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The Role of Large Language Models (LLMs) Driven Chatbots in Shaping the Future of Government Services and Communication with Citizens in UAE

Dina Fares
ddf3329@rit.edu

RIT

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By

Dina Fares

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Thesis Approval

Student Name: Dina D. Ahmed Fares

Thesis Title: The Role of Large Language Models (LLMs) Driven Chatbots in Shaping the Future of Government Services and Communication with Citizens in UAE

Name: **Dr. Sanjay Modak** **Date: December 2023**

Designation: **Chair of Committee**

Name: **Dr. Ayman Ibrahim** **Date: December 2023**

Designation: **Member of Committee**

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Abstract

As technological advancements continue to redefine the landscape of Government Services and Communication with Citizens in the UAE, and in line with the UAE government's efforts towards achieving the UAE charter for future services, the integration of Large Language Models (LLMs) driven chatbots emerges as a pivotal factor in shaping the future of government services and communication with citizens in the United Arab Emirates (UAE).

Through a comprehensive review of literature and collaboration with industry experts, this thesis explores the development of AI-based chatbots and the introduction of the breakthrough in the field of Deep Learning Language models (Transformers, and Attention Mechanism). It will also highlight the main drawbacks and limitations of advanced NLP-large language models that demand thoughtful consideration.

In this foresight study, different future foresight tools have been used to identify and explore the four plausible future scenarios of using Large Language Models in shaping the future government citizens' communications and streamlining governmental services in the UAE.

The vignette for each scenario has been thoroughly outlined, shedding light on the opportunities and challenges inherent in each scenario. Additionally, the strategic response for each scenario has been outlined. This comprehensive approach is geared toward gaining a nuanced understanding of the transformative potential associated with the utilization of Large Language Models (LLMs) in government settings. The overarching goal is to augment the future responsiveness of government interactions with citizens by providing a forward-looking perspective on how the integration of LLM-driven chatbots can impact government-citizen interactions, foster transparency, and contribute to the establishment of technologically advanced communication between the government and citizens, ultimately facilitating seamless government services.

Keywords:

Large Language Models, Government- citizen communication, Efficient Chatbots, Future Foresight, Scenario Planning, Horizon Scanning, Systems Thinking, Generative AI, Citizens Engagement, Citizens Trust, AI Ethics, AI-powered Chatbots

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Chapter 1: Introduction

AI-powered chatbots have been widely used in the public and private sectors. While mainly used to enhance communications with customers, customer satisfaction with chatbots is highly mixed. Customers reported feeling frustrated by chatbots because of questions being misunderstood, responses being irrelevant, and poor integration with human service agents (Shumanov and Johnson, 2021). This thesis adds to the existing literature by investigating how government chatbots can be improved using disruptive AI-powered natural language processing tools like ChatGPT built using the GPT-4 AI model. We scanned also other tools like Bard using LaMDa, Ernie (**E**nhanced **R**epresentation from K**N**owledge **I**nt**E**gration) and the recently announced open-source first-of-kind Arabic Large Language Model developed in the United Arab Emirates, JAIS (Jais MBZUAI, 2023) or Noor, an Arabic Natural language processing (NLP) model API (Noor, 2023). This enhancement will not only enhance communication with citizens but also transform the future of government services to align with the UAE Government Charter for Future Services. Additionally, these improvements are expected to have a positive impact on the competitiveness index of the UAE, as streamlined and efficient government services often contribute to a more favorable business environment, attracting investments and fostering economic growth.

Background

For many years, various sectors have made substantial use of artificial intelligence (AI) approaches to support and improve the quality of communication, decision-making, and problem-solving. Building on the successes reported by the private sector, Governments have also begun to adopt AI technologies across different domains to realize their full potential in addressing critical government challenges and needs.

During the late COVID-19 pandemic, one of the main challenges for governments was to develop a communication strategy that was both effective and consistent. This strategy needed to remind people of the important precautions that needed to be taken in their

day-to-day lives, but it also needed to encourage people to get back to their normal activities so that the economy could continue to function, and the social impacts of the lockdown could be mitigated (WPP Gov, 2021).

Effective communication between citizens and governments has always been a challenge and problematic (Androutsopoulou et al., 2019). Moreover, the lack of transparent, inclusive, and responsive communication can result in significant costs for governments worldwide (OECD, 2021). The challenges of ineffective communication can stem from various reasons, including:

Language barriers:

When providing information to the public, governments frequently use specialized terminology or jargons, which can be challenging for individuals to understand, particularly if they do not speak the language that is being used to provide the information. As a result of this, it may be difficult for individuals to comprehend their obligations and responsibilities or to utilize the services effectively provided by the government ("OECD Report on Public Communication: The Global Context and the Way Forward Report Highlights," 2021).

This challenge is highly visible in countries with high levels of cultural and ethnic diversity such as the UAE with citizens and visitors coming from all over the world with several languages and dialects.

Restricted information access:

Citizens may not always receive a comprehensive and clear explanation of their government's policies, practices, and services, which can make it challenging for them to navigate through websites and mobile applications in search of relevant information. This can impede their ability to access the services they need or obtain the information they require from their government (Androutsopoulou et al., 2019).

Transparency and trust:

Ineffective communication between citizens and their governments can stem from strained relationships characterized by a lack of transparency and trust. This

communication breakdown may be caused by various factors, including a history of official corruption or abuse of power, or a perception that the government is unresponsive to the needs and demands of its citizens. These factors contribute to the problem of ineffective communication (Alessandro et al., 2021).

Lack of Engagement:

There is the possibility of a lack of involvement from citizens or customers, who might not be interested in matters pertaining to government, or who might not believe that their participation can make a difference in the world. This could lead to a lack of feedback and input from the public, which may make it difficult for governments to comprehend and respond efficiently to public needs.

As part of their efforts in trying to solve these challenges, Governments started to invest heavily in chatbots. However, it wasn't generally powered by real artificial intelligence but relies on a simpler, rule-based algorithm (Kamoonpuri and Sengar, 2023) that uses Natural Language Processing (NLP) to respond to queries raised by a customer and mapping it to the best possible response sets available in the system and pre-defined by government.

Customer acceptance was a challenge as customers perceived current implementations of chatbots as frustrating because of questions being misunderstood, responses being irrelevant, and poor integration with human service agents (Shumanov and Johnson, 2021). Chatbots face the challenges of understanding different dialects, and complex language. One of the significant difficulties in chatbots is comprehending the conversation's context and producing an appropriate response (Nirala et al., 2022).

According to the UAE National Strategy for AI in 2031, issued by the Ministry of State of AI for Artificial Intelligence, Digital Economy and Remote Working Applications Office ("UAE Strategy for Artificial Intelligence, 2018), the UAE is positioning itself as a global leader in artificial intelligence and has adopted an AI strategy to enhance government services. In 2020, the UAE set an ambitious vision for the future of government services by announcing the "UAE Government Charter for Future Services" (The UAE Promise,

2020). The goal of the charter is to establish the primary 8 principles for designing and delivering government services in the UAE. These principles are as follows:

- **Human-centered services**
- **Digital services by default**
- **Integrated, varied, and consistent service channels**
- **Seamless and proactive experience**
- **One-time data provision**
- **Safe data and guaranteed privacy**
- **Listening to customers' voice**
- **Value-added services**

For efficient implementation of the eight pillars, the UAE government must adopt innovative and disruptive technologies. This will make it easy to design human-centered services and listen to customers' voices to enable governments to co-design services that meet the aspirational pillars of the UAE Promise Charter.

Problem Statement

Effective communication between citizens and governments has always been a challenge and problematic (Androutsopoulou et al., 2019). The utilization of AI-powered chatbots has been extensively observed across both public and private sectors. Although they are mainly used to improve customer interactions, the level of customer satisfaction with chatbots is considerably varied. The chatbot's inability to accurately comprehend customer inquiries, provide pertinent responses, and seamlessly integrate with human service agents led to customers' frustration (Shumanov and Johnson, 2021). This thesis investigates how government chatbots can be improved using the recent developments in large language models. This enhancement will not only enhance communication with citizens but also transform the future of government services to align with the UAE Government Charter for Future Services.

Research Aim and Objectives:

This thesis aims to explore and analyze the potential of augmenting the current implementations of government chatbots with the power of the disruptive artificial intelligence advanced natural language processing tool LLMs such as ChatGPT, Bard, Ernie, etc. It also aims to understand how this can impact/disrupt communication with governments and help in shaping the future of government services in such a way that will efficiently serve the goals of the UAE Government Charter for Future Services.

Research Objectives:

- Explore the challenges of current government chatbots.
- Discuss the potential benefits of augmenting government chatbots with the disruptions offered by LLMs.
- Investigate how these advanced NLP large language models can improve the efficiency and effectiveness of government services in the UAE.
- Comprehend the different elements of the above system along with their interconnections and dynamic consequences of its components.
- Explore and understand the different plausible scenarios of the future of government services and communication with citizens using large language models.

Research Questions

- What factors contribute to the challenges in communication between governments and citizens?
- How do the limitations of current government chatbots hinder efficient communication and service delivery?
- How can Large Language Models (LLMs) disrupt the current traditional communication channels in government-citizen interactions?
- What are the main limitations of applying LLMs to government services and communication?

- Explore the dynamic consequences of integrating LLMs into government-citizen communication.
- What are the plausible future scenarios for government-citizen communication in the UAE when employing Large Language Models? What are the main challenges and opportunities of each scenario?

Structure of the Thesis

This Thesis will be structured as follows:

Chapter 1 will introduce the research topic and it's background, then formulate the problem statement along with the research objectives and the research questions.

Chapter 2 will review the literature on the topic and will briefly discuss the different types of chatbot implementations and their limitations. It will explore the development of AI-based chatbots and the introduction of the breakthrough in the field of Deep Learning Language models (Transformers, and Attention Mechanism). This chapter will also explore the main drawbacks and limitations of advanced NLP-large language models that demand thoughtful consideration.

Chapter 3 will introduce the research methodology and identify its overall objectives, along with the main research questions that this thesis will target to provide some clear answers and insights. In this chapter, we will identify the three main stages that will be covered throughout the thesis, which are as follows: Stage one, will include the literature review, and summary takeaways. Stage two will include the influence map along with the different archetypes, and will be covered in detail in chapter four. Stage three will follow the scenario planning process that is based on the findings of stages one and two and will be covered in detail in chapter five.

Chapter 4: In this chapter, we will draw the influence map. Influence maps aim at identifying different system elements and visualize their interconnections through causal loops and archetypes. Upon drawing the influence map and understanding different system variables and their interconnections, we will start crafting our 4 scenario vignettes, this will start by identifying the main driving forces. Driving forces are considered the factors that will influence the future of government- citizens' communication and government service design across a PEST model (Political, Economic, Social, Technological). Based on the PEST analysis, the two critical uncertainties will be identified, and will construct a scenario matrix. Finally, we will outline the main characteristics of the four plausible scenarios.

Chapter 5: This chapter will start by identifying the opportunities and risks of each of the four plausible scenarios that were described in Chapter four, along with the expected strategic response of each scenario.

Chapter 6: This chapter summarizes the conclusion and the recommendations from this thesis and suggests areas for further study.

Chapter 2: Literature Review

This chapter aims to explore the possible outcomes of incorporating advanced NLP tools using large language models into government chatbots. It seeks to look at the current status quo of chatbot implementations and the current disruptions caused by advanced NLP chatbots using large language models and their potential impact on the future of United Arab Emirates (UAE) government services and enhancing the communication between government and citizens.

No doubt, that the use of chatbots has become increasingly popular among governments all over the world as a means to communicate with citizens and provide automated assistance to users to enhance the accessibility, efficiency, and effectiveness of government service delivery (Ju et al., 2023; Kamoonpuri and Sengar, 2023).

Types of Chatbots' Implementations and their limitations:

As per a survey on recent advances in chatbots, chatbots' implementation methods are either classified as **rule-based chatbots** or **artificial Intelligence-based chatbots**. Within AI chatbots we have two types; **information-retrieval chatbots** and **generative chatbots** (Caldarini et al., 2022).

Traditional chatbots which are known as rule-based chatbots, use pre-programmed rules and algorithms to understand user inputs. They rely on keywords and decision trees to interpret the user's inputs and are highly dependent on the specific domain they were programmed for. For example, a rule-based chatbot is programmed to recognize certain keywords or phrases or match specific strings of words and look up a response (ChatGPT & LLMs in the Enterprise, 2023). This makes them inflexible since they require manual rule-writing for each domain they are intended to operate (Caldarini et al., 2022). Despite being commonly used in various industries and, particularly in customer service and support to provide answers to frequently asked questions and guide users toward relevant resources, traditional chatbots have certain limitations. These include challenges related to their functionality, contextual understanding, flexibility, and training. (Hsu and Lin, 2023).

For artificial Intelligence (AI) based chatbots, there are two types; **Information-Retrieval chatbots** and **Generative chatbots** (Caldarini et al., 2022). Information retrieval models are based on algorithms designed to often use Natural Language Processing (NLP) to understand and generate information that is retrieved from a dataset of text based on user input. They aim to interact with users as real humans using either shallow learning, rule-based, or deep learning algorithms. These models have a pre-defined set of possible answers based on a knowledge base of question-answer pairs. When the user provides an input, the model treats it as a query and matches it with similar ones in the chat index. The output returned to the user is the answer paired with the selected question. Overall, these models are used to power chatbots and other natural language processing systems to provide accurate and relevant responses to user inquiries.

