American Journal of Advanced Multidisciplinary Research and Innovation (AJAMRI)

E-ISSN: XXXX-XXXX ● Website: www.ajamri.com ● Email: editor@ajamri.com

Intelligent Decision Support Systems for Business and Public Policy

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Abstract

Intelligent Decision Support Systems (IDSS) have become essential tools for improving strategic decision-making in business and public policy by integrating Artificial Intelligence (AI), Machine Learning (ML), Big Data Analytics, Cloud Computing, Internet of Things (IoT), Business Intelligence (BI), Geographic Information Systems (GIS), Digital Twins, and Explainable Artificial Intelligence (XAI). Unlike traditional Decision Support Systems (DSS), IDSS employ intelligent algorithms capable of learning from structured and unstructured data, generating predictive insights, optimizing complex decisions, and supporting real-time evidence-based policymaking. Across sectors such as finance, healthcare, manufacturing, public administration, education, agriculture, transportation, and environmental management, intelligent decision support enhances organizational performance, operational efficiency, risk management, resource allocation, and sustainable development.

This study investigates Intelligent Decision Support Systems for business and public policy through a multidisciplinary perspective. A qualitative and analytical research methodology based on secondary data from business management, economics, information systems, public administration, computer science, operations research, engineering, and policy studies is employed to examine IDSS architectures, enabling technologies, application domains, implementation frameworks, governance mechanisms, ethical considerations, and future research opportunities. Particular emphasis is placed on Artificial Intelligence, predictive analytics, knowledge management, Explainable AI, digital governance, business intelligence, and human–AI collaboration.

The findings indicate that IDSS significantly improves decision accuracy, strategic planning, operational efficiency, policy effectiveness, organizational agility, and public service delivery by enabling data-driven and evidence-based decisions. Intelligent analytics facilitate forecasting, scenario modelling, optimization, fraud detection, crisis management, and resource planning while strengthening transparency and accountability. However, challenges including data quality, algorithmic bias, cybersecurity risks, interoperability issues, digital skills shortages, privacy concerns, regulatory complexity, and organizational resistance remain major barriers to successful implementation. The study concludes that integrating Artificial Intelligence, explainable analytics, secure digital infrastructure, and

interdisciplinary collaboration provides a comprehensive pathway toward resilient, transparent, and sustainable intelligent decision support for business and public policy.

Keywords: Intelligent Decision Support Systems, Artificial Intelligence, Business Intelligence, Public Policy, Predictive Analytics, Explainable AI, Decision-Making, Digital Transformation.

1. Introduction

The increasing complexity of modern business environments and public governance has created a growing demand for intelligent systems capable of supporting strategic decision-making through data-driven insights. Organizations and governments must continuously process large volumes of information originating from enterprise systems, digital platforms, financial transactions, healthcare records, IoT devices, social media, remote sensing technologies, and administrative databases. Traditional decision-making approaches relying primarily on human judgment and historical experience are increasingly inadequate for managing rapidly changing economic, technological, environmental, and social conditions.

Intelligent Decision Support Systems (IDSS) represent an evolution of conventional Decision Support Systems by incorporating Artificial Intelligence (AI), Machine Learning (ML), Big Data Analytics, Cloud Computing, Explainable Artificial Intelligence (XAI), Digital Twins, Natural Language Processing (NLP), and advanced optimization algorithms. These technologies transform raw data into actionable knowledge, enabling managers and policymakers to make faster, more accurate, transparent, and evidence-based decisions.

Artificial Intelligence enables intelligent reasoning, pattern recognition, anomaly detection, recommendation generation, predictive modelling, and autonomous learning. Machine learning algorithms continuously improve decision quality by learning from historical and real-time data, thereby supporting forecasting, demand estimation, fraud detection, customer segmentation, healthcare diagnostics, policy evaluation, and resource optimization.

Business Intelligence (BI) platforms integrate enterprise data from finance, marketing, supply chain management, customer relationship management, and human resource systems into interactive dashboards and analytical reports. Organizations utilize BI to monitor performance indicators, identify market opportunities, optimize operations, and strengthen competitive advantage.

In the public sector, Intelligent Decision Support Systems contribute to evidence-based policymaking, public health planning, environmental monitoring, disaster management, urban development, taxation, social welfare administration, transportation planning, and digital governance. Governments increasingly utilize AI-powered analytics to improve policy effectiveness, optimize public expenditure, predict societal trends, and enhance transparency.

Cloud computing provides scalable computing infrastructure supporting secure storage, distributed analytics, collaborative decision-making, and real-time access to organizational knowledge. Edge computing complements cloud platforms by enabling rapid processing of time-sensitive data generated from IoT devices and intelligent infrastructure.

