



Analyzing Barriers to Data-Driven Governance in Iraq's Public Policymaking: Evidence from COVID-19 Crisis Management in Salah al-Din Province

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ABSTRACT

This study aimed to analyze the technological, institutional, human-resource, legal, ethical, socio-cultural, and political-administrative barriers to data-driven governance in Iraq's public policymaking through the experience of COVID-19 crisis management in Salah al-Din Province. This qualitative, applied, descriptive-analytical study was conducted in Salah al-Din Province, Iraq. Participants were 18 individuals with relevant professional experience in public administration, healthcare management, information technology, data management, digital governance, policymaking, and COVID-19 crisis response. Participants were selected through purposive sampling, and data collection continued until thematic saturation was achieved. Data were collected through individual semi-structured interviews focused on digital infrastructure, data quality, interagency coordination, analytical capacity, legal and ethical considerations, organizational culture, and crisis-related evidence use. Interviews were recorded with consent, transcribed, and analyzed using thematic analysis through familiarization, initial coding, theme development, theme review, theme definition, and interpretation. Credibility, dependability, confirmability, and transferability were strengthened through systematic documentation, constant comparison, careful transcription, reflexive analysis, and cross-checking of emerging themes. The analysis identified five interrelated categories of barriers: technological and data-infrastructure limitations, institutional and organizational fragmentation, human-resource and analytical-capacity limitations, legal and ethical data-governance challenges, and socio-cultural and political-administrative barriers. Institutional fragmentation emerged as the most pervasive barrier, followed by weak data quality and standardization, lack of interoperability, bureaucratic delays, shortages of specialized analytical personnel, insufficient training, ambiguous data-sharing rules, privacy and cybersecurity concerns, resistance to digital transformation, weak interorganizational trust, and continued reliance on authority- and experience-based decision-making. During the COVID-19 crisis, these barriers contributed to delayed situational awareness, inconsistent public-health indicators, difficulty forecasting healthcare demand, inefficient resource allocation, and predominantly reactive rather than anticipatory crisis management. Data-driven governance in Salah al-Din Province is constrained by a systemic combination of technological, institutional, human, regulatory, and cultural weaknesses, indicating that effective reform requires integrated improvements in digital infrastructure, data interoperability, analytical capacity, interagency coordination, legal safeguards, and evidence-oriented administrative practices.

Keywords: Data-Driven Governance; Public Policymaking; COVID-19; Crisis Management; Big Data; Digital Governance; Salah al-Din Province; Iraq

1. Introduction

The increasing digitalization of public administration has fundamentally altered the ways governments collect information, formulate policy, allocate resources, and evaluate public programs. Contemporary public organizations operate in environments characterized by rapidly expanding volumes of administrative, social, economic, geographic, and behavioral data, creating unprecedented opportunities for evidence-informed and anticipatory governance. Data-driven governance refers to the systematic use of high-quality, timely, integrated, and analytically processed data to improve public decision-making, enhance policy coordination, increase administrative efficiency, and strengthen governmental responsiveness. Unlike conventional administrative models in which information is primarily used for reporting or recordkeeping, data-driven governance emphasizes the transformation of raw data into actionable knowledge that can support policy design, implementation, monitoring, and revision. This transformation is increasingly connected to broader processes of digital government and public-sector modernization, in which technological change is accompanied by institutional, organizational, and cultural restructuring (1). The emergence of artificial intelligence, predictive analytics, automated decision systems, and integrated public data infrastructures has further expanded the potential scope of data-driven governance and has encouraged governments to reconsider how administrative authority and policy capacity are exercised in increasingly complex environments (2, 3).

The strategic significance of data-driven policymaking derives from its capacity to improve both the speed and quality of public decisions. Governments increasingly face policy problems characterized by uncertainty, interdependence, rapidly changing conditions, and multiple interacting actors, making conventional linear approaches to policymaking progressively less adequate. Complexity-oriented perspectives emphasize that public problems are rarely isolated and that interventions in one part of a governance system may generate consequences elsewhere, requiring policymakers to continuously gather, interpret, and update information (4). Under these conditions, access to comprehensive and timely data can improve situational awareness, reveal emerging patterns, identify vulnerable

populations, enable forecasting, support policy experimentation, and provide feedback on the effects of governmental interventions. Predictive analytics, in particular, can help decision-makers move from retrospective reporting toward anticipatory governance by identifying likely future trends and risks before they fully materialize (5). Nevertheless, the value of advanced analytics depends not simply on the availability of large datasets but on governments' ability to organize, interpret, and responsibly incorporate data into decision processes.

The increasing emphasis on big data in government has generated considerable optimism regarding the possibility of more precise, responsive, and evidence-based public policy. Big data analytics enables organizations to integrate diverse data sources, identify patterns that may be difficult to detect through traditional analytical techniques, and generate more sophisticated forms of forecasting and decision support. However, organizational capability remains critical. The capacity to derive value from big data requires appropriate technological infrastructure, skilled human resources, data-oriented management practices, organizational learning, and the ability to integrate analytical outputs into operational and strategic decisions (6). In the public sector, these requirements are especially demanding because governmental organizations are frequently characterized by legacy information systems, fragmented institutional mandates, strict legal obligations, multiple accountability structures, and bureaucratic procedures that can inhibit rapid data exchange. Consequently, the existence of large quantities of data does not necessarily result in better policymaking. Research on big data and policy has therefore cautioned against treating data-intensive governance as an automatic technological solution to complex administrative problems, emphasizing instead that institutional context strongly determines whether data can be converted into policy value (7).

One of the central challenges in public-sector data use is organizational readiness. Governments may possess extensive administrative datasets while lacking the institutional infrastructure necessary to integrate and analyze them effectively. Public organizations often maintain separate databases designed for specific departmental functions, resulting in fragmented information environments in which data are difficult to combine across organizational

boundaries. Differences in data formats, standards, definitions, and technological platforms may further reduce interoperability, while uncertainty about ownership and responsibility can restrict information exchange. Klievink et al. emphasize that the adoption of big data in the public sector is accompanied by substantial uncertainties concerning technological readiness, organizational capability, governance arrangements, and the broader environment in which data are used (8). These constraints are particularly consequential when policy problems cross institutional jurisdictions and require information from multiple administrative sectors.

Policy coordination therefore represents an essential component of data-driven governance. Effective public policymaking frequently requires ministries, agencies, local governments, healthcare institutions, and other organizations to share information and coordinate decisions. Yet public-sector institutions often operate within differentiated administrative structures in which mandates, incentives, professional cultures, and information systems vary substantially. Coordination failures can produce duplication, inconsistent decisions, delayed responses, and competing interpretations of the same policy problem (9). Data-driven governance cannot overcome such fragmentation through technology alone. If institutions lack clear mechanisms for interagency cooperation, common standards, agreed procedures for information exchange, and shared responsibility for data quality, new digital tools may reproduce or even intensify existing organizational divisions. The creation of interoperable public data environments therefore depends on governance arrangements that align technical integration with institutional coordination.

The quality of data-based decision-making is also shaped by the characteristics of the data themselves and by the processes through which information is analyzed. Data may be incomplete, outdated, duplicated, inconsistent, biased, or collected under definitions that differ between organizations. Under such circumstances, advanced analytical technologies cannot compensate for deficiencies in the underlying information. Research on big data decision-making has shown that decision quality depends on multiple interrelated factors, including data quality, analytical capability, organizational processes, and the capacity of decision-

makers to interpret analytical results appropriately (10). This is particularly important in public administration because inaccurate or poorly contextualized data can affect decisions concerning healthcare, public safety, social protection, resource allocation, and other areas with direct consequences for citizens. The development of data-driven governance therefore requires not only data availability but also mechanisms for validation, standardization, updating, documentation, and responsible interpretation.

The governance of public data also raises fundamental concerns related to privacy, transparency, fairness, accountability, and public trust. Governments possess highly sensitive information about citizens, and the increasing integration of datasets creates both administrative opportunities and ethical risks. Data-driven policymaking can potentially increase surveillance, reproduce social biases, generate unequal impacts, or reduce transparency if citizens cannot understand how automated or algorithm-supported decisions are produced. The increasing use of artificial intelligence in government has therefore intensified debates about public values and responsible innovation. National strategies for public-sector AI increasingly recognize that efficiency and innovation must be balanced against fairness, accountability, transparency, security, inclusion, and democratic legitimacy (3). Similarly, research on explainable artificial intelligence demonstrates that perceptions of accuracy, fairness, and trustworthiness can be affected by how algorithmic decisions are explained to those influenced by them (11). These findings suggest that data-driven governance must be evaluated not only by its technical efficiency but also by whether citizens and public officials regard data-based decisions as legitimate and accountable.

