

Framework

Artificial Intelligence Adoption Framework



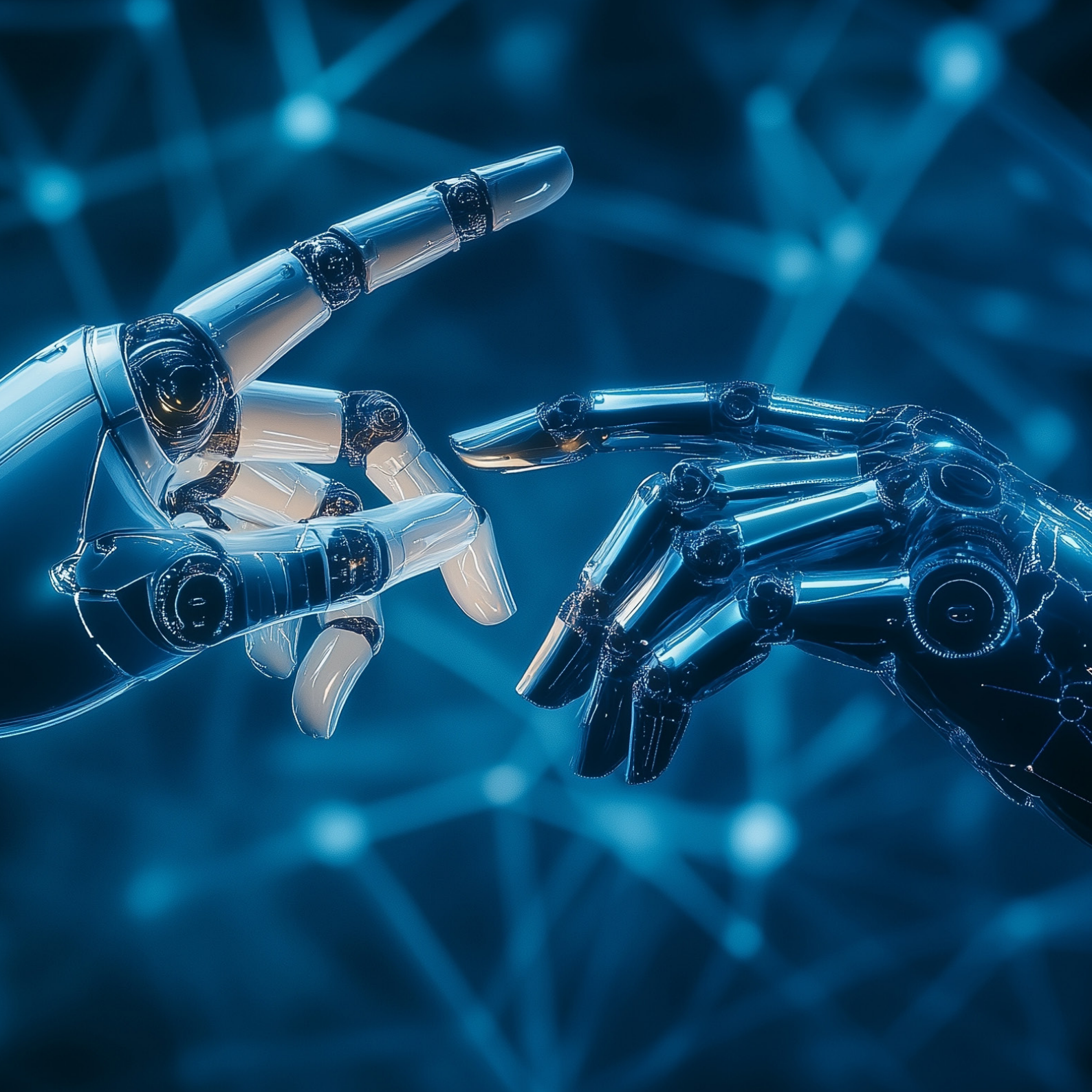


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1.Introduction

The world is undergoing a profound transformation fueled by advancements in AI technologies. These technologies have become a powerful force in reshaping the landscape of the economy and society, redefining enterprise roles, modes of service delivery, and decision-making processes. They have progressed from theoretical ideas or experimental tools to practical applications across diverse fields, including healthcare, education, industry, transportation, government, and financial services, establishing themselves as key pillars of the Fourth Industrial Revolution.

AI technologies are no longer a delayed future option, but a competitive necessity for countries and organizations wishing to achieve operational efficiency, enable innovation, provide more proactive and reliable services, and enhance the investment of data as a national asset. These technologies are expected to play a pivotal role in addressing development challenges, raising the quality of life, and enhancing governments' readiness for the future, especially as global changes accelerate and data-driven models become increasingly used in planning and policy-making.

Amid these rapid advancements, Saudi Arabia recognizes the enormous potential of AI in supporting the objectives of the Saudi Vision 2030, stimulating its digital economy, and strengthening its position as a global leader in technology and innovation. Through its National Strategy for Data and AI, Saudi Arabia has embraced an ambitious strategy to harness these technologies for effective problem-solving, fostering new avenues for growth, and achieving lasting economic and social impact, while emphasizing the need to uphold the highest standards of governance, privacy, and ethics for their responsible and secure use.

In its capacity as a key national enabler of data and AI, the Saudi Data & AI Authority (SDAIA) presents this comprehensive guidance framework to facilitate the adoption of AI technologies across both government and private sectors. The framework is grounded in SDAIA's organizational mandate, as established by the Council of Ministers Resolution No. (292), dated 27/4/1441 AH, which designates SDAIA as the national authority on all matters related to data, including big data and AI, across regulation, development, oversight, and integration. This framework is designed to help entities take confident, strategic steps toward AI adoption and to guide technology investments for maximum impact, reinforcing Saudi Arabia's global digital leadership.

1.1 Purpose

This framework aims to accelerate smart transformation in government and private entities through the systematic and responsible adoption of AI technologies, in alignment with national priorities and with the goal of achieving tangible and sustainable impact. The framework focuses on developing an integrated enterprise and technological environment that includes a flexible infrastructure, clear organizational structures, and supportive policies that enable the implementation of effective, measurable solutions.

The framework also offers practical tools for planning, implementation, and assessment, boosting the readiness of government and private entities while helping align adoption efforts with national strategic goals. It places special emphasis on developing human capacity, reinforcing enterprise governance, and maintaining a strong commitment to national values.

This framework serves as a comprehensive practical guide to assist entities in designing and implementing AI initiatives, generating added value, improving spending efficiency, and positioning technology as a core driver of a competitive and sustainable knowledge economy.

1.2 Target Audience

The AI Adoption Framework is intended as a practical guide tailored to address the needs of two primary categories:

Government Entities

The framework aims to support the integration of AI technologies within strategies, enhance digital infrastructure, and activate enterprise governance to ensure national impact.

Policymakers and Legislators

The framework aims to assess the ecosystem's readiness, identify regulatory gaps, and develop legislative and ethical frameworks that support the responsible use of AI and promote a balance between innovation and societal protection.

1.3 Scope

The AI Adoption Framework covers a comprehensive enterprise scope that encompasses all components of adoption within government and private entities and provides practical guidance for planning, implementation, and evaluation within regulatory and technical contexts. This involves establishing the enterprise and technological foundations, enhancing human capacity, and developing models and techniques that have a measurable impact on service quality, operational efficiency, and economic outcomes.

The framework targets all government and private entities, regardless of their specialties and levels of digital maturity. It takes into account variations in sectoral and operational contexts, thereby providing entities with flexibility in implementation without compromising the principles of systematic adoption. The framework focuses on AI applications based on structured and unstructured data, including predictive systems, natural language processing, image and video analysis, intelligent automation, and other technologies that have a direct impact on performance improvement.

The framework does not address theoretical scientific research unless it has direct practical application. It also does not establish detailed technical standards but rather provides guiding principles and enablers to support entities in making decisions aligned with their enterprise context.

1.4 Methodology

The AI Adoption Framework has been developed through a comprehensive analytical methodology that takes into account the unique national context of Saudi Arabia and is based on global best practices and leading trends in the field. The methodology aims to ensure that the framework aligns with the actual needs of national entities and to enhance their capacity to adopt AI technologies in a scientific and structured manner that reflects Saudi Arabia's aspirations for responsible digital transformation.

The development process began with a set of integrated steps, such as assessing the current landscape of AI adoption within national sectors, identifying related challenges and opportunities, and conducting benchmark comparisons with international frameworks to uncover performance gaps and draw on global best practices. In-depth interviews were also conducted with a group of local and international experts and practitioners to support the development of a well-rounded framework, ensure its inclusivity, and align it more closely with the enterprise realities of Saudi Arabia. **Figure (1) shows the sequence of stages of the development of the framework for the AI adoption.**

Figure 1: Stages of development for the AI Adoption Framework**Current State Analysis**

The current state of local and national indicators and frameworks specialized in measuring readiness and the level of adoption of digital transformation initiatives has been analyzed.

Benchmarking

Benchmarking was conducted against international indicators and experiences to benefit from global best practices.

Expert and Specialist Interviews

Interviews were conducted with experts and specialists to gather insights and experiences in support of the index development.

Developing the National AI Index

The National Artificial Intelligence Index was developed based on analyses and standards to ensure its alignment with national needs.