Information retrieval-based chatbot models are typically utilized in government services to ensure that high-quality and appropriate responses are provided to users. However, these models are limited to handling conversations that align with their pre-written responses and possess challenges related to their functionality, contextual understanding, flexibility, and training. (Hsu and Lin, 2023). And as a result, conversations can sound artificial if they stray from the pre-set topics (Nuez et al., 2017).

The second type, which is known as generative chatbots or generative models (Caldarini et al., 2022), generates responses word by word, creating entirely new sentences based on the user's input. However, to do so, they need to be trained to learn sentence structure and syntax. While they can create new responses, their outputs can sometimes lack quality or consistency.

Advantages of Generative Models

This model provides several advantages. Firstly, it is an end-to-end solution that can be trained using various datasets, enabling it to work with different domains without requiring domain-specific knowledge. Additionally, the model can be adapted to work with other algorithms for domain-specific analysis if needed. This makes it a simple, flexible, and widely applicable model that can be used for various natural language processing (NLP) tasks (Shum et al., 2018).

The Sequence-to-Sequence model has emerged as a popular choice for dialogue generation and various other NLP tasks. However, it has a significant limitation: it needs to encode all the information from the input sentence into a fixed-size context vector. Consequently, longer sentences have a higher chance of losing some information during the encoding process, which makes the model less effective in responding to longer sentences or dialogues and often results in vague and inconsistent answers. Additionally, the model tends to focus on a single response while generating an answer, which can lead to incoherent turns in a conversation(Jurafsky and Martin, n.d.).

Concept of Transformers and Attention Mechanism

The introduction of "Transformers" was a breakthrough in the field of Deep Learning language models, brought forth by Vaswani (Vaswani et al.,2017). These models employ an "Attention Mechanism" that assigns weights to different parts of the input data in a conversation, enabling the model to draw global dependencies between input and output. This makes it possible to train on much larger datasets than before, leading to the development of pre-trained systems like BERT (Bidirectional Encoder Representations from Transformers) and GPT (Generative Pre-trained Transformer), which were trained on massive language datasets like Wikipedia Corpus and Common Crawl (Devlin et al., 2019). These models are called large language models. Large language models can predict the next word that could potentially be used in a given context within a fraction of a second. These models have been trained on an enormous amount of data, ranging from billions to trillions of words (Openai et al., 2018). Additionally, they can be tailored to suit the distinct needs of various applications, such as government services and chatbots. The Transformer architecture serves as the foundational component for all LLMs, allowing them to produce output that is both contextually relevant and highly precise (Vaswani et al., 2017).

Natural Language Processing and Natural Language Understanding

Recent research has highlighted the increasing demand for more efficient chatbots, which can be achieved through the integration of advanced Natural Language Processing (NLP) tools. Natural Language Understanding (NLU) and Natural Language Generation (NLG) are two critical components of NLP (Nirala et al., 2022).

NLU involves comprehending the meaning of text in a manner that mimics human understanding. NLG generates text based on meaning. These models use deep learning techniques that when combined with the power of Generative Large Language Models can power chatbots with the ability to learn from user interactions and provide tailored responses (Caldarini et al., 2022).

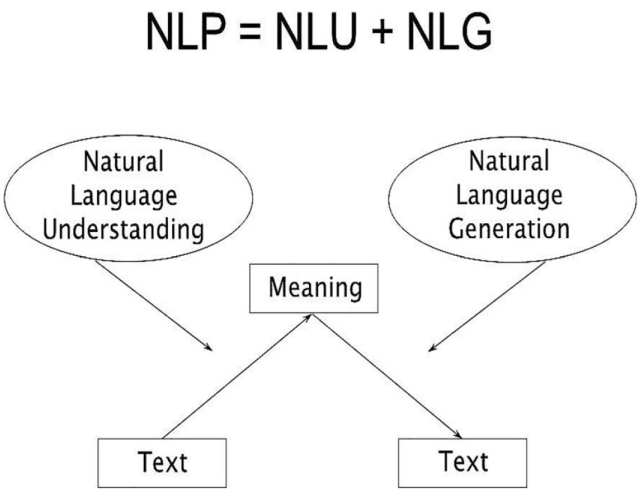

Figure 1: Relation between NLP, NLU and NLG (Mehr, 2017)

Transforming Government-Citizen Interaction in UAE using chatbots:

The more satisfied citizens are with their governance system, the higher the citizen happiness index tends to be (Nirala et al., 2022). Governments' usage of Artificial Intelligence to interact with citizens has mainly fallen into five categories: answering questions, filling out and searching documents, routing requests, translation, and drafting documents (Mehr, 2017).

In the area of building agile chatbots for real use in public administration services, very little work has been done so far (Nirala et al., 2022). Therefore, if a selected number of services that are currently only available in an office /online setting and require human intervention are made available via humanized chatbots, it is possible to enable citizens to access genuine and objective services without being constrained by factors such as location, inability to use/access digital services due to technical/non-technical reasons, accessibility for citizens with disabilities (visual/hearing impairments) or any other factors.

Futuristic chatbots in governments may include services such as counseling complaints, call inquiries, suggestions, immediate service provisioning, prompt response, and communication between the government and citizens. This will create a positive impact on society and will help improve transparency and ease of getting services by the society.

In UAE, several government chatbots have been launched such as Rammas, a chatbot by the Dubai Electricity and Water Authority (DEWA) introduced in 2017, which was able to respond to more than 698,000 inquiries. The Dubai Department of Economic Development (DED) has introduced a new Chabot called ***Saad***. Saad offers only information to business owners regarding the process of registering their companies and obtaining licenses. In March 2018, Digital Dubai launched ***Rashid*** within their city mobile app known as Dubai Now. Rashid is only able to respond to a variety of questions in both Arabic and English. Later Chatbot ***Mahboub*** was released by the Transport and Road Authority (RTA) in September of 2018, and it provides users with information regarding public transportation options, information regarding the availability of public parking, and the renewal of driving licenses. Etc. (Mohasses, 2019).

All implementations mentioned above rely heavily on information-based, uni-directional communication. The use of agile and humanized chatbots that replicate natural conversations with people could be a significant breakthrough for the UAE government. By adopting this technology, the government can create a single-user interface that facilitates seamless personalized bi-directional communication with citizens, enhances their involvement, and delivers top-notch customer service. Moreover, it can help the government establish a cutting-edge digital ecosystem that interacts with citizens, gauges their preferences through data analytics, and provides a range of government services via integrations with existing digital enablers such as UAE PASS for identity verification and digital signatures, as well as digital payment gateways like Dubai Pay, Abu Dhabi (AD) Pay, and Ajman Pay, government integration hubs available across UAE (GSB – Federal Level, Abu Dhabi AD-connect, Dubai Service Bus, Ajman Service Bus…etc), all through a single interface with the government. By chatting with chatbots that mimic human interactions, citizens can send their documents online and receive necessary processing, sign through UAE-Pass digital signatures, and make payments via the

government payment gateways. However, to execute this initiative, the government may need to streamline some of its services and re-engineer specific business processes to make them more amenable to online execution with the support of chatbots. Internal and external agility are considered critical factors of success for the innovative use of chatbots (Wang et al., 2022).

Overall, the existing body of literature reinforces the significant importance and impact of advanced NLP-large language models powered chatbot usage on shaping the future of governments. Nevertheless, the literature also highlighted the drawbacks and deficiencies that demand thoughtful consideration. (Bubeck et al., 2023) as well as (Fui-Hoon Nah et al., 2023) have discussed extensively several deficiencies. Some of them are outlined as follows:

Drawbacks and limitations of LLM-powered chatbots

Ethical Concerns:

1. **Misinformation, Manipulation, and Security Risks:**

Like all powerful technologies, it could be misused by malicious actors to cause damage. Disinformation could be spread and cyberattacks could be conducted due to their generalization and interaction skills. These models can also manipulate and influence people by personalizing interactions for maximum impact. LLMs can automate and spread disinformation campaigns to persuade people over time (Bubeck et al., 2023).

2. **Bias**

LLMs are trained are on high on vast amounts of corpus data, ranging from the internet, books, and other data sources that are mostly written by humans. Since humans by nature are unconsciously biased (Ross, 2020), datasets that will be used to train the models will contain inherited bias which will make algorithms amplify or replicate training data discrimination and biases which will lead to generating biased outcomes. Another issue is that- if detected- and while fixing a problem of biased data, we may introduce new biases.

3. **Digital Divide**

According to (Fui-Hoon Nah et al., 2023), The Digital divide is an ethical concern that refers to the gap in computer and internet access, but as the internet is becoming widely spread, a second digital divide in usage and skills has appeared. Due to "invisible" AI in AI-enabled systems, generative AI may widen this divide and complicate human-technology interactions (Carter et al., 2020). This could increase the first-level digital divide for those without devices or the internet, and language and cultural barriers may arise for marginalized or minority cultures. Second, some elderly people may struggle to use generative AI tools, creating a digital divide. (Bozkurt and Sharma, 2023) More accessible AI and AI literacy training would help solve this problem.

Other Main Concerns

4. **Hallucination:**

LLMs can generate unexpected errors in math, programming, attribution, and higher-level concepts without warning. These errors are often referred to as hallucinations due to their apparent reasonableness or alignment with truthful inferences. Invalid references, content, and statements can appear correct and convincing, making identification difficult without close inspection and fact-checking. This could still be managed when generative AI is used within closed domains as it is easier to be checked for validity, but it becomes very difficult when used in open domains as it requires extensive research and information gathering to be validated (Fui-Hoon Nah et al., 2023).

5. **Data Handling**

Generative AI models are trained by collecting, processing, and analyzing massive amounts of data. Data could get misused or abused without the consensus of users. Accordingly, data must be handled responsibly by governments as per privacy, data protection, and ethical standards. Mishandling data can compromise privacy, misuse sensitive information, and propagate training data biases. As per (EU Government Digital Service, 2019), Generative AI (GPT-4), is already violating several EU principles of privacy and data governance—including, for example, GDPR and the “right to forget”.

Additionally, another issue related to data is **Data transparency**—including the need for **explainability** (Explainable AI| Royal Society, 2019). Transparency and explainability are

a black box that makes it difficult to understand the reasoning behind the generated text, which will impact its use in governance, compliance (e.g., demonstrating adherence to regulations), and legal questions (e.g., about intellectual property).

6. **Prompt Engineering**

The ability to interact with generative AI efficiently and effectively has become a crucial media literacy due to its widespread use. Generative AI users must master prompt engineering principles, which involve designing inputs to generate valuable outputs. Human languages are ambiguous, so prompts between humans and machines may cause errors or misunderstandings. The quality of prompts matters. Debugging prompts and improving generative AI communication are other challenges (Liu and Chilton, 2021). It is crucial to provide prompt engineering training, particularly for those who frequently interact with generative AI.

7. **Copyright & Governance**

AI-generated content may violate copyright whether directly or indirectly. AI governance is a challenge for governments. Governance is essential for generative AI to benefit society (Taeihagh et al., 2021).

Despite all the above-mentioned limitations, Generative AI is still very promising, and its positive sides cannot be ignored. Collaboration between AI and humans is key to addressing challenges and seizing generative AI opportunities (Fui-Hoon Nah et al., 2023). Nevertheless, robust data governance practices are crucial to mitigate the risk of the above-mentioned limitations and maintain public trust when governments use generative AI.

Conclusion

The existing body of literature reinforces the significant importance and impact of advanced NLP-large language models powered chatbot usage on shaping the future of governments. With the help of this disruptive technology, government chatbots can be completely transformed in such a way that will drastically improve the accessibility, efficiency, and effectiveness of public service delivery, thus boosting citizen engagement,

trust, and confidence in the government. Furthermore, humanized chatbots can offer citizens a way to participate in decision-making processes, leading to more informed and inclusive policymaking. Adopting this approach will help the UAE government work towards achieving its ambitious goals outlined in the UAE Promise Charter.

In summary, the **main takeaways** of the literature review are as follows:

- Chatbots are classified either as rule-based chatbots or artificial intelligence AI-based chatbots:
    - Rule-based: These models are typically used in Governments. However, those models are ***limited*** to handling conversations that align with pre-written responses and lack flexibility, contextual understanding, and functionality.
    - AI-Based (Generative Models): These models generate responses word by word through Large Language models (LLMs). LLMs are a type of generative model that is trained on an enormous amount of data (which is the reason why it is named Large). These models lessen the flexibility and functionality issues of rule-based models. However, it still lacks contextual understanding/conversational context.

- Transformers was a breakthrough that employs an “Attention Mechanism” that helps to better understand conversations and have better contextual understanding.
- Advanced NLP-large language models powered chatbots could have a substantial impact on shaping the future of governments and enhancing communications with citizens.
- There are drawbacks and deficiencies of generative AI, that must be considered and demand thoughtful consideration such as hallucination, misinformation, manipulation, security risks, bias, data handling, privacy, explainability, and transparency.

