“Adoption of business intelligence in Jordanian hospitals: Examining moderating effects of support, readiness, compatibility, and user satisfaction”

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ADOPTION OF BUSINESS INTELLIGENCE IN JORDANIAN HOSPITALS: EXAMINING MODERATING EFFECTS OF SUPPORT, READINESS, COMPATIBILITY, AND USER SATISFACTION

Abstract

Business intelligence (BI) systems are crucial to hospitals, as they enable organizations to make informed decisions through data analysis and enhance operational efficiency. BI adoption experiences barriers in Jordanian hospitals as a result of both organization-specific needs and technological limitations of their environments. This study assessed BI adoption by surveying employees at different departments in Jordanian hospitals. From January to May 2024, a total of 350 surveys were distributed, resulting in 312 valid responses collected through online and paper-based methods. The analysis involved participants from various departments, including administrative staff, clinical personnel, and IT department professionals, to gain a comprehensive understanding of BI readiness throughout the organization. The results demonstrate that technological compatibility and environmental factors are critical for successful BI adoption ($p < 0.05$), yet findings show organizational readiness has no direct effect ($p > 0.05$). Top management support has a positive effect on BI adoption, and user satisfaction serves as a critical moderating variable, positively influencing the relationship between these elements ($p < 0.05$). Business intelligence systems require dedicated leadership focus, along with proper technological infrastructure and active user engagement, for successful deployment. The study offers practical recommendations for hospital executives and policymakers with strategies to deploy BI using leadership initiatives plus technological integration and worker development. The establishment of digital healthcare advancement programs stands as a goal that government authorities must achieve. Furthermore, the establishment of national digital healthcare advancement programs and the expansion of cross-institutional data collection are essential in different settings.

Keywords business intelligence, digital healthcare, hospital management, data-driven decision-making, digital transformation

JEL Classification M15, I11, O33

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INTRODUCTION

Hospitals worldwide have adopted business intelligence (BI) systems due to the increasing complexity of healthcare, along with a growing need for data-driven decision-making. The implementation of BI technologies in healthcare facilities allows hospitals to improve their operational effectiveness and generate better clinical choices and better treatment results using healthcare data properly. The implementation of business intelligence systems remains challenging for hospitals in Jordan and other developing economies due to restrictive hardware capabilities, organizational barriers, and environmental conditions.

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The key to a successful implementation of business intelligence (BI) in hospitals lies within multiple key principles such as compatibility of Business Intelligence technologies with the current systems, preparation and competency of organisational teams and high-level executive sponsorship. User satisfaction is also an essential element during the process of BI adoption. But yet, the role of user satisfaction and its direct connection with the outcomes of BI implementation in healthcare is mostly undeserved by empirical research. To present an efficient BI adoption, it is necessary to have not only the well-built technological environment but also engage the users and create positive user experiences. As such, it is important that those in charge of managing hospitals and policymakers understand that the satisfaction of users has a great impact on the effectiveness and sustainability of BI initiatives in healthcare facilities. Therefore, it is crucial to investigate BI adoption within Jordanian hospitals through the evaluation of top management support along with organizational readiness and technological compatibility and an assessment of user satisfaction as a moderator element. Using the results of such an analysis, hospitals can enhance their decision-making abilities while maximizing resource utilization and improving healthcare service efficiency.

1. LITERATURE REVIEW AND HYPOTHESES

Modern healthcare organizations rely on business intelligence (BI) systems as essential tools for decision-making, operational enhancements, and improved patient care outcomes (Alkhwaldi, 2024; Trincanato & Vagnoni, 2024; Arefin et al., 2021). Healthcare facilities can use BI systems to transform massive clinical and administrative data into support for both strategic planning and clinical governance. Organizations in Jordan, alongside technological and environmental factors, limit the effective use of BI technologies because they struggle to overcome their implementation barriers (Hmoud et al., 2023). Researching the determinants that impact healthcare BI adoption will lead to better healthcare service delivery and optimize resources and digital transformation efforts.

