



هيئة الحكومة الرقمية
Digital Government Authority

Guideline of The Emerging Technology Adoption

November 21, 2022

Document Type: Guideline

Document Classification: Public

Issue No. : 1.0

Document No: DGA-1-2-5-208



Table of Content

01	Introduction	3
02	Guideline Objectives	4
03	Guideline Scope	5
04	Target Audience	6
05	Guideline Statement	6
	5.1 Emerging Technology Adoption	6
	5.2 Factors of ET Adoption Journey	15
	5.3 ET Adoption Framework	20
	5.4 Regulatory Methodologies for the Process of Adopting Emerging Technology	30
	5.5 KSA in the ET Landscape	33
06	Table of Definitions	42
07	Table of Abbreviations	44



01. Introduction

Proceeding from the importance of integration between government entities, to adopt and enable emerging technologies in a successful and safe manner, the Authority has prepared the “Guidelines for Adopting Emerging Technologies” for government entities to be guided with and apply it, to achieve the most prominent requirements of the modern era and keep pace with the interest in adopting emerging technologies, as this becomes clear through the presence of many innovative and applicable use cases in various sectors, in addition to the availability of many job vacancies, and the intensity of efforts on the process of innovation and continuous research and development that shed light on the solutions and capabilities inherent in the technologies themselves. Therefore, the adoption of these technologies represents an enabling strategic means that governments rely on to achieve their specific goals in modern ways that stimulate creativity, productivity, and accuracy factors. Despite the lack of maturity and ambiguity associated with emerging technologies, it should be highlighted the importance of gradual adoption efforts where they are implemented in a comprehensive and flexible strategy in line with the rapid growth of these technologies and the changing needs of specific stakeholders in order to avoid potential negative impacts and unexpected risks.



02. Guideline Objectives

This guideline aims to guide government entities in the journey of adopting their emerging technologies through:

1. Familiarize with sufficient general knowledge related to emerging technologies, its general characteristics and its potential contributions.
2. Introducing the most prominent organizational methods that are compatible with the strategic directions of the digital government and what meets the aspirations and needs of the beneficiaries.
3. Defining methodologies and frameworks for developing PoCs, MVPs and prototypes for innovative and agile solutions to provide digital government services in line with the strategic directions of the digital government and what meets the aspirations and needs of the beneficiaries.
4. Supporting government entities in decision-making related to emerging technologies and investing in them in a way that contributes to promoting innovation in the provision of digital government services, raising their quality, and helping to reduce costs.
5. Enabling digital government services by taking advantage of inspiring global success stories related to the adoption of an emerging technology.
6. Directing government entities in the executive and organizational efforts to promote a successful and safe adoption journey for emerging technologies by clarifying the means that contribute to the control, governance and use of technologies without limiting creativity.

03. Guideline Scope

This guideline applies to government entities to support in the journey of adopting emerging technologies, with the aim of developing their e-services and/or their internal systems, which in turn improve the productivity of the government entities, and thus this is reflected in an increase in beneficiary satisfaction.

The enclosed guideline defines the most prominent ET that fit government entities specifically and the Kingdom's established strategy and vision generally. Hence, the guideline defines and illustrates the impact of their adoption in the Kingdom from several aspects and provides some examples and applications that could inspire their adoption in the government entities. Essentially, the provided examples are intended to encourage the adoption of the targeted ET and support the existing efforts such that ET would yield the expected positive outcomes by highlighting how each of the ET could be integrated.

As the concept of ET is constantly and rapidly evolving, the enclosed guideline supports its adoption by identifying the different factors that need to be cautiously considered from multiple perspectives. Hence, government entities would be able to organize their efforts to ensure that they yield the intended outcomes while proactively preventing unintended consequences that could arise from unforeseen risks.

As the factors associated with ET adoption have been identified, the enclosed guideline proposes an adoption framework to provide incremental and comprehensive guidance to establish and enable the execution of an effective adoption strategy. Thus, the ET adoption framework inherently considers key milestones, factors, and constraints to minimize the potential of unforeseen early adoption risks and maximize the associated opportunities that could arise accordingly and promote a competitive advantage.

The scope of ET guidelines is also centered on the ET Adoption Framework, which is a structured framework that provides incremental and comprehensive guidance to establish an adoption strategy that enables successful ET adoption. Thus, the adoption framework considers key milestones, factors and constraints that have been highlighted to minimize the potential of unforeseen early adoption risks and maximize the associated opportunities to gain a competitive advantage.

To further promote a secure and successful ET adoption, the enclosed guidelines shed light on the regulatory aspect of ET adoption as it is considered a key foundation to the overall success of the adoption journey. Hence, the section discussing the regulatory aspect of ET adoption highlighted the need to optimize the regulatory landscape along with the potential challenges of doing so. The enclosed guideline further provides potential mechanisms that government entities could consider identifying the most suitable way and time to regulate ET adoption such that the governance of ET does not impede with the strategic objective of fostering innovation. Lastly, the enclosed guideline focuses on the current ET landscape in KSA and defines the Digital Government Authority (DGA's) role and accomplishment in establishing the GovTech Program to steer the kingdom towards its established vision. To capture the current ET landscape, the guideline recognizes some successful efforts and accomplishments in KSA to demonstrate the potential and the feasibility of integrating ET and witnessing its significant impact across the government entities to primarily serve the citizens' needs.

04. Target Audience

This guideline targets government entities as well as the private sector that works as a developer or operator of businesses related to digital government.

05. Guideline Statement

5.1 Emerging Technology Adoption

5.1.1 Definitions and Characteristics

ET is a term used to describe technologies that are not yet mature in the marketplace as their features, uses and characteristic traits are still being gradually unfolded and entail higher-than-average risk due to their ambiguity and unfamiliarity to the users. However, common characteristics that are evident across ET are:

- Novelty
- Coherence

5.1.2 Potential Uses and Impacts of Common ET

To further illustrate the concept of ET, the following technologies provide examples of contemporary innovations that meet the characteristics identified earlier.

Immersive Technologies

Immersive technologies are defined as technologies that emulate a physical world through the means of a digital or simulated world. Some examples of immersive technologies include virtual reality, augmented reality, 3D games and simulation. The primary benefit that supports the adoption of immersive technologies is their ease of implementation and immediate impact on digital projects. Some government sectors that benefit most from this technology: smart cities, entertainment, and education.

The following uses demonstrate how each of the previously identified sectors could adopt immersive technologies:

- Immersive technologies are widely used in the field of mental health and medicine generally in different applications, for example, people who are afraid of flying can use an immersive experience that takes the wearer of a virtual reality helmet from leaving the house to waiting at the boarding gate to take the flight. Those who suffer from social phobia can also go through a virtual simulation that allows them to practice public speaking and experience speaking on stage.
- Immersive technology is vastly used in the education sector, particularly for simulating experiences to promote effective training.

- 
- Immersive technology is further used in the entertainment and tourism sectors to enhance the overall user experience.
 - Smart cities sector relies on immersive technologies to develop three-dimensional designs that are used to develop plans and assess their effectiveness.

The expected impacts of immersive technologies include:

- A more optimal user experience for citizens through the provision of digital services across the tourism and entertainment sectors
- A more holistic user journey in education to enhance the availability and the quality of the proof-of-concepts provided. As a result of the use of immersive technologies to present educational services, students, trainees and practitioners would be able to fulfill their responsibilities more accurately and efficiently.
- Improving the user experience in smart cities and reducing administrative costs, as the use of immersive technologies to visualize designs reflects the user experience and allows the development of iterations and redesigns in a more cost-effective manner.

Internet of Things

Internet of Things (IoT) technology describes physical factors through sensors and converts them into information through the ability to process and analyze. This technology is usually associated with internet connection and other technologies exchange data with other devices and systems. The industries that could benefit from the use of IoT technologies are security, transportation and smart cities.

