Integrative Strategies for Generative AI in Government Operations

Wadhwani Center for Government Digital Transformation (WGDT)

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1. Executive Summary

Governments are increasingly exploring and adopting Generative AI (GenAI) to improve government efficiency and service delivery. For India, GenAI has been identified as a powerful tool that has potential to drive economic opportunities across various industries. It is expected to improve productivity, automation, and decision-making capabilities across sectors. According to EY India Report, GenAI has the potential to add a cumulative US$1.2-1.5 trillion to India's Gross Domestic Product over the next seven years, contributing an additional 0.9% to 1.1% in annual CAGR.[1]

In this paper, we identify the various types of GenAI technologies, and their applications, relevant to the government, based on an extensive review of available literature on the subject in India and abroad. We then situate these applications within the government context to develop a typology of 4 main uses of GenAI for government, namely:

a. *Data Analysis and Summarization*
b. *Software Development*
c. *Public engagement*
d. *Content Generation*

Using these typologies, we suggest further applications of GenAI across sectors such as education, healthcare, urban development, law and justice. Acknowledging India's openness to embrace modern technology, we identify a few challenges that would need to be overcome before we witness a holistic adoption of GenAI in government. These are:

a. Infrastructural challenges such as lack of sovereign foundational models in India, non-availability of compute capacity and energy requirements needed to support such large facilities.
b. The lack of skilled human resources to build, operate and run GenAI powered applications.
c. Black-box problem that is associated with GenAI makes it difficult to build public trust in these models and use off-the-shelf models that are developed outside India.
d. Propensity to breach copyrights of several individuals and institutions, which law may not be equipped to handle, thus restricting the development of AI models.
e. Unavailability/ dearth of training data sets with minimal bias to improve precision and recall of GenAI systems, restricting the development of sovereign models.

We recommend that Indian government shall be able to overcome these challenges by:

a. Building a robust government workforce that is familiar with AI and GenAI applications in terms of use and indigenously building the same.

[1] https://www.ey.com/en_in/ai/generative-ai-india-report?WT.mc_id=10854311&AA.tsrc=paidsearch&gad_source=1&gclid=Cj0KCQjwwMqvBhCtARIsAIXsZpZ6FycMeGXy7HGnRwr-BjTch1Q4o_mDO9RPfDbROW7cZHT5FB6s9vgaAvGGEALw_wcB

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b. Engage in Public-Private Partnerships to leverage the AI knowledge, skills and expertise of the private sector and import them into the public sector to increase the efficiency of service delivery.
c. Invest in infrastructure to build compute capacity and foundational models.
d. Adopt and drive responsible AI practices in the absence of specific regulatory mandates like other countries such as European Union, United States of America, China etc.

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2. Introduction

The governance landscape has been evolving with technology enabling governance to be more efficient and transparent. While the rapid advancements in the field of Artificial Intelligence (AI) are yet to find complete adoption in the government, the advent of Generative AI (GenAI) has impelled the government to reevaluate their pace of adoption to be globally competitive. For India, GenAI has been identified as a powerful tool that has potential to drive economic opportunities across various industries. Precursor to the idea of adopting Gen AI into government functioning is its macro-economic potential. Gen AI is expected to improve productivity, automation, and decision-making capabilities across sectors. According to EY India Report, GenAI has the potential to add a cumulative US$1.2-1.5 trillion to India's Gross Domestic Product over the next seven years, contributing an additional 0.9% to 1.1% in annual CAGR.[2] The report forecasts that by fully capitalising Gen AI technology and its applications across sectors, India can potentially add $359-438 billion in FY30 alone, reflecting a 5.9 per cent to 7.2 percent increase over and above baseline GDP.[3]

Not only is GenAI capable of significantly adding to India's revenue, GenAI, when paired with other forms of automation and human judgement, is also expected to have a transformative impact on the government administration, governance and public service delivery. The GenAI can automate time consuming processes which shall help in improving productivity and efficiency. It has a repository of world knowledge and resonates human capabilities of logical deductions, language command and creativity which helps it produce innovative solutions and designs.

However, it also raises concern on privacy and other policy issues which makes it important that its development and application must be conducted responsibly and ethically. This makes it imperative to understand how this technology impacts work and the unique barriers in different sectors. The government and its functionaries need to comprehend the usage of GenAI and gradually adapt in government functions and processes, thereby accelerating its adoption. The next few sections elucidate in brief the terms AI, GenAI, etc. to facilitate the understanding and establish correlation for its appropriate application in government.

[2] https://assets.ey.com/content/dam/ey-sites/ey-com/en_in/topics/gen-ai/2023/12/ey-the-aidea-of-india-generative-ai-s-potential-to-accelerate-india-s-digital-transformation.pdf
[3] https://assets.ey.com/content/dam/ey-sites/ey-com/en_in/topics/gen-ai/2023/12/ey-the-aidea-of-india-generative-ai-s-potential-to-accelerate-india-s-digital-transformation.pdf

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3. Understanding Generative AI

The evolution of the GenAI can be traced to the development of AI over decades. It is therefore important to understand the difference between AI and Generative AI.

AI: In 2004 John McCarthy described AI as "It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable."[4] In other words, Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision[5]

Generative AI: Generative artificial intelligence (AI) describes algorithms (such as ChatGPT) that can be used to create new content, including audio, code, images, text, simulations, and videos[6]. The Generative AI is powered by "Foundational models".

Foundational Models: The Stanford Institute for Human Centered Intelligence (Centre for Research on Foundational Models) was the first to popularize the word "foundational model". A foundational model is an AI solution trained on broad data that can be adapted to wide range of downstream tasks[7]. A more simplified understanding would be that foundational models can be trained on a huge amount of data and adapted to many applications. This saves us the time and resources spent on developing training data from scratch each time we want to leverage AI. Table 1 explains in brief some of the Foundational Models along with examples and uses.

