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A Catalogue of Artificial Intelligence Tools for Use by South African Policymakers

Briefing Note

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Introduction

In recent years, there has been an explosion of digital tools being used by governments across the world (see Figure 1 below). When considering which tools could be useful in the South African context, it can be difficult to know where to begin and what the opportunities are. Artificial intelligence (AI) can potentially deepen the digital divide by enabling communities that already have a developed digital infrastructure to benefit while those without digital infrastructure fall further behind. In this case, South Africa has the infrastructure to develop and deploy sophisticated tools that benefit the whole of society in government. The motivation for this work is to help identify which tools South Africa should pursue, and how we should pursue them, so that all South Africans benefit.

The Policy Innovation Lab decided to investigate which of those tools could be most useful by reviewing Public Sector Tech Watch's (PSTW) catalogue of where AI tools have been used and are being used by EU governments. PSTW is an institution of the European Commission tasked with monitoring the use of digital technologies in the European public sector.

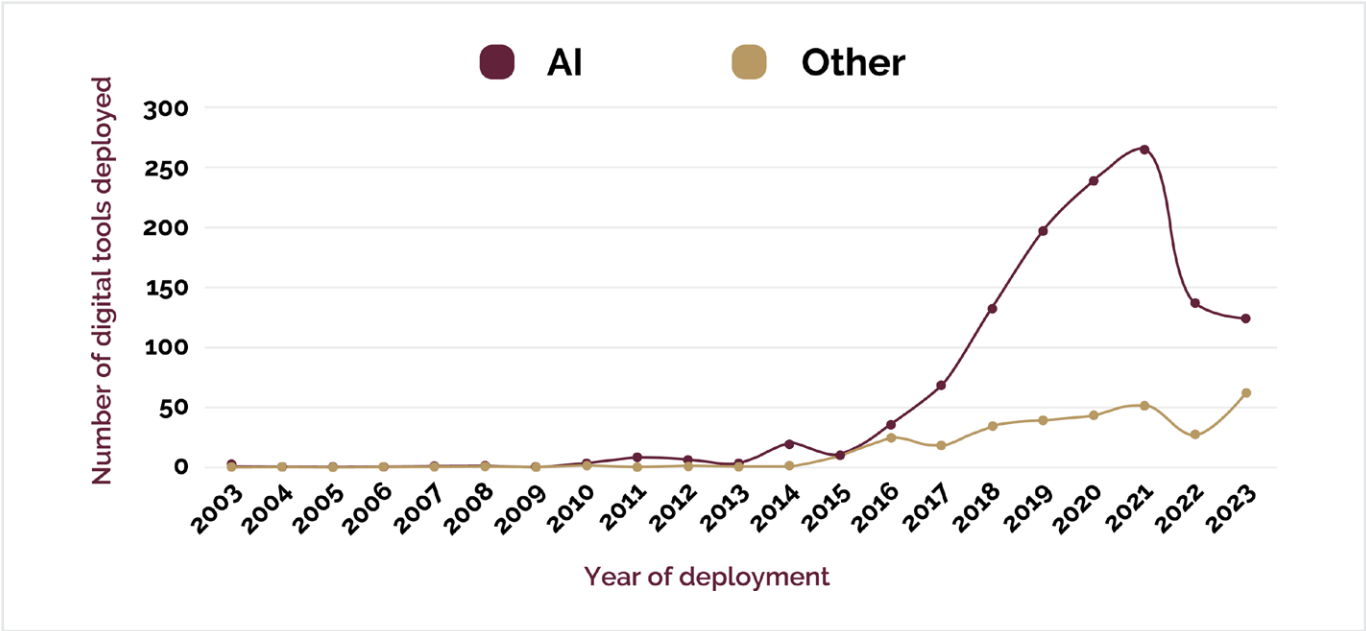

Figure 1: Plot of the number of AI and other digital tools deployed in the EU since 2003, according to PSTW's catalogue, May 2024

The outputs of that investigation are twofold: First, we curated the PSTW catalogue to be applicable in the South African context. A searchable version of our curated catalogue is available on the Policy Innovation Lab website.[1] The catalogue has columns for filtering to find examples by using either technical filters (type of AI) or functional filters (what it is used for) which will make it easier to find many examples for interested users. It has also been sorted by intent so that similar applications should be found together. This catalogue will be updated in the future to include new applications from the latest PSTW catalogue (which will be updated biannually) and to include applications we have come across in our own work that are not necessarily from EU countries.