The following uses demonstrate how each of the previously identified sectors could adopt IoT:

- used to enhance safety and security measures.
- used significantly in the transportation sector to track and control goods.
- contributes to disaster recovery by enabling continuous monitoring that could be used to detect warnings and resolve prior to their escalation
- the field of financial technology through payment by smart watches.
- the health field by utilizing the measurements of vital signs issued from smart watches or headphones that are worn.

The expected impacts of IoT include:

- This technology helps in reducing crimes, accidents and road congestion by monitoring signals from devices to plot the density of congestion in an area.
- Optimizing the use of equipment and mechanisms in cities will contribute to reducing electrical consumption, raising efficiency, and helping to preserve the environment by reducing harmful carbon emissions.

- Information captured by sensors and devices significantly enhances the efficiency and effectiveness of the decision-making process due to the accuracy and high availability of the underlying information that the decisions are built upon.

Data Analytics

Data Analytics technologies have become significantly important as they are now considered a requisite, underlying enabler for other technologies. The reason being is that technologies used for data analytics provide the input that is further leveraged to generate valuable insights. Usually, such technologies are directly related to artificial intelligence technology and IoT technology. The industries that could benefit from the use of data analytics are the financial, commercial, security and healthcare sectors. The following uses demonstrate how some of the previously identified sectors could adopt data analytics:

- used heavily in the security field, where it is used to analyze data to detect patterns and infer information that can be used when making decisions
- used in the healthcare sector to detect diseases at early stages
- Forecasting events and natural disasters, and thus planning accordingly to prevent these accidents or mitigate their impacts

The expected impacts of data analytics include:

- Improving the quality of services provided across all government sectors
- Enhances the ability to make informed decisions in a timely manner such that the decision-making process is more efficient
- It is expected that technologies related to data analytics like Artificial Intelligence will contribute at least SAR500 billion to the Saudi economy by 2030.

Robotics

Robotics is still considered an emerging, renewable technology despite the existence of robots from a long time ago. With the development of contemporary technologies in the field of software and automation industries, programs can perform tasks in a more integrated manner. Hence, RPA enhances programmed bots' ability to perform the same tasks as data entry operators more accurately and efficiently. The industries that could benefit from the use of robotics are the financial, industrial, security and healthcare sectors.



The following uses demonstrate how some of the previously identified sectors could adopt robotics:

- Automating manual operations that require significant effort and time.
- Scanning and monitoring places that are considered hard to reach.
- Using chatbots to enhance the interaction with citizens and residents to answer their inquiries in a timely manner.

The expected impacts of robotics include:

- Improving productivity as robots would be programmed to perform repetitive operations, which alternatively reduces human errors.
- Reducing operational and administrative costs across the different sectors
- Utilizing human resources in value-added and non-repetitive tasks that require time and effort
- Robotics are expected to contribute approximately 18.3 trillion riyals to the Kingdom's economy

Blockchain

Blockchain is one of the most important technologies that have revolutionized the field of digital currency and information retention. An advantage of blockchain technology is that it provides a secure and efficient method to verify information. Additionally, blockchain enables users to store information across several points through an interconnected chain. The industries that could benefit from the use of blockchain are the financial, education, transportation, and healthcare sectors.

The following uses demonstrate how some of the previously identified sectors could adopt blockchain:

- Tracking patient and medical information
- Tracking shipment and customs information
- Issuing and verifying certificates

The expected impacts of blockchain include:

- Data validity and non-human modification, in addition to maintaining data security
- Blockchain technology enhances the healthcare sector by providing a seamless and convenient way to store and share patient information between different parties to ultimately enhance the user journey.
- Blockchain technology reduces tracking costs and ascertains the accuracy and quality of shipped items across the transport and customs sectors. Additionally, blockchain technology enables the preservation of all required documents between the various transport sectors

- In the education sector, blockchain technology enables the verification of certificates issued by accredited educational bodies, whether internal or external, and reduces the phenomenon of forged certificates.
- Blockchain technology is expected to contribute approximately 6.75 trillion riyals to the Kingdom's economy.

5.1.3 Inspiration from Global Success Stories

Immersive Technologies

Use Case	Sector	Country
Assist in making informed decisions related to urban development	Smart Cities	 Australia

“My Virtual Moreland” provides a means to virtually present maps and 3D models using virtual reality technologies. In addition, My Virtual Moreland allows the users to insert the developed maps and models into a 3D geographic information system in order to help make informed and data-supported decisions for urban development planning. This solution meets the needs of rapid urban environmental changes and enables the community to participate more in the design and development process.

The system uses virtual reality technology to visualize the status of cities and urban areas, to plan projects, and then take the appropriate decision for this project after collecting information. The system also develops 3D modeling for buildings and all urban development projects. This program is seen by municipal managers and decision makers to enter new information that can be seen in real time.

An evident impact of this system is the enhanced interaction and engagement of both citizens and residents in order to enhance their requirements and standards of living, which further led to the reduction of construction and unnecessary costs attributed to rework.

Use Case	Sector	Country
First-aid training in ambulances	Healthcare	 United States

“AmBus VR” is an augmented reality system for training paramedics to handle cases in ambulances. This system provides an environment that simulates the realistic experience in terms of size and equipment, in order to prepare the trainees to respond to various situations that require training and prior preparation. The program also measures the extent of user interaction and readiness. The system is also used for department placement tests at Texas State University.

The first step is to create an interactive map of the ambulance environment. After that, an integrated 3D environment is designed with several scenarios that allow the user to review all their steps by recording information and displaying it in an innovative manner. Once the user wears the interactive glasses, they can walk around the environment and perform all the required scenario or exercise requirements.

Among the effects that were measured as a result of this training is the improvement in the memory of the paramedics by 45% in terms of recall as they were more capable of remembering the places of things and making the necessary steps. In addition, paramedics became more efficient in completing their responsibilities as the time required to complete their tasks was reduced by 30%.

Internet of Things

Use Case	Sector	Country
Enhancement of train maintenance	Transportation	 Australia

The New South Wales government has contracted Downer to maintain the Wareaah trains. In partnership with other companies such as Microsoft, the company has been able to integrate multiple technologies such as cloud computing and artificial intelligence with heavy reliance on Internet of Things technology to make instant and highly credible analyses that they leveraged to enhance their ability to maintain the trains and foresee and resolve risks prior to their occurrence.

This project used more than 300 sensors and 90 cameras to collect information that yielded 300,000 signals that were sent every 10 minutes to the control center to help determine the locations of risks and the type of maintenance required. This project had a significant impact as it played a major role in reducing maintenance and operational costs as it enabled the engineers to monitor the trains remotely.

Use Case	Sector	Country
Establishing a smart transportation system in the city of London	Smart Cities	 UK

London is developing the features of its smart underground system by connecting multiple smart devices using the internet to provide a holistic, smart ecosystem. The functionality of the individual technologies along with the established interactions is established by operating the escalators, elevators and railway tracks simultaneously to improve customer service for passengers at lower costs.

The sensors measure, relay and track captured information related to the movement of elevators in order to optimize the speed or the number of machines used, which consequently reduces energy consumption and improves the user experience in terms of speed and efficiency. This project is expected to contribute to increasing beneficiary satisfaction by 30% and reducing operating costs by more than 30%.

Data Analysis

Use Case	Sector	Country
Monitor the mobility of tourists	Tourism and Entertainment	 Estonia

Positum Barometer is a mobile-position-based online tourism monitoring tool. The system has been developed, with a geographical focus on urban and regional planning and tourism management, to obtain statistical overviews and standardized analyses about the space-time behavior of tourists. The need for a tourism barometer arose mainly from the rapid growth of the Estonian tourism industry and the need to manage geographical change, investment and improve spatial planning in development.

