

## RESEARCH ARTICLE

# Malaysia Public Sector Challenges of Implementation of Artificial Intelligence (AI)

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**ABSTRACT** Artificial Intelligence (AI) has witnessed exponential growth in recent years fueled by advancements in software, hardware, and application development across diverse domains. This research utilizes a thorough analytical methodology to investigate the multifaceted concept of AI implementation in Malaysia's public sector. It underscores the transformative potential of AI to enhance operational efficiencies yet highlights critical challenges hindering its adoption. Through a detailed examination of the Malaysian public sector's AI landscape and previous research, our investigation identifies three key obstacles: a lack of qualified expertise, concerns over data privacy, and entrenched resistance to changes in organizational culture. The main findings suggest that despite these hurdles, the benefits of AI implementation, such as increased operational efficiency, streamlined processes, and improved public service delivery, are significant. Ultimately, this research concludes that Malaysia can navigate these challenges effectively with persistent efforts and strategic commitments. Embracing AI promises correctness advancements in public service quality, benefiting citizens and the nation's clarity.

**INDEX TERMS** Artificial intelligence, challenge, framework, public sector.

## I. INTRODUCTION

The rapid emergence of new technologies in Southeast Asia, including Malaysia, is reshaping societal patterns at an unprecedented pace. This digital wave is transforming the fundamental nature of work, demanding that leaders adapt and leverage these tools to stay ahead. As [1] aptly noted, technologies like robotic process automation, machine learning, AI, cloud computing, and the Internet of Things are fundamentally altering how organizations operate. Echoing this sentiment, former Science, Technology and Innovation Minister Datuk Seri Dr Adham Baba emphasized the crucial need for "agile, adaptable, and transformative technology" to sustain the digital economy in the wake of COVID-19 [2]. By working together, individuals and organizations can combine their expertise and resources to explore and implement innovative technologies, share knowledge and best practices, leverage economies of scale, and promote

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inclusivity and diversity. AI, a branch of computer science focused on imbuing machines with human-like intelligence, is at the forefront of this revolution [3]. Machine learning, a key subset of AI, empowers machines to "learn" and become progressively adept. Besides that, [4] stated that how Filipino users interact with airline chatbots, a type of artificial intelligence. It examines their experiences, offering valuable insights into how AI is applied in the airline industry. Recognizing the transformative potential of these emerging digital technologies, the government has implemented various incentive programs to encourage their widespread adoption [5]. Although AI has the potential to bring about significant changes, there are still gaps in research that need to be addressed. These gaps include the need for comprehensive strategies that consider ethical implications, cybersecurity risks, workforce adaptation, and the smooth integration of AI into existing government infrastructures. It is important to ensure transparency, accountability, and collaboration with stakeholders in the public sector. Thus, this research utilizes a thorough analytical methodology to investigate the

multifaceted concept of AI implementation in Malaysia's public sector.

## II. LITERATURE REVIEW

### A. DEFINITION OF IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE (AI)

Defining human intelligence remains a subject of debate, though a widely accepted perspective recognizes it as an individual's ability to reason, solve problems, grasp concepts, and learn effectively [6]. It also encompasses adaptability, informed decision-making through information utilization, and the complex interplay of various mental and emotional capacities.

Extending this concept to AI, [7] argues that the term "intelligence" aptly applies to machines exhibiting human-like reasoning, problem-solving, and environmental adaptation. While this framework remains valuable, significant recent advancements in AI necessitate the potential development of a new conceptual framework.

Ergen [8] offers a more specific definition, framing AI as the ability of machines or computer systems to mimic and perform tasks typically requiring human intelligence, such as logical thinking, learning, and problem-solving.

On the other hand, Abbass [7] presents a unique perspective, viewing AI as a social and cognitive phenomenon enabling machines to integrate into society, perform cognitively demanding tasks, and communicate effectively. This definition elevates AI beyond mere technology, recognizing its social and cognitive impact.

The Department of Industry, [9] emphasizes the practical applications of AI technology in aiding small businesses, enhancing local manufacturing competitiveness, and optimizing environmental and resource management.

AI's potential extends beyond specific tasks, augmenting human capabilities in diverse fields like resource efficiency, autonomous systems, healthcare, and agriculture. While performing some tasks with ease, AI may replace certain human jobs, but it also presents opportunities to boost productivity and transform existing roles.

### B. IMPORTANCE OF ARTIFICIAL INTELLIGENCE (AI)

The once-futuristic vision of AI-powered technology has become a tangible reality, pervading our daily lives. By automating routine tasks, The rise of AI is causing anxiety, with some predicting widespread job losses. However, others view AI as an opportunity for positive change, reshaping work and freeing humans from repetitive tasks, ultimately leading to a more balanced and productive society. The key lies in human-AI collaboration, leveraging the unique strengths of each to achieve greater efficiency, innovation, and well-being. AI's unique ability to learn and adapt based on experience and data elevates it from mere tool to independent technological entity.

This transformative potential extends beyond convenience. AI possesses the power to revolutionize how we live and

work, making our lives easier, more efficient, and more productive. From tackling complex problems to facilitating informed decision-making, AI's applications span diverse fields like healthcare, finance, and transportation, holding immense promise to improve our quality of life.

Beyond its utilitarian applications, AI is also being developed to facilitate daily needs and desires, encompassing roles in home comfort, social companionship, transportation, and even warfare. According to Matlab. [10], AI's rapid adoption has seen it permeate industries like automotive, data recognition, healthcare, cargo management, and cybersecurity, demonstrating its profound impact on the landscape of human social interaction and daily activities.

Pratt [11] highlights seven key benefits reaped by businesses utilizing AI: enhanced efficiency and productivity, accelerated processes, expanded capabilities and business models, improved customer service, intensified monitoring, reduced human error and quality improvement, and optimized talent management. Independent consultant Katherine Jones further emphasizes AI's ability to reduce hiring costs and boost workforce productivity through efficient candidate identification and selection.

Fueled by its potential for breakthroughs and economic growth, AI has become a top priority for governments and corporations alike. Recognizing the significant GDP gains projected from AI adoption, leading countries like the US, China, and Japan have implemented dedicated strategies and plans, underscoring AI's critical role in shaping future societal and economic landscapes [12].

Overall, AI's potential extends far beyond mere task automation. Its ability to eliminate human error, operate tirelessly, render unbiased decisions, liberate us from repetitive tasks, reduce costs, and facilitate data analysis positions it as a vital tool for human advancement.

### C. AI IMPLEMENTATION ISSUES

While AI has the potential to significantly improve many aspects of our daily lives, there are also some issues to consider from a technology, process, human, and acceptance perspective that sometimes arise during implementation. Here are some of the main issues that often arise in the context of AI implementation:

#### 1) TECHNOLOGY PERSPECTIVE

*Weaknesses and limitations of AI:* Although AI has advanced rapidly, there are still limitations in the capabilities of AI technology. For example, AI may have difficulty understanding complex contexts, handling new or unexpected situations and often cannot provide sufficient explanations to decide [13].

*Solution:* Continue to invest in AI research and development. This allows the development of better AI technology in understanding more complex contexts. Additionally, it is important to provide training and education to AI users to maximize the benefits of this technology. With increased resources and understanding, we can reduce the impact of

AI's weaknesses and limitations in the public sector and make it more effective in decision-making [14].

