

Adoption of Artificial Intelligence (AI) in Local Governments: An Exploratory Study on the Attitudes and Perceptions of Officials in a Municipal Government in the Philippines

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ABSTRACT. Emerging technologies like artificial intelligence (AI) have been instrumental in transforming governments in recent years, which is why several agencies worldwide have integrated them into their governance strategies. One of the countries that have paid attention to the potential of AI is the Philippines, which launched its national AI roadmap in 2021. This study investigated the perceived acceptance and adoption of AI in the Municipality of Carmona located in the Province of Cavite. Following the combined constructs from the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT), perception data were gathered from among Carmona's local executive and department administrators. The study found moderate to high levels of positive attitude and behavioral intention toward the use of AI in government operations. Moreover, correlation analysis revealed that all acceptance and adoption factors had positive moderate to very strong relationships with the attitude and behavioral intent to use AI, except for the anxiety factor, which only had significantly negative moderate to very weak correlation with attitude toward AI. As component of the sequential mixed-method design, the thematic analysis provided context to the findings. This paper contributes to the growing literature on the governance, acceptance, and adoption of AI in governments.

Keywords: *artificial intelligence, local government, TAM, UTAUT, Philippines*

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INTRODUCTION

Technology is ever evolving, and these changes cause some disruptions to the way humans live. Technology experts have coined this phenomenon as disruptive technology. Girasa (2020a) described the stages of disruptive technology in two models. The first model consists of three stages: paralysis, reaction, and transformation, whereas the second model is composed of five stages: confusion, repudiation, shaming, acceptance, and forgetting. Both models depict how disruptive technologies cause organizations, including the public sector, to freeze at the initial stage to observe and study the new technology. After a series of positive and negative reactions, the organization, along with its stakeholders (e.g., citizens), learns how to accept and adopt the technology. Through the years, various disruptive technologies have emerged (Girasa, 2020a) such as cloud computing, blockchain, the Internet of Things, and the focus of this paper – artificial intelligence (AI).

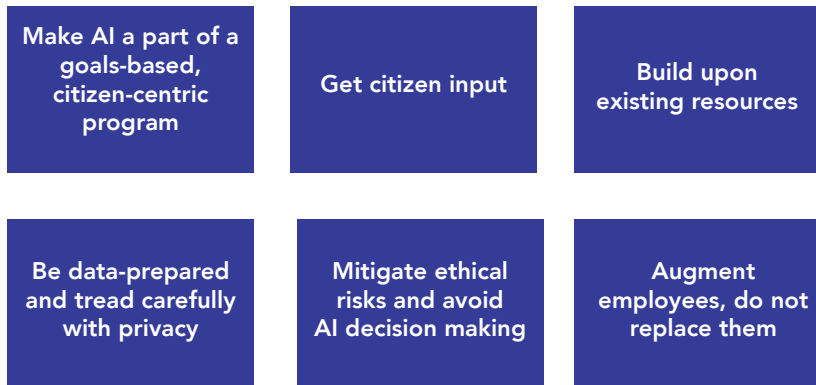
Various governments have started integrating AI into their strategies (United Nations [UN], 2020; Girasa, 2020b; International Telecommunication Union [ITU], 2017a). However, others still have some reservations, especially in developing countries such as the Philippines. The Philippine government can consider Mehr's recommended strategies (2017; Figure 1) in future developments of the recently developed national AI roadmap. In addition, this study offers insights not only on the status of the local governments' ICT infrastructure but also on their personnel's attitude toward disruptive technologies such as AI, which could affect the success of AI's implementation across the country.

This paper addresses the research question: how do Philippine local government officials perceive the use of AI for e-government initiatives? Using the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) frameworks (Davis, 1989; Venkatesh et al., 2003), this research explores the case of the Municipality of Carmona, Cavite in the Philippines through a mixed methods approach to identify the perceived acceptance and adoption of AI in the public sector.

AI Applications and Risks in Digital Government

AI is one of the most common disruptive technologies, which is known for its ability to imitate human innate intelligence and behaviors (Al-Mushayt, 2019). Computer scientist John McCarthy first introduced

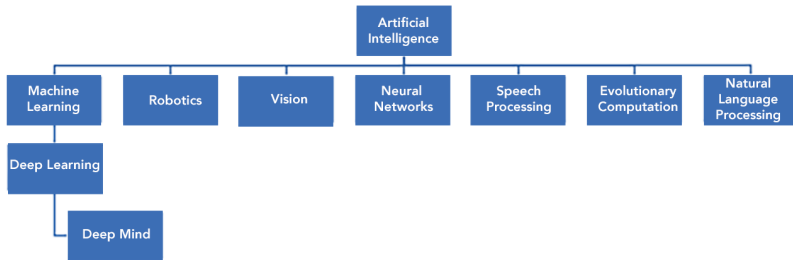
Figure 1
Recommended strategies for navigating AI in government (Mehr, 2017)



the concept of AI in the 1950s. However, the logic behind AI has already been utilized centuries ago. McCarthy's AI became more prominent in the present setting with the emergence of innovations such as Alan Turing's machine, which used mathematics to test its capability to play a game of logic and strategy – chess (Girasa, 2020a).

Fast-forward to the 21st century, AI is becoming more relevant in transforming institutions and societies. According to the 2019 report by the Stanford Human-Centered Artificial Intelligence (Stanford HCAI), the generation of AI-related jobs in the USA alone increased by 0.5% from 2012 to 2019. AI-related startups also received increasing investments globally with an annual increase of 48% since 2010. Gross domestic products globally are also estimated to increase by around 26% in 2030 due to AI alone (Kaya, 2019). Aside from the evident benefits of AI, especially in the private sector, national governments have already started integrating AI in their e-government initiatives as part of transitioning toward digital governance. Some of the early adopters include South Korea with its Intelligent Government Master Plan, the United Arab Emirates' Strategy for AI, and the European Union's Digital Europe Programme (UN, 2020). AI is also evident in smart traffic management in countries like the USA and China (ITU, 2017a). The USA uses AI in measuring performance in government agencies (Girasa, 2020b). AI also emerged as an important technology in improving health services such as Croatia's virtual doctor, which acts as a medical assistant that answers inquiries (UN, 2020).