Use Case	Sector	Country
Optimizing public bus schedule for workers with limited economic capabilities	Transportation	 South Korea

The South Korean government collaborated with workers who have limited economic, financial capabilities to create a public bus schedule that matches the working hours of workers. The need for such a system was justified by the high costs that taxis demand, particularly when transporting to poor neighborhoods, in addition to the safety and security risks associated with those areas. Hence, OWL Bus service leveraged big data analytics to serve the needs of night travelers and have collected data from three billion calls and text messages, as well as five billion points of corporate taxi data, to design night bus routes optimized to provide passengers with the safest and most cost-efficient transportation experience.

Amongst the advantages that were recorded is that more than 620,000 workers used this bus during the first 100 days of implementation. The efficiency of the company is evidenced by the fact that the company operates only 8 buses to cover more than 49% of the requests.

Robotics

Use Case	Sector	Country
AI robot for supporting elderly people	Healthcare	 South Korea

Where people over 65 years of age make up 15% of the population, this proportion will peak in 2024 with the elderly comprising 19% of the projected 51.3-million-person population. The AI powered robot acts as a companion and guardian of the elderly and allows care givers and city officials to monitor them and provide timely support. The robot offers a voice command feature and weighs 1.5 kg. It tries to talk with the elderly who do not speak for more than 30 minutes and automatically calls a guardian if the elderly person does not move in five hours.

One of the advantages that have been recorded for this technology is that the health staff can monitor a large number of patients and elderly, as well as providing the opportunity for those who do not have the financial ability to fully employ health practitioners.

Use Case	Sector	Country
Improve citizen experience by focusing on RPA	Smart Cities	 Denmark

In order to better service the growing population in Copenhagen, the city council has focused on launching robotic process automation to enable over 45,000 government employees to serve more than 600,000 of the city’s citizens. By automating and digitizing government services, the municipality is expected to reduce the cost of delivering exceptional and fast government services.

Blockchain

Use Case	Sector	Country
Assuring integrity of centralized medical records and trust	Healthcare	 Estonia

The Electronic Health Record (e-Health Record) is a nationwide system integrating data from Estonia’s different healthcare providers to create a common record every patient. The tool allows medical practitioners access a patient’s records easily from a single electronic file, doctors can read test results as they are entered, including image files such as X-rays even from remote hospitals. Blockchain technology is used to protect the integrity of medical information.

With this solution, 99% patients have countrywide digital records and 1.8 million queries made on health records every month.

Use Case	Sector	Country
Blockchain Land Register	Real Estate	 Georgia

Georgia converted its land registry to blockchain. The blockchain land register cuts costs by over 90% and the time to handle land-related issues is considerably shortened. The register has seen over 300,000 entries on the register, which in turn, mitigated corruption attempts. The blockchain register handles registration of new title deeds, rentals, mortgages, sales of title deeds and plenty more.

5.2 Factors of ET Adoption Journey

Multiple factors need to be proactively considered to support the ET adoption efforts and promote a successful adoption journey. The consideration of such factors would enable government entities to thoroughly establish and execute an effective strategy, which further results in the ability to tackle potential risks in a timely manner such that their likelihood and impact are effectively contained.

The identified factors are clustered into the following categories, which are further detailed below:

5.2.1 Funding and Resources

The factors belonging to the “Funding and Resources” cluster shed light on the need to consider and ensure the availability of the required functional and technical support the success and the effectiveness of the ET itself and the allocated efforts. The “Funding and Resources” cluster are primarily centered on factors that could potentially impede with the feasibility of successfully adopting the desired ET from a technical and a functional perspective.

The factors belonging to this cluster include:

- Allocated investments, operational costs and budgets associated with the ET’s procurement, operation and maintenance.
- The availability of the required technology infrastructure.
- The availability of the required frameworks and requisite tools to maximize the effectiveness and potential field of information technology.
- The availability of required forecasts and metrics to justify purchasing and operational costs and ensure that a desirable return could be achieved.

Some potential efforts to consider that would enhance the overall performance with respect to the “Funding and Resources” cluster are highlighted below:

- Ensure that the budget allocated for the R&D and ET adoption support the availability of the required relevant resources that essentially capture the citizens’ needs and enhance their user experience.
- Ensure that the budget allocated for R&D efforts specific to ET are continuously updated.
- Consider and integrate the changes in the overall ET landscape to the established strategic plan to ensure that the contemporary pain points that citizens encounter are being addressed or mitigated.
- Establish financing portfolios for ET initiatives and projects to capture and update relevant factors such as budgets and available resources.



5.2.2 Skills and Knowledge

As the concept of ET is yet emerging, its effective adoption requires the adequate skills and knowledge to mitigate the likelihood and impact of potential misuses, risks, and unintended consequences. The factors identified in the “Skills and Knowledge” cluster essentially ensure the appropriate utilization of the ET such that the entity would leverage its capabilities and maximize its potential.

The factors belonging to this cluster include:

- The complementary skills required to ensure the successful adoption of the ET.
- Familiarity and competence with each of the ET to ensure its effective operations and handling.
- Availability of comprehensive awareness sessions and training plans to the employees to ensure that they are well-versed around market trends and developments in the field of ET.

Some potential activities to consider that would enhance the overall performance with respect to the Skills and knowledge category are highlighted below:

- Identify training needs and establish a training plan accordingly.
- Ensure the thoroughness, adequacy, and comprehensiveness of the training material.
- Conduct as many exploratory awareness sessions as possible that will capture the changes to the ET landscape and adopt the most appropriate frameworks to align with the entity’s needs as well as the existing digital capabilities and objectives.
- Provide engaging training sessions that are relevant to the entity’s maturity and culture to promote the adoption of the practices and lessons learned in the awareness sessions.

5.2.3 The government entity's culture

The government entity's culture determines the relationships and actions of its employees and shape its public image and perception. A government entity's culture is primarily demonstrated through values, norms and attitudes that employees share collectively. With respect to ET, a culture of innovation is a pillar to the success of the ET adoption journey as it enables employees to support the ET adoption efforts and contribute to the increase in the innovative strength of the government entity.

The specific factors that have been considered as a part of the culture category are highlighted below:

- foster a culture that empowers employees to express their attitudes and opinions towards adopted technologies and recommend potential emerging technologies that they believe would suit their entity's needs.
- adoption of digital processes and workflows to nurture an agile mindset that enhances the overall efficiency.
- employees' willingness to invest the time and effort to embrace change and utilize new emerging technologies that will require a new set of practices.
- cultural appropriateness of the emerging technology to ensure that it is aligned with the adopted norms and practices.

Some potential activities to consider that would enhance the overall performance with respect to the culture category are highlighted below:

- Ensure that employees are aware of the potential value that ET adds to the innovation value chain.
- Foster an innovative, collaborative culture where the entity empathizes with the citizens to capture their needs.
- Ensure that proposed ideas are openly discussed and shared to ensure their comprehensiveness and roundedness.
- Establish empowering policies that enable employees to express their opinions and recommendations.
- Focus on user-centricity throughout the ET adoption journey.
- Focus on enhancing the technology's fit and ability to enhance the governmental entity's value chain.

5.2.4 Laws and Regulations

An adequate regulatory landscape that minimizes the likelihood and impact of potential uncontained risks is crucial to ensure a successful ET adoption journey across the government entities. Meanwhile, an adequate regulatory landscape needs to be strategically considered to ensure that it does not result in overregulating ET and restrain the ability to foster an innovative culture across the Kingdom. As government entities aim to effectively introduce ET regulations, they would need to foresee some potential challenges that may disrupt the regulatory landscape. Hence, this guideline supports government entities in identifying some key challenges so they could strategically and proactively tackle them in a suitable manner that aligns with its intended objectives and overarching strategy if they arise.

