



HAL
open science

Adopting Artificial Intelligence in the Saudi Arabian Public Sector: Preliminary Findings

Albandari Alshahrani, Denis Dennehy, Matti Mäntymäki

► **To cite this version:**

Albandari Alshahrani, Denis Dennehy, Matti Mäntymäki. Adopting Artificial Intelligence in the Saudi Arabian Public Sector: Preliminary Findings. 20th Conference on e-Business, e-Services and e-Society (I3E), Sep 2021, Galway, Ireland. pp.71-81, 10.1007/978-3-030-85447-8_7. hal-03648115

HAL Id: hal-03648115

<https://inria.hal.science/hal-03648115>

Submitted on 21 Apr 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License



This document is the original author manuscript of a paper submitted to an IFIP conference proceedings or other IFIP publication by Springer Nature. As such, there may be some differences in the official published version of the paper. Such differences, if any, are usually due to reformatting during preparation for publication or minor corrections made by the author(s) during final proofreading of the publication manuscript.

Adopting Artificial Intelligence in the Saudi Arabian Public Sector: Preliminary Findings

Albandari Alshahrani¹ Denis Dennehy¹ Matti Mäntymäki²

¹National University of Ireland Galway, Galway, Ireland

²University of Turku, Turku, Finland

Abstract. Artificial Intelligence (AI) has received significant attention in recent years, with claims of unlimited potential across sectors and industries. Despite the media hype about AI, there is limited understanding of how governments can utilize AI for the delivery of value to citizens and what are the barriers and trade-offs that need to be addressed to lead to value realization. AI has the potential to bring transformative benefits to society, but first we need to understand the current state of play in the public sector through an appropriate theoretical lens. We adopt the attention-based view of the organization to identify key challenges in terms of organizational attention. This study draws on a single case study in Saudi Arabia to identify key challenges associated with the adoption of AI.

Keywords: Artificial Intelligence, Data, Big Data, Public sector, AI Adoption, Saudi Arabia

1 Introduction

AI has been claimed to convey significant transformative potential across sectors. Global spending on AI is predicted to be nearly \$98 Billion in 2023, more than double what was spent in 2019 (International Data Corporation), and by 2025, nearly a quarter (24%) of global GDP will come from AI technologies (World Economic Forum). AI technologies have the potential to significantly change how we live and work, as Google CEO Sundar Pichai recently stated “*AI is one of the most important things humanity is working on. It is more profound than electricity or fire*” [8]. In the words of the late Stephen Hawking: “*AI could be the biggest event in the history of our civilization. Or the worst! We just don’t know*”. For example, the power of IBM Watson in a cancer diagnosis and Google DeepMind in a military sphere [9-11].

Simply put, AI can be described as a set of techniques used to simulate human cognitive processes such as learning, inference, and self-correction human-like tasks [1-2]. AI is attributed as being the catalyst of the so-called Fourth Industrial Revolution [3]. AI as a concept is not new, as it can be traced back to 1956 but since then it experienced cycles of silence known as AI winter [5]. Despite its long history, there is still no universal standardized definition [4]. AI aims to improve computer capability in four broad domains, namely, natural language processing (NLP), knowledge representation (KR), automated reasoning (AR), and machine learning (ML) [6-7]. AI can also be used in general tasks such as fraud detection [12-13], robotic process

automation (RPA) [14], chatbots being used as an interactive model with citizens [15], and use in new drug discovery [16-19].

Despite the popularity of AI there is a scarcity of rigorous studies that focus on AI adoption in the real world, specifically within the public sector [20-22]. Furthermore, there is a need to advance understanding of AI, by considering the mixed views regarding AI applications and providing empirically based insights [23-24, 20]. Arguably, AI in the public sector has a different area of implementation with diverse opportunities and challenges, where the decision-making context is heavily influenced by policies, effects on society and commerce, and the wider environmental characteristics are continuously changing [21, 25, 26,].