*Dependence on Data:* AI requires sufficient and high-quality data to produce good product results. However, reliance on this data can be problematic if the data used is unrepresentative, biased, or inaccurate.

*Solution:* Emphasizing careful data monitoring and maintenance. Authorities need to ensure that the data used is balanced, free from bias, and accurate [15]. Additionally, it is important to promote reporting and transparency in the use of data, so that problems related to bias and inaccuracy can be quickly detected and remedied. With a careful approach to the use of data, AI can work better and more fairly in the public sector.

## 2) PROCESS PERSPECTIVE

*The complexity of Development:* Building an effective and reliable AI system involves a complex process, including data collection and pre-processing, selection of appropriate algorithms, model training and rigorous testing. This process will take a lot of time, resources and expertise.

*Solution:* By increasing the sharing of knowledge and resources. Collaboration between researchers, AI experts, and public organizations can reduce the burden of AI development. In addition, investment in training and continuous monitoring is also important [16]. By developing expertise in the public sector and sharing resources, we can speed up the AI development process and make it more efficient in the long run.

*Reliability and Stability:* Ensuring the AI system works accurately and consistently is important. Low reliability or instability can hinder the use of AI in many fields, including critical industries such as healthcare or finance.

*Solution:* Emphasizing continuous testing and monitoring. A thorough testing and regular maintenance can help identify problems and quickly fix instabilities. In addition, it is important to develop strict reliability standards in the use of AI, especially in critical areas [17]. By focusing on aspects of reliability and stability, we can increase confidence in using AI in industries that require stability and accuracy.

## 3) HUMAN PERSPECTIVE

*Training and expertise:* AI implementation requires a skilled and trained workforce to understand, develop and manage AI systems. Lack of sufficient skills in AI can be a barrier to adopting and using this technology effectively [13].

*Solution:* Emphasizing training and education in the field of AI. Authorities need to provide learning and development opportunities to civil servants to improve their capabilities in AI. Additionally, collaboration with universities and educational institutions can help produce more AI experts [18].

It is also important to encourage the sharing of knowledge and expertise among the public and private sectors. This will help build shared expertise in facing AI challenges [19]. By prioritizing training, education, and knowledge sharing,

we can overcome the lack of expertise in AI implementation and ensure the success of this technology in the public sector.

*Fear of Job Loss:* The perception that AI can replace human jobs can create anxiety and uncertainty among workers. It is important to anticipate these changes and prepare strategies to coordinate technological changes with human work needs.

*Solution:* Focus on career development and skill enhancement. Authorities need to provide training and education opportunities to workers to improve their ability to cope with technological change [20]. In addition, continuous planning and dialogue with workers and trade unions is essential to ensure that technological change does not destroy human jobs but increases efficiency and productivity.

It is also important to encourage innovation in the sector that can create new and potential jobs. By taking these steps, we can reduce the fear of job loss and ensure that the development of AI technology provides positive benefits to workers and society [21].

## 4) RECEPTION PERSPECTIVE

*Fear and Lack of Trust:* Ignorance about AI technology and fear of negative outcomes of AI production can hinder AI adoption. Public trust must be built through education, transparency and evidence of the tangible benefits in using AI.

*Solution:* Raise public awareness of AI through clear education and information campaigns. Explaining the benefits that can be obtained through the use of AI and explaining the measures to protect data privacy and security are also important [22].

Additionally, it is important to ensure transparency in the use of AI in the public and private sectors. Showing how this technology is used responsibly and providing concrete evidence of improvements in public services or business products can build public trust [23].

With good education, continued transparency, and evidence of AI's positive performance, we can overcome fear and lack of trust in adopting this technology, making it more acceptable in society [23].

*Inequality and Inclusion:* There are concerns about inequality in AI access to and use. It is important to ensure that AI is developed with diverse needs and contexts in mind and to avoid the concentration of different capabilities or skills after development.

*Solution:* Encourage multiple involvement in the AI development process [24]. This includes the participation of diverse groups, including the disadvantaged, women, and people of color/underrepresented groups, in the development, testing, and use of AI.

Additionally, it is important to encourage collaboration between the public, private, and civil society sectors to ensure more equitable opportunities in access to and benefits from AI. This includes improvements in education and training to provide the necessary skills to all sections of society [20]. With an inclusive and integrated approach, we can

overcome the problem of inequality and ensure that AI provides more equal benefits to all levels of society.

Addressing these issues requires a holistic approach, including developing more sophisticated technologies, transparent and standardized processes, better skills training for the workforce, and a human-centred approach to AI design and implementation. Community acceptance also needs to be increased through education, awareness and active involvement of various stakeholders.

### III. RESEARCH METHODOLOGY

The study of Malaysia's public sector challenges in implementing Artificial Intelligence (AI) can be effectively approached using an analytical research methodology, a systematic approach that investigates complex subjects by analyzing data [25]. This methodology is particularly valuable in understanding, problem-solving, and making informed decisions about AI adoption in the public sector. To generate insightful evaluations, the researchers must draw upon preexisting facts and conduct a comprehensive study, which is crucial in a field as intricate as AI implementation. This approach involves a detailed analysis and evaluation of current information to clarify the complex occurrences surrounding AI adoption [26]. The primary focus is on interpreting relationships and studying existing information, all of which are essential for addressing the challenges that Malaysia's public sector faces in embracing AI technology. Thus, this research aims to explore the challenges and opportunities of AI implementation in Malaysia's public sector, focusing on overcoming obstacles to enhance operational efficiency and public service quality.

### IV. RESULTS OF THE STUDY

The study findings demonstrate that the integration of Artificial Intelligence (AI) in the public sector offers both opportunities and challenges. Although AI has the potential to improve operational efficiency, service delivery, and resource management, it also gives rise to significant challenges related to public values, data quality, and social governance. Important challenges encompass accountability, privacy, injustice, and ethical quandaries, all of which must be addressed in order to guarantee proper utilisation of AI. Furthermore, concerns such as the accuracy of data, unfairness in algorithms, and risks to cybersecurity emphasise the necessity for thorough methods and frameworks to regulate the implementation of AI. In order to optimise the advantages of AI, it is crucial to adopt a cooperative and well-regulated approach that tackles these obstacles while promoting creativity.

### V. ARTIFICIAL INTELLIGENCE (AI) IMPLEMENTATION SCENARIO IN THE MALAYSIAN PUBLIC SECTOR

Fueled by government initiatives, Malaysia's Artificial Intelligence (AI) landscape is experiencing rapid growth. This burgeoning field is nurtured by strategic frameworks like the National AI Framework, the Malaysia Digital Economy Blueprint, and the Fourth Industrial Revolution

(IR 4.0) plan. These initiatives provide a roadmap for industry development, encompassing research and development, talent cultivation, infrastructure expansion, and regulatory frameworks. Their overarching goal is to propel Malaysia towards becoming a regional AI hub and leverage AI's potential for economic growth.

The National AI Framework is anchoring this development, a strategic document outlining the government's vision and roadmap for AI adoption [11]. Delving into areas like research, talent development, infrastructure, and regulation, this framework aims to position Malaysia as a leading AI player and drive economic advancement.

Complementing this framework is the Malaysia Digital Economy Blueprint (2020) [27], which establishes a roadmap and targets for data and digital intelligence as the backbone of the nation's digital economy. In conjunction with the 4IR and MyDigital action plan, the government aims to achieve a 30% productivity boost across all sectors by 2030 compared to 2020, with AI serving as a critical enabler [28].