Our second output is the discussion of the opportunities we found in the process of going through the thousands of AI tools used in the EU with the South African context in mind. We attempt to be as practical as possible, prioritising those opportunities that appear to us to give the best societal return on investment. The target audience is South African policymakers and other parties interested in using AI for the benefit of South African society.

We begin by describing the methodology used in the curation process. We then discuss different opportunities, which are grouped by the different functions of the AI tools from a governance perspective. There were several applications of AI used in European governments that we did not consider good candidates to be used by the South African government but seemed suitable to be used by the South African private sector and which would require government support in the form of regulation or use, and we discuss a few of these. We include a table of notable examples from the catalogue for each section of the discussion. Finally, we mention some of the limitations of this work.

Methodology

In this section we describe the PSTW catalogue and the method used for curating it for the South African context. We also mention the limitations of our approach.

The PSTW catalogue

The dataset that we curated is the version of the *Public Sector Tech Watch latest dataset of selected cases* by the European Commission's Joint Research Centre (JRC), last modified on 2024-05-30.[2] This is a catalogue of 1 620 examples of emerging digital technologies, including AI and blockchain, deployed in EU governments that is published under a Creative Commons Attribution 4.0 International Licence. We chose this data source for the following reasons:

1. It is an extensive catalogue with a substantial amount of data describing the context, development, technological components, and use of the tools, including links to the tools' websites.
2. The EU includes a diverse group of countries in various stages of development, so although we may have additional work to do in considering the South African context, many of the tools will be applicable.
3. The EU is far ahead of the rest of the world in terms of regulating the use of AI. We therefore assume that tools in this catalogue could be deployed in South Africa and meet its regulatory requirements for AI as they develop.
4. The publishing licence allows us to share the original material, whole or in part, whether adapted or not, indefinitely given that we do not break any terms of the licence.

Curating the PSTW catalogue

We began by cleaning the dataset in minor ways. The Python code and a more detailed description can be found in a git repository.[3] We then filtered the dataset first with an objective filter, which automatically removed examples that were not relevant, and then with a subjective filter, where we went through the examples and chose to remove some of them that we deemed irrelevant. We describe each of these filtering processes in more detail.

Objective filter

To curate the original PSTW dataset we began by filtering it by removing feature values as described in Table 1, which took the catalogue from 1 620 to 967 examples.

Table 1: Filters applied to the PSTW catalogue

FEATURE TO FILTER	EXCLUDE	INCLUDE
Responsible Organisation category	Community-led, Consortium, European Institute/Agency, Non-governmental, Private sector	Academic-research, Central-Government, Local Government, Regional Government, Central-government
Status	Not in use anymore	Implemented, In development, Pilot, Planned
Cross Border	Yes	No
Technology	Blockchain, Quantum Computing, AR/VR, Virtual Worlds	Artificial Intelligence
Date-updated	*Excludes everything after May 2024 by default.	*Includes everything up to and including May 2024

Subjective filter

We further filtered the catalogue by going through each example and removing those that we considered to be either clearly irrelevant to or clearly impractical in the South African context. We judged an application irrelevant if:

1. The tool is already used for the same purpose in South Africa. This was checked using internet searches.
2. State-owned enterprises might procure the tool with no changes needed for the South African context; for example, AI tools for detecting cancer.
3. The tool would be prohibitively expensive to develop or maintain compared to its social benefit, according to our hard knowledge of AI and soft knowledge of South Africa.
4. The data required for development or use is unavailable and not easily obtainable. For this, we referred to several data catalogues.

From this subjective filtering we went from 967 to 727 examples.