To this end, the aim of this study is “*to explore the challenges of AI adoption in the public sector of Saudi Arabia*”.

We draw on the attention-based view (ABV) of the organisation as the theoretical lens through which to study AI adoption in Saudi Arabia as it encompasses the noticing, encoding, interpreting, and focusing of time and effort by organizational decision-makers to address challenges and seize opportunities.

The remainder of this paper is structured as follows. First, we provide context to this study by reviewing extant literature on AI in the public sector and Saudi Arabia. Then the research methodology and data collection methods are discussed. Next, key findings and discussion are presented. The paper ends with conclusion, limitations, and future research.

2 Related Literature

2.1 AI in the Public Sector

The reported opportunities of AI in the public sector include increased productivity and performance, less human errors and lower costs, by removing administrative duties and better resource allocation [12, 14, 27, 28, 29]. There are also claims that AI impact many rules-based activities and repetitive, while also creating more than 133 million new jobs by 2022 [30-31].

In the context of AI adaption budget, AI technology spending in Europe for 2019 has increased 49% over the 2018 figure to reach \$5.2 billion [32]. By 2030, AI may lend 20% of GDP in China by 2030 [33]. The value of Saudi Arabia’s data and AI economy is currently estimated at 4-5.3 billion USD, and there is an opportunity to generate additional revenues and savings of over 10.6 billion USD using these insights to help guide government decisions. It is expected to contribute an estimated 14 percent growth to its GDP by 2030, “the equivalent of an additional 15.7 trillion USD”. [34-36]. Furthermore, the importance of data for artificial intelligence (AI), such as the importance of water for plants. As Clive Hamby stated that “*Data is the new oil*” [36]. Some studies argue about AI ability to interpret and learn from external data to obtain useful outcomes in a dynamic way. The success of AI in delivering outstanding performance for specific tasks, such as robotic vehicles, flexible scheduling, etc. relies on big data availability. AI and big data are now apparently inseparable [37,38].

Along similar lines, recently, the importance of AI and Data can be shown when it comes to deal with the COVID-19 pandemic. For example, an AI-based model of HealthMap used as a tracking model at Boston Children's Hospital (USA). It alarmed the first sign earlier than a scientist warning at the Program for Monitoring Emerging Diseases (PMED). Moreover, a prognostic prediction model was developed using Algorithmic Machine learning at Tongji Hospital in Wuhan, China. It predicts the death-rate risk of an infected person and how accurate s/he is affected by COVID-19 (with 80% accuracy). [39,40].

Despite the raised level of AI adoption advantages within many areas in term of efficiency, improved productivity and reliability, and a big bright picture, these technologies are not welcoming globally when it is deal with work displacement [41], as well as it raises ethical concerns connected to data bias, governance, safety, privacy, and data ownership [42]. The adoption of AI technology in the public sector creates a demanding challenge that likely remains a shortcoming within the next years [43,44, 27]. AI and Data regulations and ethics are another global concern [45,46]. Nevertheless, there is still humble knowledge about the types of AI applications' contribution for governments and how to bridge the gap between citizens' satisfactions and government abilities considering AI within the capabilities of arising challenges [47].

2.2 AI Adoption in Saudi Arabia

The government of Saudi Arabia launched the Vision 2030 initiative in 2016 with specific goals and development directions to diversify its economy. Driven by this vision to ensure the nation can reduce its dependency on oil [48,6]. One plan covers investing and developing in AI technology and its assimilation into a new mega-city called "*Neom*" [49,6]. Recent developments have seen Saudi Arabia become increasingly interested in the AI revolution. For instance, in September 2019, King Salman Bin Abdulaziz gave a decree to set up a "National Authority for Data and Artificial Intelligence.". There are currently several AI-related technologies available, but none have explanations of their challenges in Saudi Arabia, particularly from the viewpoint of leadership.