Figure 2
Artificial intelligence's branches (Girasa, 2020a)



The field of AI is broad (Figure 2), and each aspect can help improve public service delivery and the internal processes in the government. For instance, natural language processing can be utilized for creating chatbots (Oxford Insights, 2020). Machine learning can also be used in generating legal proceedings predictions (Girasa, 2020a).

Dickson (2017) categorized AI into three types. First, artificial narrow intelligence which can only perform one task at a time such as the legal proceedings predictions. Second, artificial general intelligence which is perceived as a strong AI for being able to mimic some of the abilities of the human brain albeit not doing more complex tasks such as reasoning. And third, the artificial super intelligence which is deemed as a futuristic version of AI that can do everything a human brain can, and even surpass it.

Similar to other e-government efforts, AI has its fair share of advantages, risks, and challenges. Many of the news articles as well as researches on AI in the past years covered AI ethics and data privacy (Stanford HCAI, 2019). Some of the emerging malicious uses of AI include massive surveillance and even the DeepFake technology that contributes to fake news proliferation (Oxford Insights, 2020). A study on AI's use in medical treatments showed that only half of the respondents believe in the technology's ability and resist the idea of using AI for their treatments (Carrasco et al., 2019).

Mehr's (2017) study laid out the six common challenges faced by governments with AI that are very evident in developing countries such as the Philippines. These include: (1) resource allocation, (2) large datasets, (3) AI expert shortage, (4) predictable scenario, (5) repetitive procedures, and (6) data diversity.

Current State of AI Applications and Digital Government

Based on the 2022 E-government Survey of the United Nations, the Philippines ranked 89th on the E-government Development Index (EGDI), which is twelve steps lower than its 2020 ranking (UN, 2020 & 2022). Although the Philippine information and communications technology (ICT) infrastructure is still developing unlike other ASEAN countries, which are already advanced, the latter reflects surprising progress. For instance, the penetration of mobile services in the country has exceeded the 100% mark (ITU, 2017b).

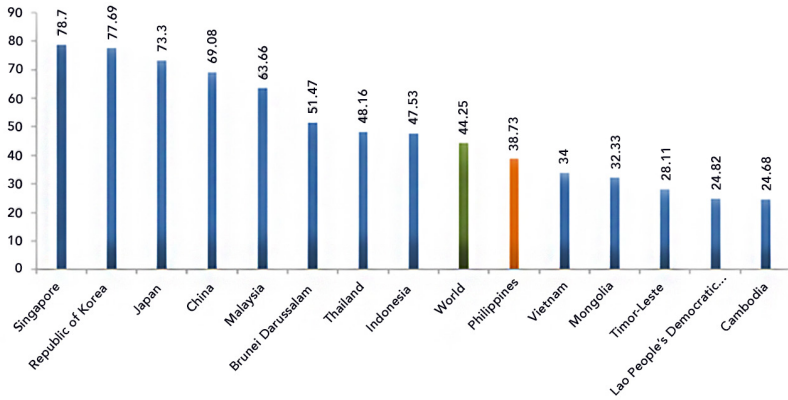
However, the Philippine government still needs to focus on improving its Internet and broadband services, especially in terms of accessibility and bandwidth. Only 60% of the population have Internet access and around 3% have fixed broadband subscriptions (UN, 2020). In terms of bandwidth per Internet user, the Philippines exhibits slow performance compared to the Asia-Pacific (0.384 Mbps) and global (0.596 Mbps) averages with only 0.3472 Mbps (ITU, 2017b).

Nevertheless, some improvements in the Philippine ICT infrastructure have been observed during the pandemic. A report by the Philippine Daily Inquirer (Baclig, 2021) showed that major telecommunication companies in the country recorded an increasing number of subscribers as people transitioned to study and work from home set-ups. The same report also cited Ookla's Speedtest Global Index that there has been an enhancement in the country's Internet speed as it moved 15 places higher from its last ranking.

In terms of AI adoption, the Philippines is tagged as one of the lagging countries based on the AI Index 2019. It pales in comparison to its neighboring countries such as Vietnam, Thailand, Indonesia, and Malaysia, which are named or tagged as emerging and to Singapore, which is in the cutting edge category (Stanford HCAI, 2019). But when it comes to the Government AI Readiness Index (GAIRI) 2020 by the Oxford Insights (Figure 3), the Philippines is ranked 74th, which is higher than Vietnam (75th), Laos (127th), Cambodia (128th), and Myanmar (131st). The report explains that one of the reasons behind the low ranking of ASEAN countries such as the Philippines in GAIRI 2020 is the existing digital divide and the still developing ICT and AI infrastructure in the region.

Unlike countries with established AI strategies and policies, the Philippine government is still in its formation stage. In April 2019, Department of Trade and Industry (DTI) Secretary Ramon Lopez said in

Figure 3
The Philippines and select Asian countries' Government AI Readiness Index (Oxford Insights, 2020)



an interview that the country seeks to be known as a “global AI hub”. He further explained that the country has more than 100,000 graduates from the field of science, technology, engineering, and mathematics (STEM) annually who can be mentored in the field of AI by mentors like Dado Banatao, a Filipino technopreneur with a thriving career in the Silicon Valley (Dumlao-Abadilla, 2019). The Philippine government launched the AI roadmap on 5 May 2021, which laid down several government strategies for maximizing AI’s potentials such as through the creation of the National Center for AI Research or N-CAIR (DTI, 2021).

As early as 2017, Filipino policymakers also showed interest in AI. Senator Paolo Benigno “Bam” Aquino introduced the Senate Resolution No. 344 or the “Plans and Initiatives of the Government on the Developments in Artificial Intelligence” (2017). In 2019, Senator Ralph Recto also introduced one controversial AI issue through the Senate Resolution No. 188 or the “Proliferation of AI-Synthesized Audiovisual Materials, known as DeepFakes” (2019). Despite the promises of both introductory resolutions, both are still pending in the science and technology committee of the Congress.

Model and Theory on Technology Acceptance

This study applied the TAM and UTAUT because they are two of the most used technology acceptance model and theory, especially in relation to using AI, and they are highly compatible with one another for sharing the same determinants-attitude-intention thread.