Recent research has consequently shifted from purely technology-centered models toward data-centric and governance-oriented approaches to responsible artificial intelligence and advanced analytics in the public sector. Responsible adoption requires attention to the quality, provenance, accessibility, representativeness, and governance of the data on which algorithmic systems depend. Public organizations must confront challenges involving fragmented datasets, insufficient standards, regulatory uncertainty, bias, cybersecurity, institutional accountability, and limited organizational preparedness (12).

These issues reinforce the principle that data-driven governance is fundamentally an institutional transformation rather than a simple process of adopting new software. Governments must develop appropriate regulatory frameworks, professional competencies, coordination structures, and ethical safeguards alongside technical infrastructure.

The concept of shared data spaces further illustrates the importance of institutional design in contemporary policymaking. Integrated data environments can potentially enable different public organizations to contribute to and access common information resources, thereby supporting collective problem-solving and more coordinated policy responses. However, shared data spaces also raise questions about control, access rights, standards, institutional autonomy, accountability, and collective rationality. Nanni and Napolitano argue that data spaces offer significant opportunities for public administration but also face structural limits arising from the organizational and political conditions under which data are produced and shared (13). The challenge is therefore not merely to create larger databases but to establish governance mechanisms through which diverse institutions can cooperate while maintaining appropriate safeguards and responsibilities.

These challenges become especially visible in smart governance and digitally mediated urban administration. Studies of smart governance have emphasized that digital technologies can strengthen coordination, participation, service delivery, and administrative responsiveness only when they are embedded within appropriate institutional arrangements (14). Technology does not operate independently from administrative structures, political relationships, or patterns of public participation. The same principle applies at provincial and national levels: data systems are effective only when governance institutions possess sufficient capacity to collect reliable information, share it across organizational boundaries, interpret it appropriately, and connect it to actual decision processes.

The COVID-19 pandemic provided an unusually powerful test of governments' ability to operate under conditions requiring rapid and continuous use of data. Public authorities needed real-time information on infections, mortality, hospital capacity, testing, population movement, healthcare personnel, equipment availability, geographic

hotspots, vaccination, and vulnerable populations. The pandemic demonstrated that administrative capacity during emergencies depends heavily on the ability to collect and integrate diverse streams of information while making decisions under extreme uncertainty. Ansell et al. describe COVID-19 as a major challenge to conventional models of public administration and leadership because it required governments to respond rapidly, coordinate across institutional boundaries, and adapt to continuously changing circumstances (15). The pandemic therefore highlighted the importance of flexible governance, interorganizational collaboration, and timely information.

Experiences from countries with relatively advanced digital infrastructures demonstrated the potential value of data integration during the crisis. Taiwan's response to COVID-19, for example, illustrated how big data analytics, technological tools, and proactive testing could be combined to support rapid identification of risks and targeted public-health interventions (16). Such cases showed that integrated health and administrative information can contribute to situational awareness and policy responsiveness when appropriate technological and institutional mechanisms are already available. At the same time, the contrast between technologically advanced systems and less-prepared administrative environments exposed substantial inequalities in governmental capacity to benefit from data-intensive crisis management.

The pandemic also highlighted the strategic importance of policy capacity. Governments were required to mobilize analytical, operational, political, and institutional capabilities simultaneously while coordinating multiple actors under conditions of incomplete information. Policy capacity during COVID-19 included the ability to obtain reliable evidence, interpret evolving scientific knowledge, forecast resource needs, coordinate public organizations, communicate with citizens, and adapt interventions as new information became available (17). Where these capabilities were weak, governments were more likely to experience delayed responses, inconsistent policies, difficulties in resource allocation, and limited ability to anticipate changes in crisis conditions.

The growing application of artificial intelligence and big data in pandemic management further demonstrates how advanced analytics may contribute to crisis preparedness and

response. Big data and AI can assist with epidemiological surveillance, forecasting, resource optimization, early-warning systems, pattern recognition, and the identification of high-risk populations (18). Nevertheless, these applications depend on the availability of reliable, sufficiently granular, interoperable, and ethically governed data. In resource-constrained settings, the most significant barriers may arise before sophisticated analytics can even be implemented, particularly where public records remain fragmented, digitization is incomplete, analytical expertise is scarce, or institutional mechanisms for data sharing are weak.

These issues are especially relevant in countries affected by conflict, institutional fragility, fiscal pressures, and uneven administrative development. In such contexts, digital transformation occurs within public institutions already confronting challenges related to infrastructure, coordination, staffing, administrative continuity, trust, and governance capacity. Iraq represents an important setting for examining these dynamics. The country's public institutions have undergone prolonged periods of political transition, security instability, reconstruction, and administrative reform, while simultaneously facing rising expectations for digital modernization and improved public services. Data-driven governance in such an environment cannot be understood solely as a question of technological adoption; it must be examined as an institutional and administrative process shaped by organizational fragmentation, human-resource capacity, legal frameworks, bureaucratic practices, and social trust.

Salah al-Din Province provides a particularly significant empirical case. The province has experienced substantial post-conflict reconstruction pressures while also confronting the administrative and public-health demands generated by the COVID-19 pandemic. These overlapping pressures created a demanding governance environment in which public institutions needed timely and accurate information while operating under infrastructural and organizational constraints. Crisis management required coordination among provincial authorities, healthcare organizations, administrative departments, information-management units, and other governmental actors. Yet the effectiveness of such coordination depended on whether data could be generated

consistently, transmitted rapidly, interpreted correctly, and incorporated into policy decisions.

Despite the increasing international literature on big data, digital government, artificial intelligence, predictive analytics, and data-driven public administration, important empirical gaps remain regarding how these approaches function in institutionally fragile and post-conflict environments. Much of the existing literature has focused on technologically advanced governments, national digital strategies, smart cities, or organizations with relatively mature information infrastructures. Less is known about the barriers encountered when data-driven governance is pursued in provincial administrative systems characterized by fragmented infrastructures, uneven digitalization, limited specialist capacity, and complex interorganizational relationships. This gap is important because the benefits often attributed to data-driven governance may depend precisely on institutional capacities that cannot be assumed in such settings. Understanding these barriers therefore requires attention to both technological limitations and the broader governance conditions surrounding the production and use of public information.

The literature further indicates that successful data-driven governance requires a combination of technical capability, organizational readiness, institutional coordination, analytical expertise, legal clarity, ethical safeguards, and public legitimacy rather than any single technological intervention (7, 8, 10). The evolution toward AI-enabled public administration increases the importance of these foundations because more advanced systems amplify both the potential value and the risks associated with governmental data use (2, 12). Examining the experience of COVID-19 crisis management in Salah al-Din Province can therefore reveal not only crisis-specific deficiencies but also deeper structural barriers affecting Iraq's longer-term transition toward evidence-based and digitally enabled public governance.

Accordingly, the aim of this study was to analyze the technological, institutional, human-resource, legal, ethical, socio-cultural, and political-administrative barriers to data-driven governance in Iraq's public policymaking through the experience of COVID-19 crisis management in Salah al-Din Province.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a qualitative research design to explore and analyze the barriers to data-driven governance in Iraq's public policymaking system, with particular emphasis on the experience of COVID-19 crisis management in Salah al-Din Province. A qualitative approach was selected because the research problem concerns a multidimensional governance phenomenon shaped by technological capacity, institutional arrangements, administrative practices, human-resource competencies, legal and ethical considerations, organizational culture, and the broader socio-political environment. These dimensions cannot be adequately understood through quantitative indicators alone, particularly in a governance context characterized by institutional fragility, uneven digital development, resource limitations, and the continuing effects of post-conflict reconstruction. The study was applied in terms of purpose and descriptive-analytical in terms of orientation. Its primary objective was not merely to describe existing deficiencies in the use of data but to identify and interpret the underlying mechanisms that constrained the collection, integration, exchange, analysis, and utilization of data in governmental decision-making during a major public health emergency. The COVID-19 pandemic was therefore treated as an empirical case through which the strengths and weaknesses of data-driven public policymaking could be examined in a concrete crisis-management setting.