Further shaping the landscape is the Artificial Intelligence (AI) Roadmap (AI-RMAP) [29]. A collaborative effort between Universiti Teknologi Malaysia, industry consultants from PIKOM, and the National Science and Research Council of the Ministry of Science, Technology and Innovation (MOSTI), this roadmap serves as a living document, adaptable to the ever-evolving technological landscape. It outlines strategies and initiatives for AI-powered transformation, accelerating Malaysia's journey towards becoming a high-income nation.

The AI-RMAP aims to establish a catalytic hub fostering a data-driven ecosystem. This "facilitator sandbox" enables consortia to collaborate on national "grand challenges," harnessing AI to propel innovation and growth. The solutions will not be business-as-usual, but rather world-leading applications of AI.

Serious discussions on AI only arose in Malaysia with the introduction of the 12th Malaysia Plan [30]. Emerging technologies like virtual reality, augmented reality, and AI will complement existing teaching, learning, research, and development activities. The plan outlines five priority areas to be achieved by 2025, including accelerating strategic and high-impact industries. AI-dependent advanced semiconductor manufacturing and expanded access to quality education (pre-school to higher) are key to improving *Bumiputera* socioeconomic status [30].

Sabah courts have pioneered AI applications for data analysis and decision-making in criminal trials, exemplifying the "Improvement in Governance" chapter. Kuala Lumpur's cyber court tackles cyber offences like online gambling, defamation, and fraud.

The National Innovation and Technology Sandbox (NTIS), a strategic collaboration between MOSTI, the Ministry of Housing and Local Government, and the Ipoh Municipal Council, implemented a pilot project in AI robotics. AI robots deployed in the Amanjaya Public Market, Ipoh, to clean

floors, transport chickens, and manage waste [29]. This marks the first public market using robots for cleanliness and transportation of goods.

Established in January 2021, the Malaysian AI Technology Research Organization serves as a platform for AI research and development in Malaysia. Its goals include:

- Security sector AI research and development
- Building a panopticon AI system for crime prevention
- Ethical AI research
- Robotics AI research and development
- Research on privacy in AI technology, including panopticon systems [31]

The Malaysian public sector's current landscape of AI implementation reveals a burgeoning yet nascent development trajectory, marked by both promising initiatives and lingering challenges [32]. Several agencies have embarked on AI integration, exemplified by MAMPU's innovative "FaRA" application utilizing facial recognition for contactless employee attendance tracking. This internally developed AI solution, funded under the ICT R&D program, represents a pilot implementation launched in November 2022 at two MAMPU locations [33].

Similarly, the Ministry of Home Affairs (KDN) spearheads advancements like the National Integrated Immigration System (NIISe). Replacing the antiquated MyIMMs system, NIISe leverages "Big Data Analytics" (BDA) to enhance enforcement against illegal immigrants through fingerprint and facial biometrics of all arriving individuals. Expected to fully operationalize by 2024, this 19-module system promises a new era of digital immigration enforcement [34].

Furthermore, KDN's Integrated Real-Time Attendance System (IRAS) showcases AI's potential beyond immigration. This comprehensive system utilizes facial recognition to accurately verify employee identities and capture real-time attendance. IRAS boasts features like automated attendance reports, leave management, and data security, resulting in significant improvements like reduced manual work, enhanced workforce management, and increased employee satisfaction. Overall, IRAS demonstrates the value proposition of AI for improved attendance management, productivity, and cost reduction.

Recognizing the benefits of collaboration, the Malaysian government actively partners with private companies for AI development [29]. This strategic approach merges private sector expertise with public sector needs, as evidenced by numerous successful AI applications co-developed by local companies and government agencies [35].

However, a robust legal framework remains a crucial missing piece in the AI implementation puzzle. Issues like privacy, data security, and AI governance require clear and strong legislation to safeguard individual rights and ensure ethical AI utilization [36].

Equally vital is upskilling the public sector workforce in AI. Effective AI implementation demands technological proficiency and a nuanced understanding of both its potential and risks [36]. The recent allocation of RM40 million

by the Prime Minister for AI training of civil servants, particularly focusing on younger generations, is a step in the right direction. Ongoing training and education initiatives will be crucial in cultivating a future-ready public sector workforce equipped to leverage AI for optimal performance.

In conclusion, while the Malaysian public sector's AI journey is marked by positive progress, ample opportunities for improvement remain. By addressing critical needs in legal infrastructure, workforce expertise, and collaborative partnerships, Malaysia can unlock the full potential of AI to propel its public services towards greater efficiency, effectiveness, and citizen-centricity [32].

## VI. PREVIOUS STUDIES RELATED TO THE IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE (AI)

Understanding how AI systems make judgments and inform human/institutional decisions within a framework of determinable accountability necessitates adapting methods from various disciplines. Reference [37] suggest incorporating empirical studies of human personality, judgment, and decision-making from cognitive science, social, and behavioral sciences.

However, A. Atabekov [42] argues for a broader scope, encompassing not just human inferences and behavior, but also "artificial inferences" and "AI behavior". They advocate for testing the reliability, value, and responsibility of AI judgments and decisions. To achieve this, they propose a comprehensive study program spanning natural sciences, technology, humanities, and social sciences.

J. Wolff [43] conducted a systematic literature review (SLR) emphasizing the crucial need for rigorous safety considerations in future research on AI-based autonomous vehicles (AVs). From an initial pool of 4870 articles, they meticulously curated a sample of 59 research articles. These studies were categorized to address their research questions, and a novel AV system model was proposed to guide the SLR discussion. A key finding highlights the urgent need for robust safety agendas in future AI-based AV research. This study's proposed AV system model extends the Dynamic Driving Tasks (DDT) model by incorporating a "human-in-the-loop" component, fostering a more realistic representation of the complex human-system interaction. This model facilitates document organization, analysis, and discussion. Additionally, they created a comprehensive map of AI techniques employed in the reviewed literature.

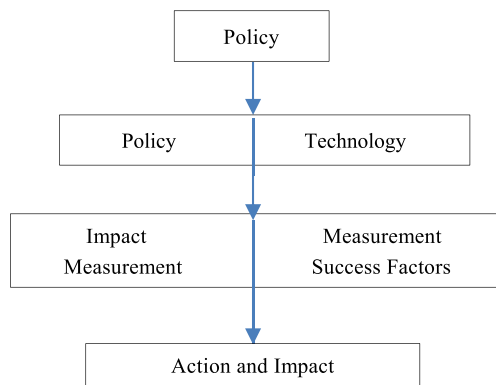
The expanding role of AI in biomedicine is undeniable. Its rise is fueled not only by its own continuous advancements but also by the inherent complexity of biomedical problems and AI's increasing involvement in their solutions. New AI capabilities drive solutions for biomedical advancements, requiring further development in both areas. This parallel growth fosters significant progress in biomedicine, ultimately improving the lives of those in need.

H. Benbya [44] comprehensively summarize recent advancements in AI applications across various biomedical domains, including disease diagnosis, life support systems,

information processing, and research. Their goal is to highlight new scientific breakthroughs, analyze the current technological landscape, and inspire further research in biomedicine by demonstrating the immense potential of AI.

Other than that, A. Zuiderwijk [45] said to ensure ethical AI development, recommendations encompass technical safeguards, fostering an ethical organizational culture, educational initiatives, and legislation safeguarding human rights and promoting responsible AI advancement.