Lessons Learned Analysis

Lessons learned from local and international experiences were identified and analyzed to enhance the quality of the index.

1.5 The Need for a Framework

Even with major advancements in AI, the mere presence of the technology does not ensure its effective implementation or success within an entity. Effective adoption of these technologies requires an integrated enterprise environment built on strategic and operational foundations, and supported by appropriate regulatory and operational frameworks to ensure safe and sustainable implementation. International and local experiences indicate that the real impact of AI is closely tied to an entity's readiness and the availability of enablers that support technological expansion, enterprise maturity, and effective governance.

In this context, there is a clear need to develop an operational and assessment framework that enables entities to measure their enterprise maturity in AI, identify strengths and areas for improvement, and establish a realistic roadmap for implementing technology initiatives.

This framework is built upon three interconnected pillars:

- ▷ **Directions:** It covers the strategic and enterprise aspects, including the clarity of vision and goals, the quality of technology initiative design, the effectiveness of governance frameworks, and the degree of adherence to them.
- ▷ **Enablers:** It covers the infrastructure and enabling factors, such as the size, specialization, and continuous growth of the human workforce; the availability, quality, and reliability of data; and the robustness, adaptability, and maturity of technical systems.
- ▷ **Outcomes:** Outcomes reflect the actual results of AI adoption, demonstrated through the efficiency of developing and deploying technical models, the presence of effective mechanisms for monitoring, security, and technical governance, and the impact of AI on enterprise performance, such as cost reduction, improved service quality, and enhanced resource sustainability.

The framework adopts a gradual approach to enterprise maturity, enabling entities to align AI initiatives with strategic objectives and achieve real integration between technology and governance. This positions AI as a catalyst for effectiveness, not a risk factor, and as a key enabler of long-term enterprise innovation.

The framework is not merely an operational tool; it is a smart transformation system that helps build a flexible, automated, data-driven government environment capable of leveraging AI efficiently. This trend aligns with the Saudi Vision 2030, which aims to foster a digital, knowledge-based, and innovation-driven economy.

Directions		Enablers			Outcomes	
Strategy	Governance	Data	Infrastructure	Human capacity	Applications	Impact
Plan and Performance	Frameworks and Policies	Availability and Access	Technical Standards	Number and Diversity	Development and Deployment	Operational Efficiency
Initiatives	Organizational Empowerment	Quality and Integration	Availability and Follow-Up	Professional Development	Privacy and Safety	Employee Productivity
Budget	Trustworthiness and Safety	Reliability	Operational Flexibility	Academic Cooperation	Operation and Management	Service Quality Enhancement
	Regulatory Compliance			Job Stability		

2. AI in Brief

AI is considered one of the major accomplishments of the digital era, becoming a core technological pillar that redefines how we live and work. Far from the stereotypes of the past, AI is no longer just a futuristic ambition or a set of theoretical ideas; it has become a tangible reality, with applications visible in our daily lives, from smart assistants and recommendation apps to big data analytics, medical diagnostics, and business automation.

Although the term “artificial intelligence” was introduced in the mid-20th century, its meaning has evolved rapidly, driven by massive advances in computing power, data availability, and algorithm development. Today, the term refers to a wide range of systems capable of performing tasks that typically require human intelligence, such as learning from data, logical reasoning, language understanding, and decision-making.

This section marks the entry point to exploring the fundamental conceptual and technological layers of AI by reviewing common definitions and the key technologies shaping its structure. It enables entities to gain a clearer understanding of AI as a crucial first step toward responsible and effective adoption.

2.1 AI Definition

Although theoretical definitions of AI vary, they generally center on the ability of computing systems to perform tasks that imitate human behavior or require human-like intelligence, such as learning, inference, and decision-making.

Drawing from the current practical applications, AI systems may be defined as:

Software systems that rely on advanced technologies to predict, generate content, provide recommendations, or make decisions, with varying levels of autonomy, depending on the data and the context in which they operate.

This definition highlights the functional nature of AI and reflects the broad range of its use, from simple tasks to complex operations, positioning it as one of the most influential technological enablers of our time.

2.2 AI Technologies

AI relies on a set of advanced technologies that enable it to analyze data, learn from it, interact with its environment, and make intelligent decisions. At the core of these technologies is machine learning, which forms the foundation of many modern applications. This technology allows systems to learn from data and improve performance autonomously, without being explicitly programmed. Machine learning comes in several forms: supervised learning (from labeled datasets), unsupervised learning (from unlabeled data), and reinforcement learning (which uses environmental feedback through trial and error to optimize outcomes).

Within this field, deep learning has emerged as a breakthrough technique based on multi-layered neural networks. It is used to process complex data such as text, images, and audio, powering major advances in AI.

Another key technique is Natural Language Processing (NLP), which enables systems to understand and generate human language. Applications include machine translation, text generation, and question answering, all contributing to more natural, seamless human-machine interaction.

In the visual domain, computer vision allows systems to “see” and interpret content by recognizing objects and people in images and video, making it useful in security, healthcare, autonomous vehicles, and other areas.

Speech processing technologies also play a pivotal role in converting speech to text and vice versa, enabling the development of voice-based interfaces that rely on spoken commands. These are now used in smart assistants and accessibility applications for individuals with disabilities.

As AI continues to integrate with physical systems, intelligent robots have emerged, combining software-driven analysis with physical movement. These include industrial robots used on production lines and service robots deployed in commercial or personal settings.

One of the most transformative developments in recent years is Generative Artificial Intelligence (GenAI), which has redefined the field. This technology creates new content, such as text, images, music, and code, based on the data the model has been trained on. GenAI is among the fastest-growing and most influential branches of AI due to its creative potential, time-saving capabilities, and productivity enhancement, with growing use in education, healthcare, media, and government services.

This broad spectrum of technologies forms the foundation for understanding and adopting AI effectively. Familiarity with these technologies is essential for developing integrated strategies that leverage AI's full potential while considering regulatory, ethical, and operational frameworks.

2.3 AI Applications

AI is a strategic tool capable of driving transformative change in entities by enhancing operational efficiency, improving service quality, and facilitating data-driven decision-making. Rather than relying on traditional methods for task execution and service delivery, AI provides advanced capabilities for processing vast amounts of data, identifying patterns, predicting needs, and interacting intelligently with users.

Government and private entities can use AI to automate routine administrative tasks, shorten processing times, and improve the overall user experience. It can also help optimize resource allocation by predicting risks or prioritizing needs with greater precision. AI technologies also support decision-makers by analyzing data from multiple sources and offering recommendations based on accurate predictive models, enhancing planning and public policy effectiveness.

Beyond operational improvement, AI enables innovation by helping develop new services, offering creative solutions to societal challenges, and increasing agility in responding to rapid changes. It also strengthens governance by enhancing transparency, detecting risks early, and reducing human error in oversight processes.

Through the responsible and integrated use of AI, government and private sectors can build more responsive and efficient environments that foster public trust and deliver measurable impact on both economic and social levels, aligned with the aspirations of digital transformation and Saudi Vision 2030.

2.4 Challenges and risks

While AI offers unprecedented opportunities to reimagine systems and services, its widespread adoption is not without structural, technical, and ethical challenges that must be seriously addressed. One of the most critical challenges lies in the nature of data, the core driver of AI models. Poor data quality or lack of consistency and integration across sources can result in inaccurate or biased outputs, undermining the reliability and impact of intelligent systems. Another challenge involves the opacity of AI algorithms, which often function as “black boxes” with unclear decision-making processes. This raises serious concerns about transparency and accountability, especially when such systems influence decisions that directly affect individuals or society.

A further challenge is the shortage of specialized talent. Developing and operating AI models requires a blend of skills in data science, engineering, and digital policy, compelling institutions to invest in national capacity building and create environments that attract and retain AI talent. At the enterprise level, AI demands a fundamental shift in how services are designed and decisions are made, requiring cultural and organizational transformation, guided by strong leadership, flexible infrastructure, and readiness to adopt new governance models that balance innovation with enterprise control.

Ethical concerns are also central, particularly issues related to fairness, privacy, and unintended discrimination. As content generation and decision-making systems become more prevalent, the need for clear and actionable ethical frameworks becomes essential, not a regulatory luxury, to ensure these technologies remain human-centered and foster public trust in institutions using them. In this context, an entity’s ability to address these challenges is closely linked to its level of digital maturity, organizational awareness, and capacity to anticipate risks through well-considered adoption strategies that strike a balance between technological enablers and enterprise safeguards.

Concept of AI Adoption Framework

AI adoption is a systematic process focused on embedding AI technologies and systems into an entity’s operations, services, and decision-making to improve efficiency, foster innovation, and ensure greater reliability. Adoption goes beyond the mere use of technical tools as it involves building enterprise capabilities, developing digital infrastructure, and preparing the legal and regulatory environment to ensure that the use of these technologies delivers real and sustainable value.

Effective adoption includes several stages: identifying opportunities and challenges, designing appropriate solutions, implementing them in practice, and continuously evaluating and improving outcomes. Successful adoption also requires engaging all relevant stakeholders within the entity, promoting a culture of data and AI, and ensuring alignment with national values and frameworks.

