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APPLICATION OF STATISTICAL ANALYSIS IN INFORMATION SYSTEMS TO SUPPORT DATA-DRIVEN DECISION MAKING: A LITERATURE STUDY

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Abstract

Although information systems are increasingly used to support organizational decision processes, understanding of how statistical analysis is applied within these systems and how it contributes to decision quality remains limited. This study aims to examine the application of statistical analysis in information systems to support data-driven decision making. Using a literature review approach, this study analyzes relevant scientific articles on statistical analysis, information systems, business intelligence, decision support systems, and data-driven decision making. The findings indicate that statistical analysis plays a central role in transforming data into meaningful information through descriptive analysis, correlation, regression, prediction, classification, and data visualization. Its integration into information systems enables organizations to understand actual conditions, identify patterns, estimate trends, and formulate more objective decision recommendations. This study concludes that the integration of statistical analysis in information systems can improve evidence-based, measurable, and organizationally relevant decision making. The study contributes to the literature by clarifying the analytical role of statistical methods in information systems and provides practical implications for

organizations seeking to strengthen decision quality through data-driven approaches.

Keywords: Statistical Analysis; Information Systems; Data-Driven Decision Making; Decision Support Systems; Business Intelligence

INTRODUCTION

The advancement of information technology has encouraged organizations to manage data as a strategic asset in operational processes and decision making. Information systems no longer function merely as transaction recording media, but also as tools for collecting, processing, storing, analyzing, and presenting information relevant to management. In this context, data generated by information systems needs to be processed using analytical approaches to provide added value to the organization. One approach that plays an important role is statistical analysis, as it can help organizations understand data patterns, measure relationships between variables, evaluate trends, and support evidence-based decision making(Snyder, 2019).

Data-driven decision making has become increasingly important as organizations face dynamic, complex, and competitive environments. Decisions based solely on intuition risk inaccuracy in planning, evaluation, and control. Conversely, the use of data through statistical methods can help decision makers obtain more objective, measurable, and accountable information. Szukits and Móricz explain that management support for business analytics and data quality plays a role in fostering a culture of analytical decision making within organizations(Page, 2021). This indicates that the success of data-driven decision making depends not only on the availability of technology, but also on the organization's ability to properly process and interpret data.

In the field of information systems, statistical analysis is widely used in various contexts, such as business intelligence, decision support systems, big data analytics, system performance evaluation, user behavior prediction, customer satisfaction analysis, and measurement of digital service effectiveness. Chatterjee et al. demonstrate that the application of big data analytics affects decision-making processes, forecasting, and company performanc(Kitchenham et al., 2019). These findings reinforce the view that data analysis can improve decision quality when supported by reliable data and appropriate analytical

methods. Additionally, Mekimah et al. explain that business intelligence plays an important role in supporting organizational decision making through data analytics utilization, although research gaps remain in the integration of business intelligence with decision-making processes, data mining, and other management fields (Watson & Webster, 2021).

Although statistical analysis has been widely applied in information systems, studies that specifically map its forms of application, the statistical methods used, and its contribution to data-driven decision making still need further examination. Existing literature tends to discuss data analytics, business intelligence, or big data analytics separately, and thus has not fully provided a comprehensive picture of the role of statistical analysis in information systems. Furthermore, technological developments such as machine learning, artificial intelligence, and real-time analytics have broadened the role of statistical analysis both as the foundation of modeling, validation of results, and interpretation of decisions. This situation creates the need for a systematic literature review to identify patterns, trends, opportunities, and research gaps on this topic.

Based on this problem, this study uses a literature review approach to examine the application of statistical analysis in information systems in order to support data-driven decision making. The literature review approach was chosen because it is capable of summarizing previous research results, comparing findings from various sources, and identifying open research spaces(Snyder, 2018). With this approach, this article is not merely descriptive but also aims to synthesize the relationship between statistical analysis, information systems, and data-driven decision making.

The novelty of this research lies in the effort to integrate three main focuses statistical analysis, information systems, and data-driven decision making within a single literature review. This study is expected to provide a conceptual contribution by mapping frequently used statistical methods in information systems, their areas of application, and their benefits in supporting organizational decisions. Furthermore, this study can serve as a foundation for future researchers to develop more adaptive decision support models, frameworks, or systems for data-driven organizational needs.

The objective of this study is to analyze the application of statistical analysis in information systems as an effort to support data-driven decision making through a literature review. The study aims to identify frequently used statistical methods, their forms of application in information systems, and their contribution to improving organizational

decision quality. In addition, this study aims to provide a conceptual overview of the relationship between statistical analysis, information systems, and data-driven decision making, so that it can serve as a reference for future research in the development of more effective, objective, and evidence-based information systems.

