Exploring the Adoption of the Artificial Intelligence in the Public Sector

[a]Vasileios Yfantis, [b]Klimis Ntalianis,

[a]University of West Attica, Greece, v.ifantis@uniwa.gr

[b]University of West Attica, Greece,kntal@uniwa.gr

Abstract

The evolution of artificial intelligence boosts its usage in the private sector, however the public sector seems to lag behind. There are specific reasons which prevent the public servants and the citizens from using this innovative technology. This paper first identifies the advantages and potential challenges for the implementation of the artificial intelligence in the public sector to prove its benefits. Afterwards, a gamification framework called Octalysis is suggested as a technique to affect the intention of the stakeholders to use the artificial technology. Octalysis consists of 8 core drives that describe the types of motivations and the game elements that the ideal gamified system should have. Finally, the Octalysis model is applied on an existing chatbot of the public sector which is used to offer information about the public administration of Dubai. The application of Octalysis results in the rating of the information system regarding its potentiality of becoming a gamified system.Finally, several game elements are suggested to improve the overall score of the system and help the usersto adopt successfully the artificial technology. The practical value of this paper lies in the fact that it suggests gamification and Octalysisas a useful tool for decision makers that aim to adopt this technology in public organizations.Games could be the next big thing in both entertaining and helping the public sector to use new technologies. Unless the public administration adopts this exciting concept then the citizens will lose the opportunity to enjoy all the benefits that AI will offer for the digital world.

Keywords

Artificial Intelligence,

Gamification,

Public Administration,

Technology Adoption,

Chatbot,

Algorithm,

Octalysis

1. Introduction

The exploration of the artificial intelligence (AI) began in the decade of the 1940s [1] [2] and continued through the 2010s [3] [4] and beyond. The AI systems are operating without the participation of the human element, by detecting, learning patterns and ending in logic decision-making [5]. Moreover, AI refers to the ability of specific devices to think by examining their environment, analyzing the data and acting towards the achievement of a successful goal [6]. The trend of artificial intelligence has been applied in several sectors and became a topic of discussion for the scientific community. The public sector is one of the late AI adopters, however at the moment, numerous countries decided to use AI due to its potentiality [7].

The implementation of AI in the public sector features the design, editing and use of the appropriate algorithms and technical methods that lead to the management of the public offices. Machine learning and deep learning are two AI technologies who contribute in the management of big data. The public sector benefits from the management of the big data because it helps in the identification of patterns that define the decision-making in cost savings and re-use of the organization's resources. The effectiveness of AI

technology depends on the both quality and quantity of the retrieved data that the AI system uses to detect patterns [8]. The more data the AI system gathers the more effective the output of the system will be.

The importance of the AI in the public sector is defined by the fact that the public personnel is not always enough to monitor and manage all the transactions carried out in the public sphere. The use of the social media in the public administration [9] produces a large amount of data that could be useful for the public administration. The quantity of the social comments, the identification of public trends and other factors, are data that the AI technology can handle and make decisions based on this information. In other words, AI could take a central role in the governance of a country by monitoring the online behavior of the citizens.

The use of artificial intelligence in the private sector is known to almost everyone that uses the client services of various companies. For instance, there is almost always an AI call agent that answers technical questions upon calling to report a technical issue with the internet services at home. Moreover, when someone shops online, there are virtual AI agents that suggest the best commercial offers based on the detection of shopping behavior patterns. While the private companies have found the value of the AI in the transactions with the public, the research of the AI use in the public sector is still limited. The scope of this paper is to explore the use of the artificial intelligence in the public administration by identifying the needs, upcoming trends and challenges of the sector. The methodology is an exploratory research which will present the most important concepts and analyze them from an information management perspective. The contribution of this paper lies in the fact that the public decision makers will find how to use AI as a tool to improve the decision-making and adopt this technology in the government.

