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An Analysis of Local Government Employees' Desire to Adopt 4IR Technologies Using an Application and Extension of the Extended UTAUT Model

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Abstract

This study investigates the behavioural intention of South African local government employees to adopt Fourth Industrial Revolution (4IR) technologies using an extended Unified Theory of Acceptance and Use of Technology (UTAUT2) model. The model incorporates trust and personal innovativeness to address contextual factors often present in public-sector environments. A quantitative survey of 351 municipal employees was analysed using SPSS and AMOS. Results demonstrate that performance expectancy, effort expectancy, social influence, facilitating conditions, trust, and personal innovativeness significantly predict behavioural intention to adopt 4IR technologies. This study contributes to theory by extending and validating the UTAUT2 model with trust and personal innovativeness in a developing-country public-sector context. It contributes to practice by providing actionable insights for policymakers to foster digital transformation in municipalities. The research offers valuable perspectives for scholars regarding the adoption of 4IR technologies among local government employees. Additionally, the findings support academics and policymakers in the effective implementation and replication of 4IR technology models that are rigorously researched and publicly endorsed.

Keywords: Behavioural intention, Fourth Industrial Revolution, Local government, Technology adoption. Trust

1. Introduction

Globalisation, technological advances, and increasing citizen expectations have compelled governments to reconsider traditional service delivery models (Yaya, Out & Labonté, 2020; Gürün, 2018. Recent studies highlight that digital transformation in the public sector is no longer optional but rather a strategic imperative, driven by demands for efficiency, transparency, and citizen-centric services (Trip, 2025 ;Haug, Dan & Mergel, 2023). Governments are adopting emerging technologies such as artificial intelligence (AI), cloud computing, and data analytics to modernise operations and enhance responsiveness (Gartner, 2022). These changes reflect a global trend towards digital-era governance, where agility and inclusivity are central to meeting evolving citizen expectations (OECD, 2023).

In South Africa, local government faces persistent challenges ranging from skills shortages and governance failures to limited technological readiness that hinder effective service delivery (Mbandlwa, Dorasamy & Fagbadebo, 2020). As 4IR technologies emerge, municipalities are under pressure to modernise operations

and adopt digital solutions (Sutcliffe & Bannister, 2020). Recent research underscores that digital transformation in South African municipalities is constrained by infrastructure deficits, digital divides, and cybersecurity concerns, even as citizen expectations for seamless service delivery continue to rise (Mangai & Ayodele, 2025;Hofisi & Chigova, 2023;).
The South African government has faced criticism regarding its ability to provide adequate public services (Fourie & Poggenpoel, 2017). This has resulted in numerous service delivery protests impacting the local government sector (Akinboade, Mokwena & Kinfack, 2014; Fakir, 2014; Mugambiwa & Tirivangasi, 2017). This sector is confronted by several inherent constraints that adversely affect the successful technological advancement required to meet citizens' adoption of Fourth Industrial Revolution (4IR) technologies.

Despite efforts by the government to implement and trial various quality improvement programmes, the anticipated improvements in service performance have generally not materialised (Enaifoghe, 2025 Ekuma, 2017). The lack of effective service delivery within local administration can be attributed to inadequate staffing levels, insufficient staff competencies, and poor institutional capacity (Hofisi & Chigova, 2023). Political involvement also poses a significant challenge (Mangai & Ayodele, 2025), while Mhelembe and Mafini (2019) point to deficiencies in supply chain risk management and performance, as well as factors impeding efficiency, such as regulatory barriers, supply chain complexity, process inefficiency, supplier monitoring gaps, insufficient skills, and information security concerns.

In addition to these leadership concerns, the demands associated with technological advancements related to the 4IR further impede the adaptability of local government. Recent studies emphasise that while 4IR technologies offer opportunities for improved governance and service delivery, municipalities face barriers such as digital infrastructure deficits, cybersecurity vulnerabilities, and limited digital literacy among employees (Chilunjika, 2024; Moitse et al., 2022). Leadership within this sector remains critical for advancing the nation's development objectives, notwithstanding prevailing constraints (Haywood et al., 2019). To enhance public service delivery, it is essential to foster competency among local government employees, strengthen leadership and management capacity, and improve the application of information technology within the sector (DPSA, 2024; Enaifoghe, 2025).

Despite the promise of 4IR technologies, adoption within local government remains limited. Few empirical studies have examined the behavioural factors influencing employee acceptance of these technologies. This study addresses this gap by applying and extending the UTAUT2 model to identify determinants of 4IR technology adoption among local government employees.

2. Literature Review

2.1 Digital transformation in the local government sector

Digital transformation has reshaped public-sector operations globally, compelling local governments to adopt digital tools that improve service delivery and enhance accountability (Ogada et al., 2016). Electronic governance (“e-governance”) and digital governance models elevated efficiency, transparency, and citizen engagement. E-governance has significantly improved the administration of government operations by streamlining procedures, reducing service access costs, increasing accountability and responsiveness, and expediting response times. Through the internet, individuals are able to obtain information and services offered by their government, a practice known as e-government (Allio, 2015). This digital approach

encompasses all uses of information and communication technology within the local government sector, while e-governance specifically refers to leveraging ICT (information and communications technology) to deliver government services (Rawat, 2020).

E-governance aims to integrate ICT into all governmental functions to optimise service delivery. At present, ICT is utilised by governments to enhance their various services and operations (McKinsey & Company, 2015). Recent research underscores that digital technologies such as AI, blockchain, and cloud computing have become central to e-governance strategies, improving transparency, efficiency, and citizen engagement.In contrast, "e-democracy" leverages electronic communication tools and technologies to facilitate improved decision-making through active public and citizen participation. Studies reveal that ICT-enabled platforms, including e-voting and participatory portals, are reshaping democratic processes and fostering inclusive governance, though challenges such as digital divides and data privacy persist (Fischli & Muldoon, 2024).

