 pilot authorities. This cohort is distinct from later guidance, demonstrations and institutional engagement. Formal model-based approvals must be evidenced independently of inclusion in a programme list.

Table 3: Dated Malaysian NBeS evidence and precise limits of reported local-authority involvement

Date	Evidence or event	Authority / scope	Attribution and limit
2017 - 2019	NBeS development and four 2019 pilots.	PPj; MBPJ; MPK (Kangar); MBMB.	CIDB Malaysia (2020), primary evaluation; historical pilot cohort.
2019 annual report	Prospective 58→39 day efficiency pathway; further participation discussed.	Early pilot programme; later DBKU engagement.	CIDB Malaysia (2019), historical programme statement, not a second independent trial.
2020 evaluation	Simulation of NBeS-OSC integration; 24 item programme appraisal.	Four 2019 PBTs.	CIDB Malaysia (2020), pp. 55-59; not live national approval data.
Aug 2023	Municipal NBeS launch and local implementation statement.	MPKK (Kulim).	Majlis Perbandaran Kulim (2023); dated institutional account.

Date	Evidence or event	Authority / scope	Attribution and limit
Jun 2024	Guidebook v3.0: LOD 300, IFC2x3 CV2.0; purpose groups I, III, IV, V, VI.	NBeS submitting professionals; MPKK named.	CIDB e-Construct Services (2024), pp. 13, 21; requirements, not uptake.
Sep 2026	MPKK recognition; DBKK NBeS pre-checking and planned 2027 online service.	MPKK, DBKK; DBKK distinct from DBKU.	Majlis Perbandaran Kulim (2026), institutional statement; Sabah Media (2026), mayor's remarks reported by news media. DBKK pre-checking ≠ statutory e-submission (planned 2027).
2026 scholarly study	Seven model-checking examples; reported 58→39 days and 35% higher error detection.	Husam et al.'s evaluated projects.	Husam et al. (2026), pp. 4-5; study-specific author findings.
Portal (Oct 2026)	'Active' / 'Involving' programme labels.	Listed PBTs, not a statutory approval count.	NBeS (n.d.), programme listing; no national adoption inference.

An earlier CIDB Digital (2022) account documents the pilot programme and its extension. The current programme portal labels PBTs 'Active' and 'Involving' (NBeS, n.d.), which identify participation categories, not numbers of approved BIM applications. Official MPKK notices report a local launch in 2023 and institutional recognition in 2026 (Majlis Perbandaran Kulim, 2023, 2026). DBKK and DBKU are separate authorities. A September 2026 account described DBKK's NBeS pre-checking while full online plan e-submission was planned for 2027 (Sabah Media, 2026). Neither a pilot label nor a future service date establishes completed OSC decisions. Table 3 records these distinctions without presenting a uniform operational-adoption count.

Table 4: Reported Malaysian NBeS metrics and their denominator / attribution limitations

Measure	Reported figure	Source	Basis	Bounded interpretation
OSC process simulation	50→15 days (70%).	CIDB Malaysia (2020)	Prospective integrated workflow.	Not live national time saving.
Pilot appraisal	92%, 24 items.	CIDB Malaysia (2020)	Programme assessment matrix.	Not PBT adoption or approval success rate.
Approval turnaround	58→39 days; 32% reported.	Husam et al. (2026)	Published evaluated/pilot comparison; historical figure also appears in CIDB (2019).	Not national mean or independent replication.
Error detection	35% improvement.	Husam et al. (2026)	Pilot comparison; raw baseline counts unpublished.	Attributable author finding; not national rate.

Measure	Reported figure	Source	Basis	Bounded interpretation
Checking examples	4, 48, 6, 6, 14, 6, 12 h.	Husam et al. (2026)	Seven model-level checker times.	Not days to statutory approval.
Model specification	LOD 300; IFC2x3 CV2.0.	CIDB e-Construct Services (2024)	Guidebook, specified purpose groups.	Data requirement, not observed use.