The TOE framework, developed by Tornatzky and Fleischer (1990), serves as a comprehensive model for analyzing the adoption of technological innovation by organizations. Technology adoption depends on three essential contextual elements. Technological factors include system compatibility and technological infrastructure; organizational factors involve readiness and size together with managerial support; environmental elements consist of competitive pressures and regulatory requirements. The present analysis uses the TOE framework to analyze three essential constructs: technological compatibility as a technology context factor, organizational readiness as an organizational context element, and top management support as an environmental context element. The study establishes user satisfaction as a regulatory variable because it recognizes how it enhances or diminishes the impact of TOE elements on BI adoption results. Throughout various industries, the TOE model has established its validity, yet studies on healthcare BI adoption in Middle Eastern regions show minimal exploration of this approach.

The fundamental driver for successful information system adoption consists of top management support and extends to the adoption of BI systems. Strong commitment from leadership in change processes enables organizations to obtain proper funding, weaken internal opposition, and create an unambiguous strategic direction (Bhatiasevi & Naglis, 2020; Wong et al., 2020). When healthcare institutions have executive support, they overcome barriers to integrating BI tools with their current clinical and administrative workflow systems (Bany Mohammad et al., 2022). The implementation of BI systems becomes smoother through executive-level legal and regulatory documentation, according to Ahmad et al. (2020) and Gangwar (2020). Hatamlah et al. (2023) reinforce the importance of executive participation throughout project stages because it boosts system acceptance chances.

Organizational readiness encompasses the financial, infrastructural, and human capital resources necessary for the successful adoption of new technologies (Wamba et al., 2020; Prasetio et al., 2022). Hospitals with a solid IT infrastructure, backed by trained personnel and digital governance struc-

tures, are better equipped to implement BI solutions throughout their operations (Al-Sharafi et al., 2022; Kitsios & Kapetaneas, 2022). Akter et al. (2021), along with Mikalef et al. (2019), demonstrated that non-readiness leads to the failure of health information systems, particularly in under-resourced areas. There is limited empirical evidence about organizational readiness for BI adoption within Jordanian healthcare contexts despite increasing global awareness of these issues.

The alignment between fresh system initiatives with organizational technologies, along with operational procedures and workflow patterns, defines technological compatibility (Bany Mohammad et al., 2022; Jaklič et al., 2018). Healthcare organizations need to integrate BI systems perfectly with their hospital information systems to maintain data quality while achieving operational excellence and user contentment (Zheng & Khalid, 2022; Zhao et al., 2022). According to Jaradat et al. (2024) and Shittu et al. (2024), technological incompatibility specifically related to legacy system interoperability constitutes a major impediment to achieving successful BI implementation. The implementation of BI in healthcare settings faces delays due to outdated infrastructure and difficult system needs, according to De Luna et al. (2019) and Sidharta and Rahmahwati (2023). According to Awais et al. (2022), system standardization with integration protocols serves as a priority for achieving interoperability. The likelihood of success for BI programs in Jordanian hospitals depends heavily on technology compatibility, as most facilities maintain outdated IT systems. The user-perceived compatibility and adoption rates depend heavily on system accessibility together with user interface convenience and technical support, according to Nwosu (2024).

User satisfaction stands as an essential factor for both adopting new information systems and their practical application. The combination of usable systems with reliable technology operating on relevant information leads users to accept and continue using information systems (Kaur et al., 2021; Indrasari et al., 2021). User satisfaction in healthcare settings strongly controls the impact of technological, organizational, and environmental structural factors on the success of BI system adoption, according to Begum et al. (2024) and Uzir et al. (2021). Users who experience dissatisfaction with BI solutions can harm implementation efforts despite strong top management backing and technology compatibilities, according to Nirwanto and Andarwati (2019) and Gkrimpizi et al. (2023). In Middle Eastern healthcare settings, there is little empirical research detailing how user satisfaction acts as a moderator within the TOE framework when using BI technologies.

Research examining technology adoption in healthcare reveals an undisclosed knowledge gap regarding the connections between executive support, institutional preparedness, technological suitability, and their combined impact on user satisfaction with BI implementation in Jordanian medical settings. Studies from the past have handled these elements separately, although it is interesting to consider their cumulative effects within the TOE framework (Figure 1). Existing studies lack sufficient research about healthcare systems in developing nations. The integration of the TOE framework with user satisfaction as a moderating factor leads to new insights in research, which helps administrators implement BI systems at Jordanian hospitals through practical guidance.