Table 1 Few Types of Foundational Models

	Large Language Model (LLM)[8]	Computer Vision Model[9]	Multimodal Model[10]
Description	It can analyze large quantities of human languages and text. It is inbuilt with various parameters that enable it to practice self-supervised learning.	A computer vision model takes in uploaded content such as images/videos and generates pre-learned labels/concepts.	Modality refers to the medium/format in which data is interpreted or stored. A multimodal model is thus able to seamlessly transition

[4] https://www-formal.stanford.edu/jmc/whatisai.pdf
[5]https://www.techtarget.com/searchenterpriseai/definition/AI-Artificial-Intelligence#:~:text=Artificial%20intelligence%20is%20the%20simulation,speech%20recognition%20and%20machine%20vision.
[6]https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-generative-ai
[7] https://crfm.stanford.edu/report.html
[8] https://www.geeksforgeeks.org/large-language-model-llm/
[9] https://towardsdatascience.com/introduction-to-computer-vision-model-training-c8d22a9af22b
[10] https://www.analyticsvidhya.com/blog/2023/12/what-are-multimodal-models/

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	Large Language Model (LLM)[8]	Computer Vision Model[9]	Multimodal Model[10]
	This feature enables it to apply its learnings from one context to another context.		across image-text while assimilating inputs and generating outputs.
Use	• Translation of languages • Chatbots • Content generation • Code generation • Debugging and documentation of code	• Developing Facial Recognition Technology • Identify the location of objects • Classifying images	• Interpreting land records • Judgements of courts/ quasi-judicial authorities
Examples	GPT-3, BERT	ViT, ResNet, YOLO, Florence	UniLM combines both Natural Language Processing and Computer Vision and is used to digitizing physical documents

Most of the current GenAI tools which are commonly used are based on LLMs. These tools have been trained on billions of resources which help them to intelligently analyse and generate responses for different queries. Below is a brief explainer as to how the LLMs process the prompt (Box 1 provides details on some of the concepts):

a. Tokenisation of the Prompt: As the first step, the prompt made by the user is broken down into tokens which can be words, part of words or just characters depending on the language and the model.
b. Understanding the Tokens: Each token is then converted into a numerical vector using pre-trained embeddings. These vectors represent the meaning and context of each token within the overall sentence. LLMs consider the relationship between tokens and the context in which they appear. This allows the model to understand nuances, such as the difference between "bank" as a financial institution and "bank" as the side of a river.
c. Prompt Processing:
    i. Passing Through Neural Networks: The vector representations of the tokens are fed through a deep neural network, usually consisting of multiple layers. Each layer processes the tokens, gradually building a complex understanding of the entire prompt.
    ii. Attention Mechanism: Modern LLMs often utilize attention mechanisms that allow the model to focus on specific parts of the input when generating a

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response. This can be compared to how humans pay attention to key information when listening or reading.

d. Generating a Response:
    i. Decoding Process: The processed information is then used to generate a response. The model selects tokens (words or subwords) one by one, considering the previous tokens selected and the information gained from the input prompt.
    ii. Completing the Puzzle: The selected tokens are assembled into a coherent response, much like putting together puzzle pieces to form a complete picture.

The LLM can provide an alternative response by generating a different sequence of predicted words. The nature of language prediction is probabilistic, meaning that there are many possible responses that could be generated from a given prompt, each with a different probability. By sampling from these probabilities in a slightly different way, the model can come up with a different, but still contextually relevant and coherent, response.

Box1

Token: In the context of Large Language Models (LLMs), the term "token" refers to a chunk of text that the model reads or generates. A token is typically not a word; it could be a smaller unit, like a character or a part of a word, or a larger one like a whole phrase.[11]

Embeddings: Embeddings are vectors or arrays of numbers that represent the meaning and the context of the tokens that the model processes and generates. Embeddings are derived from the parameters or the weights of the model and are used to encode and decode the input and output texts.[12]

In the United Kingdom, the Centre for Data Ethics and Innovation conducted research on public perceptions of foundational models.[13] It concluded that participants were open and positive to using foundation models by the public sector. Some of the highlighted sectors are healthcare, decision-making by the government, and urban planning. However, the report noted some apprehensions by the public when AI models have a direct impact on individuals, like autonomous surgery. As there is no similar study conducted in India to assess the public perception of the usage of Gen AI by the government, these results have been considered to highlight the practical use cases of Gen AI for India.

[11] https://medium.com/@michaelhumor/understanding-tokens-and-tokenization-in-large-language-models-1058cd24b944
[12] https://learn.microsoft.com/en-us/semantic-kernel/memories/embeddings
[13]https://assets.publishing.service.gov.uk/media/650192e3572780000d251a9d/Thinks_CDEI_Public_perceptions_of_foundation_models.pdf

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4. Applications of Generative AI in Government

According to McKinsey research, GenAI could have an estimated US$480 Billion productivity effect on the public sector and adjacent industries.[14] The report further identifies four substantial potential areas (refer Figure 3) – *Data Analysis and summarization, Software Development, Public engagement, Content generation:*[15]

Table 2 Gen AI Estimated Productivity Impact (Developed by the authors from McKinsey report)

Sector	Forecast of productivity Effect by Gen AI (USD Billion)
Public and Social Sector	100
Healthcare	200
Education	180
High Tech	351
Retail	283
Banking	273
Consumer packed goods	216
Energy	194
Services (Technical, Professional, Scientific)	171
Transport and Logistics	169
Electronics and Semiconductors	132
Construction	117
Chemicals	112
Others	944

4.1 *Data Analysis and Summarization:*

Gen AI can identify and summarize relevant insights from large bodies of text. It can sift between large sections of unlabelled data to establish predictable as well as unpredictable co-relations that lend to a more comprehensive analysis process. The outputs generated through learning language models are more comprehensive and overcome bias, errors and the time constraints of manually undertaking the work.

Box 2

The Government of Singapore has developed an app called "Pair" for text summaries and reports for internal use.[16] The Indian judiciary has also taken the assistance of GenAI to summarize cases.[17]

[14] https://www.mckinsey.com/industries/public-sector/our-insights/unlocking-the-potential-of-generative-ai-three-key-questions-for-government-agencies
[15] https://www.mckinsey.com/industries/public-sector/our-insights/unlocking-the-potential-of-generative-ai-three-key-questions-for-government-agencies
[16] Pair (open.gov.sg)
[17] https://ai.nic.in/AI/Judiciary_Case_Deep_Learning

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Below are some use cases for applying the content summarization and synthesis feature of GenAI:

Use Case 1 - Policy Making:
There is a large amount of data generated through government systems which is difficult to analyse manually to generate quality insights in quickly and take appropriate policy decisions. Gen AI's prowess in content summarization, synthesis and analysis can be leveraged for quick data analysis and analytical information from analysis. It not only drastically reduces the time required to generate responses but also provides in-depth analysis to the generated responses. It helps policymakers devote more time to other aspects of their response such as context-based applications, implementation considerations, communication and intensifying their stakeholder management.[18]

Use Case 2 - Simplifying Public Consultation:
Government, in order to enable participative governance, carries out public consultation on many aspects against which it receives a plethora of responses. The content summarization and synthesis feature can be applied to increase the efficiency of public consultation. GenAI can collectively analyse responses from a public consultation to gather a more extensive and comprehensive understanding of stakeholder perspectives. It can also create heatmaps for a better visual representation of the data inputs from the public consultation.