The specific factors that have been considered as a part of the laws and regulations category are highlighted below:

- Alignment with applicable national and international laws and regulations such as but not limited to the ones mandated by the DGA and other laws and regulations on a national and an international level.
- The governance and ownership of ET is a critical factor to consider as it directly impacts the ability to manage the risks and leverage the stemming benefits.
- The preeminent objective that governmental entities seek to fulfill is utilizing ET to enhance citizens' quality of living.
- The adopted laws and regulations need to provide a wheel for innovation such that they do not restrict the adoption of specific ET and innovations without an adequately studied justification.
- The need to ensure that regulations are released in a timely manner such that they reflect the inherent risks of the contemporary ET and their latest trends.
- The constraints and degree of freedom imposed by the regulations and their impact on the ability to operate in an innovative manner.
- Data security and privacy challenges imposed of the ET.



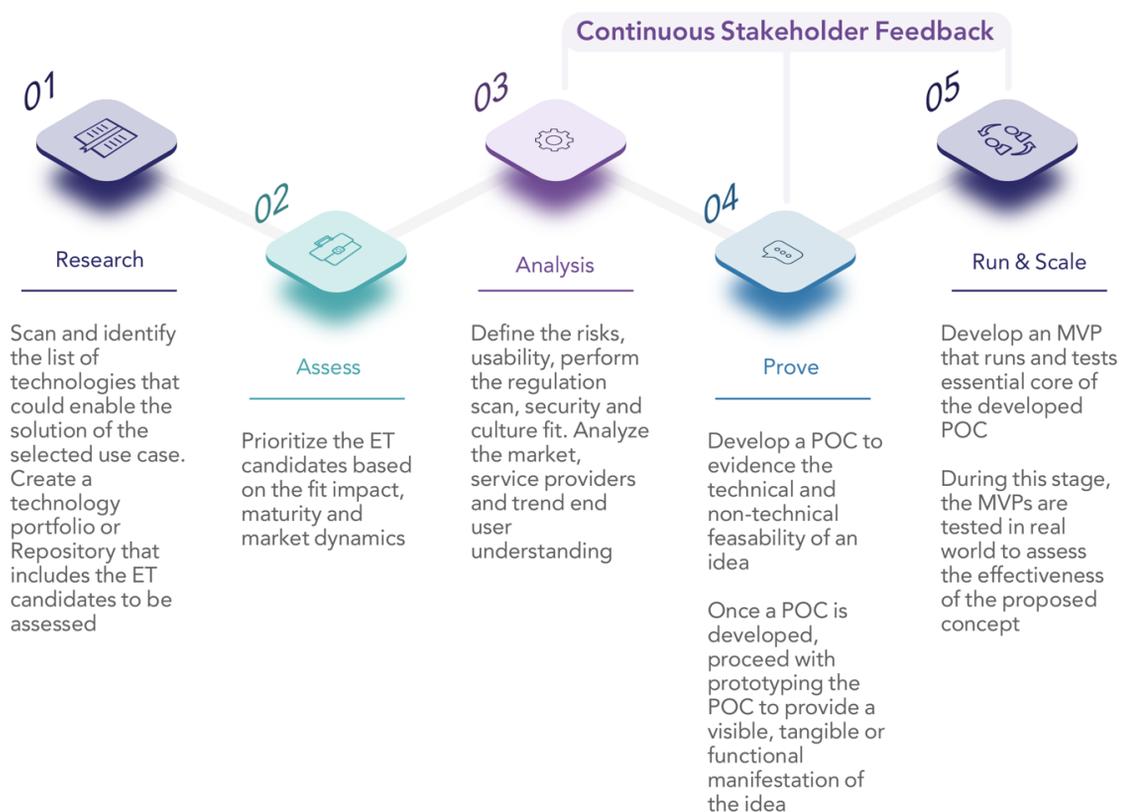
Some potential activities to consider that would enhance the overall performance with respect to the laws and regulations category are highlighted below:

- Identify and continuously monitor applicable regulations to ensure compliance.
- Regularly conduct internal and external audits to ensure the fulfillment of DGA's requirements.
- Review and maintain status of compliance and relevant evidences.
- Communicate any actions that could result in the violation of any identified requirements.
- Review the technologies promoted from a legal perspective to ensure that applicable laws and regulations are considered.
- Proactively engage and involve experts in the legal landscape to highlight any potential issues that may escalate to potential legal non-compliances.
- The need to consider technology-specific challenges, such as but not limited to bias potentially entailed in AI algorithms.
- Foster a positive and stable enabling regulatory environment – across all domains – in order to attract investment in new technologies and allow for innovation while not jeopardizing the operation and future evolution of other networks.
- Consider duplication of regulation to alleviate challenges from complying with differing regulatory requirements.
- Ensure that existing regulations promote and support pilot projects and test beds for new technologies and consider incentives to promote adoption of ET.
- Ensure that existing regulations are aligned with technology developments.
- Promote flexibility in the regulatory landscape to accommodate and leverage the benefits of new ET, secure investment and stimulate innovation while balancing the needs of government entities and citizens simultaneously.
- Protect the citizens' privacy against risks from a variety of different sources and adapt to existing regulations.
- Consider regulations as a mean that protect citizens from challenges posed by cyber threats, including the types of devices and information at risk, and their ever-changing nature.

5.3 ET Adoption Framework

The adoption of ET follows a systematic approach that considers the previous factors to promote a smooth adoption and integration journey with consideration of potential risks. The utilized framework is centered on embedding innovation into the core design principle of DGA's innovation and ET center while ensuring that a collaborative and agile culture is fostered within the government entities to promote the successful adoption of ET. Essentially, the successful adoption of ET would shed light on the enforced legislations as the successful adoption of ET would require some flexibility to enhance the innovative value chain. An overview of the main components of the ET adoption framework that are elaborated in subsequent sections are shown below along with a brief overview of each stage.

ET Adoption Framework Components



5.3.1 Research

Activities

Once a well-defined and articulated problem statement has been formulated to justify the use of ET. The adoption would be to research the products and how the entity envisions them being integrated into the existing processes and workflow. During this phase, it is essential to understand the entity's culture and consider the options that are could potentially fit to prevent unforeseen adoption failures that would come at higher costs at later stages. This puts an emphasis on researching how the ET will solve the problems and understanding the specifications and characteristics that the ET should have to add value rather than focusing your research on the technology itself.

Methodology

During the research phase, ET are scanned through studying use cases applied in a similar context, conducting desk-based research and interviewing SMEs on specific technologies in relevance with the problem statement. Researching about the types of trends that have been enabled by emerging technology can also enable the entity to preliminarily assess the success and appropriateness of the ET.

Output

During this phase, practices, and activities such as technology scans and market research would enable the entity to build a list of potential technologies that could be considered for the given problem statement. Once the potential options for ET are identified, the entity would proceed with identifying ET requirements (must have, should have, and could have) requirements to provide clarity and enable the entity to narrow the options that are derived through the market research and technology scan. Hence, the governmental entity would essentially have short-listed the potential ET that will be considered for the subsequent sections of the framework.

5.3.2 Assess

Activities

During this phase, the ET that has been identified as a part of the Research stage is validated to ensure the alignment with the problem statement and identified constraints, such as organizational readiness, and identifying external factors such as organizational readiness, regulatory standards, and social acceptance.

As the ET adoption framework is centered on the innovation principle, governmental entities should assess the innovation team to ensure their competence in achieving business objectives, capturing, and monitoring market and technology trends in addition to managing projects.

Methodology

During this phase, it is essential to have a network of stakeholders who are proactively involved in the planning and decision-making processes such that their feedback is captured and leveraged throughout the adoption journey. Ideally, the most influential stakeholders that would support governmental entities in their ET adoption journey would have the following characteristics:

- Communicate well.
- Have a wide network.
- Trusted among colleagues.
- Inspire others and work within multiple groups each day.

Additionally, during this phase, two important pillars that the ET adoption depends on is the ability to accurately capture and assess the desired metrics and KPI's in addition to the ability to maintain constant communication throughout the entire ET adoption journey.