3. Directions

3.1 Strategy

Leading organizations in the field of AI adopt ambitious strategic visions aimed at deeply integrating these technologies into their core operations and activities, in pursuit of sustainable growth and enhanced innovation capacity. These organizations are redesigning their operating models based on big data and advanced analytics, which contributes to improving operational efficiency, reducing costs, and enhancing service quality. They also focus on improving customer experience by analyzing behavior and needs to deliver personalized AI-powered services that boost loyalty and satisfaction. AI is employed as a strategic tool to create added value for stakeholders, respond flexibly to market changes, and strengthen competitive positioning.

An AI strategy is crucial for institutions, serving as a roadmap to guide efforts toward maximizing the value derived from AI technologies, supporting strategic objectives, operational excellence, and competitive advantage. A 2017 global survey revealed that 60% of executive leaders emphasized the critical importance of an AI strategy in enabling enterprise transformation, increasing financial returns, and improving performance and productivity by deeply understanding enterprise data and using it to automate processes and enhance products.

In contrast, the absence of a clear AI strategy may lead to experiments lacking strategic value and reduce the likelihood of successful AI adoption.

Concept of AI Strategy

AI Strategy is a long-term plan that outlines the entity's vision for leveraging and utilizing AI to achieve its overarching goals and build a competitive advantage. It includes a set of guiding principles and measurable practices that support understanding AI initiatives, identifying added value, priorities, capabilities, and needs, as well as defining actions, timelines, and the governance structures necessary for implementation and successful AI adoption.

3.1.1 Planning and Performance

Planning and performance are two essential components of an AI strategy, serving as a guiding framework that aligns all efforts toward achieving clear and measurable goals. By developing a well-structured plan grounded in a long-term strategic vision, an entity can define the overall direction for AI deployment and identify priority areas where real value can be generated.

The plan and vision help foster a shared understanding across the entity regarding the purpose of AI adoption, while facilitating effective allocation of resources and technology investments aligned with strategic objectives. They also ensure that AI initiatives are linked to broader enterprise goals, whether in improving operational performance, enhancing customer experience, or supporting data-driven decision-making.

To ensure full integration of AI into enterprise direction, the following steps are recommended for building a clear and sustainable strategy:

- ▷ **Developing a Comprehensive AI Strategy Document :** A detailed document should be prepared to define the long-term vision, priority areas, and expected outcomes from AI implementation. This document should be built on a sound understanding of the entity's objectives and technical and human capabilities.
- ▷ **Aligning the Plan with National Strategies:** The AI strategy should be linked to national plans such as Saudi Vision 2030 and the National Strategy for Data and AI (NSDAI) to ensure coherence and support integration between enterprise and national efforts.
- ▷ **Defining Key Performance Indicators (KPIs):** A set of performance indicators should be adopted to measure implementation effectiveness, such as the number of smart projects executed, the percentage improvement in service quality, and the degree to which enterprise objectives are achieved through AI.
- ▷ **Preparing a Timeline Roadmap:** A clear timeline should be developed, covering the planning, launch, expansion, and evaluation phases, with responsibilities and required resources specified for each stage.

Simplified Practical Example:

The entity develops a document titled "AI Strategy," which includes a two-year timeline that specifies when pilot projects will be launched and when systems will be applied. These phases are linked to the achievement of service-related objectives and quality improvements.

3.1.2 Initiatives

Based on the strategic vision and plan for AI adoption, initiatives represent the next phase in transforming theoretical direction into a tangible, practical reality. These initiatives serve as implementation tools that translate strategic objectives into actionable projects capable of delivering real impact on the entity's performance and efficiency.

Many entities today are implementing a variety of AI initiatives that span operational, strategic, and experimental goals. These initiatives may include, for example, process automation to reduce manual tasks and increase efficiency, or the development of intelligent recommendation systems that provide personalized services and products based on customer behavior. Such initiatives reflect a multidimensional approach that combines internal performance improvement, user experience enhancement, and innovation exploration, all aimed at achieving sustainable competitive advantage.

To ensure the integration of AI within enterprise directions, the development of a clear and sustainable strategic plan generally involves the following steps:

- ▷ **Designing and Implementing Initiatives Targeting Real Use Cases:** Clear priorities should be established by launching AI projects that address practical use cases, such as traffic congestion prediction, automated responses to inquiries, and fraud detection and prevention. These initiatives should be based on actual user needs or existing operational challenges.
- ▷ **Linking Each Initiative to Specific Performance Indicators:** Each initiative should be associated with a set of measurable outputs, such as the number of work hours saved, the percentage improvement in beneficiary satisfaction, and the accuracy of models used in predictive or analytical scenarios.
- ▷ **Implementing a Regular Review Mechanism :** A quarterly evaluation system should be adopted to assess initiatives' performance. This is carried out in coordination with digital transformation teams and operational units to ensure responsiveness to developments and adjust the approach as needed.
- ▷ **Ensuring Alignment with National and Enterprise Priorities:** Each initiative should reflect the broader directions of the entity or the state, including national transformation initiatives, in order to ensure coherence, avoid fragmentation of efforts, and prevent duplication.
- ▷ **Preparing a Timeline Roadmap:** A clear timeline should be developed, covering the planning, launch, expansion, and evaluation phases, with responsibilities and required resources specified for each stage.

Entities adopting AI can enhance the effectiveness and sustainability of its applications by adopting a comprehensive ecosystem of Key Performance Indicators (KPIs) that cover operational, financial, and ethical dimensions.

This ecosystem covers the following:

- ▷ **Measuring Internal Adoption Rates:** This involves assessing the extent to which intelligent solutions are being used within the entity, through the analysis of actual usage data, employee surveys, and evaluation of training and capacity-building levels.
- ▷ **Monitoring the Accuracy of Predictive Models:** Metrics such as classification accuracy can be used to evaluate the reliability of models, with regular assessments conducted to ensure their continued relevance in changing environments.
- ▷ **Tracking the Transition of Projects from Pilot to Production:** The move from experimental stages to implementation may serve as an indicator of enterprise maturity and system readiness for wide-scale AI deployment.
- ▷ **Evaluating Economic Impact:** This includes measuring Return on Investment (ROI) and the extent to which AI contributes to improved operational efficiency.
- ▷ **Ensuring Compliance with Ethical Principles:** AI applications should adhere to standards of transparency, fairness, and privacy protection. Regular reviews are conducted to reinforce public trust and ensure responsibility and long-term sustainability.

In adopting AI, entities may also apply a robust enterprise approach to managing initiatives, thereby ensuring maximum impact and sustainability in implementation. This may be achieved through adherence to the following practices:

- ▷ **Conducting Regular Quarterly Reviews:** Specialized committees should be formed to carry out periodic reviews of each AI initiative, using KPIs tailored to reflect the specific objectives of each project. This ensures continuous oversight and precise guidance.
- ▷ **Analyzing Results and Identifying Development Paths:** These reviews should include a detailed analysis of achieved results, a careful assessment of success factors and challenges, and the proposal of development plans or strategic adjustments as needed, enhancing adaptability and ongoing improvement.
- ▷ **Utilizing Interactive Digital Dashboards:** Real-time data monitoring systems are recommended through the use of interactive digital dashboards. These enable decision-makers to track progress instantly and make informed, timely decisions based on accurate and up-to-date data.
- ▷ **Continuously Aligning with Strategic Objectives:** Every AI initiative should be subject to continuous evaluation regarding its alignment with the entity's strategic directions and goals, especially in dynamic environments that require flexible and swift responses.

The strategic AI implementation plan can be divided into three interrelated phases, reflecting a logical adoption progression while maintaining the flexibility necessary to keep pace with technological developments.

- ▷ **Short Term (1 to 2 years):** The first phase focuses on quick wins by automating routine processes and activating predictive analytics to support decision-making, thereby improving efficiency, reducing costs, and enhancing performance quality.
- ▷ **Medium Term (3 to 5 years):** This phase involves expanding usage toward more advanced applications such as smart products and services, with investments in specialized skills development, digital infrastructure, and innovation-supporting teams.
- ▷ **Long Term (Over 5 years):** This phase aims for a fundamental transformation through the development of intelligent systems capable of self-learning and adaptation, enhancing the entity's readiness for emerging technologies such as quantum computing and advanced AI via R&D investment and strategic global partnerships.

Simplified Practical Example:

The entity launches a big data analysis initiative to improve resource allocation. Results are assessed quarterly, and the model is updated based on feedback and actual outcomes.

3.1.3 Budget

The budget is a key element in turning technological aspirations into tangible outcomes. This requires allocating sufficient financial and human resources, adopting flexible investment models that encourage innovation, and ensuring long-term sustainable returns.

Leading institutions embody this approach through a growing strategic commitment to accelerating digital transformation, directing well-planned investments that create lasting impact. This commitment relies on the effective integration of technological and human resources and the promotion of innovation in an ever-evolving environment. Among the main directions adopted by these institutions are:

Allocating an Independent Annual Budget: Introducing a dedicated financial item within the entity's budget for AI initiatives to ensure continuous funding away from unstable or emergency sources.

Allocating Resources for R&D: Dedicating part of the budget to support research and development activities, including pilot experiments, model testing, and emerging technology assessments to foster innovation and discover scalable future solutions.