AI alongside other emerging and disruptive technologies are gaining the attention of governments globally mainly for their economic and operational benefits (Stanford HCAI, 2019; Kaya, 2019; UN, 2020). However, little is still known for the other drivers of acceptance and adoption of AI. While a wide range of studies have applied TAM and UTAUT to AI, examples of their application in the government are still scant. Hwang and Nam (2020) studied how the socio-demographics of Korean citizens affect their AI acceptance and found that higher education and high trust in government positively affected their acceptance. Another study focused more on the institutional use of AI such as Arizona's COPLINK, a knowledge management system for law enforcers (Lin et al., 2004). Through the said study, which used TAM alongside the Theory of Planned Behavior, law enforcers' perceived usefulness was shown to be the most crucial factor affecting their acceptance to use COPLINK. Another case study from the United Arab Emirates government investigated AI in the health sector and found that several factors were integral to increasing medical practitioners' perception of AI's functionality and practicality—the organization, management, and the existing ICT infrastructure (Alhashmi et al., 2019).

Besides these studies, there is still an existing research gap on what motivates governments to accept and adopt AI in their governance strategies especially from the perspective of the main decisionmakers. Is it driven by the hype of the technology? Or is it driven by the actual need of the government agencies and their constituents? To provide a deeper understanding of the drivers of AI acceptance and adoption in governments, this study focused on the case of Philippine government officials in one municipal government drawing from the constructs of the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). The researchers presumed a sequential relationship between a combination of adoption factors and two dependent variables: attitude toward using AI and behavioral intention to use AI.

Technology Acceptance Model (TAM). Davis (1989) argued that one's acceptance of new technology is determined by his or her behavioral intention. Two main determinants are responsible for behavioral intention. First, he defined perceived usefulness as the user's extent to see the technology as beneficial in enhancing one's performance. AI-related studies in different fields such as medicine have supported the notion that the perceived usefulness has a significant relationship with the attitude and behavioral intention to implement the behavior (Alhashmi et al., 2019). On the other hand, Davis used the perceived ease

of use to refer to the extent of user's effort in using the technology. One paper studying China's telecommunications sector found that Chinese users preferred simplicity and user-friendliness compared to high-tech yet complicated services (Rahi et al., 2018). Alhashmi et al.'s review of related literature (2019) argued that perceived ease of use can have indirect and direct impacts on both the attitude and behavioral intention. Perceived usefulness is a mediating factor of perceived ease of use toward behavioral intention, yet perceived ease of use has a significant influence over behavioral intention beyond the effect of perceived usefulness (Davis, 1989). Moreover, Davis together with Bagozzi and Warshaw explained in their 1992 paper that in TAM, it is postulated that one's attitude toward a technology can also affect behavioral intention. This stemmed out of TAM's theoretical inspiration, the theory of reasoned action.

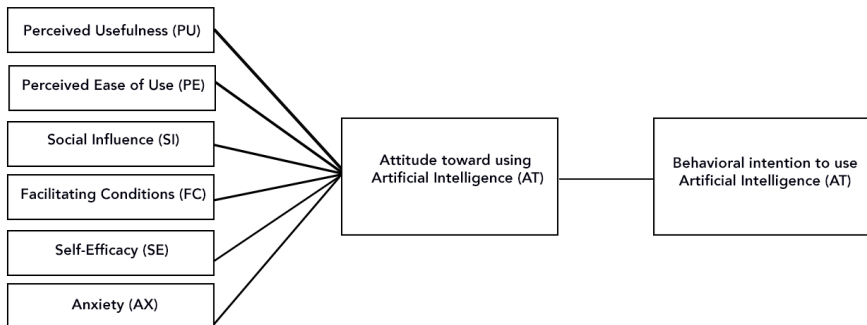
Unified Theory of Acceptance and Use of Technology (UTAUT). Proponents of the UTAUT, Venkatesh and his colleagues (2003), have aligned arguments with Davis (1989) but use the terms performance expectancy and effort expectancy instead as key predictors of behavioral intention to use new technologies. In particular, they agreed with the definition (Davis, 1989; Davis et al., 1989) that associated usefulness with relative advantage and extrinsic motivation.

Another key factor that they added is social influence, defined as the extent of the user's environment and social circle affecting his/her technology usage. In Venkatesh's recent article (2021), he argued the timeliness of UTAUT in the age of AI. The UTAUT proponents also refer to facilitating conditions as the infrastructure supporting the technology. However, beyond the infrastructure, which usually translates to software and hardware, studies have shown how facilitating conditions related to the organization's culture and practices such as information dissemination may affect the adoption of the technology (Gruzd et al., 2012). In UTAUT, self-efficacy is defined as the user's belief in his or her capacity to use the technology. Venkatesh (2021) further explained that individual characteristics such as self-efficacy are very influential toward technology adoption and those who are more "risk-seeking, tolerant of uncertainty, and with a desire to learn" have higher chances of accepting and adopting the technology. Meanwhile, Venkatesh et al. (2003) defined anxiety as the user's apprehensions toward the technology. Although some studies view this determinant as non-significant toward technology acceptance and adoption, Gruzd et al.'s (2012) study showed how some forms of anxieties such as time constraints and information overload hinder academicians from using social media for their research. Lastly, the behavioral intention in UTAUT refers to the user's intent to use the technology.

Conceptual Framework

Guided by the TAM and UTAUT, a case study was conducted to identify the perceived acceptance and adoption of AI in the Philippine government. AI acceptance is determined by two factors such as attitude toward using artificial intelligence and behavioral intention to use artificial intelligence. On the other hand, six adoption factors were considered, namely: perceived usefulness, perceived ease of use, social influence, facilitation conditions, self-efficacy, and anxiety (Figure 4).

Figure 4
Conceptual framework combining TAM and UTAUT



METHODOLOGY

Research Location

The case study was conducted in the Municipality of Carmona in the Province of Cavite in the Philippines. The local government unit (LGU) of Carmona has a pending line-up of AI projects such as the AI-enabled chatbot for the local government's official Facebook page and the use of facial recognition technology for barangay or village-level registry system. The national government has also recognized Carmona LGU as a Center for Excellence for its ICT programs. Moreover, Carmona has received the most coveted Seal of Good Local Governance for five years in a row where ICT innovations play a big role.