METHODS

This study uses a qualitative research design with a Systematic Literature Review (SLR) approach to examine the application of statistical analysis in information systems in order to support data-driven decision making. The SLR approach was chosen because it is capable of identifying, evaluating, and synthesizing previous research results in a structured manner, thereby producing a more comprehensive understanding of a research topic [8]. The data used in this study are secondary data in the form of journal articles, proceedings, and electronic books relevant to the themes of statistical analysis, information systems, data-driven decision making, business intelligence, and decision support systems. Literature sources were obtained through scientific databases such as Google Scholar, ScienceDirect, SpringerLink, IEEE Xplore, Emerald, and DOAJ, considering article accessibility, topical relevance, and publication quality.

The research procedure was carried out through several stages: concept design, literature collection, article selection, data extraction, content analysis, finding synthesis, and preparation of review results. These stages adhere to PRISMA reporting principles, which emphasize transparency in the identification, screening, eligibility, and inclusion of articles(Kitchenham et al., 2020). In brief, the research algorithm is: formulate research questions, determine keywords, search for articles in scientific databases, filter articles based on titles and abstracts, read article content in full, assess article eligibility, extract important information, categorize findings based on statistical methods and their application in information systems, and then prepare the synthesis results. The keywords used include: statistical analysis, information systems, data-driven decision making, business intelligence, decision support system, and systematic literature review. Selected articles are those relevant to the topic, fully available, with clear sources, and discussing the relationship between data analysis, information systems, and decision making.

The evaluation method in this study was carried out through a quality assessment of the literature based on inclusion and exclusion criteria. Inclusion criteria include articles

discussing statistical analysis, information systems, data-driven decision making, or the application of analytics in organizations. Exclusion criteria include articles irrelevant to the topic, unavailable in full text, without clear bibliographic information, or discussing only statistics without connection to information systems. Literature that passed the selection was then analyzed using a descriptive-qualitative analysis technique by categorizing findings based on the type of statistical method, area of application, contribution to decision making, and research gaps. The final result of this method is a literature synthesis explaining how statistical analysis is applied in information systems and how its application can improve the quality of data-driven decisions.(Watson & Webster, 2019)

RESULTS

Literature Identification Results

Based on the literature review results, statistical analysis plays an important role in information systems because it is capable of transforming operational data into information that can be used in the decision-making process. In the context of modern information systems, data collected through transaction applications, management systems, dashboards, business intelligence, and decision support systems is not merely archived but also analyzed to discover patterns, trends, relationships between variables, and possible future outcomes. The integration of analytics in enterprise information systems has been proven to support strategic decision making, as systems not only provide reports but also help organizations understand business conditions more objectively (Neri et al., 2021). This indicates that statistical analysis is an important component of information systems because it provides a quantitative basis for organizational decisions.

The literature review results show that the statistical methods frequently used in information systems can be grouped into four main categories: descriptive analysis, diagnostic analysis, predictive analysis, and prescriptive analysis. Descriptive analysis is used to describe data conditions through measures such as averages, percentages, frequencies, and trends. Diagnostic analysis is used to understand the causes of a condition through relationships between variables. Predictive analysis is used to estimate future events based on historical data, while prescriptive analysis is used to provide the best decision recommendations based on analysis results(Kraus et al., 2023) .In information systems, these

four categories can be applied progressively, from simple report presentation to the development of more intelligent decision support systems.

Table 1 presents the results of the literature synthesis on the application of statistical analysis in information systems to support data-driven decision making.

Table 1. Synthesis Results of the Application of Statistical Analysis in Information Systems

No.	Form of Statistical Analysis	Application in Information Systems	Contribution to Decision-Making
1	Descriptive Analysis	Transaction reports, dashboards, data recapitulation, data visualization	Helps organizations understand actual conditions based on data
2	Correlation and Regression Analysis	Evaluation of relationships between variables in the system, e.g., service quality and user satisfaction	Helps determine the factors influencing a decision
3	Predictive Analysis	Sales forecasting, risk assessment, customer needs prediction, and organizational performance	Helps organizations formulate strategies based on future possibilities
4	Classification and Segmentation Analysis	Grouping of customers, users, products, or services	Helps determine decision priorities and policy targets
5	Prescriptive Analysis	Recommendation systems, decision optimization, and decision support systems	Provides the most appropriate decision alternatives based on data conditions
6	Data Visualization	Charts, diagrams, dashboards, and interactive reports	Enables users to understand analysis results quickly and communicatively

Based on Table 1, it can be explained that statistical analysis does not stand alone but is an integral part of the data processing process in information systems. Data that is initially raw is processed through stages of collection, cleaning, grouping, analysis, interpretation, and presentation of information. At this stage, the information system serves as the medium providing data, while statistical analysis serves as the method for generating knowledge from that data. Chen et al. explain that business intelligence and analytics has developed as an important field because organizations need the capability to manage large-scale data and transform it into information that impacts business decisions (Surbakti et al., 2021). Thus, information systems equipped with analytical capabilities can improve decision quality, since decisions are based not only on intuition but also on quantitative evidence.