Limitations

There are several limitations in the results of this work when using it to find opportunities for the application of AI in the South African public sector. These include the following:

1. The original dataset is limited in the sense that it does not contain all modern technological tools deployed or planned for government use in the EU but only those collected by Public Sector Tech Watch.
2. A serious limitation of this document is that we do not know the performance of the tools deployed since there are very few quantitative empirical studies on the effectiveness of these AI tools in government. This is mainly because these tools were deployed too recently to fairly judge their effectiveness or because it is difficult to quantify their effectiveness. Thus, our recommendations and some of the steps taken in curating the data boil down to informed opinion, and are, ironically, not necessarily data-driven decisions.
3. Our knowledge of what data already exists is limited. This is in part because there is no centralised repository where we can find all governments' national and departmental databases.
4. There were two primary contributors to this project, and due to time constraints, they did not cross-validate each other's work, leading to inconsistencies in determining what is important.

Categories of AI tools for use by South African policymakers

Overview

While reviewing the Public Sector Tech Watch catalogue, we came across many examples of AI being used in EU governments that are applicable in a South African context. Here we discuss these opportunities with the following approach:

1. We organise the opportunities by the function they would serve in the South African government.
2. Where relevant, we refer to examples from the catalogue by their unique identifiers, called PSTW-IDs, and include a list of reference examples for each section in a table. Descriptions of the tools associated with each PSTW-ID and links to their websites can be found in our online catalogue. Thus, while this document can stand alone in providing an overview of the AI-in-government landscape, it may be more beneficial when used in conjunction with our catalogue for a closer view of what tools are being used and how they are being used.
3. In certain cases, we mention the challenges associated with deploying tools that were successful in Europe in the South African context, such as data access or regulatory constraints.
4. Where possible, we mention whether the relevant data exists or whether it is easily obtainable. A list of relevant data sources is contained in the methodology 'readme'.

Government-to-citizen chatbots

Description

We begin by considering chatbots and virtual assistants that governments use for cheap, reliable and effective communication with their citizens. Typically, these are chat interfaces where an AI is an 'expert' on a particular topic and provides citizens with answers to their questions in a dialogue format that takes the context of the conversation into account. More than 10% of the examples in our curated catalogue fall into this category. For example, a chatbot, which provided information regarding both the election procedures and political information (PSTW-983), was used during the 2021 federal election in Germany. From the technical side, these chatbots are usually a combination of Large Language Models (LLMs), that enable them to take human language (written or otherwise) as input and produce written text as output, and Retrieval Augmented Generation (RAG), which provides the chatbot with data sources related to the service it provides that is used to produce its output. Sometimes AI is used to catalogue information to make it easier to find (PSTW-585). RAG-based chatbots are commonplace and relatively easy to implement using recent software. Additionally, the data used in these applications typically exists in government documents, manuals and reports. Thus, the economic investment to launch one of these chatbots is small, with a small operational cost.