- Despite the limitations mentioned above, Generative AI is still very promising, and its positive side outweighs its limitations. Collaboration between AI and humans is key to addressing those challenges and seizing generative AI opportunities.

From the above, government communication with citizens using chatbots with the help of this disruptive technology, will be completely transformed in such a way that will drastically improve the accessibility, efficiency, and effectiveness of public service delivery, thus boosting citizen engagement, trust, and confidence in the government.

Chapter 3: Research Methodology

This thesis aims at foresighting the future of augmenting the current implementations of government chatbots with the power of the disruptive artificial intelligence advanced natural language processing tool LLMs such as ChatGPT, JAIS, Noor, Bing, Bard, Ernie, etc. It also aims to understand how this can impact/disrupt communication with governments and help in shaping the future of government services in such a way that will efficiently serve the goals of the UAE Government Charter for Future Services.

Thesis Objectives:

- Explore the challenges of current government chatbots.
- Discuss the potential benefits of augmenting government chatbots with the disruptions offered by LLMs.
- Investigate how the usage of these advanced NLP large language models can improve the efficiency and effectiveness of government services in the UAE.
- Apply systems thinking tools to comprehend the different elements of the system along with their interconnections. Later, represent through a visual influence map the potential dynamic consequences of its components and identify different archetypes.
- Use scenario planning as a qualitative research methodology to explore and understand the different plausible scenarios of the future of government services and communication with citizens using large language models.

Research Questions

- What factors contribute to the challenges in facilitating communication between governments and citizens?
- How do the limitations of current government chatbots hinder efficient communication and service delivery?
- What are the key drawbacks of relying solely on rule-based chatbots for government-citizen interactions?

- How can Large Language Models (LLMs) disrupt the traditional communication channels in government-citizen interactions?
- What are the main limitations of applying LLMs to government services and communication?
- How can systems thinking tools such as influence maps and causal loops identification help in visualizing the related elements of integrating LLMs into government-citizen communication?
- Through scenario planning, what are the plausible future scenarios for government-citizen communication in the UAE using Advanced NLP Large Language Models? What are the most significant obstacles and opportunities in each scenario?
- How can advanced AI-powered large language models such as ChatGPT, JAIS, Noor, Falcon 180B, Bard, Ernie, and others be utilized to improve government communication with citizens and reshape the future of government services?

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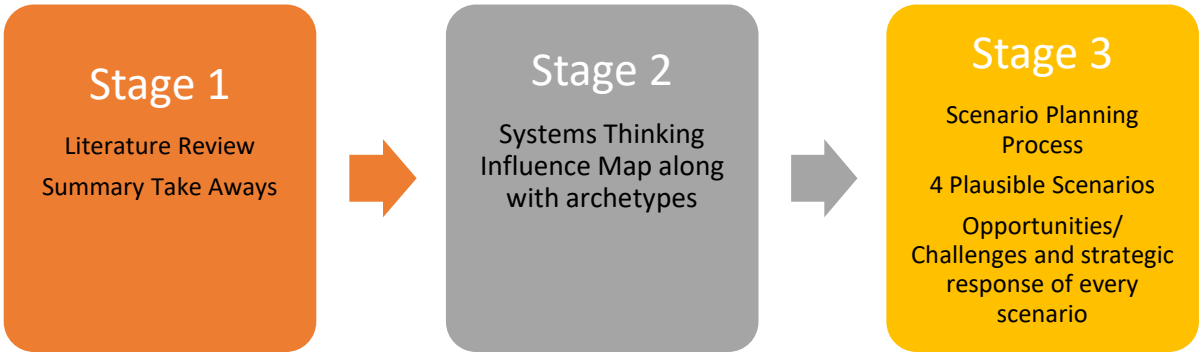
This thesis will consist of ***3 stages. Stage 1***, will identify relevant literature related to the topic and will provide a summary of the key takeaways of the literature.

Stage 2, will be applying systems thinking using an influence map with a focus on different causality patterns and archetypes to explore and understand different dynamic components/variables and their interconnections within the whole system. ***Stage 3,*** will use scenario planning as a qualitative research methodology to explore and understand the 4 plausible scenarios of the future of government services and communication with citizens using large language models along with opportunities and challenges for each scenario and the expected strategic response in case the scenario occurs.

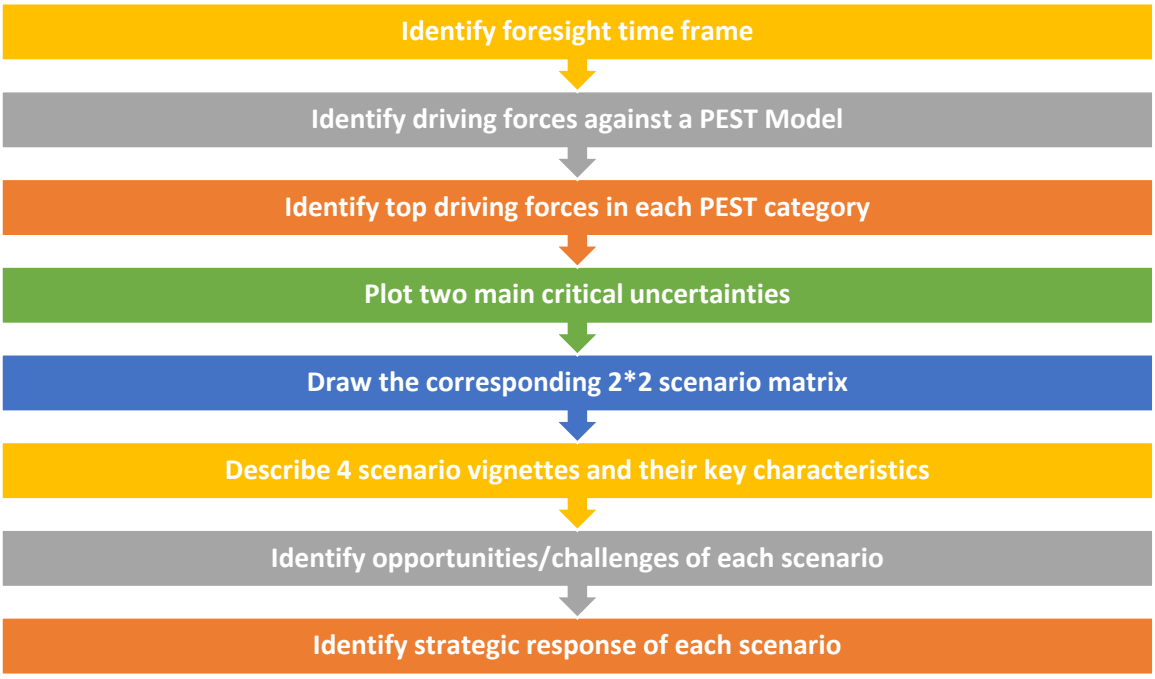
Figure 2: Stages of Thesis



Our Scenario Planning process will undergo the following stages ("See Your New Normal Scenario Planning for Strategists," 2021):

1. Identify foresight timeframe and frame the challenge.
2. Identify the main driving forces against the PEST Model (political, economic, social, and technological aspects).
3. Sort and shortlist all driving forces and select the top driving forces of the four PEST categories.
4. Place driving forces on a matrix of probability versus impact to identify the two main critical uncertainties that could impact our scenarios.
5. Draw the corresponding 2X2 scenario matrix based on the two selected critical uncertainties.
6. Describe the four different scenario vignettes and the key characteristics of each scenario.
7. Identify opportunities and challenges of each scenario.
8. Identify the main strategic response for every scenario.

Figure 3: Scenario Planning Process



The findings of this study will contribute to the existing literature and help foresight the role of large language models driven by government chatbots in shaping the future of UAE government services and enhancing communication with citizens for a time frame of 5-7 years and finally will conclude with suggestions for future research.

Chapter 4: Findings and Data Analysis

This chapter discerns the components of our system and its interrelated connections via causal loops and archetypes. For this purpose, the influence map will be used as it offers a graphical depiction of the various constituents with their interconnectedness and cultivates a comprehensive comprehension of how the various system elements impact one another. In addition, it exposes the governing principles that govern the behavior of the system.

Influence maps are crucial for decision-makers, allowing them to predict the consequences of system changes. It is considered a valuable tool for systems thinkers as it will help identify key connections and dependencies, aiding in recognizing visual clarity and navigating complexity, and promoting informed decision-making for sustainable outcomes. (Schwarz et al., 2023)

Stage 2: Influence Map

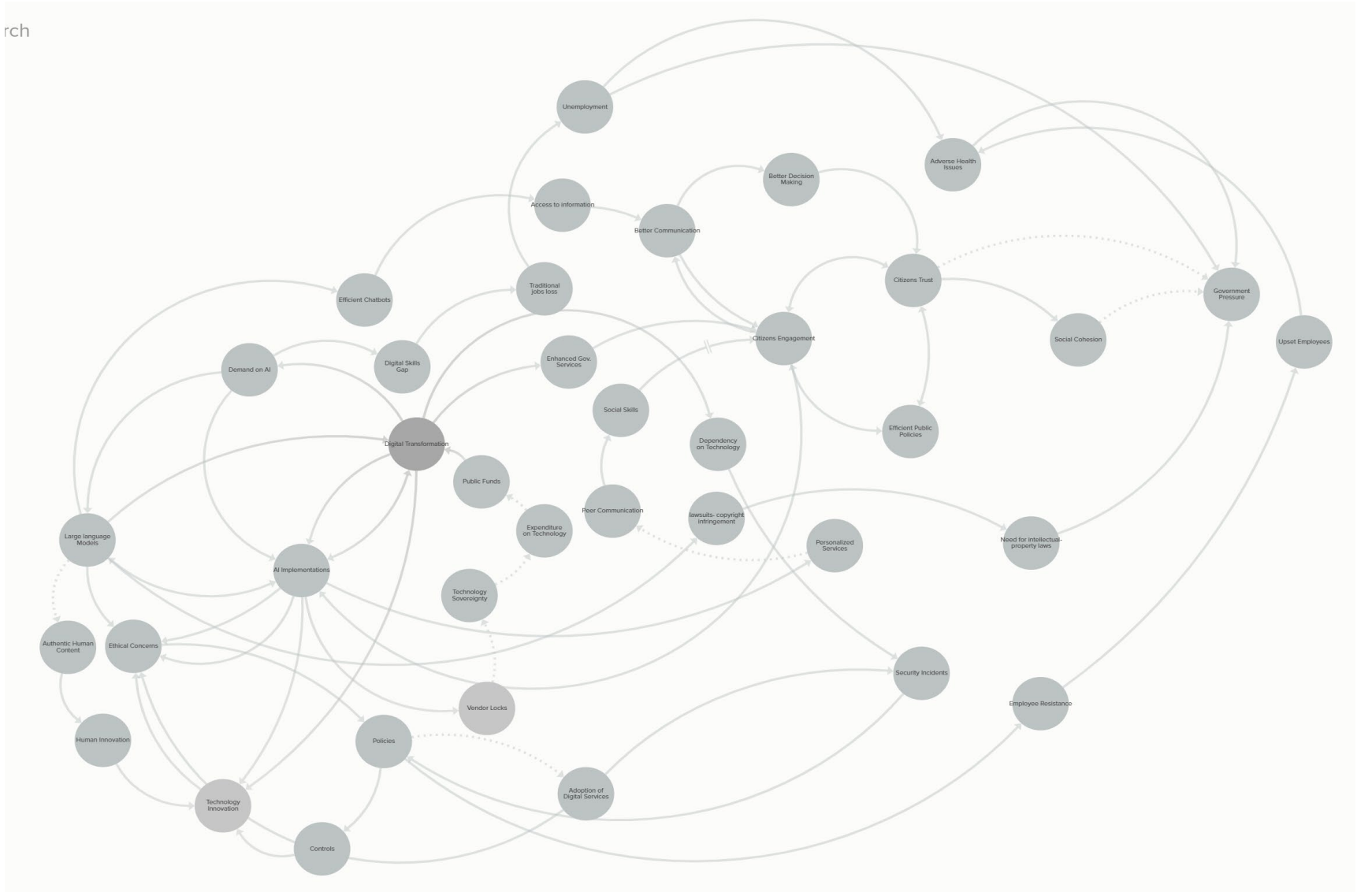


Figure 4: Influence Map, Full Map Link: https://embed.kumu.io/3fe11872767ceaf821618bd9f5667f86

Description of Influence Map

UAE has positioned Digital Transformation as a cornerstone of its development agenda (“The UAE Digital Government Strategy 2025, 2023) and released the “UAE Government Charter for Future Services” (“The UAE Promise - The Official Portal of the UAE Government”, 2020.). In addition to that, UAE has also released its AI National Strategy 2031 (“UAE Strategy for Artificial Intelligence, 2018). These concentrated nationwide efforts will increase the demand for Artificial Intelligence which will lead to more AI implementations.

More AI implementations will also lead to more efficient LLMs which will increase the efficiency of government chatbots. Efficient Chatbots will increase citizens' access to information which will enhance citizen-government communication. Better communication will lead to shared involvement in shaping public policies. In addition, better decision-making will positively impact citizens' trust and reduce government pressure. (Bubeck et al., 2023)

Nevertheless, AI implementations will increase digital transformation which will enhance government services. Enhanced government services will heighten citizens' active engagement and again increase citizens'' trust as they are confident that their voice is heard, and their government is responsive. This will increase social cohesion and lead to a harmonious citizen-government partnership which will reduce government pressure.