The study was conducted in Salah al-Din Province, Iraq, which was selected as the research setting because of its particular administrative, infrastructural, socio-economic, and post-conflict characteristics. Salah al-Din experienced substantial pressure on its governmental and healthcare institutions during the COVID-19 pandemic while simultaneously confronting persistent challenges related to institutional capacity, digital infrastructure, coordination among public agencies, resource allocation, information management, and reconstruction. These conditions made the province an analytically relevant case for investigating the feasibility and limitations of data-driven governance in a resource-constrained public-sector environment. The province also reflects several governance challenges that are

observable at the broader national level in Iraq, including fragmented information systems, varying levels of administrative capacity, limited interoperability among government databases, shortages of specialized technical personnel, and difficulties in interorganizational coordination. The selection of Salah al-Din Province therefore enabled the study to examine data-driven governance within a context in which timely, reliable, and integrated information was particularly important for public decision-making, resource allocation, disease surveillance, healthcare planning, and crisis response.

The study population consisted of individuals possessing direct professional knowledge or practical experience related to public policymaking, governmental administration, healthcare management, information technology, digital governance, data management, and COVID-19 crisis response in Salah al-Din Province. Participants were recruited using purposive sampling, as the research required information-rich cases capable of providing detailed accounts of institutional practices and barriers associated with the use of data in public decision-making. Participants were drawn from relevant governmental departments, provincial administrative bodies, healthcare institutions, information technology and information-management units, academic institutions, and other organizations involved in policy implementation or crisis management. Inclusion in the study required participants to have relevant professional or managerial experience in at least one of the areas directly associated with the research problem, including public administration, policy formulation or implementation, healthcare administration, digital technologies, information systems, data management, institutional coordination, or COVID-19 response activities. Particular attention was given to selecting participants who had sufficient familiarity with the manner in which governmental information was collected, communicated, interpreted, or used during the pandemic. Individuals without direct professional experience relevant to the study objectives or without sufficient familiarity with the governmental or healthcare response to COVID-19 in the province were not included.

Sampling and data collection proceeded concurrently and continued until thematic saturation was reached. Saturation was considered to have occurred when successive interviews

no longer produced substantively new concepts, categories, explanations, or dimensions relevant to the barriers to data-driven governance. This criterion was used rather than determining the qualitative sample solely on the basis of a predetermined numerical target, thereby allowing the adequacy of the sample to be determined by the informational richness and conceptual completeness of the collected data. Maximum variation was also considered during participant selection to obtain perspectives from individuals occupying different professional and institutional positions. This strategy reduced the likelihood that the findings would reflect the experience of only one governmental sector or occupational group and facilitated comparison across administrative, healthcare, technological, and policy-related perspectives. Participation was voluntary, and participants were informed of the purpose of the research, the nature of their involvement, the confidentiality of the information provided, and their right to decline to answer particular questions or withdraw from the study. Informed consent was obtained before each interview, and identifying information was excluded from the analytical reports to protect participants' confidentiality.

2.2. Data Collection Tools

Data were collected primarily through individual semi-structured interviews. The semi-structured interview method was selected because it provided sufficient consistency across interviews while allowing participants to elaborate on their personal experiences, institutional observations, and interpretations of the barriers affecting data-driven policymaking. This flexibility was particularly important because the implementation of data-driven governance involves interconnected technological, managerial, political, organizational, legal, and socio-cultural factors that may vary considerably across institutions and professional roles. The interview guide was developed on the basis of the research objectives and a review of the conceptual and empirical literature on data-driven governance, big data in the public sector, digital government, evidence-based policymaking, public-sector information management, institutional capacity, and crisis governance. The initial interview framework was designed to move from general questions about the role of data in governmental decision-

making toward more focused questions concerning the participants' experiences during the COVID-19 pandemic.

The interviews examined several interconnected dimensions of data-driven governance. Participants were asked to describe the existing digital and technological infrastructure available within governmental institutions and the extent to which administrative and healthcare information was generated, stored, updated, and accessed electronically. Considerable attention was paid to participants' perceptions of data availability, completeness, timeliness, reliability, standardization, and accuracy, as these characteristics directly affect the usefulness of information for public policymaking. The interviews also investigated the existence and effectiveness of institutional procedures for exchanging information among governmental agencies, healthcare institutions, provincial authorities, and other organizations involved in crisis response. Participants were encouraged to discuss whether information systems were interoperable, whether different institutions used compatible data formats, how rapidly information could be transmitted between organizations, and whether administrative procedures facilitated or obstructed interagency data sharing.

Another major area of inquiry concerned the human and organizational capacities required for data-driven governance. Participants were asked about the availability of personnel with expertise in data analytics, database management, statistical analysis, digital systems, information security, and evidence-based decision-making. Questions also explored opportunities for professional training, institutional support for developing digital competencies, managerial understanding of data analytics, and the extent to which analytical evidence influenced actual policy choices. Organizational and cultural issues were investigated by examining attitudes toward information sharing, reliance on traditional or experience-based decision-making, resistance to technological change, hierarchical administrative practices, willingness to adopt digital systems, and levels of trust in data produced by different institutions. Participants were further asked to discuss whether political, bureaucratic, or organizational considerations sometimes affected the interpretation, circulation, or use of available evidence.

Legal, ethical, and security issues formed an additional component of the interview protocol. Participants were asked about their understanding of existing rules and institutional procedures governing access to public-sector data, data confidentiality, privacy protection, authorization for information exchange, cybersecurity, and responsibility for data management. The interviews explored whether uncertainty regarding legal responsibilities or privacy requirements discouraged governmental institutions from sharing data and whether participants perceived deficiencies in the regulatory framework governing digital information. Particular attention was also paid to public trust, concerns about misuse of personal information, and the potential tension between rapid access to health-related information during a crisis and the protection of individual privacy.

The COVID-19 pandemic constituted a central component of the interviews because it provided a practical context in which the functioning of existing information systems could be evaluated. Participants were asked to describe how data were collected and communicated during the crisis, what information policymakers required, what difficulties were encountered in obtaining timely and accurate data, and how information was used to support decisions concerning public health measures, healthcare capacity, resource allocation, disease surveillance, mobility restrictions, and other crisis-management interventions. They were also encouraged to identify situations in which insufficient, fragmented, delayed, inconsistent, or inaccessible information affected the quality or speed of governmental decisions. Follow-up and probing questions were used whenever participants introduced issues requiring clarification or provided examples with potential analytical relevance. This procedure enabled the interviews to capture both the formal institutional dimensions of data governance and the participants' practical experiences of how information systems operated under crisis conditions.

Interviews were conducted individually to allow participants to discuss institutional challenges and potentially sensitive administrative issues freely. With participants' consent, interviews were audio-recorded to ensure the completeness and accuracy of the data. Field notes were also used to document contextual observations, emerging analytical ideas, and issues requiring further exploration in subsequent interviews. Following each

interview, the recordings were transcribed carefully and checked against the original audio material to minimize transcription errors. The resulting transcripts constituted the primary qualitative dataset. Data collection and preliminary analysis proceeded iteratively, meaning that emerging concepts identified in earlier interviews informed the use of probing questions in later interviews. This iterative process increased the depth of the dataset and facilitated the progressive refinement of the emerging conceptual categories without changing the central focus of the interview protocol.

2.3. Data Analysis

The interview data were analyzed using thematic analysis. This analytical approach was selected because it provides a systematic yet flexible procedure for identifying, organizing, interpreting, and explaining recurring patterns of meaning within qualitative data. Thematic analysis was particularly appropriate for the objectives of the study because the research sought to identify multiple categories of barriers to data-driven governance and to understand how these barriers interacted within the institutional context of public policymaking and COVID-19 crisis management. Analysis began concurrently with data collection and continued throughout the interview process. This iterative relationship between data collection and analysis enabled emerging concepts to be examined in subsequent interviews and contributed to determining when thematic saturation had been achieved.