In line with AI and Data opportunity, Saudi Data and AI Authority (SADAIA)¹ in partnership with the Ministry of Health, launched two common applications called Tawakkalna, "توكلنا" and Tabaud "تباعد" in response to Covid-19. Both applications use Machine learning algorithms and citizens/foreigner's data to manage virus spreading. Tabaud uses in tracking and predicting affected areas [50,51]. Despite AI contribution to the COVID-19 outbreak, it is used to help the vaccination process. For instance, Tawakkalna application has been used in vaccination organizing where it helps to identify automatic alerts to determine where the closed vaccination center is and

¹ The Saudi Data and Artificial Intelligence Authority (SDAIA) was set up by a Royal Decree in August 2019.

generate e-pass to those who are already vaccinated to let them free public moving [50]. Another example indicating the importance of AI to Saudi Arabia's economic development, the Global Artificial Intelligence Summit 2020 was held in Riyadh in Oct 2020 [6]. And then Saudi government announced the Line, it is a proposed smart city project where it is in Neom under construction; it seeks to integrate robotics and AI seamlessly into every aspect of citizens' lives [52].

3 Methodology

This exploratory work embraces the most widely recognized methods for data gathering used in qualitative research, interview study. It involves professionals responsible for the adoption of AI technology in the public sector of Saudi Arabia. The case study method was selected because it is suited to explore experiences and views on specific issues [53-55]. The case was chosen for two key reasons that are pertinent to this study. First, this case is considered an exemplar case of a public sector organisation adopting AI technology in Saudi Arabia at different stages, which provided rich awareness of the challenges encountered. Second, a member of the research team had direct access to the case, as they are a citizen of Saudi Arabia, and their doctoral research is funded by the Saudi Arabian government.

The case studied is a public university established in 1998. It is one of the top universities in Saudi Arabia, with more than 70,000 students. This university has earmarked AI & Data department responsible for coordinating the adoption AI to automate more than 137 tasks such as evaluating student performance, student performance prediction, learning outcomes, predicting students learning style, a recommendation system for students, and more [56]. This University classified as F9. Education in OECD Classification where the sectors are categorized by function of government [57].

To select individuals that are representative of the population in the case studied, we employed 'snowball sampling' [58,59]. Five key decision-makers (see Table 1) were interviewed as they had extensive experience with AI hold PhD qualifications in data science.

Table 1. Interviewee profile

Code	Job title	Years of experience
R1	Director of Centre for AI	16
R2	Vice Dean of IT	9
R3	Academic staff in IT	11
R4	E-learning Department and IT project	7
R5	Project Manager and Data Scientist	7

The interviews were conducted remotely using online meeting tools (e.g., Zoom, Microsoft Teams, and Google Meeting). The duration of interviews ranged between 40 and 60 minutes. Semi-structured interviews were used to obtain rich insights to the context of the three cases and the emergent challenges. Interviews were recorded and transcribed, some in Arabic Language and then translated to English. Notes were taken during the interviews. For the purpose of research rigour and anonymity, a code (e.g., R1) was assigned to each interviewee.

Analyses of the data was guided by the Gioia method [cf. 66, 67] as this method can extract novel insights by carefully investigating how different actors of an organizational process experience events (i.e., adoption of AI). The Gioia method also facilitates ‘research rigor’ [ibid] as it enables inductive researchers to use systematic, conceptual, and analytical discipline, that can lead to findings that are credible.

4 Analysis and Findings

Analyses of the data was guided by the Gioia method as it facilitates ‘research rigor’ [66, 67], by enabling researchers to use systematic, conceptual, and analytical discipline, that can lead to findings that are credible. The key findings that emerged from the interviews are presented in the remainder of this section.