However, more AI LLM Implementations also come with a cost. It will lead to more vendor locks with foreign technology providers and less technology sovereignty since governments are consumers of technology and don’t produce or innovate technology by themselves. Hence, they have limited to no control over the development of the technology and its infrastructure, data governance, digital policies, and usage. Proprietary technology entanglement and sovereignty will be a growing concern for the UAE and will elevate government expenditure on technology. This increase will reduce public funds, which will impact the pace of digital transformation initiatives (Bubeck et al., 2023).

More LLM applications will increase the ethical concerns related to AI LLMs such as misinformation, bias, manipulation, hallucination, copyright infringement, data security,

and privacy…etc. More ethical concerns will demand a need for new policies and laws. These policies will create the need for more controls. Those new controls will create a demand for new technological innovations to implement the controls. Those new technologies will create further new ethical concerns which will again require new policies and legal frameworks (Fui-Hoon Nah et al., 2023)

More demand for AI will widen the digital skills gap and will amplify the displacement of traditional jobs that could be replaced by AI. For example, governments might need to rethink their employment of customer service representatives, if the successful implementation of LLM-powered chatbots can perform the job more easily, faster, and with greater precision. This could lead to negative impacts on unemployment and can increase adverse health issues which could add pressure on the Government (Fui-Hoon Nah et al., 2023).

More AI implementations and advancements of LLM will increase the amount of AI platforms, which will lead to becoming cheaper and widely used and will reduce the amount of authentic human content which could after time cause innovation to slow down over time as humans make less and less new art and content (Bubeck et al., 2023).

Interacting extensively with AI-LLM systems may reduce peer interactions and social skills due to the ability of AI systems to provide personalized services to citizens. This could gradually reduce citizens' engagement. While AI optimizes daily tasks, it raises questions about its potential limits on human intelligence, capacities, and community involvement (Bubeck et al., 2023).

The more AI LLM-driven content creation landscape availability, the more need for copyright and intellectual property laws. This is because of the growing demand for identifying ownership of AI-generated content and the need to address issues related to originality and creativity (Explainable AI| Royal Society, 2019;Taeihagh et al., 2021).

Balanced Loop (1)

More digital transformation will lead to more AI implementations. More AI implementations will lead to more vendor lock-ins with foreign technology providers and a decrease in technology sovereignty, as governments are consumers of technology and do not produce or innovate it themselves. Hence, they have limited to no control over the development of the technology and its infrastructure, data governance, digital policies, and usage. The entanglement of proprietary technologies and technology sovereignty will become a growing concern for the UAE, leading to an increase in government spending on technology. This increase will result in a reduction of public funds, which will unquestionably slow down digital transformation initiatives. Since there are an odd number of opposite relationships (3 opposite variables) this loop is considered a balanced loop.

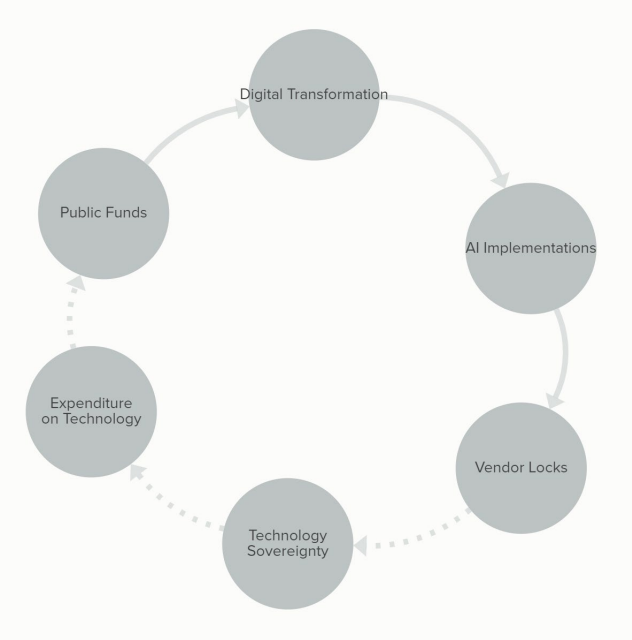


Figure 5: Balanced Loop 1

Balanced Loop (2)

The growing demand for AI-based solutions will further widen the digital skills gap, Accordingly, traditional jobs may be negatively impacted, as AI solutions can replace them more efficiently and operate around the clock. Governments might consider slowing down the pace of AI demand to ensure responsible implementation of AI and avoid adverse effects of unemployment.

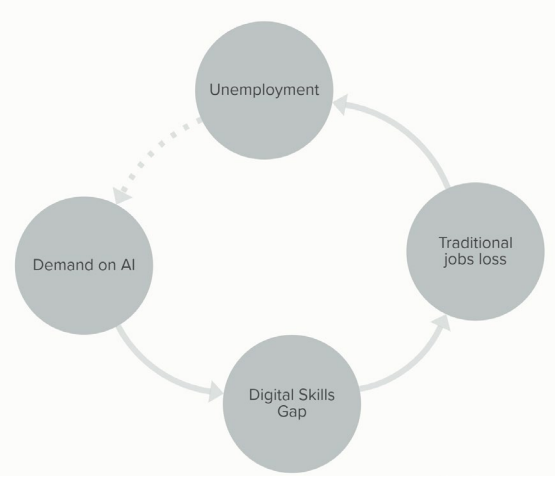


Figure 8: Balanced Loop 2

Reinforcing Loop (1)

More Digital Transformation will increase the demand for AI, more demand will increase the different AI implementations. More Implementations will increase advancements of large language models. Those advancements will introduce new approaches that will enhance and increase digital transformation.

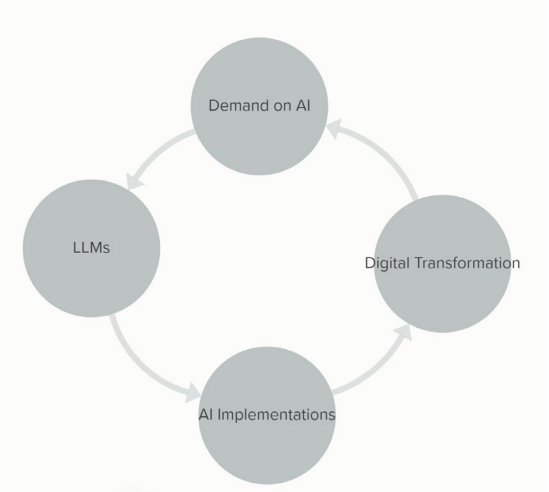


Figure 11: Reinforcing Loop

Reinforcing Loop (2)

Successful and efficient AI LLM systems will enhance government-citizen communication. This will lead to better decision making which will enhance citizens' trust in government as they feel heard by the government. Citizens' trust and better communication along with better decision making will all lead to efficient public policies. This will contribute to positive citizens' engagement which will increase demand for LLMs as an efficient way to communicate with the government.

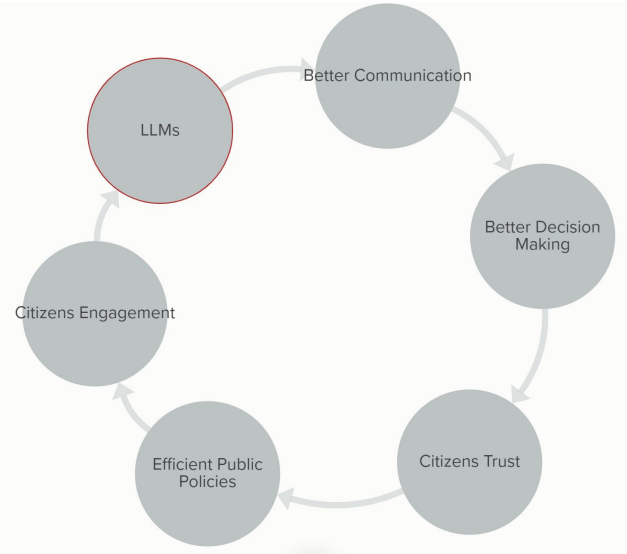


Figure 14: Reinforcing Loop

Archetype 1: Fixes that fail

More NLP LLMs applications will increase the ethical concerns related to AI LLMs such as misinformation, bias, manipulation, hallucination, copyright infringement, data security and privacy…etc. More ethical concerns will demand a need for new policies and laws. Over time, these policies will create the need for more controls. Those new controls will create a demand for new technological innovations to implement the controls. Those new technologies will create further new ethical concerns which will again require new policies and legal frameworks.

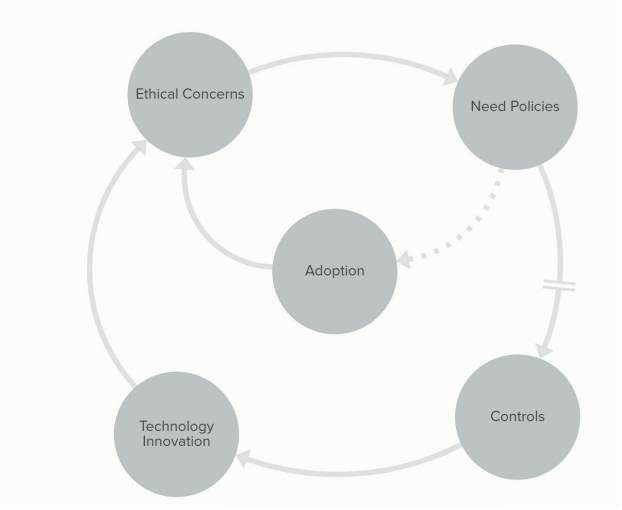


Figure 17: Archetype 1

The analysis of the above-mentioned influence map along with the different archetypes helps to explore and understand the different dynamic components/variables and their interconnections. Utilizing the information from the map, and based on the analysis, we will identify our main driving forces (political, economic, social, technological) which will become our main building block, leading us to our main two-critical uncertainties, based on which our four scenarios vignette will be constructed, as illustrated in Figure 3 and described in details in stage 3.

Stage 3: Scenario Planning Process

In this stage, and as per the steps mentioned in Figure 3, we will first identify the time frame of this foresight study and then will start identifying our driving forces based on which our 4 scenario vignettes will be described.

Foresight Time Frame

Due to the very high pace of advancements in this field, this future foresight study should only be considered for a time frame of around 5-7 years. This is due to the rapid technological advancement of artificial intelligence, particularly in large language models (LLMs), Accordingly, citizens' expectations are changing and what was once considered cutting-edge will become the new normal. The regulatory environment is also changing, oscillating between tighter and more relaxed controls, requiring a delicate balance between fostering innovation and addressing potential risks associated with LLMs. Additionally, other emerging technologies, such as quantum computing, could further alter the landscape. The evolving cybersecurity threats, encompassing the protection of citizens' data and offensive cyberattacks, are keeping pace with technological progress, necessitating constant monitoring, consideration, and proactive measures.

Identifying Driving Forces across PEST Model

Political Factors:

- Continuous commitment of the UAE government towards digital transformation and technological innovation. (UAE Promise, 2020; UAE Strategy for AI, 2018)
- Evolving regulations related to cybersecurity and Data Protection (Dubai Cyber Security Strategy, 2017; WEF Global Cybersecurity Outlook, 2023)
- The availability of related strategies (The UAE Digital Government Strategy 2025 ” n.d.; UAE Strategy for Artificial Intelligence, 2018)
- The UAE's geopolitical relations and collaborations with AI and technology leaders (“WAM - Emirates News Agency,” 2023)
- UAE’s aspiration to achieve leading positions in digital competitiveness metrics, innovation performance assessments, and overall economic well-being. (The UAE Promise, 2021)

- The stability of the UAE government and its leadership can impact the continuity of long-term technology adoption strategies.
- Government initiatives to improve citizen engagement and participation in policymaking (The UAE Promise, 2020)

Economic:

- UAE's economic diversification can impact the allocation of resources and budgets for AI initiatives, including chatbots. (Ministry of Foreign Affairs," 2020.)
- Global oil price fluctuations could have an impact on the UAE's revenue stream as per the International Trade Administration in 2022, 30% of the UAE's GDP is based on the oil and gas industry (United Arab Emirates - Oil and Gas," 2022).
- Growing opportunities for private sector innovation in developing LLM solutions for government use (Influence map) ("WAM - Emirates News Agency," 2023)
- Pressure to streamline government services and reduce bureaucracy (The UAE Promise, 2020)
- Growth of the gig economy and freelance work, leading to more diverse government service needs (UAE Digital Economy Strategy, n.d.; Dubai Chamber of Commerce, 2023.)
- Cost-saving potential of automation through chatbots and enhancing communication with citizens (Influence map) (Dwivedi et al., 2023)
- Improved productivity as fewer employees can do more and automating repetitive tasks will free up time for employees for training and innovation. (Cambria and White, 2014)
- Recovery of tourism and services industries influencing the demand for efficient government services accessible through chatbots. (Dwivedi et al., 2023)
- Job creation, as chatbots may reduce the need for certain types of jobs, they can also create new jobs in areas such as data analysis, software development, and user experience design. These new jobs can contribute to economic growth and development. (Svetlana et al., 2022)