2. Application of AI in the Public Sector

The implementation of the AI in the government is present in critical departments of the government, such as the health care. In 2010, several hospitals in Great Britain used a disease surveillance system which is based on machine learning technology [10]. The adoption of the machine learning algorithms was successful, since the system managed to reduce the spreading of viruses. AI in the healthcare sector could be a very helpful tool. Whether a researcher uses supervised or unsupervised learning algorithms, the output leads to interesting results. Another critical condition sector of the government, is the national safety. The usage of AI for security reasons could lead to the prediction of crime in the urban areas. In the early 2010s, a police department in California adopted AI to find areas where criminal incidents would take place [11]. The results were impressive, since the AI's output contributed to a reduction of property crimes, up to 27%. The probability that a criminal activity will occur, could be calculated based on the condition that another criminal activity has already taken place. The machine learning algorithm of Baye's Theorem, calculates the probability of a hypothesis by taking into account prior knowledge [12]. In this case if we use the algorithm of Baye's Theorem, then we could end up calculating the probability of someone to act illegally. Baye's Theorem is defined as [13]:

$P(h|d) = (P(d|h) \, P(h)) \, / \, P(d)$

- $P(h|d)$: The probability that hypothesis h is true, based on the data d.
- $(P(d|h)$: The probability of submitted data if hypothesis h is true.
- $P(h)$: The probability that hypothesis h is true (regardless of the data).
- $(P(d|)$: The probability of the data (regardless of the hypothesis).

For instance, it is assumed that 100% of citizens associated with illegal activity are in a specific financial status. When another citizen is in the same status, it does not mean that this person has a 100% chance of becoming a criminal. By taking into account the incidence rate (1/100000 and 1/10000 non-criminals people with the same financial status worldwide) we submit data to the algorithm and retrieve results about the probability of people with certain income to become criminals. The results will help the police to monitor the annual income of people in an area and predict the potential criminal record profile of those persons. Consequently, the police could plan the appropriate number of personnel that is required to guard in the neighborhoods.

Another interesting example of AI application in the public sector, was implemented in the country of Australia. The Australian authorities in charge of the tax services, created an AI bot that answers citizens

questions for the taxes [14]. The result was an increase of first contact resolution rate to 80% [15]. The chatbot systems consist of three elements [16]: A knowledge base, a chat engine interface and an interpreter program that communicates with the interface. The citizen enters a question (data input) which is being analyzed by the system and looks for a potential answer in the knowledge base. Then the system displays an answer with the help of the natural language processing (NLP) and artificial intelligence. The value of the AI chatbot system lies in the fact that the AI learns patterns from the human behavior and business information for a specified business database. The citizens benefit from both those elements because the client service is information driven without the unexpected factors of the human intervention. While this system is virtually located, it could be physically installed in a real office. The suggested system would consist of a chatbot system inside an empty public office which is connected to an internet of things (IoT) system. The citizen will enter questions and several sensors around will measure his/her blood pressure/temperature, etc. In case the sensor spots that the heart rate or blood pressure is high then it probably means that the citizen is feeling angry due to issues with chatbot system. The sensors will transfer this type of information to an administrator device, who will call a real public servant to come inside the office and answer the questions.

Of course there are other examples of AI application in the public sector as well. However, by taking into account the advantages of the technology, it is important to find out about the challenges of the technology's implementation as well.

3. Challenges of AI in the Public Sector

The adoption of AI technology in the public sector is the first issue that the decision makers have to deal with. There are case studies who prove the value of AI in the public sector. Nevertheless, what are the factors that influence the successful implementation of the AI in the public sector? There are several scholars that argue about how challenging the implementation of AI [17] is and how weak or unsuccessful the implementation could be [18].

Security is a factor which absolutely affects the likelihood of implementing the AI technology. It is common knowledge that the AI system learns from a behavior and makes decisions based on this knowledge. What would happen if the system adopts a negative behavior [19] [20]? This is a serious issue that could transform AI from a prediction tool to a destruction tool. Consequently, there should be a security mechanism behind the AI implementation which defines the positive or negative behavior. Maybe an ambient intelligent methodology or an IoT one which detects the human condition with the sensors. In this case, sensor signals that detect a risky human condition could boost a mechanism that interrupts the implementation of the AI process.

Privacy of the citizen's data is a factor that the information technology personnel of the government should also take care. The non-authorized access to the AI system could allow the loss or modification of critical data. Especially, the issue of privacy is also discussed in the use of AI surveillance systems that act as a monitoring system for very sensitive data [21].