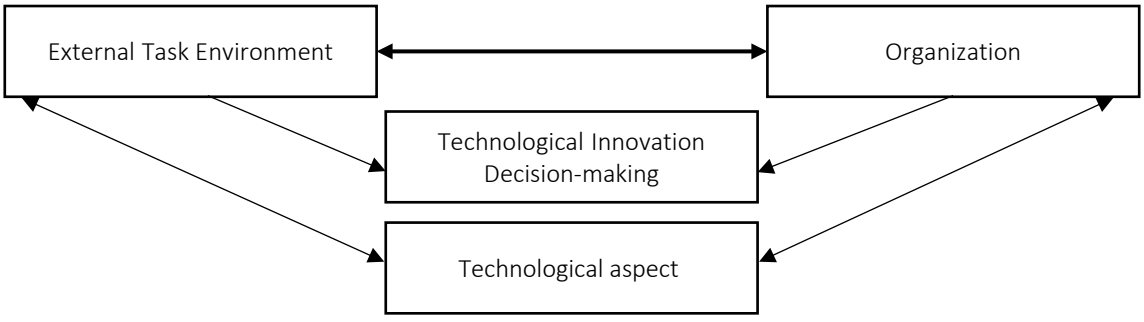

Figure 1. Conceptual model of the study

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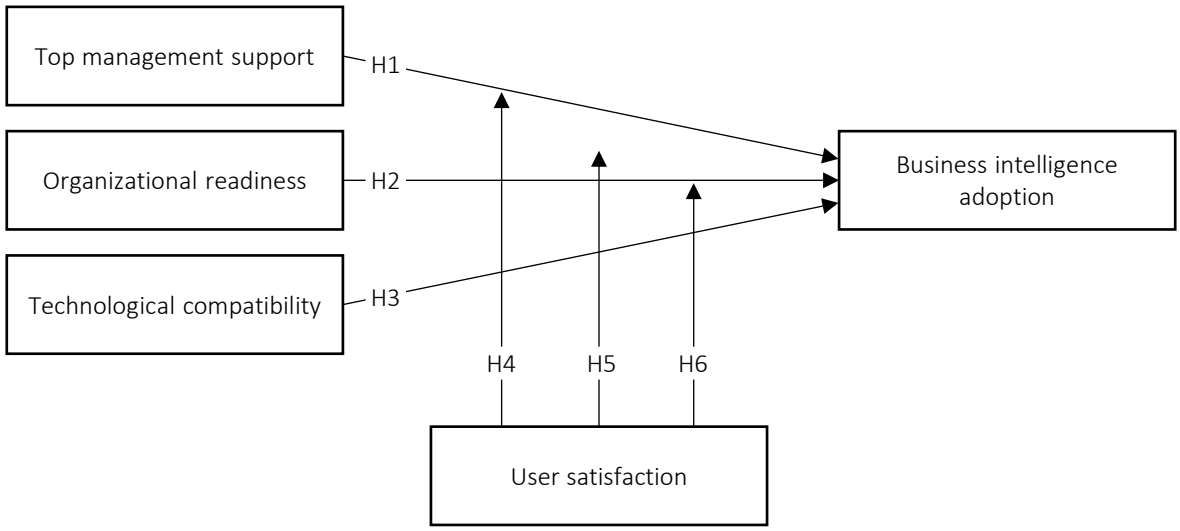

Figure 2. Conceptual framework

The primary aim of this study is to examine how top management support, organizational readiness, and technological compatibility affect Business Intelligence adoption in Jordanian hospitals, while user satisfaction serves as the moderating variable (see Figure 2):

H1: Top management support positively influences the adoption of business intelligence in Jordanian hospitals.

H2: Organizational readiness positively influences the adoption of business intelligence in Jordanian hospitals.

H3: Technological compatibility positively influences the adoption of business intelligence in Jordanian hospitals.

H4: User satisfaction moderates the relationship between top management support and business intelligence adoption in Jordanian hospitals.

H5: User satisfaction moderates the relationship between organizational readiness and business intelligence adoption in Jordanian hospitals.

H6: User satisfaction moderates the relationship between technological compatibility and business intelligence adoption in Jordanian hospitals.

2. METHOD

A structured survey enabled this paper to conduct quantitative analyses of factors that impact business intelligence (BI) system adoption in Jordanian hospitals. Hospital employees from clinical and administrative, as well as IT functions, made up the study sample. To guarantee hospital representation, participants were selected through stratified random sampling. The study gathered insights regarding organizational adoption factors as well as the barriers that hospital institutions face in their implementation of BI systems.

