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Smart Cities in UAE: Governance, Innovation and Quality

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A B S T R A C T

This article is a trail to investigate and evaluate the quality and innovation in the governance of the smart cities of UAE. It will highlight 3 major issues: the current governance of the smart cities of UAE, the need and the role of the quality and innovation in smart cities, the need of a framework to achieve the vision of the smart cities through innovative governance. Quantitative technique is used to collect the primary data from the target audience. The target audience are high level business/management positions and technology professionals working under the governance system of smart city of UAE at different positions. The article concludes that current governance approaches of the smart cities of UAE are not much effective to cater to the current challenges of the smart city such as maximum use of the resources and attain sustainability. Some governance approaches of the smart cities of UAE need to be modified or upgraded to be able to cater to the current problems of the smart cities. There is need to upgrade or innovate the approaches of the governance to achieve the best use of resources and provide quality of life through sustainable development. The study recommended that governance of the smart cities should provide solution at a centralized single platform, the flow of information to maximize the use of resource and minimize the waste, establish digital leadership, digital learning platform and collaboration between the stakeholders.

1. INTRODUCTION

Smart city is a small or medium or large size area that adopts an innovative governance approach to design integrated and innovative policies and improve the quality life of the citizens by promoting environmental, social and economic sustainability (T M Ghazal et al., 2023a). The definition of the smart city has six axes that explain what a smart city should be. These axes are environment, mobility, citizenship, living, economy and government and political participation (Aziz et al., 2023).

Smart city governance refers to the crafting of new forms of human collaboration with the use of the ICTs in order to obtain better outcomes and allow open governance processes (H. M. Alzoubi et al., 2022h; Hani Al-Kassem, 2021).

Further, governance of a smart city is all about designing an organizational structure that seek to the higher participation of the stakeholders (such as people living in the city) into urban governance (A I Aljumah et al., 2022a). Several solutions are adopted to coordinate and to manage the projects

of the smart cities and one of them is the effective governance in the smart cities (Alshawabkeh et al., 2021; El Khatib et al., 2020a). This study is also focusing on the quality and innovation in the governance of the smart cities in general (Tariq et al., 2022b)(H. M. Alzoubi et al., 2022a; El Khatib et al., 2022).

The current governance of the smart cities is unable to cater to the challenges of the smart cities to focus on the wise use of resources and achieve the sustainable growth and development (Nuseira and Aljumahb, 2020; Wu et al., 2016). These challenges have arisen due to the ineffective governance system of the smart cities (Muhammad Turki Alshurideh et al., 2023c) (El Khatib and Ahmed, 2020). Due to insufficient involvement of the participatory governance in terms of attaining with innovation to wisely use its energy, water and other resources and further, providing solutions to maintain quality of the life of people (Al-Maroof et al., 2022b; Aljumah et al., 2021a; H. M. Alzoubi et al., 2022e) (AlDhaheri et al., 2023). In short, the governance system of the smart cities is not much smarter to optimally use the existing capacity and resources.

1.2. Research Objectives

The aim of the study is to evaluate the quality and innovation in the governance of the smart cities of UAE. Hence, the objectives of the study are as follows:

- To evaluate the current governance of the smart cities of UAE
- To identify the need of the quality and innovation in smart cities
- To suggest the framework to achieve the vision of the smart cities through innovative governance

1.3. Research Questions

1. What are the current strategies of the governance system of the smart cities of UAE?
2. What is the need of quality and innovation in the governance systems of the smart cities of UAE?
3. What should be the governance framework to achieve the vision of the smart cities of being the sustainable cities?

1.4. Research Significance

This research study is an in-depth understanding of the current trends about the smart city governance. This study highlights the need of quality and innovation in governing a smart city through the use of information and communication technologies. It is matter of concern that technology alone cannot make a city smarter. To build a city smart, the governance of the city requires the approach of the political understanding of the technology. Several evaluation approaches and models have been put forwards in the various previous studies (Al-Kassem et al., 2013; M T Alshurideh et al., 2022; H. M. Alzoubi et al., 2022c; Nuseir, 2021). However, these studies were lacking in evaluating the innovativeness of the governance system of the smart cities. Thus, evaluating the quality and innovation of the governance systems of the smart cities is the need of the hour. This paper aims to do the assessment of the smart city governance. The findings of this research study will help to manage the emerging smart cities through quality and innovation in governance and gain economic and public values.

2. STUDY BACKGROUND

2.1. Six axes of the Smart cities

Environment: Smart cities promote energy saving, use of renewable energy, reduction of environmental pollution and reduction of CO_2 emission (Alzoubi et al., 2021).