"E-commerce" refers to the electronic transfer of funds for acquiring goods, services, and utilities online, which encompasses transactions such as car registrations, utility bill payments, tax settlements, leisure programme enrolments, and government procurement of office supplies (Kamaruddin & Noor, 2013). Recent developments highlight the rise of digital procurement platforms and e-procurement systems, which streamline public purchasing processes and enhance transparency (OECD, 2023; Brohan, 2023). The cumulative impact of these technological advancements has been the evolution of e-government, which now encompasses integrated digital ecosystems designed to deliver citizen-centric services and support sustainable governance (UN DESA, 2022).

The implementation of a robust e-government framework necessitates the strategic integration of public service delivery initiatives and the adoption of a citizen-centric approach. A citizen-centric approach involves local government entities organising and managing both the processes and outcomes of service quality to better address the needs of citizens (Omweri, 2024) service value chain during the establishment of an e-government system (Kasserchun, 2020).

The Fourth Industrial Revolution (4IR) introduces disruptive technologies AI, cloud computing, the IoT (Internet of Things), and data analytics that offer opportunities for innovation in municipal service delivery. However, South African municipalities face structural challenges such as political interference, limited skills, and governance failures, which constrain digital transformation (Mhlongo & Thomas, 2024; Layton-Matthews & Landsberg, 2022).

The UTAUT model predicts technology acceptance through performance expectancy, effort expectancy, social influence, and facilitating conditions. Extensions to the model incorporate constructs such as trust and personal innovativeness, which are especially relevant in environments where organisational readiness and institutional confidence vary (García de Blanes et al., 2022). This study therefore extends UTAUT to better understand 4IR adoption within South African local government.

2.2 The Fourth Industrial Revolution

Implementing digital transformation initiatives enhances local government service delivery by streamlining public service processes, improving employee and citizen experiences, and supporting effective risk management (Bob & Kebede, 2025; Sibanda et al., 2020). These initiatives focus on data collection and the

analysis of business processes, tailored to the specific needs of each municipal sector organisation (Chen, Gasco Hernandez, 2024).

Successful digital transformation requires a data-driven culture that fosters creativity, collaboration, and risk-taking in adopting digital technologies (Stobierski, 2019). Organisations that integrate artificial intelligence (AI) and data analytics into strategies and operations gain a competitive advantage (Misa et al., 2020). Establishing such a culture in e-government must begin with senior leadership, who set the tone through data-informed strategic decisions, and encourage evidence-based performance across all levels (Adie et al., 2024; López-Figueroa et al., 2025; UNIDO, 2020).

Historically, industrial revolutions have been driven by transformative technologies. The First Industrial Revolution harnessed steam and water power; the Second employed electricity to enable mass production; and the Third, or Digital Revolution, introduced electrical and digital technologies to automate manufacturing (Dosso, Nwankwo & Travaly, 2021).

The Fourth Industrial Revolution (4IR) is characterised by the widespread adoption of paradigm-shifting technologies, including the Internet of Things (IoT), AI, and cloud computing (Mhlongo & Thomas, 2024; Shava & Vyas-Doorgapersad, 2024; Ebekozien & Aigbavboa, 2021). These innovations make services more accessible, sophisticated, and efficient. According to Klaus Schwab, Chair of the World Economic Forum, 4IR technologies enable citizens to engage with governments, coordinate initiatives, and bypass traditional oversight, as the physical, digital, and biological worlds converge (Layton-Matthews & Landsberg, 2022; Ranchod, 2020). By improving government responsiveness to social and environmental challenges, 4IR technologies can reduce poverty and enhance citizen well-being.

In summary, digital transformation in local government is most effective when guided by data-driven leadership, underpinned by a culture of innovation and collaboration, and informed by the opportunities presented by 4IR technologies.

2.3 UTUAT Model

The effective implementation of any information technology (IT) or information system (IS) critically depends on user acceptance. In pursuit of a more comprehensive model of IT acceptance, Venkatesh et al. (2003) conducted a systematic review of existing studies and an empirical investigation, synthesising key elements from eight behavioural intention models previously applied in technology adoption contexts. These models include the Technology Acceptance Model (TAM), the Theory of Reasoned Action (TRA), Innovation Diffusion Theory (IDT), the Theory of Planned Behaviour (TPB), the combined TAM–TPB model, the Motivational Model (MM), the Model of PC Utilisation (MPCU), and Social Cognitive Theory (SCT). By integrating the core components of these models, Venkatesh et al. (2003) proposed the Unified Theory of Acceptance and Use of Technology (UTAUT), designed to predict and explain technology adoption, acceptance, and usage comprehensively.

Since its introduction, the UTAUT model has been extensively applied and empirically tested across diverse fields to predict system usage and inform technology-adoption and technology-usage decisions (Noureddine et al., 2025; Xue,Li & Wang,2024;Venkatesh et al., 2003;Venkatesh & Morris, 2000;). Recent studies have extended UTAUT by incorporating constructs such as environmental attitudes, trust, and enjoyment to improve explanatory power in contexts such as blockchain adoption and online learning systems (Ronaghi, 2025; Or, 2023; Nikolopoulos & Likothanassis, 2025). Similarly, UTAUT2 extensions have been applied to emerging technologies such as artificial intelligence, adding factors such as perceived enjoyment and safety (Gansser & Reich, 2021). Accordingly, this study adopts the UTAUT model as its

theoretical foundation, as illustrated in Figure 1, providing a unifying framework to understand how users accept and utilise technology.