Use Case 3 - Support in Government Procurement Processes:
The content generation and synthesis feature can also add great value to procurement processes by the government, helping the officials navigate the numerous proposals at a rapid pace by helping them check the proposals for accuracy of information, compliance with the requirements, comparing the proposals to market data and shortlisting some of them for further evaluation.[19] The government can use Gen AI to automatically classify incoming bids after evaluating the bids on specific parameters.

4.2 Software Development:

Software development and upgradation in the government is a challenge as it is a quickly evolving landscape and involves a complex tapestry of integrated systems that must work together. Software solutions for the government should facilitate timely implementation of streamlined solutions and minimize substantial change requirements in the later stages. Gen AI can be utilized to-

i. To streamline the initial **requirement gathering process** through automation and intelligent analysis for software development which can be refined using human interventions. By leveraging existing documentation, user feedback data, and even unstructured conversations from interviews and brainstorming sessions, GenAI can

[18] https://www.bcg.com/publications/2023/unlocking-genai-opportunities-in-the-government
[19] https://www2.deloitte.com/us/en/insights/industry/public-sector/automation-and-generative-ai-in-government.html#generative-ai

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efficiently synthesize well-structured and comprehensive requirements documents. This not only reduces the time and effort required for manual analysis but also promotes a more thorough and accurate understanding of user needs. Further, GenAI's ability to identify potential inconsistencies or gaps in requirements facilitates proactive refinement and ensures alignment with project objectives. This shall help the software developers to develop the software in a more streamlined manner.

Box3

In the United Kingdom, the HM Treasury (economic and finance ministry) is testing out a Gen AI integration that has been done into the Git Hub - Git Hub Copilot that intends to optimize the work of the government software developers.[20]

ii. **Improved Planning and Estimation:** Drawing upon historical data and vast knowledge repositories, GenAI promises enhanced project planning accuracy. Its capabilities span precise project estimation, optimized resource allocation, and the rapid creation of detailed work breakdown structures and schedule tracking documents. This automation not only streamlines project management but also fosters informed decision-making for improved project outcomes.

iii. **Better Design and Development:** Generative AI holds significant potential to streamline and enhance the design and development phases of the software development lifecycle. GenAI can generate diverse UI/UX mockups based on user preferences and industry trends, providing a valuable starting point for exploration and refinement. It can effectively translate natural language descriptions into functional code snippets, reducing the manual effort involved in implementing routine functionalities.

iv. **Enhance Testing and Deployment:** GenAI can analyze code and user behavior patterns to generate comprehensive and personalized test suites, targeting potential vulnerabilities and edge cases. This enhanced testing and deployment efficiency frees up developers to focus on innovation and problem-solving.

v. **Comprehensive Documentation:** One of the major concerns in public sector software development is the proper documentation of the software being developed. GenAi can be employed to automatically generate user guides, technical manuals, change logs, and even annotated code comments, thereby, streamlining the process, saving time and resources.

This implies that the public sector could reduce the software development lifecycles of public digital infrastructure, increase efficiency across various stages of the software development process.

4.3 Public engagement:

Government services have enormous public engagement as it provides services which have impact on common people. This results in generation of substantial number of queries,

[20] https://www.technologyreview.com/2023/12/06/1084457/ai-assistants-copilot-changing-code-software-development-github-openai/

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complaints and grievances which consume substantial amount of government officials' time. In government agencies, GenAI based chatbots could answer questions from or customize services for residents. It can help governments and public sector organizations provide enhanced service experiences that make government more accessible and less time-consuming by acting as an "Information Assistant" – answering frequently asked questions, recommending services based on inputs, and even handling simple transactions.

Further GenAI can also be used to support citizens to provide a narrative of their current circumstances and discover service options/government entitlements they previously did not know existed. GenAI has the capacity to enable such an interactive process across several languages, and even voice-to-text. This would free up public sector workers to focus on strategic projects instead of being tied down to mundane, repetitive functions such as responding and follow-up to common questions. Thus, GenAI can help to improve the experience of individuals and families interacting with human services programs, by reducing load of case workers such as ASHA workers and other volunteers, and process registration/ on-boarding forms.

Box 4

- The city of Heidelberg, in Germany, has launched the Lumi chatbot, the country's first digital citizen assistant.[21] The tool enables people to easily navigate government services such as applying for a new identity card, getting a driving license, and registering a place of residence.
- VIA Metropolitan Transit, which serves San Antonio, Texas, uses an IBM watsonx-powered chatbot to provide up-to-date transit information for riders. Beyond operating 24/7, the chatbot leverages call-center data and collects real-time transit data via APIs, to give riders information on where their next bus is.[22]
- In the United States, DHS employees are permitted to use commercially available generative AI for image generation in day-to-day work. These tools are able to dynamically create graphical content through text prompts submitted by the user. They use Natural Language Processing (NLP), in conjunction with other Machine Learning techniques such as Generative Adversarial Networks (GANs) and Diffusion Models, to produce images in a wide variety of contexts and styles.[23]
- KISSAN GPT: An interactive AI chatbot named 'Kissan GPT',[24] went live on March 15, 2023, is designed to help India's agriculture sector, allowing farmers to query over an interactive interface, from the convenience of their phones. It enables a user to ask questions on topics of agriculture such as agricultural cultivation, insect management, and irrigation over voice in nine Indian languages Tamil, Hindi, Bengali, Malayalam, Gujarati, Telegu, Kannada, Marathi, etc. It leverages OpenAI's ChatGPT technology in

[21] https://www-heidelberg-de.translate.goog/Digitale-Stadt/startseite/projekte/ki-buergerassistenz+lumi.html?_x_tr_sl=de&_x_tr_tl=en&_x_tr_hl=en&_x_tr_pto=sc
[22] https://www.ibm.com/case-studies/via-metropolitan-transit
[23] https://www.dhs.gov/publication/ai-use-case-inventory
[24] https://kissan.ai

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conjunction with the platform's knowledge store to give the answers to the queries raised.