Prospects for South Africa

- South Africa ranks 84th on the ease of doing business rankings. One of the challenges to small businesses, especially in townships, is a lack of access to information and mentorship about the administrative aspects of setting up and running a small business. Here systems can provide answers and connect prospective entrepreneurs to sources of information, administrative documents and labour laws that can help expedite and simplify the process of starting a small business. This type of administrative data already exists, for example, the DSBD-ILO SMME database, but may be difficult to access, especially from a cell phone. In France, the chatbot NOA was given information regarding the administration of small businesses. Thus, NOA *"is able to answer questions related to the creation of a business on various aspects such as recruitment, taxation, industrial property, import/export, social obligations"* (PSTW-602).
- These tools are especially useful for education, both for students and for adults. This is because students are more vulnerable to misinformation accidentally spread by bots or by teachers while RAGs can retrieve the source information, mitigating that risk. Consider a specific example: South Africa has a rich and diverse history. However, this diversity often results in contradictory versions of the same stories. This is particularly true in South Africa, where different citizens may have been educated under history curriculums that contradict one another. This contributes to social and political tensions, an online community that is susceptible to disinformation, and often violence, discrimination and hate speech. Making our high-school history syllabus, as well as additional South African history, available online and interactable via an AI chatbot that can refer to primary and secondary sources, may prove useful in helping students, assisting teachers, and informing other non-students. This type of RAG can easily be integrated with museums to provide an immersive museum experience where the broader history can be interrogated. For example, in France, the chatbot Hello Charly provides more than 110 000 training courses for 14-24-year-olds and has been used by more than 220 000 people since 2016 (PSTW-1057), while museums have integrated their historical documents into chatbots (PSTW-57).
- Many chatbots in the catalogue are geared towards tourists (for example, PSTW-38 and PSTW-1582). They can guide tourists while providing them with information about the sites they are seeing. By recommending specific routes, security for tourists can be increased. Furthermore, these types of applications can be used to market events, restaurants and products, increasing the economic benefits of tourism in the local communities. These types of AI products would best be developed at a local level in tourist hotspots where they can be continuously updated with relevant information.
- Gender-based violence (GBV) is a frequently discussed issue in South Africa and is known to be underreported due to societal stigmas and feelings of hopelessness. Many schools have counsellors, nurses, or teachers to whom victims of GBV could turn. However, these staff members are usually not trained to handle those types of delicate situations. AI systems trained on the interviews of professionals dealing with cases of GBV could be beneficial for providing guidance when professional guidance is not directly available (PSTW-1290).

Citizen-to-government chatbots

Description

These types of applications are used to generate and collect citizen-generated data. They typically involve using an LLM or a menu of choices to engage with citizens on specific topics, either as a survey or as a feedback mechanism. For example, in Finland, Crowdsorsa turned collecting information regarding Helsinki's physical assets into a game (PSTW-1482). This can also be done using social media and without requiring direct input from citizens. For example, the governments of Ireland and Belgium use AI to analyse Twitter and produce monthly reports and data visualisations on public opinions (PSTW-55, PSTW-1811). This citizen-generated data can then be analysed by LLMs to provide actionable insight into the citizen feedback. A notable benefit of these types of applications is that they generate their own data for analysis, which itself is a valuable commodity.

Prospects for South Africa

- More than 400 000 South Africans are U-Reporters – a UNICEF application that allows users to either find information or fill out surveys and polls about specific topics by navigating with a menu via WhatsApp and Facebook. This suggests that many South Africans are willing to engage with this type of software. However, this software can be improved by utilising the recent developments with LLMs, which will allow users to engage with the bot in dialogue, instead of menu options. Policy Innovation Lab is currently working on a tool to collect citizen-generated data regarding service delivery and provide analysis of this data to government and the public. This will provide national and provincial governments and citizens with a way to monitor service delivery in local municipalities over time based on real-time citizen reports. It therefore increases accountability both within government and to the public. By making the collected data open it may also be useful to other organisations such as businesses who can identify what the needs are in various locations. Through engagement with citizen text messages, photos and videos, service workers may be able to identify the problems and solutions without having to go the location just to inspect the site.
- Apart from surveys and feedback, citizens may be more active. In Iceland, citizens can engage in "*agenda setting, participatory budgeting, and policymaking [sic]*" (PSTW-1912). While that level of engagement becomes more difficult in larger countries, the Policy Innovation Lab has begun working on a citizen engagement tool for policies and bills that are open for comments, making citizen and business feedback more informed, effective, accessible and useful, with the goal of assisting policymakers.

Personalisation and recommender systems

Description

Personalisation is one of the most well-known and developed fields of AI, particularly when it comes to recommending products or services. Examples of these recommendation systems used in governments include recommending jobs to jobseekers, recommending tourist attractions to tourists, recommending treatment to healthcare providers and entertainment recommendations on platforms such as YouTube, Instagram and Netflix. For example, in Belgium, a recommender is used to help determine who is eligible for education allowances depending on their socioeconomic circumstances (PSTW-420). These may be combined with chatbots to provide a way to communicate preferences and recommendations. From a practical perspective, our view is that many of these systems, especially regarding health care, will be developed overseas or in private industry, and the best products may then be purchased later if the need arises. However, there are applications where it may make sense to develop these tools in-country.