Analysis of the Application of Statistics in Information Systems

The application of statistical analysis in information systems can be seen from the increasing use of business analytics, big data analytics, data visualization, and decision support systems. Information systems that previously focused on transaction recording have now evolved into systems capable of providing analytical information to management. In information systems research, predictive analysis is considered important because it can help researchers and practitioners understand data patterns and estimate possible outcomes [16]. For example, in academic information systems, statistical analysis can be used to predict student graduation, evaluate user satisfaction, or analyze the effectiveness of digital services. In business information systems, statistical analysis can be used to predict market demand, segment customers, and evaluate sales performance.

This flow shows that data must go through an analysis process before it can be used as a basis for decisions. Data that has not been analyzed does not necessarily have meaning for decision makers. Therefore, information systems need statistical methods to transform data into valid, relevant, and understandable information. In the context of business analytics, data is used to support strategic, tactical, and operational organizational decisions(Chen et al., 2018). The better the data quality and analytical methods used, the greater the organization's opportunity to make sound decisions. Conceptually, the contribution of statistical analysis in information systems can be formulated through the following simple equation:

$$\mathbf{DQI = f(DQ, AM, IV, DR)} \qquad \mathbf{(1)}$$

Description: DQI is the decision quality index, DQ is data quality, AM is the analytical method, IV is information visualization, and DR is decision relevance. Equation (1) shows that decision quality in information systems is influenced by data quality, the appropriateness of the analytical method, the clarity of information presentation, and the relevance of the analysis results to organizational needs. If the data used is inaccurate, the analytical method is inappropriate, or information is not clearly presented, then the resulting decisions are also at risk of being suboptimal. Conversely, if data is of high quality and analyzed with the appropriate statistical method, information systems can support decisions more effectively.

Contribution to Data-Driven Decision Making

The literature review results show that statistical analysis contributes to data-driven decision making through three main aspects: improving decision accuracy, increasing the speed of information interpretation, and enhancing the organization's predictive capability. In traditional decision making, managers often rely on experience, intuition, or organizational habits. However, in data-driven decision making, decisions are formulated based on evidence obtained from data processing and analysis. Brynjolfsson and McElheran explain that data-driven decision making practices are related to the use of data to improve managerial processes and organizational performanc(Shmueli & Koppius, 2021). This indicates that organizations capable of utilizing data appropriately have a greater opportunity to produce rational and measurable decisions.

The application of statistical analysis also supports information systems in generating insights that are more easily understood by users. One form of this support is data visualization. Visualization helps simplify statistical analysis results so that they can be read by users from various scientific backgrounds. In the context of AI-assisted decision making, data visualization plays an important role because it can help users understand complex information and evaluate the results of system recommendation(Brynjolfsson & McElheran, 2023). Therefore, statistical analysis results should not only be presented in the form of numbers but also in the form of tables, charts, diagrams, and dashboards to be more communicative.

Furthermore, statistical analysis plays a role in strengthening decision support systems. Decision support systems require historical data, decision criteria, analytical models, and evaluation mechanisms to generate recommendations. At this stage, statistical methods such as regression, correlation, classification, clustering, forecasting, and multi-criteria analysis can be used to assist the decision alternative selection process. Research on prescriptive analytics systems shows that prescriptive analytics is an advanced form of business analytics that can improve organizational decision making through the integration of technology, analytical models, and recommendation syste (Neri, 2010). In other words, information systems equipped with statistical analysis do not only answer "what happened," but also "why it happened," "what might happen," and "what action should be taken."

DISCUSSION

Based on the synthesis results, it can be concluded that the application of statistical analysis in information systems is closely related to the development of business intelligence and business analytics. Business intelligence focuses on the collection and presentation of information to support decisions, while business analytics places greater emphasis on the use of statistical, mathematical, and computational methods to generate knowledge from data. Fjermestad et al. explain that analytics in business intelligence can include simple methods such as reports and dashboards up to more complex quantitative methods such as data mining [21]. This aligns with the findings of this study that statistical analysis can be applied at various levels of complexity in information systems.

Other findings show that the application of statistical analysis does not depend solely on software or technology, but also on organizational factors. The success of using analytics in information systems is influenced by data readiness, human resource capability, organizational culture, and management support. Research on business analytics adoption shows that technological, organizational, and environmental factors influence the success of analytics implementation at the organizational level [22]. This means that even if an organization has a modern information system, the benefits of statistical analysis will not be optimal if data quality is poor, users do not understand the analysis results, or decisions are still made without considering the available information.