Social:

- Growing use of mobile devices and social media among people. (Smartphone Market Size, Share, Growth, 2020)
- Increased importance of mental health and wellness in society (ßak Kalkanci et al., 2019 ; Dwivedi et al., 2023)
- Aging populations require more accessible and user-friendly government services (ßak Kalkanci et al., 2019)
- The United Arab Emirates (UAE) is well known for its high diversification of people living within its borders.
- Fear of job loss of conventional jobs (Svetlana et al., 2022)
- The Digital skills gap will widen with the demand and advancements of AI. (Svetlana et al., 2022)
- Different generations may have varying levels of comfort and familiarity with AI-driven chatbots (Dwivedi et al., 2023)
- Higher society expectations for efficient government service delivery (Dwivedi et al., 2023)

Technological:

- Rapid Advancements in AI (natural language processing and machine learning algorithm) (Accenture, 2019)
- Data residency and cybersecurity-related issues.(WEF Global Cybersecurity Outlook, 2023)
- Offensive Cyber- attack related risks (for example: use GPT to generate code to hack other devices) (Bubeck et al., 2023)
- The increasing demand for explainable LLMs (Bubeck et al., 2023)
- The fear of bias, hallucination, and disinformation (Bubeck et al., 2023)
- Integration with other technologies and systems, such as large language models and chatbots can be integrated with other government systems and technologies, such as machine learning, data analytics, and artificial intelligence, to create more advanced and effective government services (Accenture, 2019; Mohasses, 2019)

- The increase towards cloud computing is because of the huge amount of collected and generated data, which will make it hugely costly to keep data on-premises and maintain it. As per Gartner's research, in 2023, the worldwide public cloud services reached $600 Billion and is expected in 2024 to reach $724 Billion (101 Shocking Cloud Computing Statistics, 2023),

Based on the above PEST factors, our 2 critical uncertainties will be as follows:

Critical Uncertainty 1: *UAE Government commitment towards adoption of LLMs*

Government Adoption**:** The UAE government will fully embrace the use of LLMs and will integrate them intensively into various government-citizen communication channels and government service design, leading to a significant transformation in how governments communicate with citizens and how services are designed and delivered.

No Adoption: UAE government chooses not to adopt LLMs, out of fear of related risks. Accordingly, traditional methods of delivering government services and communicating with citizens will continue as is.

Critical Uncertainty 2*: UAE Government Control Over LLMs*

Tight Controls: If the UAE government opts for tight controls over LLMs, it may heavily regulate and monitor the use of language models in government services.

Loose Controls: In a scenario with looser government controls, there might be fewer regulations and restrictions on the use of LLMs in government services.

Based on the above-identified 2 critical uncertainties, we can expect a scenario matrix that will look like the following:

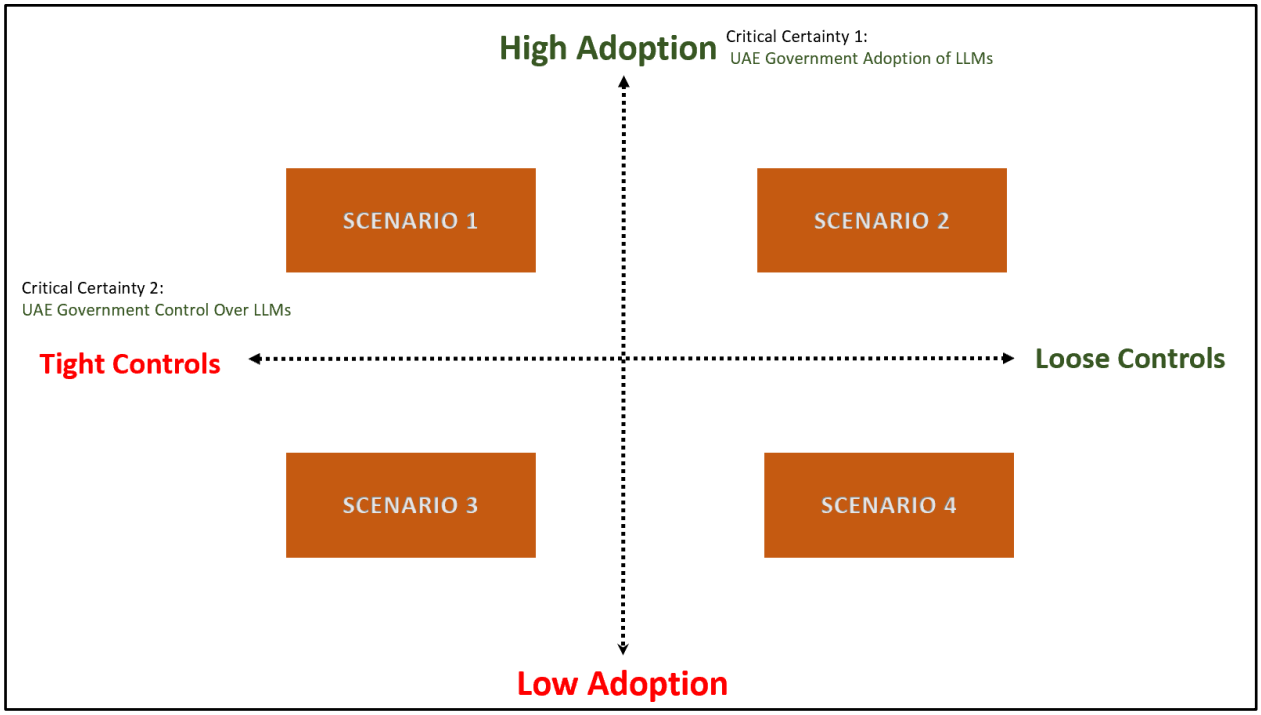


Figure 18: 2x2 Scenario Matrix for a Time Frame of 5-7 Years

The Key Characteristics of our scenario matrix is as follows:

Scenario 1: High LLMs Adoption, Tight Controls – The Golden Era

In this scenario, the UAE government's adoption of Large Language Models (LLMs) has soared. The country stands as a global role model of technological advancement and effective governance. Driven by a relentless commitment to the government's national agenda towards safe and human-centered digital transformation, the government started to invest heavily in building its own first-of-its-kind Arabic-based LLM, that are trained in the context of the UAE. This comes as part of the efforts of the UAE to mitigate risks related to data training, bias, data residency, cyber security, and the risk of offensive cyber-attacks. The drive of the UAE government to build trust with its citizens will place more pressure on the demand for explainable LLMs, and tight measures will be put in place to mitigate bias, hallucination, and disinformation. Integrating LLMs with other

technologies and systems while ensuring their compliance with cyber resilience and governance frameworks will be a priority to create more advanced and trustworthy government services and government-citizen communication channels.

The geopolitical collaborations with AI and technology leaders have empowered the UAE to harness cutting-edge LLM technology. The country's economic competitiveness has skyrocketed, driven by strategic LLM integration across government, while stable government leadership ensures the continuity of these technological strides.

Innovative initiatives like citizen engagement programs and streamlined government services have been boosted by LLM-powered chatbots, saving time and resources. As the gig economy flourishes, diverse and new government service needs are efficiently handled, and automation along with LLMs has not only reduced costs but also enhanced productivity, efficiency as well and government-citizen communication. LLMs are used heavily in this landscape to facilitate public engagement and participation in government decision-making processes through chatbots, surveys, and social media. It provides information and collects feedback on policies and initiatives, making governance more transparent and participatory.

The design of government portals and mobile applications, as well as government call centers, is undergoing a radical transformation. Although there has been a strong push in recent years to add a vast amount of information content to government channels for customers, the government is now using all this data to train the models in the background while keeping the main interface for users very simple and without a large amount of text, only a powerful chatbot that could be using voice or text, supercharging information discovery where customers simply say/post their question and the system can respond directly to their question. As technology matures and grows, the government will reduce the number of customer service representatives over time. Initially, the government is eager to provide the option of connecting to human agents upon request to provide needed support and assist senior citizens with their inquiries. As technology matures and grows, the government will reduce the number of customer service representatives over time.

The government is embracing the power of LLM to analyze policies and provide insights into their effectiveness, potential impacts, and feasibility. It can also suggest improvements or alternatives to existing policies based on data and analysis.

Furthermore, the UAE's forward-thinking strategy encompasses not only the rapid development and nurturing of artificial intelligence (AI) technologies but also building close strategic collaboration with the private sector and academic institutions, especially in the domains of natural language processing and machine learning algorithms. This is driven by the strong Government belief that the private/academic sector plays a pivotal role in developing advanced Large Language Model (LLM) solutions, as well as their important role in UAE economic growth. This proactive approach solidifies the UAE's position as a technological leader.

The government implements rigorous measures to address concerns related to data residency and cybersecurity. The UAE's steadfast commitment to AI ethics is demonstrated by its emphasis on creating LLMs that are explainable and free from bias, resulting in trustworthy LLMs. The seamless integration of LLMs with other cutting-edge technologies optimizes the delivery of government services, meeting the rising expectations for efficiency. The UAE's embrace of cloud computing and mobile integration enhances service accessibility and responsiveness to societal needs, including mental health and an aging population. Through comprehensive education and reskilling programs, concerns about job displacement are mitigated, and society smoothly transitions into an AI-driven future.

Citizens and international partners are assured of the country’s responsible use of LLMs by the government’s solid dedication to strict regulations and governance framework regarding data residency and cybersecurity. The UAE's commitment to ethical AI is demonstrated by its emphasis on explainable LLMs and its ongoing fight against bias, hallucination, and disinformation. This government commitment extends to integrating LLMs with other advanced government systems and technologies, thereby facilitating the delivery of more advanced and efficient services. This futuristic scenario illustrates the UAE's unwavering dedication to technological innovation and governance excellence in the twenty-first century all while striving to maintain control over these technologies.

Scenario 2: High LLMs Adoption, Lose Controls – No Pain No Gain

In this future landscape, the UAE government will witness an exponential increase in the adoption of large language models (LLMs) while simultaneously loosening controls over them. The continuous commitment of the UAE government towards digital transformation and technological innovation, in line with the UAE AI National Strategy and Digital Transformation Strategy, will encourage investments in UAE-made LLMs (such as JAIS, NOOR, FALCON…etc) and the integration of LLMs into various government systems to enhance services and communication with citizens while loosening controls to increase further innovation in this domain. The government's aspiration to achieve leading positions in digital competitiveness metrics and overall economic well-being will drive the use of LLMs to enhance efficiency and productivity. This will improve the UAE government's adoption of LLMs that are more flexible and less regulated.

Additionally, the UAE's stable government and its strong leadership will ensure the continuity of long-term technology adoption strategies. The growth of the gig economy and freelance work will lead to diverse government service needs, prompting the government to leverage LLMs for streamlined and personalized government services. Furthermore, the cost-saving potential of automation through chatbots, as well as improved productivity, will make LLMs an attractive solution.

The growing increase in demand for efficient and streamlined government services and effective communication will cause rapid advancements in AI, including natural language processing and machine learning algorithms. This will make LLMs more powerful and versatile, creating job opportunities in data analysis, software development, and user experience design. However, job displacements for conventional jobs will be seen in the future as well. For example, the demand for human staff in government call centers will drastically decrease. Call center agents who handle routine and frequently asked questions are finding their roles evolving or being phased out and replaced by LLMs. Administrative duties are becoming less necessary as well since LLMs-based applications are taking on their tasks.

In this future, the government is gradually loosening controls to encourage innovation and flexibility in data residency, and cybersecurity, and placing upfront proactive measures to reduce risks of offensive cyberattacks. The country is still facing cyber security threats but trying through proactive measures to reduce its impact as much as possible.

LLMs are used heavily in this landscape to facilitate public engagement and participation in government decision-making processes through chatbots, surveys, and social media. It provides information and collects feedback on policies and initiatives, making governance more transparent and participatory.

Ethical considerations are continuing to be a priority, the government is adopting a more open dynamic approach to the development and deployment of LLMs, allowing for a broader range of applications and use cases. This strategy will prioritize innovation and efficiency over stringent controls, with a particular emphasis on maximizing the potential of LLMs across a variety of government services and communication channels.

While concerns about job displacement due to LLMs adoption persist, the government is proactively addressing the digital skills gap, ensuring that the workforce is equipped to work alongside LLMs. Recognizing generational differences in AI familiarity, the government will provide user-friendly interfaces to accommodate varying comfort levels. Ultimately, the UAE government's strategic and measured approach, coupled with the pressing need for efficiency and innovation, will lead to the increased adoption of LLMs, ushering in a new era of government service delivery.

Scenario 3: Low LLM Adoption, Tight Controls- UAE Tech Tightrope

In this scenario, the UAE government must navigate a complex landscape of factors that collectively contribute to a decrease in the adoption of LLMs while simultaneously implementing tighter controls.

Evolving regulations, driven by concerns over data privacy and cybersecurity and LLMs drawbacks such as fear of LLM hallucination, misinformation, and bias are prompting the government to introduce stricter rules governing LLM usage. Accordingly, and to protect

the country from those risks. The government is no longer interested in LLMs and not encouraging government entities to embrace this technology.