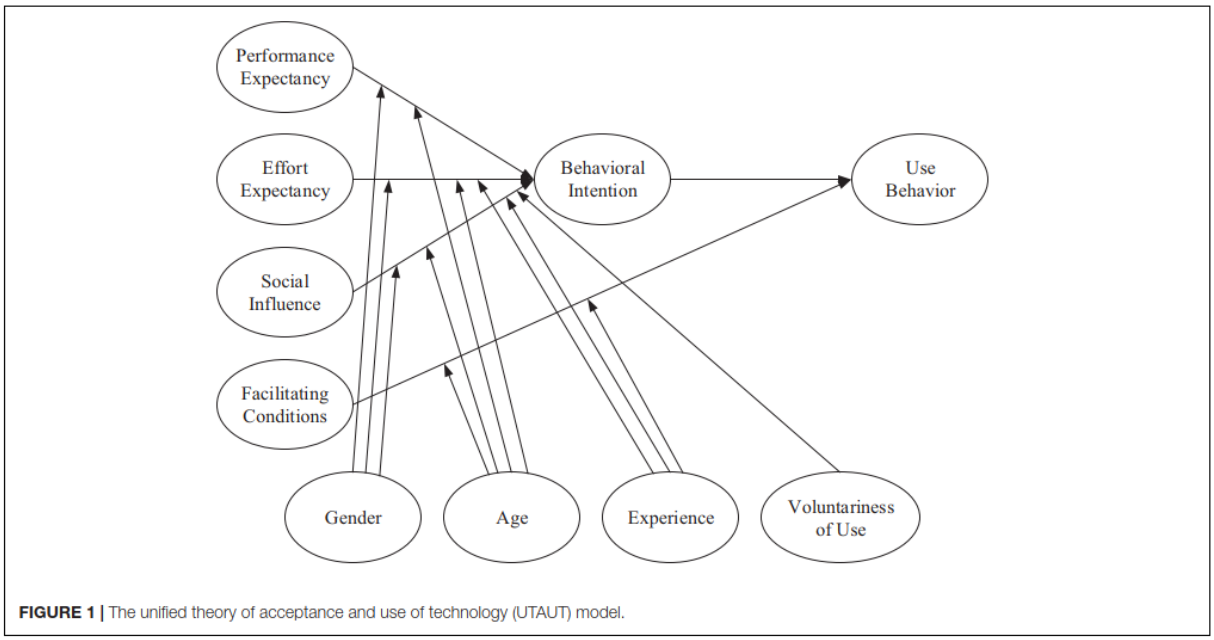

Figure 1: UTAUT model. Source : Venkatesh et al. (2003)

Venkatesh et al. (2003) introduced an integrated framework the Unified Theory of Acceptance and Use of Technology (UTAUT) model (see Figure 1) which accounts for approximately 70% of the variance in user intention. Empirical findings support the UTAUT model as a highly effective tool for analysing technology acceptance. The UTAUT model comprises six principal constructs: performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC), behavioural intention (BI) to use the system, and usage behaviour. It identifies four core determinants PE, EE, SI, and FC that directly influence BI and usage behaviour, along with four moderating factors: gender, age, experience, and willingness to use technology (Venkatesh et al., 2003).

Despite the widespread application of the UTAUT model, questions remain regarding its ability to comprehensively account for individual differences in technology acceptance. Consequently, several extensions to the original model have been proposed. Researchers recommend incorporating additional external variables to enhance the predictive capacity of the UTAUT model concerning information technology adoption (Su, Chen& Wang 2023; García de Blanes, López & Ruiz, 2022; Kenesei, Horváth & Tóth 2025; Kabra et al., 2017; Khalilzadeh, Ozturk & Bilgihan 2017). Suggested additions include self-efficacy, trust, habits, satisfaction, and perceived risk. Kabra et al. (2017) integrated personal innovativeness specific to IT and trust into the UTAUT model to assess factors influencing users' behavioural intentions regarding IT usage. Similarly, Khalilzadeh et al. (2017) introduced self-efficacy, risk, trust, security, and attitude to examine determinants affecting users' intentions to make mobile payments. For instance, García de Blanes et al. (2022) integrated personal innovativeness and trust into UTAUT2 to assess factors influencing behavioural intentions regarding AI virtual assistants, while Su et al. (2023) introduced perceived trust and perceived risk to examine determinants affecting the adoption of AI health assistants.

Similarly, Kenesei et al. (2025) demonstrated that trust and perceived risk play a central role in the acceptance of autonomous vehicles within an integrated UTAUT framework.

Recent studies also highlight personal innovativeness as a critical determinant of technology adoption. Hapsari et al. (2023) found that personal innovativeness significantly influences perceived risks and attitudes toward online booking behaviour, while Wijayadne (2025) confirmed its direct effect on the intention to use digital platforms, mediated by trust. These findings align with broader research emphasising trust as a significant predictor of users' intentions to adopt technology (Goßwein & Liebherr, 2025). Accordingly, this study extends the UTAUT model by incorporating personal innovativeness and trust to predict the adoption of Fourth Industrial Revolution (4IR) technologies.

3. Problem Statement

While national policy prioritises digital transformation, there is insufficient empirical evidence on factors influencing employees' readiness to adopt 4IR technologies within South African municipalities (Mhlongo & Thomas, 2024; Layton-Matthews & Landsberg, 2022; Nalubega & Uwizeyimana, 2019; Sihlongonyane, Ndabeni & Ntuli, 2020; Sutcliffe & Bannister, 2020). This gap limits the effectiveness of technology implementation strategies and contributes to inconsistent adoption outcomes (Shava & Vyas-Doorgapersad, 2024; Lin, Yang & Demirkan, 2007)

Scholarly examination is warranted concerning the role of local government leaders in recognising and addressing the complexities essential for governmental systems to effectively adapt to Fourth Industrial Revolution (4IR) technologies, thereby improving the performance of public organisations (López-Figueroa et al., 2025; Adie et al., 2024;Jarbandhan, 2017). This study therefore asks:

What factors hinder or facilitate the acceptance and use of 4IR technologies in the local government context?

