

# The Internet of Things and its anticipated influence on digital service quality: A survey at the Central Library of the University of Babylon

Omaima Hameed Aladilee

University of Kerbala, Fraiha, Karbala, 56001, Iraq  
Corresponding author, email: omaima.h@uokerbala.edu.iq

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## Keywords

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## Abstract

This study examines the anticipated influence of Internet of Things (IoT) applications on digital service quality in the Central Library of the University of Babylon. The research focuses on IoT as an independent variable represented by technical infrastructure, integration with digital services, user experience, and security and privacy. Digital service quality is treated as the dependent variable and is represented by impact on beneficiaries, information control, the library physical and digital environment, and smart interaction. A survey method was used to collect responses from a purposive sample of 209 library beneficiaries. The questionnaire was designed using a five-point Likert scale, and the data were analyzed through descriptive statistics, reliability analysis, confirmatory factor analysis, correlation, and linear regression using SPSS and AMOS. The findings indicate that IoT has a statistically significant positive effect on digital service quality, explaining 46% of the variance. Technical infrastructure, integration with digital services, and user experience significantly contribute to enhancing service quality, whereas security and privacy, although rated highly by users, did not show a statistically significant direct effect in the regression model. The study recommends strengthening technical infrastructure, improving information control systems, integrating digital services, and developing smart interaction features to support user-centered digital transformation in university libraries.

## 1. Introduction

The rapid development of digital technology has encouraged university libraries to redesign their service systems around intelligent, connected, and user-centered platforms. Within this transformation, the Internet of Things (IoT) has become one of the most promising technological approaches because it connects physical devices, sensors, communication networks, and digital platforms to support real-time data exchange and service automation (Atzori et al., 2010; Gubbi et al., 2013; Whitmore et al., 2015). In the context of academic libraries, IoT applications can support smart lending, indoor navigation, resource tracking, environmental monitoring, security systems, and personalized user services (Garcia & Llorente, 2019; Sharma & Jain, 2019; Zhang & Lee, 2020).

Despite the increasing implementation of digital solutions in university libraries, IoT-based services remain at an early stage in many local academic contexts. This creates a need to understand how beneficiaries perceive IoT before full implementation and how they expect such technology to improve digital service quality. User expectations are important because the success of digital transformation depends not only on technical readiness but also on perceived usefulness, ease of use, trust, and service relevance (Hussain & Abalkhail, 2021; Yoon & Kim, 2020). Therefore, this study investigates the anticipated influence of IoT applications on digital service quality at the Central Library of the University of Babylon.

The research problem is grounded in the limited clarity regarding the extent to which library beneficiaries are aware of IoT applications and the extent to which they expect these applications to improve the quality of digital services. Although university libraries increasingly invest in digital systems, there may be a gap between technological potential and actual user expectations. This study

examines the anticipated relationship between IoT applications and digital service quality among beneficiaries of the Central Library of the University of Babylon.

The objectives of the study are to analyze user expectations toward IoT adoption in the library, identify the dimensions of digital service quality most affected by IoT applications, and measure the expected effect of IoT dimensions on digital service quality from the perspective of library beneficiaries. Scientifically, the study contributes to the Arab literature on smart libraries and digital service quality. Practically, it helps library managers prioritize infrastructure, service integration, user experience, and data protection.

IoT refers to a networked digital infrastructure in which physical objects are equipped with sensors, computing capacity, and communication tools that allow them to collect, process, and exchange data (Bandyopadhyay & Sen, 2017; Minerva et al., 2020). In library environments, IoT enables the integration of physical collections and digital services through smart devices, RFID systems, environmental sensors, and data-driven platforms (Sharma & Jain, 2019; Singh & Mahajan, 2013). Prior research suggests that IoT can improve operational efficiency, increase access to resources, automate routine processes, and create more interactive experiences for users (Al-Momani et al., 2022; Garcia & Llorente, 2019; Zhang & Lee, 2020).

Digital service quality refers to the extent to which digital systems provide efficient, accessible, reliable, secure, and user-oriented services (Alshurideh et al., 2023; Parasuraman et al., 2005). In academic libraries, digital service quality includes the ability to provide fast access to digital resources, responsive assistance, integrated search systems, effective digital platforms, and inclusive access to information (Kim & Lee, 2022; Rahman & Singh, 2019). Because IoT changes the nature of service delivery, smart interaction should also be considered as a dimension of digital service quality in IoT-supported library environments (Lin & Huang, 2021; Zhang et al., 2021).