The analytical process began with extensive familiarization with the data. Interview transcripts were read repeatedly in their entirety to develop a comprehensive understanding of participants' experiences, perceptions, and explanations. During this stage, preliminary notes were made regarding recurring problems, contrasting perspectives, institutional processes, significant examples, and potentially important relationships between different barriers. The researchers then conducted systematic initial coding of the transcripts. Meaningful segments of text were identified and assigned descriptive or interpretive codes that captured the central idea expressed by the participant. Coding remained sufficiently detailed to preserve the contextual meaning of participants' statements while allowing similarities and differences across interviews to be

identified. Examples of issues addressed during initial coding included fragmented databases, inadequate digital infrastructure, delayed information exchange, poor data quality, insufficient analytical skills, shortages of specialized personnel, institutional resistance to information sharing, administrative fragmentation, unclear legal responsibilities, privacy concerns, cybersecurity risks, limited public trust, and reliance on conventional decision-making practices.

Following initial coding, conceptually related codes were compared and grouped into broader categories. Constant comparison was used throughout this stage to examine similarities and differences between participants, professional groups, and institutional contexts. Codes describing related forms of technological deficiency, for example, were examined together to determine whether they reflected a broader technological barrier, while codes concerning coordination, organizational mandates, administrative fragmentation, and information-sharing procedures were considered in relation to institutional barriers. The same procedure was applied to codes associated with human-resource capacity, legal and ethical concerns, and socio-cultural conditions. Importantly, categories were not imposed mechanically on the data in advance. Although the literature and research objectives provided sensitizing concepts, the final analytical structure was developed through continuous engagement with participants' accounts and was revised whenever the empirical material indicated that codes should be combined, separated, renamed, or repositioned.

Candidate themes were subsequently reviewed against both the coded extracts and the complete dataset. The purpose of this stage was to ensure that each theme demonstrated adequate internal coherence while remaining conceptually distinct from other themes. Themes that were excessively broad were divided into more analytically meaningful components, whereas overlapping themes were merged when the distinction between them was not adequately supported by the data. Attention was also given to negative or divergent cases so that the final interpretation would not simply reproduce the most frequently expressed perspectives while overlooking meaningful differences among participants. Once the thematic structure had been stabilized, each theme was clearly defined and named

according to its conceptual content and explanatory contribution to understanding the barriers to data-driven governance. The final interpretation centered on major interconnected dimensions that included technological and infrastructural constraints, institutional and organizational barriers, limitations in human-resource and analytical capacity, legal and ethical challenges, and socio-cultural impediments to the adoption and effective use of data in policymaking. The analysis also considered how these barriers interacted rather than treating them as isolated deficiencies. For example, limited digital infrastructure could reduce data quality and accessibility, while inadequate technical expertise could restrict the ability of institutions to transform available data into actionable evidence, and weak interorganizational coordination could prevent analytically useful information from reaching relevant decision-makers.

In the final analytical stage, the themes were interpreted in relation to the specific experience of COVID-19 crisis management in Salah al-Din Province and the broader conceptual framework of data-driven public governance. Particular attention was given to identifying the ways in which structural weaknesses that may have existed before the pandemic became more visible or consequential under emergency conditions. The analysis therefore distinguished, where possible, between long-standing institutional barriers and crisis-specific manifestations of those barriers. Participant accounts were used to explain how deficiencies in data infrastructure, institutional coordination, analytical expertise, information-sharing procedures, and governance arrangements affected the capacity of public institutions to produce timely evidence and incorporate that evidence into crisis-related decisions. Interpretive conclusions were grounded in the interview data, and representative participant quotations were retained for use in the findings section to demonstrate the empirical basis of the themes.

Several procedures were incorporated into the analytical process to strengthen the trustworthiness and methodological rigor of the study. Credibility was enhanced through sustained engagement with the interview material, repeated reading of transcripts, systematic comparison of accounts across participants, careful checking of transcripts, and the use of follow-up questions during data collection to clarify ambiguous or incomplete statements. Where appropriate, interpretations were checked against

participants' intended meanings to reduce the risk of misrepresentation. Dependability was supported by maintaining a transparent record of the analytical process, including coding decisions, modifications to the thematic structure, theme definitions, and the rationale for combining or separating categories. Confirmability was strengthened by grounding interpretations in the original interview data, retaining a clear connection between codes, themes, and participants' statements, and reflecting critically on assumptions that could influence interpretation. Independent review and discussion of coding decisions were used where appropriate to examine the consistency and defensibility of the emerging analytical framework. Transferability was addressed by providing a detailed description of the institutional, administrative, socio-economic, and post-conflict context of Salah al-Din Province, as well as the characteristics of the participant groups and the circumstances surrounding COVID-19 crisis management. Rather than claiming statistical generalizability, the study provides sufficient contextual detail to enable readers to assess the relevance of the findings to other Iraqi provinces and comparable public-sector environments characterized by institutional fragility, resource constraints, and emerging digital-governance capacities.

3. Findings and Results

A total of 18 participants took part in the qualitative phase of the study, and data collection continued until thematic saturation was achieved. The participants represented a range of professional backgrounds directly relevant to data-driven governance and COVID-19 crisis management in Salah al-Din Province. Thirteen participants were male and five were female. In terms of age, four participants were

between 30 and 39 years old, eight were between 40 and 49 years old, and six were aged 50 years or older. Five participants were employed in provincial governmental and public-administration institutions, five worked in healthcare management or public-health-related organizations, four were specialists in information technology, information systems, statistics, or governmental data management, and four were academics or policy-related experts with experience in public administration, crisis management, or digital governance. Regarding professional experience, three participants had between 5 and 9 years of relevant work experience, six had between 10 and 14 years, five had between 15 and 19 years, and four had 20 years or more of professional experience. Several participants had direct responsibilities during the COVID-19 pandemic involving health surveillance, administrative reporting, crisis coordination, resource allocation, information management, or the implementation of governmental measures. The diversity of participants provided perspectives from administrative, healthcare, technical, and policy environments and enabled comparison of the barriers experienced at different stages of the data cycle, from data generation and recording to transmission, analysis, interpretation, and final use in public decision-making. The thematic analysis of the interviews resulted in five major themes encompassing 23 subthemes. These themes represented technological and data-infrastructure limitations, institutional and organizational fragmentation, human-resource and analytical-capacity limitations, legal and ethical data-governance challenges, and socio-cultural and political-administrative barriers. Although analytically distinguishable, the themes were strongly interconnected, and participants repeatedly indicated that weaknesses in one dimension intensified limitations in other dimensions.

Table 1

Overall thematic structure of barriers to data-driven governance in Salah al-Din Province

Main Theme	Subthemes	Number of Participants Referring to Theme	Overall Interpretation
Technological and data-infrastructure limitations	Fragmented digital infrastructure; continued reliance on paper-based systems; absence of interoperable databases; poor data quality and standardization; limitations in connectivity, cybersecurity, and system reliability	17 of 18	Public institutions lacked an integrated and technically mature digital environment capable of generating, exchanging, and processing reliable data in real time.

Institutional and organizational fragmentation	Weak interagency coordination; organizational data silos; unclear responsibility for data ownership; bureaucratic delays in information exchange; weak institutionalization of evidence-based policymaking	18 of 18	The governance architecture surrounding data was fragmented, causing information to remain within organizational boundaries and limiting its timely use across institutions.
Human-resource and analytical-capacity limitations	Shortage of specialized personnel; limited analytical competencies; insufficient training and professional development; weak integration of analysts into decision-making structures	16 of 18	Government institutions had limited capacity to convert available administrative and health data into meaningful evidence for policy formulation and crisis response.
Legal and ethical data-governance challenges	Unclear legal framework for data sharing; privacy and confidentiality concerns; weak cybersecurity and accountability mechanisms; uncertainty regarding data access and authorization	14 of 18	Ambiguity concerning legal authority, confidentiality, responsibility, and data protection discouraged information exchange and contributed to inconsistent practices among institutions.
Socio-cultural and political-administrative barriers	Resistance to digital transformation; preference for experience- and authority-based decision-making; low interorganizational trust; public distrust and misinformation; political and administrative influence over information flows	16 of 18	Data-driven governance was constrained not only by technical deficiencies but also by organizational norms, trust deficits, administrative culture, and political considerations affecting how evidence was produced and used.