Mixed Methods Approach

This study used a mixed methods approach to capture the perceptions of AI adoption in local governments. While most studies utilizing the TAM and UTAUT only used the quantitative approach (Lee & Baskerville, 2003), recent researches also deemed it necessary to integrate a qualitative lens in understanding technology acceptance and adoption (Jayaseelan et al., 2020; Hanif & Lallie, 2021; Williams et al., 2021; Zhu & Zhang, 2021). Specifically, this study used the explanatory sequential mixed methods design, which constitutes two phases of data gathering: the quantitative data is collected and analyzed first followed by the collection of qualitative data. As defined by Creswell and Creswell (2018), the intent of this type of mixed methods design “is to have the qualitative data help explain in more detail the initial quantitative results” (p. 304).”

The authors deployed a self-administered survey to all 20 department heads of the Carmona LGU after orienting them about AI and its implications in their respective offices. The survey questionnaire included three to four statements for each of the six adoption factors and two dependent variables adapted from earlier TAM and UTAUT studies. Responses were weighted through a semantic Likert scale (1 or “strongly disagree” to 7 or “strongly agree”). The responses were descriptively analyzed and subjected to Pearson correlation using STATA 13.

Thematic analysis was conducted to explain and contextualize the quantitative findings (Braun & Clarke, 2006). Selected department heads and the municipal mayor were interviewed in-depth to generate needed information. To ensure that all department heads were well-represented in the interviews, the sample of respondents were selected based on the Beresford Research’s age range by generation (2021). Only the Millennials (1981 – 1996), Generation X (1965 – 1980), and Boomer II (1955 – 1964) were actually represented in the pool of the Carmona LGU’s department heads. Aside from the age, this study also ensured that all department clusters were represented – administrative/legislative, social, infrastructure, and finance (For the demographic information of the survey and in-depth interview respondents, refer to Appendix 1).

In total, 21 open-ended questions around the concepts presented in the TAM and UTAUT questionnaires were fielded to the interviewees with follow-up questions for probing. The duration of the interviews varied between 21 and 73 minutes. All interview sessions were conducted and recorded using the Zoom video conferencing tool. The interviews were manually transcribed, translated, and coded to generate salient codes and subcodes.

RESULTS AND DISCUSSION

Descriptive Statistics and Correlation Analysis

Table 1 shows the overall mean scores of all AI acceptance and adoption factors among the surveyed department heads in the Carmona LGU (for the descriptive statistics of all questionnaire statements, refer to Appendix 2). The department heads mostly agreed with the statements describing four variables with the highest means, namely: perceived usefulness (5.75), perceived ease of use (5.43), social influence (5.63), and attitude toward using AI (5.96).

Table 1
Overall mean scores of AI acceptance and adoption factors

Variable	Overall mean score
Behavioral intention to use AI	5.08
Attitude toward using AI	5.96
Perceived usefulness	5.75
Perceived ease of use	5.43
Social influence	5.63
Facilitating conditions	5.13
Self-efficacy	5.25
Anxiety	3.63

Meanwhile, facilitating conditions received an overall mean of 5.13, self-efficacy was 5.25, and behavioral intention was 5.08. These mean scores demonstrate that the respondents were ambivalent to the statements related to facilitating conditions, self-efficacy, and behavioral intention. Only anxiety received a low yet neutral overall mean score (3.63).

In terms of the correlation of the AI acceptance and adoption factors with behavioral intention (Table 2), perceived ease of use ($r = 0.8501$) and perceived usefulness ($r = 0.8373$) showed the strongest correlations. This means that the perception of the department heads of Carmona LGU on how easy it is to use an AI intervention and how they see AI's usefulness in their departments' functions were strongly associated with higher behavioral intention to use the AI tool. Attitude toward using AI also exhibited a strong correlation with behavioral

Table 2
Correlation of AI acceptance and adoption factors

Variable	BI	AT	PU	PE	SI	FC	SE	AX
BI	1.0000							
AT	0.7224*	1.0000						
PU	0.8373*	0.7476*	1.0000					
PE	0.8501*	0.7722*	0.8757*	1.0000				
SI	0.6930*	0.8136*	0.8170*	0.7586*	1.0000			
FC	0.6895*	0.5007**	0.5905*	0.6453*	0.5484**	1.0000		
SE	0.5647*	0.4073***	0.5979*	0.6990*	0.5202**	0.5112**	1.0000	
AX	-0.3002	-0.5490**	-0.5445**	-0.5360**	-0.6275*	-0.1653	-0.3617	1.0000

Notes: * $p < 0.01$, ** $p < 0.05$, *** $p < 0.10$ (2-tailed)

PE: Perceived ease of use

PU: Perceived usefulness

SI: Social influence

SE: Self-efficacy

AT: Attitude toward using AI

AX: Anxiety

BI: Behavioral intention to use AI

FC: Facilitating conditions

intention ($r = 0.7224$), which can be construed as a positive attitude of the department heads toward AI leading to higher behavioral intention to use the AI interventions. Whereas, social influence ($r = 0.6930$) and facilitating conditions ($r = 0.6895$) also obtained strong correlations while self-efficacy ($r = 0.5647$) received a moderate correlation with behavioral condition.

Meanwhile, for the correlation of attitude toward using AI, social influence showed the strongest relationship ($r = 0.8136$). This indicates that the people who have influence over the department heads such as the mayor, their colleagues, and even their loved ones may have an effect on the latter's attitude toward using AI in their respective offices. Perceived usefulness ($r = 0.7476$) and perceived ease of use ($r = 0.7722$) also demonstrated strong correlations with attitude toward using AI. Facilitating conditions ($r = 0.5007$) and self-efficacy ($r = 0.4073$), on the other hand, showed moderate correlations with attitude toward using AI. Anxiety ($r = -0.5490$) is the lone variable which exhibited significant negative correlation with attitude toward using AI.