Mobility: Smart cities promote accessible and safe transport and creation of an integrated mobility system with low environmental impact (Muhammad Turki Alshurideh et al., 2023b).

Citizenship: Smart cities promote life-long learning and education, nurture cultural diversity, civic engagement and creativity of the citizens (H. M. Alzoubi et al., 2022b; Louzi et al., 2022a).

Living: Smart cities safeguard individual and public health. It implements welfare, tourists and cultural policies and also promotes social cohesion (Abudaqa et al., 2021; Al-Kassem et al., 2012).

Economy: Smart cities promote creation of a flexible labor maker, support for innovation and entrepreneurship, especially for women and young people (Aljumah et al., 2021b; Gaytan et al., 2023).

Government and Political Participation: Smart cities encourage the adoption of transparent decision -making, promotion of political participation, creation of accessible online services (Ahmed and Nabeel Al Amiri, 2022; Almasaeid et al., 2022; Lee et al., 2023; Mat Som and Kassem,

2013)..

Governance: Governance is a very broad concept. It is the process of governing all the tasks or activities undertaken by the government, market, network, formal or informal organization through the norms, laws, power, or language (M. Alshurideh et al., 2022).

The UAE has been at the forefront of adopting emerging technologies. Research by (Tariq et al., 2022a) discusses how innovations like blockchain, AI, and IoT are being integrated into various aspects of smart city infrastructure, such as transportation and healthcare. Innovation in the UAE's smart cities extends to sustainable practices. (Al-Kassem et al., 2022; H. M. Alzoubi et al., 2022f) underline the adoption of renewable energy sources, efficient waste management systems, and eco-friendly urban planning as key components of sustainability-driven innovation (Khatib et al., 2022) (Kassem and Martinez, 2022).

Smart city initiatives in the UAE prioritize citizen satisfaction. (Al-Dmour et al., 2023) highlight the importance of citizen engagement through mobile applications and digital services, enabling citizens to actively participate in decision-making processes.

Research by (H. M. Alzoubi et al., 2022g) emphasizes the enhancement of citizens' quality of life as a primary goal of smart city development in the UAE. Factors such as improved healthcare services, education, and safety contribute to this aspect.

Quality infrastructure is essential for the smooth functioning of smart cities. (El Khatib et al., 2021) discuss how the UAE's commitment to high-quality urban infrastructure, including transportation networks and connectivity, underpins the success of smart city projects. Ensuring the quality of digital services is crucial. (Alzoubi et al., 2020; Harguem et al., 2022) explore the role of quality assurance mechanisms in digital services and the importance of continuous improvement to meet evolving citizen needs.

Moreover, the concept of smart cities has gained significant attention worldwide as urbanization continues to accelerate (Alzoubi et al., 2019; Blooshi et al., 2023)(Amiri et al., 2020; Mubeen et al., 2022). In the United Arab Emirates (UAE), the rapid development of smart cities has been a focal point of government initiatives and investments (T M Ghazal et al., 2023b). This literature review aims to provide insights into the governance, innovation, and quality aspects of smart cities in the UAE based on prior research articles.

A research by (El Khatib, 2015) highlights the pivotal role of the UAE government in driving smart city initiatives. The UAE Vision 2021 and the Smart Dubai initiative have played crucial roles in aligning government policies with smart city development (Arshad et al., 2023; Mohammed T. Nuseir et al., 2022). As discussed by (Ali et al., 2023; Khatib et al., 2016) data governance is a critical aspect of smart cities in the UAE. The government's efforts in data management, security, and privacy are crucial for building citizens' trust and ensuring the responsible use of data (Nuseir and Aljumah, 2020) (M Alshurideh et al., 2023).

The study by (Varma et al., 2023; Yasir et al., 2022) emphasizes the significance of PPPs in smart city projects. These collaborations have been instrumental in leveraging private sector expertise and resources for sustainable smart city development (Aljumah et al., 2020; El Khatib and Ahmed, 2019).