4.4 Content generation:

Government officials are required to produce a wide variety of documents/content which may include a simple correspondence, memos, social media post, press briefing, speeches, reports, responses to questions, citizen guides, request for proposals, etc. The officers can reduce time in generating such information by making use of GenAI to provide a helpful first drafts of such documents/content. The information provided by GenAI can be validated and further improved by the officials and ensure that the information is complete and not misleading. Gen AI as a creative writing aid can accelerate the process dramatically and help light the creative spark while reducing time-to-completion for common writing tasks.

The Table 2 provides a typology of capabilities of GenAI for government officials, and is intended as to help illustrate the potential uses of government adoption of GenAI tools:

Table 3 Summary of GenAI Applications

For basic information gathering • As a research assistant • As personal assistant	**As Conversational Agent** • Chatbot (Info dissemination, scheme eligibility, grievance filing, application filing assistant etc.) • Call Centre Agent (citizen engagement and feedback)
To analyse data, documents • Summary creation (of large docs) • Analyse data in CSV/Excel and create graphs	**As Productivity tool** • Co-pilot for Excel/Word/Outlook • Dashboard reader • Doctor's assistant
For creative writing • Speech drafting • Email reply drafting • Improving language • Content generation	**For Training and Education** • To design interactive and personalised training modules • Collaboration and brainstorming: provide ideas and challenges, and the LLM could provide suggestions, insights, and even alternative approaches
For Office • AI Office assistant sitting on top of e-file system	**Decision support system** • In analyzing and summarizing complex datasets.

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• Translation and multilingual communication • Legal and regulatory compliance	• In analyzing policy documents, identifying trends, and predicting potential outcomes
Real time analysis of data • Environment data analysis • Social welfare programs (Applying GenAI to analyse data related to social welfare programs, identifying areas for optimization, fraud prevention, and ensuring resources reach the intended beneficiaries.) • Analyse public sentiment, media coverage, and social media trends to inform government communication strategies and public relations efforts.	**Fraud detection and prevention** • Integrating GenAI into systems that monitor financial transactions, procurement processes, and other government operations to detect and prevent fraudulent activities. **Cybersecurity and Data Protection:** • Employing GenAI for advanced threat detection, anomaly analysis, and data protection to safeguard government systems and sensitive information. **Employee engagement** • Implementing GenAI for analysing employee feedback, performance data, and workforce trends to optimize human resource management within government organizations.

1. Sectoral Uses of Generative AI

Gen AI uses can be seen across different public sector domains in India, a few of which are explained below –

Table 4 Education: Potential Areas for the usage of Gen AI in the Government

Type of GenAI	Application
Data Analysis and Summarization	Generate insights for policy decision based on data of UDISE, NPSSE
Software Development	Help in creating algorithms/ models determining allocations of resources such as budgets, schools, teachers, teaching-learning material

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Type of GenAI	Application
Public Engagement	• Act as a student assistant chatbot, providing career related guidance and higher education guidance to students • Serve as a virtual tutor for after school student engagement to administer mock tests/ examinations and also the assistant chatbot can provide well-sourced answers to student doubts • Act as a parent assistant chatbot providing information of central and state schemes for scholarships, quotas, other entitlements available for persons belong to marginalised or economically weaker sections.
Content Generation	• Review and/or create draft curriculum based on the competence /skillset required at different level of education. • Create/translate teaching and learning material in/from different languages. • Generate preliminary drafts of teaching aids, such as lecture scripts and quizzes • Design learning material for children with disabilities to learn at their own pace

Table 5 Healthcare: Potential Areas for the usage of Gen AI in the Government

Type of GenAI	Application
Data Analysis and Summarization	Summarize data for health care providers from large population level data sets[25] such as NSSO, NFHS, National TB Elimination Program, towards framing data responsive policies and programs.
Software Development	Act as a co-pilot to summarize imaging diagnostics for clinicians as is currently being used in tuberculosis, diabetic retinology, glaucoma, cancer screening

[25] https://www.brookings.edu/articles/generative-ai-in-health-care-opportunities-challenges-and-policy/

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Type of GenAI	Application
Public Engagement	• Enhance the Asha workers'/ volunteer/ other health care providers' efficiency in information collection and reporting by enabling/ training them to engage with patients in understandable language, by posing specific questions in a conversational manner. • Chatbot on matters such sexual and reproductive health that may have associated taboos actively discouraging persons from approaching or seeking health care.[26] • Chatbot to inform citizens on public health entitlements available under various schemes such as the National TB Elimination Program, National AIDS Control Program, POSHAN Abhiyaan.
Content Generation	• Create simple and accessible content/information with descriptions of complex diseases to improve patients' understanding of them. • Create posters/ dissemination material for awareness creation such as during Covid-19, and dengue outbreaks in various languages. • generate concise protocols for standardisation in emergency health care response.

Table 6 Urban development: Potential Areas for the usage of Gen AI in the Government

Type of GenAI	Application
Data Analysis and Summarization	• Assist in pre-emptive evacuation/ relocation in the event of natural calamities such as floods • Summarize citizen feedback/ grievances from hotlines for city planners

[26] https://www.youtube.com/watch?v=wv99pfgp7sM

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Type of GenAI	Application
Software Development	• Generate alternative routing guidance based on predictive traffic flows in the event of public events, traffic closures, public works to reduce traffic congestion • Simulate urban design impacts, such as traffic flow or sunlight exposure • Design optimal public transport routes using available traffic data and geo-spatial data in maps and call for public-private collaborations where public transport is not available • Provide design-compliance assistance to urban administrators, such as naturally prompting when a building design does not have safety or accessibility standards
Public Engagement	chatbot to inform citizens of local bye laws, permitted and illegal constructions
Content Generation	• Create awareness materials in various languages to mitigate crimes and enhance safety of women in public places which have a higher risk of crime • Create awareness materials in various languages to improve citizen awareness on garbage disposal, plastic use, use of clean energy, prevention of water wastage • In emergency preparedness and responses, genAI can be used in crime prevention and lifesaving, providing broadcast messages in several languages, dispelling misinformation, forecasting areas of vulnerability.

