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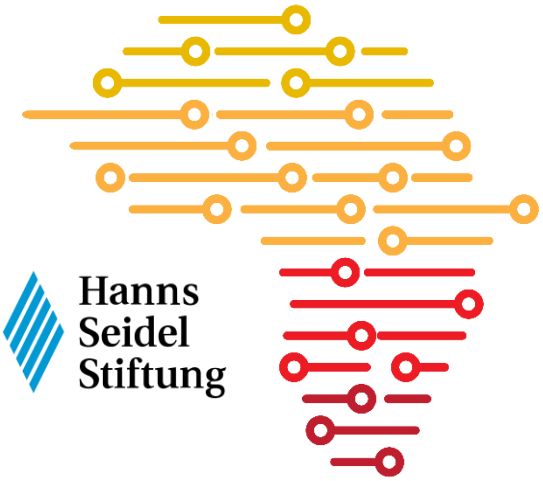
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AI–Citizens' relationship: Analysing Egypt and Mauritius national AI strategies

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Abstract

Recently, in the African context, there has been a great appetite for digitising services, more specifically infrastructure services, and using artificial intelligence (AI). To facilitate the development of AI, governments publish national AI strategies (NAS). In this context, governments across Africa started to issue national AI strategies to keep up with the advancements in AI (see Bareis and Katzenbach, 2022). So far, few African countries have published national AI strategies (Digiwatch, 2020; TRT Afrika, 2023). Mauritius and Egypt are the only African countries with a publicly available national strategy outlining vision and objectives (Onyango, 2022). There is an increased use of artificial intelligence (AI) in infrastructures that support the many functions performed by society. For example, public transportation, (renewable) energy, education and workplaces have all included AI and smart technology in their infrastructure. Building on the need to ensure access to AI infrastructure as it continues to disrupt African cities, this paper uses the understandings from the analytical framework of infrastructure citizenship to analyse Egypt and Mauritius NASs in order to explore the following: How is the relationship between citizens and infrastructure (AI applications) portrayed in each strategy? and How are AI applications framed in both strategies to improve or hinder the relationship between citizens and infrastructure?

Introduction, rationale and method

Recently, in the African context, there has been a great appetite for digitising services, more specifically infrastructure services, and using Artificial intelligence (AI). AI is defined as 'the extension of human intelligence through the use of computers' (Kok, 2009). 'AI is the science of instilling intelligence in machines so that they are capable of doing tasks that traditionally required the human mind' (Ghosh et al., 2018). Thus, the use and deployment of AI in public sectors has grown into a national vision and project that requires citizens and governments to collaborate. To facilitate the development of AI, governments publish national AI strategies (NAS) (see Bareis and Katzenbach, 2022; Papadopoulos and Charalabidis, 2020). The objective of an NAS is to share the ways in which AI is planned to be implemented and in which sectors. Therefore, NASs are guidelines that governments use to accommodate their policies in order to achieve the greatest benefits of AI while decreasing its potential risks (Papadopoulos and Charalabidis, 2020). As such, national-level topics are the focal point of NASs, which policymakers and scientists develop to legitimise the use of AI in public sectors (Paltieli, 2022). In 2021, the Organization for Economic Cooperation and Development (OECD) AI policy observatory (OECD.AI, 2021) estimated that more than 200 national strategies and plans on AI around the world have been issued thus far. In this context, there has never been a time in global history when so many nations have released policy documents almost simultaneously on a single technology (Papadopoulos and Charalabidis, 2020). It was in March 2017 that Canada first published its NAS promoting the usage and advancement of AI (Canadian Institute for Advanced Research, 2017).

In this context, governments across Africa started to issue national AI strategies to keep up with the advancements in AI (see Bareis and Katzenbach, 2022). So far, few African countries have published national AI strategies (Digiwatch, 2020; Galindo et al., 2021). Mauritius and Egypt are the only African countries with a publicly available national strategy outlining vision and objectives (Onyango, 2022) (also Table 1 below). Several more countries, including South Africa, Ghana, Kenya, Rwanda, Tunisia and Morocco, are in the process of developing and consulting on AI policy (Digiwatch, 2020). For instance, South Africa set up a Presidential Commission on the Fourth Industrial Revolution as a precursor to an official national AI plan. In Kenya, an AI task force of 11 experts from various stakeholders, government agencies, the

commercial sector and academia is expected to develop a blueprint for how East African countries could use AI (Onyango, 2022). Despite the fact that many African countries do not yet have specific AI strategies, African countries are interested in and working on the process of developing AI strategies (Digiwatch, 2020). In this context, as previously mentioned, the African Union's AI Working Group conducted its first meeting in 2019 (Ministry of Communications and Information Technology, 2019).

Table 1: Currently developed national AI strategies in Africa

Country	Title	Date	Author	Involved actors	Link
Egypt	Egypt's National Artificial Intelligence Strategy	July 2021	The National Council for Artificial Intelligence	The National Council for Artificial Intelligence Ministry of Communications and Information Technology and the Ministry of Higher Education and Scientific Research	https://mcit.gov.eg/Upcont/Documents/Publications_672021000_Egypt-National-AI-Strategy-English.pdf
Mauritius	Mauritius Artificial Intelligence Strategy November 2018	November 2018	Working Group on AI	The working group consisted of senior ministers and advisors, Ministry of Finance and Economic Development Ministry of Finance and Economic Development	https://ncb.govmu.org/ncb/strategicplans/MauritiusAIStrategy2018.pdf

Source: authors

There is increased use of artificial intelligence (AI) in infrastructures that support the many functions performed by society. For example, public transportation, (renewable) energy, education and workplaces have all included AI and smart technology in their infrastructure. This denotes a need to consider access to infrastructure and how infrastructural citizenship

(rights) will be recognised in cities using new technologies. Splintering urbanism could arise, which could have negative externalities such as exclusionary access to infrastructure and fragmentary effects due to privatising infrastructure provision (Graham and Marvin, 2001). The exponential acceleration of the use of AI will have a significant impact on citizens' everyday access to and use of city infrastructure. In this context, it is postulated that the use of AI and advanced technology can either improve and broaden access to infrastructure for citizens or hinder it.

In 2019, the analytical framework of 'infrastructure citizenship' emerged from the work of Charlotte Lemanski (2020b) on contemporary South Africa's subsidised housing projects by the state, in which she examined how political strategies affected citizenship identity and led to adapting houses in order to access infrastructure through off-grid practices (Lemanski, 2019). The concept was proposed to redefine the relationship between citizens and public infrastructure, emphasising how access to and use of infrastructure affect and are affected by citizenship identities and practices in everyday urban life. In the framework of infrastructural citizenship, Lemanski (2022: 936) defines citizenship 'as the state–citizen relationship (rights and responsibilities), but is not restricted to those with a legal claim, and includes all urban dwellers who, by virtue of their presence in the city, have some form of contractual relationship with, and expectations of, the state (e.g., service provision)'. Infrastructural citizenship focuses attention on how 'citizenship acts and practices' are fundamentally based on public infrastructure for both citizens and the state, focusing on the citizen's daily experience (Lemanski, 2022: 936). Hence, for both citizens and the state, infrastructural citizenship provides a comprehensive analytical framework to investigate the way in which relationships between the state and society are perceived and practised (Lemanski 2019, 2020a, 2020b).