National strategies such as UAE Cyber Security Strategy, AI National Strategy, and Digital Transformation Strategy are undergoing revisions to align with these regulatory changes and emphasize responsible and restricted AI use. In addition to that, geopolitical relations, technology sovereignty, and economic diversification efforts are further influencing the government's cautious approach.

Technology sovereignty is of the utmost importance in the field of artificial intelligence and large language models for numerous compelling reasons. Firstly, it safeguards the country's ability to independently develop, control, and utilize AI technologies, reducing reliance on foreign entities and enhancing national security. Secondly, it ensures that AI solutions can be tailored to the UAE's specific needs and values, reducing the possibility of adopting biased or culturally insensitive models. Moreover, technology sovereignty fosters innovation by fostering the growth of the domestic AI industry, creating jobs, and promoting economic growth. In addition, it enables governments to establish robust regulations and ethical frameworks for AI usage, thereby aligning technology with their own legal and societal norms. In an era where AI is increasingly intertwined with critical infrastructure, communication, and decision-making, technology sovereignty enables countries to retain autonomy and resilience in the face of rapidly evolving AI landscapes while promoting ethical and responsible AI development.

Moreover, public expectations for efficient government services and the widening digital skills gap are posing additional challenges, necessitating a delicate balance between technological advancement and addressing societal concerns. Ultimately, the government faces the complex task of adapting its AI policies to ensure responsible LLM usage while pursuing its goals of digital competitiveness, economic well-being, and efficient service delivery.

This scenario may challenge the government's goal of achieving leading positions in digital competitiveness metrics while responding to evolving societal expectations for efficient service delivery and data privacy.

Scenario 4: Low LLMs Adoptions, Loose Controls- The Uncharted Water

In this landscape, the UAE government faces a dual problem: the decreasing adoption of large language models (LLMs) and the eroding control over their usage. Despite the UAE's longstanding dedication to digital transformation and technological innovation, the AI governance and technology landscape is evolving in ways that challenge its traditional approach. To comply with international standards and norms, the government has given up some control over LLMs due to evolving regulations concerning cybersecurity and data protection.

Risks are arising and LLMs are under fire. Government entities are reluctant to use LLMs out of fear of hallucinations, bias, misinformation, and offensive cyber-attacks that could be triggered by LLMs. Countries around the world are taking different approaches ranging from complete openness and embracement of this new technology while focusing on explainable AI and developing ethical and responsible usage of AI LLMs, while others are completely banning the usage of LLMs and watching how other countries are implementing LLM and what is the risks they are facing and how are they managing those risks.

In addition, the UAE's geopolitical relationships and collaborations with AI and technology leaders are complicating its strategy for adopting new technologies. There is a growing emphasis on technological sovereignty, which is reducing direct control over technologies.

Efforts to improve citizen engagement and streamline government services are driving the demand for more efficient solutions. However, the government is looking for other technological alternatives to achieve its vision and strategic goals while monitoring the experiences of other countries in this field and attempting to benefit from their best practices.

Chapter 5: Discussion

As mentioned in the previous chapter and based on the driving forces and the 2 critical uncertainties identified, the four plausible scenarios vignette were described. In this section, we will highlight the opportunities and challenges of each scenario and explain the recommended strategic responses to each.

Scenario 1: The Golden Era (High Adoption, Tight Controls)

Opportunities

- **Technological Advancement** as high adoption of LLMs along with tight controls will position the UAE among the global leaders in this era.
- **Data Security and Privacy** as tight controls will ensure placing the right regulatory and ethical framework in place that will assure the protection of citizens' data, its residency, and privacy.
- Achieving a **high global world competitiveness ranking** in related indexes.
- **Explainable and ethical AI** will improve drastically as tight controls will force technology providers to provide explainable AIs that are not considered black boxes
- **Enhanced citizens' engagement and participation** in policy formulation through chatbots, making governance more transparent and inclusive.
- **Enhanced government services & effective communication with citizens.**
- Government **upscaling and reskilling programs** will be launched to reduce the impact of AI LLMs on job displacements.

Challenges

- **Challenging citizens' expectations,** as it will be difficult to strike a balance between citizens' expectations for efficient government services and the cautious approach to the adoption of LLMs, given that citizens may expect improved services through advanced technologies.

- **The digital skills gap will widen**, as the demand for LLMs will require employees to get re-skilled and will increase the demand for tech-savvy employees.
- **Legislative and regulatory burdens will increase,** as strict regulations will place big burdens on governments; first to have the right human capability that can develop those frameworks. Second, to insure that those regulations will not negatively affect the private sector and won't paralyze the innovation pace which is a very important aspect for the UAE.
- **Heavy reliance on LLMs** and advanced technologies may create a dependency that could present difficulties in the UAE in case of disruptions or breakdowns in these systems.
- **Human-AI Balance** will continue to be a challenge in identifying the right delicate balance between AI-powered interactions and human support, especially when dealing with inquiries from senior citizens or people with specific needs.
- **Ethical Dilemmas** as in situations where AI-LLM powered systems make crucial decisions, achieving a balance between the responsible use of AI and technological advancement will present new ethical challenges.
- **Maintaining Control**, as the UAE's commitment to maintain control over LLMs necessitates constant vigilance and adaptation, due to changes in the technological landscape.

Scenario 2: No Pain, No Gain (High Adoption, Loose controls)

Opportunities

- **Enhanced government services,** as the widespread use of LLMs can significantly improve the effectiveness of government services by streamlining processes, increasing efficiency, and boosting output.
- **Enhanced citizens-government communications,** as LLMs will be used to gather citizen feedback on government programs and policies. Using surveys and chatbots, governance will become more responsive to citizen needs.

- **Fostering Innovation and flexibility in using LLMs,** in spite that loose controls impose risks that could be difficult to anticipate and mitigate, however, it will have a huge positive impact on the pace of innovation in this domain in addition to successful implementations and use cases that could be of huge value to citizens.
- **Cost Savings,** apart from the cost of the technology itself, LLMs–based applications could be used to gather citizen feedback on government programs and policies in a more cost-effective manner.
- **Economic Growth,** due to the growth of the gig economy and supported by the adoption of LLMs, new economic and employment opportunities will be created in new domains such as data analysis, software development, user experience design…etc.

Challenges

- **Data privacy and security issues,** as loosened regulatory controls will impose risks on data privacy and security
- **Cybersecurity threats will increase,** with the absence of a strong regulatory framework, there could be a possibility of facing offensive cyber security threats that are initiated using LLMs such as prompt injections, data leakage, Unauthorized code execution..etc (OWASP, 2023).
- **Poisoned data training,** as training data could be manipulated to introduce vulnerabilities and biases that could affect the model's efficiency and ethical behavior.
- **Job displacements,** as more efficient LLMs could result in job loss of traditional jobs since not all employees can get re-skilled and upscaled.
- **Generational gaps,** although efforts are made to accommodate varying levels of AI familiarity, there may still be a generational gap in technology adoption and usage, which could impact user acceptance, especially among senior citizens.

Scenario 3: The UAE Tech Tightrope (Low adoption, Tight controls)

Opportunities:

- **Enhanced Data Privacy and Security** as stricter regulations on LLMs will contribute to enhanced data privacy and cybersecurity, thereby reducing the likelihood of data breaches and unauthorized access.
- **Encouraging customized AI Solutions** with a focus on technology sovereignty, the UAE can develop AI solutions tailored to its specific needs and cultural values, ensuring a better fit for its society and reducing the risk of adopting biased models.
- **Ethical Frameworks and robust regulations** are developed for AI usage. These frameworks and regulations will ensure the alignment of LLMs with the National AI strategy as well as the UAE Cyber Security Vision. Hence, promoting the development of ethical, explainable, and responsible AI.

Challenges

- **Low Competitiveness ranking** in related indexes as UAE will no longer be interested in implementing successful use cases for LLMs and this will adversely affect its ranking.
- **Need for significant human and financial resources will be required** as implementing stricter regulations and ensuring responsible, explainable usage of LLMs will require securing those resources**.**
- **Geopolitical Relations** could be affected in this scenario as it may involve collaboration or competition with other countries in the AI LLM space.

Scenario 4: The Uncharted Water (Low Adoption, Loose Controls)

Opportunities

- **Avoidance of LLM risks,** since there is low adoption of LLMs, the government will not need to worry about LLM-related risks such as hallucination, misinformation, and bias. In addition to that, there will be no risks related to offensive cyber-attacks that are triggered by LLMs.
- **Monitoring global usage of LLMs,** learning from their mistakes, and benefiting from their best practices.
- **Technology Sovereignty**, as there will be minimum to low control over specific technologies, The UAE will be able to focus on technology sovereignty and encourage domestic innovation and growth of a local artificial intelligence industry, thereby promoting economic growth and job creation.
- **Looking for technology alternatives,** since there will be low adoption of LLMs, the UAE will focus on searching for/ providing different technology innovations/solutions that can help achieve the country's strategic objectives and national plans**.**

Challenges

- **The pace of innovation in UAE within this field will be negatively affected,** as other countries will continue their quest to embrace the opportunities created by LLMs and foster their economic growth.
- **Citizen expectations will keep growing**, while services will still lack the expected efficiency and digital engagement that is brought and enhanced through the usage of LLMs.
- **Resource allocation,** since the UAE will no longer be interested in LLMs, the country may require dedicating a substantial amount of resources to look for and develop alternative technologies, which can also divert those resources from other important initiatives.
- **Difficulties related to the inability to receive real-time feedback from citizens**, while striving for effective citizen-government communication, will persist.

The suggested strategic approaches for each scenario are outlined as follows:

Strategic Response for Scenario 1 (High Adoption, Tight Controls)

- Continue the commitment towards achieving the UAE AI and digital transformation strategies while maintaining strict legal and regulatory frameworks to ensure the implementation of proper controls.
- Invest in developing and further strengthening UAE-made LLMs (Noor, JAIS, FALCON 180B..etc)
- Review current data and privacy policies and controls and ensure frequent reviews that are properly aligned with the unique challenges and considerations posed by AI in general and Large Language Models in particular (such as the Human-Machine relationship).
- Consider establishing incubators for local startups dedicated to developing large language models and providing different incentive schemes. Those incubators will focus on enhancing the local talent development of this technology, conduct research, and develop AI solutions tailored to the region's specific requirements and linguistic nuances within the country's borders. Hence, reducing the dependence on importing this technology from other countries that could have different strategies and priorities.
- Establish LLM-related indices by collaborating with industry experts and academics. Promote openness in AI development and highlight UAE's ethical AI initiatives on the international stage.
- Create AI-powered platforms that facilitate citizen engagement and policy feedback.
- Provide training and certification programs for AI-related fields in collaboration with educational institutions and private sector partners. Provide training to a diverse workforce to ensure adoption and inclusiveness.
- Ministry of AI, Digital Economy, and Remote Work Applications will need to closely oversee the deployment of LLM implementations and provide guidance and frameworks to help entities adapt to technological developments properly and safely, Moreover, the ministry will need to collaborate with international

organizations to establish global AI governance and control standards especially in the domain of LLM.

Strategic Response for Scenario 2 (High Adoption, Loose Controls)

- Invest in developing and further strengthening UAE-made LLMs (Noor, JAIS, FALCON 180B..etc).
- Establish partnerships with educational institutions and private sectors to ensure continuous development of owned LLMs and skill development.
- Implement comprehensive training programs to equip the workforce with the necessary digital skills required to collaborate effectively with LLMs.
- Create knowledge-sharing platforms to share lessons learned and discuss joint projects to maximize the potential of LLMs in various sectors.
- Develop adaptive and responsive regulatory frameworks that balance the need for innovation with ethical considerations and protection against potential misuse.
- Regularly review and update regulations to stay ahead of emerging challenges in the rapidly evolving landscape of LLMs.
- Facilitate citizens' engagement through LLM-driven chatbots to gather feedback on policies, ensuring more transparent and participatory governance.
- Use LLMs to enhance and personalize government services, catering to the diverse needs of a growing gig economy and freelance workforce.
- Ensure efficient integration of LLMs in government services without compromising on the quality and accessibility of those government services.
- Encourage explainable and transparent LLMs applications and ensure that decision-making processes are explainable and fair.
- Actively participate in global collaborations and partnerships to exchange regulatory methodologies, technological innovations, and best practices about LLMs.

Strategic Response for Scenario 3 (Low Adoption, High Controls):

- Develop and enforce comprehensive regulations for responsible and secure LLM usage.
- Strengthen technology sovereignty by investing in domestic LLMs R&D and collaborating intensively with academic institutions such as Mohammed Bin Zayed University for Artificial Intelligence, with a specific focus on local and international experts.
- Implement a transparent communication strategy to address public concerns and build trust in the government's cautious approach.
- Invest in AI overall education and skills development to address the digital skills gap and ensure a knowledgeable workforce.
- Assess the geopolitical implications and initiate diplomatic discussions to foster collaborations or avoid conflicts in the field of artificial intelligence.
- Investigate alternative metrics for assessing the competitiveness of artificial intelligence, especially LLMs usage with an emphasis on responsible implementation and quality.
- Placing stricter regulations on LLMs in a strategic manner, with public-private partnerships being taken into consideration.
- Cultivate an innovation ecosystem through creating and supporting for technology incubators, research initiatives, and startups.
- Place significant emphasis on success stories and innovative use cases that exemplify the responsible implementation of AI- LLMs.
- Ensure that national strategies, such as the UAE Cyber Security Strategy, UAE National Strategy of Artificial intelligence, and other UAE-related strategies are in line with the principle of technology sovereignty.
- Optimize the utilization of resources for monitoring and compliance purposes by implementing technology and automation.