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Table 7 Judicature, Taxation: Potential Areas for the usage of Gen AI in the Government

Type of GenAI	Application
Data Analysis and Summarization	• Act as a real-time legal assistant to judges and attorneys by summarising case laws and laws to be referred in crafting arguments or judgements • Simplify and explain intricate legislation and case law to enable citizen and stakeholder compliances in various languages • Keep legal professionals updated with summarized regulatory changes • Create case summaries to analyse judgements to assess access to justice for marginalised groups • Summarise citizen feedback on draft legislations released for public consultations • Synthesise compliance reports, audit reports to identify areas of non-compliance or identify red flags • Assist in analysis of large public data bases such as GST, income tax, land revenue, customs filing to create nudges for administrative purposes where data shows an unexpected pattern/trend
Software Development	Suggest potential outcomes for judicial sentencing for judges' consideration
Public Engagement	• Provide real time assistance in tax filing and troubleshooting to simplify the process and enable compliances • Chatbots to assist citizens file grievances and understand tax, judicial and quasi-judicial processes
Content Generation	• Counsel repeat offenders with tailored legal education • Automate the drafting of various legal documents to ease administrative burdens • Create templates for case filing to speed up litigation and reduce costs • Suggest frameworks to draft legislations based on international practices • Prepare first drafts of demand notices, non-compliance notices, show-cause/termination notices

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A non-exhaustive compilation of GenAI uses by governments across the world is shared at **Annexure 1.**

2. Challenges in Adoption of Generative AI

While GenAI has the potential to augment the public sector manifold, a few inherent challenges need to be addressed for India to unlock the potential of GenAI in government. A few of the significant challenges are listed below –

1. **Infrastructure to Embrace GenAI:**
   a. **Absence of Sovereign Foundational Models:** India does not have its foundational model which makes it dependent on third-party foundational models. Foundational models created by third parties come with the risks and biases built into the training data set and the testing data set of the creators of the foundational models. When a government uses pre-existing foundational models to create GenAI applications, likely, the same biases and influences present in the training and testing data will also creep into the outputs created by the GenAI built on those foreign models. Third-party foundational models use also create security and privacy concerns, specifically in the government domain.
   b. **Compute Capacity:** The expenditure to operate a supercomputer that runs GPT-4 is well above one billion EUR.[27] A study has shown that since the first deep neural network-based AI model was demonstrated in 2012, the amount of compute resources needed to train frontier models has increased by 55 million times and has a doubling rate of about every six months.[28]

      OpenAI's ChatGPT is said to run on a brain composed of at least 20,000 NVIDIA GPU (Graphics Processing Unit) chips, and Nvidia chips are a critical component of the cloud infrastructure that Alphabet, Amazon and Microsoft use.[29] NVIDIA owns 80% of the market for a particular kind of chip called a data-center accelerator, and the current wait time for one of its AI processors is anywhere between eight – eighteen months.[30] India does not have the kind of compute capacity required to create such systems and need to quickly build it to be globally competitive.

   c. **Energy Considerations for Data Centers:** Foundational Models development is a very energy intensive activity and requires continuous power support. It is estimated that GPT3 has emitted close to 552 tCO2e in CO2 which is similar to electricity consumed by 121 U.S. households in an entire year or 1,287 MWh in energy consumption during training. Ideally, they should be situated where energy can be

[27] https://ellis.eu/news/ai-foundation-models-a-roadmap-for-europe
[28] https://montrealethics.ai/compute-trends-across-three-eras-of-machine-learning/
[29] https://www.bloomberg.com/news/features/2023-06-15/nvidia-s-ai-chips-power-chatgpt-and-multibillion-dollar-surge
[30] https://www.nytimes.com/2023/08/21/technology/nvidia-ai-chips-gpu.html

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produced sustainably and affordably, where cooling is readily achievable, and where waste heat can be potentially repurposed.[31]

2. **Algorithmic Opaqueness/Black Box Problem:** Any AI system makes automated decisions based on an algorithm. The algorithm is created by programmers through training data and a set of instructions. This requires a great deal of caution as misinformed decisions by programmers on the set of instructions and training data sets that lack diversity can lead to discrimination among other adverse implications. However, many AI creators and companies that use the AI do not practice algorithmic transparency (including Open AI that developed Chat GPT)[32]. Today most of the foundational models, are quite opaque. An index developed by researchers at Stanford University index graded 10 popular foundational models on 100 different transparency indicators, such as training data and how much compute was used. The results were "unimpressive" meaning that even the most transparent model, Meta's Llama 2, received a score of 53 out of 100. OpenAI's GPT-4 model received a score of 47 out of 100, signifying that even the most well-known foundational models as they exist today are ridden with concerns of being opaque.[33] The research found profound opaqueness in Foundational models, both upstream and downstream – meaning that too little is known about the sources of the data, data creators, copyright sources (all upstream factors) as well as the impact of the model, limitations of the model or intentional harms that can be done by the model (all downstream factors).[34]

3. **Training Datasets:** In order to develop sovereign foundational models, there shall be huge amounts of datasets required to train these foundational models. To instil trust in GenAI applications adopted by the government, it is imperative to curate data sets that are obtained based on ethical consent and full disclosures, and without any copyright violations. Further once the algorithm is developed, it must be ensured that inherent biases are identified and managed and that the data used by the Generative AI system, its components, and the algorithm itself are secured from unauthorized access, corruption, and adversarial attack. The training methods and decision criteria of Generative AI should be understood, documented and readily available for human operator challenge and validation.[35]

4. **Skilled Resources:** The government ecosystem generally has a shortfall of quality technical resources that can help drive evolving technology adoption in the government domain. The momentum at which GenAI is evolving shall require a

[31] https://ai.gov/wp-content/uploads/2023/09/FAQs-on-Foundation-Models-and-Generative-AI.pdf
[32] https://www.nytimes.com/2023/05/16/technology/openai-altman-artificial-intelligence-regulation.html
[33] https://hai.stanford.edu/news/introducing-foundation-model-transparency-index
[34] https://timesofindia.indiatimes.com/blogs/niveditas-musings-on-tech-policy/transparency-and-ai-why-is-india-still-hesitating-to-regulate-ai-applications/
[35] https://www.ey.com/en_in/ai/how-gen-ai-governance-framework-can-help-build-trust-in-tomorrow-s-tech#:~:text=To%20build%20and%20sustain%20trust,%2C%20transparent%20and%20performance%2Dbased.

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dedicated pool of technology resources who can understand, manage and enable those technology adoptions in the country.

5. **Intellectual Property Breach:** Generative AI such as Chat GPT, Bard and Dall-E is extensively used to create content without attribution to the original author/authors and often causing copyright violations. The copyright over such AI-generated outputs even with minor edits does not vest with the human. The overreliance on AI has led to generate content has to led to multiple issues in the IP rights arena. The New York Times has filed a suit against OpenAI alleging that millions of articles of the New York Times were used to train chatbots created by OpenAI.[36] A prominent online sci-fi magazine was forced to stop accepting new submissions after the editorial team received an onslaught of what appeared to be AI-generated submissions[37]. It is argued by several creators of AI tools that the AI becomes the lawful owner of the copyright generated by it. However, since AI technology is often unable to differentiate between open source and copyrighted content while generating content, a copyright infringement by the AI is highly likely. A class action suit by artists in Anderson et al. demonstrated that AI platforms cannot sufficiently transform copyrighted content into lawful derivate works[38].