Linking Investment to Enterprise Objectives: Ensuring funding aligns with the enterprise transformation vision by supporting strategic projects related to performance enhancement, data enablement, and service efficiency, rather than isolated tech initiatives with limited impact.

Integrating Investment into Enterprise Governance: Including AI investments in the overall organizational plan, and reporting on them periodically to higher administrative councils or relevant regulatory bodies to ensure transparency and effective financial governance.

Simplified Practical Example

The entity establishes an "AI Innovation Funding Program" with an annual allocation of SAR 5 million to support internal projects and university partnerships for experimental AI solutions, reviewed yearly.

3.2 Governance

With the accelerated adoption of AI technologies across government and private sectors, there is a growing need for an effective governance framework to ensure responsible and disciplined use. AI is not just a technological advancement, but rather a force that reshapes decision-making and directly impacts individuals, society, and the economy. Thus, governance becomes an enterprise necessity, enabling entities to leverage AI capabilities effectively while maintaining transparency, privacy, fairness, and accountability.

Concept of AI governance

AI governance refers to a set of frameworks, policies, and enterprise structures that regulate the development and deployment of AI technologies within the entity, outlining roles, responsibilities, decision-making, and oversight mechanisms. Its aim is to ensure compliance with local and international regulations and promote safe, fair, and responsible AI use through regular policy updates and adoption of best practices locally and globally.

3.2.1 Frameworks and Policies

Enterprise AI governance is a core element to ensure the organized and responsible use of intelligent technologies within an entity, enhancing commitment to ethical values and legal standards. This commitment strengthens the institution's capacity to develop trustworthy AI solutions that respect Saudi Arabia's cultural and developmental specificity, build public trust, and support sustainable enterprise excellence, in alignment with national digital transformation goals. To achieve this effectively, the following steps are recommended:

- **Designing a Comprehensive Internal Governance Model:** An organizational model should be developed to clearly define roles, responsibilities, and decision-making mechanisms related to AI projects. This ensures clarity of accountability lines and rapid response to regulatory challenges.
- **Aligning Frameworks with National Standards:** Compliance should be ensured with the “AI Ethics Principles and Controls” as the foundational reference that ensures transparency, fairness, and accountability in all stages of intelligent system development. Entities are also obligated to implement the “Personal Data Protection Law” and its Implementing Regulations, along with a set of specialized guidance documents.
- **Conducting Periodic Reviews and Continuous Updates:** Governance models should be updated regularly in response to technological and regulatory developments, using both local and global benchmarks to enhance performance and anticipate future challenges.
- **Implementing a Comprehensive Performance Indicator System:** A set of indicators should be developed to measure ethical, regulatory, and operational effectiveness of AI governance. These may include: the number of projects undergoing risk assessment, audit outcomes, employee awareness of governance policies, and the impact of governance on innovation, coordination quality, and customer satisfaction.

Simplified Practical Example

The entity establishes an AI governance framework titled “AI Management Model,” which is updated annually based on recommendations from SDAIA and the experiences of other entities. The structure includes a supervisory committee, an implementation unit, and a compliance officer.

Policies and procedures form the backbone of AI governance, defining decision-making mechanisms, access controls, risk management processes, and output quality assurance in line with enterprise values. To ensure robust legal governance capable of addressing future AI challenges, the entity should develop a clear internal policy system rooted in a solid legal framework. The following steps are recommended:

- ▷ **Establishing Internal Legal Policies Defining Responsibilities:** Policies and procedures should be formulated to regulate legal frameworks to deal with possible errors or damages resulting from the use of artificial intelligence systems, including determining who is responsible for the decision or outcome.
- ▷ **Analyzing Legal Gaps:** The national legal framework should be reviewed, and gaps or uncovered aspects should be identified in the context of emerging technologies, aiming to avoid future legal ambiguity or conflict.
- ▷ **Relying on Modern Contractual Models:** Updated legal contracts should be used that include clear clauses on intellectual property rights, privacy protection, and liability resulting from using intelligent systems, aligning with ongoing technological and legal developments.
- ▷ **Constantly Updating Policies:** Changes in local and international regulations related to AI should be monitored, and legal policies and procedures should be updated accordingly, ensuring ongoing compliance and reducing risks.

Simplified Practical Example

The entity is adopting an internal legal protocol containing liability clauses for recommendation system outcomes and reviewing it in collaboration with the legal advisor and the general legal department.

3.2.2 Organizational Empowerment

Legal readiness is a fundamental pillar for ensuring the safe and effective handling of legal challenges accompanying the use of AI technologies. This includes protecting intellectual property rights, accurately defining legal responsibilities, and developing clear mechanisms for responding to potential disputes, which contribute to a stable and secure operational environment.

With the increasing complexity and continuous transformation of AI technologies, every smart project becomes a potential source of risks such as algorithmic bias, cyber violations, and privacy concerns. In this sense, legal readiness and prior risk assessment become a strategic necessity. It is recommended, in this context, to adopt a set of preventive measures, the most prominent of which are:

Conducting Comprehensive and Structured Risk Assessments: Systematic evaluations should be conducted across all use cases before adopting any AI system, aiming to identify critical points and potential challenges related to safety, fairness, or regulatory compliance.

Utilizing Smart Digital Monitoring and Analysis Tools : Advanced analytical systems should be used to automatically classify and monitor risks, including machine learning tools that continuously detect and track early indicators of potential threats.

Unifying Documentation Through Interactive Dashboards: Risk assessment results should be documented in unified dashboards, accessible to governance, cybersecurity, and technology departments, to facilitate rapid decision-making and prompt corrective action.

Aligning Assessments with National Frameworks: Enterprise risk evaluations should be aligned with the AI Risk Assessment Framework issued by the Saudi Data & AI Authority (SDAIA), ensuring that internal practices conform to national directions.

Simplified Practical Example

When developing a smart customer service assistant, bias and quality assessments are carried out, and the outcomes are recorded in a dashboard connected to compliance, data, and technology departments. This integration supports faster decisions and responsive system updates.

3.2.3 Reliability and Safety

AI reliability and safety are concerned with ensuring that systems operate efficiently and deliver accurate and consistent results while minimizing errors and potential risks to individuals or other systems. This is achieved through regular testing, auditing, and the enforcement of strict security protocols.

To ensure reliability and safety, entities should implement an integrated oversight framework that aligns technological solutions with national standards, enhancing trust and reducing organizational and technological risks. Recommended steps include:

Verifying Full Regulatory Compliance: AI systems should be checked to ensure compliance with national regulations, such as the Personal Data Protection Law (PDPL), the Generative Artificial Intelligence Guidelines for Government, and the Generative Artificial Intelligence Guidelines for Public. This compliance should be documented in project reports.

Raising Awareness and Training Employees: Regular training programs should be delivered to keep staff updated on regulatory changes related to privacy and cybersecurity.

Integrating Compliance into the System Lifecycle: Safety and compliance requirements should be incorporated throughout all stages of system development, from analysis and design to deployment and maintenance.

Developing Monitoring and Early Alert Tools: Technical mechanisms should be created to monitor AI systems and detect potential violations or vulnerabilities related to safety and privacy, with instant alerts and reporting capabilities in place.

Simplified Practical Example

When building an AI-powered document classification system, a mandatory PDPL compliance check is included and documented within project reports. The Data Office reviews each system update as part of the oversight process.

3.2.4 Regulatory Compliance:

AI adoption requires adherence to applicable local laws and regulations, including privacy, cybersecurity, and user rights regulations, ensuring legal and ethical accountability. This compliance extends beyond formal alignment with SDAIA's frameworks to practical integration within day-to-day operations. Sustained compliance is achieved through:

- **Applying SDAIA's Regulatory Guidelines:** Official resources such as the Generative AI Guidelines, Deepfake Guidelines, and the National Occupational Standard Framework for Data and Artificial Intelligence should be adopted to ensure operational and technical compliance.
- **Conducting Regular Regulatory Reviews :** Internal assessments should be regularly performed based on SDAIA's models to maintain compliance and proactively address any gaps.
- **Pursuing Incentive Badges:** Incentive badges are an effective way to measure regulatory maturity and build stakeholder trust.
- **Participating Actively in Policy Development:** Practical feedback and operational insights should be shared with SDAIA to support the evolution of more effective, realistic regulatory guidelines.
- **Establishing Specialized Oversight Units:** Define clear oversight bodies or committees—such as an AI Committee, a Digital Transformation Office, or a Data Ethics Unit—to serve as the reference unit for monitoring compliance, governance, and the development of internal policies.
- **Establishing an AI Office:** Creating a dedicated AI office within an entity represents a strategic step toward structured, secure AI deployment. It enhances digital readiness and helps balance innovation with risk management.

Simplified Practical Example

AI projects are evaluated using SDAIA tools such as the AI Index and Incentive Badges. The entity also takes part in SDAIA's consultation sessions to help shape future guidelines.

4. Enablers

4.1 Data

Data is the backbone of all AI applications, as it represents the primary source for training models, enhancing their performance, and generating inferences. The effectiveness of AI directly depends on the quality of the available data, its accessibility, comprehensiveness, and its representation of reality. This makes enabling the data ecosystem a strategic priority for the success of smart transformation efforts.