4. Research Model and Hypothesis Development

The study adopts the UTAUT2 model and incorporates two additional constructs trust and personal innovativeness to reflect contextual factors relevant to South African local government. Hypotheses examine the influence of performance expectancy, effort expectancy, social influence, facilitating conditions, personal innovativeness, and trust on behavioural intention, and the effect of behavioural intention on actual use (Liu, Zhang & Wang 2025; García de Blanes et al., 2022).
UTAUT is recognised by numerous scholars as an effective and comprehensive framework, as it integrates various existing theories concerning technology adoption. Its explanatory capability in the field of technology surpasses that of other technology acceptance models (Noureddine et al., 2025; Xue et al., 2024; Venkatesh et al., 2011). Researchers have frequently enhanced the classical UTAUT model by introducing additional independent variables and determinants, or revising specific established determinants and moderators, such as trust, perceived risk, and personal innovativeness, to improve predictive power in emerging technology contexts (Tamilmani, Rana & Dwivedi 2021; Or, 2023).

In this study, the UTAUT model was adapted by incorporating the constructs of trust and personal innovativeness for the analysis of employees' willingness to adopt Fourth Industrial Revolution (4IR) technologies. The revised model underwent empirical testing. Three principal objectives guided this investigation: (1) to identify factors influencing behavioural intention to use 4IR technologies; (2) to

establish an expanded UTAUT model integrating personal innovativeness and trust; and (3) to empirically evaluate the developed model.

4.1 Performance Expectancy (PE)

Performance expectancy refers to users' perceptions of performance improvement resulting from the adoption of technology (Hasan et al., 2019; Hung et al., 2019). Within this research context, performance expectancy reflects users' beliefs that technology utilisation enables the completion of specific tasks and enhances job performance (Venkatesh et al., 2003). In online learning environments, it denotes students' expectations regarding improvements in their academic performance. In this study, performance expectancy is defined as customers' anticipation that 4IR technologies will enhance their performance due to anticipated benefits from service innovation and increased experience. Prior studies indicate that performance expectancy substantially affects usage intentions the greater the perceived productivity benefits, the higher the likelihood of adoption (Venkatesh, 2000).

H1: Performance expectancy influences employees' behavioural intentions to adopt 4IR technology.

4.2 Social Influence (SI)

Social influence concerns the degree to which individuals consider the opinions of significant others when adopting new systems, encompassing those whose perspectives they value and who affect their behaviour within social contexts (Venkatesh et al., 2003) In educational settings, social influence can include peers, teachers, family members, and other relevant stakeholders utilising online learning systems. The introduction of new technologies sees social influence act as a direct predictor of behavioural intention, with its effect diminishing as familiarity with the technology increases (Venkatesh & Davis, 2003).

H2: Social influence exerts a positive impact on employees' behavioural intentions regarding the use of 4IR technologies.

4.3 Effort Expectancy (EE)

Effort expectancy is defined as the perceived ease associated with operating a system (Venkatesh et al., 2003). In online learning scenarios, it represents the simplicity experienced by students when engaging with digital platforms. Research consistently demonstrates a significant positive relationship between effort expectancy and behavioural intention; technologies requiring substantial effort are deemed less beneficial (Venkatesh, 2000; Venkatesh & Davis, 2003). Effort expectancy thus plays a pivotal role in facilitating technology adoption (Venkatesh et al., 2003).

H3: Users' expectations regarding ease of use impact their behavioural intentions to employ 4IR technologies.

4.4 Facilitating Conditions (FC)

Facilitating conditions pertain to individuals' confidence in their organisation's capacity to provide adequate infrastructure supporting IT usage (Venkatesh et al., 2003). They include perceptions of available technical and organisational resources necessary for implementing intended systems.

H4: Facilitating conditions positively influence employees' behavioural intentions to utilise 4IR technologies.

4.5 Behavioural Intention (BI)

Behavioural intention gauges the strength of an individual's intent to perform a given behaviour and their willingness to engage with a system (Fishbein & Ajzen, 1977). According to the UTAUT model, actual technology usage is contingent upon one's behavioural intention. This construct reliably predicts real-world usage patterns (Venkatesh & Davis, 2000). Within this research, behavioural intention specifically denotes employees' intended engagement with 4IR technology in local government contexts, reflecting both initial adoption and sustained utilisation (Venkatesh et al., 2012).

H7: Behavioural intention has a positive effect on employees' capacity to utilise 4IR technologies.

4.6 Additional Constructs

Beyond the original UTAUT framework, this study introduced supplementary constructs to further refine the model. Trust and personal innovativeness were incorporated as key variables.

4.7 Personal Innovativeness (PI)

Personal innovativeness characterises an individual's openness to novel ideas and innovations (Midgley & Dowling, 1978). To enhance the UTAUT model's efficiency in evaluating technology adoption, Wong et al. (2015) integrated personal innovativeness, representing an individual's propensity to experiment with new technologies. It is considered a critical determinant of mobile technology adoption (Agarwal & Prasad, 1998).

H5: Personal innovativeness positively affects employees' behavioural intentions to use 4IR technologies.

4.8 Trust

Trust is a crucial determinant in predicting individuals' intentions to adopt IT (Kabra et al., 2017). Empirical evidence suggests that trust in governmental institutions significantly influences the adoption and utilisation of e-government services (Mensah, Jianing & Durrani, 2017; Mpinganjira, 2015).

H6: Trust positively impacts employees' behavioural intentions toward the adoption of 4IR technologies.