Output

The main outputs of this phase are summarized below:

- A thorough understanding of the overall suitability of the ET along with the employees' perception of the ET.
- Feedbacks that would serve as a key component to continuous improvement.
- An overarching view of ET's performance with respect to identified metrics and indicators while ensuring that the data needed for the analysis stage is available.

5.3.3 Analysis

Activities

Once the Assess phase is done and the governmental entity has clarity on the overall performance of the ET, governmental entities would analyze factors such as: technical and financial feasibility as well as compliance to established regulations. The main objective of this phase is to provide sufficient justification for adopting the ET within the governmental entity while mitigating the potential likelihood and impact of uncalculated risks.

Methodology

The main activity in this phase is the assessment of the identified ET according to predefined requirements and criteria. Some factors that need to be considered as an integrated part of the Analysis phase are summarized below:

- **Functional requirements:** Those requirements would include an analysis of the core requirements described with specific use cases and key metrics that define their success and validate if the technology considered either meets or has limited or no use for the functional requirements defined. Additionally, critical functional requirements that need to be considered are the suitability of the ET's architecture and alignment with the governmental entity's current and envisioned Enterprise Architecture in the future.
- **Non-functional requirements:** Those requirements describe the technology attributes that are required for deployment but that are not part of the core capabilities include attributes such as security, reliability, performance, maintainability, scalability and usability. However, such factors are still important aspects to consider as they influence the overall adoption and effectiveness of the technology.

Output

The main outputs of this phase are summarized below:

- A clear outcome after conducting this stage of the right emerging technologies that will be tested within the organization for adoption.
- The documented results of all the factors analyzed such that government entities could decide which ET will be used to address their specific needs and the appropriate way in which it would be integrated.

5.3.4 Prove

Activities

Once the suitability of the ET has been justified in the Analysis phase, governmental entities would proceed to the Prove phase. The Prove phase is divided into two key steps that are designed and developed in controlled lab environments, which are “POC” and “Prototype”. The two key steps entailed in the Prove phase are further outlined below as each step’s methodology is provided in the subsequent section:

POC: A POC mainly tests the technical feasibility of an idea by utilizing a small-scale, working model of a specific feature or an interactive visualization of the proposed solution with minimal design. The main activities entailed in the POC step are:

- Defining the concept
- Formulating the hypotheses
- Testing the hypotheses

Prototype: A prototype mainly assesses the usability, look and feel of the product being developed with the intent of validating the UX/UI design and flow of design elements. The main activities entailed in the prototype step are:

- Developing initial POC
- Reviewing the POC
- Revising and enhancing the POC

During this phase, the governmental entities would be primarily focused on proving the fit and the potential success of the ET within their entity. Hence, usability tests and launching a proof-of-concept to obtain user-feedback is an effective and common activity that would enable the entities to prove the outcomes of their analyses. Essentially activities in this phase should allow governmental entities to test, measure, improve and retest innovations and ET until the most suitable option is identified and confirmed.

Methodology

As the Prove stage is divided into the “POC” and the “Prototype”, both of which entail recurring steps that should be performed iteratively to yield the most optimal outcome. The defined methodology associated with each of the stages is further detailed in the table below.



Stage	POC			Prototype		
Step	Define the concept	Formulate the hypotheses	Test the hypotheses	Develop initial prototype	Review of the POC	Revise and enhance the POC
Methodology	<ul style="list-style-type: none"> - Use shortlisted use cases as inputs to understand the initiative team, owners, and any key stakeholders that will be needed. - Collectively define goals, inputs, objectives, scope, and success criteria. - Establish resource commitments and finalize a POC schedule. 	<ul style="list-style-type: none"> - Identify minimal but necessary functionalities within the POC scope. - Work with stakeholders to analyze the ideation sketches and prioritize functionalities. 	<ul style="list-style-type: none"> - Identify use cases, conduct SME interviews and research to establish the practicality of the solution. - Review and validate the results with all stakeholders. - Compare outcomes to success criteria to develop findings summary and present lessons learned. 	<ul style="list-style-type: none"> - Develop rough sketch or drawing of the solution being developed. - Configure and test the required infrastructure and test to replicate the solution in a closed operational environment, if required. 	<ul style="list-style-type: none"> - Present the rudimentary working model to important stakeholders. - Collect the user feedback in an organized manner and use for further enhancements. 	<ul style="list-style-type: none"> - Review the feedbacks and reassess factors like – time and budget and technical feasibility of the actual implementation. - Incorporate the changes to the newer versions of the prototype until the customer expectations are met.

The evaluation of the ET should be performed during the Prove stage while considering inputs from all the identified stakeholders with respect to technological testing, team collaboration and cultural integration, as elaborated below:

Technological Testing

It is important to prove the technological analysis conducted in the previous step true or false. This evaluation can take the form of conducting independent proof-of-technology tests to examine whether a specific hypothesis about potential value added to a service or product is meeting expectations or not.

Team Collaboration

The stakeholders should understand the problem and what the solution is intended to accomplish. Each employee should have a strong grasp on the ET and help to roll it out among the rest of the staff.

Cultural Integration

Separate departments within the organization that will leverage the ET will need to integrate with each other whenever necessary to ensure seamless collaboration. This will be a strong indicator of how much value is being felt at an organizational level.

Output

Essentially, a decision made by key decisionmakers on whether to implement the ET or dispense it based on the results of the steps and activities performed during the "Prove" stage. Nonetheless, each step is associated with a unique set of outputs, which are further highlighted below.

Stage	POC			Prototype		
Step	Define the concept	Formulate the hypotheses	Test the hypotheses	Develop initial prototype	Review of the POC	Revise and enhance the POC
Output	- Mobilization - High level timeline and resource needs	Business requirement document	Concept viability and business model	- User journey flow - Mockups and wireframes	Rudimentary working model and iterations	POC assessment

5.3.5 Run & Scale

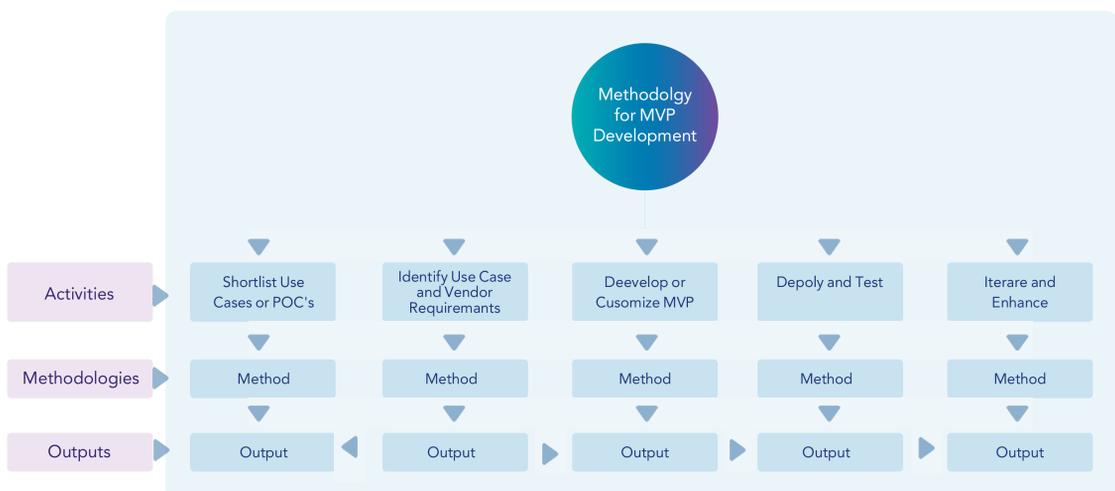
Activities

The last stage is the Run & Scale stage, which is mostly associated with implementation of POC's and prototypes to develop Minimum Viable Products (MVP). The developed MVPs are introduced prior to the release of a new product, that has a major new feature. MVP's mainly aim to validate user needs and demands prior to developing a more fully featured product. Hence, to reduce development time and effort, an MVP would only include the minimum capabilities required to be a viable solution. Nonetheless, MVP's come in a usable form of the solution and are integrated with internal and external systems to pilot test the solution and obtain insights about its usability alignment with the user needs.