As shown in Table 1, the findings demonstrate that barriers to data-driven governance in Salah al-Din Province were multidimensional rather than attributable to a single technological deficiency. Institutional and organizational fragmentation emerged as the most pervasive theme and was discussed by all 18 participants, indicating that the principal challenge was not simply the absence of technology but the lack of an integrated governance structure through which information could move reliably between institutions and become incorporated into policy decisions. Technological and data-infrastructure limitations were reported by 17 participants and were closely linked to institutional fragmentation because incompatible databases, paper-based records, uneven digitization, and unreliable connectivity reinforced the separation of information across governmental organizations. Human-resource and analytical-capacity limitations and socio-cultural and political-administrative barriers were each reported by 16 participants, demonstrating that even when data were technically available, government institutions frequently

lacked either the specialized analytical expertise or the organizational culture necessary to transform those data into policy-relevant evidence. Legal and ethical data-governance challenges were mentioned by 14 participants and mainly concerned uncertainty regarding authorization, privacy, confidentiality, data ownership, and accountability. The combined thematic pattern therefore revealed a systemic problem in which the effectiveness of data-driven governance depended simultaneously on infrastructure, institutional coordination, professional capability, regulatory clarity, trust, and decision-making culture. Participants consistently emphasized that the COVID-19 crisis exposed these pre-existing weaknesses because policymakers suddenly required rapid, accurate, and continuously updated information concerning infections, hospital capacity, population movements, medical resources, and vulnerable communities. Under emergency conditions, limitations that had previously been manageable within routine administrative processes became major obstacles to timely evidence-based decision-making.

Table 2

Technological and institutional barriers to data-driven governance

Main Theme	Subtheme	Representative Codes Identified in Interviews	Participants Mentioning the Subtheme	Illustrative Participant Evidence
Technological and data-infrastructure limitations	Fragmented digital infrastructure	Separate institutional systems; disconnected departmental databases; isolated health and administrative records; inconsistent software platforms	15	"Every institution had its own information, but the systems were not connected. During the crisis, obtaining a complete picture required contacting several offices separately." (P4)
Technological and data-infrastructure limitations	Continued reliance on paper-based and manual procedures	Paper files; handwritten reports; manual data entry; repeated data transcription; physical transfer of documents	14	"Some information was still collected on paper and later entered into a computer. This created delays and sometimes different versions of the same figures." (P9)

Technological and data-infrastructure limitations	Lack of interoperability	Incompatible databases; absence of common standards; inability to automatically exchange information; multiple data formats	14	"The problem was not only whether data existed. The problem was that the systems could not communicate with each other." (P7)
Technological and data-infrastructure limitations	Poor data quality and standardization	Missing data; duplicated records; inconsistent definitions; delayed updating; contradictory figures; absence of validation procedures	16	"Different offices sometimes reported different numbers for the same issue because the definitions and updating procedures were not unified." (P11)
Technological and data-infrastructure limitations	Connectivity, system reliability, and cybersecurity limitations	Unstable internet access; system interruptions; inadequate servers; limited backup procedures; security concerns	11	"Even when an electronic system was available, network problems and fear of losing or exposing data limited confidence in depending completely on the system." (P3)
Institutional and organizational fragmentation	Weak interagency coordination	Limited coordination meetings; irregular communication; absence of integrated crisis information channels; parallel reporting systems	17	"Health institutions needed information from other government bodies, but there was no permanent mechanism that guaranteed rapid exchange." (P6)
Institutional and organizational fragmentation	Organizational data silos	Institutional ownership mentality; reluctance to release databases; information retained within departments; restricted circulation	15	"Some departments considered their information to belong only to them. Sharing depended more on relationships between officials than on an established system." (P13)
Institutional and organizational fragmentation	Unclear responsibility for data ownership and management	Ambiguous institutional mandates; overlapping responsibilities; unclear data custodian; uncertainty regarding verification authority	12	"When there was a difference between two datasets, it was sometimes unclear which institution had the authority to determine the official figure." (P10)
Institutional and organizational fragmentation	Bureaucratic delays	Formal letters; multiple authorization levels; slow approval; hierarchical communication; procedural rigidity	16	"During normal periods, formal procedures may be acceptable, but during COVID-19 we sometimes needed information immediately while official requests took too long." (P2)
Institutional and organizational fragmentation	Weak institutionalization of evidence-based policymaking	Limited use of dashboards; data used mainly for reporting; decisions preceding analysis; lack of formal analytical units; weak feedback between analysts and decision-makers	14	"Many reports were prepared because they were required administratively, but preparing a report did not necessarily mean that the information would influence the decision." (P17)

Table 2 indicates that technological deficiencies and institutional fragmentation operated as mutually reinforcing barriers. Sixteen participants identified deficiencies in data quality and standardization, making this the most frequently reported technological problem. Participants described missing information, duplication of records, inconsistent definitions, delayed updates, and discrepancies among figures produced by different institutions. Such inconsistencies were especially problematic during COVID-19 because even relatively small delays or definitional differences could affect estimates of infection levels, hospital demand, resource requirements, and the geographical distribution of public-health interventions. Fifteen participants described fragmented digital infrastructure, while 14 emphasized the continued dependence on paper-based processes and the absence of interoperability among databases. The findings suggest that digitization had occurred unevenly and often at the level of individual departments rather than through a coordinated provincial information architecture. Consequently, the

presence of computers or electronic records did not automatically translate into integrated digital governance. Participants frequently described hybrid systems in which information originated in paper form, was manually entered into local databases, summarized in spreadsheets, and subsequently transmitted through administrative channels. Each additional stage increased the likelihood of delay, transcription error, duplication, or loss of contextual detail. Institutional weaknesses compounded these technical problems. Seventeen participants identified inadequate interagency coordination, 16 described bureaucratic delays, and 15 referred to organizational data silos. Interviewees explained that information exchange often depended on formal correspondence, personal relationships, or temporary crisis committees rather than institutionalized protocols. In several accounts, even when a department possessed relevant information, other agencies could not automatically access it and had to request it through hierarchical administrative procedures. This problem was intensified by uncertainty regarding data ownership and responsibility.

Twelve participants reported that overlapping mandates sometimes made it difficult to determine which organization was responsible for validating, updating, or authorizing the use of a particular dataset. Fourteen participants further argued that evidence-based policymaking remained weakly institutionalized. Data were often collected to satisfy administrative reporting requirements rather than explicitly designed to support analytical decision-making. Participants distinguished between “having information” and “using information,” emphasizing that numerous reports were

produced without systematic mechanisms for transforming them into predictive analysis, comparative indicators, operational dashboards, or policy recommendations. The COVID-19 crisis therefore exposed a gap between data production and decision utilization: government bodies generated considerable administrative information, but fragmented systems, bureaucratic processes, inconsistent standards, and limited analytical integration prevented this information from functioning as a coherent policy resource.

Table 3

Human-resource, analytical, legal, and ethical barriers to data-driven governance

Main Theme	Subtheme	Representative Codes Identified in Interviews	Participants Mentioning the Subtheme	Illustrative Participant Evidence
Human-resource and analytical-capacity limitations	Shortage of specialized data professionals	Few data analysts; shortage of statisticians; insufficient database specialists; limited data-science expertise; reliance on general administrative staff	15	“We had employees who could enter information, but there were very few people who could analyze large datasets and explain what the results meant for policy.” (P8)
Human-resource and analytical-capacity limitations	Limited analytical competencies	Basic descriptive reporting; weak predictive analysis; limited visualization skills; insufficient statistical interpretation; limited use of geospatial analysis	14	“Most analysis stopped at totals and percentages. More advanced analysis that could forecast needs or compare areas was much less common.” (P15)
Human-resource and analytical-capacity limitations	Insufficient training and professional development	Limited specialized courses; absence of continuous training; lack of crisis-data training; inadequate technical updating	13	“Technology changes quickly, but training was not continuous. Many employees learned the system through practice rather than through structured professional training.” (P12)
Human-resource and analytical-capacity limitations	Weak integration of analysts into decision-making	Separation between technical staff and senior managers; limited analyst participation in policy meetings; evidence communicated too late; managerial misunderstanding of analytical outputs	12	“Technical staff might prepare an analysis, but they were not always present when the important decision was discussed.” (P5)
Legal and ethical data-governance challenges	Unclear legal framework for data sharing	Uncertain sharing authority; differing interpretation of regulations; lack of explicit protocols; fear of unauthorized disclosure	12	“Sometimes an office refused to provide information not because it wanted to hide it, but because officials were unsure whether they were legally allowed to share it.” (P14)
Legal and ethical data-governance challenges	Privacy and confidentiality concerns	Personal health information; patient confidentiality; unauthorized access; disclosure of identifiable data; fear of misuse	13	“Health data are sensitive. During an emergency there is pressure to share quickly, but there was uncertainty about how much detail could safely be shared.” (P1)
Legal and ethical data-governance challenges	Weak cybersecurity and accountability mechanisms	Limited security protocols; password-sharing practices; inadequate access control; fear of hacking; weak audit mechanisms	10	“If institutions do not fully trust the security of the system, they become more cautious about putting sensitive information into it or sharing access.” (P16)
Legal and ethical data-governance challenges	Uncertainty over data access, authorization, and responsibility	Multiple approval levels; unclear user permissions; unclear accountability for errors; hesitation in granting access	11	“There was no single clear rule explaining who should have access to which information during a crisis and who would be responsible if something went wrong.” (P18)