Data quantity and quality are two additional factors that could influence the implementation of AI in the public administration. The more data the system retrieves the more patterns identifies for analysis. In sectors such as healthcare, the quantity of data is low [22] which makes the AI less effective. On data quality level, the integration of data is a critical issue because there should be a connection between types of data in the database such as demographic with clinical data [23].

Expertise is the next factor that will adopt the implementation of AI in the public sector. The value of the AI system depends on the people who will design and modify its features. The lack of data scientists with the appropriate skills, could reduce the development rate of AI in the public sector. The human resources department of the government should offer a competitive advantage to hire the specialists.

At last but not least, the ethical issue of machines replacing the human beings [24] boosts reactions from the employees and not only. Is a smart machine more important than a skilled worker? How many public servants are going to lose their jobs? The fact that AI systems have no emotion and consciousness [25] compared with the humans, poses the question if an emotionless entity could make decision about an entity with emotions.

These are numerous challenges that are points of discussion for the public decision makers that want to adopt the AI in the government. Moreover, there are other challenges related to the managerial side of the

implementation such as economic and organizational changes. Since this research work is in process, more details will be published in a next paper which will categorize and analyze each different challenge.

4. Adoption of AI in the Public Sector

The adoption of the artificial intelligence in the public sector needs a successful framework which will foster both citizens and public servants to trust it. A potential implementation of the AI (Artificial Intelligence) in the public administration could be adopted through a gamified technique. Gamification is a methodology to use game elements in a non-game environment [26]. According to a research by Sailer, gamification targets the motivational mechanisms and as a result of that, enhances the motivation [27]. The concept of gamification has been successfully used in the public sector [28] and there is an ongoing discussion about the transformation of the public services to a gamified environment [29].

On empirical research level, scholars have detected that gamification affects positively the intention to use an information system such as the mobile banking services [30]. If gamification affects the intention to use a new technological framework (m-banking) then why not using it to affect the potential usage of the AI public information services? The suggested framework of this paper is a gamification model called Octalysis which was developed by Yu-kai Chou [31]. The model features 8 core drives of motivation that are associated with game elements.

A.   Epic Meaning & Calling

This is the core drive where the player feels that he was chosen to implement something brave and great. This type of person likes contributing in the community and that is why he/she spends a lot of time on developing things for the community.

B. Development & Accomplishment

This core drives describes a player who wants take risks and likes to get trained.

C. Empowerment of Creativity & Feedback

This type of player intends to take care of issues by taking into account his creative skills and moreover seeks for feedback about his actions.

D. Ownership & Possession

This core drive describes players who feel that they should own a virtual or a tangible asset.

E. Social Influence & Relatedness

This core includes the social features that the play player feels comfortable with. For instance, this drive is related to game elements such as companionships, social reactions and competition.

F. Scarcity & Impatience

This core drive is related to the player who is not able of having instant access to an asset or the access is very difficult.

G. Unpredictability & Curiosity

This is a motivating element of gamification because the player might remain logged in the game's environment because he is curious or cannot predict what is coming up next.