As the last stage of the adoption of ET, government entities need to consider how the ET will be deployed and scaled. Future opportunities can be revealed through technology driven innovation efforts after implementation by turning proven opportunities into disruptive innovation programs.

Methodology

The last stage is the Run & Scale stage, which is mostly associated with implementation



Methodology

Step	Shortlist Use Cases or POC's	Identify Use Case and Vendor Requirements	Develop or Customize MVP	Deploy and Test	Iterate and Enhance
Methodology	<p>- If the entity has the required resources to support developing its MVPs inhouse, then it will identify the POC's that are to be considered for MVP development. In this case, the entity should reassess its business model, business case, feasibility with respect to factors such as but not limited to budget and resources, strategic needs and quick wins to ensure its capability to develop its MVP.</p> <p>- If the entity does not have the sufficient resources to develop its MVP, it will shortlist use cases for quick deployment (the use cases selected are generally established, innovative case examples, which eliminates the need to do a POC).</p>	<p>- If the entity develops its own MVP, it will identify minimal but necessary functionalities within the POC scope. Entities developing their MVP will need to define expected outcomes and success parameters.</p> <p>- If an entity outsources its MVP, it will establish vendor requirements and identify appropriate vendors or partners for deploying similar solution in KSA. In this step, the entity will initiate contact with vendors and show intent to deploy their solution.</p>	<p>- If the entity develops its MVP, it will assign appropriate resources for development purpose or identify and onboard appropriate partners. If the entity develops its MVP, it will undertake the development of the solution.</p> <p>- If the entity outsources its MVP, it will provide requirements and expectations to the vendor to support them with identifying a customized offering. Once the vendor responds, the entity will review the vendor's proposal and decide whether it should be accepted as it is or customized to ensure better alignment.</p>	<p>- If the entity develops its MVP, it will configure and test the required infrastructure and test to replicate the solution in a limited way in a operational environment. During this stage, it will collect data to support parameters defined for success and other technical aspects.</p> <p>- If the entity outsources its MVP, it will invite the vendor to deploy and demonstrate their solution in a relevant, operational environment.</p>	<p>At this step, the entities will present the rudimentary working model to important stakeholders. Additionally, they will collect the user feedback in an organized manner and use for further enhancements .</p>

The following are some of the critical considerations when selecting an implementation vendor:

- It's essential to select a vendor with the proven industry experience in implementing the technology solution.
- The vendor capability is essential to assure the government entity's key technology stakeholders. It's critical the implementation vendor has previous experience with at least a few critical implementations that are relevant to the respective ET.
- Consider speed and deadlines: Integrate into the entity's existing team at a pace that enhances the internal support, competence and buy-in from the employees. Meanwhile, ensure that the adoption is efficient such that the adoption of the ET still provides the intended value.

Additionally, during this stage, innovations within the government entities can be driven around a set of ET experiments that identify the entities' future needs, as well as seek Long term innovation opportunities

Output

Essentially, During the "Run and Scale" phase, the outcome of each of the steps for MVP development are highlighted below:

Outputs for MVP Development					
Step	Shortlist Use Cases or POC's	Identify Use Case and Vendor Requirements	Develop or Customize MVP	Deploy and Test	Iterate and Enhance
Output	List of selected use cases or POC's	- Business requirement document if an entity develops its MVP - Expression of interest for entities outsourcing their MVP	- A working solution if the entity develops its MVP - Decision on whether vendor's proposal is accepted or needs modification for entities outsourcing their MVP. If the entity decides that the vendor's MVP needs modifications, then those modifications would need to be identified.	Integration of solution.	- An official acceptance or rejection communicated to the vendor if the MVP is outsourced. - Iterations for MVP

The key outputs of this stage are highlighted below:

- The selection of key partners that help build, configure, and deploy the technology solution.
- The implementation of the identified ET and its scaling into experiments for future opportunities.
- Identification of areas to develop partnerships and provide support on commercializing a disruptive product or service used by the emerging technology.

5.4 Regulatory Methodologies for the Process of Adopting Emerging Technology

Regulatory Methodologies help increase the opportunity of successful adoption of emerging technologies so that the adoption of a certain Regulatory Method leads to the desired results. The following are more details on the Regulatory Methodologies for the process of adopting emerging technologies.

5.4.1 ET Regulation Lifecycle

To better capture the regulatory landscape altogether, an ET Regulations Lifecycle that is centered on addressing 4 critical questions that are distributed across its 4 stages is utilized as explained below. The ET Regulations Lifecycle assists with establishing a structured approach to regulating ET and would highlight the key actions that would need to be performed at each stage. Hence, DGA would be able to ensure that its role as a regulator is adequately fulfilled:

Stage 1 – What do we have now?

The first stage in the ET Management process is capturing the current ET regulatory landscape with respect to identifying the currently adopted ET along with the respective efforts done to establish effective management and regulation. In this stage, the aim is to effectively capture the whole ET ecosystem, which entails the respective requirements and regulations that the ET is expected to fulfill as mandated by DGA and other regulators. Meanwhile, when identifying and assessing the current efforts done to manage the ET and the respective requirements, it is critical to consider the purpose that the ET is intended to serve.

Stage 2 – When to regulate?

After forming a clear picture of the ET regulations, we move on to the second stage, which is the testing and evaluation phase. Time frames are very important at this stage as it is necessary to determine the right time to introduce new regulations, and to facilitate this point, we provide guidelines as a tool to help government agencies assess the right time to introduce new regulations, as it brings the Digital Government Authority and other regulators closer to technical innovations, by adopting a flexible model (agile) that meets the requirements of technical development more.

Stage 3 – What’s the right regulatory approach?

As regulators ultimately strive to protect citizens and promote the adoption of ET across the government entities, it is essential to consider the right approach that could be used to adequately regulate ET. Potential approaches include heavy, precautionary regulation on one end of the spectrum and little to no regulation on the other end. The selection of the regulatory approach should foster a hospitable environment that provides innovators and entrepreneurs with the flexibility to innovate and experiment with ET.

Stage 4 – What has changed in the regulatory landscape?

Considering the rapid rate at which emerging technologies are progressing and business models evolving, it is important for regulators to review established regulations at regularly planned intervals to maintain their relevance. The review of the regulatory landscape will shed light on laws that are either obsolete or in need of revision.

5.4.2 ET Regulation Mechanisms

As technologies evolve, regulators from around the world are rethinking their approaches, adopting models that are agile, iterative, and collaborative to face the challenges posed by emerging technologies and the fourth Industrial Revolution. To promote innovation, regulators are also moving toward creating outcome-based regulations and testing new models in sandboxes. The mechanisms outlined below help government entities balance the need to protect citizens and foster innovation effectively. The following mechanisms assist government entities in identifying when to regulate and the right regulatory approach that could be adopted to effectively optimize the regulatory landscape.

Adaptive Regulation

This mechanism focuses on creating a shift from “one-time regulation” to a responsive, iterative approach. Traditionally, regulators adopt a reactive approach as they conceptualize new rules and regulations in response to market developments or new legislation. The issue with the traditional approach is that regulators often don’t know how businesses and consumers will react to new regulations; and second, the rules are rarely reconsidered once in effect.

Contrarily, the adaptive regulation approach that the first principle is promoting relies on trial and error and co-design of regulation and standards. The benefit of such an approach is that it has faster feedback loops that consequently allow regulators to evaluate policies against set standards, feeding inputs into revising regulations.