As presented in Table 3, the capacity to establish data-driven governance was constrained not only by technological infrastructure but also by limitations in

professional expertise and uncertainty surrounding the legal and ethical governance of information. Fifteen participants described a shortage of specialized personnel capable of

conducting advanced data analysis, while 14 reported that analytical activity within governmental institutions frequently remained limited to descriptive summaries, basic statistics, and routine administrative reporting. Participants repeatedly differentiated between data-entry capacity and analytical capacity. Government organizations often had employees capable of entering or compiling figures, but considerably fewer personnel possessed the competencies needed to clean complex datasets, integrate information from multiple sources, conduct statistical or predictive analysis, produce meaningful visualizations, identify emerging trends, or translate analytical findings into policy alternatives. Thirteen participants regarded the lack of continuous professional training as an important contributor to this problem. They noted that employees commonly learned new information systems informally, while structured training in data analytics, digital governance, geographic information systems, visualization, cybersecurity, and crisis-oriented information management remained limited. Twelve participants further emphasized an organizational separation between technical specialists and senior decision-makers. Analytical personnel were not always incorporated into policy meetings, and technical outputs could be communicated after key decisions had already been made. This weakened the policy value of available expertise and reinforced a model in which analysts served primarily as information providers rather than active participants in evidence-based decision processes. Legal and

ethical uncertainty further reduced willingness to share data. Thirteen participants raised concerns regarding the confidentiality of health-related and personally identifiable information, and 12 described uncertainty about the legal basis for exchanging data between institutions. Participants did not generally reject the importance of privacy protection; rather, they emphasized the absence of sufficiently clear operational rules defining which data could be exchanged, under what circumstances, at what level of aggregation, through which technical channels, and with what safeguards. Eleven participants reported uncertainty regarding authorization and accountability, while 10 specifically discussed cybersecurity concerns. These findings reveal a governance dilemma in which institutions were simultaneously expected to exchange information rapidly during a public-health emergency and to protect sensitive information without always having sufficiently standardized security, authorization, and accountability frameworks. As a result, some officials adopted highly cautious practices, delaying or restricting information exchange to avoid potential administrative or legal consequences. The combined effect of limited analytical capacity and regulatory uncertainty was therefore substantial: even when data existed and could technically be transmitted, government institutions did not always possess either the human expertise required to extract policy value from the data or the governance rules needed to exchange and utilize those data confidently.

Table 4

Socio-cultural and political-administrative barriers and their manifestations during COVID-19 crisis management

Barrier / Crisis Dimension	Subtheme	Representative Codes and Manifestations	Participants Mentioning the Subtheme	Illustrative Participant Evidence
Socio-cultural and political-administrative barriers	Resistance to digital transformation	Preference for established routines; discomfort with new systems; resistance among some senior personnel; perception of digital systems as additional workload	13	"Some employees trusted the procedures they had used for many years and considered the new electronic requirements to be additional work rather than a replacement for old procedures." (P3)
Socio-cultural and political-administrative barriers	Preference for authority- and experience-based decision-making	Reliance on managerial judgment; limited demand for analytical evidence; decisions based on precedent; evidence used after rather than before decisions	14	"Experience of senior officials was very important, but sometimes the decision came first and the data were requested afterward to support or explain it." (P7)
Socio-cultural and political-administrative barriers	Low interorganizational trust	Doubt about accuracy of other institutions' data; reluctance to rely on external databases; repeated verification; institutional competition	12	"One organization might receive figures from another but still repeat the collection because it did not completely trust how those figures were produced." (P11)

Socio-cultural and political-administrative barriers	Public distrust, misinformation, and incomplete reporting	Fear of stigma; reluctance to disclose illness; rumors; misinformation through social media; inconsistent public compliance	13	"At some stages, the official data did not necessarily represent the full situation because some people avoided testing or did not report their condition." (P6)
Socio-cultural and political-administrative barriers	Political and administrative influence over information flows	Sensitivity around negative indicators; preference for favorable reporting; hierarchical control of information; pressure concerning publication of figures	10	"Some information was considered sensitive because figures could be interpreted as evidence of weak performance, so officials were sometimes cautious about releasing them." (P14)
COVID-19 crisis manifestation	Delayed situational awareness	Lag between field developments and official reports; slow aggregation of local data; delayed recognition of emerging hotspots	15	"By the time information moved through all administrative levels, the situation on the ground could already have changed." (P9)
COVID-19 crisis manifestation	Difficulty forecasting healthcare demand	Limited predictive models; uncertain case trajectories; weak linkage between infection data and hospital planning	13	"We could count current cases, but predicting how many beds, oxygen units, or staff would be needed in the coming weeks was more difficult." (P15)
COVID-19 crisis manifestation	Inefficient resource allocation	Difficulty matching resources with geographic need; delayed supply decisions; incomplete information regarding equipment and staffing	14	"Sometimes the question was not whether resources existed but whether decision-makers had an accurate picture of where the greatest need was at that moment." (P2)
COVID-19 crisis manifestation	Inconsistent public-health indicators	Differences in case counts; inconsistent reporting periods; changes in definitions; incomplete community-level data	14	"When institutions used different reporting periods or definitions, comparing the numbers directly could be misleading." (P10)
COVID-19 crisis manifestation	Reactive rather than anticipatory crisis management	Decisions after escalation; limited early-warning capacity; weak scenario modeling; reliance on emergency responses rather than predictive planning	16	"The system was better at reporting what had already happened than predicting what might happen next." (P18)

Table 4 demonstrates that the transition toward data-driven governance was also influenced by organizational culture, trust, political-administrative practices, and public behavior, and that these factors had direct consequences during COVID-19 crisis management. Fourteen participants reported a persistent preference for experience-, authority-, or precedent-based decision-making, suggesting that the organizational problem extended beyond limited access to data. Participants acknowledged the value of professional experience, particularly during emergencies, but expressed concern that analytical evidence was not always systematically integrated into the formulation of decisions. In some cases, data were perceived as a reporting or justification instrument rather than as an input used before choosing among alternative policy actions. Thirteen participants identified resistance to digital transformation, explaining that some personnel viewed digital procedures as additional administrative obligations layered onto existing practices rather than as a replacement for inefficient manual systems. This resulted in parallel paper and electronic processes and weakened the efficiency gains expected from digitalization. Twelve participants described low trust between organizations, leading to repeated verification and

duplicate data collection. Such duplication not only consumed administrative resources but also contributed to inconsistent datasets because separate institutions sometimes measured the same phenomenon using different procedures. Public-level factors further complicated the reliability of crisis information. Thirteen participants explained that misinformation, fear, reluctance to report illness, inconsistent testing behavior, and public distrust could reduce the completeness of official health data. Consequently, even a technically well-functioning government information system could not produce fully reliable situational intelligence if the underlying community-level data were incomplete. Ten participants additionally referred to political or administrative sensitivities surrounding the publication of unfavorable indicators. These accounts did not necessarily imply systematic manipulation of data; rather, they revealed that information could acquire political significance when indicators were interpreted as measures of institutional performance, creating incentives for caution, delayed disclosure, or selective circulation. The consequences of these combined barriers became particularly evident during COVID-19. Sixteen participants characterized crisis

management as more reactive than anticipatory because existing systems were better at documenting past developments than generating early warnings or forecasts. Fifteen reported delayed situational awareness, while 14 identified difficulties in resource allocation and inconsistencies in public-health indicators. Thirteen participants specifically described limitations in forecasting hospital demand, including future requirements for beds, medical staff, oxygen, medication, and equipment. These findings suggest that the fundamental weakness was not simply a shortage of data. Rather, Salah al-Din Province faced difficulties in transforming fragmented and sometimes delayed information into integrated, trusted, forward-looking intelligence capable of supporting anticipatory crisis management. The pandemic therefore functioned as a stress test for the province's information-governance system and revealed that effective data-driven policymaking requires simultaneous development of technological infrastructure, institutional coordination, professional competencies, regulatory safeguards, organizational trust, public confidence, and a decision-making culture in which analytical evidence is routinely incorporated before, rather than after, major policy choices.