H. Loss & Avoidance

This is a motivating core drive which is associated with the loyalty of the player to the game's system because otherwise might lose something he considers valuable (e.g. data).
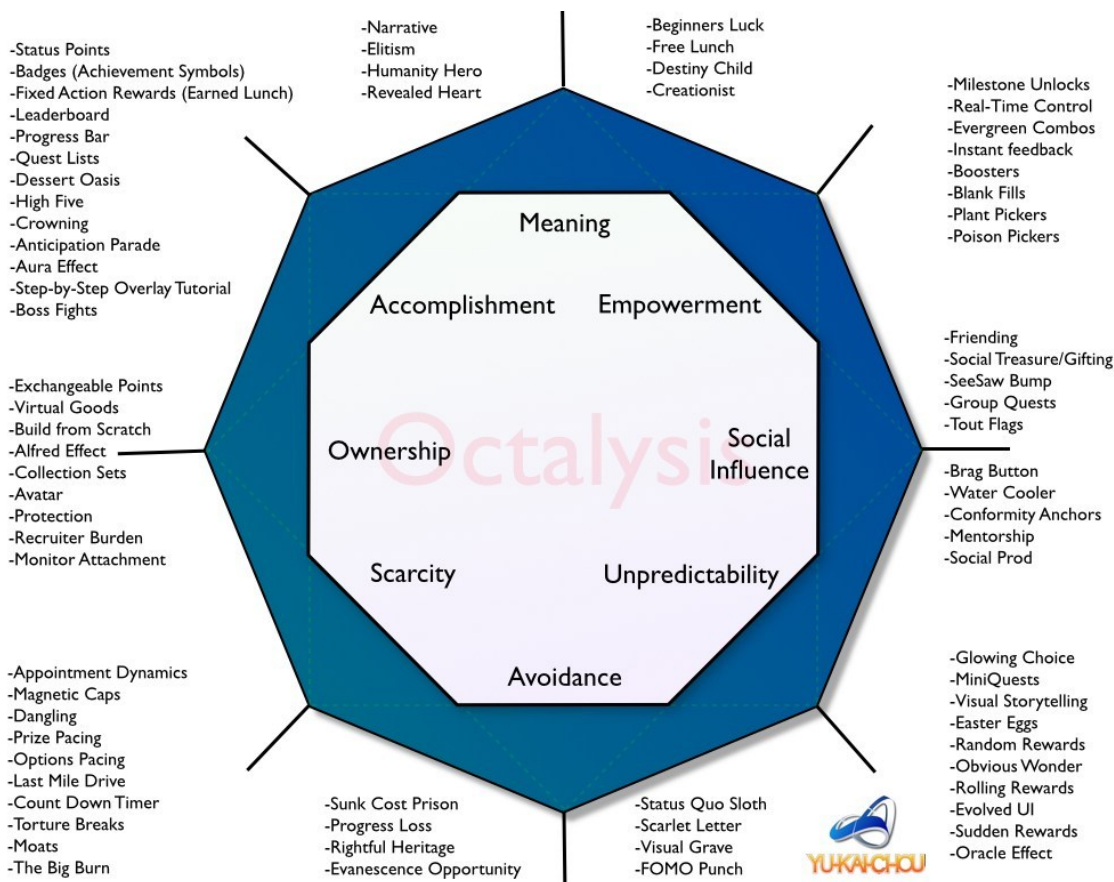
Figure 1: OctalysisModel

The value of this model lies in the fact that by applying Octalysis to a system, the researcher could rate how gamified is the system. Since gamification is crucial for the adoption of a new technology, then the rating of an AI system could reveal its strengths and weakness on the intention to be used by its stakeholders. There are several cities that have used AI systems to offer public services, one of them is Dubai that launched the AI chatbotRammas [32]. Rammas was developed by the Dubai Electricity & Water Authority and on 17th January 2017 and is capable of communication in both English and Arabic. The development of the chatbot was implemented on Google AI platform and its role is to receive requests from citizens, process the data and make decisions based on AI techniques.
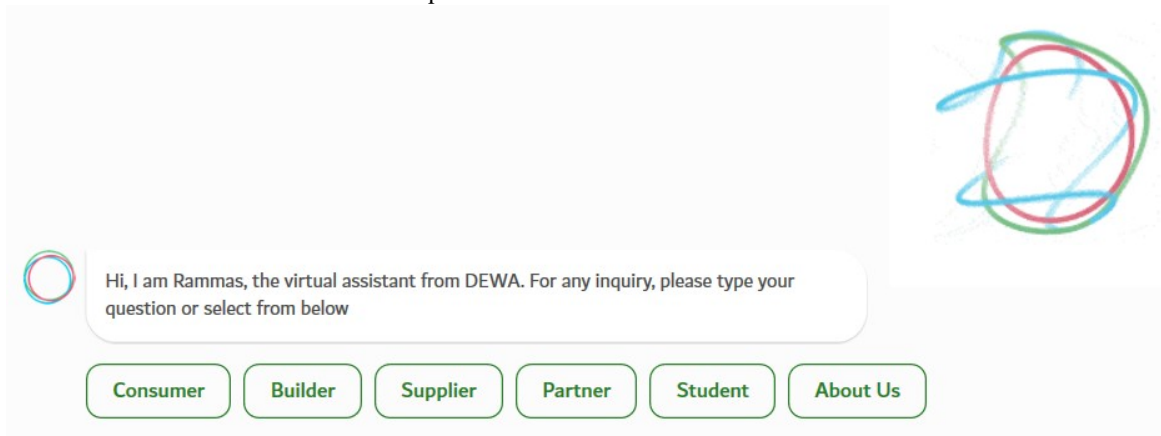