Several AI acceptance and adoption factors have also shown very strong relationships with one another such as perceived usefulness and perceived ease of use, which obtained the highest correlation ($r = 0.8757$). This indicates that when the department heads see that the AI tool has a user-friendly interface and it is easy to navigate, they may most likely have a higher perception that the AI tool can make their department's duties more efficient. Social influence likewise showed a very strong correlation with perceived usefulness ($r = 0.8170$), which implies that the usefulness of AI is affected by the social environment of department heads (e.g., their colleagues, the mayor, and their families). A practical example of this is if ever the municipal mayor does not favor the AI intervention in their department, the department head would most likely see AI as useless. On the other hand, most variables also exhibited a strong relationship with perceived ease of use. For instance, a department head's perceived ease of use of AI in their office's programs would go higher with their individual self-efficacy or self-reliance in using the AI intervention ($r = 0.6990$).

It can also be observed that some anxiety relationships, particularly with facilitating conditions ($r = -0.1653$), self-efficacy ($r = -0.3617$), and most importantly behavioral intention ($r = -0.3002$), were not significant on any of the given significant levels (1%, 5%, 10%). This supports the claims made by Venkatesh and colleagues (2003) when they formulated UTAUT wherein anxiety and self-efficacy were deemed to

be indirect drivers of behavioral intention. Furthermore, all the observed negative relationships were only exclusive to anxiety. This finding is a good sign since this implies that the worries of the department heads about AI were limited and may not have any significant effect with the other variables.

To further explain the correlation findings, the in-depth interviews were subjected to a thematic analysis. Findings are discussed in the next section.

Qualitative Findings

Previous Use of AI. The respondents had prior experience in using AI-enabled technologies. Most of them used AI in the form of digital voice assistants such as Amazon's Alexa and Apple's Siri using their personal smartphones. Another AI application that the respondents were accustomed to using for personal use is the chatbot available on e-commerce apps and websites. In terms of work-related use of AI, the IT department head was very knowledgeable because of his technical and educational background. *"When I was taking my master's, we developed a loan system using artificial neural networks,"* the IT department head shared. The health department head also shared that he was able to use AI programs that their national government counterpart cascaded down to local governments, especially during the COVID-19 pandemic. Aside from work-related AI experience in the public sector, the accounting department head also said that he was able to use an AI system in the past when he worked as an accountant for multinational firms.

Perceived Usefulness. Most of the themes that emerged from the interviews are related to increasing the performance and efficiency of the local government services. Some of these include reduced errors, enhanced accuracy, and increased time efficiency. The planning department head also explained that since their department oversees the local census by using the community-based monitoring system (CBMS) technology, they handle a huge amount of data, and sometimes, the storage and retrieval of the data are tricky and time-consuming. *"We face some backlogs in the current system of using CBMS, and sometimes, when some people request data from our department, it takes time to generate them. I think with AI, we can better manage our data. Uploading, processing, and linking data would much be easier too,"* she added.

The municipal administrator and IT department head both shared that AI can be useful both for internal and external users citing that it can upgrade the skills of civil servants and enable them to focus more on high-level and non-routine tasks. Further, most respondents agreed that AI can make transactions for local government clients more convenient because they would not have to travel to the municipal hall just to avail of some services. The municipal mayor said that AI can help him and the local government in general in decision making, but he stressed that *"AI should only be a guide on decisions and not entirely be the one to have the final say."*

Perceived Ease of Use. Majority of the respondents agreed that the local government employees and their fellow department heads can easily learn new technology like AI. The accounting department head explained that employees will be motivated to learn AI since it is an additional skill set for themselves. The municipal mayor also shared the same sentiment and emphasized that it is also a matter of compliance with the vision of Carmona LGU, and if the employees will not adjust easily, they and their departments will be left behind in the digital transformation. *"I believe in the willingness of the employees of our local government. I think, as long as there's passion to improve, dedication to serve, you will never get tired of learning including learning new technologies,"* the mayor said.

However, most of the respondents agreed that the ease of use might be heavily affected by the age of the users. Both the professional bureaucrats – the accounting department head (a certified public accountant) and the health department head (a physician) shared that there can be some bottlenecks in learning new technology. *"Older healthcare workers are not that techy. For younger healthcare workers, they might be digital natives, but based on my observation, they also receive the biggest workload. They might also find it hard to insert studying AI in the midst of their jobs,"* the health department head said.

The IT department head highlighted that most of the time, people especially the local government's constituents focused too much on how "high-tech" an innovation is, but he clarified that, *"we must actually focus not on how high-tech an innovation like AI can be, but rather on how easy it is to understand and use it. I also think that a simple technology can increase its acceptance and adoption."*

Social Influence. In terms of the influential personalities on the future implementation of AI in Carmona LGU, all of them mentioned the mayor first including the local chief executive himself. *“I definitely can say that mayors like me have the say on innovations like AI, so yes, it’s me,”* he shared. The accounting department head affirmed that the current mayor is very supportive of innovations and urges all department heads to suggest plans to him. The IT department head supported this opinion and even added that the mayor *“is also a very effective and maybe the best champion of new technologies like AI. We know that he is already old, yet he still supports innovation. And I think, if I also back him up when he vouches for technologies like AI, his credibility on the subject increases, and citizens will most likely be convinced to further use AI.”*

The health department head said that since they have direct contact with the citizens as healthcare practitioners, they can also heavily influence their patients as “champions of innovations.” Meanwhile, the municipal administrator shared that for her, other like-minded and innovation-oriented local governments such as Valenzuela City and Pasig City in the National Capital Region can influence the Carmona LGU to adopt AI and other technologies or to “embrace technology beyond politics.”

Facilitating Conditions. Both the answers of the mayor and IT department head are in sync in terms of how ready the Carmona LGU is in implementing AI. *“I personally think that AI is very costly, but I think we can start implementing it phase by phase,”* the mayor said.

The IT department head added, *“I also think that it depends on the level of AI that will be deployed. It is easy if it is software-related, and I think we can implement it right away. But if it’s hardware or something complex, I will be honest that our department’s load can’t take it. And maybe, if there’s a need to implement it right away, we can outsource for an external service provider.”*

According to the planning department head, budget is very essential in implementing AI, but building the capacity of the employees and the citizens are equally as important. The municipal administrator has the same opinion and emphasized having pilot sites first before the implementation so that resources will not be wasted.

Self-Efficacy. Table 1 shows that most department heads are ambivalent with the statements used to measure self-efficacy. This can be explained by the results of the in-depth interviews. All the respondents

preferred to be guided step-by-step when AI will be introduced to them rather than rely on themselves when navigating AI for the first time. *"I think if I will only rely on myself and same for my staff, we will face a lot of errors and maybe the implementation will be even slower because of those errors,"* the accounting department head imparted.