Similarly, there are other ethical challenges related to unintended bias that may result from Generative AI algorithms, misinformation created by hallucinated GenAI outputs, and lack of clarity on issues of liability for harm caused by GenAI models which makes it imperative that the government must take responsible approach to developing and implementing Gen AI tools.

3. Global Approaches in Adoption of Generative AI

A robust framework embodying principles that inform the adoption of GenAI in government is desirable for a trust-based and successful implementation of GenAI in India. Some other countries have already taken steps in this direction:

The **United Kingdom** released a Generative AI Framework for use in public sector applications laying out the following ten principles:[39]

a. Principle 1: You know what generative AI is and what its limitations are.
b. Principle 2: You use generative AI lawfully, ethically and responsibly.
c. Principle 3: You know how to keep generative AI tools secure.
d. Principle 4: You have meaningful human control at the right stage.
e. Principle 5: You understand how to manage the full generative AI lifecycle.

[36] https://www.nytimes.com/2023/12/27/business/media/new-york-times-open-ai-microsoft-lawsuit.html
[37] https://www.npr.org/2023/02/24/1159286436/ai-chatbot-chatgpt-magazine-clarkesworld-artificial-intelligence
[38] https://journals.library.columbia.edu/index.php/stlr/blog/view/479
[39] https://www.gov.uk/government/publications/generative-ai-framework-for-hmg/generative-ai-framework-for-hmg-html

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f. Principle 6: You use the right tool for the job.
g. Principle 7: You are open and collaborative.
h. Principle 8: You work with commercial colleagues from the start.
i. Principle 9: You have the skills and expertise needed to build and use generative AI.
j. Principle 10: You use these principles alongside your organization's policies and have the right assurance in place.

The **United States** published an executive order (EO) on Principles for Use of AI (including Generative AI) in Government are as follows:[40]

a. *Safety and security.* The E.O. promotes the development and implementation of repeatable processes and mechanisms to understand and mitigate risks related to AI adoption, including with respect to biosecurity, cybersecurity, national security, and critical infrastructure.
b. *Innovation and competition*. The E.O. compels actions to attract AI talent to the United States, understand novel intellectual property (IP) questions, protect inventors and creators, and promote AI innovation, including at startups and small businesses.
c. *Worker support*. The E.O. states that AI adoption may be disruptive to the workforce and directs agencies to research and develop potential mitigations against such disruptions.
d. *Consideration of AI bias and civil rights*. The E.O. states that AI models may perpetuate biases and their implementation may lead to civil rights violations. The E.O. includes a section on equity and civil rights considerations for use of AI in the criminal justice system and the administration of federal government programs and benefits.
e. *Consumer protection.* The E.O. instructs agencies to enforce existing, technology-agnostic authorities in an effort to minimize harms to consumers, and to identify needed authorities related to AI.
f. *Privacy*. The E.O. calls for the evaluation and mitigation of privacy risks—potentially exacerbated by AI— associated with the collection, use, and retention of user data.

Federal use of AI. The E.O. requires the Office of Management and Budget (OMB) to establish an interagency council to coordinate AI use by federal agencies and develop guidance on AI governance and risk management activities for agencies. It acknowledges the ubiquity of generative AI (GenAI) tools, and directs agencies to move toward adoption with safeguards in place. The E.O. also calls for additional agency hiring and training activities to increase the AI workforce capacity across the federal government.
International leadership. The E.O. declares that the United States should be a global leader in AI development and adoption by engaging with international allies and partners, leading efforts to develop common AI regulatory and accountability principles, and advancing responsible global technical standards for AI.

[40]https://crsreports.congress.gov/product/pdf/R/R47843#:~:text=14110%20on%20Safe%2C%20Secure%2C%20and,The%20E.O.

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In **China**, organizations (this is not exclusive to public sector) using generative AI to deliver products or services to the public within China must adhere to the following principles:[41]

1. **Uphold the Core Socialist Values** - Organizations are required to undertake strict measures to eliminate chances of the creation of any content that might:
    1. Incite subversion of national sovereignty;
    2. Endanger national security;
    3. Harm the nation's image;
    4. Advocate separatism;
    5. Undermine social stability;
    6. Advocate terrorism;
    7. Promote ethnic hatred and discrimination;
    8. Proliferate fake and harmful misinformation;
    9. Suggest overturning the socialist system.
2. **Minimize Discrimination** - Organizations must carefully curate processes such as algorithm design, the selection of training data, model generation, and optimization to proactively prevent the creation and proliferation of any unintended discrimination.
3. **Respect IP Rights** - Organizations must implement rigorous internal measures to respect and protect all commercial secrets and intellectual property rights while also minimizing the possibility of monopolies or unfair competition.
4. **Respect Rights & Interests** - Organizations must ensure the lawful rights and interests of individuals and organizations, such as their image, reputation, honor, privacy, and personal information, are not endangered in any way,
5. **Ensure Transparency** - Organizations must undertake strict and effective measures to increase the transparency of their generative AI services and the overall accuracy and reliability of any content generated via generative AI services.

On similar lines, **Singapore** government released a draft Model AI Governance Framework for Generative AI to set forth a systematic and balanced approach to address generative AI concerns while continuing to facilitate innovation.[42]

4. Recommendations: Gen AI Adoption by the Government

GenAI has several applications in the government administration and governance. But as is with new technologies, governments would need to build sufficient capacity and competency to harness the potential of these technologies meaningfully and without risk. India too will need to systematically build its capacity and competency across infrastructural pre-requisites, data management practices and skill development of its public sector workforce in order to embrace the capacities of GenAI productively.