2.2. Governance in Smart Cities

Governance is one of the six characteristics of a Smart Sustainable City. The participatory governance is responsible for the sustainable economic growth and high quality of life, with the wise management of the resources (I. Akour et al., 2022). The success of today's governance in the smart cities must be measured in terms of wise use of its energy, water and other resources and how smartly it is attaining prosperity for a sustainable foundation (M T Nuseir et al., 2022a) (T M Ghazal et al., 2023c). In short, the governance in the smart cities must practice on becoming smarter in terms of using existing capacity and resources (Akour et al., 2023). As per the author, a smart city with good governance attempts to enhance the effectiveness and quality of smart city services (A. Al-Maroof et al., 2021) (R. S. Al-Maroof et al., 2021a)(Khatib, 2022). It mandates transparency and accountability at all levels of the participatory governance (Muhammad Turki Alshurideh et al., 2022c). A good governance system provides the means to listen to the needs of the citizens, understand them, and then respond to these needs (Bawaneh et al., 2023).

It is suggested that the current governance system of the smart cities require the involvement of the

citizens in decision- making (Muhammad Turki Alshurideh et al., 2022b; M T Nuseir et al., 2022b) (A I Aljumah et al., 2022b; M. El Khatib et al., 2021). The study stated the development of the efficient and effective governance, for wise use of resources and maintaining sustainable growth of the smart cities (Nuseir et al., 2020)(Al-Kassem, 2017; Sakkthivel et al., 2022). The study suggested three approaches for this. One is by playing the role of a coordinator and bringing stakeholders together to establish new platform for collaboration (H. M. Alzoubi et al., 2022d) (Fatima et al., 2023). Second is by playing the role of a regulator and making sure that all the common standards and norms are in place (I. A. Akour et al., 2022; Nuseir and Aljumah, 2022). Third is by playing the role of a founder and ensuring infrastructure funding and demonstration of the projects (Al-Maroof et al., 2022a) (El Khatib et al., 2019).

European Parliament insisted the active participation of the citizens of the smart cities to create a sense of ownership and commitment, to ensure local level commitment and to ensure the integration of solutions across the portfolios of initiatives (Ahmad Ibrahim Aljumah et al., 2022; E. Khatib et al., 2021) (Farrukh et al., 2023). To achieve the objective and vision of the smart cities all the urban actors such as NGOs, SMEs, schools, transport, housing corporation, local government etc (Nuseir and Aljumah, 2020). has, to come together because quality and innovation in governance of the smart cities is all about the outcomes of interactions between all the urban actors in the public domain (H. Alzoubi et al., 2022; El Khatib et al., 2020b) (Nuseir and Aljumah, 2020).

2.3. Governance styles in Smart Cities

There are different governance methods to the concept of smart city, ranking from institutional conservation to institutional transformation (Louzi et al., 2022b)(Alshurideh et al., 2020). The networking environment has introduced new means of governance which are different from traditional bureaucracy (Kurdi et al., 2022b). For example, the technocratic nature of the smart cities promotes the self-governance model of the smart city (Ali Salahat, 2021)(Al-Awamleh et al., 2022). On another side of spectrum of governance models is the bureaucratic model of smart city governance under which, the local government has prominent role in the implementation and controlling of smart initiatives in the city (Nuseir et al., 2021) (Alzoubi and Ahmed, 2019). Another governance model is the medium of spectrum of interactions and control of the local government and the other actors are responsible for managing the smart cities (Muhammad Turki Alshurideh et al., 2022a) (Ahmed et al., 2022; Nadzri et al., 2023). Now, in smart cities, the power balance has now changed and citizens now need their government while the governments need the cooperation and intelligence of their citizens to function well (M. Alzoubi et al., 2021)(Taher M. Ghazal et al., 2023; Khatib and Opulencia, 2015). This demand of the citizens has changed the governance system of the smart cities.

2.4. Needs of the quality and innovation in the governance system of smart cities

A study was conducted by (Muhammad Turki Alshurideh et al., 2023a), under which he stated that smart cities face many challenges due to their classical process of governing. Further, the results of the study (Khan et al., 2022) (Nuseir and Aljumah, 2020) stated that governance of the smart cities needs to be more innovative and advanced to meet these challenges (Aityassine et al., 2022; Al-Kassem, 2014) (Abudaqa et al., 2022). The study suggested that use of ICT in the governance can improve the political participation, implement public policies effectively, provide sector services to the people and engage the stakeholders in the sustainable development of the smart cities (R. S. Al-Maroof et al., 2021b) (Akour et al., 2021). The implementation of the ICTs (Information and Communication Technologies) improves the participation of the citizens in the decision-making processes (Kurdi et al., 2022a) (Muhammad Alshurideh et al., 2023). The implementation of the ICT facilitates in achieving the transparent governance and helps to implementing political strategies and perspectives (Nuseir, 2020).