Leveraging these identified results, private and public organizations have successfully implemented existing AI solutions, accelerating the translation of theoretical advancements into practical applications [42]. Other key success factors include confidence-building measures, data classification guidelines, and robust risk assessment frameworks. Recognizing the interdependence of these factors, [43] advocates for future research focusing on optimizing their interactions to unlock AI's full potential in real-world applications.



**FIGURE 1.** Visually summarizes the interplay between policy, technology, and the impact of measurement success factors.

## VII. THE CHALLENGE OF IMPLEMENTING ARTIFICIAL INTELLIGENCE (AI) IN THE PUBLIC SECTOR

The integration of AI into government processes, while promising increased efficiency and effectiveness, necessitates addressing numerous complex challenges. Reference [44] comprehensively examine these challenges in “The Challenge of Implementing Artificial Intelligence in the Public Sector,” highlighting the difficulties governments encounter when attempting to leverage AI for operational improvement. These challenges encompass data processing, innovative implementation, ethical considerations, navigating political landscapes, regulatory compliance, and ensuring equitable access to benefits.

Drawing upon their research, five key AI challenges are identified:

- 1) **Limited Production Deployment:** Many organizational AI systems remain in experimental phases, hindering economic returns on investment and limiting their potential impact.
- 2) **AI Talent Scarcity:** Implementing AI necessitates a diverse workforce with expertise in technology integration, business process redesign, personnel reskilling,

and data engineering. However, a critical shortage of individuals possessing these skills and knowledge exists.

- 3) **Transparency and Algorithmic Bias:** AI algorithms can perpetuate biases against specific groups, leading to discriminatory outcomes. Additionally, the inherent complexity of certain models, like deep learning neural networks, renders them difficult to interpret, exacerbating issues of accountability and transparency.
- 4) **Public Skepticism:** Concerns surrounding algorithmic bias, unpredictable consequences, privacy infringements, and lack of accountability foster skepticism towards AI amongst workers and consumers. This hinders the widespread adoption and acceptance of AI solutions.
- 5) **Data Dependency:** Many AI models, particularly deep learning architectures, require vast amounts of data for effective training. This reliance on big data raises concerns regarding data availability, quality, and privacy.

Addressing these challenges is crucial for organizations to fully capitalize on the transformative potential of AI. Enterprises must prioritize deployment strategies, talent acquisition, fostering transparency and trust, and addressing data requirements.

A. Zuiderwijk [45] identified numerous obstacles to utilizing AI in government, including eroded public trust due to lack of transparency, rapid technological advancements exceeding governance frameworks, reluctance to share data, insufficient knowledge and expertise among public officials, difficulties interpreting complex AI results, ethical concerns about fairness and potential misuse, and legal and policy hurdles not addressing the unique challenges of AI in public governance. These unaddressed challenges can significantly hinder the effectiveness of AI in transforming public service delivery.

While AI possesses the potential to automate routine tasks, empowering employees to focus on more stimulating and value-adding work, its implementation in Malaysia faces hurdles. The lack of data scientists and AI talent, coupled with limited awareness and understanding among businesses and the public, pose significant obstacles. The government has taken proactive steps to address these challenges, spearheading the development of an AI Roadmap [29] and establishing a catalytic hub to cultivate a data-driven ecosystem.

Beyond talent and awareness, implementing AI in Malaysia faces infrastructural and resource constraints. These include limited access to high-quality data and the need for more advanced computing power. Additionally, increased investment in research and development is crucial to fostering innovative AI technologies and applications.

As outlined in the Malaysia National AI Roadmap 2021-2025 [29], AI-Catalyst serves as the nucleus of the AI Innovation Ecosystem. Hosted virtually, it establishes consortia focused on tackling specific industry or public sector challenges via AI. This industry-led consortium model fosters

collaboration between quad-helix players within micro-ecosystems, accelerating AI adoption and implementation.

Y. Y. M. Aung [49] highlights managerial challenges associated with AI implementation at various organizational levels. Managers must understand situational needs and adopt the appropriate administrative role, including energizing the formal network, strengthening partnerships, building trust, and managing conflict. Moreover, they require the knowledge and skills to utilize analytical tools and facilitate knowledge transfer, reception, and networking connectivity. Collaboration across industries for AI implementation is further hindered by differing approaches to risk management in the public and private sectors.

C. W. L. Ho [50] identifies challenges associated with AI use in Spanish public administration, including opaque decision-making processes, regulatory uncertainty, inherent biases in AI systems, and personal data privacy violations. These difficulties underscore the importance of robust legal frameworks and regulations to mitigate potential risks associated with government AI utilization.

R. Calo [51] categorizes AI challenges into two types: those arising from government data usage and those stemming from logically guided selection. The first type concerns data availability and quality in AI systems. Government data, especially Big Data and Open Government Data, is vast and diverse, but ensuring data security and interoperability presents significant complexities. The second type of challenge relates to the intricate nature of AI models and understanding their internal decision-making processes. The opaque nature of AI learning techniques makes it difficult to explain their workings or justify their decisions to those impacted. Additionally, AI models can overfit to training data, leading to inaccurate predictions for new data.

These challenges have implications for the core principles of digital governance: openness, transparency, accountability, integrity, and privacy. Addressing these challenges is critical for building trustworthy AI in digital governance.

A. Kerr [52] categorize AI challenges into several domains: data, organizational and managerial, skills, interpretation, ethical and legitimacy, political, legal and policy, social and societal, and economic. Collectively, these challenges illustrate the intricate and multifaceted nature of AI implementation in government. Thorough analysis and mitigation of these challenges are essential for successful AI governance in the public sector.

Data acquisition remains the paramount challenge in implementing AI within healthcare, according to [49]. AI algorithms, particularly machine and deep learning models, necessitate vast datasets for effective identification or prediction of various activities. However, data availability presents a critical hurdle in the healthcare domain. Health data is inherently expensive, and hospitals exhibit reluctance towards data sharing. Additionally, the quality of data employed for training AI systems remains difficult to assess due to inconsistencies, errors, and lack of standardization, thereby reducing the scale and precision of data utilized

in algorithm development. Furthermore, regulatory frameworks and data security standards can hinder cross-regional collaborations and joint research endeavors. These challenges highlight the need for well-defined regulations governing the safe utilization and evaluation of AI technology, alongside further research exploring the possibilities and limitations of AI in healthcare settings.

A. Kerr [45] delves into the challenges associated with governing AI, categorizing them into three main groups: public values, data quality and processing, and societal governance challenges. Their comprehensive review provides a vast array of sources for further exploration within each category, presented in Table 1. Public value challenges pertain to potential harm to societal values if AI governance is not carefully considered. One key challenge for AI systems lies in ensuring transparency and accountability, with [50] and [51] emphasizing the lack of robust mechanisms in this regard. Fairness and inclusivity also pose significant challenges within AI implementation, as highlighted by [49]. Additionally, privacy and safety remain critical concerns, further compounded by concerns regarding inadequate regulatory frameworks to prevent potential misuse of AI [52].



FIGURE 2. Artificial intelligence governance challenge.