[41] https://securiti.ai/blog/chinas-interim-measures-on-generative-ai-the-basics-to-know/
[42] https://aiverifyfoundation.sg/downloads/Proposed_MGF_Gen_AI_2024.pdf

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1) **Capacity Building:** The government needs to initiate the capacity building of all its officials on the emerging technology of AI and specifically on GenAI so that they can familiarize themselves with the technology and its uses. The capacity building must be an intensive time bound exercise and should cover the following aspects:
   a) **Technology Familiarisation:** The officials should be trained on the GenAI technology which should cover all basic concepts along with its possible applications and implications. The training should be supported by refresher information in form of short periodic capsules which can augment the basic understanding and update on the new changes or developments.
   b) **Technology Adoption:** Government decision-makers should engage employees at all levels to identify key pain points and challenges that could be addressed with GenAI. From there, they can launch pilots to prove the value of the technology, build the organizational muscle for change, and better understand their technology baseline. As these shall be new charters support and handholding through experts and mentors should be provided which the government can arrange through a Public Private Partnership.
   c) **Security Sensitisation:** The officials should also be sensitised on the purpose for which GenAI can be adopted in their respective departments. There should be a clear list of activities which should be laid out and declared as prohibitive in nature while using any third party GenAI, for example, avoid referring or using confidential documents/information, any other non-public information, using official email ids to access these models, etc. They should also be sensitised to always validate any content generated by GenAI, especially when it has potential public impact.

2) **Building a GenAI ready workforce through public private partnership:**
   The emerging technology and its applications would mean that old roles may phase out and several new roles will get created. A report by the Economic Times identifies Data labeller, Data annotator, AI modeller, AI auditor, and Promt engineer as the new roles that the booming AI industry would create, and these roles are likely to be applicable for the government also.[43]

   Traditionally, governments haven't had AI engineers, AI ethics officers, or prompt engineers, but such roles must now be created and filled. A robust AI workforce for the government is thus dependent on private-public partnerships (PPP). It is recommended that the Ministries/Departments can create a dedicated AI Workforce to strengthen its workforce by collaborations with the private sector who have made significant advancements in the direction. This is because the risks and exposures created by AI and GenAI systems are such that a nodal office must consider questions of principle and provide guiding directives to other implementing ministries. There is a need for a senior executive to lead the team, preferably from the private sector, who has prior experience in driving AI and GenAI initiatives at scale to coordinate all gen AI-related activities and ensure that risks are addressed effectively at the federal level.[44]

[43] https://drive.google.com/file/d/1GbJTb4GJHBkyH6GFcZe1W6OaL14imdXp/view
[44] https://witp.wfglobal.org/wp-content/uploads/2023/05/CTO-for-India.pdf

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Box 5

The PPP model witnessed success in the United States towards strengthening its cyber-security.[45] The United States Digital Service hires top technologists into term-limited 'tours of civic service.' By working alongside civil servants, they help build better tools for the people.[46] Similarly the United States Digital Response places experienced, pro-bono technologists to work with government and organizations responding to moments of crisis, to quickly deliver critical services and infrastructure that support the needs of the public.[47]

3) Employ Optimum Third-Party Foundational Models:

As there is no sovereign foundational model available in India, the government officials shall involuntarily use third party foundational models. It is recommended –

a) The government should use open-source foundational models as these models shall not invite any cost and are more transparent as compared to proprietary models. The Ministries should carry out cost-benefit analysis of the model in the long run before deciding on its usage.

b) Ministries should also do an internal analysis of the use of GenAI model by its officials on a specific time interval as this shall help them to do estimation of the costs involved in using the foundational model. These estimations should be revisited and revised on a periodic interval.

c) Ministries can consider making use of shared foundational model which can be downloaded and installed on an infrastructure whose cost can be shared among the Ministries while using it.

d) In order to build-in more security, the Ministries can also consider exploring installing privateGPTs which is a middle layer between the foundational model and the user and helps to ensure privacy of data.

Box 6

PrivateGPT is a production-ready AI project that allows you to ask questions about your documents using the power of Large Language Models (LLMs), even in scenarios without an Internet connection. 100% private, no data leaves your execution environment at any point.[48]

4) Building Datasets for Foundational Models:

India can leverage its vast sources of data including data from GST, highways, banking, education etc. as an asset to train GenAI applications and sovereign foundational models. Towards this, the National Data Management Office which is endowed with the role of supervising the administration and control of non-personal and anonymized data will play

[45] https://www.axios.com/sponsored/content-item/microsoft-how-public-private-partnerships-can-strengthen-u-s-cybersecurity
[46] https://www.usds.gov/mission
[47] https://www.usdigitalresponse.org
[48] https://github.com/imartinez/privateGPT

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a crucial role towards building a robust India Datasets Program[49] that will play a pivotal role in developing indigenous foundational models.

5) Infrastructural Responses to Embrace GenAI in Government in India

a) Building Sovereign Foundational Models

India should focus on development of sovereign foundational models which refers to the idea of an autonomous and self-contained artificial intelligence (AI) ecosystem. It should establish a division under its National Program for AI which shall specifically focus on development of the indigenous foundational model. It can also consider engaging private sector experts who have worked on these models. As these models are resource intensive, it should draw a roadmap for development of such model and ensure that the resources are made available as per the requirement

b) Building Compute Capacity

India needs to secure GPU chips and cloud compute capacity and is known to be in talks with GPU chip manufacturer NVIDIA to deliver one large batch by July 2024.[50] In September 2023, NVIDIA signed AI partnerships with Indian conglomerates such as Reliance Industries and Tata Group to develop cloud infrastructure and language models, as well as generative AI applications.[51] In this context, India should work towards developing at least one large data and compute centre as part of an AI research organisation, endowed with cutting-edge computational facilities providing the capacity required to train the next generation of foundation models.

c) Building Database of Use Cases

India must create a publicly accessible database of use cases of GenAI in the Government, on the lines of similar initiatives in the United States[52] and United Kingdom.[53] While this will help to foster the public trust in government, it will also help the Government to create standard protocols in the future in matters of using GenAI. Use case repositories from public consultations and private sector hackathons to explore potential use cases for GenAI will also be immensely helpful to take decisions on what types of problem are best solved by GenAI and the available talent in the country towards leveraging this potential.