3. RESEARCH METHODS

This section includes the research design, research technique, data collection methods, population size, sample size, sampling techniques, data analysis tools, data presentation tools and pilot testing or pre-testing.

Research methodology is a science that helps in determining that how a research can be carried out. It can be defined as the logical and systematic

way of searching information in a particular area.

3.1. Data collection

This study, both primary and secondary data are collected. Secondary data have been collected regarding the current governance system of the smart cities and the approaches used by the governance authority to achieve sustainable growth of the city. Different governance methods of the smart cities are also accessed through the secondary source of data. Various journals, reports and authentic articles are used to gather the information. The secondary data are presented in the form of literature review. The primary data are collected to know the current situation of the quality and innovation in the governance of the smart cities of UAE. This primary data has provided the access to reach to the objectives of the study. Primary data are collected through conducting the surveys.

3.2. Research Approach

Quantitative technique is used to collect the primary data from the target audience. The reason for choosing this method is that this research is related to the quality and innovation in the governance system of the smart cities. To identify the level of relationship between the variables it is necessary to have the data in numeric as it is used to perform the statistical analysis. Hence data must be collected in the numeric form with the help of quantitative research approach. Under this approach a questionnaire is prepared to collect the data.

3.3. Target Audience

There are hundreds of people in the smart city who handle various functions in various departments such waste management department, energy consumption department, water management department, information and communication department, transportation department. All these people are the target audience for the study as they know the best about the governance system of their smart city.

Target population is the people working under the governance system of smart city of UAE at different positions such as engineers, quality analysts, management experts, environmental experts etc.

3.4. Data Sampling and Sample Size

With the help of convenient non-probability sampling, a sample of 30 respondents is selected to collect data by including them in survey. The reason for choosing this sampling technique is due to the flexibility given to the researcher and the respondent to select and attempt to the survey as per their convenience.

3.5. Mode of primary data collection

Questionnaire: A structured close ended questionnaire is prepared to conduct the survey. All the questions of the questionnaire have some options and respondents have to select only one option for each question. It hardly takes 5-10 minutes to answer all the questions. Paper pen mode is used to collect the responses. This method is most suitable for the studies with small span of time.

3.6. Hypothesis

H1: Quality & Innovation in governance in Smart Cities leads to wise use of resources in the smart city

H2: Quality & Innovation in governance in Smart Cities leads to quality life and overall sustainability of the Smart Cities.

4. DATA ANALYSIS

For the purpose of data analysis a regression analysis is performed to test the hypothesis and the level of relationship between the variables. Pie charts and graphs are used to visualize the data.

Q1. Gender

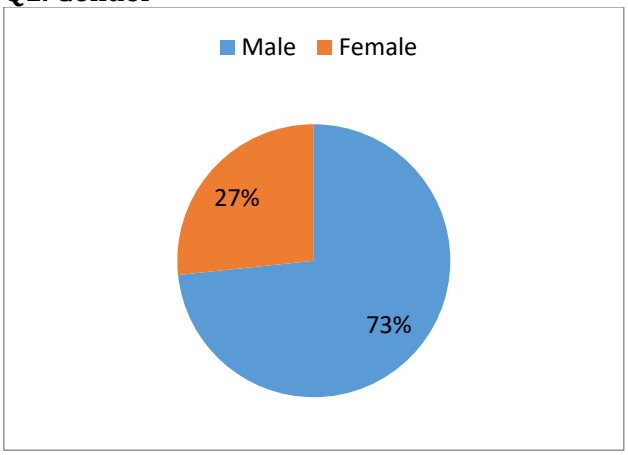

Figure 1

Analysis: Out of total respondents, majority of the respondents were male. The share of the male respondents was 73% while the share of the female

respondents working in the different departments of the smart city was 27%.

Q2. Age

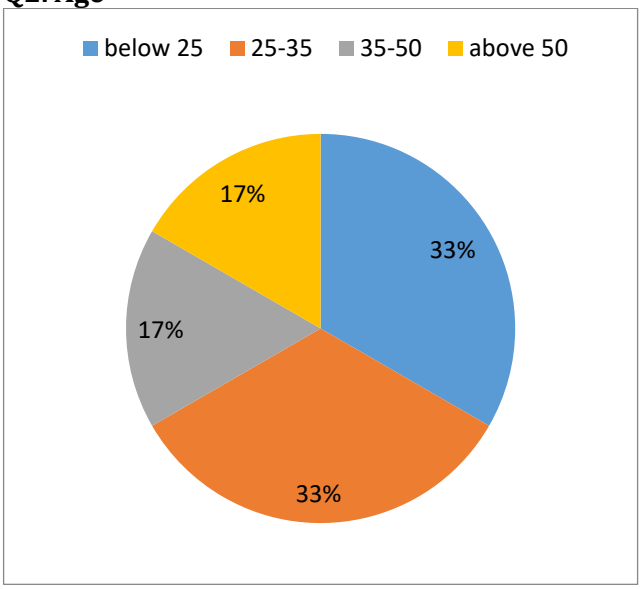

Figure 2

Analysis: Out of total respondent's majority of the respondents were from the young age group as the concept of the smart city is new and it requires more technological persons than experienced one and that is why 66% of the respondents were below 35 years of age.