Strategic Response for Scenario 4: (Low Adoption, Loose Controls)

- Investigate alternative technological solutions to achieve strategic objectives and foster citizen participation.
- Gain insights from worldwide experiences by engaging in proactive international collaboration.
- Encourage domestic innovation to foster technological autonomy and stimulate economic expansion.
- Maintain the country's innovation-oriented mindset despite the diminished emphasis on LLMs.
- Leverage alternative technologies to optimize the efficiency of government services.
- Allocate resources for innovation in a strategic manner, ensuring that no other initiatives are compromised.
- Invest in effective communication strategies and real-time citizen feedback systems.
- Construct a governance framework that is adaptable to the ever-changing technological environment.
- Beyond LLMs, concentrate on talent development for emerging technologies.
- Transparently communicate the transition away from LLMs and technological decisions.
- Implement mechanisms for ongoing monitoring and adjust strategies in response to global dynamics.

Chapter 6: Conclusion

In previous chapters, we examined four possible future scenarios involving the use of chatbots propelled by Large Language Models (LLMs) to influence the evolution of government service design and citizen communication in the United Arab Emirates. Subsequently, we identified the vignettes of these four scenarios, revealing the potential benefits and drawbacks of each scenario. Finally, the strategic response expected for each scenario was discussed.

In this chapter, we will conclude this thesis with our final recommendations. However, it is worth mentioning that this foresight study should only be considered for a time frame of around 5-7 years. This is due to the following:

- An exceptionally rapid rate of development in the domain of LLMs and the field of artificial intelligence overall.
- Evolving citizens' expectations as what was previously considered advanced and cutting edge is now considered the baseline.
- The regulatory landscape between tighter controls and less stringent controls creates a delicate balance between fostering innovation and managing potential risks and drawbacks related to LLMs.
- Emerging technologies apart from LLMs are also advancing, those technologies advancements such as Quantum computing for example could also change the landscape again.
- Cyber security threats related to protecting citizens' data and offensive cyberattacks are also evolving as every new technology is introducing new threats that need to be monitored, considered, and actioned on.

In light of the above-mentioned considerations, our final recommendations are as following:

- LLM Advancements need to be monitored continuously and rigorously, as this emerging technology is bringing along lots of opportunities and risks.

- Emerging trends, updates, and breakthroughs in the area of Artificial Intelligence overall and other emerging technologies need to be kept continuously under the radar of UAE.
- Develop agile response mechanisms to adapt to technological changes and act promptly in response to evolving LLM capabilities and applications.
- Conduct frequent scenario reviews and ensure proper modification, to ensure continuous updates and relevance based on the changing landscape of AI-LLMs space and update technology strategies accordingly.
- Collaborate with industry experts and researchers to gain insights into the potential impact of LLM advancements.
- Keep citizens informed about the government's adaptive approach to LLMs through efficient and effective communication channels.
- Allow customers to be connected at any time with a human customer service representative- upon their request- throughout any point in the digital space to enhance trust and citizens' engagement.
- Promote awareness of the benefits and potential challenges associated with evolving LLM technologies.
- Foster collaboration between local/federal government departments to ensure a cohesive and unified approach to LLM adoption.

Future areas of study

The future research areas identified in this section stem from the gaps, questions, and potential extensions highlighted in the current thesis such as: the best-preferred training model for large language models, cost considerations when adopting LLMs, further impacts on using advanced chatbot technologies…etc.

These areas not only address the limitations observed but also pave the way for future exploration and innovation in understanding the below-discussed topics:

- Investigate the criteria and considerations for selecting the most suitable training methodology for Large Language Models (LLMs) in the context of advanced chatbot development. (Fine-tuning the LLM Base Model, retrieval-based learning

to expand its extended knowledge base, in-context learning to expand short-term memory) (Bubeck et al., 2023).

- Ongoing updates of NLP and LLM technology advancements, recognizing that the field is continually evolving, with breakthroughs emerging even after the publication of this thesis, making it an area that requires ongoing research and innovation.
- Examine cost considerations related to utilizing language models APIs (such as OpenAI APIs) versus using open-source alternatives such as JAIS (“Meet Jais, MBZUAI, 2023) and explore the opportunities and challenges of each. This analysis should focus on different models' usage (for example, Davinci, Ada…etc. in OpenAI) and the pricing model of each. It is worth mentioning that the pricing model of tokens differs based on different languages for the same input text. For example, Arabic language tokens incur a cost that is two to three times more than English language tokens (“OpenAI Platform,” 2023).
- Assess the feasibility of using LLMs for providing all government services or selective services taking into consideration services with the least risks for both governments and citizens.
- Assess the potential impact of advanced chatbot technology on the human brain and social life, including aspects related to human-computer interaction and potential phenomena of "hallucination" in digital communication (Yen and Chiang, 2021).
- The measures and criteria are based on which the government can ensure that government chatbots are not trained on biased data and are not biased. How to ensure that further bias will not be introduced when correcting any existing one?
- Investigate the effectiveness of chatbots in serving citizens from diverse cultural backgrounds and various languages, taking into consideration the high diversity within the UAE's population.

References

101 Shocking Cloud Computing Statistics (UPDATED 2023) [WWW Document], n.d. URL https://www.cloudzero.com/blog/cloud-computing-statistics/ (accessed 11.26.23).

Accenture, 2019. How Natural Language Processing is Driving Government Innovation.

Alessandro, M., Cardinale Lagomarsino, B., Scartascini, C., Streb, J., Torrealday, J., 2021. Transparency and Trust in Government. Evidence from a Survey Experiment. World Dev 138, 105223. https://doi.org/10.1016/J.WORLDDEV.2020.105223

Androutsopoulou, A., Karacapilidis, N., Loukis, E., Charalabidis, Y., 2019a. Transforming the communication between citizens and government through AI-guided chatbots. Gov Inf Q 36, 358–367. https://doi.org/10.1016/J.GIQ.2018.10.001

Androutsopoulou, A., Karacapilidis, N., Loukis, E., Charalabidis, Y., 2019b. Transforming the communication between citizens and government through AI-guided chatbots. Gov Inf Q 36, 358–367. https://doi.org/10.1016/J.GIQ.2018.10.001

Bozkurt, A., Sharma, R.C., 2023. Challenging the Status Quo and Exploring the New Boundaries in the Age of Algorithms: Reimagining the Role of Generative AI in Distance Education and Online Learning. https://doi.org/10.5281/ZENODO.7755273

Bubeck, S., Chandrasekaran, V., Eldan, R., Gehrke, J., Horvitz, E., Kamar, E., Lee, P., Lee, Y.T., Li, Y., Lundberg, S., Nori, H., Palangi, H., Ribeiro, M.T., Zhang, Y., 2023. Sparks of Artificial General Intelligence: Early experiments with GPT-4.

Caldarini, G., Jaf, S., McGarry, K., 2022. A Literature Survey of Recent Advances in Chatbots. Information 2022, Vol. 13, Page 41 13, 41. https://doi.org/10.3390/INFO13010041

Cambria, E., White, B., 2014. Jumping NLP curves: A review of natural language processing research. IEEE Comput Intell Mag 9, 48–57. https://doi.org/10.1109/MCI.2014.2307227

Carter, L., Liu, D., Cantrell, C., 2020. Exploring the Intersection of the Digital Divide and Artificial Intelligence: A Hermeneutic Literature Review. AIS Transactions on Human-Computer Interaction 12, 253–275. https://doi.org/10.17705/1thci.00138

ChatGPT & LLMs in the Enterprise [WWW Document], n.d. URL https://content.dataiku.com/chatgpt/chatgpt-llm-dataiku#page=1 (accessed 3.28.23).

Data Scientists : Occupational Outlook Handbook: : U.S. Bureau of Labor Statistics [WWW Document], 2023. URL https://www.bls.gov/ooh/math/data-scientists.htm (accessed 9.6.23).

Devlin, J., Chang, M.-W., Lee, K., Google, K.T., Language, A.I., 2019. BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding.

Digital Economy Strategy | The Official Portal of the UAE Government [WWW Document], n.d. URL https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/strategies-plans-and-visions/finance-and-economy/digital-economy-strategy (accessed 11.26.23).

Dubai Chamber of Digital Economy Engages Industry Players in Shaping Future Gig Economy Landscape in Dubai – Dubai Chamber of Commerce [WWW Document], n.d. URL https://www.dubaichamber.com/en/media-center/news/dubai-chamber-of-digital-economy-engages-industry-players-in-shaping-future-gig-economy-landscape-in-dubai/ (accessed 11.26.23).

DUBAI CYBER SECURITY STRATEGY Establishing Dubai as a global leader in innovation, safety and security, 2017.

Dwivedi, Y.K., Kshetri, N., Hughes, L., Slade, E.L., Jeyaraj, A., Kar, A.K., Baabdullah, A.M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M.A., Al-Busaidi, A.S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., Carter, L., Chowdhury, S., Crick, T., Cunningham, S.W., Davies, G.H., Davison, R.M., Dé, R., Dennehy, D., Duan, Y., Dubey, R., Dwivedi, R., Edwards, J.S., Flavián, C., Gauld, R., Grover, V., Hu, M.-C., Janssen, M., Jones, P., Junglas, I., Khorana, S., Kraus, S., Larsen, K.R., Latreille, P., Laumer, S., Malik, F.T., Mardani, A., Mariani, M., Mithas, S., Mogaji, E., Nord, J.H., O'Connor, S., Okumus, F., Pagani, M., Pandey, N., Papagiannidis, S., Pappas, I.O., Pathak, N., Pries-Heje, J., Raman, R., Rana, N.P., Rehm, S.-V., Ribeiro-Navarrete, S., Richter, A., Rowe, F., Sarker, S., Stahl, B.C., Tiwari, M.K., van der Aalst, W., Venkatesh, V., Viglia, G., Wade, M., Walton, P., Wirtz, J., Wright, R., 2023. "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. Int J Inf Manage 71, 102642. https://doi.org/10.1016/J.IJINFOMGT.2023.102642

EU Government Digital Service [WWW Document], 2019. URL https://www.gov.uk/service-manual/service-standard (accessed 8.22.23).

Explainable AI | Royal Society [WWW Document], n.d. URL https://royalsociety.org/topics-policy/projects/explainable-ai/ (accessed 8.22.23).

Fui-Hoon Nah, F., Zheng, R., Cai, J., Siau, K., Chen, L., 2023. Generative AI and ChatGPT: Applications, challenges, and AI-human collaboration. Journal of Information Technology Case and Application Research. https://doi.org/10.1080/15228053.2023.2233814

Global Cybersecurity Outlook 2023 J A N U A R Y 2 0 2 3 In collaboration with Accenture Contents, 2023.

Hsu, C.L., Lin, J.C.C., 2023. Understanding the user satisfaction and loyalty of customer service chatbots. Journal of Retailing and Consumer Services 71. https://doi.org/10.1016/J.JRETCONSER.2022.103211

Ju, J., Meng, Q., Sun, F., Liu, L., Singh, S., 2023. Citizen preferences and government chatbot social characteristics: Evidence from a discrete choice experiment. Gov Inf Q 101785. https://doi.org/10.1016/J.GIQ.2022.101785

Jurafsky, D., Martin, J.H., n.d. Speech and Language Processing An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition Third Edition draft Summary of Contents.

Kamoonpuri, S.Z., Sengar, A., 2023. Hi, May AI help you? An analysis of the barriers impeding the implementation and use of artificial intelligence-enabled virtual assistants in retail. Journal of Retailing and Consumer Services 72. https://doi.org/10.1016/J.JRETCONSER.2023.103258

Liu, V., Chilton, L.B., 2021. Design Guidelines for Prompt Engineering Text-to-Image Generative Models. Conference on Human Factors in Computing Systems - Proceedings. https://doi.org/10.1145/3491102.3501825

Meet “Jais”, The World’s Most Advanced Arabic Large Language Model Open Sourced by G42’s Inception - MBZUAI [WWW Document], n.d. URL https://mbzuai.ac.ae/news/meet-jais-the-worlds-most-advanced-arabic-large-language-model-open-sourced-by-g42s-inception/ (accessed 11.12.23).

Mehr, H., 2017. Artificial Intelligence for Citizen Services and Government Artificial Intelligence for Citizen Services and Government artificial intelligence for citizen services and government.

Ministry of Foreign Affairs [WWW Document], n.d. URL https://www.mofa.gov.ae/en/Missions/Paris/The-UAE/UAE-Economy (accessed 11.26.23).