5. Way Forward: Towards Trustworthy GenAI Applications by the Government

[49] https://techcrunch.com/2023/09/28/india-national-data-management-office/
[50] https://wccftech.com/nvidia-secures-a-huge-ai-gpu-order-from-india-worth-over-half-a-billion-dollars/
[51] https://www.reuters.com/technology/india-data-centre-firm-yottas-nvidia-ai-chip-orders-reach-1-bln-ceo-2024-01-11/
[52] https://ai.gov/ai-use-cases/#:~:text=The%20federal%20government%20is%20leveraging,the%20environment%2C%20and%20benefits%20delivery.
[53] https://insidegovuk.blog.gov.uk/2024/01/18/the-findings-of-our-first-generative-ai-experiment-gov-uk-chat/

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India has suggested principles for Responsible AI.[54] Taking a cue from countries that have set out a framework/ guiding principles, it is recommended that the Government must formulate Principles of Responsible and Ethical Generative AI Adoption. This should be followed up with guardrails that support the implementation/adoption of these Principles. Based on international best practices, Principles and the associated guardrails for Responsible and Ethical Generative AI Adoption for Government Application are detailed below:

1. **Principle of Inclusivity and Sustainability**

   Generative AI needs to be free from bias and discrimination. It should also ensure equitable access and equitable user experience.

   Guardrails are required to ensure accessibility of Generative AI solutions, equity and non-discrimination of GenAI outcomes for marginalized groups. Guardrails also need to be in place to offset the negative impacts of Generative AI on the environment.

2. **Principle of Transparency and Explainability**

   Training data for Generative AI should be ethically sourced and not infringe on copyright. The rationale behind Generative AI's decision-making as well motivations/ determinants of decisions towards the adoption of GenAI is necessary.

   Guardrails under this principle should consider how to address end-user actions that go against transparency by providing channels of accountability.

3. **Principle of Accountability**

   Generative AI should be subject to multiple checks and audits (internal and external) for quality control, use case justification and accuracy before, during and after deployment. An incident reporting mechanism should be built in all Generative AI systems. Users should also be able to report incidents through an easy grievance redressal process. Generative AI should also contain built-in safeguards to prevent and minimize harm to users.

   Guardrails under this principle should provide for responsible and impartial audits of GenAI outcomes.

4. **Principle of Privacy and User Safety**

   Generative AI should operate predominantly on disaggregated information and respect individual privacy. It's use for surveillance and user safety should be balanced against other user considerations such as privacy and informed consent.

   Guardrails under this principle must ensure human-in-the-loop at the appropriate stage of GenAI deployment.

[54] https://www.niti.gov.in/sites/default/files/2021-02/Responsible-AI-22022021.pdf

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5. Principle of human-centric approach

Generative AI should be designed to align with human-centric values and safety mechanisms should be designed in Generative AI applications to allow human intervention and oversight in exigencies. In the interest of end-users, discouraging overreliance on Generative AI should also be considered.

Guardrails under this principle must ensure measures for optimal use of GenAI, and minimise human and environmental harm ensuing from the adoption of GenAI.

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Annexure -1: Compilation of Global Genai Use Cases in Government

Country	Type of AI Used	Sector/ Area	Description
United States	Chatbots	Civil Services	Chatbots are being used in the public sector to improve customer service, efficiency, and transparency. Chatbots can answer citizens' questions, process paperwork, and even detect fraud.
Singapore	LLMs	Civil Services	Pair, created by GovTech's Open Government Products team in Singapore, is a productivity software designed for public services, assisting in writing and brainstorming with robust security features. Currently under trial by 4,000 civil servants, Pair aims to streamline writing and research tasks, such as producing drafts, summarizing extensive data, or crafting emails and speeches. It can swiftly draft policy reports and redact sensitive details. By incorporating AI language models like ChatGPT, Pair seeks to enhance efficiency, enabling civil servants to focus on complex tasks. Developed in collaboration with Singapore's SNDGO and other departments, there's a plan to expand its pilot to potentially 150,000 officers.
Singapore	LLMs	Education	In Singapore's progressive educational landscape, institutions are embracing the potential of AI tools like ChatGPT in classrooms. Recognizing the transformative power of technology, many universities, including Nanyang Technological University (NTU) and Singapore Management University (SMU), are integrating ChatGPT to enhance learning experiences. The primary motivation behind this adoption is to harness the capabilities of AI in facilitating personalized learning, answering student queries in real-time, and providing instant feedback. The benefits are manifold: students receive tailored assistance, educators can address a broader range of queries efficiently, and the overall learning process becomes more interactive and engaging. It also

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Country	Type of AI Used	Sector/ Area	Description
			makes students future ready by incorporating AI tools into the curriculum.
United States	Chatbots	Civil Services	IRS has launched voice and chat bots to help taxpayers with simple tax questions. These bots can answer questions about payments, collection notices, and other tax-related topics. This is expected to reduce wait times for taxpayers who call the IRS and free up human customer service representatives to focus on more complex issues.
Japan	Chatbots	Travel and Tourism	Bebot, an AI chatbot by Bespoke Inc., offers multilingual guidance to tourists at locations like hotels, airports, train stations, and cities. Initially launched at Tokyo's main train hub, Tokyo Station, it expanded to Narita International Airport and various hotels. In train stations, Bebot is accessible via QR codes on posters, guiding users about the station and surrounding attractions. Its AI, a blend of human chat and Bespoke's AI, allows travelers to seek specific advice, directions, and reviews directly in the chat. For businesses, Bebot reduces operational costs, influences traveler traffic to desired areas, and gathers passenger feedback to enhance services and facilities.
Japan	Chatbots	Travel and Tourism	Bebot is an AI chatbot deployed in several Japanese airports, including Haneda and Narita International Airport. This multilingual guidance service offers travelers information about airport facilities and flights. Its natural language processing engine, derived from chat histories of over 30 million users, enables precise responses to questions. Designed for foreign travelers, the elderly, and the visually impaired, Bebot can vocalize answers, display user-friendly text, and provide multilingual

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Country	Type of AI Used	Sector/ Area	Description
			information. Its applications extend to online city halls, crisis management, tourist guidance, and gathering resident feedback. Continuous refinements are made to Bebot based on extensive chat data, ensuring accuracy even with informal or lengthy queries.
United States	Chatbots	Travel and Tourism	In 2020, Amtrak, the premier train passenger transportation provider in the U.S., witnessed a significant drop in its passenger count, attributed largely to the global pandemic. To combat this downturn and the challenges of having a limited workforce to manage extensive customer inquiries, Amtrak turned to technology. They introduced an AI-backed chatbot named "Ask Julie," building upon their initial 2012 chatbot experiment. This advanced AI platform efficiently handled millions of questions each year, from booking assistance to travel advice. The result was a remarkable 50% annual growth in the chatbot's usage. By 2023, "Ask Julie" had not only revolutionized Amtrak's customer service approach but also yielded an impressive 800% return on investment. This innovation led to substantial annual savings of around $1 million in customer service expenses and played a pivotal role in rejuvenating Amtrak's bookings amidst challenging times.

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