Q3. Project Role

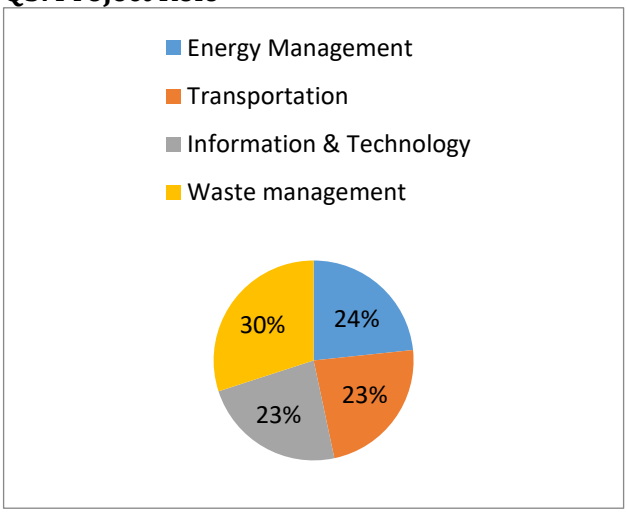

Figure 3

Analysis: Out of total respondents, major 30% of the respondents were from the waste management department followed by energy management department (24%), IT and transportation department (23%). This shows that all of the departments are covered in the study to get the overall view.

Q4. Years of Experience

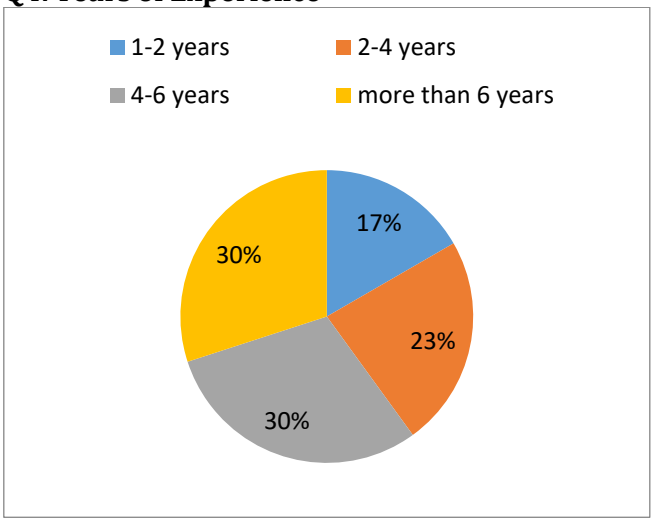

Figure 4

Analysis: Out of total respondents, 30% of the respondents were having more than 6 years of experience in their respective field. There are 17% respondents those who have only 1-2 years of experience in the field of maintaining smart cities' activities.

Q5. Whether the current governance framework is modified as per the need after the first implementation or not?

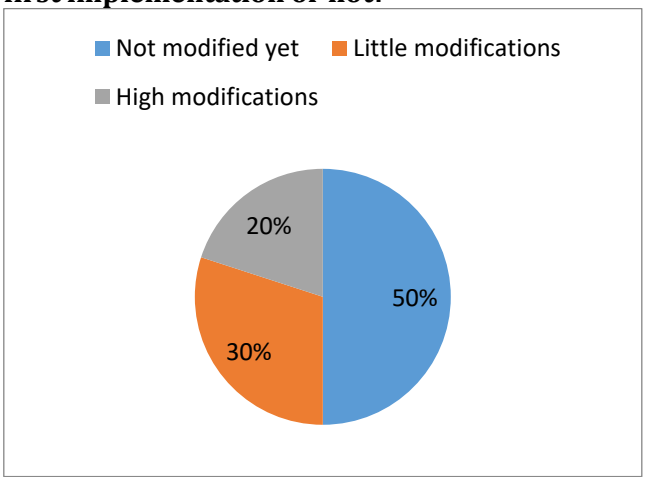

Figure 5

Analysis: Respondents are asked about the

modification in the governance system in their concerned department in response to which, 50% of the respondents stated that no modification has been taken yet in the traditional governance system of the smart city. Only 20% of the respondents stated that high level of modification has been carried out in the governance system of their department.