This requires building a robust national and enterprise data infrastructure that ensures continuous availability of data from multiple sources, including historical and real-time data, and providing it within a secure, flexible, and integrable environment. It also requires defining access levels and permissions in a way that balances privacy protection with maximizing the analytical value of data.

On the other hand, data quality and integrity are essential for enhancing AI model performance. This requires thorough data cleaning, the elimination of duplication and noise, and adherence to standardized criteria that enable seamless integration and analysis across various platforms and systems.

Reliability is a central dimension in data management, where mechanisms for periodic verification and auditing should be established to ensure the data is accurate, up-to-date, and free from biases or distortions that may affect the credibility of results. Moreover, transparent documentation of data sources, collection methods, and analysis processes reinforces trust in AI outputs and enhances their social and enterprise acceptance.

True AI enablement begins with data enablement, through an integrated vision that encompasses governance, technology, and people. This vision lays the foundation for building an intelligent, responsible, and future-ready data environment.

4.1.1 Availability and Access

Ensuring the availability of data and ease of access is a fundamental requirement for any entity to effectively and securely benefit from AI. Data is the core component on which models and algorithms rely to make accurate, evidence-based decisions. This includes:

- ▶ **Using a Flexible Access Permissions System:** Adopting a Role-Based Access Control (RBAC) model ensures the distribution of permissions according to business needs without compromising sensitive data. This system enables precise control over who can access, modify, or share data, thereby enhancing the protection of information assets and supporting security compliance and governance.

- **Using Data Discovery Tools:** Data catalog tools allow users to explore and understand the data assets within an entity. They enable various teams to locate data, understand its context (metadata), assess its quality, and determine its readiness for use in analytics or models. This contributes to reducing duplication, enhancing collaboration, and accelerating data-driven decision-making.
- **Automating Data Updates:** Maintaining data freshness and accuracy is essential for the efficiency of analytical models and AI. This is achieved through periodic and automated update mechanisms that synchronize databases with actual changes in the sources, ensuring that decisions are based on current and reliable information. These updates also help reduce human error and increase the reliability of data in supporting business operations.
- **Complying with National Privacy Regulations:** Ensuring compliance with the Personal Data Protection Law (PDPL) and relevant regulatory frameworks is a strategic priority for protecting individual rights and enhancing trust in digital platforms. This includes implementing strict data processing policies, obtaining legal approvals when necessary, defining and managing access permissions, and enforcing cybersecurity controls according to best recognized practices.
- **Activating Data Governance Office:** The Data Governance Office serves as a centralized supervisory entity responsible for policy development, monitoring implementation, and ensuring that various teams adhere to data management controls. The office plays a pivotal role in organizing access processes, documenting data usage, and conducting regular audits to ensure compliance, thereby achieving a balance between effective data use and maintaining its security and confidentiality.

Simplified Practical Example

The entity implements an internal data management platform that allows relevant employees to search data sources using a central data catalog. Their access permissions are automatically defined based on their roles, with periodic audit reports to verify that no violations have occurred.



4.1.2 Quality and Integration

Data quality and integration are key determinants of the effectiveness and accuracy of AI models. To ensure this, the following practices should be adopted:

- ▷ **Comprehensive Governance of Data Sets:** Effective data governance relies on an integrated system for documenting and regulating the use of data sets, with periodic reviews to ensure consistency and operational readiness. This includes identifying data sources, accurately describing them, and monitoring their suitability for analytical purposes, supporting decision quality, and improving the efficiency of analytical and intelligent models.
- ▷ **Automated Quality Verification Tools:** Automated verification tools are a cornerstone for ensuring clean and reliable data. These tools detect and systematically correct missing values, duplicates, and inconsistencies without manual intervention, thereby enhancing the quality of data used in analytics or training and reducing the risks of bias and errors in outcomes.
- ▷ **Accurate Data Source Tracking:** Accurate data source helps ensure full compliance with laws and regulations. This involves classifying data based on its nature (open, licensed, internal, or sensitive) and documenting usage rights for each source, facilitating audits and reviews, and preventing data misuse or violations of ownership rights.
- ▷ **Ensuring Tagging Accuracy:** When using labeled data to train AI models, the accuracy of tags is a critical factor in the model's efficiency and outputs. This requires adopting double auditing methodologies and human or automated review tools to ensure the labeled data is free of bias or errors and accurately reflects the intended reality.
- ▷ **Legal Data Reviews:** Before using any data set, it is essential to verify the validity of associated licenses and intellectual property rights. This step involves clear legal procedures, including reviewing contracts, verifying terms of use, and coordinating with legal compliance teams, ensuring the entity is protected from legal risks or regulatory violations.

Simplified Practical Example

The entity uses a platform to analyze data quality, which automatically alerts users to inconsistencies or poor classification quality. Each data set's source is documented, along with its legal validity and permitted usage period.

4.1.3 Reliability

The reliability of data and the integrity of its usage over time are critical factors in ensuring the effectiveness and sustainability of AI solutions. This is achieved through:

- ▷ **Distributed Cloud Storage:** Distributed cloud storage forms a foundation for ensuring business continuity by distributing data across multiple locations, thereby enhancing protection against loss or downtime. This includes automated backup mechanisms and rapid disaster recovery, ensuring business readiness and uninterrupted operations.
- ▷ **Status Monitoring and Failure Response:** Self-alert systems and real-time monitoring are vital tools for early detection of any infrastructure failure or connection loss. These are accompanied by automated procedures such as rerouting or rebooting, ensuring quick response and minimizing the impact of failures on critical operations.
- ▷ **Version Control:** Recording different versions of data helps track changes accurately, enabling teams to review updates and retrieve previous versions in case of errors or the need for verification. This is an essential tool for maintaining transparency and workflow control in data and modeling projects.
- ▷ **Automated Audit Logs:** Automated audit logs are a key element of governance and oversight. They document every modification or use of data, recording the user, date, and event. These logs are used for security audits, compliance assurance, and behavioral reviews in sensitive data environments.
- ▷ **Data Lineage Tracking:** Data lineage tracking involves tracing the complete path of data from its original source through processing to its use in analytical or predictive models. This helps ensure integrity, verify input quality, and accelerate the detection of potential errors or biases.

Simplified Practical Example

The entity stores AI data on a cloud platform that provides instant backups and maintains a version history. Any member of the development team can retrieve the version used to train a specific model on a given date for analysis or auditing purposes.

4.2 Infrastructure

The technological infrastructure represents the foundation upon which AI technologies are adopted and activated at the enterprise and national levels. It encompasses an integrated set of physical and digital resources, such as data centers, high-performance servers, cloud computing, and data and model management platforms, that provide the appropriate environment for the efficient and reliable development, deployment, and operation of AI solutions.

Infrastructure requires the adoption of technical standards that ensure integration and interoperability between systems, along with continuous availability of digital resources through intelligent monitoring and operation systems that support immediate response and fault anticipation. It should also exhibit operational flexibility, with the capacity to scale and adapt to changing conditions and to accommodate complex models and data without compromising performance or stability.

Overall, investing in advanced digital infrastructure is an investment in future readiness and a fundamental requirement for the success of AI projects and their sustainable impact on services, decisions, and enterprise transformation.

4.2.1 Technical Standards

To ensure a ready and effective infrastructure, strict technical standards should be adopted to guarantee system compatibility, ease of integration across solutions, and support for future scalability. This includes defining reference architectural frameworks, adopting advanced computing technologies such as cloud intelligence and parallel computing, and providing secure, up-to-date testing and development environments. To achieve the highest levels of technical standards, the following can be implemented:

- ▷ **Maintaining Scalable Infrastructure:** Scalability is a basic requirement to support the rapid growth of AI applications. This involves designing a flexible technological infrastructure that can accommodate changes in data volume, user numbers, and model complexity. This approach ensures performance sustainability and the ability to handle future projects without the need to rebuild the infrastructure from scratch.

- **Providing AI Acceleration Hardware:** Graphics Processing Units (GPUs) and Tensor Processing Units (TPUs) are vital for enabling AI models to function efficiently, both during training and inference stages. Investing in these devices is a key factor in achieving technical excellence, as they reduce execution time and improve resource efficiency.
- **Defining Upgrade Cycles:** Regularly updating the infrastructure ensures alignment with the latest technological and architectural advancements, whether in hardware or software. These plans include evaluating actual performance, replacing outdated components, and adopting new technologies to enhance the entity's readiness to respond to future opportunities and transformations.
- **Using Real-Time Performance Monitoring Tools:** Real-time monitoring tools enable continuous tracking of key performance indicators, such as processor and memory usage and processing speed. Predictive algorithms based on AI can be integrated to detect anomalies and predict failures before they occur, reducing downtime and maintaining the stability of critical operations.
- **Comparing with National Standards:** Comparing infrastructure readiness with national standards is a strategic step to ensure compliance and direct technological investments toward locally approved priorities. This assessment reveals gaps and identifies improvement opportunities, contributing to the development of a reliable digital infrastructure aligned with the ambitions of digital transformation and the Saudi Vision 2030.

Simplified Practical Example

The entity invests in a hybrid cloud infrastructure, upgraded every two years, and monitors performance in real time using dashboards that display execution speed and resource utilization, supporting smart task distribution.



