PSYCHOMETRIC ASSESSMENT OF A BILINGUAL INSTRUMENT FOR MEASURING OPEN DATA ADOPTION: A PILOT STUDY IN SAUDI ACADEMIC LIBRARIES

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Abstract: Open data in academic digital libraries is central to Saudi Arabia's Vision 2030, yet adoption remains constrained by data quality, security, and institutional factors. This pilot study validates the psychometric properties of a bilingual (Arabic–English) instrument measuring awareness, perceptions, adoption barriers, and opportunities related to open data in Saudi digital libraries while evaluating feasibility for a multi-university main study. A cross-sectional pilot was conducted with 35 participants from four Saudi universities using expert validation, internal consistency testing, and item-total analysis. Results indicated acceptable to good reliability across constructs: Awareness/Usage ($\alpha = 0.75$), Perceived Benefits ($\alpha = 0.74$), Adoption Barriers ($\alpha = 0.85$), and Opportunities/Improvements ($\alpha = 0.81$). Feasibility indicators showed high completion rates, short completion times (16–23 minutes), and low missing data, confirming the instrument's psychometric soundness and the viability of a multi-institutional main study.

Keywords: Academic Libraries, Adoption Barriers, Instrument Validation, Open Data, Saudi Arabia.

1. Introduction

Open data the practice of publishing structured, reusable datasets with clear rights of access and reuse has reshaped research ecosystems, enabling transparency, reproducibility, collaboration, and innovation. In higher education, digital libraries sit at the center of the open data ecosystem, aggregating and curating datasets, managing metadata and identifiers, providing discovery tools, and safeguarding preservation and governance.

Saudi Arabia's Vision 2030 aligns closely with this agenda by emphasizing digital transformation, research excellence, and knowledge-based growth, and promotes infrastructures and policies that support open science practices in universities.

Despite strategic attention, actual open data adoption often faces practical bottlenecks: variable data quality and metadata consistency; privacy and security concerns; insufficient training and incentives; misaligned policies for data governance; and institutional cultures that prioritize publications over data sharing. Existing instruments often focus on general technology acceptance or are developed for Western contexts, limiting their applicability to the Saudi higher education environment with its unique linguistic, cultural, and institutional characteristics.

This pilot study addresses two critical gaps. First, it provides a validated, bilingual (Arabic–English) instrument to assess four key constructs: awareness and usage, perceived benefits, adoption barriers, and opportunities for improvement. The instrument draws on established technology acceptance models (TAM/UTAUT) while incorporating context-specific factors identified through local stakeholder consultation and literature review (Venkatesh et al., 2003; Alharbi & Drew, 2014). Second, it

demonstrates feasibility for a multi-university main study using practical indicators: response and completion rates, time burden, missing data, and logistics.

Saudi Arabia has made significant strides in open data, ranking 41st globally in the 2024 Open Data Inventory (ODIN), a jump of 28 places compared to 2022 (General Authority for Statistics, 2026), reflecting the Ministry of Education's commitment to open data in support of scientific research (Ministry of Education, 2025).

The study's research questions were: (RQ1) Does the instrument demonstrate adequate internal consistency and conceptual coherence across constructs when administered to Saudi digital library stakeholders? (RQ2) Are feasibility metrics consistent with the successful rollout of a multi-site main study?

This pilot contributes to the field by providing a bilingual, psychometrically validated instrument specifically tailored to the Saudi academic context, demonstrating the feasibility of multi-institutional data collection, and offering a reproducible template for open data evaluations in comparable multilingual research environments (Fecher et al., 2015; Kim & Stanton, 2016).

2. Methods

2.1 *Study Design and Conceptual Framework*

A cross-sectional pilot was conducted to validate the instrument psychometrically and to assess feasibility for a subsequent main study following established feasibility study guidelines. The conceptual framework integrated technology acceptance models (TAM/UTAUT) with open data adoption literature, emphasizing user perceptions, institutional barriers, and improvement opportunities. The workflow comprised expert content validation, online administration across four universities, and comprehensive statistical evaluation of reliability, item performance, and feasibility indicators.

2.2 *Setting and Participants*

Participating institutions were King Saud University (Riyadh), King Abdulaziz University (Jeddah), Umm Al-Qura University (Mecca), and Taibah University (Medina), selected to represent geographic diversity and varying stages of digital library development. Participants were purposively sampled spanning researchers, faculty, librarians, IT staff, administrators, and students. Inclusion criteria required current institutional affiliation, basic familiarity with digital library services, and willingness to complete a bilingual online questionnaire.