Different kinds of vision and data are emphasised by each national AI strategy helping citizens imagine a democratic future with the use of AI and, accordingly, reformulating the relationship between citizens and the government (Paltieli, 2022). This highlights the need for further attention to state–citizen interactions (see Przewor, 1998). This article focuses on citizenship as a state-citizen-infrastructure relationship, with a focus on AI as an infrastructure. A document analysis of national AI strategies and policies offers insightful

information on how various nations deal with the development and deployment of AI, as well as how they are addressing the role of citizens and the social implications of this technology for human society. The process of content analysis includes categorising and quantifying the content of the materials. This technique can be used to determine how frequently specific topics or themes appear in the documents (‘Clootrack’, n.d.). Specifically, using the understanding from the analytical framework of infrastructure citizenship, this paper analyses the national AI strategies of Egypt and Mauritius.

Recent work demonstrates that an ecosystem of AI is emerging across Africa (Arakpogun et al., 2021; Elsahn et al., 2021). It is argued that Africa is contributing to the worldwide AI ecosystem, as Leila Janah, the founder and CEO of Samasource, states, ‘If you use a mobile phone's or laptop’s facial recognition features, drive a car, or shop online, there’s a good chance that a person in East Africa helped train the algorithm that makes your technology work’ (Janah, 2018: para. 2). However, it is crucial to emphasise that, similar to the Industrial Revolution, the AI revolution may leave Africa less developed (Business Wire, 2019). Therefore, an enabling environment needs to be developed in Africa for AI start-ups to thrive and thereby advance the continent's socioeconomic growth (ibid.). Before creating this enabling environment, the African continent's AI investment shortage must be addressed. AI spending is anticipated to reach US$79.2 billion by 2022. This sum is nearly 560 times what has been spent on AI in Africa to date (ibid.). In light of this, previous observations by the MIT Technology Review and others assert that Africa has a bright future in artificial intelligence compared to the rest of the globe (Hao, 2019; Moltzau, 2020). This bright future is supported by a young population; however, funding and a lack of ready infrastructure would be impediments to realising full potential (Kiedme and Kora, 2021).

Building on the need to ensure access to AI infrastructure as it continues to disrupt African cities, this paper uses the understandings from the analytical framework of infrastructure citizenship to analyse Egypt and Mauritius NASs in order to explore the following questions:

- Q1: How is the relationship between citizens and infrastructure (AI applications) portrayed in each strategy?
- Q2: How are AI applications framed in both strategies to improve or hinder the relationship between citizens and infrastructure?

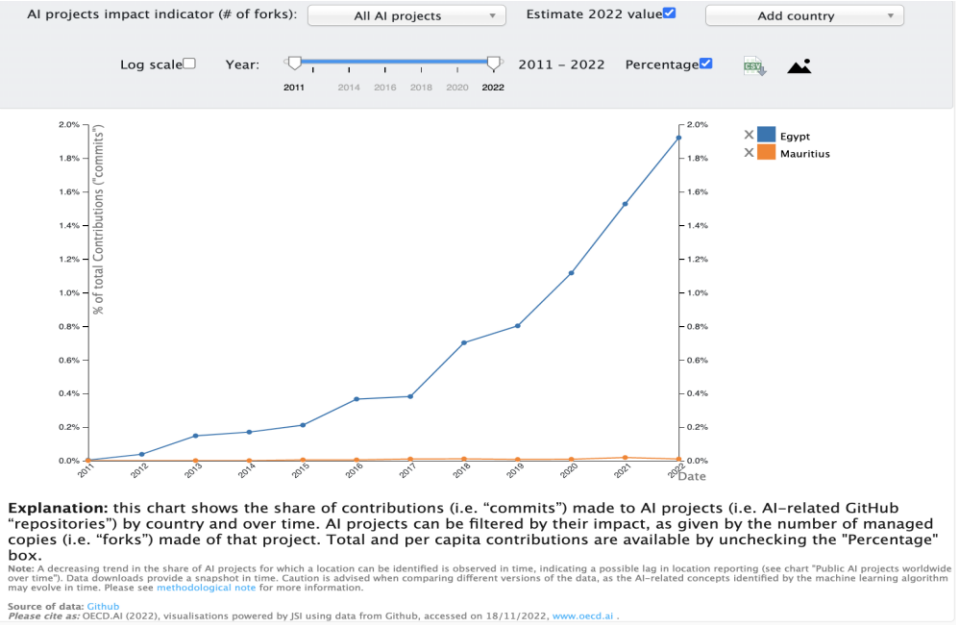
To conduct the content analysis of the NASs, we search for the following keywords: infrastructure, citizen, equality, equity and accessibility (or accessible) to understand in which context they are used and how each strategy approaches them. The article deals with published documents of AI National Strategies as the main unit of analysis, postulating that they have agency – a power to act and influence the public debate and the interrelationships between all those involved: material (that is, technology and infrastructure) and social actors (that is, the state and the citizens). This view is adopted because the published strategies are primarily initiated and created by national governmental agencies and, when published, become a reference document for future practices in their contexts.

The paper proceeds with a brief description of AI advancements in Egypt and Mauritius and the National AI Strategies of Egypt and Mauritius. This is followed by the results of the analysis of the AI–Citizens' relationship as portrayed in the NASs of Egypt and Mauritius. Next, the paper continues by comparing both national strategies through the lens of Infrastructure citizenship. Eventually, the article proposes recommendations for improving national AI strategies.

AI advancements in Egypt and Mauritius

The Organization for Economic Cooperation and Development (OECD) has been publishing reports on AI policy since 2021 (OECD, 2021). A comparison of Egypt to Mauritius in Figure 1 shows the contributions made to AI projects by country and over time. According to the graph, Egypt has made significant progress from 2019 to 2022, rising from 0.8% to nearly 2%, while Mauritius' contribution percentage increased slightly between 2020 and 2022.

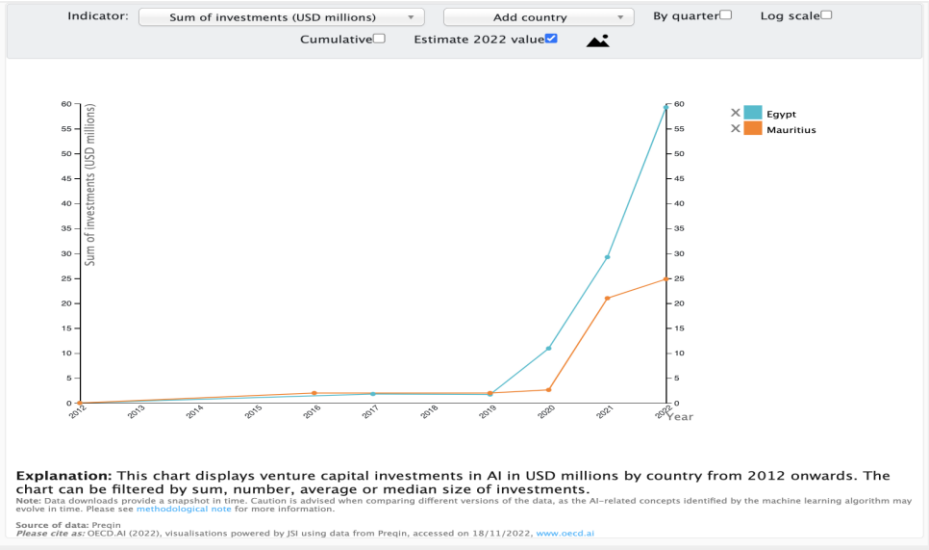
Figure 1: The share of contributions made to AI projects by country and over time