Figure2 :RAMMAS chatbot system of Dubai

We tested the chatbot of Rammas by trying to make requests and interact with it to detect its gamified characteristics. The tool to rate its performance on motivation level (8 Core Drives) is the Octalysis online

rating tool which is available here: https://www.yukaichou.com/octalysis-tool/. The process of rating the chatbot resulted in the total score of 95. Rammas seems to have few high rated gamified features, such as Ownership & Possession and Scarcity & Impatience. The citizen by reading the answers of Ramma feels that he should own or have access to some benefits that Dubai offers. Moreover, the content of the information is sometimes limited and difficult to reach from the citizens, a fact that increases the Scarcity score. The other core drives of Octalysis are somehow limited and the whole experience of the chatbot is not gamified friendly.

Figure 3: Applying Octalysis for the rating of RAMMAS chatbot system

Our suggestion is that the city of Dubai could add game elements such as milestone unlocks and boosters to foster the empowerment of the user. A powerful user could be a powerful citizen that will appreciate this gift from the government. On Social Influence level, it would be interesting for the Rammas to offer abilities for the user to share the received information on the social media. Friending and companionships are some other game elements that the chatbot could offer to the citizens. For instance, if there is a difficult question from the citizen then the system could display a virtual friend for helping the person. Unpredictability is another core drive which the chatbot seems to have low performance. Game elements such as Easter Eggs could increase the rating of this core drive. For an example, while the citizen chats with Rammas, the system could offer an unpredictable opportunity for a live phone call with a real public servant!

5. Conclusion and Future Scope

The paper discusses the use of artificial intelligence in the public sector by taking into account its current applications and challenges of technology's implementation. According to our research, the most significant challenges are: Technology adoption, security, privacy, data quantity/quality, expertise and ethical issues. The potential use of AI in the public sector will minimize the cost of the public expenses by identifying behavior trends of the citizens and re-using available data assets.

Gamification is a technique that should be taken into account seriously for the motivation of the users to start using AI applications towards their interaction with the government. However, as a requirement the governments have to invest time and money for testing other gamification models such as Octalysis. The advantage of Octalysis is that it could be adopted easily even from people with limited academic background. On the other hand, if other scholars try to prove empirically the academic value of each core drive then a new framework will be created with less or more core drives.

The research agenda for the future usage of the artificial intelligence in the public sector should include forthcoming technological trends such as blockchain and internet of things. The integration of these technology trends in the public sector is the elixir for infinite issues such as lack of resources and allocation of the public spending on buying new tools for the business continuation of the government.

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Author'sBiography

Yfantis Vasileiosis a Phd candidate in the University of West Attica andholds an MSc in Information Technology with Web Technology (University Of The West Of Scotland) and an MSc in Information Security (Luleå University of Technology). He has also been a freelance journalist for more than 15 years by contributing content to both electronic and printed media. As a researcher, he has presented conference papers in both Europe and Africa. The main areas of his research interests feature: Information Communications Technology, e-Tourism, Digital Divide, e-Government, Digital Entertainment Industry.

Dr KlimisNtalianisreceived his diploma and PhD both from the Electrical and Computer Engineering Department of the National Technical University of Athens (NTUA) in 1998 and 2003 respectively. Between 2004 and 2006 he has completed two Post-docs in the areas of multimedia protection and emotion analysis. From 1998 till 2009 he was a Senior Researcher at the IVM Lab of NTUA, where he has participated in more than 20 R&D projects under different calls from the General Secretariat of Research and Technology (GSRT) of Greece, the Research Promotion Foundation of Cyprus (RPF) and the European Union. In parallel and from 2005 till 2011 he has worked as an adjunct lecturer at the University of Peloponnese, the Hellenic Naval Academy, the Hellenic Air Force and the Cyprus University of Technology. From March 2018 he is an Associate Professor at the University of West Attica. Dr. Ntalianis has written more than 120 scientific articles and has received more than 600 citations. His main research interests include information processing, social computing and multimedia security.

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