Theme 1: Fear of AI

Fear of failure: a number of employees have the ability and capability to learn and master new experiences. However, to adapt to a complex technology like AI, most university staff fear failure. This was explained by one of the managers in the department when he commenced that:

“ The employees in some departments have passion about AI, but they fear failure”. **R4**

Losing Jobs: Job security is the main challenge factor for employees who work **routine** jobs. They are not aware of AI, which uses as assisting tools not to replace their jobs. One of the respondents said:

“Many employees are influenced by the media about AI danger and the uncertainty of the future when using AI”. **R3**

Theme 2: Administrative Challenges

Understanding the significance of Data and AI technology: at the administrative level, some managers are not aware of AI and Data's importance to ease the decision-making process. One of the interviewers mentioned this in his statement:

“ There are some decision-makers who are still stuck working on a traditional way. They don't want technological intervention or any innovations to interrupt the

ngoing processes. It is difficult to deal with them or convince them of the benefits of the technology in facilitating work". R5

Department Collaboration: at the administrative level with the same organization, they have a conflict where different colleges, departments, and sections have a different system. Some departments do not integrate with some initiatives launched AI center. They do not share data, *"There is no administrative incorporation with each other, as each department has a different system"....." No one wants to take the responsibility to share data, as we still do not have any regulation or rules to manage this". R3*

Theme 3: Issues with Data

Data Digitalization: Digital transformation will also contribute to achieving sustainable development goals. There is a massive amount of data at the university still saved and stored handily way, one of the E-learning Department and IT project team reported:

"We have a huge number of documents still stored in a traditional way, paper-based stores. It takes years to Digitalize it". R4

Big Data: Dealing with big data is a significant challenge facing organizations. Big data management and engineering require efforts to handle data size, variety, and processing methods. It also demands a suitable infrastructure and tools and needs advanced technology to store, clean, update and analysis, etc. the Dean of Information Technology reported:

"We have a large volume of data, 75K students, and each student has dedicated data. In addition, university's materials, employees' databases, etc. This huge number needs to be managed efficiently also need a well technological infrastructure must be established to manage it". R5

Lack of Data Specialist: Data expert can be someone who has the capability to deal with data warehouse tools as well as an individual or group of specialists to build, clean, engineering, and preparing data for AI algorithmic models. Specialization and expertise are other important aspect of implementing AI technology in the public sector. Some organizations called them data scientists where other data engineers. In Saudi Arabia, this skill is absent, especially for someone with relevant skills to support and promote AI development.

" To build a solid infrastructure, we need manpower, such as database administrators, data scientist, data engineer, we need a real data scientist who has a good experience, not those who attended three months online course". R5

Data Governance: One of the problems that is almost repeatedly mentioned by most of the interviewees was Data governance, policies, and guidelines. In the use of AI, we are in circle one of Data accessibility and regulations. The Director of the Centre for AI stated:

“We don’t have ethical regulations for using AI and its consumed Data specifically here in the university, and you could use that as the novelty of your research”. R1

Furthermore, another informant shared a similar view saying *“There are many legislations for the uses of technology in the university such as not inappropriately using personal data also not disclosing them, but currently, there is no governance and legislation for artificial intelligence and its structured data”. R2*