Source: OECD.AI, 2022a

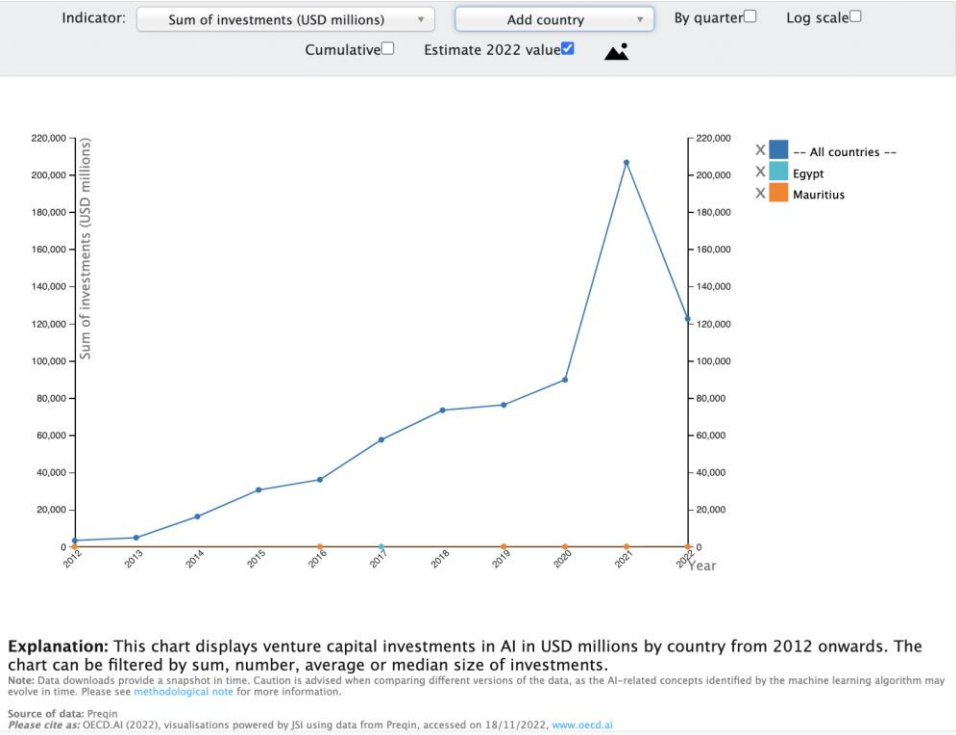
Furthermore, looking at venture capital (VC) investments in AI in Egypt and Mauritius (Figure 2 below) and comparing them to the rest of the globe (Figure 3 below) illustrates that, while Egypt has achieved success in this area in contrast to Mauritius, both nations still have a long way to go and must step up to catch up with the rest of the world.

Figure 2: Venture capital investments in AI in USD millions by country from 2012 onwards



Source: OECD.AI, 2022b

Figure 3: Venture capital investments in AI in USD millions by country from 2012 onwards



Source: OECD.AI, 2022c

National AI strategies of Egypt and Mauritius

Egypt's National AI Strategy, published in 2021 (Ministry of Communications and Innovation Technology, 2021), represents a milestone in the country's quest to capitalise on the potential of artificial intelligence, as noted by the president in Egypt's NAS, 2021. The strategy's primary objective is to leverage AI technologies to support Egypt's sustainable development goals while establishing the nation as a prominent player in the field of AI regionally and internationally (Egypt's National Council for Artificial Intelligence, 2021). The strategy outlines several key dimensions of action. Firstly, it emphasises the integration of AI technologies in government operations, seeking to enhance efficiency and transparency within the public sector. Secondly, it aims to apply AI in crucial developmental sectors to drive economic growth and competitiveness. Through public-private partnerships, the strategy encourages investment in AI research and innovation. The creation of a thriving AI ecosystem is another pivotal goal, as is nurturing local entrepreneurship, promoting an academic environment conducive to AI advancements and fostering a culture of innovation. Embracing a human-centric AI approach, the strategy prioritises societal well-being and seeks multi-stakeholder

dialogue on responsible AI deployment. In addition, the strategy highlights the potential of AI as a tool for inclusion, aiming to benefit marginalised communities and contribute to workforce development. By focusing on capacity building, from general awareness to professional training, Egypt aims to prepare its population for an AI-driven future. Internationally, as the president noted, Egypt commits to fostering regional and global cooperation, representing African and Arab perspectives in AI discussions, and actively engaging in relevant initiatives and projects (ibid.). Through its NAS, Egypt endeavours to harness the transformative power of AI, enhancing the lives of its citizens, fostering innovation and making significant contributions to the global AI landscape (ibid..).

Mauritius AI strategy was published as a report in November 2018 by a working group on AI. The report highlights how the government aims to use AI for development and suggests ways to achieve these goals (Government of Mauritius, 2018). It comes from discussions in the AI Working Group under a committee overseeing budget plans. The group was supported by the Ministry of Finance and Economic Development. The Economic Development Board managed the group and wrote the report. The group responsible for this report highlights the potential areas where AI can be used to boost productivity and economic effects in those sectors, such as manufacturing, healthcare, fintech, agriculture, the ocean economy, transport, citizen services and government. The Mauritius NAS highlights the following aspects: the economic effects of AI, Mauritius' unique advantage in AI, AI's impact, creating a supportive ecosystem and collaborations, the needed skills and workforce of AI, as well as the rules and incentives for AI development. The group recommends that there should be a Mauritius AI council to manage and oversee the project's execution while also analysing the socioeconomic impact and working with different stakeholders. Furthermore, they assert that AI goes beyond the economy. It can also improve society by tackling daily challenges and promoting safety and inclusion. The group mentions that AI could be used for social development in different areas, such as social inclusion, diagnosing diseases, environmental protection, better public services, fighting against criminal activities and transport.

In the next two sections, we investigate strategies in relation to AI–citizen interaction and the accessibility of AI as an infrastructure (infrastructure citizenship).

AI–Citizens' relationship in the NASs of Egypt and Mauritius

As mentioned earlier, infrastructure citizenship builds upon everyday citizen-centric perspectives (Lemanski 2019, 2020a, 2020b). It underscores how the actions and behaviours related to citizenship are fundamentally connected to public infrastructure for the state and citizens (Lemanski 2019, 2020a, 2020b). In this section, we investigate infrastructure citizenship by dealing with AI as an infrastructure and exploring the AI–citizen relationships as portrayed in the NASs of Egypt and Mauritius. Thus, the analysis starts by interpreting the strategy in relation to the above-mentioned keywords in the following order: (1) infrastructure; (2) accessible and accessibility; (3) equal, equality, inequality, equity; and (4) citizen. Afterwards, we deduce from this analysis what the investigation shows with regards to infrastructure citizenship and access to infrastructure.