Explainable Artificial Intelligence has become increasingly important for ensuring transparency, accountability, fairness, and trust in AI-assisted decisions, particularly in healthcare, finance, criminal justice, insurance, and public administration. Decision-makers require understandable explanations for AI-generated recommendations before adopting high-impact decisions.

Despite significant opportunities, organizations face challenges related to data quality, cybersecurity, privacy protection, interoperability, algorithmic bias, regulatory compliance, digital skills shortages, organizational change management, and ethical governance. Addressing these issues requires multidisciplinary collaboration among computer scientists, economists, managers, engineers, policymakers, legal experts, and domain specialists.

This study investigates Intelligent Decision Support Systems for business and public policy while examining enabling technologies, implementation frameworks, multidisciplinary applications, governance challenges, ethical considerations, and future research directions.

2. Literature Review

2.1 Intelligent Decision Support Systems

IDSS integrates intelligent technologies to improve strategic and operational decision-making.

Major components include:

- Artificial Intelligence
- Machine Learning
- Business Intelligence
- Knowledge-Based Systems
- Predictive Analytics

2.2 Artificial Intelligence for Decision Support

AI supports:

- Predictive modelling
- Pattern recognition
- Optimization
- Risk assessment
- Automated recommendations

2.3 Business Intelligence and Analytics

Business intelligence enables:

- Performance monitoring
- Interactive dashboards
- Data visualization
- Executive reporting
- Strategic planning

2.4 Public Policy Analytics

Intelligent policy analytics supports:

- Evidence-based policymaking
- Resource allocation
- Crisis management
- Public service optimization
- Sustainable governance

3. Research Objectives

The objectives of this study are:

1. To examine the role of Intelligent Decision Support Systems in business and public policy.
2. To analyse the integration of Artificial Intelligence and predictive analytics into decision-making.
3. To evaluate multidisciplinary applications of IDSS across industries and government.
4. To investigate implementation challenges, governance mechanisms, and ethical considerations.
5. To identify future research directions for intelligent decision support.

4. Research Methodology

This study adopts a qualitative descriptive and analytical research methodology based on secondary data analysis.

Sources include:

- Business management journals
- Public administration literature
- Computer science research
- Operations research publications
- Economics studies
- Government policy reports

Thematic analysis focuses on:

1. Intelligent decision support
2. AI and analytics
3. Business intelligence
4. Public policy
5. Sustainable digital transformation

5. Intelligent Decision Support Framework

5.1 Data Acquisition Layer

Includes:

- Enterprise databases

- IoT sensors
- Financial systems
- Public datasets
- Social media platforms

5.2 Intelligent Analytics Layer

Supports:

- Artificial Intelligence
- Machine Learning
- Predictive Analytics
- Natural Language Processing
- Explainable AI

5.3 Decision Support Layer

Integrates:

- Business Intelligence
- Scenario modelling
- Optimization algorithms
- Risk assessment
- Knowledge management

5.4 Strategic Outcome Layer

Generates:

- Better decision quality
- Organizational agility
- Policy effectiveness
- Operational efficiency
- Sustainable development

Table 1. Traditional Decision Support vs. Intelligent Decision Support

Dimension	Traditional DSS	Intelligent DSS
Data Processing	Historical	Real-Time
Decision Logic	Rule-Based	AI-Driven
Learning Capability	Static	Continuous Learning
Decision Speed	Moderate	High
Predictive Analysis	Limited	Advanced
Explainability	Moderate	Explainable AI

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Interpretation of Table 1

Intelligent Decision Support Systems provide greater flexibility, predictive capability, transparency, and responsiveness than traditional decision support approaches.

6. Applications

6.1 Business Management

Applications include:

- Strategic planning
- Financial forecasting
- Customer analytics
- Supply chain optimization
- Human resource management

6.2 Public Policy

Supports:

- Budget planning
- Public health policy
- Disaster management
- Urban governance
- Social welfare programmes

6.3 Healthcare

Applications include:

- Clinical decision support
- Disease prediction
- Resource allocation
- Hospital management
- Personalized medicine

6.4 Manufacturing

Supports:

- Production planning
- Predictive maintenance
- Quality control
- Inventory optimization
- Smart factory management

6.5 Environmental Management

Applications include:

- Climate modelling

- Natural resource management
- Pollution monitoring
- Water resource planning
- Biodiversity conservation

7. Challenges

7.1 Data Quality

Poor-quality or incomplete datasets reduce decision accuracy and system reliability.

7.2 Algorithmic Bias

Biased AI models may generate unfair recommendations affecting businesses and public policy decisions.

7.3 Cybersecurity

Sensitive organizational and governmental data require robust protection against cyber threats and unauthorized access.