Prospects for South Africa

- Given the large unemployed population of South Africa, job-matching software is particularly useful. This software can match a prospective jobseeker to a position they can fill and recommend further training to fill any potential gaps (for example, PSTW-590). Well-known private platforms such as LinkedIn, Indeed or Areeba Jobs use AI in this way. However, these privately owned platforms may perform poorly when trying to match a job to an unskilled worker with no qualifications for it to base its recommendations on. However, a tool that is tailor-made to the South African context would be able to perform better at, for example, matching unskilled workers to several types of local manual labour positions. This type of recommender system can be integrated with LLMs and existing software such as the Employment Services of South Africa (ESSA) website.[4] This website has a drop-down of hundreds of job titles, whereas an LLM would be able to make recommendations on jobs that match closely, if not exactly, to a typed input. The ESSA should have data that could be used for this type of training.
- Tourism is an important industry in South Africa. A nationwide tourism recommender AI that can recommend places to go, events to attend, and products to buy may make the tourist experience in South Africa better and more diverse, as has been done in Bulgaria (PSTW-15). This may encourage tourists to consider lesser-known tourist destinations, which existing tourist websites or packages

would be unlikely to recommend. This would not only provide a more complete tourist experience but also bring tourist business into new sectors of the South African economy, such as townships. However, this type of system has downsides, namely acquiring excellent quality input data and competing with existing platforms and marketing.

Adjudication tools

Description

Several AI systems are used in governments for the purpose of adjudication; that is, judging the validity of something. These typically involve judging applications of several types. Examples in the catalogue include AI used to judge applications for pension grants, social grants, disability grants, unemployment benefits, research grants, university applications and asylum applications.

Prospects for South Africa

- In Norway, an AI application is used to assist in processing applications for a wide variety of grants (PSTW-1988). Through centralisation it is easier to oversee and monitor its performance, given that these types of AIs can be prone to bias depending on the quality of the input data. In South Africa, we would recommend caution in relying solely on AI interpretations of the data due to issues of bias, examples that are outliers of the training set and the lack of human oversight without adequate understanding of the AI tools. However, these systems may greatly speed up certain administrative processes and make them more accurate: for example, by automatically checking whether the applicant is already receiving a grant over the same period, determining whether the documents are correctly completed, checking that bank statements meet the given criteria and making justified recommendations to be considered by a human user.

Monitoring and prediction with physical processes

Description

Here we consider AI systems linked to hardware used to take measurements for analysis, monitoring and regulation. These systems are trained, usually with supervised learning, on labelled data to determine which label best fits future data. Many of the examples from the catalogue are concerned with traffic monitoring and prediction (for example, PSTW-1773). In South Africa, radar and cameras are used to take photos of speeding vehicles and their licence plates are then analysed by AI to identify the owner of the vehicle. Likewise, drivers on cell phones can also be identified. In the Netherlands, ProRail uses monitors to determine when and where preventative maintenance is required on railway tracks, optimise train schedules, and determine where illegal rail crossings are happening (PSTW-83). While these systems are expensive to develop and maintain, requiring hardware, software, training data and human oversight that may be expensive at scale, they also have the greatest direct economic and societal benefits. For example, while South Africa has been successful in increasing access to basic services such as water and electricity, it is well known that it has struggled to maintain this infrastructure effectively over such a large area.

Prospects for South Africa

- In South Africa, water access and quality are a concern for many communities. The government has recently introduced smart meters to improve service delivery and revenue collection.[5] Furthermore, in Portugal and elsewhere, AI systems monitor many different aspects of the water infrastructure, including identifying the location of leaks and monitoring consumption (PSTW-104). Monitoring hardware and AI can be deployed in South Africa to predict when boreholes or water trucks are needed to provide water to communities with little or no water access and when intervention is needed to fix water leaks or improve water quality. This could save millions of litres of water, prevent further maintenance issues by solving problems promptly, and increase the overall health of the South African population.