AI–Citizens' relationship in Egypt's NAS

In the Egyptian NAS, the keyword 'infrastructure' is used 30 times (including twice in the table of contents) by mentioning it in different contexts, such as in relation to digital and data infrastructure, inclusive and sustainable infrastructure, and infrastructure planning or management. The term 'infrastructure' is used in Egypt's NAS to address mostly the required infrastructure for the development and use of AI in different industries, such as agriculture, transportation and healthcare. However, the keyword is not used to address access to digital and ICT infrastructure or its effect on citizens' rights and citizenship. Nevertheless, the keyword is used to refer to the growing concerns 'about increasingly automated and autonomous AI systems widening the technological, economic and social gaps due to the lack of basic infrastructure and human capacity capable of exploiting this technology, especially in countries with a large proportion of low-skilled or unskilled labour' (Egypt's National Council for Artificial Intelligence, 2021: 8). This quote reflects how the strategy takes into consideration the various social groups with different levels of knowledge needed to use the technology and the basic infrastructure required, as well as the inequalities that can result from these problems. In addition, the strategy mentions the term infrastructure in relation to addressing the sustainable development goals (SDGs) and the commitment of the Egyptian National AI Strategy to achieve these goals. For example, they mention that the strategy 'is a

key priority for helping Egypt achieve relevant UN Sustainable Development Goals as they pertain to Egypt (in numerical order 4, 5, 8, 9, 10, 11). [...]'. It spells out the country's plans to deepen the use of AI technologies to transform the economy, going beyond just adopting technology to fundamentally rethinking business models and making deep changes to reap productivity gains and create new areas of growth.[1] (Egypt's National Council for Artificial Intelligence, 2021: 23). While it is promising that Egypt's NAS aims to use AI in its mission to achieve the sustainable development goals for the benefit of all people in Egypt, it could be challenging to achieve equality and inclusion in the decision-making and implementation phases of developing sustainable infrastructure by using AI. This challenge exists because the basic and digital infrastructures are not provided equally in addressing widening social gaps due to the lack of equal access to the basic infrastructure.

With regards to the keywords 'accessible and accessibility', these are used four times in Egypt's NAS. One time, accessibility is used to address access to educational programmes related to AI, for example, by stating that 'programs and content must be accessible to even those with limited or no formal education' (ibid.: 37). 'These courses should also be accessible to non-CE and CS graduates' (ibid.: 39). In addition, the terms are used to address data accessibility by mentioning that 'having an effective data strategy means having the right type of data, at the right time, accessible to the right people via the right channels' (ibid.: 48), and also telecommunication accessibility by mentioning that 'the Egyptian government is committed to improving telecommunications efficiency and accessibility, whether in infrastructure or services for the citizens' (ibid.: 20). In this context, improving accessibility to telecommunication infrastructure, which is the base for the development of AI, can improve the relationship between infrastructure and citizenship through AI applications.

The keywords 'equal, equality, or inequality' are used seven times in the NAS of Egypt. Sometimes these keywords address infrastructure citizenship indirectly (not addressing bias or gender equality in direct relation to infrastructure or access to it, but instead just addressing them in general) by referring to 'concerns about the ethics of AI systems and issues

[1] Goal 4: Quality education, Goal 5: Gender equality, Goal 8: Decent work and economic growth, Goal 9: Industry, Innovation and Infrastructure, Goal 10: Reduced inequality, Goal 11: Sustainable cities and communities.

such as bias and gender equality' (Egypt's National Council for Artificial Intelligence, 2021: 8). The NAS addresses equality by referring to SDG 5, which focuses on gender equality (ibid.: 23) and SDG 10 that is associated with 'reducing inequalities within and between countries' (ibid.: 23). Also, equality is addressed through increasing AI knowledge by stating that 'general awareness programs so as to achieve equal footing between literacy and AI literacy' (ibid.: 60). However, in other parts of the strategy, these keywords are not used in relation to infrastructure citizenship; for instance, mentioning 'equal attention to AI start-ups' (ibid.: 50), and the part focusing on 'countering inequality biases and employment challenges' (ibid.: 28). With regards to the term 'equity', it is not used in the strategy at all. To summarise, although the improvement of equality by AI applications is not addressed in Egypt's NAS, the concerns about the inequalities that may occur with the use of AI systems, such as bias and gender inequalities, are mentioned.

The keyword 'citizen' is used nine times in Egypt's NAS in different contexts by referring to services, citizens' data, citizens' experiences and citizens' participation. These contexts address infrastructure–citizen relationships directly. For example, in relation to the service received by the public and their experience, AI is mentioned as having 'the power to transform the way that governments around the world deliver public services. In turn, this could greatly improve citizens' experiences with government services' (ibid.: 26). The improvement of the infrastructure–citizens' relationship is addressed in the strategy with regards to providing better services to citizens, stating that increasing 'the efficiency, quality, and speed of government-to-citizen services' is one of the two goals served by the 'ongoing "Digital Egypt" strategy already underway since 2017' and how 'the digital and data infrastructure already built and still being further developed, will be utilized to create new AI applications and add layers of AI functionality on top of existing ones' (ibid.: 26). In the NAS, the use of AI in organisational management in the public sector is discussed by mentioning that 'public sector bodies need to discover and realise how AI applications can add value to their internal organisational processes and/or provide high-quality services to citizens' (ibid.: 28). As this suggests that the strategy aims to focus on the efficiency and quality of public services, it contributes to being effective in terms of infrastructure citizenship. The infrastructure–citizenship relationship is also addressed by the provision of citizens' participation and feedback to improve the connection between citizens and the government by mentioning

that one of the ‘key areas where AI can support government operations’ is ‘citizen policy participation and feedback, public sentiment gauging’ (ibid.: 28). In another part of the NAS it mentions that ‘understanding and drafting documents: a system to help parliament member offices respond to citizen questions by drafting answers using AI’ (ibid.: 28). Consequently, Egypt’s NAS demonstrates that using AI in the improvement of citizen–government connection is effective as all citizens can give feedback freely and equally on public services and infrastructure, which may affect decisions about urban interventions.