Taken together, the findings show that the barriers to data-driven governance in Salah al-Din Province formed an interdependent system. Technological fragmentation reduced the accessibility and comparability of information; institutional fragmentation restricted data exchange; insufficient analytical expertise limited the transformation of raw information into actionable knowledge; legal and ethical uncertainty reduced institutional willingness to share sensitive data; and socio-cultural, political, and administrative factors influenced whether available evidence was trusted and used. The experience of COVID-19 demonstrated the cumulative effect of these barriers. When the crisis created an urgent demand for rapidly updated, geographically disaggregated, interoperable, and analytically meaningful data, existing governance arrangements were unable to consistently produce a unified evidence base for decision-makers. The results therefore indicate that improving data-driven governance in Iraq cannot be achieved solely through investment in software, databases, or digital infrastructure. Technological modernization must be accompanied by institutional

mechanisms for interagency coordination, standardized data definitions and protocols, development of specialized analytical capacity, clear rules governing privacy and data access, stronger cybersecurity arrangements, greater integration of analysts into policymaking structures, and organizational reforms that normalize the systematic use of evidence in public decision-making. Within the context of Salah al-Din Province, the COVID-19 pandemic revealed both the necessity of such reforms and the risks associated with maintaining fragmented information systems in periods of complex and rapidly evolving public crises.

4. Discussion and Conclusion

The findings of this study showed that barriers to data-driven governance in Salah al-Din Province were multidimensional, interconnected, and deeply embedded in the technological, institutional, administrative, human-resource, legal, ethical, and socio-cultural characteristics of the public sector. Five major categories of barriers emerged from the interviews: technological and data-infrastructure limitations, institutional and organizational fragmentation, human-resource and analytical-capacity limitations, legal and ethical data-governance challenges, and socio-cultural and political-administrative barriers. The COVID-19 pandemic amplified the consequences of these weaknesses because crisis management required rapid access to accurate, integrated, and continuously updated information. Participants emphasized that the major challenge was not simply the absence of data, but the inability of governmental institutions to transform fragmented and unevenly collected information into timely, reliable, and actionable evidence for policy decisions. This finding is consistent with the broader literature on data-driven policymaking, which emphasizes that the mere availability of large amounts of data does not guarantee improved policy quality. Instead, data must be supported by adequate organizational capacity, governance mechanisms, technical infrastructure, analytical expertise, and decision-making processes capable of converting information into policy action (6, 7, 10).

One of the most prominent findings concerned fragmented technological infrastructure and the lack of interoperability among governmental information systems. Participants reported that many institutions relied on separate databases, incompatible platforms, paper-based

reporting procedures, and manually transmitted information. These conditions created duplication, inconsistencies, delayed data aggregation, and difficulties in obtaining a unified picture of crisis conditions. Such findings are consistent with research emphasizing that public-sector big data initiatives frequently encounter substantial technological and organizational readiness problems. Klievink et al. showed that big data adoption in the public sector is constrained by uncertainty regarding infrastructure, organizational preparedness, data access, and integration across institutional boundaries (8). Similarly, digital transformation in government is not limited to converting paper procedures into electronic formats; rather, it requires deeper organizational changes, integration of digital processes, redesign of workflows, and development of interoperable systems (1). The findings of the present study reinforce this distinction. In Salah al-Din Province, partial digitization often coexisted with manual procedures, meaning that electronic systems did not necessarily eliminate older bureaucratic practices. This hybrid environment increased administrative workload while limiting the speed and reliability of information exchange.

The poor quality and insufficient standardization of data constituted another major barrier. Participants described missing values, duplicated records, delayed updating, incompatible definitions, and contradictory figures reported by different institutions. These deficiencies directly reduced confidence in available information and sometimes required repeated verification before data could be used in policymaking. This result aligns with Janssen et al., who emphasized that the quality of data-driven decision-making depends heavily on data quality, analytical processes, and organizational conditions surrounding information use (10). Data-driven governance therefore cannot be reduced to the accumulation of large datasets. If source data are incomplete, delayed, or inconsistently defined, even sophisticated analytical systems may generate unreliable conclusions. The growing importance of predictive analytics further increases the significance of this issue because forecasting models depend on the consistency, completeness, and comparability of historical and real-time information (5). In the context of COVID-19, data-quality problems were especially consequential because policymakers needed accurate information on infection patterns, hospital capacity, resource

shortages, and geographic variations in disease prevalence. The results suggest that improving analytical technologies without first strengthening data standards and validation procedures would provide only limited benefits.

Institutional and organizational fragmentation emerged as the most pervasive category of barriers and was reported by all participants. Weak coordination among governmental bodies, organizational data silos, ambiguous responsibility for data ownership, bureaucratic authorization procedures, and limited institutionalization of evidence-based policymaking all restricted the flow of information. This finding is closely aligned with Peters' analysis of policy coordination, which highlights the difficulty of aligning agencies with different mandates, priorities, professional cultures, and organizational interests (9). Data-driven governance depends on cross-organizational information exchange, but public institutions often operate within vertically structured administrative systems in which information is controlled within departmental boundaries. In Salah al-Din Province, participants frequently noted that information exchange depended on formal correspondence or personal relationships rather than standardized interagency protocols. This reduced the timeliness of data circulation and created uncertainty regarding which institution was responsible for validating or authorizing information. The findings also correspond with Nanni and Napolitano's argument that shared data environments require forms of collective rationality and institutional arrangements capable of balancing organizational autonomy with coordinated information use (13). Without such governance arrangements, technological integration alone is unlikely to produce effective data sharing.

The results also demonstrated that the availability of data did not necessarily result in its meaningful use in policymaking. Participants repeatedly distinguished between data collected for administrative reporting and data used for analytical decision support. In several institutions, reports were produced routinely, yet mechanisms for transforming them into forecasts, policy scenarios, interactive dashboards, or strategic recommendations were limited. This finding supports Giest's argument that the policy value of big data depends on whether governments possess the institutional capacity to incorporate analytical evidence into policy processes rather than merely

accumulate information (7). It also relates to the broader literature on smart and digital governance, which stresses that technological systems must be embedded within institutional arrangements that connect information production to governmental action (14). The results of the current study therefore indicate that a major challenge in Salah al-Din was not simply data scarcity but a weak analytical-policy interface. Data frequently remained within administrative and technical units rather than becoming an active component of strategic decision-making.

Human-resource and analytical-capacity limitations constituted another important finding. Participants reported shortages of data analysts, statisticians, database specialists, and personnel capable of conducting advanced statistical, predictive, or geospatial analysis. In many cases, employees could enter, compile, and summarize data, but fewer possessed the capacity to interpret complex datasets or translate analytical outputs into policy recommendations. This finding is consistent with the concept of big data analytics capability proposed by Gupta and George, who argue that organizations need not only technological resources but also human skills, managerial capability, organizational learning, and data-oriented cultures to derive value from large-scale information (6). The results also indicate that training was often episodic rather than continuous, which is particularly problematic in rapidly changing digital environments. The increasing use of artificial intelligence and advanced analytics in public administration will make such professional competencies even more important. Contemporary models of AI-enabled governance emphasize that public-sector transformation requires new forms of administrative expertise capable of working with intelligent systems while retaining human judgment and accountability (2).

Another important result concerned the weak integration of technical experts into decision-making structures. Participants noted that analysts and information technology personnel were not always involved in meetings where major policy decisions were made, thereby reducing the practical value of their expertise. This institutional separation between technical knowledge and administrative authority may help explain why evidence was sometimes produced after decisions had already been formulated. Such a pattern is particularly problematic in crisis governance,

where the usefulness of data depends on whether analytical insights reach decision-makers quickly enough to shape action. The COVID-19 pandemic demonstrated that effective crisis response requires the simultaneous mobilization of analytical, operational, managerial, and political capacities (17). Where these capacities remain institutionally separated, the government may possess information without being able to mobilize it effectively. The results therefore support the view that strengthening data-driven governance requires organizational reforms that bring analysts, policy specialists, managers, and operational officials into closer interaction.