- Load shedding is a means of controlling electricity consumption and demand on the grid at peak times, something that AI can assist in optimising. In general, the road to renewable energy is paved with AI systems that can balance intermittent energy supply and demand (for example, PSTW-2066). Eskom already works with virtual power plants to help meet its power shortfall[6], and there are plans for this type of software to be extended to include small businesses or private citizens who produce excess electricity.[7]
- Video footage from police dash cameras and body cameras can be used by AI systems to identify the need for road maintenance before potholes or other damages occur (PSTW-1776) and improve driver safety by recognising dangerous situations and alerting the driver.

Monitoring and prediction with digital processes

Description

Like AI systems that are trained to monitor physical systems, AI systems can also be trained using supervised learning to monitor digital data to make predictions and detect anomalies. These systems need to be trained on large datasets with enough known anomalies for the algorithms to learn how to identify anomalies or make predictions. Some of these types of datasets are publicly available; however, in general, it will require investment to produce or procure access to these datasets. For example, health care requires dynamic and complex procurement and prescription systems to provide resources to those in need in a timely manner. In Norway (PSTW-1265) and Portugal (PSTW-99), these types of AI systems were used to identify incorrect procurement payouts and fraudulent prescriptions, respectively, while in Ukraine DoZorro is used to identify corrupt tenders (PSTW-580). In Italy, the AI systems XLAW and KEYCRIME use digital crime records to predict the time and place of potential crimes as well as the characteristics of the perpetrator before the crime even happens, allowing for the effective use of police resources (PSTW-451, PSTW-1059, PSTW-562, PSTW-450). They report remarkable statistics including a roughly 90% crime prediction accuracy across different cities, and a 58% drop in commercial crime and 89% drop in bank robberies in Milan.

There are many other examples of criminal profiling and facial recognition in the catalogue. However, regardless of the remarkable success that they claim, there are serious ethical concerns about these systems; for example, biases existing in justice system data being learnt by the AI leading to a feedback loop. Furthermore, the right of government to profile or monitor its citizens using facial recognition software and data without their consent remains controversial (PSTW-1140, PSTW-1143, PSTW-992). Another ethical concern is whether the inner workings of these models should be made public, given that doing so would give criminals access to that information and thus likely make them less predictable; yet, by not doing so, one cannot publicly justify their decisions.

Prospects for South Africa

- As discussed, we recommend caution for tools that profile citizens or track citizens without their consent due to ethical concerns. However, there are examples that focus on predicting the characteristics of the crime, and not the criminal. This may mitigate some of the ethical concerns. Furthermore, given South Africa's extremely elevated level of crime the potential gains of such systems are massive. Thus, it may be useful to have systems that predict instances of criminality. The data used to train the model would need to be anonymous, checked for systemic bias and aggregated to remove demographic features that could lead to bias, while the output of the model can be monitored for replication of systemic biases with existing tools.
- Fraud and corruption are major challenges in South Africa. If datasets of financial transactions in the public sphere include enough known cases of fraud, then this can be used to train a model that can detect instances of fraudulent transactions in close to real time. For example, SARS uses AI to detect fraud and non-compliance.[8] Furthermore, fraud detection AI software is already used by banks and large corporations in South Africa; for example, DTect by Deloitte.[9] The government already has access to internal data and tenders are already opened to the public, so it appears feasible to build systems to detect suspicious government procurements or resource allocations.

- There are a few dual-purpose models that could be useful to the South African government. Consider the processes of submitting a tender. In many instances, the person in charge of procurement may have no reference for understanding what that service would typically cost. Here a predictive AI can be used to give a good estimate of the cost. Another model could be incorporated into the same process to identify instances of corruption, where the tender is awarded based on a proposal that either does not meet the requirements of the tender or is too expensive based on the predicted cost (PSTW-580). Similarly, in the hiring process, AI systems could determine a reasonable salary for a given set of skills and qualifications and check for instances of jobs being awarded that do not match those criteria.