The above content analysis of Egypt's NAS in relation to the keywords of investigation shows that, in the strategy, infrastructure citizenship is addressed in different ways. These include (1) improving the citizens’ experience associated with public services by the government, (2) responding to citizens’ questions using AI applications, (3) improvement of public service delivery, (4) citizen participation policies, (5) efficiency in digital infrastructure, and (6) access to digital infrastructure. These responses can affect use of AI by citizens and therefore affect the infrastructure–citizenship relationship. An example of the first direct reference to infrastructure citizenship in relation to proving that the citizens’ experience is addressed is that ‘AI has the power to transform the way that governments around the world deliver public services. In turn, this could greatly improve citizens’ experience with government services’ (Egypt’s National Council for Artificial Intelligence, 2021: 26). This quote indicates that the use of AI can be effective in improving the infrastructure–citizen relationship by improving citizens’ experiences through better public services. Another example of addressing infrastructure citizenship in the Egyptian NAS is mentioning that the ‘Egyptian government is committed to improving telecommunications efficiency and accessibility, whether in infrastructure or services for the citizens’' (ibid.: 20). This quote shows that Egypt focuses particularly on the digital infrastructure needed to develop AI by addressing the government’s commitment to facilitating accessible telecommunication in infrastructure and services. In addition, Egypt’s NAS mentions this: ‘Infrastructure: including fair access to compute, storage, networking, and other assets’ (ibid.: 7). In this regard, the strategy addresses infrastructure citizenship, as mentioned, but does not tackle the inequalities, bias or discrimination that may occur during the data collection for AI systems and does not tackle how to overcome these problems in decision making or in urban infrastructure and services.

AI–Citizens' relationship in Mauritius NAS

In Mauritius NAS, the keyword 'infrastructure' is used 20 times, focusing on the development of digital infrastructure and enhancing efficiency in urban infrastructure, such as traffic and transportation, agriculture and healthcare infrastructure. With regards to the development of digital infrastructure, the strategy addresses the development of communication and technology infrastructure which aims to build a fintech hub by stating that 'Mauritius has also been a regional pioneer to create the adequate framework (regulatory, capacity building, network, infrastructure, institutions, incentives) to become a leader in the world of fintech driven by such technologies like AI' (Government of Mauritius, 2018: 42). In this regard, the Mauritius NAS highlights Mauritius' potential to become a technology hub by focusing on the size of the tech market in Africa and on economic developments, such as financial investments and trades related to the African market. The strategy asserts that some companies are already engaged in different fintech activities, including mobile payment, E-banking, cross-border clearances, digitisation of platforms, robot advisory, business intelligence, wealth management and trade finance. However, they do not address accessibility to these services or how they want to improve digital inclusion for all citizens.

With regards to enhancing efficiency in urban infrastructure, the strategy addresses improving safety and developing efficient solutions by predicting traffic incidents and public emergencies through the use of AI in transportation infrastructure (Government of Mauritius, 2018: 56). With regards to AI in agriculture, the strategy addresses AI applications in improving efficiency through 'smart irrigation, remote sensing technology, drone applications and cold storage solutions that rely on AI and IoT accessible both through web and mobile applications' (ibid.: 51). In relation to healthcare, AI applications are addressed in relation to developing medical tourism (ibid.: 33). In addition, the strategy highlights the economic effect of investment in AI in healthcare infrastructure and mentions the health sectors where AI can be used to improve the efficiency of treatment methods and the healthcare system. However, they do not mention how they aim to use AI to improve accessibility to healthcare services for all citizens equally.

The keyword ‘accessible’ is used once in Mauritius NAS, addressing IoT accessibility by stating that ‘the promotion of precision agriculture, smart irrigation, remote sensing technology, drone applications and cold storage solutions that rely on AI and IoT accessible both through web and mobile applications should tremendously boost the agricultural sector in Mauritius’ (ibid.: 51). Accessibility to digital infrastructure is the main foundation for AI development which can support citizen–infrastructure relationships. However, it has missed the spotlight in the Mauritius NAS.

The keywords ‘equality or inequality’ are not mentioned in Mauritius NAS. Nevertheless, The term ‘equal’ is mentioned once in the strategy, but not in the infrastructure citizenship context. Instead, it is stated in relation to opportunities in research and proposals on social topics, stating that ‘NGOs and/or public funded bodies in collaboration with academic/research institutions/private sector companies can submit proposals that combine action-research and a social innovation potential with tangible outcomes in social development research areas, including but not limited to social integration of vulnerable groups, equal opportunities, and environmental issues’ (ibid.: 20). The lack of attention to these keywords may reflect that improving equality in the urban context is not the primary aim of the strategy, especially with regard to access to infrastructure while using AI.

The keyword ‘citizen’ is used ten times in Mauritius NAS, addressing mainly the efficiency and effectiveness of citizen–government relationships and service delivery to citizens using AI. The strategy addresses using AI in the development of better services for people by stating, ‘ince the earliest days of the Internet, most government agencies have eagerly explored how to use technology to better deliver services to citizens, businesses, and other public-sector organizations’ (ibid.: 62). Another example that indicates that the strategy is addressing the improvement of public service delivery (and, in turn, infrastructure citizenship) is that which states ‘With citizen satisfaction with digital government offerings leaving much to be desired, AI may be one way to bridge the gap while improving citizen engagement and service delivery’ (ibid.: 62). In this regard, it is clear that the strategy aims to improve the relationship between citizens and government through AI applications, such as chatbots. This is emphasised by mentioning that ‘many AI case studies in citizen services today fall into five categories: answering questions, filling out and searching documents, routing requests, translation and

drafting documents. These applications could make government work more efficiently while freeing up time for employees to build better relationships with citizens' (ibid.: 62). In addition, in another part of the strategy, they state that 'AI will create a faster, more responsive government. AI enables the creation of autonomous, intelligent agents, for example, online catboats that answer citizens' questions, real-time fraud detection systems that constantly monitor government expenditures and virtual legislative assistants that quickly synthesise feedback from citizens to lawmakers' (ibid.: 62). Moreover, in the NAS, effective citizen engagement through AI technology is addressed by stating, 'Nevertheless, there is benefit in preparing for the future, and making technology investments to keep pace with trends in how citizens prefer to engage with service providers' (ibid.: 63). In general, these quotes from the strategy suggest that one of the main objectives is to improve the connection between citizens and the government by providing AI technology, such as answering citizens' questions and receiving feedback from people on public services. This entails improving citizen participation and engagement and it also improves infrastructure citizenship.

Comparing Egypt and Mauritius NASs from the lens of infrastructure citizenship

Both Egypt's NAS and Mauritius' NAS focus on using AI in different infrastructures and facilitating better service delivery to citizens through AI applications. Both NASs aim to improve efficiency and effectiveness in different sectors, such as healthcare, transportation and agriculture, through AI applications. In addition, they both indicate attention to investments in start-ups working on AI. However, both strategies do not address the use of AI in improving equal access to infrastructure for all citizens. Both strategies mention the development of the required digital infrastructure for AI but do not mention providing equal access to this infrastructure for all citizens. Therefore, a lack of attention to all citizens at the same level makes these strategies not totally effective if AI is not used to provide social inclusion and to consider all citizens equally.

Besides the similarities between Egypt and Mauritius NAS, there are some differences. Egypt NAS addresses the development of skills in AI among both employees and the general public

to improve the efficiency of its usage. On the contrary, Mauritius NAS focuses only on improving the knowledge of employees and increasing the skilled workforce in AI without referring to the knowledge of the public. In addition, Egypt's NAS addresses accessibility to urban services and the Egyptian government's commitment to providing access to telecommunication services, but Mauritius' NAS does not mention digital accessibility by the citizens or the need to improve accessibility in Mauritius. In Egypt's NAS, equality and inequality are addressed in different contexts, such as gender equality and equality in access to AI literacy, which can, at least, be associated with infrastructure citizenship indirectly, while Mauritius NAS does not mention equality directly or indirectly in relation to infrastructure citizenship and access to infrastructure.