Table 4 distinguishes Malaysian NBeS performance measures, model-checking times and technical specifications by their reporting basis and inference limits. CIDB Malaysia (2020) reported a simulated NBeS–OSC workflow of 50 to 15 days (70% reduction) and a separate 92% attainment appraisal covering 24 evaluation items. Husam et al. (2026) reported 58 to 39 days (described as 32%), 35% improved error detection and seven model checks of 4–48 hours. The last measure is time spent checking models, not the statutory approval interval; the 58–39-day endpoints also appear in earlier CIDB reporting and must not be counted as independent replications. RQ2 answer: the evidence establishes an original four-PBT pilot, technical model specifications, published pilot checking results and subsequent engagement. The available records do not quantify sustained, nationwide NBeS statutory approvals; absence of such published counts is not proof of non-use.

Discussion

These comparisons do not identify a 'most mature' country. They show that different technologies and administrative records support different propositions about model data, regulatory checking and decisions. Three implications follow. First, every claim must retain its observation unit, such as a model, respondent authority or covered project. Second, technical checking and end-to-end approval demand different evidence. Third, legal recognition and programme engagement cannot establish throughput or operational continuity on their own.

CIDB Malaysia's (2020) evaluation itself distinguishes achievements from conditions for scale-up. Alongside positive pilot feedback and a 92% appraisal, it records divergent PBT rulesets, the continued relevance of 2D/hardcopy evidence, training needs, cybersecurity, digital signing and a proposed OSC integration pilot. These are the report's historical recommendations, not verified deficiencies at every authority today. Singapore's bounded CORENET X mandate concerns which projects enter a defined inter-agency route; Norway's IFC4 guidance concerns acceptable model documentation; Germany measures respondent authorities and Estonia describes selected checking functions. Comparing them as identical 'BIM adopted' events would misrepresent their administrative mechanisms.

Similarly, Croatia addresses statutory recognition rather than measured throughput (Klasinc, 2026). UK, US and NSW portals demonstrate electronic lodgement at their respective administrative scales; none alone proves national IFC-based permit checking (Planning Portal, n.d.; New York City Department of Buildings, n.d.; NSW Government, 2020). Malaysia's comparative position is best understood through the forms of implementation evidence that are publicly documented. CIDB's reports, the NBeS guidebook and attributed pilot research establish programme development, specified model requirements, local-authority participation and reported checking outcomes. Singapore's records describe defined regulatory applicability,

Estonia reports selected semi-automated functions, Germany supplies respondent-authority data and Croatia considers legal recognition. These are informative contrasts, not measurements on one national maturity scale. In the sources reviewed, no harmonised PBT-level series traces the same model through NBeS submission, checking, OSC routing and final statutory decisions; this is a limitation of externally available evidence, not a finding that participating authorities lack operational implementation.

This independent comparison also gives CIDB Malaysia's NBeS initiative a clearer place within international scholarship on BIM-based permitting. Recognising its documented development and reported achievements does not require treating programme communications or study-specific outcomes as independently verified national performance measures. The added knowledge is a bounded account of what NBeS documentation demonstrates relative to other jurisdictions and which further records would enable stronger future assessment by researchers, CIDB and local authorities.

For Malaysia, stronger future verification would link accepted model versions, documented rulesets and checking reports to reviewers, OSC routing, lawful decisions and preserved approval records. The guidebook and Husam et al.'s pilot findings substantiate specified technical workflows and reported case-level results; the available documentary corpus does not support a national estimate of completed statutory BIM approvals. That reporting limit neither negates CIDB's documented development work nor establishes non-use of NBeS by participating PBTs. CIDB should maintain a version-controlled authority register identifying official council names, event dates, activity class (briefing, pilot, pre-check, electronic filing or statutory decision), applicable ruleset and source. The original 2019 MPK cohort is attributed to CIDB Malaysia (2020) as Majlis Perbandaran Kangar; the later wording in Husam et al. (2026) is not used to alter that historical identification without project-level corroboration.

For PBTs and OSC administrators, an auditable transaction should connect the IFC model/version, checking report, reviewer and ruleset to agency routing, approval/return decisions and archival records. Husam et al.'s (2026) case-specific hours should remain distinct from full approval days. Useful indicators include submitted and accepted models by purpose group, stage timestamps, revisions, checker exceptions, returned applications and final decision outcomes. Before-after comparisons must align case mix, start/end points and observation periods. CIDB can curate technical versions and test results; PBTs can define model information, reviewer competency and exceptions; OSC can document hand-offs and signed decisions; regulators and professional bodies can clarify the evidentiary force of automated outputs. These are recommendations inferred from the review, not claims of current nationwide deficiencies.