2.3 *Instrument Development and Content Validation*

Instrument development drew on a comprehensive scoping review of open data adoption constructs and established technology acceptance models. Recent studies highlight that perceived usefulness, institutional support, and cultural readiness are key determinants of adoption behaviour (Tenopir et al., 2015; Kim & Stanton, 2016). The growing role of AI in digital library services further underscores the need for updated, context-sensitive measurement tools (Emerald Publishing, 2025).

The draft instrument included four domains: Awareness and Usage (3 items), Perceived Benefits (5 items), Adoption Barriers (6 items), and Opportunities and Future Improvements (5 items), supplemented by a demographics section. Items were developed bilingually using parallel construction, culturally appropriate terminology, and a 5-point Likert scale. Semantic equivalence was achieved through iterative translation and back-translation (Aldbyani et al., 2026).

A panel of seven subject-matter experts reviewed the instrument, including faculty with open data expertise (n = 3), digital library professionals (n = 2), and IT/data management specialists (n = 2) from

non-participating institutions. Expert feedback led to linguistic refinements, modification of the role item to allow multiple selections, and minor reordering of items to improve logical flow.

2.4 *Data Collection and Psychometric Evaluation*

Data collection was conducted electronically via a secure, GDPR-compliant bilingual survey platform over a three-week pilot window. Internal consistency was evaluated using Cronbach's alpha (target ≥0.70), supplemented by item-total correlations (target ≥0.30) and "alpha if item deleted" diagnostics. Inter-construct correlations assessed discriminant validity, with moderate values (0.30–0.60) preferred

Feasibility assessment encompassed recruitment success, completion rates, time burden, data quality, technical accessibility, and institutional representation, with predetermined progression criteria established prior to data collection. Exploratory Factor Analysis (EFA) was deferred to the main study (~291 participants) given the pilot sample size, consistent with established statistical guidelines (Aldbyani et al., 2026).

3. Results

3.1 *Participant Characteristics*

A total of 35 participants completed the pilot survey. Table 1 presents comprehensive participant characteristics. Educational attainment showed strong representation of advanced degrees (PhD: 34.3%; Bachelor's: 31.4%). Role diversity was notable, with 71.4% selecting multiple roles, reflecting the interconnected nature of academic work. All four target universities were represented with reasonable distribution.

Table 1: Participant Characteristics (N=35)

Characteristic	Category	Frequency (n)	Percentage (%)
Educational Level	PhD	12	34.3
	Bachelor's	11	31.4
	Master's	3	8.6
	High School	9	25.7
Years of Experience	More than 6 yrs	10	28.6
	1–3 years	9	25.7
	4–6 years	8	22.9
	< 1 year	8	22.9
Primary Role*	Researcher	11	31.4
	Faculty	10	28.6
	IT Staff	10	28.6
	Administrator	6	17.1
	Librarian	4	11.4
University	Taibah University	11	31.4
	King Abdulaziz University	8	22.9
	Umm Al-Qura University	7	20.0
	King Saud University	5	14.3

Note: *Multiple role selections were common (71.4% of participants).

3.2 *Reliability and Item Analysis*

Internal consistency analysis revealed acceptable to good reliability across all constructs after targeted refinements (Table 2). Awareness/Usage achieved acceptable reliability (α = 0.75) with no modifications. Perceived Benefits initially fell below threshold (α = 0.68); replacing one misaligned item improved reliability to α = 0.74. Adoption Barriers demonstrated strong consistency (α = 0.85) with no refinements required. Opportunities/Improvements initially showed very high reliability (α ≈ 0.91), indicating redundancy; merging two overlapping items maintained strong reliability (α = 0.81) and improved scale parsimony.

Table 2: Psychometric Properties and Reliability Analysis

Construct	Items	Initial α	Final α	Item-Total r	Interpretation
Awareness & Usage	3	0.75	0.75	0.55–0.62	Acceptable
Perceived Benefits	5	0.68	0.74	0.34–0.61	Acceptable (improved)
Adoption Barriers	6	0.85	0.85	0.50–0.68	Good
Opportunities/Improvements	5	0.91	0.81	0.51–0.68	Good (optimized)

3.3 *Discriminant Validity and Construct Relationships*

Inter-construct correlations were moderate and theoretically consistent, supporting discriminant validity. Awareness/Usage correlated moderately with Perceived Benefits ($r \approx 0.45$). Perceived Benefits showed expected negative relationships with Adoption Barriers ($r \approx -0.51$) and positive associations with Opportunities ($r \approx 0.58$). Adoption Barriers correlated negatively with Awareness ($r \approx -0.32$) and Opportunities ($r \approx -0.42$). All correlations remained in the moderate range (0.30–0.60), supporting both discriminant validity and theoretical coherence suitable for structural modeling in the main study.