Based on these arguments, the main hypothesis is that IoT has a significant effect on enhancing digital service quality in the studied library. Four sub-hypotheses are derived: technical infrastructure significantly affects digital service quality; beneficiary experience significantly affects digital service quality; integration with digital services significantly affects digital service quality; and security and privacy significantly affect digital service quality.

## 2. Method

This research used a survey design to measure the expected effect of IoT applications on digital service quality. The research was conducted at the Central Library of the University of Babylon between November 1, 2024, and May 1, 2025. The research population consisted of students and researchers who actively used the library services. A purposive sample was selected based on academic level and library-use frequency. A total of 217 questionnaires were distributed, and 209 valid responses were returned, representing a response rate of approximately 96%.

The questionnaire consisted of three parts: demographic information, IoT items, and digital service quality items. The IoT scale included 20 items across four dimensions: technical infrastructure, integration with digital services, user experience, and security and privacy. The digital service quality scale also included 20 items across four dimensions: impact on beneficiaries, information control, the library physical and digital environment, and smart interaction. Responses were measured using a five-point Likert scale. The data were analyzed using SPSS and AMOS through descriptive statistics, Cronbach's alpha, confirmatory factor analysis, correlation, and regression analysis.

**Table 1. Research Variables and Measurement Dimensions**

Variable	Dimension	Source
Internet of Things	Technical infrastructure	Sharma and Jain (2019)
Internet of Things	Integration with digital services	Sharma and Jain (2019)
Internet of Things	User experience	Sharma and Jain (2019)
Internet of Things	Security and privacy	Sharma and Jain (2019)
Digital service quality	Impact on beneficiaries	Association of Research Libraries (2022)
Digital service quality	Information control	Association of Research Libraries (2022)
Digital service quality	Library physical and digital environment	Association of Research Libraries (2022)
Digital service quality	Smart interaction	Zhang et al. (2021); Zeng et al. (2020)

**Table 2. Demographic Characteristics of the Sample**

Description	Category	Frequency	Percentage
Gender	Male	122	58.4%
Gender	Female	87	41.6%
Age group	21-25	163	78.0%
Age group	26-30	14	6.7%
Age group	31-35	27	12.9%
Age group	36+	5	2.4%
Type of study	Morning	163	78.0%
Type of study	Evening	46	22.0%
Monthly library visits	1-5	93	44.5%
Monthly library visits	6-10	62	29.7%
Monthly library visits	11-15	45	21.5%
Monthly library visits	16+	9	4.3%

### 3. Results and Discussion

The descriptive results show that beneficiaries hold positive expectations regarding the role of IoT in improving digital service quality. At the general level, IoT obtained a mean of 4.21 and an agreement rate of 84.3%. Security and privacy recorded the highest mean ( $M = 4.60$ ), followed by user experience ( $M = 4.50$ ), integration with digital services ( $M = 4.14$ ), and technical infrastructure ( $M = 3.61$ ). These results indicate that beneficiaries attach high importance to trust, ease of use, personalized services, and continuous access.

**Table 3. Descriptive Indicators for the Internet of Things Dimensions**

Dimension	Mean	SD	Agreement rate	CV	Rank
Technical infrastructure	3.61	1.29	72.2%	35.7%	4
Integration with digital services	4.14	0.99	82.8%	23.9%	3
User experience	4.50	0.77	90.0%	17.1%	2
Security and privacy	4.60	0.72	92.0%	15.7%	1
Internet of Things overall	4.21	0.94	84.3%	22.4%	-

For digital service quality, the overall mean was 3.66, indicating a generally positive evaluation. Smart interaction was the strongest dimension ( $M = 4.49$ ), followed by impact on beneficiaries ( $M = 3.55$ ), the library physical and digital environment ( $M = 3.51$ ), and information control ( $M = 3.09$ ). The lower score for information control suggests a need to improve access to electronic resources, catalogues, databases, and search-and-retrieval functions.

**Table 4. Descriptive Indicators for Digital Service Quality Dimensions**

Dimension	Mean	SD	Agreement rate	CV	Rank
Impact on beneficiaries	3.55	1.13	71.0%	31.8%	3
Information control	3.09	1.11	61.8%	35.9%	4
Library physical and digital environment	3.51	1.00	70.2%	28.5%	2
Smart interaction	4.49	0.77	89.8%	17.1%	1
Digital service quality overall	3.66	1.00	73.2%	27.4%	-

Reliability analysis showed that all dimensions exceeded the commonly accepted threshold of .70, indicating adequate internal consistency. Confirmatory factor analysis also supported the measurement structure because the item loadings exceeded the minimum saturation threshold of .40 and the model-fit criteria were reported as acceptable according to the adopted rules of goodness of fit (Hair et al., 2017).