In the context of information systems, statistical analysis also functions as a bridge between data and action. Data stored in a system does not necessarily provide value directly if it is not analyzed. Therefore, organizations need to build a systematic analytical mechanism, starting from data collection, data validation, selection of analytical methods, interpretation of results, to evaluation of decisions. Research on data science and analytics affirms that advanced analytical methods can be used to generate insights and support intelligent decision making across various application domains . This reinforces the argument that statistical analysis is an important component of modern information systems.

In terms of research innovation, this article contributes a conceptual mapping of the relationship between statistical analysis, information systems, and data-driven decision making. The review shows that statistical analysis can be positioned as the primary method for transforming data into information, while information systems serve as the infrastructure providing data and presenting analysis results. Their combination generates the

organization's capability to make decisions more objectively, quickly, and based on evidence. A business intelligence implementation roadmap also shows that organizations, including higher education institutions, need data-based systems to improve the quality of strategic and managerial decisions (Alnoukari, 2023).

The theoretical implication of this study is that statistical analysis needs to be understood as an integral part of information systems, not as a separate process. A good information system is not only capable of storing and displaying data, but also supports the process of data analysis and interpretation. Thus, the development of information systems needs to consider analytical features, visualization, and decision recommendations. A study on contemporary business analytics shows that business analytics is developing as a discipline aimed at gaining insights to support more informed decisions (Lepenioti et al., 2021). Therefore, the integration of statistical analysis in information systems becomes an important need in data-driven organizations.

The practical implication of this study is the need for organizations to improve data quality, analytical capability, and the use of analysis results in decision making. Organizations can begin implementing statistical analysis from simple stages such as descriptive reporting, then progress to predictive and prescriptive stages. The application of big data and predictive analytics has also been proven to have great potential in supporting business intelligence, particularly in assisting the decision-making process. Therefore, information systems designed to support decisions should be equipped with data processing, visualization, and analysis features that are tailored to user needs.

In addition, the findings of this study show that data-driven decision making requires a balance between technology and human understanding. Statistical analysis can produce numbers, patterns, and recommendations, but the final interpretation still requires human judgment. In the context of the development of artificial intelligence, analytics is increasingly evolving from descriptive analysis toward automated systems capable of assisting the decision-making process (Neri, 2010). However, systems that are too automated without user understanding can give rise to the risk of misinterpretation. Therefore, analytics-based information systems need to be designed so that their results are transparent, easy to understand, and evaluable.

Although the application of statistical analysis in information systems has been widely discussed, several research gaps remain. First, many studies discuss statistical analysis,

business intelligence, and decision support systems separately, so there are not many studies that integrate all three into a single conceptual framework. Second, some studies focus more on the technological aspect, but have not thoroughly discussed how the results of statistical analysis are actually used in the organizational decision-making process. Third, further research is needed to examine the relationship between data quality, statistical methods, information visualization, and decision quality in greater depth.

Research on information systems and analytics also shows that data-driven decision making is increasingly evolving toward more complex systems, including the use of machine learning, multi-criteria decision making, and artificial intelligence. Multi-criteria decision making methods can help organizations make decisions when multiple conflicting criteria exist [28]. Meanwhile, studies on artificial intelligence in decision making show that AI has great potential to improve the effectiveness of decisions, but still presents challenges in terms of transparency, ethics, and user trust . Therefore, future research needs to develop information system models that are not only statistically accurate but also easy to understand and accountable.

The results and analysis in this study show that statistical analysis plays an important role in supporting information systems to produce data-driven decisions. The application of statistical analysis can improve information quality, accelerate data interpretation, support prediction, and provide decision recommendations. However, the success of its implementation still depends on data quality, organizational readiness, user capability, and the design of information systems that support the analytical process. Therefore, the integration of statistical analysis in information systems becomes one of the key strategies for organizations seeking to improve decision quality in an objective, measurable, and evidence-based manner (Fjermestad et al., 2021).

CONCLUSION

Based on the results and analysis conducted, this study demonstrates that the objectives stated in the introduction have been achieved, namely analyzing the application of statistical analysis in information systems to support data-driven decision making. The literature review results show that statistical analysis plays an important role in transforming data into more meaningful information through the processes of processing, analysis, visualization, and preparation of decision recommendations. Methods such as descriptive

analysis, regression, correlation, prediction, classification, and data visualization can help organizations understand actual conditions, estimate future opportunities, and make more objective and evidence-based decisions. Thus, information systems supported by statistical analysis do not only function as data storage tools, but also as strategic instruments in improving decision quality. Looking ahead, this research can be developed by conducting empirical studies or designing statistical analysis-based decision support system models in specific fields, such as education, business, health, or public services, so that the results of this literature review can be applied more concretely and provide practical benefits for organizations.

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