Q1: How is the relationship between citizens and infrastructure (AI applications) portrayed in each strategy?

In Egypt's NAS, the relationship between citizens and infrastructure is portrayed mainly in terms of the required data and digital infrastructure for the use of AI. By developing digital infrastructure and using AI, the strategy aims to improve the quality of public services. Moreover, the strategy addresses the improvement of public awareness regarding the effective use of digital infrastructure by referring to the need to improve human capability and professional assets through educational programmes. This step is essential to improving the relationship between citizens and digital infrastructure. The relationship between citizens and infrastructure can also be understood by addressing capacity building. In Egypt's NAS, they address capacity building by mentioning access to educational programmes and general awareness programmes for the public.

In Mauritius' NAS, the relationship between citizens and infrastructure is limited to the improvement of the connection and communication between citizens and the government, citizen engagement and public service delivery by AI technology. However, the report does not address how to ensure that all residents can profit from these services. Moreover, the report does not mention how all communities can access these services or how to facilitate satisfactory accessibility of digital infrastructure for all groups in order to provide equal opportunities. In addition, the report highlights the skill development and capacity building

of employees and skilled labour requirements in AI. However, they do not address public capacity building and transferring the required digital literacy of public users to ensure equality in using urban digital services. Therefore, investment and skill development in research and design (R&D) and private and public sectors are not enough; the knowledge required to use the digital urban services provided by AI is also helpful.

Q2: How are AI applications framed in both strategies to improve or hinder the relationship between citizens and infrastructure?

With regards to how AI may support the relationship between citizens and infrastructure in Egypt's NAS, the strategy aims to improve the relationship between the state and citizens by increasing the efficiency, speed and quality of public services provided to citizens using AI. Moreover, the strategy addresses the use of AI applications in both the internal processes of public organisations and public service delivery to make them more efficient. It also addresses citizen participation and the improvement of the citizen–state relationship by providing citizens with feedback through AI technology, such as the provision of an AI system that can help parliament members answer the citizens' questions. With regards to how AI may hinder the relationship between citizens and infrastructure, risks of bias and discrimination by data in AI systems can endanger citizens' experiences. Furthermore, citizen–infrastructure citizenship is not addressed by the NAS.

Mauritius NAS mostly focuses on the economic effects of AI and the application of AI in different urban infrastructures, such as transportation and healthcare. With regards to how AI may improve the relationship between citizens and infrastructure, the strategy uses AI in order to improve communication between citizens and the government and to improve citizen engagement by considering citizens' feedback through AI tools. However, the strategy does not address social and digital inclusion or the need for equal access to digital infrastructure. The improvement of digital inclusion can lead to a valuable level of accessibility and hence an improved connection between citizens and the infrastructure. However, this was not addressed in the Mauritius NAS. While Mauritius aims to use AI applications, such as chatbot and answering citizens' questions, which are effective in developing the relationship between citizens and the government, the strategy should also consider digital inclusion as

significant. Even with regards to improving AI skills, the strategy only focuses on employees, not the public using urban services, who need to know how to use these digital services. This accordingly raises questions regarding the extent to which Mauritius NAS is citizen-centred. The improvement of equal access to infrastructure through AI applications is not mentioned in the strategy, and the focus is mostly on economic advantages rather than other aspects, such as usability and accessibility of AI services by all social groups. With regards to how AI may hinder the relationship between citizens and infrastructure, as the strategy misses to mention equal digital infrastructure and basic knowledge to use digital services, this may result in bias and discrimination in the data used in the AI system. In turn, using this data, which is not collected by all citizens due to the lack of equal access to digital infrastructure, could lead to bias and discrimination in urban interventions and adversely affect infrastructure and citizenship. Thus, AI applications in this context could hinder the relationship between citizens and infrastructure.

Conclusion

The 'bright' and 'dark' aspects of technological advancement have long been debatable in practice, academia and even literature (Bunge, 1976; Markus, 2017; Willcocks, 2020). Government involvement in technological advancement is thought to have both beneficial and harmful consequences (Guenduez et al., 2020). According to these viewpoints, the work on the bright and dark sides of AI is connected, either directly or indirectly, to the conversation about the state's obligations and functions in the context of AI (Cath et al., 2018).

By analysing the two national AI strategies of Egypt and Mauritius through the lens of infrastructure–citizen relationships, we find that these strategies can be effective in speeding up the use of AI in different sectors. In both NASs, the ways AI can be used in different sectors to boost efficiency are highlighted. The two countries aim to use AI in different sectors to increase efficiency, speed and quality of public services for citizens, in addition to the environmental and economic benefits that can be achieved by AI. To achieve the benefits of AI, there are many factors, such as public knowledge of using AI-driven services, basic digital

infrastructure and human skill that can ensure the improvement of AI in cities. These factors would affect the AI–citizen relationship and, hence, the applicability of AI in various sectors.

This paper concludes that improving the efficiency and quality of public services can lead to improved infrastructure–citizen relationships through AI applications that facilitate connections between citizens and service providers, such as AI chatbots and AI answering citizens' questions. We find out there are many challenges to applying these strategies, including a lack of digital inclusion and lack of required digital infrastructure which limit access to using AI as well as a lack of needed knowledge. We find providing educational programmes valuable and effective to increase public awareness of how to use AI services and improve the human resources required to develop AI in cities. Digital inclusion can be defined as ensuring the affordability, accessibility and usability of digital services for all citizens (UN-Habitat, 2021). However, in Mauritius' NAS, accessibility is missed in the national AI strategy. The need to provide accessibility of digital services and the basic infrastructure for all citizens equally, prior to using AI technology in different sectors, is not mentioned. In Egypt's NAS, they address accessibility by mentioning Egypt's commitment to providing access to telecommunication facilities in infrastructure and services.

Equality, which is an important factor in digital inclusion, directly affects the relationship between citizens and infrastructure, particularly digital infrastructure, which is the base of AI development (see, among others, UN-Habitat, 2021). In conclusion, improvement of the infrastructure–citizen relationship can be achieved by ensuring digital inclusion and the required accessible digital infrastructure for all citizens. This should be considered while developing national AI strategies and strategic visions that focus on the implementation of AI.

There are four recommendations that can be considered to improve the NASs in terms of the infrastructure–citizen relationship: (1) ensuring digital inclusion; (2) improving equality in infrastructure accessibility through AI technology and applications; (3) clarifying skills, capacities and investments needed in public awareness and knowledge sharing; and (4) highlighting the positive implications of AI when inclusion and equality are ensured.

First, to improve infrastructure–citizen relationships effectively through AI, the country should ensure digital inclusion and make the basic digital infrastructure accessible to all citizens. In both NASs, increasing digital knowledge, which is key to digital inclusion, is addressed by mentioning the provision of educational programmes related to AI skills. Capacity-building programmes should be provided for different groups with different goals and knowledge levels. In the Mauritius NAS, they address improving AI skills associated with employees working in this sector only. They should consider the importance of public awareness and the development of digital knowledge when establishing national AI strategies. Advertisements on television channels and other social channels are good platforms to increase public awareness of using digital services.