Legal and ethical challenges also constrained data sharing and utilization. Participants expressed uncertainty regarding who was legally authorized to access or exchange data, particularly sensitive health information. Privacy concerns, cybersecurity risks, unclear accountability, and ambiguous rules regarding information ownership encouraged cautious behavior and sometimes delayed interagency exchange. These findings are increasingly significant as governments move toward AI-assisted and algorithmic policymaking. Responsible public-sector AI adoption requires careful attention to data access, quality, privacy, security, transparency, accountability, and fairness (12). Similarly, the strategic use of AI in government must be evaluated in relation to broader public values rather than efficiency alone (3). The findings from Salah al-Din suggest that legal uncertainty can itself become a barrier to data utilization. When officials do not clearly understand the limits of lawful data exchange, they may avoid sharing information even when such exchange would substantially improve crisis management. Effective governance therefore requires explicit protocols defining access rights, data classification, confidentiality, security procedures, and institutional responsibility.

Public trust and perceptions of fairness are also relevant to the ethical dimension of data-driven governance. Participants indicated that distrust, concerns about the misuse of sensitive information, and uncertainty regarding the reliability of official systems could affect both institutional and public willingness to engage with digital data systems. These concerns are consistent with evidence showing that citizens' perceptions of algorithmic government decisions depend partly on transparency,

fairness, and the comprehensibility of explanations provided by public authorities (11). Although the current study focused primarily on administrative actors, its findings imply that future expansion of data-intensive governance in Iraq will require attention to citizen trust as well as institutional capability. Data-driven governance that is technically efficient but perceived as opaque or insecure may encounter resistance and reduced legitimacy.

Socio-cultural and political-administrative barriers further shaped the use of evidence. Participants described resistance to digital transformation, continued preference for familiar manual processes, reliance on managerial experience, weak interorganizational trust, and the political sensitivity of unfavorable indicators. These findings suggest that the transition toward data-driven governance represents a cultural and institutional transformation rather than a purely technological reform. The persistence of authority-based decision-making may reduce demand for analytical evidence, while organizational resistance can lead employees to maintain parallel manual and electronic systems. Such results are consistent with digital-transformation research emphasizing that meaningful change involves organizational practices, professional identities, managerial routines, and institutional culture, not merely the adoption of digital technologies (1). They also fit with complexity-oriented perspectives on governance, which emphasize that policymaking occurs through interactions among multiple actors, organizational rules, political interests, and institutional relationships rather than through a simple linear process of evidence transmission (4).

The COVID-19 crisis provided the clearest illustration of the consequences of these barriers. Participants reported delayed situational awareness, difficulty forecasting hospital demand, inefficient allocation of resources, inconsistencies in public-health indicators, and a predominantly reactive rather than anticipatory style of crisis management. This finding is consistent with international evidence showing that effective pandemic management depends heavily on rapid data integration and proactive analysis. Taiwan's early COVID-19 response demonstrated how linked databases, new technologies, and proactive testing could support rapid risk identification and targeted interventions (16). Likewise, big data and artificial intelligence have demonstrated substantial potential for epidemic surveillance, forecasting,

resource optimization, early-warning systems, and identification of vulnerable populations (18). The contrast with the findings of the present study suggests that the primary limitation in Salah al-Din was not the theoretical absence of useful technologies but insufficient institutional readiness to employ them effectively.

The findings further support the argument that crises expose underlying governance capacities rather than creating all administrative weaknesses from the outset. COVID-19 required governments to coordinate across organizational boundaries, operate under severe uncertainty, and revise policies continuously as new information emerged. Ansell et al. characterize the pandemic as a major challenge to traditional public administration precisely because it required flexibility, collaboration, adaptive leadership, and rapid knowledge integration (15). In Salah al-Din Province, pre-existing problems involving fragmented data systems, bureaucratic procedures, weak coordination, and limited analytical expertise became more consequential under emergency conditions. The pandemic therefore functioned as an institutional stress test that revealed the extent to which existing public-sector arrangements were capable of supporting real-time evidence-based governance.

More broadly, the results indicate that strengthening data-driven governance in Iraq requires an integrated reform strategy. The literature increasingly demonstrates that advanced analytics, AI, and public data spaces can generate substantial benefits, but only where organizational, legal, technical, and ethical conditions are sufficiently developed (2, 12, 13). The results of this study similarly show that technological investment alone would be insufficient. New databases or analytical software would remain underutilized if institutions continued to operate through fragmented mandates, incompatible standards, weak coordination, insufficient expertise, unclear legal responsibilities, and decision cultures that do not systematically demand evidence. Data-driven governance must therefore be understood as a whole-of-government capability involving technological infrastructure, institutional coordination, standardized data governance, professional analytical capacity, legal safeguards, and administrative cultures that value evidence before decisions are made.

The study has several limitations that should be considered when interpreting the findings. First, the research was conducted exclusively in Salah al-Din Province, and the institutional, infrastructural, and administrative characteristics of this province may differ from those of Baghdad, the Kurdistan Region, or other Iraqi provinces. Accordingly, the findings should not be interpreted as statistically representative of the entire Iraqi public sector. Second, the study used a qualitative design and relied on participants' professional experiences and perceptions, meaning that the results reflect interpreted accounts rather than direct quantitative measurement of information-system performance, data accuracy, or policymaking outcomes. Third, although participants were selected from diverse administrative, healthcare, technical, and academic backgrounds, some relevant stakeholder groups may have been underrepresented. Fourth, the study focused on the COVID-19 crisis, which represented an exceptional emergency context; therefore, some barriers may have become more visible or more severe than they would be under routine administrative conditions. Finally, because issues such as organizational weakness, political influence, and data-sharing practices may be institutionally sensitive, some participants may have exercised caution when describing their experiences despite the measures used to protect confidentiality.

Future research should extend the investigation across multiple Iraqi provinces and administrative levels in order to compare regional differences in digital readiness, institutional coordination, data quality, and analytical capacity. Comparative studies between federal institutions, provincial governments, and the Kurdistan Region could provide a more differentiated understanding of Iraq's data-governance landscape. Mixed-method research could combine qualitative interviews with quantitative assessments of digital infrastructure, interoperability, data quality, employee competencies, and organizational readiness. Future studies should also examine the perspectives of citizens, frontline healthcare personnel, civil-society organizations, and private technology providers to complement the institutional perspective emphasized in the present research. Longitudinal studies would be especially useful for evaluating whether investments in digital government produce sustained changes in

administrative practices and policy outcomes over time. Additional research could investigate particular technologies such as AI-assisted decision systems, public-sector dashboards, geospatial information systems, predictive analytics, and integrated health-information platforms. Research should also examine public trust, data privacy expectations, cybersecurity preparedness, and the institutional conditions required for responsible use of AI in Iraqi public administration.

From a practical perspective, Iraqi governmental authorities should approach data-driven governance as an integrated administrative reform rather than as a narrowly technological initiative. Priority should be given to establishing interoperable information systems and common data standards across provincial and national institutions, reducing dependence on paper-based reporting, and developing secure mechanisms for real-time information exchange. Clear institutional responsibilities should be assigned for data ownership, validation, updating, access, and cybersecurity. Government organizations should establish specialized data-analysis units staffed by trained statisticians, information specialists, data analysts, and policy professionals, while ensuring that these specialists participate directly in decision-making processes. Continuous professional development should be provided in data management, statistical analysis, predictive modeling, visualization, cybersecurity, and evidence-based policymaking. Formal protocols for interagency data sharing should replace dependence on personal relationships and lengthy administrative correspondence, particularly during emergencies. Legal frameworks should clearly define privacy protections, authorization procedures, accountability standards, and permissible uses of sensitive information. Finally, senior managers should promote an administrative culture in which data are not collected merely for reporting purposes but are routinely analyzed before major policy decisions, thereby strengthening anticipatory governance, institutional learning, and the capacity of public institutions to respond effectively to future crises.

Authors' Contributions

All authors contributed substantially to the study and to manuscript development, and all approved the final version.

Declaration

The authors declare that artificial intelligence tools were used only to assist with language editing, translation, and improvement of the manuscript's readability. All conceptualization, study design, data collection, data analysis, interpretation of findings, and final approval of the manuscript were performed by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the content.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

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Ethics Considerations

The study placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki.

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