5. Methodology

During the quantitative phase, this study employed the Unified Theory of Acceptance and Use of Technology (UTAUT) model. Data collection was conducted via a self-administered survey. The target population comprised municipal leaders registered within the 257 municipalities listed in the South African Local Government Association (SALGA) database. These participants were well-suited to the research as they are employed by SALGA and operate within the public sector's municipal structures. Purposive sampling was implemented based on two criteria: (i) participants had to be local government employees, and (ii) specifically, City of Johannesburg municipal leaders involved with the implementation or anticipated use of Fourth Industrial Revolution (4IR) technologies in their professional roles. The sample size was determined using Cochran's (1977) statistical formula, resulting in 351 participants selected from an estimated population of 4 000 leaders.

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5.1 Instrument

A self-administered survey, adapted to incorporate UTAUT constructs, served as the primary data collection instrument. Participants were fully informed about the study and their right to withdraw at any stage without repercussion; written consent was obtained accordingly. Prior to the commencement of data collection, ethical clearance was granted by the researcher's university Research Ethics Committee and specifically authorised by the Milpark Business School Research Ethics Committee (No. DBA2021/08/003). The questionnaire was divided into two sections: (1) demographic information, and (2) constructs pertinent to the study.

- **Performance Expectancy**

The following constructs were measured: perceptions of IT systems' usefulness, the extent to which IT systems facilitate task completion and efficiency, the utility of 4IR technologies in daily work, their impact on performance metrics, customer-centricity, and enhancement of business decision-making.

- **Effort Expectancy**

Consistent with Venkatesh et al. (2003), effort expectancy was assessed through items evaluating users' perceived ease or complexity regarding technology use. Constructs included clarity and simplicity of interaction with IT systems, proficiency in knowledge technology systems, learning curves, adaptability, and understanding of 4IR technologies in relation to job responsibilities.

- **Facilitating Conditions**

Following Venkatesh et al. (2003), "facilitating conditions" captured respondents' perceptions regarding the sufficiency of organisational and technological infrastructure to support workplace technology adoption. Measured constructs included knowledge availability, access to assistance when needed, consultation opportunities with IT departments, resource adequacy for 4IR technology use, and compatibility with existing technologies.

- **Behavioural Intention**

Behavioural intention defined as the willingness to use or continue using a particular technology (Venkatesh et al., 2012) was measured through constructs assessing future usage intent, recommendations to others, and the planned frequency of 4IR technology utilisation.

- **Trust**

Trust was assessed beyond technological dimensions, encompassing confidence in institutional competence and reliability regarding digital transformation initiatives. Items addressed faith in the organisation's provision of IT services, trustworthiness of platforms, confidence in online learning technologies, effectiveness in delivering e-learning, and the capacity for fraud detection.

- **Personal Innovativeness**

Personal innovativeness the propensity to embrace and experiment with new technologies (Agarwal & Prasad, 1998; Yi et al., 2006) was evaluated through constructs relating to experimentation, enthusiasm for

new IT systems, early adoption relative to peers, openness to 4IR technologies, and encouragement for broader adoption.

5.2 Data Analysis

SPSS software was utilised to examine the reliability and validity of survey items, while AMOS 27 facilitated measurement and path analysis modelling. Internal consistency of the instrument was gauged through Cronbach's alpha computations for each construct (Arbuckle, 2020).

Results and Discussion

Table 1: Exploratory factor analysis

				Bartlett (1951) test of sphericity	
Constructs	**Items**	**Factor loadings**	**KMO measure**	**Chi-square**	**Sig.**
Performance expectancy	PE1	.359	0.763	511.281	<0.001
	PE2	.641			
	PE3	.820			
	PE4	.852			
	PE5	.847			
	PE6	.759			
	PE7	.724			
Social influence	SI1	.698	0.780	635.339	<0.001
	SI2	.853			
	SI3	.927			
	SI4	.883			
	SI5	.688			
	SI6	.760			
Effort expectancy	EE1	.812	0.885	731.693	<0.001
	EE2	.822			
	EE3	.863			
	EE4	.827			
	EE5	.861			
	EE6	.817			
	EE7	.831			
Facilitating conditions	FC1	.790	0.814	312.440	<0.001

				Bartlett (1951) test of sphericity	
Constructs	**Items**	**Factor loadings**	**KMO measure**	**Chi-square**	**Sig.**
	FC2	.749			
	FC3	.805			
	FC4	.801			
	FC5	.836			
Personal innovativeness	PI1	.813	0.829	470.456	<0.001
	PI2	.857			
	PI3	.744			
	PI4	.792			
	PI5	.736			
	PI6	.824			
Trust	TR1	.785	0.866	593.752	<0.001
	TR2	.901			
	TR3	.692			
	TR4	.897			
	TR5	.890			
	TR6	.812			
Behavioural intention	BI1	.848	0.791	691.527	<0.001
	BI2	.878			
	BI3	.901			
	BI4	.907			
	BI5	.892			

Table 1 demonstrates that the Cronbach's alpha scores surpassed the acceptable threshold of 0.7 (Gefen et al., 2003; Nunnally & Bernstein, 1978), with composite reliability for the constructs ranging from 0.797 to 0.933. Additionally, the Average Variance Extracted (AVE) values met the criterion of explaining at least 50% of the variance, typically falling between 0.389 and 0.739 (Al Kurdi, 2016; Falk & Miller, 1992). These results confirm that convergent validity was attained for the scales used to assess the constructs. Discriminant validity requirements were satisfied as all AVE values exceeded the squared correlations among constructs in the measurement model (Hair et al., 2010. Previous research indicates that constructs can account for a minimum of 50% of measurement variance when AVE is approximately 0.5 or higher.