### A. PUBLIC VALUES CHALLENGES

Public values challenges represent a fundamental component in the discourse surrounding AI adoption in the public sector. This multifaceted challenge encompasses determining and prioritizing relevant public values while navigating competing stakeholder interests [53]. Decision-making in this sphere raises critical questions regarding justice, transparency, and accountability. For instance, value considerations in AI-powered public service delivery can ignite debate about the underlying democratic principles at stake. Reference [54] provide a comprehensive overview of public values challenges, including:

- Lack of accountability: Concerns surrounding the attribution of responsibility for AI-driven decisions and potential harm [55].
- Privacy concerns: Balancing the benefits of AI with the protection of individual data and privacy [56].
- Inequity concerns: Ensuring AI systems do not amplify existing societal biases or disadvantage specific groups [57].
- Lack of responsibility: Addressing ethical dilemmas arising from AI deployment and potential misuse [55].
- Safety concerns: Mitigating potential risks associated with AI-powered systems, including cybersecurity vulnerabilities [58].

- Moral dilemmas: Navigating complex ethical scenarios and balancing competing values in AI applications [59].
- Social acceptance and trust concerns: Building public confidence and trust in the fairness and reliability of AI systems [60].
- Lack of AI expertise and knowledge: Addressing the need for skilled professionals capable of developing and overseeing ethical AI implementations [56].
- Malicious use of AI: Protecting against the potential for AI to be weaponized or utilized for harmful purposes [55].
- Administrative evil: Recognizing the potential for AI to exacerbate existing bureaucratic inefficiencies and power imbalances [59].

### B. DATA QUALITY AND PROCESSING AND OUTCOME CHALLENGES

Data quality and processing complexities pose significant challenges to AI implementation in the public sector. Uncertainties surrounding the quality of data used to train and operate AI models, privacy concerns regarding the collection of sensitive information, and the need for transparent and reliable data processing procedures all contribute to this multifaceted challenge [61]. Additionally, ensuring fairness and avoiding discriminatory outcomes necessitate careful evaluation and re-examination of AI-generated results. Reference [54] offer a comprehensive breakdown of data quality and processing challenges, encompassing:

- Data quality and management: Concerns about the accuracy, consistency, and completeness of data used in AI systems [56].
- AI rule-making concerns: The need for clear and transparent processes for establishing and implementing AI-based decision-making rules.
- Financial feasibility: Evaluating the cost-effectiveness of AI solutions and ensuring adequate resources for their development and maintenance [56].
- Lost control of AI: Mitigating the risk of AI systems becoming self-governing and exceeding their intended scope or purpose.
- Interaction problems with humans: Addressing potential difficulties arising from human-AI interaction, such as trust, acceptance, and collaboration.
- Adverse impacts: Identifying and mitigating potential negative consequences of AI deployment, such as job displacement or societal inequalities [58].
- Difficulty of measuring performance: Establishing robust and reliable metrics to evaluate the effectiveness and efficiency of AI-powered systems.
- Uncertain human behavioral responses: Anticipating and understanding how individuals may react and adapt to AI-based interventions [58].

### C. SOCIETAL GOVERNANCE CHALLENGES

Societal governance challenges encompass the crucial aspects of oversight and management for AI technology

within society [62]. This necessitates navigating questions regarding the appropriate level of supervision to ensure responsible AI utilization, delineating decision-making authority and accountability for oversight mechanisms. Additionally, guaranteeing fair and non-discriminatory AI implementation presents a significant hurdle, requiring the development of effective policy frameworks. Reference [54] further highlight societal governance challenges, including:

- Replacing human jobs: Addressing potential job displacement and economic consequences of AI automation [56].
- Value judgment concerns: Navigating ethical dilemmas surrounding value-laden decisions made by AI systems [56].
- Insufficient regulation and “soft laws”: Establishing robust and enforceable legal frameworks to govern AI development and deployment [63], [64].
- Replacing human discretion: Striking a balance between AI-driven decision-making and the preservation of human judgment and oversight [65].
- Authoritarian abuses: Mitigating the potential for AI misuse by governments for surveillance, control, and suppression [65].
- Cross-sector collaboration hardship: Fostering effective collaboration between public, private, and civil society stakeholders in governing AI [66].
- Power asymmetry: Addressing imbalances in power dynamics between AI developers, users, and potentially disadvantaged groups [57].
- Threatening autonomy: safeguarding individual autonomy and freedom of choice in an increasingly AI-driven society [67].

AI implementation in government presents challenges related to information processing and decision-making. Biases inherent in training data can lead to discriminatory outcomes and potential harm to individuals' rights [50]. This concern is amplified by limited human control over AI systems and the difficulty of measuring their performance, further exacerbating potential risks [58], [68].

Beyond technical hurdles, AI integration raises societal governance challenges. These include complexities in inter-organizational collaboration, job displacement anxieties, and threats to individual autonomy in an increasingly AI-driven society [56], [67]. Additionally, AI can disrupt established power dynamics between governments and other stakeholders, including businesses and civil society organizations, hindering coordinated governance efforts [66].

Beyond the immediate strides in AI implementation, a critical lens must be cast on its potential ethical and social implications [69]. Job displacement due to automated routine tasks necessitates proactive workforce regeneration strategies to minimize disruptions and equip employees with new skills for a changing landscape [70]. Equally concerning is algorithmic bias, capable of producing discriminatory or unfair outcomes if left unchecked. A nuanced understanding of AI's ethical and social ramifications is paramount for



ensuring responsible and impactful implementation in the public sector [71].

Integrating AI systems seamlessly with existing government infrastructure and processes presents a significant challenge [36]. Decades-old structures and procedures may not readily accommodate cutting-edge AI solutions. To bridge this gap, a comprehensive integrated transformation is crucial, ensuring AI systems interact and operate efficiently with existing components without jeopardizing service delivery [72]. This transformation necessitates careful consideration of human-AI interaction, encompassing factors like user interfaces, AI decision-making transparency, feedback loops, and human cognitive load. Extensive research, development, testing, and adaptation of existing government processes are indispensable. Striking a balance between AI innovation and government process stability is key to overcoming this challenge.

Formulating an AI implementation strategy demands a detailed analysis of its financial implications, encompassing cost and budget considerations [36]. Understanding the costs associated with AI solutions, including technology acquisition, staff training, and infrastructure integration, is essential for effective planning and resource allocation. Furthermore, budget considerations must account for ongoing maintenance, updates, potential savings, and revenue generation opportunities brought about by AI. Careful attention should be paid to costs associated with software, hardware, human resources, data management, and long-term budget considerations to ensure financial traceability and resource stability during and beyond implementation. As the literature emphasizes, transformative improvements in public financial and physical resource management processes are crucial for successful AI integration [73].

The potential risks and vulnerabilities accompanying AI implementation necessitate close monitoring, with cyber security threats and data breaches ranking high on the list of concerns [58]. AI systems often handle vast amounts of data, including sensitive and personal information, making them prime targets for malicious actors. Cyber-attacks can not only compromise data privacy but also disrupt government operations and erode public trust [74]. Data leaks can have equally devastating consequences. Consequently, data and system security must be prioritized at every stage of AI implementation [58]. This includes comprehending potential threats, implementing robust data protection measures, and adhering to strict cyber security policies.

Integrating awareness of these risks into AI implementation planning is critical. Engaging cyber security experts, conducting regular system security audits, and ensuring compliance with data privacy laws are vital steps to mitigate potential vulnerabilities and ensure responsible AI utilization in the Malaysian public sector.