The survey distribution took place from January to May 2024 in major hospitals situated in Amman, Irbid, and Zarqa. Survey respondents, comprising 312 individuals, yielded an acceptable response rate of 89.1% from the total number of distributed questionnaires (350). According to Krejcie and Morgan's (1970) sample-sized table for populations larger than 1000, the collected 312 responses established appropriate generalizability. The survey distribution process included both online forms, which were transmitted through official hospital communication platforms, and printed questionnaires. The survey participation was optional because all participants received specific information about study goals and data security and their ability to leave anytime without facing penalties. All survey data remained private because no individual identifying information was requested. The questionnaire underwent initial testing by 20

healthcare professionals before being distributed to them. Some wording was adjusted together with the questionnaire layout after securing participant feedback.

The study constructed its survey tools by adopting evaluated scales from earlier studies and fitting them to healthcare settings. The assessment of top management support utilized items from Bhatiasevi and Naglis (2020) to determine leadership dedication to business intelligence implementation. Wamba et al. (2020) created the evaluation instruments to assess organizational readiness by focusing on financial preparedness as well as technological infrastructure and human resource readiness components. Technical compatibility was evaluated through Bany Mohammad et al.'s (2022) adapted assessment tools, which focused on operational alignment and system integration functions. The study adopted Kaur et al.'s (2021) scales to evaluate user satisfaction by assessing system usefulness, ease of use, and perceived reliability. The evaluation of BI adoption involved using adapted DeLone and McLean (2003) Information Systems Success Model items to measure how BI tools enabled integration into organizational decision-making procedures. The scale used for measuring all constructs operated via a five-point Likert system that ranged between 1 (Strongly Disagree) and 5 (Strongly Agree).

PLS-SEM analysis with SmartPLS 4.0 software served to test the proposed relationships. PLS-SEM provided an appropriate solution because this model addressed both the exploratory design elements and the intricate research network with several moderation effects. Cronbach's alpha, along with composite reliability (CR) and average variance extracted (AVE), served to evaluate reliability and validity as per recommendations from Hair et al. (2019) and Ali et al. (2024). The statistical model fit assessment utilized RMSEA and CFI together with TLI and Chi-Square/df. To check for multicollinearity, the study used variance inflation factor (VIF) to validate that all predictors were below 5.0.

Table 1 displays the participant demographics. The research subjects comprised 57.8% male and 42.2% female participants. The demographic segment consisting of people within the 30–39 age range made up the most prominent group that engages in BI adoption efforts since they accounted for 41.3% of respondents, whereas those between 40–49 came in second with 29.4%. The majority, 67.5%, of surveyed participants held a bachelor's degree as their highest educational qualification, though 21.8% of respondents possessed master's degrees or more advanced qualifications, thus creating skill disparities within the BI implementation team. A majority, 45.6%, of participants engaged in healthcare BI system deployment maintained 6–10 years of professional experience.

Table 1. Demographic profile of respondents

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	180	57.8%
	Female	132	42.2%
Age Group	18–29 years	70	22.4%
	30–39 years	129	41.3%
	40–49 years	92	29.4%
	50+ years	21	6.9%
Education Level	High School	40	12.8%
	Bachelor's Degree	211	67.5%
	Master's Degree	68	21.8%
	Ph.D.	11	3.5%
Work Experience	0–5 years	85	27.3%
	6–10 years	143	45.6%
	11+ years	84	27.1%

3. RESULTS

This study produces experimental evidence about what drives Jordanian hospital facilities to adopt business intelligence (BI). User satisfaction operated as a regulating factor in the relationship analysis conducted by structural equation modeling (SEM-PLS) between top management support, organizational readiness, technological compatibility, and BI adoption. The paper reveals important survey participant information, revealing that healthcare professionals, IT managers, and hospital administrators comprise the majority of respondents.

A confirmatory factor analysis (CFA) confirmed the validity and reliability of the measurement model, as shown in Table 2. All measurement indicators in this study exceeded the 0.70 criterion recommended by the researchers (Alzubi et al., 2021;

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Kowalski et al., 2021), confirming their suitability for the research. The internal consistency of the study was established by composite reliability (CR) values that spanned between 0.85 and 0.92. The model has sufficient convergent validity because its average variance extracted (AVE) values in Table 3 surpass the 0.50 threshold. The assessment results for model fit indices showed excellent results because RMSEA measured 0.048, CFI recorded 0.940, and TLI achieved 0.926. This confirmed that the proposed model matched the observed data excellently.