Table 5: Cross-case insights translated into Malaysian evidence requirements

Comparison	What evidence establishes	Implication for CIDB, PBTs and OSC
Model data vs digital filing (Norway; UK/NSW; Malaysia)	IFC model information requirements and ordinary online filing are distinct functions (Table 2).	Publish verifiable model information standards, exchange versions and applicability by PBT.
Prototype checking vs statutory decision (South Korea; Estonia; Malaysia)	Selected technical checks and experimental workflows do not alone establish authorised decisions.	Link checker outputs to model versions, reviewer actions, OSC routing and recorded decisions.

Comparison	What evidence establishes	Implication for CIDB, PBTs and OSC
Pilot results vs repeat use (Malaysia; Germany)	Pilot metrics and respondent-authority service data use different units and denominators.	Document recurrent submissions, case mix, stage times, exceptions and final outcomes.
Institutional scope and responsibility (Singapore; Malaysia)	Mandated project classes, participation labels and legal decision rights are distinct.	Specify eligible projects, responsible PBT/OSC signatories and inter-agency hand-offs.
Legal recognition (Croatia; Malaysia)	Model evidentiary status, technical capability and formal statutory authority may differ.	Clarify legal weight of model/checking records, retention and review or appeal procedures.

Contextual and conceptual contribution: the review provides an independent, Malaysia-centred account of NBeS within international BIM permitting discussions, while distinguishing technological capabilities from administrative and legal use. Methodological contribution: a dated, source-located claim matrix makes provenance, observation units and inference boundaries explicit without imposing a maturity ranking. Practical contribution: cross-case contrasts identify auditable model, checking and statutory-decision records relevant to CIDB, PBTs and OSC procedures (Table 5). These evidence-informed implications are not expert-validated institutional requirements. Future statutory BIM review should identify responsible decisionmakers, the controlling rule version, professional discretion and appeal or correction procedures. IFC/LOD standardisation does not by itself constitute an approved regulatory pathway (CIDB e-Construct Services, 2024; Klasinc, 2026).

Future research can test these requirements against selected PBT case files and OSC transaction logs; this study did not conduct such fieldwork. The CIDB Malaysia (2020) pilot report recommends policy alignment, training, cybersecurity, digital signing and integrated pilot testing. We report these as historical proposals and call for updated authority-level evidence before evaluating their present status.

Limitations: this purposively selected documentary corpus does not represent a worldwide census or an internal assessment of NBeS operations. Its evidence ranges from directly inspected CIDB evaluation, NBeS guidebook and Husam et al. (2026) documents to other public institutional accounts and published summaries; the DBKK news account provides contextual evidence outside the 18-record analytical set. Internal model-submission logs, OSC case files and complete authority-level approval registers were not examined. Husam et al.'s findings remain attributable to their authors, although the underlying counts needed to recalculate the reported 35% improvement are unavailable here. Consequently, differences in denominators and source access constrain conclusions about nationwide uptake, causality or institutional maturity; lack of public records must not be interpreted as evidence of non-implementation.

Conclusion

RQ1 establishes that the eleven jurisdictions document different permitting functions and administrative scales, so their reports cannot sustain a single national maturity ranking. RQ2 positions Malaysia's NBeS through CIDB's documented 2019 four-PBT pilot (including MPK, Kangar), model specifications and reported programme and pilot outcomes, including the distinct CIDB simulation/appraisal and Husam et al. (2026) findings. RQ3 derives conditional

evidence needs for model information, operational verification, institutional accountability and statutory NBeS-OSC decisions (Table 5).

The review's principal contribution is an independent, evidence-bounded positioning of CIDB Malaysia's NBeS initiative within selected international BIM-based permitting practices. It makes documented development more visible to scholarly comparison while distinguishing recorded achievements from outcomes requiring authority-level verification. The approach does not constitute an internal CIDB audit, demonstrate nationwide causal efficiency or validate a maturity model; access to PBT transactions and statutory workflow records is the priority for subsequent research.

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