Table 2 presents the construct reliability and validity outcomes, including results from confirmatory factor analysis, composite reliability, AVE, and Cronbach's alpha, where all alpha values exceeded 0.70, demonstrating acceptable reliability ranges.

Table 2: Construct reliability and validity

Constructs	Items	Factor loadings	Composite Reliability (CR)	Cronbach's alpha	Average Variance Extracted (AVE)
Performance expectancy	PE1	0.244	0.851	0.843	0.473
	PE2	0.520			
	PE3	0.788			
	PE4	0.864			
	PE5	0.852			
	PE6	0.697			
	PE7	0.634			
Social influence	SI1	0.593	0.891	0.888	0.586
	SI2	0.834			
	SI3	0.956			
	SI4	0.907			
	SI5	0.569			
	SI6	0.637			
Effort expectancy	EE1	0.762	0.926	0.926	0.642
	EE2	0.794			
	EE3	0.829			
	EE4	0.799			
	EE5	0.847			
	EE6	0.787			
	EE7	0.789			
Facilitating conditions	FC1	0.768	0.856	0.852	0.544
	FC2	0.643			
	FC3	0.724			
	FC4	0.736			

Constructs	Items	Factor loadings	Composite Reliability (CR)	Cronbach's alpha	Average Variance Extracted (AVE)
	FC5	0.806			
Personal innovativeness	PI1	0.750	0.884	0.876	0.561
	PI2	0.795			
	PI3	0.673			
	PI4	0.776			
	PI5	0.701			
	PI6	0.790			
Trust	TR1	0.739	0.914	0.910	0.641
	TR2	0.877			
	TR3	0.648			
	TR4	0.880			
	TR5	0.873			
	TR6	0.758			
Behavioural intention	BI1	0.726	0.926	0.930	0.718
	BI2	0.770			
	BI3	0.845			
	BI4	0.945			
	BI5	0.928			

For all the constructs, the composite reliability (CR) and reliability coefficient went above the value of 0.7, which depicts internal reliability among multiple measurements of a construct (Hair et al., 2010. The results are presented in Table 3 below:

Table 3: Correlation between constructs to examine convergent reliability

Correlation									
	Mean	**Std. dev**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Behavioural intention	4.5140	.51785	--						
Performance expectancy	4.5407	.39733	.507**	--					

Correlation									
Social influence	4.1068	.63766	.501**	.415**	--				
Effort expectancy	4.2791	.56686	.505**	.510**	.718**	--			
Facilitating conditions	4.3140	.55826	.428**	.459**	.655**	.658**	--		
Personal innovativeness	4.0493	.67109	.298**	.419**	.419**	.536**	.640**	--	
Trust	4.1678	.67049	.494**	.425**	.450**	.656**	.579**	.535**	--
**. Correlation is significant at the 0.01 level (2-tailed).									

The correlations between the constructs were signified by off-load diagonal elements. Table 3 above clearly indicates that the range of 0.363–0755 encapsulated the square root of the AVE values, and this range was mostly higher than the suggested value of 0.5.
A summary of the hypotheses and results are depicted in Table 4.

Table 4: Results from regression model

Hypothesis	IV	DV	R^2	F statistics	Model Sig.	Regression coefficient	P-value	Results
H1	PE	BI	0.244	46.277	<0.001	0.603	<0.001	Supported
H2	SI	BI	0.181	31.578	<0.001	0.341	<0.001	Supported
H3	EE	BI	0.203	36.411	<0.001	0.411	<0.001	Supported
H4	FC	BI	0.430	108.060	<0.001	0.610	<0.001	Supported
H5	PI	BI	0.335	71.599	<0.001	0.444	<0.001	Supported
H6	TR	BI	0.286	56.915	<0.001	0.415	<0.001	Supported
H7	BI	USR	0.029	4.241	> 0.001	0.081	P = 0.041	Supported

- **Performance Expectancy**

This hypothesis explores the relationship between performance expectancy and employees' behavioural intention, specifically regarding the adoption of 4IR technologies. The statistical analyses conducted indicate that performance expectancy is a strong predictor of employees' utilisation of 4IR technologies, with a statistically significant association ($\beta = 0.603$, $p < 0.001$), thereby confirming *H1*. Existing literature, including Xue et al. (2024), Noureddine et al. (2025), and Venkatesh et al. (2003), underscores the importance of effort expectancy in facilitating technology adoption, further supported by numerous studies demonstrating its influence on behavioural intention.

- **Effort Expectancy**

The research examined participants' perceptions of 4IR technologies, including recent advancements and their ease or complexity of use. Effort expectancy was found to have a significant impact on behavioural intention to adopt 4IR technologies, as evidenced by statistical significance ($\beta = 0.411$, $p < 0.001$). The positive regression coefficient suggests a favourable association between effort expectancy and the desire to utilise 4IR technologies, thus confirming *H2*. These findings align with prior studies using the UTAUT framework (Chu et al., 2022; Tamilmani et al., 2021; Oke & Fernandes, 2020).

- **Facilitating Conditions**

The study assessed participants' ability to access resources and support for employing 4IR technologies in service delivery. Results demonstrate that effort expectancy exerts a statistically significant influence on behavioural intention to use 4IR technologies ($\beta = 0.411$, $p < 0.001$). The data further suggest that the perceived ease of use encourages continued engagement with 4IR technologies, confirming *H3*. This outcome is consistent with earlier research applying the UTAUT model across various technologies (Gansser & Reich, 2021; Hržica et al., 2025; Venkatesh et al., 2003). Consequently, the findings reinforce the view that municipal leaders' behavioural intention to adopt and employ 4IR technologies is significantly shaped by both performance expectancy and effort expectancy.