Table 4 shows that top managerial backing, organizational readiness, and technological compatibility have a strong impact on the adoption of business intelligence systems in Jordanian hospitals. This study shows that the commitment of top leadership to BI adoption leads to its successful implementation ($\beta = 0.38$, $p < 0.001$) (Al-Muhrami et al., 2021). Organizational readiness showed a strong association ($\beta = 0.41$, $p < 0.001$) as a primary indicator because successful BI adoption requires a well-equipped IT infrastructure, trained workers, and a data-oriented organizational culture. The study reveals that technological compatibility significantly drives BI adoption, with a statistically significant relationship ($\beta = 0.35$, $p < 0.001$). Hospitals integrating BI solutions into their existing systems demonstrate better BI adoption rates.

The study investigated how user satisfaction impacted the relationship between different variables. User satisfaction demonstrated positive effects on the connection between BI adoption and top management support ($\beta = 0.29$, $p < 0.01$) and organizational readiness ($\beta = 0.32$, $p < 0.01$) along with technological compatibility ($\beta = 0.27$, $p < 0.01$). User satisfaction demonstrates its ability to boost the relationship between organizational and technological elements and BI adoption efforts. The decline in user satisfaction results in substantial reductions in the capacity of top management support, organizational readiness, and technological compatibility to promote BI adoption.

The study generates significant data points that explain the essential factors contributing to the adoption of BI systems in Jordanian hospitals. The study highlights the key roles of leader-driven digital initiatives, IT infrastructure support, and employee education in operationalizing business intelligence solutions. High user satisfaction and engaged hospital staff enhance the positive outcomes from organizational and technological factors that encourage BI adoption. Hospitals dedicated to these strategic elements will achieve increased operational efficiency, better decision-making, and improved patient outcomes through the implementation of a BI system.

Organizational readiness stands as the essential factor during BI implementation in Jordanian hospitals because it combines top management support and system-specific technological requirements with organizational planning.

Table 2. Construct reliability and validity assessment

Constructs	Number of Items	Factor Loadings	AVE	CR	Cronbach's Alpha (α)
Top Management Support	4	0.73–0.88	0.65	0.89	0.86
Organizational Readiness	4	0.75–0.90	0.67	0.90	0.87
Technological Compatibility	4	0.72–0.86	0.63	0.88	0.85
User Satisfaction	4	0.74–0.89	0.66	0.91	0.88
BI Adoption	4	0.76–0.91	0.68	0.92	0.89

Table 3. Model fit indices

Fit Index	Obtained Value	Recommended Threshold	Decision
RMSEA	0.048	RMSEA < 0.08	Good Fit
CFI	0.940	CFI > 0.90	Good Fit
TLI	0.926	TLI > 0.90	Good Fit
Chi-Square/df	2.15	< 3.00	Good Fit

Table 4. Hypotheses testing results

Hypothesis	Path Coefficient (β)	S.E.	C.R.	P-Value	Result
H1: Top Management Support → BI Adoption	0.38	0.06	6.5	< 0.001	Supported
H2: Organizational Readiness → BI Adoption	0.41	0.07	6.8	< 0.001	Supported
H3: Technological Compatibility → BI Adoption	0.35	0.06	6.1	< 0.001	Supported
H4: User Satisfaction moderates Top Management Support → BI Adoption	0.29	0.05	5.7	< 0.01	Supported
H5: User Satisfaction moderates Organizational Readiness → BI Adoption	0.32	0.06	5.9	< 0.01	Supported
H6: User Satisfaction moderates Technological Compatibility → BI Adoption	0.27	0.06	5.4	< 0.01	Supported

4. DISCUSSION

The implementation of business intelligence (BI) systems depends on executive support, which includes staff preparedness with technological abilities. Companies derive the most benefits from BI through support from executives throughout the development process, as well as by making crucial operational adaptations to organizational functions. Leaders need to provide the necessary resources and technical infrastructure from the beginning to the end of information system development, according to Arefin et al. (2021) and Elbashir et al. (2022). Top leadership in digital healthcare development acts as an indispensable driver, which produces substantial business benefits for healthcare organizations in their BI implementation procedures. Hospital executives at the top level use strategic resource planning to develop readiness levels required for adoption, according to Puklavec et al. (2018). Good BI solution results emerge from organizations that create proper readiness by having both well-trained staff and superior data management systems. Digital success emerges through an organization's willingness and internal capabilities to transform in response to new system adaptations, as explained by Rouhani et al. (2016). Jordanian medical facilities need to develop their healthcare staff through effective programs that empower employees, as this foundation ensures improved capabilities in BI solution readiness and usage.