**Table 5. Reliability Results for the Study Variables**

Variable	Dimension	Items	Cronbach alpha
Internet of Things	Technical infrastructure	5	.881
Internet of Things	Integration with digital services	5	.901
Internet of Things	User experience	5	.920
Internet of Things	Security and privacy	5	.832
Digital service quality	Impact on beneficiaries	5	.962
Digital service quality	Information control	5	.919
Digital service quality	Library physical and digital environment	5	.901
Digital service quality	Smart interaction	5	.824

Regression analysis supports the main hypothesis. IoT had a statistically significant positive effect on digital service quality (standardized estimate = .668,  $F = 34.543$ ,  $p < .001$ ), explaining 46% of the variance in digital service quality. This result confirms that greater attention to IoT applications is associated with higher perceived quality of digital services.

**Table 6. Effect of Internet of Things on Digital Service Quality**

Path	Standard estimate	SE	Critical value	F	R2	p
IoT -> Digital service quality	.668	.096	8.654	34.543	46%	.000

The sub-hypotheses show differentiated effects. Technical infrastructure, integration with digital services, and user experience significantly affected digital service quality. Security and privacy, despite being highly valued by beneficiaries, did not reach statistical significance in the regression model.

**Table 7. Effects of IoT Dimensions on Digital Service Quality**

Dimension	Beta	R	R2	F	t	p	Decision
Technical infrastructure	.323	.654	42.8%	21.907	11.098	.000	Supported
Integration with digital services	.432	.545	29.7%	19.109	8.087	.000	Supported
User experience	.254	.323	10.4%	11.176	12.119	.000	Supported
Security and privacy	.021	.077	0.6%	1.176	1.119	.320	Not supported

The findings demonstrate that IoT is strongly associated with the perceived improvement of digital service quality in the studied library. This supports prior arguments that smart library services can enhance access, responsiveness, resource management, and user engagement (Al-Momani et al., 2022; Sharma & Jain, 2019; Zhang & Lee, 2020). The strongest explanatory role of technical infrastructure indicates that beneficiaries connect the quality of digital services with the reliability of library systems, internet connectivity, smart devices, and technical readiness.

Integration with digital services also emerged as a significant predictor. This suggests that IoT applications are most valuable when connected with catalogues, lending systems, databases, institutional repositories, and learning platforms. Fragmented systems may reduce user satisfaction, whereas integrated systems allow continuous access and smoother service delivery (Khan & Qutab, 2021). User experience was also significant, confirming that ease of use, personalization, fast access, and accurate information shape beneficiaries' quality perceptions (Adeyemi & Haruna, 2019; Hsu et al., 2021).

The non-significant direct effect of security and privacy should not be interpreted as unimportant. Rather, the descriptive results show that users rated this dimension very highly. The absence of a significant regression effect may indicate that beneficiaries consider security and privacy as baseline requirements rather than as visible drivers of service quality. Libraries therefore need to maintain strong data-protection practices while also communicating these practices clearly to users (Lim & Tan, 2020; Patil & Suresh, 2021).

#### 4. Conclusion

The study concludes that beneficiaries of the Central Library of the University of Babylon have positive expectations toward IoT applications and perceive them as a promising mechanism for improving digital service quality. IoT significantly explains changes in digital service quality, particularly through technical infrastructure, integration with digital services, and user experience. Digital service quality is strongest in the smart interaction dimension but weakest in information control, indicating a need for better catalogues, databases, search systems, and remote access to digital resources.

The study recommends that the library prioritize smart interaction services, such as personalized recommendations, smart lending, and navigation support. It should also improve information control by developing electronic catalogues, databases, metadata quality, and search-and-retrieval systems. Technical infrastructure should be upgraded through reliable internet connectivity, stable servers, smart devices, and continuous system maintenance. Finally, data privacy

and security policies should be strengthened and communicated clearly so that users trust IoT-supported library services.

### Data Availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

### Conflicts of Interest

All authors in this publication declare no conflict of interest regarding the title, data, location, and results of the research.

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### Supplementary Materials

This study does not include any supplementary materials.

### Declaration on AI Use

The authors declare that no artificial intelligence (AI) or AI-assisted tools were used in the preparation of this manuscript. AI were used only to improve readability and language under strict human oversight; no content, ideas, analyses, or conclusions were generated by AI.

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