3.4 *Feasibility Metrics and Main Study Readiness*

Comprehensive feasibility assessment strongly supported progression to the main study (Table 3). The target sample was achieved within the three-week pilot window, with completion rates exceeding 90%. Mean time-to-complete was approximately 19.5 minutes (range: 16–23), within the ≤25-minute threshold. Item-level missing data remained below 5% with no systematic non-response patterns. No platform stability issues were reported, and the bilingual format enhanced clarity and inclusiveness. The multi-select role option captured the multi-hat nature of academic roles (71.4% multiple roles).

Table 3: Feasibility Assessment Results

Domain	Metric	Results	Criterion	Status
Recruitment	Sample achieved	35/35 (100%)	Target N	✓ Met
Completion	Survey completion rate	>90%	≥80%	✓ Exceeded
Time Burden	Mean completion time	16–23 min	≤25 min	✓ Met
Data Quality	Item-level missing data	<5% per item	≤10% missing	✓ Exceeded

Technical	Platform stability	No issues	No major barriers	✓ Met
Language	Bilingual format	Enhanced clarity	Clear comprehension	✓ Met
Representation	Universities covered	4/4 institutions	Multi-institutional	✓ Met

4. Discussion

4.1 *Principal Findings and Theoretical Contributions*

This pilot study successfully achieved its dual objectives of psychometric validation and feasibility demonstration. The bilingual instrument demonstrated acceptable to good reliability across all four constructs after targeted refinements that enhanced conceptual coherence without compromising theoretical coverage.

The study provides empirical support for a four-factor model of open data adoption encompassing awareness, benefits, barriers, and improvement opportunities, aligning with technology acceptance frameworks while incorporating domain-specific institutional factors (Davis, 1989; Venkatesh et al., 2003).

Moderate inter-construct correlations support discriminant validity while revealing theoretically meaningful relationships. The negative correlations between barriers and positive constructs, and positive associations between awareness and perceived benefits, align with theoretical expectations and suggest clear pathways for intervention design.

The successful bilingual implementation demonstrates the feasibility of culturally inclusive measurement, with participants reporting enhanced comprehension through concept triangulation across languages.

4.2 *Practical and Policy Implications*

The validated instrument provides practical assessment capabilities for digital library professionals and institutional leaders. Libraries can use the tool to benchmark current readiness, identify training needs, and evaluate intervention effectiveness.

Barrier identification offers direct input for infrastructure and policy development: technical barriers may require systems upgrades or training programs, while institutional barriers may need policy reforms or incentive restructuring.

At the national level, the study's findings have direct relevance for Saudi Arabia's Vision 2030 goals. Institutional policies should move beyond technical infrastructure to address cultural and incentive-based barriers; universities should implement standardized data management protocols and formal recognition for data sharing (Ministry of Education, 2025).

Integrating AI in academic libraries has transformed user expectations regarding data accessibility (Emerald Publishing, 2025), necessitating clear governance frameworks aligned with national strategy.

4.3 *Limitations and Future Directions*

Several limitations should be considered. The purposive sampling and small pilot sample (N = 35) limit generalizability, though this is appropriate for pilot psychometric evaluation. The cross-sectional design precludes causal inferences, and self-report methods introduce potential social desirability bias.

EFA and CFA were deferred to the main study (~291 participants) to ensure adequate statistical power (Aldbyani et al., 2026). Future research should incorporate behavioral indicators alongside self-report

measures and explore longitudinal applications to track adoption progress and evaluate intervention effectiveness over time.

5. Conclusion

This pilot study successfully validated a bilingual instrument for assessing open data adoption in Saudi digital libraries and demonstrated strong feasibility for a multi-institutional main study. The instrument showed acceptable to good reliability across four theoretically coherent constructs after minimal refinements, and all feasibility criteria were met or exceeded.

The validated instrument provides a foundation for systematic assessment of open data readiness across Saudi higher education and evidence-based development of targeted interventions, contributing to Saudi Arabia's Vision 2030 digital transformation objectives.

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