- **Social Influence**

Social factors were observed to directly affect the intention to use technology. The study's findings indicate that socialisation has a statistically significant effect on behaviour, particularly concerning the intention to use 4IR technology ($\beta = 0.34$, $p < 0.001$), confirming *H4*. These results are congruent with multiple studies evaluating the impact of social influence, which consistently demonstrate its role in increasing technology adoption (Kenesei et al., 2025; Or, 2023; Bindah & Othman, 2014).

- **Behavioural Intention**

Behavioural intention (BI) in this context refers to employees' plans to utilise 4IR technology in future local government operations. The construct was measured and found to be statistically significant ($\beta = 0.081$, $p < 0.001$), indicating a verified intention to accept and adopt technology, thus confirming *H5*. Prior research supports the influence of behavioural intention on actual technology usage (Liu et al., 2025; García de Blanes et al., 2022; Venkatesh et al., 2003).

- **Trust (TR)**

Trust was identified as a significant factor in this investigation. Study findings reveal that trust positively and significantly affects employees' behavioural intention to engage with 4IR technologies ($\beta = 0.415$, $p < 0.001$), confirming *H6*. These results are consistent with a range of prior studies examining trust's role in technology adoption (Goßwein & Liebherr, 2025; Su et al., 2023; Alsaif, 2013; Abu Nadi, 2012;).

- **Personal Innovativeness**

The analysis demonstrates that personal innovativeness exerts a statistically significant effect on behavioural intention towards 4IR technologies ($\beta = 0.444$, $p < 0.001$), confirming *H7*. Research by Ko,

Kim and Lee (2009) and Kuo and Yen (2009) illustrates a positive relationship between personal innovativeness and technology adoption. Additional evidence (Wijayadne, 2025; Hapsari et al., 2023; Luqman et al., 2016) supports personal innovativeness as a key component promoting 4IR technology adoption.

Furthermore, Table 4 outlines the model's explanatory power. The analysis accounts for a substantial portion of variance in all endogenous variables: PE (24.4%), SI (18.1%), EE (20.3%), FC (43.0%), PI (33.5%), TR (28.6%), and BI (2.9%). According to Falk and Miller (1992), the coefficient of determination (R^2) should exceed 0.10. All endogenous variables met this criterion in the present study. The observed explanatory strength affirms the stability and robustness of the proposed model.

6. Discussion

The findings validate the extended UTAUT2 model and demonstrate that behavioural intention to adopt 4IR technologies is influenced by multiple determinants. The actual use of 4IR technologies was significantly and positively influenced by enabling circumstances. This is consistent with the findings from Xue et al. (2024), Noureddine et al. (2025), and Venkatesh et al. (2003).

Performance expectancy emerged as a strong predictor, indicating that employees adopt technologies they believe will improve their work performance (Chu et al., 2022; Tamilmani et al., 2021). Effort expectancy also significantly influenced behavioural intention, highlighting the importance of easy-to-use systems. According to research by Venkatesh et al. (2003), effort expectancy is a crucial factor in promoting technology adoption. Many researchers, including Gansser & Reich (2021), Hržica et al. (2025) and Venkatesh et al. (2003), have highlighted these constructs as critical determinants of technology acceptance across diverse organizational contexts.

Facilitating conditions such as training, IT support, and adequate infrastructure were shown to be essential for supporting adoption. According to Venkatesh et al. (2003), "facilitating conditions" refer to a user's impression of the availability of sufficient organisational and technological infrastructure to support the use of specific technology. Social influence played a meaningful role, emphasising the impact of leadership and peer endorsement in shaping employee behaviour. This result is therefore consistent with various earlier research that advocated improved supporting conditions to promote the acceptance and use of mobile applications for micro-operations from a technological and human perspective (Kenesei et al., 2025; Or, 2023; Jong & Wang, 2009; Lakhal et al., 2013).

Trust significantly predicted behavioural intention, underscoring the need for secure and reliable systems in governance contexts marked by institutional uncertainty. Thus, according to this hypothesis, employees' intentions to use 4IR technologies will be greatly influenced by their level of trust in the government (Liu et al., 2025; García de Blanes et al., 2022; Alsaif, 2013).

Personal innovativeness is generally believed to refer to the process of creating or implementing concepts or novel behaviours in relation to technology, products, services, systems, or practices (Damanpour, Chiu & Wischnevsky, 2009). Personal innovativeness further contributed to adoption, suggesting that cultivating an innovation culture may enhance readiness for digital transformation. According to previous studies (Thusi & Maduku, 2020; Venkatesh et al., 2012), there is a strong and positive association between the intention to use and use the behaviour of 4IR technologies (Hapsari et al., 2023; Wijayadne, 2025).

Overall, the results highlight the interplay between individual perceptions, organisational readiness, and institutional factors in driving technology adoption within municipalities (Adie et al., 2024; López-Figueroa et al., 2025).

6.1 Implications

The validation of the extended UTAUT2 model demonstrates that behavioural intention to adopt 4IR technologies is shaped by multiple determinants, including performance expectancy, effort expectancy, facilitating conditions, social influence, trust, and personal innovativeness. These findings have significant implications for leadership, governance, and employee readiness within South African municipalities.

6.2 Leadership Implications

Performance expectancy and effort expectancy emerged as strong predictors, underscoring the need for leaders to articulate the tangible benefits of 4IR technologies and ensure that systems are intuitive and user-friendly. Leaders should champion digital transformation by fostering a clear vision, allocating resources, and promoting a culture of innovation. Visible leadership support can enhance social influence, motivating employees to embrace technological change.

6.3 Governance Implications

The role of facilitating conditions and trust highlights the importance of robust governance frameworks. Municipalities must invest in infrastructure, training, and IT support to create an enabling environment for technology adoption. Additionally, transparent policies and accountability mechanisms are essential in building institutional trust, particularly in contexts where governance challenges and political interference may undermine confidence in digital initiatives.