In summary, while AI promises efficiency gains, potential pitfalls include data management complexities, organizational resistance to change, skill gaps in the workforce, ethical considerations, political resistance, inadequate legal

frameworks, societal anxieties, and economic disruptions. Successfully navigating these challenges necessitates a holistic and collaborative approach, engaging stakeholders from various sectors to ensure trustworthy and effective AI integration into government processes.

## VIII. PROPOSED FRAMEWORK OF ARTIFICIAL INTELLIGENCE IN THE PUBLIC SECTOR

The proposed AI framework serves as a pivotal roadmap for adapting AI technology to enhance public sector services and management in Malaysia. Delineating strategic stages and a comprehensive AI development process, it prioritizes reliability, transparency, and societal well-being. In the quest for excellence in AI utilization, this framework emerges as a key driver of digital transformation within the public sector.

### A. WHAT IS AN AI FRAMEWORK?

An AI framework serves as the skeleton and nervous system for designing, developing, and deploying AI applications [75]. It lays the groundwork for building an AI system by orchestrating a series of crucial steps, from data collection to rigorous model testing. Integral to this framework is the selection of algorithms tailored to the specific problem at hand, followed by meticulous model learning and optimization processes [76]. This comprehensive approach helps ensure the AI application functions flawlessly in real-world scenarios and delivers on its intended goals. Ultimately, the AI framework acts as an indispensable guide for individuals and organizations seeking to harness the transformative power of AI to streamline processes, make informed decisions, and achieve excellence across diverse domains.

### B. WHAT YOU NEED TO CONSIDER TO BUILD AI FRAMEWORK

Just like a strong foundation is crucial for building a sturdy house, high-quality data forms the essential backbone for successful AI development. Fashioning an effective AI framework necessitates meticulous consideration of planning, algorithm selection, data quality, security, and privacy [9]. Profoundly comprehending project goals and desired outcomes acts as the bedrock for a thriving framework. By diligently exploring these factors, we ensure that the resulting AI provides tangible benefits across diverse applications.

Global AI software revenue is projected to reach \$62.5 billion in 2022, representing a 21.3% increase from 2021 [77]. Let us delve into the fundamental steps for mastering AI development from the outset [77]:

*Step 1(Problem Identification):* This crucial stage demands pinpointing the specific issue or need AI will address. It necessitates a thorough analysis of project objectives and intended impact.

*Step 2(Data Acquisition and Cleaning):* Data, the lifeblood of AI, necessitates access to relevant, high-quality fuel for training models. Pre-processing involves meticulously

cleaning the data from inaccuracies or missing values, ensuring its readiness for utilization.

*Step 3(Algorithmic Design):* Here, crafting an appropriate AI algorithm to tackle the identified problem takes center stage. The choice hinges on the problem type, be it classification, prediction, or optimization.

*Step 4(Algorithmic Training):* With the algorithm chosen, this stage involves training it on meticulously gathered and processed data. This iterative process allows the AI model to learn patterns within the data.

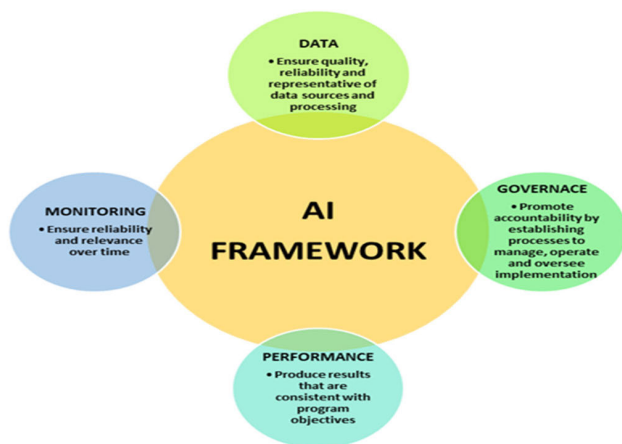
*Step 5(Platform Selection):* Choosing the right platform or AI software for model development and testing is paramount. TensorFlow, PyTorch, and sci-kit-learn are popular options for training AI models.

*Step 6(Programming Language Selection):* Identifying the suitable programming language for AI model implementation is essential. Python reigns supreme in AI development, but R and Julia offer viable alternatives.

*Step 7(Deployment and Monitoring):* Once trained, the AI model must be implemented in a real-world setting. Continuous monitoring of the model’s performance ensures it functions as intended, with ongoing maintenance and updates implemented as needed [77].

**C. PROPOSED AI FRAMEWORK**

This proposed recommendation framework constitutes a meticulously crafted roadmap for implementing positive systemic or field-specific transformations. It delineates the strategic steps necessary to achieve desired outcomes, prioritizing quality results as the overarching objective. This framework is the culmination of rigorous analysis, a deep-seated understanding of the pertinent challenges, and the imperative to formulate well-structured interventions.



**FIGURE 3.** Proposed AI framework.

Analogous to a specialized tool, an AI framework empowers individuals to develop AI programs with enhanced efficiency and ease. These programs possess remarkable abilities, such as learning, comprehending language, and autonomously making decisions. As AI pervades various

sectors, organizations are amassing vast amounts of data. To effectively analyze and leverage this data, a robust technology like an AI framework becomes indispensable. This explains the widespread adoption of AI frameworks across numerous contemporary technologies.

**1) DATA PRINCIPLE**

The Data Principle emphasizes the fundamental tenet of utilizing reliable and trustworthy information for AI development [78]. To guide entities in leveraging data suitable for specific AI system objectives, a set of key principles has been established. These principles, outlined in Table 1, focus on ensuring data quality, reliability, and representativeness.

**TABLE 1.** Data principle.

No.	Entity	Description
<i>Data used for Model Development</i>		
1.	Sources	Document the beginnings and ends of data used to create the AI system's models.
2.	Reliability	Evaluate the dependability of the data used to create the models.
3.	Categorization	Evaluate the attributes that are utilized to categorize data.
4.	Data variable evaluation	Examine the data variables used in the AI component models.
5.	Improving	Examine the use of synthetic, imputed, and/or augmented data.
<i>Data Used for System Operation</i>		
6.	Dependency	Examine the relationships and reliance of data streams used to power the AI system
7.	Bias [77]	Evaluate the dependability, effectiveness, and representativeness of the data used in the system's operation, including any possible biases, injustices, and other societal concerns related with the data used by the AI system.
8.	Data security and privacy	Evaluate the AI system's data security and privacy.

**2) GOVERNANCE PRINCIPLE**

Fostering responsible AI utilization by [78] is to ensure ethical and equitable implementation of AI systems, a set of key principles guides the responsible conduct of actors and organizations. As outlined in Table 2, these principles establish frameworks for managing and overseeing AI usage, promoting accountability and transparency.

**3) PERFORMANCE PRINCIPLE**

Aligning outcomes with objectives by [78] is to ensure AI systems deliver results aligned with intended program goals, established procedures guide their development and evaluation. As outlined in Table 3, these principles focus

**TABLE 2. Governance principle.**

No.	Entity	Description
<i>Governance at the Organizational Level</i>		
1.	Clear goals	Define specific goals and objectives for the AI system to guarantee desired outcomes are met.
2.	Roles and responsibilities	Define explicit roles, responsibilities, and authority delegation for the AI system to ensure effective operations, prompt corrections, and long-term oversight.
3.	Values	Demonstrate a commitment to the entity's values and principles in order to create public trust in the ethical usage of the AI system.
4.	Workforce	Recruit, train, and retain employees with diverse skills and expertise in AI system design, development, deployment, assessment, and monitoring.
5.	Involvement of stakeholders	To limit risks, include various opinions from a community of stakeholders throughout the AI life cycle.
6.	Risk management	Create an AI-specific risk management strategy to detect, analyze, and reduce risks.
<i>Governance at the Systems Level</i>		
7.	Specifications	Create and describe technical specs to guarantee the AI system performs as expected
8.	Compliance	Ensure that the AI system follows all applicable laws, rules, standards, and guidelines.
9.	Transparency	Increase transparency by allowing external stakeholders to access information about the AI system's design, operation, and limits.

on guaranteeing that AI systems effectively achieve their designed purposes.