4.2.2 Availability and Monitoring

Availability and operational monitoring are two critical components for ensuring service continuity and performance reliability. They refer to continuous access to digital resources 24/7, supported by advanced performance monitoring and analysis systems that allow for immediate response to interruptions or failures and enable predictive analysis to anticipate issues. To achieve this, the following is recommended:

- ▷ **Maintaining a Defined Downtime Threshold:** Minimizing downtime is a vital goal for any AI application used in production environments. A standard of less than 30 minutes of downtime per year is set as a strategic indicator of service quality and continuity, enhancing user trust and reducing operational and economic impacts of any outages.
- ▷ **Adopting Predictive Failure Analytics:** Using predictive analytics is an effective tool for preventing unexpected failures. AI models are employed to detect abnormal patterns and predict failures before they occur. This approach supports proactive maintenance, improves system readiness, and enhances the efficiency of managing technological resources.
- ▷ **Implementing Infrastructure Governance:** Effective infrastructure governance requires defining the nature of ownership (internal, external, or hybrid), with clear distribution of permissions and responsibilities among stakeholders. This approach strengthens oversight, ensures compliance with the technical Service Level Agreements (SLAs), and facilitates the management of expansions or external contracts.
- ▷ **Generating Regular Infrastructure Reports:** Infrastructure performance indicators are key tools for detailed monitoring and continuous improvement. These indicators include: Availability rate, resource consumption, number of failures, and response time. Such reports are submitted regularly to relevant departments and technical committees to support data-driven decision-making.
- ▷ **Publishing Monthly Readiness Reports:** Monthly readiness reports are reviewed by the Technology Governance Committee and are used to track trends, identify potential risks, and ensure uninterrupted service. This practice is part of a comprehensive oversight system that enhances transparency and contributes to achieving the highest levels of technical readiness and operational reliability.

Simplified Practical Example

The entity applies a 24/7 AI application monitoring system that sends instant alerts in case of performance degradation or potential outages. Monthly reports presenting availability rates are published and reviewed by the Technology Governance Committee.

4.2.3 Operational Flexibility

Operational flexibility is essential amid rapid developments in AI and shifts in the operational environment. The infrastructure should be scalable and adaptable, capable of handling more complex models and larger datasets without affecting performance quality. It should also include flexible mechanisms for workload management, data recovery, and disaster resilience. To achieve this, the following is recommended:

- ▷ **Integration with National Platforms:** Integrating AI infrastructure with national platforms such as the Government Cloud (G-Cloud) is a strategic step to ensure alignment with national digital transformation, cybersecurity, and data sovereignty objectives. This integration enables the utilization of shared services, facilitates inter-agency coordination, and accelerates innovation within a unified and secure environment.
- ▷ **Designing a Flexible, Auto-Scalable Infrastructure:** Flexibility is a core trait of modern infrastructure. Auto-scaling (or elastic provisioning) enables systems to adapt to changes in load and demand without manual intervention. This improves resource utilization, reduces operational costs, and offers dynamic responses to user and project needs.
- ▷ **Managing Data Flow:** Handling massive volumes of data requires building efficient data processing pipelines that ensure smooth information flow and balanced workload distribution. This includes managing extraction, transformation, and loading (ETL/ELT) operations, supporting stable and fast advanced analytics and machine learning.
- ▷ **Integrating Operational Excellence Frameworks:** Adopting integrated operational frameworks that address performance, governance, quality, and emergency response ensures stable and efficient technological environments. These frameworks help build reliable operations, reduce risk, and align with global best practices in infrastructure management.
- ▷ **Building a Disaster Recovery System:** Ensuring service continuity requires infrastructure capable of automatically restoring systems within minutes in case of major failures or disasters. This includes real-time data replication, activating standby sites, and training technical teams on advanced response plans, maintaining minimal downtime, and boosting system trust.

Simplified Practical Example

The entity equips its unified infrastructure with elastic computing that auto-scales during peak demand. This infrastructure is tied to crisis response protocols that allow systems to continue operating uninterrupted, even if a part of the service is disrupted.

4.3 Human capacity

Human capabilities represent the fundamental pillar for ensuring the successful adoption of AI technologies and realizing their enterprise impact. Smart transformation requires specialized, technically qualified talent capable of designing, developing, and operating intelligent models in alignment with national priorities and ethical and technological standards. This human enablement includes developing human capital through talent acquisition, upskilling existing competencies, fostering a supportive work environment, and building strategic academic partnerships that feed the AI ecosystem with renewed skills and specialized knowledge.

Entities aim to achieve a balance between quantity and quality by ensuring a sufficient number of skilled individuals with diverse backgrounds and disciplines that support innovation. Establishing sustainable career development paths is also crucial to preparing the workforce for the rapid evolution of AI, covering both technological skills (e.g., machine learning, data engineering, and cloud computing) and soft skills (e.g., analytical thinking, AI ethics, and data-driven decision-making).

Continuity and stability are critical factors in building enterprise knowledge, which requires effective incentive policies, a creative and innovative environment, and opportunities for employees to grow and actively contribute to AI projects. Collaboration with universities and research centers also helps enhance human readiness by providing joint training and research programs and pathways to prepare the next generation of local AI experts.

4.3.1 Number and Diversity

Building structured enterprise capacities and a specialized workforce is the cornerstone of any effective AI strategy, especially in light of the national trends toward adopting AI technologies and boosting their role in driving efficiency and impact. Relying solely on general technological expertise is no longer sufficient. It is now essential to attract talent with deep skills, innovation capacity, and leadership potential. To move from limited experimentation to widespread, sustainable adoption, a flexible, well-defined organizational structure is needed, with diverse, specialized teams operating within national frameworks. The details are as follows:

- ▷ **Establishing a Clearly Defined AI Team:** Creating a dedicated AI unit within the organizational structure, either as a standalone entity or as part of a digital transformation center.
- ▷ **Clearly Assigning Roles:** Defining responsibilities precisely across model development, data analysis, solution design, and governance management to ensure cohesive efforts.
- ▷ **Aligning with the National Occupational Standards Framework (NOSF):** Aligning job descriptions and roles with national standards to ensure professionalism and equity.
- ▷ **Achieving Clear Team Diversity:** Ensuring fair representation, including women and people with disabilities, to support innovation and inclusion.
- ▷ **Planning for Annual Team Growth:** Linking expansion plans to employment support initiatives to ensure structured and sustainable growth.

Simplified Practical Example:

The entity establishes an AI unit composed of 35 employees across 10 career tracks. Women make up 40% of the hires, and people with disabilities make up 5%. Job descriptions are updated annually in line with the National Occupational Standards for Data and Artificial Intelligence.

4.3.2 Professional Development

Developing human capabilities is a core pillar of AI adoption. No technology, regardless of how advanced, can create a lasting impact without talent capable of understanding, adapting, and continuously improving it. Leading entities aim to build training and professional development ecosystems that align with rapid technological transformation and foster a sustainable learning culture within the workplace.

Entities adopting AI can build capable teams by taking the following steps:

- ▷ **Creating a Career Development Plan:** Defining clear professional growth paths based on role requirements. The National Occupational Standards for Data and Artificial Intelligence outlines career tracks and progression requirements.
- ▷ **Linking Training to Accredited Certifications:** Establishing certified programs that enhance profes-

sionalism and add value for trainees. The programs offered by the SDAIA Academy are a prime example, combining deep specialization with official accreditation. They contribute to the development of national competencies in data and AI and provide trainees with a competitive edge in the job market.

- ▷ **Building and Updating Role-Based Skill Matrices:** Accurately identifying the skills required for each job role and regularly updating them in line with technological advancements and business needs ensures alignment of competencies with strategic objectives. These matrices help identify skill gaps, design targeted training programs, and make performance evaluations more efficient and objective, supporting effective planning for career development and leadership succession.
- ▷ **Linking Individual Performance to Skill Growth:** This linkage helps promote a culture of continuous learning and motivates employees to improve themselves. By measuring the acquisition and application of skills in the work context, performance can be evaluated more comprehensively and fairly. This also allows promotions and rewards to be based on actual achievements and professional growth, fostering enterprise loyalty and supporting the effective realization of organizational goals.

Simplified Practical Example

Each employee is evaluated quarterly based on an AI skills matrix and is required to complete specialized courses throughout the year. Achievements are tracked via an internal board that links development to annual performance.

4.3.3 Academic Cooperation

Collaborating with universities and institutes is a strategic path to ensure a continuous flow of talent and to prepare the next generation of AI specialists. Through long-term academic partnerships, it is possible to develop advanced curricula, organize joint training programs, and fund applied research that addresses real-world challenges. Such collaboration also supports the creation of joint research centers, scientific competitions, and the attraction of top academics and experts to contribute to sector development. This builds an integrated ecosystem that links education with employment and prepares a generation capable of creativity and innovation in AI applications that serve national priorities.

To establish effective collaboration channels, the following measures can be taken:

- ▷ **Attracting Talented AI Trainees and Students:** It is advisable to establish effective communication channels with universities and institutes to attract students and talents in the field of AI, through offering professional training opportunities that allow them to work on real projects. It is also recom-

mended to activate early talent discovery programs such as tech competitions, innovation challenges, summer programs, and career mentorship under expert supervision.