The health department head shared that their office cannot afford to commit any mistakes because the health and even the lives of their patients are at stake. According to her, *"It's really critical for social services like us. And if ever we commit errors when we use the AI without any expert's help, it will definitely affect their trust not only on our department, but also on new technologies in the future, and on the local government. So, I prefer to be assisted step-by-step...slowly but surely."*

Anxiety. As shown in Table 2, anxiety had a significant negative correlation with attitude toward using AI as well as other acceptance and adoption factors like perceived usefulness, perceived ease of use, and social influence.

Most of the themes of the issues raised by the respondents were more on external factors. First, data privacy can be an issue. *"We experienced it when we launched our local contact tracing app last year for COVID-19. Some concerned citizens even went to our office because of it...the use of their data is not clearly stated on the app. It's a lesson learned,"* the IT department head shared.

Second, the Carmona LGU is very responsive to its constituents, and they need to devise an efficient method to obtain objective feedbacks to improve future AI programs. *"Although it's a possible application of AI from another department [social welfare and development department], I think the citizens' acceptance of AI might be affected if they were not selected by the AI, for example in financial assistance programs, which have certain criteria. I think we should be able to create an objective feedback mechanism for that,"* the health department head suggested.

The municipal administrator also mentioned another external concern related to existing national laws, which for her are not "AI-friendly": *"They should really revisit the policies because sometimes, even if the local government wants to get things automated, for example we want to send the financial assistance to our constituents by online means, the national government will still look for documentation like a manually signed payroll of the beneficiaries."*

In terms of the internal anxieties, the accounting department head mentioned that overdependence and excessive trust on AI can also be an issue as the civil servants would be less motivated to check the errors themselves.

Attitude Toward using AI. In Table 2, all variables have a significant correlation with the attitude toward using AI, which had an overall mean of 5.96 (Table 1). The interview findings likewise supported the turnout of the exploratory survey. For instance, the accounting department head said that he will most likely use AI since he perceives AI to truly contribute to making their department's functions easier. This supports the strong correlation found between perceived usefulness and attitude toward using AI. In addition, he shared that he is motivated to accept AI wholeheartedly because the mayor encourages and urges departments to innovate. This, in turn, supports the relationship between attitude and social influence which acquired the highest correlation coefficient ($r=0.8136$).

The other respondents, such as the planning department head, shared the same views as the accounting department head who mentioned that *"since AI is perceived to make transactions faster, make the government more transparent, and it increase citizen satisfaction, then definitely, we will implement AI-enabled projects soon."* But even if there is high acceptance of using AI among the department heads of the Carmona LGU, both the health department head and the municipal administrator remarked that the local government must still evaluate closely which services should apply AI. They contended that there are still some public services that are better delivered with human contact such as health services.

Behavioral Intention to Use AI. Similar to the attitude toward using AI, the behavioral intention also received high agreements both in the exploratory survey as well as in the interviews. The local chief executive himself is very enthusiastic when asked about the timeline of the local government to implement its AI-enabled programs. *"I project it is within the next two years. I already started discussing with the IT department head and other heads. Some of the projects we have on the top of our head right now include using facial recognition for law enforcement,"* the mayor shared.

The planning department head also mentioned that since the Carmona LGU's vision in the coming years is to be a smart city, they are already preparing the infrastructure such as a local data center. She believes that this will be helpful when AI programs begin to be implemented one by one. The health department head added that to

make Carmona AI-ready, other sectors of the community, especially the firms and companies inside the municipality, should also start using AI when the local government starts to launch AI programs.

Discussion

This study was exploratory and designed to draw inference about causal relationships between the six adoption factors drawn from TAM and UTAUT. Results of the correlation and thematic analysis reflect consistency with current body of research on AI acceptance.

The correlation results align with observations in previous studies on AI acceptance and adoption albeit in the private sector. For instance, in Sohn and Kwon's paper (2020) about the development of AI-based intelligent products in South Korea like smart speakers, voice assistants, and smart appliances, they found that perceived usefulness, perceived ease of use, and attitude have positive moderate to strong correlations with behavioral intention. Another case study from China focused on AI-based medical diagnosis support systems (Fan et al., 2020) also showed positive strong correlations of behavioral intention with effort expectancy (or perceived ease of use in this paper), performance expectancy (or perceived usefulness in this paper), as well as social influence. In Kim et al.'s (2019) study of finance chatbots, they found a significant positive relationship between behavioral intention and adoption factors such as effort expectancy, performance expectancy, and social influence. Another South Korean case study on healthcare AI (Kim, 2017) shared the same trends with the addition of a significant negative relationship between anxiety and behavioral intention.

As summarized in Table 3, perceived usefulness' sub-themes included performance improvement, convenience, and decision-making. In Kessler and Martin's (2017) study on the perceptions of potential users of AI voice assistants, most of their focus group discussion participants appreciated how voice assistants made people's lives easier – or the variable of perceived usefulness. Another qualitative study on AI highlighted perceived usefulness through themes such as time efficiency and diagnostic quality, among others (Buck et al., 2022). Meanwhile, this study's sub-themes for perceived ease of use are similar to previous AI perception studies. For instance, technology simplicity appeared as a key theme in the interviews, which also resonated with Kessler and Martin's finding (2017) that AI should "work without any hassle." Age was also one of the key sub-themes of perceived ease of use in this study, which

Table 3
Summary of the thematic analysis of the interviews

Theme	Sub-theme	Supporting narrative
Perceived usefulness	Performance improvement	AI as a tool for increased performance, better time efficiency, less errors, and less backlogs
	Convenience	AI as a tool that would bring convenience both for the civil servants and the constituents
	Decision-making	AI should only be a guide on decisions
Perceived ease of use	Age	Younger civil servants would find it easier to learn AI compared to the older ones
	Additional skillset	Learning AI is seen as an additional skillset and those who won't adapt can be left behind
	Technology simplicity	AI implementation should be focused on how easy it can be used rather than on how high-tech it appears to be
Social influence	Mayor as the main influencer	Local chief executive is the critical proponent in influencing decisions on AI implementation
	Civil servants as champions of innovations	Civil servants especially the street-level bureaucrats can influence citizens on AI adoption
	Like-minded local governments	Other innovation-oriented local governments can be influencers
Facilitating conditions	Budget	AI implementation is a costly project so the creation of pilot sites to avoid wasting resources
	Capacity building	Increase the AI-related capacity and skills of civil servants and constituents
	Outsourcing	Although the IT department can handle the creation of AI tools, outsourcing service providers can be an option to hasten implementation