**4) MONITORING PRINCIPLE**

To guide organizations in preserving the ongoing relevance and impact of AI systems, key strategies have been established for monitoring effectiveness, analyzing sustainability, and fostering increased adoption. Table 4 details these strategies.

**TABLE 3. Performance principle.**

No.	Entity	Description
<i>Performance at the Component Level</i>		
1.	Documentation	Provides a catalogue of model and non-model components, as well as operating requirements and parameters.
2.	Measures	Define specific, consistent, and reproducible performance measures.
3.	Evaluation	Evaluate all component's operation against stated metrics to ensure they perform as intended and are compatible with project targets and goals.
4.	Outputs	Determine whether the outcomes of every aspect belong for the AI system's operating context.
<i>Performance at the System-Level</i>		
5.	Documentation	Document the AI system's assessment techniques, performance indicators, and outcomes to provide visibility into its achievements.
6.	Metrics	Define exact, consistent, and comparable indicators of performance.
7.	Evaluation	Measure performance against predefined measures to ensure the AI system works as planned and is adequately secure.
8.	Bias	Identify the possible prejudices, injustices, and other issues in society that may arise as a result of the AI system.
9.	Human oversight	Define and build human oversight methods for the AI system to ensure responsibility

**IX. BENEFITS AND OPPORTUNITIES OF ARTIFICIAL INTELLIGENCE IMPLEMENTATION IN THE PUBLIC SECTOR**

The integration of AI into the public sector unlocks a plethora of opportunities and fosters transformative potential. By harnessing AI technologies, governments and public agencies can elevate operational efficiency, refine service delivery, and tackle multifaceted societal challenges. This growing trend presents a unique chance to reimagine public service, optimize resource allocation, and ultimately enhance citizen well-being. To illuminate this transformative potential, let us delve into some of the key benefits and opportunities associated with AI implementation in the public sector:

TABLE 4. Monitoring principle.

No.	Entity	Description
<i>Continuous Monitoring of Performance</i>		
1.	Planning	Create a strategy for ongoing or regular evaluation of the AI system to guarantee it operates as expected.
2.	Drift	Determine the specified range of information and model variation to ensure that the AI system achieves the intended outcomes.
3.	Traceability	To encourage traceability and transparency, document the findings of monitoring efforts as well as any remedial actions done.
<i>Assessing Sustainment and Expanded Use</i>		
4.	Ongoing evaluation	Evaluate the AI system's functionality to verify its significance in the current setting.
5.	Scaling	Determine whether or if the AI system can be extended or expanded outside its present application.

**A. BENEFITS OF ARTIFICIAL INTELLIGENCE IMPLEMENTATION IN THE PUBLIC SECTOR**

Integrating AI within the public sector unlocks many advantages and transformative potential, as comprehensively outlined in Table 5 [46].

Furthermore, AI integration within the public sector fosters enhanced government-citizen engagement and communication, leading to a burgeoning sense of citizen confidence and satisfaction in governance and service delivery. Ultimately, AI serves as a crucial catalyst for sustainability, empowering efficient utilization of natural resources and bolstering environmental governance across diverse sectors, including healthcare.

**B. OPPORTUNITIES OF ARTIFICIAL INTELLIGENCE IMPLEMENTATION IN THE PUBLIC SECTOR**

While numerous articles have alluded to the potential of AI in the public sector, the specific avenues for its implementation remain largely unexplored. Table 6 seeks to address this gap by enlightening key opportunities for AI integration across diverse public service domains.

The strategic deployment of AI presents a potent catalyst for accelerating the digital transformation of government, paving the way for more efficient and citizen-centric governance models. By harnessing the capabilities of AI, governments can unlock opportunities for enhanced resource stewardship, fostering a more responsive and adaptive governance approach, and ultimately, delivering superior citizen services.

However, navigating the ethical complexities of AI implementation remains paramount. Addressing concerns surrounding privacy, algorithmic bias, and potential

TABLE 5. Benefits of AI implementation in the public sector.

No.	Item	Description
1.	Improved Service Delivery [23], [45], [46], [47]	By automating repetitive jobs, cutting paperwork, and streamlining procedures, AI can improve the efficiency and efficacy of public service delivery. As a result, there may be quicker response times, less administrative work, and better citizen experiences. For example, some functions traditionally performed by healthcare personnel can be replaced by AI. Many administrative tasks performed by physicians or nurses are repetitive and require minimal cognition. AI applications could quickly replace these [44].
2.	Data-Driven Decision Making [45], [46], [47]	AI makes it possible to analyze vast amounts of data to produce insights and help decision-making based on solid facts. Public sector firms can make better-informed policy decisions and targeted actions by utilizing AI algorithms to find patterns, trends, and correlations in data.
3.	Predictive Analytics [46]	By examining historical data and finding patterns, AI can assist in forecasting future trends and results. This can be especially helpful in industries like healthcare, where AI systems can forecast disease outbreaks or pinpoint those at high risk for preventive measures.
4.	Cost Savings [45], [46], [47]	By automating manual procedures and lowering the demand for human resources, the use of AI in the public sector can result in cost savings. AI-powered chatbots, for instance, can respond to citizen inquiries, lightening the load on call centers and freeing up resources for more difficult duties.
5.	Better Public Security [46]	Engagement among governments, technology developers, public safety agencies, and the community is critical for realizing AI's full potential while resolving ethical concerns and maintaining public confidence. AI can greatly contribute to improving public safety by providing safer and more secure situations for everyone with careful design and appropriate deployment.

**TABLE 5. (Continued.) Benefits of AI implementation in the public sector.**

6.	Prevention and detection of fraud [47]	AI algorithms can detect defects and trends that suggest fraudulent activity, enabling recognition and avoiding instances of fraud in sectors such as tax evasion, social security, and government procurement.
7.	Enables the processing of large amounts of data in a limited time [45]	Which can be utilized to build intelligent networks for real-time data modelling, analysis, and prediction.

discriminatory outcomes is crucial to ensuring its responsible and equitable application within the public sector. Collaborative efforts across government agencies, technology developers, academia, and civil society are essential for maximizing the benefits of AI while safeguarding individual rights and interests [79].

**X. RECOMMENDATIONS FOR FURTHER STUDIES**

The integration of Artificial Intelligence (AI) in the public sector offers some scope for further study. Given the complexity and rapid development of AI technology, ongoing study is essential to fully understand its implications and improve implementation. Here are some key areas where further study could be beneficial:

**i. Impact of AI on Jobs in the Public Sector:**

Future studies may explore how the implementation of AI changes work roles and job patterns in the public sector. Studies may examine the balance between job replacement due to automation and job creation in new fields that utilize AI technology.