6.4 Employee Readiness Implications

The significance of personal innovativeness suggests that readiness extends beyond technical skills to include cultural and attitudinal dimensions. Training programmes should not only develop digital competencies, but also encourage creativity and adaptability. Peer and managerial endorsement, as reflected in social influence, can accelerate adoption by normalising technology use and reducing resistance to change.

Overall, these findings emphasise that successful digital transformation in local government requires a holistic approach combining visionary leadership, strong governance structures, and strategies that cultivate employee readiness for innovation. This integrated perspective can enhance the effectiveness of technology implementation and contribute to improved service delivery in the era of the Fourth Industrial Revolution.

7. Recommendations

Drawing on the findings and discussion, this study proposes several evidence-based strategies to enhance the adoption of Fourth Industrial Revolution (4IR) technologies within South African municipalities. These recommendations aim to address leadership, governance, and employee readiness dimensions, thereby ensuring sustainable digital transformation.

7.1 Strengthen Leadership Capacity for Digital Transformation

Municipal leaders should undergo targeted training in digital leadership and change management to develop competencies for guiding technology adoption. Leadership commitment is essential for articulating a clear vision, mobilising resources, and fostering an organisational culture that embraces innovation (Adie et al., 2024; López-Figueroa et al., 2025).

7.2 Establish Robust Governance and Policy Frameworks

Governance structures must incorporate transparent policies, accountability mechanisms, and cybersecurity standards to build institutional trust and mitigate risks associated with digital platforms. These frameworks should align with national digital transformation strategies while addressing local contextual challenges (Kenesei et al., 2025; Su et al., 2023).

7.3 Invest in Infrastructure and Resource Allocation

Adequate technological infrastructure including reliable connectivity, IT support, and secure data systems should be prioritised. Resource allocation must extend to training and maintenance to ensure facilitating conditions that enable effective technology use (Xue et al., 2024; Noureddine et al., 2025).

7.4 Enhance Employee Readiness through Capacity Building

Continuous professional development programmes should integrate technical training with modules on creativity, adaptability, and problem-solving. Such initiatives will strengthen personal innovativeness and reduce resistance to change, thereby improving readiness for digital transformation (Hapsari et al., 2023; Wijayadne, 2025).

7.5 Foster a Culture of Innovation and Peer Influence

Municipalities should create innovation hubs and incentivise employees to experiment with emerging technologies. Peer endorsement and managerial support can amplify social influence, accelerating adoption and normalising technology use (Liu et al., 2025; García de Blanes et al., 2022).

8. Contribution of the Study

8.1 Theoretical Contributions

a) Extension and Validation of UTAUT2

This study extends the UTAUT2 model by incorporating trust and personal innovativeness, addressing contextual factors relevant to public-sector environments in developing countries. The findings validate this extended model and confirm its applicability in predicting a behavioural intention to adopt 4IR technologies within local government settings.

b) Empirical Evidence on Key Determinants

The research provides empirical support for the influence of performance expectancy, effort expectancy, facilitating conditions, social influence, trust, and personal innovativeness on behavioural intention. This reinforces and expands prior work by Venkatesh et al. (2003) and others, while situating these determinants in a unique governance context.

c) Integration of Institutional and Individual Factor

By highlighting the interplay between organisational readiness, institutional trust, and individual innovativeness, the study contributes to a more holistic understanding of technology adoption in public-sector organisations.

9. Limitations

The objective of this study was to identify key factors that could enhance the acceptance and utilisation of Fourth Industrial Revolution (4IR) technologies within the context of local government. The research was limited to employees in South African local government; therefore, the findings may not be generalised to employees in other countries. To address this limitation, future studies are recommended to replicate this research in additional national contexts.

Furthermore, it is suggested that subsequent research explores the adoption of services by municipal consumers. Such investigations may uncover additional or alternative factors beyond those examined in the current study that influence the acceptance, dissemination, and utilisation of e-services.

10. Conclusion

Slade et al. (2015) identified the UTAUT model as a robust framework for analysing individuals' adoption of e-government services. Their principal theoretical contribution involved adapting the UTAUT model to account for technological advancements associated with the Fourth Industrial Revolution (4IR). Building on the original framework proposed by Venkatesh et al. (2003), Slade et al. (2015) incorporated seven fundamental assumptions and introduced two additional hypotheses to examine the revised model.

This adaptation enhances the understanding of how citizens engage with digital government services, particularly in contexts where technology adoption is influenced by organisational leadership, institutional capacity, and socio-cultural factors. In the African public administration context, these insights are especially valuable, as they highlight the critical role of data-driven and technology-oriented leadership in promoting e-government adoption, improving service delivery, and fostering a culture of innovation within local and national government institutions. By linking the UTAUT model to 4IR technologies, this research provides a theoretical lens for examining how leadership strategies can facilitate successful digital transformation in public sector settings across the continent.

Furthermore, the study responded to Venkatesh et al. (2012)'s call for rigorous UTAUT2 testing in developing countries, thereby strengthening generalisability and validity. By integrating trust and individual creativity as influential components governing behavioural intention within the South African context, this research provides a notable theoretical advancement. It also represents the first investigation into employees' intentions to adopt emerging technologies, such as 4IR technology. The findings affirm the significance of trust and personal innovativeness in shaping intentions to engage with 4IR technologies.

Competing Interests

The author declares that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Conflict of Interest Statement

I declare that there is no conflict of interest in the conduct of this study. All interactions with participants were conducted in a professional and unbiased manner. The involvement of institutional staff and students did not influence the objectivity of data collection or analysis. Any risks of bias were minimised through the transparent procedures and adherence to research guidelines. Furthermore, no financial, personal, or professional affiliations exist that could be perceived to have influenced the outcomes or integrity of this research.

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