Second, the NASs can be more effective by considering and addressing their plans associated with improving infrastructure accessibility through AI applications for all citizens equally. In the strategy, it should be mentioned how accessibility to new AI-driven services in healthcare infrastructure is important for citizens in order to improve infrastructure–citizen relationships. As such, citizens and the way in which they benefit should be at the centre of the strategies to ensure their applicability.

Third, the required knowledge to use digital services is linked to the relationship between citizens and infrastructure (and, thus, infrastructure citizenship). Hence, national AI strategies need to clarify the skills and capacities needed to be built to contribute to AI systems (in the various sectors). In this regard, capacity building is related to digital inclusion, and digital inclusion leads to equality. Moreover, strategies should address the awareness and capacity building of the general public as well as the ways to transfer the required digital literacy of public users to ensure equality in using AI services. In addition, the allocated investments and the knowledge required need to be clarified.

Fourth, the societal and ethical benefits that arise from building accessible and equal infrastructure (the bright side of AI) may not only facilitate the development of AI but also reduce discrimination in infrastructure. It follows that AI can and should be used to improve societies and cities by providing equal access to all citizens. Hence, the fourth

recommendation revolves around highlighting the positive implications of AI when inclusion and equality are ensured, building on the previous three suggestions.

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Appendices

Appendix 1: Keywords search and count in Egypt's NAS

Keywords	Number of mentions	Quotations
Infrastructure	30	'Create an AI Industry in Egypt, including the development of skills, technology, ecosystem, infrastructure, and governance mechanisms to ensure its sustainability and competitiveness.' (p. 6) 'Priority sectors for phase 1 include: Agriculture/ Environment/ Water Management - Healthcare - Arabic Natural Language Processing (NLP) – Economic Planning and Development - Manufacturing and Smart Infrastructure Management.' (p. 6) 'Infrastructure: including fair access to compute, storage, networking, and other assets' (p. 7) 'Concerns are growing about increasingly automated and autonomous AI systems widening the technological, economic, and social gaps due to the lack of basic infrastructure and human capacity capable of exploiting this technology, especially in countries with a large proportion of low-skilled or unskilled labour.' (p. 8) 'A survey of over 30 national AI strategies around the world shows that some countries focus on AI applications or scientific research, while others also cover initiatives to promote open data, ethical standards, digital infrastructure and labour market redesign.' (p. 10) 'The Egyptian government is committed to improving telecommunications efficiency and accessibility, whether in infrastructure or services for the citizens.' (p. 20) 'Universities and Research Institutions Physical Infrastructure' (p. 21) 'SWOT analysis (strengths): ICT sector infrastructure and provided services.' (p. 22) 'SWOT analysis (weaknesses): Inadequate research infrastructure.' (p. 22) 'The relevant SDGs address inclusive and equitable education (4), gender equality (5), inclusive and sustainable growth and decent work opportunities (8), fostering innovation via inclusive and sustainable infrastructure (9), reducing inequalities within and between countries (10), as well as working toward sustainable and resilient cities and settlements (11).' (p. 23) 'As part of its ongoing 'Digital Egypt' strategy, already underway since 2017,

		the digital and data infrastructure already built and still being further developed, will be utilized to create new AI applications and add layers of AI functionality on top of existing ones.' (p. 26)'With the rapid development and implementation of AI, all actors including governments, NGOs, companies and international organizations should encourage and prioritize the use of AI in areas of sustainable development such as healthcare, agriculture/food supply, environment, water management, education, infrastructure management, economic planning and growth, and others which are in line with the priority sectors that have been identified according to Egypt Sustainable Development Strategy and in line with the UN's Sustainable Development Goals.' (p. 29) 'More partnerships and cooperation are needed with entities that have expertise in using AI in large-scale data analysis to determine the right mix of economic activities, infrastructure planning, education, transportation needs and other services the region needs to optimize the use of its natural and human resources.' (p. 32) 'Manufacturing and Smart Infrastructure Management' (p. 32) 'On the infrastructure side, potential use cases include predictive maintenance of public assets, using predictive analytics in public safety, crime prevention, and traffic management.' (p. 32) Most studies have confirmed that the 4th industrial revolution will impose a new reality, full of opportunities and challenges, as the concept of the '4th industrial revolution' revolves around the automation of the industry and the reduction of manpower in it, as the role of the individual in it is limited to supervising only the industry, which necessitates the use of Scientific capabilities to possess an advanced technical and digital infrastructure. (p. 33) 'An elaboration of Egypt's infrastructure readiness and plans is out of the scope of this document.' (p. 49) 'However, it is important to point out that the lack of a cloud infrastructure in Egypt, especially a presence for one of the major public cloud providers, aka 'hyperscalers' such as AWS, Google CP or Microsoft Azure poses some serious obstacles to the rapid adoption of AI due to data locality restrictions which prevent any data from leaving the country.' (p. 49) 'Providing support means helping start-ups with the right advice and infrastructure (legal, ethical, technical, etc.) needed to create responsible AI products' (p. 50) 'Provide Tech parks, innovation hubs, R&D grants, competitions, etc. These will provide infrastructure and help for start-ups.' (p. 51)

		'AI4D: identify and execute pilot projects within each strategic sector (agriculture/water, NLP/ culture, Manufacturing and Smart Infrastructure Management, economic planning, healthcare) and measure their ROI and potential to develop at scale. Successful pilots are moved directly to full-scale rollout.' (p. 60) 'Pilot projects for AI in infrastructure and Manufacturing and Smart Infrastructure Management' (p. 64)
Equity	0	
Equal/equality/ inequality	7	'It is therefore important for governments and private sector to pay equal attention to AI start-ups which can be a strong contributor to an AI-driven economic growth.' (p. 50) 'Within capacity building, the focus will be on completing the general awareness programs so as to achieve equal footing between literacy and AI literacy while at the same time, strengthening the top of the pyramid by producing high-end data scientists and machine learning researchers.' (p. 60) 'There are also growing concerns about the ethics of AI systems and issues such as bias, gender equality, insufficient regulation, and the loss of nuances in culture and language, for example due to the use of Natural Language Processing (NLP) systems.' (p. 8) 'The relevant SDGs address inclusive and equitable education (4), gender equality (5), inclusive and sustainable growth and decent work opportunities (8), fostering innovation via inclusive and sustainable infrastructure (9), reducing inequalities within and between countries (10), as well as working toward sustainable and resilient cities and settlements (11).' (p. 23) 'Countering inequality biases and employment challenges are vital during the development stage.' (p. 28) 'Public Sector Specific Challenges: Inequality biases, Employment, Accountability' (p. 27)
Accessible/ accessibility	4	'General awareness must start at the very basic levels of society, and programs and content must be accessible to even those with limited or no formal education.' (p. 37) 'These courses should also be accessible to non-CE and CS graduates with adequate levels of mathematics and programming knowledge, such as graduates of the Faculty of Sciences and related fields.' (p. 39) 'In addition, having an effective data strategy means having the right type of data, at the right time, accessible to the right people via the right channels, while being governed and protected in the