Administrative automation

Description

Many of the AI systems used in European governments have to do with automating administrative processes, both within government and for its citizens. For example, citizens may fill out personal documents such as passport applications and birth registrations online, and an AI will guide them to the correct document, autocomplete duplicated information or forms and instruct them when additional data such as photos or fingerprints are required (see PSTW-624 and PSTW-1071). Within government, AI systems can be used to file documents in the correct place and forward incoming emails, calls and documents to the relevant department, team, or individual (PSTW-215). In this category we also include AI systems used for translation. For example, in Albania, LLMs are used to translate EU regulations and legislation into Albanian (PSTW-2020). Developing these types of AI systems can take time and require continuous maintenance, since user data is required to determine what decisions are correct or incorrect and it may take time to collect and review such data.

Prospects for South Africa

- South African services should be accessible in all official languages. However, it is unfeasible to have all translations of all documents always accessible in physical form, and even in digital form this is a significant challenge. Regarding education, students who fall behind in English or Afrikaans may find it difficult to perform in other subjects where the learning material is in one of those languages. A solution to this is to develop AI translators that are deployed on all government websites and chatbots that are easily accessible. With a good translator, documents, websites, and videos will only need to be made once and then can be translated into all languages when required. Furthermore, incoming documents may be translated into a single language for consistency, making analysis and comparison easier. Making the associated translation model open and free to use (see, for example, Vulavula by Lelapa AI) provides many business opportunities for those who currently feel restricted to a local market due to language barriers to expand to a national market. This can be useful for translation and simplifying complex jargon (see, for example, PSTW-1302).
- As South Africa centralises its databases, it will be difficult and time-consuming for workers who are used to one filing system to change to a new one. Here AI can be helpful in automatically making suggestions for where certain documents are meant to be filed by analysing the first page of those documents. Furthermore, those same AIs can then be used to find documents when users are uncertain where to find them or their file names. This could be done with a combination of LLMs and supervised deep learning. Furthermore, AI systems can be helpful in determining who has access to restricted documents (PSTW-1885).
- Citizens and businesses should typically not have to fill in and re-fill the same data repeatedly on different forms. Digital tools and AI can be used to auto-fill documents from a centralised database based on a citizen's ID number or business registration number and ensure that forms are not duplicated. This could increase efficiency across all departments and ensure greater accuracy. Furthermore, using digital tools may increase access to individuals who would otherwise have to rely on the physical forms in their home language and pens being available to them either in a government building, or to print from a website. While the benefit of this type of tool may seem minimal, there are also few potential downsides, particularly since there would be none of job losses sometimes associated with automation.

Summary

In this document we described how we created a catalogue of AI tools currently used in the EU that could find application in the South African public sector. A searchable online version of that catalogue is available on the Policy Innovation Lab website and can be downloaded. We then discussed themes and opportunities we found after reviewing all the examples with careful consideration of the South African context. This work is intended to be useful for policymakers and entrepreneurs seeking to understand what the opportunities are in South Africa.

To help link our discussion in this document to the catalogue, in Table 2 we include lists of PSTW-IDs, which reference examples from the catalogue that demonstrate the types of tools being discussed. These examples are not intended to be exhaustive but rather to be demonstrative.

Table 2: Notable examples from the catalogue associated with each section

DISCUSSION SECTION	PSTW-IDS OF NOTABLE EXAMPLES IN THE CATALOGUE
Government-to-citizen chatbots	57, 85, 107, 138, 145, 228, 506, 585, 601, 602, 637, 658, 679, 886, 1055, 1057, 1290, 1700, 1705
Citizen-to-government chatbots	55, 79, 185, 416, 603, 1451, 2152, 2153
Personalisation and recommender systems	12, 13, 15, 46, 87, 95, 274, 420, 590, 1373, 1588, 1612
Adjudication tools	462, 939, 1054, 1154, 1988
Monitoring and prediction with physical processes	18, 83, 282, 1275, 1305, 1676, 1776, 1989, 2066
Monitoring and prediction with digital processes	53, 99, 174, 448, 451, 489, 562, 580, 992, 1059, 1131, 1137, 1146, 1265, 1497
Administrative automation	1185, 1339, 1743, 1744, 1838, 1885, 2020

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