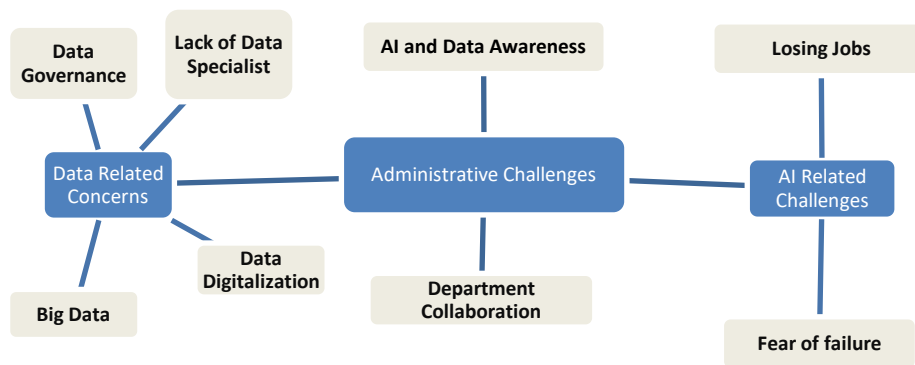


Table 2. Challenges to AI adoption

5 Discussion and Implications

Within the scope of our literature research, the scientific contribution to this study is inspired by its usefulness and originality. First, the most significant contribution of this research is addressing eight main challenges of AI adoption and Data in the context of public sector organizations in Saudi Arabia. Second, by providing an empirical review of the existing adaption plan and concerns related to AI and Data as Interdependence phases. Further, the insights achieved from this study offer implications in AI and data opportunities and challenges which helps decision-makers in the public sector to consider when adopting AI technologies.

Implications for research: As our research develops upon existing AI adoption literature in a public sector, it contributes to the original knowledge [62,63]. This research helps develop and implement AI adoption and placement policies that can contribute to embedding AI-based capabilities within and throughout the organization, leading to both business and social value to be generated by the specific AI technology. An implication for public sector leaders and key decision-makers is the need. Besides, research on AI adoption still lacks in the public sector, and its outcomes need to be regulated.

Implications for practice: based on the convincing evidence currently available, our research seems fair to suggest practical insights. First, it delivers a first overview step of the challenges associated with adopting AI in the public sector in Saudi Arabia. An implication for public sector associations targeting at development of AI-based public services is the need to review the organizational readiness [64]. This includes considerations of social and technical aspects. Second, despite the potential benefits of AI in the public sector, one of the AI adoption challenges that key decision-makers should consider as fundamental issues are data-related challenges that should not be set aside. As examples of these obstacles, data availability, quality, confidentiality, ethics, and integrity. There will be additional costly effort associated with collecting, storing, and sharing AI technology-derived large data sets. This cost can be related to the budget or extra space and management requirements for data storage, cleaning, integrating, readiness, validation, and infrastructure tools. Although, if the data are not accessible, AI adoption is a waste of effort and might fail.

6 Conclusion and Future Work

In this study, we focused on the challenges of AI in the context of a public sector organization in Saudi Arabia. As with all research, however, we acknowledge this study has two limitations, which also offer directions for future research. First, the collection and analysis of the data from a single case study limits generalisability of the findings. Future research could focus on multiple case studies of public sector organizations in Saudi Arabia or other countries. Despite this limitation, this paper provides a starting point to study the adoption of AI in the context of public sector organizations in Saudi Arabia.

To conclude, adopting AI requires consideration of not just its technical characteristics, but to take into consideration the context of its intended use and the readiness of the organization as a whole. Concluding, public sector organizations need to continually learn how to balance the social and technical aspects of AI as both can directly and indirectly have a positive or negative impact on people internal and external to the organization.

References

1. Pomerol, J.-C., "Artificial intelligence and human decision making". *European Journal of Operational Research*, 99(1), 3–25, 1997.
2. Mikalef, Patrick, Fjørtoft, Siw & Torvatn, Hans, "Artificial Intelligence in the Public Sector: A Study of Challenges and Opportunities for Norwegian Municipalities." *Digital Transformation for a Sustainable Society in the 21st Century*, 267–277, 2019.
3. Brynjolfsson, E. & McAfee, A. "The second machine age: Work, progress, and prosperity in a time of brilliant technologies". *New York, NY: WW Norton & Company*, 2014.