**ii. Cultural and Organizational Change:**

Further studies might analyze the cultural shifts necessary to facilitate AI acceptance in the lay sector. Research can focus on strategies for managing resistance to change and fostering an organizational culture that promotes technological innovation.

**iii. AI Ethics Implications:**

Ethical concerns relating to privacy, surveillance, and clarity of decisions in AI applications remain important areas of investigation. Additional investigation is needed to develop frameworks and guidelines to ensure ethical use of AI that respects citizens' rights and values.

**iv. AI and Basic Development:**

There is a need for studies that investigate how AI can influence the basic manufacturing process. Research can explore the role of AI in data-based decision making and its potential to increase the effectiveness and sensitivity of public policy.

**v. Technology and Infrastructure Challenges:**

Further investigation of technological barriers to AI implementation, including issues of data quality,

**TABLE 6. Opportunities of AI implementation in the public sector.**

No.	Item	Description
1.	Improving the quality of public services [45], [46], [47]	By providing decision assistance, accurate forecasts, and simulation of complex systems, AI can be utilized to improve the delivery of public services like transportation, public health and law enforcement.
2.	Fostering citizens' trust [45]	AI applications in government can improve government-citizen contact and communication, resulting in enhanced citizen trust in governance and public service quality.
3.	Increasing efficiency and effectiveness [45], [46], [47]	AI technologies can help to optimize service delivery, increasing the efficiency and effectiveness of government operations.
4.	Generating policy insights [45], [47]	Governments can use AI to generate insights and simulate various policy possibilities, allowing for experimentation and better decision-making.
5.	Advancing sustainability [45]	The application of AI in government has the potential to contribute to a sustainable environment and natural resource management, for example, by revolutionizing the energy sector and improving cities' natural resource management.
6.	Cost Savings [46], [47]	Implementation of AI in government can save money by automating manual operations and lowering the demand for human resources. Chatbots enabled by AI, for example, may address citizen questions, decreasing the pressure on contact centers and freeing up employees for more difficult duties.
7.	Predictive Analytics [45]	By studying historical data and recognizing patterns, AI can assist anticipate future trends and outcomes. This is especially important in fields like healthcare, where AI systems can forecast disease outbreaks and identify high-risk patients for preventative treatment.

integration with existing systems, and cyber security, will provide valuable insights. The study may also assess infrastructure improvements needed to support a robust AI system.

**vi. Long-Term Results and Impact:**

Long-term studies would be useful for assessing the long-term impact of AI on public sector efficiency, service delivery, and citizen satisfaction. Research like this will help in understanding the benefits and ongoing challenges of AI over time.

**vii. Comparative Study Between Sectors:**

Research that compares the implementation of AI in various public sectors (e.g., health, education, transportation) may reveal unique challenges and benefits associated with each sector. This will help in devising customized AI strategies for each area of public service.

**viii. International Comparison:**

Comparative studies with other countries that are at the same or different stages in AI adoption can provide lessons and insights that can be applied in the Malaysian context. This includes learning from the triumphs and challenges faced by these countries.

## XI. SUMMARY

This article, “Malaysia Public Sector Challenges of Implementation of Artificial Intelligence (AI),” delves into the complexities of integrating AI technology into the Malaysian public sector. It comprehensively explores crucial aspects of AI implementation, offering a valuable roadmap for navigating this transformative endeavor.

The introduction lays the groundwork by defining AI implementation, highlighting its potential to enhance public sector performance and efficiency, and identifying key challenges. It then paints a picture of Malaysia’s current AI implementation landscape, grounding the reader in existing research and outlining the field’s progress and hurdles.

A central focus of the article is the intricate tapestry of challenges that impede AI implementation. It meticulously dissects issues such as regulatory frameworks, data protection concerns, organizational inertia, and lack of AI expertise, proposing actionable solutions for each. The article further underscores the critical role of governance, emphasizing the government’s dual responsibility: guiding AI development and encouraging its responsible application.

In a pivotal move, the article proposes a bespoke AI framework tailored to the Malaysian public sector. It meticulously details the framework’s essential components and considerations, empowering policymakers and practitioners alike. Finally, it paints a vivid portrait of the potential rewards reaped from successful AI implementation: heightened public service efficiency, data-driven decision-making, and innovative service delivery models.

Overall, this article serves as a powerful guide, leading readers through the intricacies of implementing AI in the Malaysian public sector. It not only lays bare the challenges that lie ahead, but also illuminates the path towards a

future where AI fuels transformative change and propels the Malaysian public sector to new heights of performance and efficiency.

## XII. OUR CONTRIBUTION

The article presents a comprehensive analysis of the difficulties and possibilities associated with the integration of artificial intelligence (AI) in Malaysia’s public sector. It specifically emphasises the need to overcome barriers in order to improve operational effectiveness and the quality of public services. This paper provides significant contributions to the topic of AI implementation in the public sector of Malaysia. Firstly, it identifies and comprehensively analyses the primary obstacles hindering the integration of AI, such as legislative constraints, data protection concerns, and organisational stagnation. Furthermore, it emphasises the pivotal role of the government in directing the development of AI and guaranteeing its appropriate implementation. Furthermore, the study suggests a customised AI framework designed expressly to meet the distinct requirements of the Malaysian public sector. This framework provides practical solutions that can be implemented by policymakers and practitioners. Ultimately, it highlights the possible advantages of effectively implementing AI, such as improved efficiency in public services and the introduction of creative service methods. This serves as a good guide for future AI projects in Malaysia.

## XIII. CONCLUSION

A comprehensive and analytical study technique is crucial for gaining understanding, resolving issues, and making well-informed decisions about the implementation of AI in the public sector. This approach entails a thorough examination and assessment of available data to explain the complexity associated with the application of artificial intelligence. Such an approach is essential for producing accurate evaluations, particularly in the complex realm of AI adoption, particularly inside Malaysia’s public sector.

The main objective of this research is to investigate the challenges and opportunities related to the integration of AI in Malaysia’s public sector. The focus is on overcoming barriers in order to improve operational efficiency and the quality of public services. Artificial Intelligence (AI) is quickly revolutionising government agencies and institutions by redefining the way governance, service delivery, and decision-making are approached. Public bodies can achieve unprecedented levels of efficiency and effectiveness by leveraging the potential of AI to analyse large datasets, develop predictive insights, and automate processes. Applications span a wide range of uses, including using data analysis to forecast and prevent crime, providing personalised services to citizens, and formulating policies based on data. Artificial Intelligence (AI) has the capacity to optimise the allocation of resources, facilitate transparent governance, and improve public involvement.

Nevertheless, the use of AI also gives rise to substantial ethical questions, privacy issues, and the potential for algorithmic biases. To tackle these problems, it is necessary

to take proactive steps to ensure that AI is implemented in a responsible and fair manner. In order to enable reliable deployment of AI in the public sector, it is necessary to solve difficulties such as data quality, algorithmic transparency, and bias. While AI has the potential to automate ordinary activities, enhance staff capacities, and create more time for complex work, these challenges must be overcome.

In order to facilitate the appropriate implementation of AI in the public sector, additional research is required to investigate the consequences of AI in governance and to tackle the challenges associated with interpreting AI outputs. It is crucial to examine the possibilities of AI in improving the design of government services. Prioritising transparency, fairness, and developing citizen trust is essential in the implementation of AI-powered public services. By employing an analytical research technique, the study may methodically examine these issues, offering significant insights on the efficient implementation of AI in Malaysia's public sector.

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