Regulatory Sandboxes

This mechanism focuses on promoting the prototyping and testing of new approaches by creating sandboxes and accelerators. Essentially, the creation of accelerators and sandboxes is an enabling mean that aims to promote the experimentation with new technologies in environments that foster innovation. On one hand, accelerators speed up innovation and involve partnerships with private companies, academic institutions, and other organizations that can provide expertise in certain areas. On the other hand, sandboxes are controlled environments allowing innovators to test products, services, or new business models without having to follow all the standard regulations. Sandbox approaches are intended to help government entities better understand new technologies and work collaboratively with industry players to develop appropriate rules and regulations for emerging products, services, and business models. An additional value stemming from sandboxes is the reduced time and cost of getting innovative ideas to market.

Outcome-based regulation

This mechanism focuses on results and performance rather than form. Outcome-based regulation specifies required outcomes or objectives rather than defining the way in which they must be achieved. This model of regulation offers businesses and individuals more freedom to choose their way of complying with the law. Hence, by prioritizing performance and outcomes enables government entities to develop regulations (or other, softer mechanisms such as guidelines that focus on achieving the regulators' intended objectives.

Risk-weighted regulation

This mechanism advocates a shift from one-size-fits-all regulation to a data-driven, segmented approach. Essentially, the objective of this mechanism is to leverage the analytical capabilities of ET to optimize the speed to market for businesses. Hence, this mechanism calls for leveraging captured data, which entails new patterns and trends, information that can make the product more accurate, safe, effective, and personalized and integrate them into products with a fast speed to market.

Collaborative regulation

This mechanism is focuses on harmonizing legislation and regulations at the national and international centered on by engaging a broader set of entities across the ecosystem. This ecosystem approach—when multiple government entities collaborate with one other and with those being regulated—can encourage innovation while protecting consumers from potential fraud or safety concerns. In this approach, private, standard-setting bodies and self-regulatory organizations also have key roles to play in facilitating collaboration between innovators and government entities.

5.5 KSA in the ET Landscape

Upon capturing the ET landscape and its potential impact, the subsequent section focuses on KSA's efforts and accomplishments in the ET landscape that highlight its strategic interest in promoting ET adoption.

5.5.1 DGA Role

One of the DGA's objectives is to support government entities in adopting ET and enabling actors in the ET ecosystem, The DGA plays the 3 main following roles:

Enabler

DGA is focused on enabling the adoption of ET in the government entities by driving technology adoption positioning & opportunities and enhancing innovative capabilities.

Regulator

DGA acts as a regulator of the digital government ecosystem and focuses on identifying standards, metrics and policies that help enable the adoption and effective application of emerging technologies.

Advisor

DGA focuses on providing advisory services to government entities in multiple areas including capacity development, identifying challenges, ensuring coordination between the various actors in the system, and prioritizing and implementing use cases.

5.5.2 GovTech Program Objectives and Outcomes

The GovTech Program was founded by the DGA to enable government entities to be more future-oriented in using ET to better serve their stakeholders. The GovTech Program entails 3 objectives that are further detailed below with their respective outcomes.

The successful implementation of the program will affect the capabilities of individuals, the maturity of government entities, innovative ways of working, and the adoption of emerging technologies in the Kingdom as it would yield the following outcomes.

Empowering Government entities – The Empowering People pillar of the GovTech Program is associated with the following outcomes:

- Highly skilled workforce in the government sector
- Innovative work culture across government entities

Accelerating Adoption – The Accelerating Adoption pillar of the GovTech Program is associated with the following outcomes:

- High maturity level of public sector organizations with regards to use of ET
- Established GovTech market and an ET ecosystem

Shaping Future – The Shaping Future pillar of the GovTech Program is associated with the following outcomes:

- Better solution for real life challenges using ET
- Increased beneficiary satisfaction through innovative solutions

5.5.3 Examples of Success Stories in KSA

Several government entities have embarked on the journey to adopt ET as part of their digital transformation. Below is an overview of ET adoption cases across 7 different government entities.

Technology	Entity	Use Case
Blockchain	 هيئة الزكاة والضريبة والجمارك Zakat, Tax and Customs Authority	Experimenting with Blockchain in container tracking
Artificial Intelligence	 SDAIA الهيئة السعودية للبيانات والذكاء الاصطناعي Saudi Data & AI Authority	Tackling a global pandemic with contact-tracing
Advanced Analytics	 وزارة الصحة Ministry of Health	Facing public health threats with prescriptive analytics
Artificial Intelligence	 المركز الوطني للأبحاث والدراسات الصحية NATIONAL HEALTH RESEARCH CENTER	Patient readmission prediction
Artificial Intelligence	 هيئة تقويم التعليم والتدريب Education & Training Evaluation Commission	Monitoring remote tests
Artificial Intelligence	 الجمارك الجمرك	Automation of passenger entry and departure processes
Internet of Things	 الشركة السعودية للكهرباء Saudi Electricity Company	Remote lighting control and monitoring system

Blockchain

Use Case	Stage	Owner	Partnership
Experimenting with Blockchain in container-tracking.	Pilot	هيئة الزكاة والضريبة والجمارك Zakat, Tax and Customs Authority	

Background

- With nine different seaports serving KSA, classifying shipments and identifying the high-risk ones was always a daunting task, despite how well-equipped some ports are (e.g., Dammam, Jeddah).
- Saudi Customs, MCIT, Mawani and Maersk announced in September 2019 the successful completion of the pilot project for blockchain technology by tracking one of the containers from King Abdulaziz Port in Dammam to Rotterdam.

Actions Taken

- Initiated preliminary conversations with IBM Blockchain
- Oversaw integration of Fasah with TradeLen’s blockchain-powered platform to provide an audit trail
- Aligned and prepared for pilot with Rotterdam Port and Maersk

Achieved Outcomes

- Reduce use of paper
- Provide more visibility on shipments’ progression through the supply chain
- Reduce physical inspections rate

Artificial Intelligence

Use Case	Stage	Owner	Partnership	
Tackling a global pandemic with contact-tracing.	Live	 SDAIA الهيئة السعودية للبيانات والذكاء الاصطناعي Saudi Data & AI Authority	 وزارة الصحة Ministry of Health	 وزارة الشؤون البلدية والقروية والإسكان Ministry of Commerce

Background

- Saudi authorities implemented a nation-wide curfew on March 2020, signaling the beginning of a long fight against COVID-19
- To help curb the spread of coronavirus, SDAIA launched “Tabaud” in a major contribution to the gradual easing of lockdown restrictions.
- “Tabaud” notifies people who have been in contact with infected cases through Bluetooth-powered notifications

Actions Taken

- Aligned with MoH on approved health standard to curb the spread of the virus
- Designed an application using Bluetooth technology, capable of identifying other smart phones that use the same application, and the phones that use the same application, and the extent to which anyone nearby is posing a risk
- Rolled out the application on Apple Store and Play Store
- Enforced using the application to access public locations

Achieved Outcomes

- 22 different languages used in the application
- 29k+ users declared their positive cases
- Ranked #3 globally in adopting ET to tackle Covid-19

Advanced Analytics

Use Case	Stage	Owner	Partnership
Facing public health threats with prescriptive analytics	Live	 وزارة الصحة Ministry of Health	 World Health Organization  نوبكو nupco and Governorates' Emirates

Background

- MoH's Command and Control Center was designed to ensure full preparedness to respond to any public health threats immediately and efficiently
- The center forms a link between various stakeholders, supervising MoH's capabilities to confront public health issues.
- The vision was to go from a fragmented healthcare ecosystem to a cohesive one, powered by analytics and capable to absorb the large and speedy inflow of data volume in real-time

Actions Taken

- Designed and implemented a data collection, management, and visualization methodology
- Onboarded and ensured readiness of all regional general and primary healthcare directorates

Achieved Outcomes

- Issued specific ministry-level and general directorate-level action plans
- Achieved a more efficient order-fulfillment for general and specialist hospitals
- Conducted proactive measures to control the spread of COVID-19

Artificial Intelligence

Use Case	Stage	Owner	Partnership
Monitoring remote tests	Live	 هيئة تقويم التعليم والتدريب Education & Training Evaluation Commission	  وزارة التعليم Ministry of Education

Background

- Because of the pandemic, the Ministry of Education began an experiment in mid-2020 that required students to take exams remotely after years of taking them in person.
- Using artificial intelligence, the Education and Training Evaluation Commission has been able to monitor thousands of tests.