4. Grosz, B. J., Mackworth, A., Altman, R., Horvitz, E., Mitchell, T., Mulligan, D., & Shoham, Y.. Artificial intelligence and life in 2030: One hundred years study on artificial intelligence. *Edited by Stanford University*. (2016)
5. Hendler, J., Avoiding another AI winter. *IEEE Annals of the History of Computing*, 23(02), pp.2-4, 2008.
6. O. Hassan, "Artificial Intelligence, Neom and Saudi Arabia's Economic Diversification from Oil and Gas," *Polit. Q.*, vol. 91, no. 1, pp. 222–227, 2020.
7. Vaishali Advani, "What is Artificial Intelligence? How does AI work, Types and Future of it?", Available at: <https://www.mygreatlearning.com/blog/what-is-artificial-intelligence/> (Accessed: 31/03/2021).
8. C. Clifford "Google CEO: AI is more important than fire or electricity", CNBC, 2018; <https://www.cnbc.com/2018/02/01/google-ceo-sundar-pichai-ai-is-more-important-than-fire-electricity.html> (accessed 25 March 2021).
9. Bole, U., Popovič, A., Žabkar, J., Papa, G., & Jaklič, J. "A case analysis of embryonic data mining success". *International Journal of Information Management*, 35(2), 253–259, 2015.
10. Duan, Y., Edwards, J. S. & Dwivedi, Y. K. 'Artificial intelligence for decision making in the era of Big Data – evolution, challenges and research agenda', *International Journal of Information Management*. Elsevier, 48(January),63–7, 2019.
11. Jarrahi, M. H. "Artificial intelligence and the future of work: Human-AI symbiosis in organisational decision making". *Business Horizons*, 61(4), 577–586, 2018.
12. Agrawal, A., Gans, J., & Goldfarb, A. "How AI will change the way we make decisions". Harvard Business Press, 2017.
13. Herrera, J.L.L., Figueroa, H.V.R., Ramírez, E.J.R." Deep fraud. A fraud intention recognition framework in public transport context using a deep-learning approach. In: 2018 *International Conference on Electronics, Communications and Computers*, pp. 118-125. IEEE, 2018.
14. Davenport, T. H. & Ronanki, R." Artificial intelligence for the real world". *Harvard Business Review*, 96(1), 108–116, 2018.
15. Park, D. "A Study on Conversational Public Administration Service of the Chatbot Based on Artificial Intelligence". *Journal of Korea Multimedia Society* 20, 1347-1356, 2017.
16. Coldeway D" AI and big data won't work miracles in the fight against coronavirus". *Techcrunch* (26 March), 2020.
17. Fleming N "Computer-calculated compounds: researchers are deploying artificial intelligence to discover drugs". *Nature* 557:S55–S57, 2018.
18. Segler M, Preuss M, Waller M "Planning chemical syntheses with deep neural networks and symbolic AI". *Nature* 555:604–610, 2018.
19. Smith S" 6 things we learned about artificial intelligence in drug discovery from 330 scientists". *BenchSci Blog* (19 September), 2018.
20. Mikalef, P., Boura, M., Lekakos, G., Krogstie, J. "Big data analytics and firm performance: Findings from a mixed-method approach". *Journal of Business Research* 98, 261-276, 2019.
21. Wilson, H.J. and Daugherty, P.R.,"Collaborative intelligence: humans and AI are joining forces". *Harvard Business Review*, 96(4), pp. 114-123, 2018.
22. Cellan-Jones, R. (2014). Stephen Hawking warns artificial intelligence could end mankind. Retrieved from <https://www.bbc.co.uk/news/technology-30290540> [Accessed on 11/03/2021].
23. Grandhi, B., Patwa, N., Saleem, K. "Data driven marketing for growth and profitability". In: *10th Annual Conference of the EuroMed Academy of Business*, 2017.
24. Reis, J., Santo, P. E., & Melão, N. " Artificial Intelligence in Government Services: A Systematic Literature Review". *New Knowledge in Information Systems and Technologies*, 241–252, 2019.