		right way.' (p. 48) 'The Egyptian government is committed to improving telecommunications efficiency and accessibility, whether in infrastructure or services for the citizens.' (p. 20)
Citizen	9	'The Egyptian government is committed to improving telecommunications efficiency and accessibility, whether in infrastructure or services for the citizens.' (p. 20) 'A comprehensive database for citizen data has been gathered by the Egyptian government, including health and social data.' (p. 20) 'AI for government: AI has the power to transform the way that governments around the world deliver public services. In turn, this could greatly improve citizens' experience with government services.' (p. 26) 'Increase the efficiency, quality, and speed of government-to-citizen services' (p. 26) 'Public sector bodies need to discover and realize how AI applications can add value to their internal organizational processes and/or provide high quality services to citizens (p, 28) Citizen policy participation and feedback, public sentiment gauging.' (p. 28) 'Understanding and drafting documents: a system to help parliament member offices respond to citizen questions by drafting answers using AI.' (p. 28) 'Government classification of data is something created out of policy for maintaining national security or the privacy of citizen data.' (p. 48) 'SBU data is data that is not considered vital to national security, but its disclosure would do some harm. Many agencies classify data they collect from citizens as SBU.' (p. 48)

Appendix 2: Keywords search and count in Mauritius' NAS

Keywords	Number of mentions	Quotations
Infrastructure	20	'However, each nation, given the high costs involved, is building its plan based on different aspects of AI policy such as research and development, capacity building and skill development, education, public and private sector adoption, ethics and inclusion, standards and regulation, data and digital infrastructure, to name just a few of the components of the ecosystem that need to be developed to fully master AI.' (p. 3) 'The strategies adopted by the different countries stand out it their heterogeneity, with each nation building their plan based on their uniqueness to focus on different aspects of AI policy such as research and development, capacity building and skills development, and education, public and private sector adoption, ethics and inclusion, standards and regulations, and data and digital infrastructure. Also, countries have different approaches to driving AI in the economy.' (p. 12) 'South Korea: Develop AI talent, development of AI technology investment in infrastructure to support the development of AI start-ups and SMEs.' (p. 15) 'United Kingdom: Boost public and private R&D, invest in STEM education, improve digital infrastructure, develop AI talent, and lead the global conversation on data ethic' (p. 15) 'UK have all released strategies to promote the use and development of AI. Though no two strategies are alike, common aspects of AI policy are scientific research, talent development, skills and education, public and private sector adoption, ethics and inclusion, standards and regulations, and data and digital infrastructure.' (p. 18) 'Healthcare Infrastructure' (p. 30) 'In fact, medical tourism is one of the fastest growing sectors. To cater for the growing sector, there is a need to strengthen the healthcare infrastructure.' (p. 33) 'Mauritius has already engaged in the Fintech revolution. Backed by strong institutions, a booming financial industry and enabling Information, Communication and Technology infrastructures, Mauritius is positioning itself as an upcoming regional Fintech hub.' (p. 40) 'Mauritius has been successful in several initiatives by being a first mover such as in the textile industry by putting the right framework, the ICT sector by ensuring adequate infrastructure and workforce, the port sector, among others.' (p. 42)

		'Mauritius has also been a regional pioneer to create the adequate framework (regulatory, capacity building, network, infrastructure, institutions, incentives) to become a leader in the world of Fintech driven by such technologies like AI.' (p. 42) 'The implementation of AI in the public transport domain will assist transport technology in predicting future demands on transportation and learning to provide better, more efficient solutions. These predictions could also quickly adapt to disturbances such as traffic incidents and public emergencies, increasing the safety of cities and infrastructure.' (p. 56) 'The global non-uniformity in built-up structures, city infrastructures, road surfaces, weather patterns and traffic patterns make AI applications in autonomous trucks for on-time delivery of people and packages, highly environment specific.' (p. 56) 'The insights can then be used for event prediction to prevent road traffic injuries, eliminate peak-time traffic congestion, enhance operational efficiency or for future planning of traffic infrastructures.' (p. 57) 'Traffic demand modeling, or in modeling the transportation infrastructure health as a function of traffic, construction and weathering.' (p. 58) 'In India, the Delhi government is planning to invest around ₹1,000 Crore in intelligent traffic management system, with an aim to overhaul the existing traffic system in its capital. India's transportation system is grappling with inadequate and inefficient public transport infrastructure, organized public transport in few cities and increasing rates of motorization.' (p. 59) 'Moreover, worldwide there is no standardization of the sensing infrastructure and AI techniques used. Infrastructure costs, differing priorities among cities, and the high coordination costs among the parties involved have slowed adoption, as have public concerns over privacy related to sensing.' (p. 60) 'Use of AI to monitor effect of infrastructures on traffic and advise and model the impact of new proposed infrastructure on traffic.' (p. 67) 'A policy direction about open data and access to such platforms, with the adequate infrastructure should be considered, with the possibility of Government setting up a data centre.' (p.68)
Equal	1	'NGOs and/or public funded bodies in collaboration with academic/research institutions/private sector companies can submit proposals which combine action-research and a social innovation potential with tangible outcomes in social development research areas including but not limited to social integration of vulnerable groups, equal opportunities and environmental issues.' (p. 20)
Accessible	1	The promotion of precision agriculture, smart irrigation, remote sensing technology, drone applications and cold storage solutions that rely on AI

		and IoT accessible both through web and mobile applications should boost tremendously the agricultural sector in Mauritius.' (p. 51)
Citizen	10	'The potential impact of AI has forced countries and economic blocs to develop the appropriate strategies to ensure that the optimize on AI solutions to increase GDP and, in fine, the quality of life of citizens' (p. 12) 'It is estimated that by 2050, the number of senior citizens in the world will exceed the number of young people for the first time in history' (p. 33) 'Artificial Intelligence for Citizen Services and Government' (p. 62) 'Since the earliest days of the Internet, most government agencies have eagerly explored how to use technology to better deliver services to citizens, businesses and other public-sector organizations' (p. 62) 'Many AI case studies in citizen services today fall into five categories: answering questions, filling out and searching documents, routing requests, translation, and drafting documents. These applications could make government work more efficient while freeing up time for employees to build better relationships with citizens.' (p. 62) 'With citizen satisfaction with digital government offerings leaving much to be desired, AI may be one way to bridge the gap while improving citizen engagement and service delivery' (p. 62) 'AI will create a faster, more responsive government. AI enables the creation of autonomous, intelligent agents, for example online catboats that answer citizens' questions, real-time fraud detection systems that constantly monitor government expenditures and virtual legislative assistants that quickly synthesize feedback from citizens to lawmakers' (p. 62) 'Nevertheless, there is benefit in preparing for the future, and making technology investments to keep pace with trends in how citizens prefer to engage with service providers' (p. 63) 'Some strategies can help governments start off on the right foot with AI: make AI a part of a goals-based, citizen-centric program; get citizen input; build upon existing resources; be data-prepared and tread carefully with privacy; mitigate ethical risks and avoid AI decision making' (p. 63)