Table 3
Continued

Theme	Sub-theme	Supporting narrative
Self-efficacy	Guided learning	Preference to be guided step-by-step on using AI tools
	Critical mistakes	Social services can't afford to make mistakes
	Trust	When civil servants are not knowledgeable on AI and commit mistakes, this could affect the people's trust in the local government and on future technologies
Anxiety	Data privacy	Use of citizen data in AI initiatives should be considered
	AI's decisions	Balance between AI's objectiveness and citizen satisfaction
	AI-friendly policies	Some existing national policies inhibit the implementation of AI by the local government
	Excessive trust on AI	Some civil servants may develop overdependence on AI and might be less motivated to check errors themselves
Attitude toward using AI	Local government efficiency	There is a positive attitude toward AI brought by perceived notion that AI would make department functions easier
	Government transparency	AI is perceived to make government processes more transparent
	Citizen satisfaction	AI is perceived to make transactions faster, which could also increase citizen satisfaction
Behavioral intention to use AI	Smart city	Since Carmona is aligning itself to be a smart city, AI implementation can be a priority
	Holistic AI implementation	AI should also be implemented across all sectors including businesses

resonates with the arguments of the proponents of UTAUT that age is a moderator between effort expectancy (or perceived ease of use) and behavioral intention (Venkatesh et al., 2003).

For facilitating conditions, the department heads and the mayor of Carmona LGU acknowledged that implementing AI projects is very costly, which pointed to the sub-theme budget. This was also reflected in the findings of Atwal et al. (2021) where finances emerged as an important aspect of resources in the winery industry AI.

The Carmona LGU's case affirmed the need for AI stakeholders to upskill in AI such as those found in recent findings in AI for supply chain management (Hasiya & Esper, 2022). In terms of self-efficacy, one of the important sub-themes that appeared in the interviews in the Carmona LGU was trust. As pointed out by one of the department heads, a simple mistake due to a lack of knowledge or skill in AI may compromise the trust of citizens not only on AI but also on future technologies; it may even jeopardize their trust on the local government.

Moreover, this study revealed several sub-themes pertaining to anxiety. One of them is data privacy. This appeared in the narratives of respondents from past studies such as the AI voice assistants who were apprehensive that everything they say may be heard (Kessler & Martin, 2017). The Carmona LGU respondents were also anxious about the AI-friendliness of existing policies, which would impede AI implementation. The same concern was raised in one French AI case study (Atwal et al., 2021) where the adoption of automated harvesting equipment was not supported in the locality because local policies prescribed manual harvesting for wine production.

As this study is one of the few literatures covering AI acceptance and adoption in government, several unique sub-themes were also observed. For social influence, this study showed more organizational influencers for the citizens such as the mayor, civil servants, and other like-minded local governments. Previous studies showed influences driven by personal connections like family and friends. In terms of the attitude toward using AI, positive attitudes were detected in the interviews as the department heads and the mayor associated AI implementation with local government efficiency and government transparency. Another important attitude sub-theme is citizen satisfaction, which is supported by past local government studies wherein local governments were usually driven to do programs (e.g., AI implementation) because of increased public satisfaction that affects election turnout (Hong, 2017). When it comes to behavioral intention, the Carmona LGU is at an advantage

compared to other municipalities as there is political will backing up their smart city positioning. Since they already have this renewed vision, the integration of AI projects would not be too difficult especially since the mayor is also a key social influence. Moreover, another theme mentioned in the narratives for behavioral intention is the holistic implementation of AI across the local government. The department heads emphasized that AI adoption should not only be a concern of the local government but also of other sectors such as companies in the municipality.

CONCLUSION AND RECOMMENDATIONS

This study offers insights on how Philippine local government officials perceive the use of AI for e-government initiatives, using the case of the Carmona LGU. Findings contribute to the growing literature on AI acceptance and adoption, especially in the government setting, which is still relatively sparse.

AI is a disruptive technology that provides several potentials that can be utilized by governments to improve their services to the public and their internal processes. However, similar to any other innovation, AI also poses risks, and governments have the responsibility to maximize the potentials and minimize the risks for their intended users. These pros and cons influence the acceptance and adoption of AI in the public sector. This study explored this angle in the context of the Philippine government through a case study of one local government using the combined constructs from TAM and UTAUT. A survey was conducted to correlate the presumed drivers of attitude and behavioral intentions toward use of AI in the local government unit. In-depth interviews were thematically analyzed to determine the effect of the adoption factors related to the attitude and intent to use AI, specified in TAM and UTAUT.

Although limited in making inferences about the causal relations between the adoption factors, correlation results were consistent with trends in prior TAM and UTAUT themed studies. Most acceptance and adoption factors showed positive moderate to very strong relationships with attitude and behavioral intention. On the other hand, anxiety only showed significant negative moderate to very weak relationships with AT.

Insights from the thematic analysis revealed themes that could become the springboard for the national government to further improve its existing national AI roadmap and develop appropriate policies and

programs. One possible entry-point of the national government is through the Department of Information and Communications Technology (DICT), which has been a crucial actor in the enabling environment for use of ICT technology in the country. The Department of the Interior and Local Government (DILG), in its role to improve performance of local governments in governance, administration, social and economic development and environmental management, can also urge local governments to institutionalize AI in relevant operational. An awareness campaign along with a comprehensive upskilling program that includes AI literacy for the citizenry and civil servants, can also be initiated by the national government through DILG and DICT.