25. [S. Russek. and P. Norvig, "Artificial Intelligence A Modern Approach" *2nd Ed.*, vol. 53, no. 9. 2019.
26. Mikhaylov, S., Esteve, M. and Campion, A. "Artificial intelligence for the public sector: opportunities and challenges of cross-sector collaboration". *Philosophical transactions of the Royal Society of London. Series A: Mathematical, physical, and engineering sciences*, 376(2128), 20170357,2018.
27. Thierer, A., A. Castillo O'Sullivan, and R. Russel (2017) Artificial Intelligence and Public Policy. *Mercatus Center - George Mason University*. Available at: <https://www.mercatus.org/publications/artificial-intelligence-public-policy> [Accessed 28th March 2021].
28. Zheng, Y., H. Yu, L. Cui, C. Miao, C. Leung, and Q. Yang "SmartHS: An AI Platform for Improving Government Service Provision." *Association for the Advancement of Artificial Intelligence*, January 22, 2018.
29. Eggers, W. D., Schatsky, D. and Viechnicki, P. "AI-augmented government. Using cognitive technologies to redesign public sector work", *Deloitte Center for Government Insights*, pp. 1–24, 2017.
30. [Y. K. Dwivedi *et al.*, "Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy," *Int. J. Inf. Manage.*, vol. 57, no. August 2019, p. 101994, 2019.
31. DIN & DKE."German standardization roadmap industry 4.0". V3,2018.
32. IDC. "Automation and Customer Experience Needs Will Drive AI Investment to \$5 Billion by 2019 Across European Industries" 2019.
33. The World Economic Forum , Available at: <https://www.weforum.org/> (Accessed: 11th March 2021).
34. Samir Salama (2020) Saudi Arabia approves policy on Artificial Intelligence, expects SR500b windfall by 2030, Available at: <https://www.prnewswire.com/ae/news-releases/data-and-ai-to-add-more-than-usd-10-billion-to-saudi-arabia-s-economy-825535205.html> (Accessed: 31/03/2021).
35. Cision Global Blog (2020) Data and AI to Add More Than USD 10 Billion to Saudi Arabia's Economy, Available at: <https://www.prnewswire.com/ae/news-releases/data-and-ai-to-add-more-than-usd-10-billion-to-saudi-arabia-s-economy-825535205.html> (Accessed: 30/03/2021)
36. Palmer, M., Data is the new oil, 2006. https://ana.blogs.com/maestros/2006/11/data_is_the_new.html. Accessed(March 6, 2021)
37. Hays, J., & Efros, A. A. "Scene completion using millions of photographs". *ACM Transactions on Graphics (TOG)*, 26(3), 4, 2007.
38. B. W. Wirtz and W. M. Müller, "An integrated artificial intelligence framework for public management," *Public Manag. Rev.*, vol. 21, no. 7, pp. 1076–1100, 2019.
39. Yan L, Zhang H-T, Xiao Y, Wang M, Sun C, Liang J, Li S, Zhang M, Guo Y, Xiao Y, Tang X, Cao H, Tan X, Huang N, Luo A, Cao BJ, Xu ZH, Yuan Y "Prediction of criticality in patients with severe Covid-19 infection using three clinical features: a machine learning-based prognostic model with clinical data in Wuhan". *MedRxiv*,2020.
40. Jiang X, Coffee M, Bari A, Wang J, Jiang X, Huang J, Shi J, Dai J, Cai J, Zhang T, Wu Z, He G, Huang Y "Towards an artificial intelligence framework for data-driven prediction of coronavirus clinical severity". *Comput Mater Contin* 63(1):537–551,2020.
41. Manyika, J., Lund, S., Chui, M., Bughin, J., Woetzel, J., Batra, P., Ko, R. and Sanghvi, S., ". Jobs lost, jobs gained: Workforce transitions in a time of automation. McKinsey Global Institute, 150, 2017.