Actions Taken

- Prepare for remote exams by creating a website dedicated to learning concepts and practicing.
- Create a test interface powered by ExamSoft that uses a camera to verify identity.
- Participants will receive an email alert with an overview of the exams

Achieved Outcomes

- About 200,000 students attend remote exams.
- 96% of all students finished the exams without any challenges

Artificial Intelligence

Use Case	Stage	Owner	Partnership
Patient readmission prediction	Development	 المركز الوطني للمعلومات الصحية NATIONAL HEALTH INFORMATION CENTER	 المجلس الصحي السعودي Saudi Health Council

Background

More than 20% of the chronic patients get readmitted to the hospital resulting in cost overruns, reduced profitability and adversely affecting patient experience.

Actions Taken

- Deploying AI/ML based algorithm to analyze patient clinical details such as diagnosis, medications etc. to predict risk of readmission within 30 days of discharge
- Disease and Condition based AI/ML prediction model
- Realtime processing of patient data and predicting the risk of readmission

Achieved Outcomes

- Accurate prediction of patient readmission at the time of clinical discharge. Hence clinicians can alter or draft new treatment plan for the patient
- Enhanced patient experience and hospital reputation
- Increase in operational profits
- Enhanced quality of care
- Avoid regulatory penalties

Artificial Intelligence

Use Case	Stage	Owner	Partnership
Automation of passenger entry and departure processes	Live	 	   

Background

- Efforts have been initiated by the kingdom to improve traveler's journey and provide efficient services. A face recognition technology has been leveraged that required the below:
- Linking with data in the information center servers.
- Designing devices and gates in accordance with the procedures taken with travelers.
- Improving the quality of performance of electronic portals and self-service.
- The time it takes to terminate the service for the traveler.

Actions Taken

- Deploying Reliance on government cloud computing (at the National Information Center) to store and process data.
- Using the concept of artificial intelligence in the process of image processing and fingerprinting in security aspects.
- Use of face recognition technology.

Achieved Outcomes

- Self-service machines help control costs and increase service efficiency.
- Adjust security by taking advantage of ET.
- Contribute to the acceleration of service provision to the passenger, as it contributed in 2019 to providing the service to 692,781 passengers to and from King Khalid International Airport.
- Eliminate human intervention in the process of entering and departing passengers and completely automate the procedure.

Internet of Things

Use Case	Stage	Owner	Partnership
Remote lighting control and monitoring system	Live		N/A

Background

Riyadh City was facing difficulties following up on the monitoring work and maintenance with human intervention as it has about 480,000 lighting poles and about 2,300 panels. As such, a system has been developed for remote control of all elements of the lighting networks automatically and locating any disability.

Actions Taken

- Research and study the best technologies and sensors used in controlling lighting networks
- Numbering the lighting poles with a reflective sticker and raising their coordinates on digital maps in order to facilitate operations
- Monitoring and gathering statistical information for the lighting network
- Control the times of turning on and off the lighting stations

Achieved Outcomes

- Immediate detection of lighting network malfunctions, which reduces the cost of maintenance and operation
- Reducing energy consumption by up to 30% by dimming the lanterns
- Monitoring energy consumption and thus identifying and reducing electricity losses
- Helps making the right decisions as the accuracy of the system is not less than 90%
- Improving the quality of life and reducing environmental pollutants.

06. Table of Definitions

Term	Definition
DGA	Digital Government Authority.
Digital Government	Promotes administrative, organizational and operational processes between the various government entities in their transitioning to a comprehensive digital transformation to allow easy and effective access to government digital information and services.
Government Entity	Ministries, authorities, public institutions, councils, national centers including any additional form of a public entity
Beneficiary	Citizens, residents, visitors, government agencies, private sector, non-for-profit sector, inside or outside the KSA that require to interact with a government entity to receive any of the services offered in the Kingdom
Artificial Intelligence	It is a branch of computer science concerned with building smart machines capable of understanding their environment and performing tasks that require a certain level of intelligence
Augmented Reality	Additional information or visual images superimposed on the physical world, often through computer-generated graphics and/or sound overlays, to improve the user experience of a task or product.
Virtual Reality	A computer generated, three-dimensional environment with which a user can interact using electronic devices such as special controllers, gloves and VR headsets with a built-in screen. In a VR simulation, a user can look around in any direction and travel through the space in real time. VR first found acceptance in the video gaming space; today it has expanded to situations from healthcare to real estate, where a potential buyer of a home can walk through it as if they were actually present.
Mixed Reality	An environment which is a mixture of augmented reality and virtual reality. The user can still see the real world around them, with virtual objects integrated into the environment around them. However, the virtual objects are fixed in place and change in size or perspective as the user gets close to them. This differs from traditional augmented reality where virtual objects are the same size no matter where the user is in relation to them. Similar in function.
Blockchain	Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network

Coherence	Emerging technologies are interconnected in such a way that they provide a holistic ecosystem and experience.
Data Analytics	Used to describe statistical and mathematical data analysis that clusters, segments, scores and predicts what scenarios are most likely to happen.
Emerging Technology	Modern technologies that support the implementation of digital government activities, which its applications still under development, such as: AI, IoT, Blockchain, etc
Functional Requirements	Those requirements would include an analysis of the core requirements described with specific use cases and key metrics that define their success and validate if the technology considered either meets or has limited or no use for the functional requirements defined. Additionally, critical functional requirements that need to be considered are the suitability of the ET's architecture and alignment with the governmental entity's current and envisioned architecture in the future.
Technical Requirements	Those requirements describe the technology attributes that are required for deployment but that are not part of the core capabilities include attributes such as security, reliability, performance, maintainability, scalability and usability. However, such factors are still important aspects to consider as they influence the overall adoption and effectiveness of the technology.
Internet of Things (IoT)	A network of electronic devices, software and sensors that allow machines to interact with each other.
Proof-of-Concept	The process of testing an idea under development on a small scale to demonstrate its feasibility, impact, and the transition to the initial product stage.
Prototype	A prototype is a preliminary sample, that aims to test a product or a process. The idea is to test it before investing money and time on it. It is described as the step between the formalization and the evaluation of an idea or a process.
Minimum Viable Product	It is an initial version of the final product which has the minimum properties to test the product with users.
Organizational readiness	Constraints that identify barriers to the technology deployment within the organization or government entity.
Novelty	Emerging technologies clearly show a new function or implement a previously unseen basic principle for a new or existing mostly technological operation.
Robotics	Engineering discipline that deals with the design, manufacture and operation of physical robots. it overlaps with a number of fields including bioengineering, computer science artificial intelligence. While artificial intelligence is often confused with robotics, in reality an AI is used to make a robot execute tasks. A robot body is merely a vessel or shell to be controlled by an artificial intelligence.

07. Table of Abbreviations

Abbreviation	Expansion
AI	Artificial Intelligence
AR	Augmented Reality
DGA	Digital Government Authority
ET	Emerging Technology
IoT	Internet of Things
MCIT	Ministry of Communication and Information Technology
MoMRAH	Ministry of Municipal, Rural Affairs and Housing
MR	Mixed Reality
MVP	Minimum Viable Product
NUPCO	National Unified Procurement Medical Supplies Company
PoC	Proof of Concept
SDAIA	Saudi Data & AI Authority
SME	Small and Medium Enterprise
VR	Virtual Reality
RPA	Robotic Process Automation



هيئة الحكومة الرقمية
Digital Government Authority