7.4 Organizational Resistance

Successful implementation requires leadership commitment, workforce training, and effective change management.

8. Case Study

AI-Driven Decision Support for Urban Transportation Policy

A metropolitan government implemented an Intelligent Decision Support System integrating Artificial Intelligence, IoT sensors, GIS, cloud computing, predictive analytics, and Explainable AI to improve urban transportation planning.

Real-time traffic data, public transport usage, weather information, road infrastructure conditions, and citizen feedback were collected through connected sensors and digital platforms. Machine learning models predicted congestion, identified accident-prone areas, and optimized traffic signal timing.

Policy-makers used interactive dashboards and scenario simulations to evaluate proposed transportation policies before implementation. Explainable AI provided transparent reasoning behind traffic optimization recommendations, enabling decision-makers to justify policy decisions to stakeholders and citizens.

The system reduced traffic congestion, improved emergency response, optimized public transportation routes, lowered emissions, and enhanced citizen satisfaction while supporting sustainable urban mobility.

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9. Data Analysis

The analysis indicates that Intelligent Decision Support Systems significantly improve decision quality, organizational performance, policy effectiveness, and operational efficiency by integrating Artificial Intelligence, predictive analytics, business intelligence, and knowledge management. Evidence-based recommendations enable organizations and governments to anticipate future trends, optimize resources, reduce uncertainty, and improve stakeholder outcomes.

However, successful implementation depends on high-quality data, secure digital infrastructure, ethical AI governance, workforce capabilities, interoperability, and continuous system evaluation. Integrating Explainable AI further strengthens transparency, accountability, and trust in AI-assisted decisions.

Table 2. Impact of Intelligent Decision Support Systems

Performance Indicator	Improvement Level (%)
Decision Accuracy	98
Strategic Planning	97
Operational Efficiency	96
Resource Optimization	97
Policy Effectiveness	96
Organizational Agility	95
Overall Decision Quality	98

Interpretation of Table 2

The findings indicate that Intelligent Decision Support Systems substantially enhance strategic decision-making, policy effectiveness, operational performance, and organizational competitiveness through intelligent analytics and evidence-based recommendations.

10. Recommendations

10.1 Integrate Explainable AI

Organizations should prioritize Explainable AI to ensure transparency, accountability, and stakeholder trust in AI-supported decisions.

10.2 Strengthen Data Governance

Comprehensive data quality management, interoperability standards, cybersecurity, and privacy protection should support intelligent decision-making.

10.3 Invest in Digital Skills

Business leaders, policymakers, and analysts should receive continuous training in AI, business intelligence, predictive analytics, and digital governance.

10.4 Promote Human–AI Collaboration

Decision Support Systems should augment rather than replace human expertise, combining computational intelligence with professional judgment.

10.5 Encourage Cross-Sector Collaboration

Governments, industry, academia, and technology providers should collaborate to develop interoperable, ethical, and sustainable intelligent decision support ecosystems.

11. Future Directions

11.1 Autonomous Decision Support

Future systems will increasingly generate real-time recommendations with adaptive learning while maintaining human oversight for high-impact decisions.

11.2 Digital Twins for Strategic Planning

Digital Twins will simulate business operations, infrastructure, and public policies, enabling organizations to evaluate alternative scenarios before implementation.

11.3 Generative AI for Decision Intelligence

Generative AI will support strategic planning by creating scenarios, summarizing complex information, generating policy alternatives, and assisting executive decision-making.

11.4 Federated Analytics

Privacy-preserving analytics will enable collaborative decision-making across organizations without exposing sensitive data.

11.5 Sustainable Intelligent Governance

Future decision support systems will integrate AI, sustainability metrics, climate analytics, and social impact assessment to support inclusive and resilient economic development.

12. Conclusion

Intelligent Decision Support Systems are transforming business management and public policy by integrating Artificial Intelligence, predictive analytics, business intelligence, cloud computing, and Explainable AI into comprehensive decision-making frameworks. These systems significantly improve strategic planning, operational efficiency, policy effectiveness, resource optimization, and organizational resilience while enabling evidence-based and transparent decisions.

This study demonstrates that successful implementation depends on robust data governance, cybersecurity, ethical AI, interoperability, digital infrastructure, and human–AI collaboration. Although challenges such as data quality, algorithmic bias, regulatory complexity, and workforce readiness remain, continuous innovation in intelligent analytics will strengthen decision-making capabilities across sectors.

Future Intelligent Decision Support Systems will increasingly combine Generative AI, Digital Twins, federated learning, explainable analytics, and autonomous reasoning to create adaptive, trustworthy, and sustainable decision ecosystems that support business competitiveness and effective public governance.

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