Mohasses, M., 2019. How AI-Chatbots Can Make Dubai Smarter? Proceedings - 2019 Amity International Conference on Artificial Intelligence, AICAI 2019 439–446. https://doi.org/10.1109/AICAI.2019.8701413

Nirala, K.K., Singh, N.K., Purani, V.S., 2022. A survey on providing customer and public administration based services using AI: chatbot. Multimed Tools Appl 81, 22215–22246. https://doi.org/10.1007/S11042-021-11458-Y/FIGURES/6

Noor [WWW Document], n.d. URL https://noor.tii.ae/ (accessed 11.16.23).

Nuez, A., Advisors, E., Costa-Jussà, M.R., Segura Perales, C., 2017. Implementing ChatBots using Neural Machine Translation techniques.

OECD Report on Public Communication The Global Context and the Way Forward Report Highlights, 2021.

Openai, A.R., Openai, K.N., Openai, T.S., Openai, I.S., 2018. Improving Language Understanding by Generative Pre-Training.

OpenAI Platform [WWW Document], n.d. URL https://platform.openai.com/tokenizer (accessed 11.15.23).

OWASP lists 10 most critical large language model vulnerabilities | CSO Online [WWW Document], n.d. URL https://www.csoonline.com/article/575497/owasp-lists-10-most-critical-large-language-model-vulnerabilities.html (accessed 9.29.23).

Ross, H.J., 2020. Everyday bias : identifying and navigating unconscious judgments in our daily lives 191.

Schwarz, J.O., Wach, B., Rohrbeck, R., 2023. How to anchor design thinking in the future: Empirical evidence on the usage of strategic foresight in design thinking projects. Futures 149, 103137. https://doi.org/10.1016/J.FUTURES.2023.103137

See Your New Normal — Scenario Planning for Strategists [WWW Document], n.d. URL https://www.woodywade.com/ebooks/see-your-new-normal (accessed 3.28.23).

Shi, M., Zhang, T., Zeng, Y., 2020. A Curiosity-Based Learning Method for Spiking Neural Networks. Front Comput Neurosci 14, 477608. https://doi.org/10.3389/FNCOM.2020.00007/BIBTEX

Shum, H. yeung, He, X. dong, Li, D., 2018. From Eliza to XiaoIce: challenges and opportunities with social chatbots. Frontiers of Information Technology and Electronic Engineering 19, 10–26. https://doi.org/10.1631/FITEE.1700826/METRICS

Shumanov, M., Johnson, L., 2021. Making conversations with chatbots more personalized. Comput Human Behav 117, 106627. https://doi.org/10.1016/J.CHB.2020.106627

Smartphone Market Size, Share, Growth | Analysis Report [2029] [WWW Document], n.d. URL https://www.fortunebusinessinsights.com/industry-reports/smartphone-market-100308 (accessed 11.26.23).

ßak Kalkanci, B., Rahmani, M., Toktay, L.B., 2019. The Role of Inclusive Innovation in Promoting Social Sustainability. https://doi.org/10.1111/poms.13112

Svetlana, N., Anna, N., Svetlana, M., Tatiana, G., Olga, M., 2022. Artificial intelligence as a driver of business process transformation. Procedia Comput Sci 213, 276–284. https://doi.org/10.1016/J.PROCS.2022.11.067

Taeihagh, A., Ramesh, M., Howlett, M., 2021. Assessing the regulatory challenges of emerging disruptive technologies. Regul Gov 15, 1009–1019. https://doi.org/10.1111/REGO.12392

The Leaders' Report: What Government Communicators Can Learn from the Covid-19 Pandemic - WPP Gov [WWW Document], n.d. URL https://govtpracticewpp.com/report/leaders-report-2021/ (accessed 3.19.23).

The UAE Digital Government Strategy 2025 | The Official Portal of the UAE Government [WWW Document], n.d. URL https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/strategies-plans-and-visions/government-services-and-digital-transformation/uae-national-digital-government-strategy (accessed 8.27.23).

The UAE Promise - The Official Portal of the UAE Government [WWW Document], n.d. URL https://u.ae/en/about-the-uae/digital-uae/the-uae-promise (accessed 3.15.23).

UAE Strategy for Artificial Intelligence - The Official Portal of the UAE Government [WWW Document], n.d. URL https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/strategies-plans-and-visions/government-services-and-digital-transformation/uae-strategy-for-artificial-intelligence (accessed 3.25.23).

United Arab Emirates - Oil and Gas [WWW Document], 2022. URL https://www.trade.gov/country-commercial-guides/united-arab-emirates-oil-and-gas (accessed 9.10.23).

Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A.N., Kaiser, Ł., Polosukhin, I., 2017. Attention is all you need. Adv Neural Inf Process Syst 2017-December, 5999–6009.

WAM - Emirates News Agency [WWW Document], n.d. URL https://wam.ae/en/details/1395303159132 (accessed 11.26.23).

Wang, X., Lin, X., Shao, B., 2022. How does artificial intelligence create business agility? Evidence from chatbots. Int J Inf Manage 66. https://doi.org/10.1016/J.IJINFOMGT.2022.102535

What is Quantum Computing? | IBM [WWW Document], n.d. URL https://www.ibm.com/topics/quantum-computing (accessed 9.6.23).

Yen, C., Chiang, M.C., 2021. Trust me, if you can: a study on the factors that influence consumers' purchase intention triggered by chatbots based on brain image evidence and self-reported assessments. Behaviour & Information Technology 40, 1177–1194. https://doi.org/10.1080/0144929X.2020.1743362

Appendices

Horizon Scanning

Horizon scanning in future foresight is a crucial practice that involves systematically identifying emerging trends, weak signals, and wild cards. This is important to better understand how NLP-LLMs can shape the future of government services and communication with citizens in the UAE. By proactively anticipating and monitoring this horizon, the UAE government can better prepare for the future, mitigate risks, seize opportunities, and make informed decisions. This forward-looking approach will also enhance strategic planning, innovation, competitiveness, and long-term sustainability, ultimately helping shape a more resilient and prosperous future for the UAE in this domain.

We will identify 21 signals, then those identified signals will be evaluated against 3 main categories; Credibility, Novelty, and relevance of the signal, along with the main field of impact (Political, Social, Economic, and Technological). Every category will have a rating on a scale from 1-5, with 1 being the lowest and 5 being the highest. Later we will plot those signals of the axis of uncertainty (impact versus certainty).

Secondly, we will identify the driving forces that could impact the future of Advanced Natural Language Processing (NLP) Large Language Models (LLMs) Driven Chatbots in Shaping the Future of UAE Government Services and Communication with Citizens as per PEST (Political, Social, Economic and Technological).

Presented below is a table featuring signal names, signal types (whether they are trends, weak signals, or wild cards), along with signal descriptions. Additionally, the table outlines the identified signals within a PEST analysis context.

#	Signal Name	Type *(trend,weak signal, wild card)*	Description	PEST
1	Apocalyptic AI	Wild Card	The apocalyptic destruction of humankind has been forecast since the dawn of time. Today those warnings deal with AI development.	Political
2	Intelligence Amplification (IA)	Weak Signal	Intelligence amplification (IA), also known as augmented intelligence, refers to an attempt to enhance human capabilities with intelligent technologies. This aim is in quite	Economic

			strong opposition to the more commonly used concept of artificial intelligence (AI).	
3	Social Media Filter Bubbles and Misuses	Trend	A social media filter bubble is created when AI algorithms are applied both to search engines and social media content. The worldview inside a social media filter bubble is defined by algorithms and filters which direct the selection of content, products, services, places,	Social
4	AI Machine Learning	Trend	Machine learning predicts outcomes based on past occurrences, pattern recognition, and statistics. It applies and develops deeper mathematical methods used in statistics.	Economic Technological
5	Unfathomable AI	Weak Signal	In the coming decades, the concept of artificial intelligence will become nearly unfathomable. Already today, even the most advanced experts have trouble making sense of all the algorithms and the full scale of the phenomenon. In the future, we might become utterly blind to the nearly magical operations and goals of intelligent systems.	Technological
6	SpiNNAker Supercomputer (Shi et al., 2020)	Weak Signal	SpiNNaker (Spiking Neural Network Architecture) is a neuromorphic supercomputer, which means its structure and functions imitate those of a human brain. SpiNNaker consists of over a million processor cores mimicking the brain's neural network SpiNNaker is located in the University of Manchester, and it is part of the Human Brain Project.	Technological
7	Generative AI	Trend	The ability of artificial intelligence to create new content, such as text, images, or music, that resembles the content that is created by humans and could sometimes excel it due to it being trained on huge amount of data.	Technological
8	Artificial General Intelligence	Wild Card	AI is still in the "narrow AI" era, excelling at predefined tasks but lacking human-like reasoning. A "third wave" of AI could lead to Artificial General Intelligence (AGI), a more advanced AI with human-like reasoning, to unlock its full potential.	Technological

9	Industry 5.0	Weak signal	The next wave of the industrial revolution, Industry 5.0, will turn our focus back to humanity. It will be a revolution where robots help humans work better, faster, and safer by leveraging cognitive computing power.	Economic
10	Quantum Computing ("What is Quantum Computing? | IBM," n.d.)	Weak Signal	Quantum computing could enhance generative AI models by providing more computational power for training and generating complex and realistic content. This could result in the creation of highly detailed and immersive virtual environments, lifelike characters, and photorealistic images that are indistinguishable from reality. This will push the boundaries of Human creativity to a new era.	Technological
11.	Ethics of AI	Trend	Advancements in artificial intelligence bring about new kinds of technology-related ethical questions that will definitely require attention. The moral debate, legislation and practical guidelines regarding the development and utilisation of AI are becoming increasingly topical issues.	Political
12	Future Without Work	Wild Card	AI creativity, automation, and robotics development together with other employment disruptions may in the long run lead to a situation where even 70% of the humans become permanently unemployed, or, even worse.	Social
13	Apps for Editing Moods	Wild Card	Digitally editing our moods and emotions may become a reality with brain-computer interfaces (BCIs). As BCIs are currently under development in multiple labs, advanced BCIs technology could be used to treat mental illnesses, such as depression.	Social
14	Need for Data Scientists (Data Scientists : Outlook Handbook: U.S. Bureau of Labor	Trend	As AI technologies continue to evolve so will the demand on data scientists increase drastically.The USA bureau of statistics is estimating a demand increase 36% in the next 10 years.	Economic

	Statistics, 2023)			
15	Internet of Senses (IoS)	Weak Signal	IoS technologies may open a new dimension in the way people communicate. Digital avatars in immersive environments can interact with other users and with all our senses, potentially making physical contact obsolete. Using brains as a user interface may also become possible in the age of the IoS enabling people to operate virtual worlds only with their thoughts.	Social
16	Telepresence and the use of Avatars	Weak Signal	Telepresence means creating a feeling of presence through various technologies, even though the person is not physically present	Social
17	Neuralink	Wild Card	Learning as we know it may become outdated if it becomes possible to download data directly from the internet into the brain of humans through the aid of cranial implants to search for information from the internet and have it immediately available in their mind.	Social
18	Multi-Model AI	Weak Signal	Artificial Intelligence Systems that are capable of processing and understanding different types of data sources (text, image, audio, video)	Technological
19.	Cybersecurity	Trend	Increased use of AI LLMs requires proactive and thorough security risk assessment and mitigation to protect government data and systems' confidentiality, integrity, and availability.	Political
20.	Artificial & Robot Co-Workers	Trend	The use of automation and AI-enabled robots has been on the rise in the workplace. A wide range of businesses will continue to increase their investments in AI and automation in order to maximise productivity and seek greater financial benefits. Automation is likely to transform existing jobs by removing routine tasks	Social Economic
21.	Automated Customer Care	Trend	Customer care is being automated, with the option for instant remote human assistance. This combination is expected to provide 24/7 personalized and efficient service. A	Economic Social

			likely scenario involves digital customer service robots and instant remote human assistance revolutionizing customer service, significantly impacting retail businesses.	

Table 1: Horizon Scanning Signals (trends, weak signals, wild cards)

Note: Some signals could fall within 2 or more categories depending on the specific context and interpretation of these signals within a PEST analysis.

Signal Name	Credibility	Novelty	Relevance	Score
Apocalyptic AI	2	4	4	32
Intelligence Amplification (IA)	3	3	4	36
Social Media Filter Bubbles / Misuses	4	2	4	32
AI Machine Learning	**4**	**3**	**5**	**60**
Unfathomable AI	2	4	4	32
SpiNNAker Supercomputer	3	4	4	48
Generative AI	**4**	**3**	**5**	**60**
Artificial General Intelligence	3	2	4	24
Industry 5.0	2	3	4	24
Quantum Computing	**4**	**3**	**5**	**60**
Ethics of AI	4	2	5	40
Future Without Work	3	3	5	45
Apps for Editing Moods	4	2	4	32
Need for Data Scientists	**4**	**3**	**5**	**60**
Internet of Senses (IoS)	3	3	4	36
Telepresence and the use of Avatars	3	3	4	36
Neuralink	3	4	4	48
Multi-Model AI	**3**	**4**	**5**	**60**
Cybersecurity	**5**	**3**	**5**	**75**
Artificial & Robot Co-Workers	3	3	3	27
Automated Customer Care	3	3	4	36

Table 2: Horizon Scanning Signals scoring: Credibility, Novelty and Relevance

Based on the above table and overall scores, the signals with highest scores are the signals needed to be continuously monitored and focused on.