- ▷ **Signing MOUs with Universities:** Signing memoranda of understanding with universities is a strategic move to strengthen the integration between academic knowledge and practical application. It enables the development of advanced educational and training programs through joint curriculum design, specialized workshops and lectures, cooperative training opportunities, and support for applied research and innovation initiatives.
- ▷ **Designing a Roadmap for Graduate Employment:** A clear roadmap should be designed for graduate employment, starting with identifying the required specialties, followed by training and professional development programs, and finally integrating them into suitable career tracks. It should also include mechanisms for continuous evaluation and follow-up after employment to ensure adaptation and stability, which helps bridge the gap between supply and demand and boosts investment in national talent.
- ▷ **Aligning Academic Collaboration with National Human Capacity Building Goals:** Academic collaboration should be aligned with national goals for building human capacity, through joint efforts with educational institutions to ensure that curricula and training initiatives meet future needs, especially in fields such as technology, AI, and data analysis. This approach is a cornerstone for achieving the objectives of Saudi Vision 2030 in human capital development.

Simplified Practical Example

The entity implements the “Future of AI” program, hosting 50 trainees annually from three major universities, providing training through real projects, with a 20% conversion rate to permanent jobs.

4.3.4 Job Stability

In a global landscape that highly competes for AI talent, retaining such expertise is a strategic challenge for many entities. These rare competencies require effective retention policies, with success measured by the annual employee turnover rate. Retention programs include offering financial incentives, learning and development opportunities, participation in innovative projects, along with clear career paths and

a motivating work culture that enhances loyalty and commitment. Integrating professional development with emotional motivation creates sustainable retention that supports excellence and innovation. To retain specialized AI talent, the following strategies are recommended:

- ▷ **Analyzing Turnover:** Understanding why AI talent leaves is a crucial step in enhancing job stability and preserving human capital. This requires collecting and analyzing accurate data from sources like exit interviews, satisfaction surveys, and performance indicators to identify influencing factors such as lack of growth opportunities, workplace environment, or absence of recognition & motivation. Based on this analysis, tailored solutions can be developed, such as improving professional development programs, enhancing fairness in recognition and promotions, and cultivating an attractive organizational culture.
- ▷ **Providing Innovation-Driven Professional and Financial Incentives:** Offering targeted financial and non-financial incentives for innovation helps create a stimulating and creative work environment, encouraging employees to propose new solutions and improve existing processes. These incentives may include performance-based bonuses, public recognition programs, and support for both individual and team initiatives. This approach reinforces a culture of sustainable innovation and achieves higher levels of efficiency and enterprise impact.
- ▷ **Creating Clear Internal Career Growth Paths:** Building well-planned career tracks strengthens employees' sense of empowerment and belonging, providing continuous development opportunities without the need to leave the organization. These plans include clear promotion stages, mentorship and professional development programs, and specialized assignments that build both leadership and technical skills. This model helps reduce turnover and increase the retention of high-value talents.
- ▷ **Aligning Stability Policies with the National Occupational Standard Framework for Data & Artificial Intelligence:** Aligning internal HR plans with the national job framework is a strategic step to ensure consistency with national visions for localizing and regulating AI specializations. This includes adopting standardized job descriptions, defining the necessary training paths for each category, and linking them to incentives and job responsibilities. Such alignment enhances recruitment effectiveness and contributes to developing a generation of professionals aligned with national priorities.

5. Outcomes

5.1 Applications

Intelligent applications represent the practical output of AI adoption. They are the tools that translate technological capabilities into tangible value across services, operations, and decision-making. These applications encompass a wide range of solutions that rely on intelligent models and algorithms for data processing, prediction, automation, and user interaction with greater efficiency and accuracy.

The true value of AI adoption is only realized through these applications, enabling entities to deliver faster, more precise services, make data-driven decisions, and transform user experiences and resource efficiency.

5.1.1 Development and Deployment

Developing successful AI applications requires an integrated environment that combines deep understanding of user needs, suitable technologies, ready infrastructure, and governance frameworks that balance innovation with responsibility. The lifecycle of these applications includes designing models, testing, training, deploying in production environments, monitoring performance, and regularly updating them. To achieve this, the following is recommended:

- ▷ **Internal Model Development:** Internal model development is a strategic step toward building customized and secure solutions tailored to the entity's real needs. This includes establishing integrated in-house pipelines covering analysis, training, testing, and deployment in a connected manner. It relies on standard frameworks such as MLOps to ensure development quality and consistency across stages. To accelerate safe and automated model testing and deployment, unified interfaces (CI/CD Pipelines) are developed. Equally important is documenting the model lifecycle in detail and linking it to the enterprise governance system for data and models, enhancing transparency and efficiency in managing smart models.
- ▷ **Performance and Safety Monitoring:** Post-deployment model monitoring is essential for ensuring continued effectiveness and accuracy in real-world environments. It allows entities to continuously verify model performance and make informed improvement decisions. This includes using advanced tools for real-time performance analysis and detecting any decline in accuracy or efficiency. Benchmark comparisons with other models are also conducted to evaluate relative performance. These analyses inform continuous

improvement mechanisms, with models adjusted based on practical performance and user feedback. Another vital aspect is the early detection of performance drift and automated handling to maintain consistent and reliable model outcomes over time.

- ▷ **Development Tool Management:** Managing development tools is crucial for balancing flexibility and compliance in technological environments, especially with the variety of open-source and proprietary tools available. Such a balance is necessary for safe and sustainable development governance. This management includes automated mechanisms for tracking tool usage, such as code sources, licenses, and associated security risks. Periodic reviews are also conducted to ensure tools remain aligned with evolving development needs. Additionally, adherence to national governance policies is essential, requiring compliance with software usage regulations, whether open-source or commercial, to ensure legal and regulatory compliance at the national level.

Simplified Practical Example:

The entity establishes an internal “model development platform” enabling teams to build predictive models with custom tools. It applies the MLOps framework and automatically tracks all development stages.

5.1.2 Privacy and Safety

Ensuring privacy, security, and operational continuity is fundamental for responsible and secure AI adoption. Smart applications prioritize privacy and safety concepts to protect individual and organizational data from breaches and misuse. This is achieved through secure-by-design systems and clear risk management mechanisms, including encryption, ethical controls, and ongoing audits. To achieve this, the following is recommended:

- ▷ **Embedding Cybersecurity and Privacy:** Designing modern intelligent systems requires a “Security & Privacy by Design” approach, integrating protection requirements into every development stage, from analysis to deployment. This includes data encryption, access management, and multi-factor authentication to safeguard the system from vulnerabilities and attacks before official launch.

- **Complying with National Frameworks:** Compliance with national regulations, foremost among them the Personal Data Protection Law (PDPL), is essential for the integrity of digital operations. This includes adhering to business continuity guidelines, data classification controls, and consent management policies, enhancing trust in smart systems, and protecting individual rights.
- **Activating Recovery and Disaster Plans:** Implementing professional recovery plans helps mitigate the impact of unexpected outages. These plans include automated backups, ready-to-launch backup sites, and automated response mechanisms that restore systems within minutes, ensuring business continuity and protecting critical data.
- **Testing Risk Scenarios regularly:** Simulating failure or outage scenarios is a best practice for ensuring infrastructure readiness. These tests include: Data center failures, connection losses, or security breaches, measuring system resilience, identifying vulnerabilities, and updating contingency plans based on real outcomes.

Simplified Practical Example

The entity uses a dashboard that displays weekly model performance. Predictive algorithms alert teams when accuracy drops below a defined threshold.

5.1.3 Operation and Management

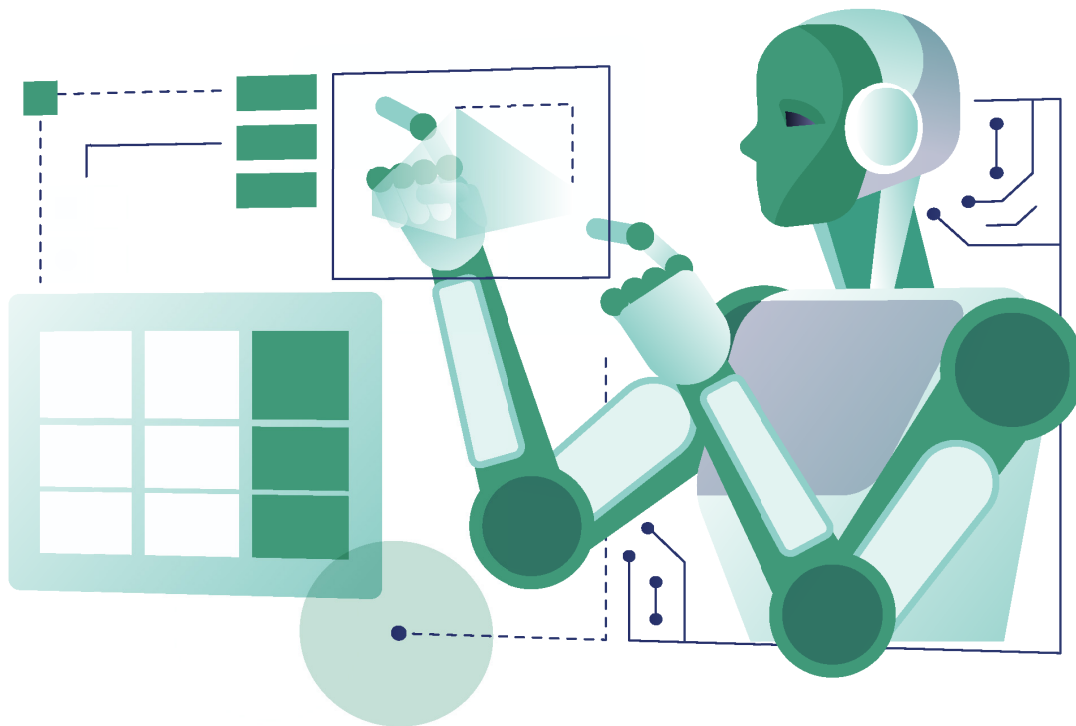
Operating models in a production environment and tracking their organizational impact are crucial for realizing the full value of AI. It is equally important that intelligent applications are managed professionally to ensure their sustained effectiveness. Application operation and management include sustainable operation mechanisms, maintenance and update plans, performance monitoring methodologies, and governance models that ensure compliance and align application development with regulatory and technological changes. The following guidance is recommended:

- **Tracking Actual Model Usage:** Monitoring actual usage of smart models is a key tool for understanding how different departments and users rely on implemented solutions. This includes tracking usage frequency, most active users, and application scenarios, helping assess effectiveness and identify opportunities for expansion or improvement.
- **Linking Performance to Business KPIs:** To ensure real value from AI, model outcomes must align with enterprise performance indicators such as improving service quality, reducing response times, increasing user satisfaction, and lowering operational costs. This alignment directs resources toward high-value models and connects AI efforts directly to organizational impact.

- ▷ **Implementing Proactive Improvement Mechanisms:** Maintaining effective model performance requires smart monitoring systems that detect usage decline, accuracy drops, or shifts in data patterns. These indicators allow for early model updates or retraining, reducing operational risks and ensuring continued positive impact.
- ▷ **Regular Reporting to Senior Management** Preparing regular analytical reports highlights AI's contribution to the organization's overall goals. These reports include dashboards, comparative analyses, and strategic recommendations, supporting decision-makers in adopting data-driven approaches and boosting investment in successful initiatives.

Simplified Practical Example:

The entity classifies every tool used in model development and links it to a legal and technological database that defines usage terms and potential risks.



5.2 Impact

AI serves as a strategic enabler capable of driving profound transformation in enterprise performance, not merely by offering technological solutions, but by reshaping business models, strengthening a culture of data-driven decision-making, and delivering more effective and personalized services. As the scope of AI adoption expands, there is an increasing need to understand the real impact that can be achieved when AI is adopted in an organized, integrated manner rooted in solid governance.

This impact is only realized when AI technologies are embedded into the enterprise environment in alignment with governance, policies, infrastructure, and human capabilities, managed under a comprehensive strategic vision.

The value of AI is not limited to performance improvement within individual entities. Its significance is greatly amplified when leveraged within an interconnected national ecosystem. When smart projects are linked to unified performance indicators and their outcomes are shared through national platforms, a compounded effect emerges, improving overall efficiency, elevating service quality at the national level, and enhancing transparency and accountability.

In alignment with this approach, the Saudi Data & AI Authority (SDAIA), through the National Center for AI (NCAI), is developing a maturity index for AI adoption within government entities. This index is designed to measure progress in technology use and the integration of organizational, technical, and human dimensions. This index enables entities to diagnose areas of strength and improvement opportunities, compare their performance with peers, and plan for sustainable, data-driven growth.

5.2.1 Operational Efficiency

To achieve a tangible and sustainable impact from AI technologies, these technologies should be systematically employed to enhance operational efficiency by reducing costs, minimizing waste, and improving the effectiveness of internal processes. Recommended steps include:

- ▷ **Automating Repetitive Administrative Processes:** AI solutions should be implemented to automate repetitive administrative tasks, including data entry, request reviews, and transaction verification, freeing up human resources to focus on strategic, value-added tasks.

- ▷ **Improving Process Flow:** AI-powered performance analysis techniques should be used to optimize process flow by identifying operational bottlenecks, improving activity sequencing, optimizing resource allocation, enhancing operational efficiency, and reducing turnaround time.
- ▷ **Minimizing Human Error:** Automated validation models should be implemented to reduce errors caused by manual data entry or verification, improving output quality and reducing the need for re-processing and audits.
- ▷ **Measuring Clear Financial Savings:** Clear financial indicators should be established to track savings resulting from automation, such as reduced temporary staffing costs and lower reliance on manual auditing, and these savings should be linked to the organization's overall financial goals.
- ▷ **Achieving Sustainable Operational Savings:** A savings benchmark of at least 8% of the annual operating budget should be adopted as a primary success indicator for AI initiatives. This target reinforces the viability of such initiatives and positions AI as a genuine driver of enterprise transformation, not just a technological tool.

Simplified Practical Example:

The entity uses an AI algorithm for dynamic employee scheduling, reducing overtime costs by 12% and decreasing wasted time by 18%.

5.2.2 Employee Productivity

AI contributes to enhancing human capabilities, not only by automating tasks but also by enabling employees to work more efficiently and make data-informed decisions. To achieve this impact, the following steps are recommended:

- ▷ **Integrating Smart Tools into Daily Workflows:** AI tools such as digital assistants, auto-classification systems, and predictive responses should be incorporated into daily operations to accelerate performance and reduce effort on repetitive tasks.
- ▷ **Broadly Supporting Roles with Smart Tools:** Core roles should be widely supported by smart tools, with at least 25% of these functions enhanced by advanced AI technologies, reducing operational burdens and freeing time for higher-value activities.

- ▷ **Achieving Tangible Productivity Gains:** Productivity gains exceeding 15-20% should be targeted, equivalent to more than 8 additional working hours per week for each employee, with impact tracked by comparing task completion times and output before and after implementation.
- ▷ **Embedding AI into Human Resources Management:** AI should be integrated into workforce planning, recruitment, training, and development programs to ensure skills are aligned with emerging technologies.
- ▷ **Analyzing Job Performance Data:** Data analytics tools should be used to evaluate AI's impact on job performance by tracking how employees spend their work time and identifying continuous improvement opportunities based on accurate performance indicators.

Simplified Practical Example:

A smart writing assistant is integrated into the legal affairs unit, enabling consultants to draft contracts 40% faster and saving each employee a full working day per week.

5.2.3 Service Quality Enhancement

Enhancing the end-user experience is a central focus of intelligent transformation efforts. AI is a powerful tool for enabling higher-quality, personalized, and efficient service delivery. To achieve this type of impact, the following steps are recommended:

- ▷ **Analyzing User Behavior to Personalize Services:** AI technologies should be employed to analyze user behavior in order to design personalized services that meet individual needs and enhance the quality of the overall experience.
- ▷ **Expanding the Scope of AI-Powered Services:** The share of AI-supported services should exceed 25% of total services, with priority given to those involving high public interaction to ensure broader impact.

- ▷ **Improving Time-Based Performance Indicators:** Response and processing times should be reduced by more than 20% by automating manual steps and simplifying procedures using smart tools.
- ▷ **Boosting Satisfaction through Proactive and Interactive Systems:** Smart proactive and interactive solutions, such as predictive chatbots and intelligent assistants, should be activated to provide immediate support and boost satisfaction and trust among users.
- ▷ **Integrating AI Across Multiple Channels:** AI should be integrated across all service delivery channels, websites, mobile apps, and call centers, ensuring seamless and continuous access to smart services through all points of interaction

Simplified Practical Example:

The entity implements an intelligent recommendation system on its e-services portal, suggesting services to users based on their previous behavior. Result: A 30% increase in service usage and a 22% improvement in processing time.



6. Conclusion

The AI Adoption Framework represents a strategic step toward enabling entities in the Kingdom of Saudi Arabia to embrace this technology in an effective, secure, and sustainable manner. By presenting a comprehensive view of adoption enablers and requirements, including human capabilities, infrastructure, data, enterprise governance, and impact measurement, this framework provides a practical roadmap to help entities transform AI from isolated initiatives into a core enterprise function.

Amid the Kingdom's shift toward a knowledge-based economy, systematic AI adoption is one of the essential enablers for realizing the ambitions of Saudi Vision 2030. This framework emphasizes the importance of aligning technology with regulation and innovation with governance to deliver reliable and impactful outcomes. It underscores that successful digital transformation is not measured solely by deploying solutions, but by the entity's readiness to adopt, lead, and align these solutions with national priorities.

The Saudi Data & AI Authority (SDAIA) is a key partner in this journey, providing legislative frameworks, building supporting platforms, and developing national indicators for measuring AI maturity. Thus, this framework is not merely a guide, but a foundation for integration, continuous improvement, and collaborative accountability.

AI adoption is not an end in itself; it is a means to enhance efficiency, improve quality of life, empower people, and build a more responsive and innovative public sector. Through continued collaboration and coordination among entities, the Kingdom can strengthen its position as a global leader in AI adoption and turn this technology into a powerful driver of inclusive and sustainable development.

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