42. Zandi, D., Reis, A., Vayena, E., & Goodman, K. " New ethical challenges of digital technologies, machine learning and artificial intelligence in public health: A call for papers". *Bulletin of the World Health Organization*, 97(1), 2, 2019.
43. Floridi, L. "Group privacy: A defence and an interpretation". In *Group privacy* (pp. 83–100). Springer International Publishing, 2017.
44. Mittelstadt, B. D., Allo, P., Taddeo, M., Wachter, S., & Floridi, L. "The ethics of algorithms: Mapping the debate. *Big Data & Society*", 3(2), 2016.
45. Müller, V. C., & Bostrom, N. " Future progress in artificial intelligence: A survey of expert opinion. *Fundamental issues of artificial intelligence*" (pp. 555–572). Cham: Springer, 2016.
46. Gasser, U., & Almeida, V. A. F. "A layered model for AI governance". *IEEE Internet Computing*, 21(6), 58–62, 2017.
47. Mehr, H. " Artificial intelligence for citizen services and government". Cambridge, MA: Harvard Kennedy School, Ash Center for Democratic Governance And Innovation, 2017.
48. Filho, W. L. *Handbook of Sustainability Science and Research*, Manchester, Springer, 2017
49. Nabbout, M. (2019, September 4). What you need to know about Saudi Arabia's new AI authority? [Video file]. Retrieved from <https://stepfeed.com/what-you-need-to-know-about-saudi-arabia-s-new-ai-authority-1276>, [Accessed on 28/03/2021].
50. Tabaud (2020) Tabaud, Available at: <https://tabaud.sdaia.gov.sa/IndexEn> (Accessed: 11th March 2021).
51. Tawakkalna (2020) Tawakkalna, Available at: <https://ta.sdaia.gov.sa/en/index> (Accessed: 11th March 2021).
52. Cajsa Carlson, " Saudi Arabia announces plans for a 100-mile, car-free linear city called The Line", Available at: <https://www.dezeen.com/2021/01/13/line-saudi-arabia-170-kilometres-long-city-neom/> (Accessed: 28/03/2021).
53. Benbasat I, Goldstein DK and Mead M. "The Case Research Strategy in Studies of Information Systems". *MIS Quarterly* 11: 369-386, 1987.
54. Eisenhardt, K. and Martin, J., " Dynamic capabilities: what are they?." *Strategic Management Journal*, 21(10-11), 105-1121, 2000.
55. Gill, P., Stewart, K., Treasure, E. "Methods of data collection in qualitative research: interviews and focus groups". *Br Dent J* 204, 291–295, 2008.
56. Alwalidi, A. and Lefrere, P. "Making E-I Invisible: Experience King Khalid Saudi Arabia", *Educational Technology*, 50(3), pp. 4–7, 2010.
57. OECD "COFOG: Classification of the functions of government". *Government at a Glance*, 194–195, 2011.
58. Naderifar, M., Goli, H., & Ghaljaie, F. " Snowball sampling: A purposeful method of sampling in qualitative research". *Strides in Development of Medical Education*, 14(3), 1-6, 2017.
59. Noy, C. "Sampling knowledge: the hermeneutics of snowball sampling in qualitative research". *International Journal of Social Research Methodology*, 11(4), 327-344, 2008.
60. Pratt, M.G., " Fitting Oval Pegs into Round Holes". *Organizational research methods*, 11(3), 481–509, 2008.
61. Metcalfe, M., *Theory: Seeking a plain English explanation*. JITTA: Journal of Information Technology Theory and Application, 2004. 6(2): p. 13.
62. Weick, K.E., *Theory construction as disciplined imagination*. *Academy of management review*, 14(4): p. 516-531, 1989.
63. Weiner, B. J. "A theory of organizational readiness for change". *Implementation science*, 4(1), pp. 1-9, 2009.
64. Fast, E., & Horvitz, E. " Long-term trends in the public perception of artificial intelligence". *Proceedings of the Thirty-First AAAI Conference on Artificial Intelligence (AAAI-17)*, 963–969, 2017.

65. Gioia, D. and Chittipeddi, K., (1991). Sensemaking and sensegiving in strategic change initiation. *Strategic Management Journal*, 12(6), 433-448.
66. Gioia, D., Corley, K. and Hamilton, A., (2013). Seeking Qualitative Rigor in Inductive Research. *Organizational Research Methods*, 16(1), 15-31.