The Carmona LGU is a high-performing local government with advanced ICT capability. Hence, the context of this research does not encompass those of LGUs with a different level of capacity. Other studies can validate the findings in other cases that could include but not limited to (1) a high-performing and ICT-challenged local government, (2) a low-performing and ICT-advanced local government, and (3) a low performing and ICT-challenged local government. Such supporting case studies can provide a richer understanding of the acceptance and adoption perceptions on AI by other local governments. Moreover, expanded and deepened research work can inform development of programmatic and policy strategies for the scaling-out of AI in Philippine local governments and beyond. In terms of research design, this study's methods provided valuable insights regarding the government acceptance and adoption of AI, however, subsequent work should also accommodate the use of analytical methods that would further test the causality of the acceptance and adoption factors against the attitude and behavioral intention to use AI. Further analysis may also check the mediating or moderating effect of attitude to behavioral intention.

This paper acknowledges some of the criticisms of TAM and UTAUT in past studies. Although UTAUT already addressed TAM's oversimplification of technology, both models still heavily rely on an individual's expectations and perceptions. It is also important to consider the complexity of the process of technology adoption, from its technical composition up to how it is integrated into the organization (Ammenwerth, 2019; Shachak et al., 2019).

Future research can add the thematic analysis sub-themes generated in this study to extend the TAM and UTAUT constructs of adoption factors. For instance, the standard questionnaires only cover the general usefulness, effectiveness, and productivity of AI to measure the variable perceived usefulness. Future research may modify this by delving

deeper and adding statements discussing the concepts of performance improvement, convenience, and decision-making. Other technology acceptance models can also be explored with additional variables from the field of motivational psychology.

Lastly, in this study, individual perceptions came from the key decision-makers who reflect the local government's vision. Though findings may not be generalizable to all local government officials and officers, they present valuable insights about the possible drivers of acceptance and adoption of AI in government agencies. Future research may re-validate the framework (Figure 4) to include other actors in government, including street-level bureaucrats or citizen-clients, to provide stronger empirical evidence on the acceptance and adoption of AI by local governments.

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Appendix 1
Respondents' demographic information

Characteristics	Exploratory study		In-depth interview	
	No. (n=20)	%	No. (n=6) ^a	%
Gender				
Male	11	55.0	4	66.7
Female	9	45.0	2	33.3
Age				
Millennial	3	15.0	2	33.3
Gen X	10	50.0	2	33.3
Boomer II	7	35.0	2	33.3
Cluster				
Administrative/ Legislative	5	25.0	3	50.0
Social	7	35.0	1	16.7
Infrastructure	4	20.0	1	16.7
Finance	4	20.0	1	16.7
Length of service in Carmona				
1-10 years	4	20.0	1	16.7
11-20 years	5	25.0	2	33.3
21-above	11	55.0	3	50.0
Length of service in current position				
1-10 years	10	50.0	3	50.0
11-20 years	4	20.0	1	16.7
21-above	6	30.0	2	33.3

^afive department heads and the municipal mayor

Appendix 2

Descriptive statistics per questionnaire statement of the exploratory survey

Var.	Statement	Obs.	Mean	Std. Dev.	Min	Max
PU	PU1: My department and I find AI useful in our job.	20	5.55	1.145931	4	7
	PU2: Using AI will enable me and my department to accomplish tasks quickly.	20	5.95	0.9445132	4	7
	PU3: Using AI will increase my own and my department's productivity.	20	5.70	1.128576	4	7
	PU4: If I use AI, my department and I will enhance our job effectiveness.	20	5.80	1.056309	4	7
PE	PE1: My department and my interaction with the AI will be clear and understandable.	20	5.30	1.174286	3	7
	PE2: It would be easy for me and my department to become skillful at using the AI.	20	5.55	1.190975	3	7
	PE3: My department and I will find the AI easy to use.	20	5.35	1.182103	3	7
	PE4: Learning to operate the AI will be easy for me and my department.	20	5.50	1.192079	3	7
SI	SI1: People who influence my behavior think I should use AI.	20	5.30	1.218282	3	7
	SI2: People who are important to me think that I should use AI.	20	5.20	1.151658	3	7
	SI3: The local government will be useful in the use of AI.	20	5.95	1.099043	4	7
	SI4: In general, the local government will support the use of AI.	20	6.05	1.050063	4	7

PE: Perceived ease of use

PU: Perceived usefulness

SI: Social influence

Appendix 2
Continued

Var.	Statement	Obs.	Mean	Std. Dev.	Min	Max
FC	FC1: My department and I have the resources necessary to use AI.	20	5.10	1.020836	3	7
	FC2: My department and I have the knowledge necessary to use AI.	20	4.95	1.190975	2	7
	FC3: AI is compatible with other systems we use in our department.	20	4.85	1.089423	2	6
	FC4: A specific department or group will be available for assistance with AI difficulties.	20	5.60	0.88258	4	7
SE	SE1: My department and I could complete most tasks using AI if there will be no one around to tell us what to do as we use it.	20	4.50	1.60591	1	6
	SE2: My department and I could complete most tasks using AI if we could call someone for help if we get stuck.	20	5.55	1.099043	4	7
	SE3: My department and I could complete most tasks using AI if we just have the built-in help facility for assistance.	20	5.70	1.080935	4	7
AX	AX1: My department and I feel worried about using AI.	20	3.70	1.454575	1	6
	AX2: It scares me and my department to think that we could lose a lot of information using AI if we click or move any wrong button or function.	20	3.70	1.657519	1	6
	AX3: My department and I hesitate to use AI for fear of making mistakes we cannot correct.	20	3.65	1.814416	1	6
	AX4: AI is somewhat intimidating to me and my department.	20	3.45	1.669384	1	6

AX: Anxiety

FC: Facilitating conditions

SE: Self-efficacy

Appendix 2
Continued

Var.	Statement	Obs.	Mean	Std. Dev.	Min	Max
AT	AT1: Using AI is a good idea.	20	6.05	1.050063	4	7
	AT2: AI will make my department and my work more interesting.	20	6.10	1.020836	4	7
	AT3: Working with AI seems fun.	20	5.60	1.046297	4	7
	AT4: My department and I will like working with AI.	20	6.10	1.020836	4	7
BI	BI1: My department and I intend to use AI in the next <n> months.	20	5.10	1.333772	2	7
	BI2: My department and I would use AI in the next <n> months.	20	5.05	1.394538	2	7
	BI3: My department and I plan to use AI in the next <n> months.	20	5.10	1.252366	2	7

AT: Attitude toward using AI

BI: Behavioral intention to use AI