The success rate of BI adoption mainly depends on the extent to which different technological systems align with one another. Business intelligence implementation occurs smoothly because organizations utilize information technology management systems that are already present within their hospitals. Findings by Isiaku and Adalier (2024) confirm that technical complications constitute hurdles for BI system deployment, but their results differ on this topic. The past years saw the obsolescence of multiple integration problems associated with cloud-based BI platforms because organizations shifted attention away from technical interoperability requirements. Healthcare facilities now experience improved deployment of data-driven processes through newly emerging cloud-based BI tools, which make IT implementation more seamless.

Research studies contradict the link between BI usage and regulatory compliance, thus creating a significant difference in academic findings. Gautam and Sharma (2020) studied hospital regulations that produced different outcomes regarding analytical system deployment. This paper suggests that Jordanian hospital regulatory guidelines establish specific performance thresholds for implementing business intelligence. Healthcare operational compliance systems enable the implementation of business intelligence through organizational and technological components that encourage regulatory compliance minimization.

The core reason why digital transformation succeeds is user participation that pairs user-desired systems with operational processes. The effective deployment of BI systems relies on employee understanding that BI tools present advantages that correspond to operational system requirements, according to Bartlett et al. (2023). Jaklič et al. (2018) showed that digital transformation depends most essentially on achieving satisfied users while involving them in the process. Collected evidence forces Jordanian hospitals to prioritize user interaction quality, staff involvement, and post-deployment technical support for their information technology systems.

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Future research should examine the combined effects of these characteristics with cultural standards to assess their regional impact worldwide, beyond Jordanian healthcare settings. It is necessary to study both the diagnosis and treatment outcomes delivered by AI-powered BI systems to healthcare patients and their impact on physician clinical decision-making. BI technology plays dominant functions within Jordanian healthcare facilities as well as other healthcare facilities around the world. The executive needs to provide ongoing support throughout the development lifecycle while training different end-users in sequential sessions. Persistent strategic changes in BI systems create positive impacts on patient health services as well as operational productivity and help executive teams base their strategic decisions on analytical findings to generate positive patient outcomes.

CONCLUSION

This study investigated the effects of top management support, organizational readiness, and technological compatibility on business intelligence adoption in Jordanian hospitals through user satisfaction as a moderator. The analysis demonstrates that environmental elements, along with technological compatibility, generate significant positive effects on business intelligence (BI) adoption, although organizational readiness fails to produce direct, significant results. User satisfaction levels improve both the supportive relationship coming from management executives, organizational preparedness, and technological fit for BI adoption. Healthcare institutions need both user-perceived satisfaction and positive feedback to achieve successful implementation of new technology. Hospital management teams should build operational system compatibility while developing feedback-based cultures throughout their full business intelligence implementation period. The support from executive leaders is a crucial requirement because they need to fund digital projects and connect organizational strategies to technological advancements. The achievement of maximum user satisfaction depends on staff training, but seamless BI system adoption is achieved when system usability meets technical support requirements and continuous improvement efforts.

AUTHOR CONTRIBUTIONS

Conceptualization: Mohammad Mahmoud Saleem Alzubi.
Data curation: Mohammad Mahmoud Saleem Alzubi.
Formal analysis: Mohammad Mahmoud Saleem Alzubi.
Funding acquisition: Mohammad Mahmoud Saleem Alzubi.
Investigation: Mohammad Mahmoud Saleem Alzubi.
Methodology: Mohammad Mahmoud Saleem Alzubi.
Project administration: Mohammad Mahmoud Saleem Alzubi.
Resources: Mohammad Mahmoud Saleem Alzubi.
Software: Mohammad Mahmoud Saleem Alzubi.
Supervision: Mohammad Mahmoud Saleem Alzubi.
Validation: Mohammad Mahmoud Saleem Alzubi.
Visualization: Mohammad Mahmoud Saleem Alzubi.
Writing – original draft: Mohammad Mahmoud Saleem Alzubi.
Writing – review & editing: Mohammad Mahmoud Saleem Alzubi.

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