Q6. What is the current status of the stakeholders in the involvement of the smart city initiatives?

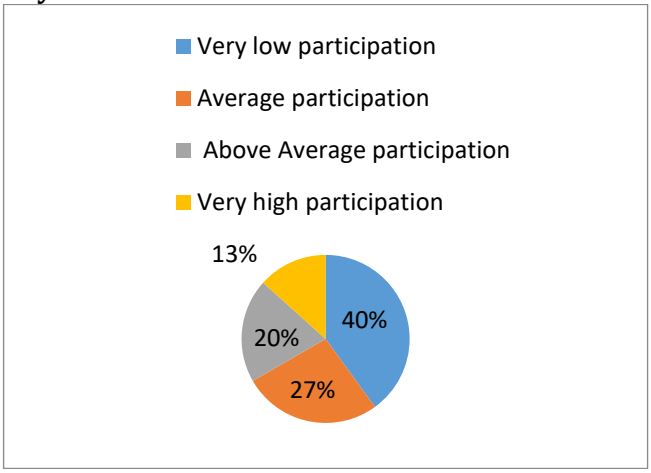

Figure 6

Analysis: Out of total respondents only 13% of the respondents stated that participation of the stakeholders is high in the governance system and the smart city initiatives while more than 2/3rd of the respondents stated very low or average participation of the stakeholders in the governance system of the smart city.

Q7. Do you agree with the fact that current governance system do not provides solutions for energy and waste management and assist for maximum utilization of resources?

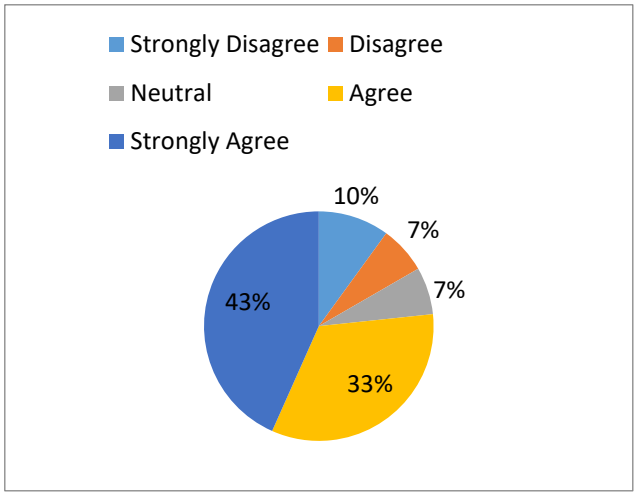

Figure 7

Analysis: Out of total respondents more than 75% of the respondents agreed with the fact that current governance system do not provides solutions for energy and waste management and assist for maximum utilization of resources.

Q8. Do you agree with the fact that the governance system of the smart cities is lacking in implementing ICTs and demonstrating its value?

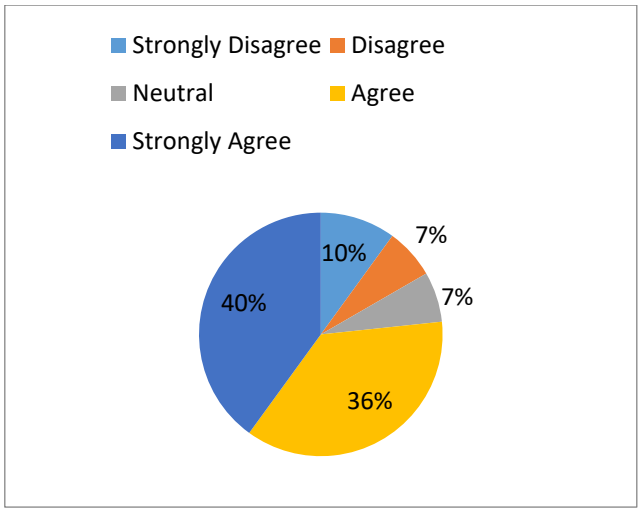

Figure 8

Analysis: Out of total respondents more than 75% of the respondents agreed with the fact that the governance system of the smart cities is lacking in implementing ICTs and demonstrating its value.

Q9. Do you agree with the fact that current governance system in the smart cities lacks in digital education of the stakeholders?

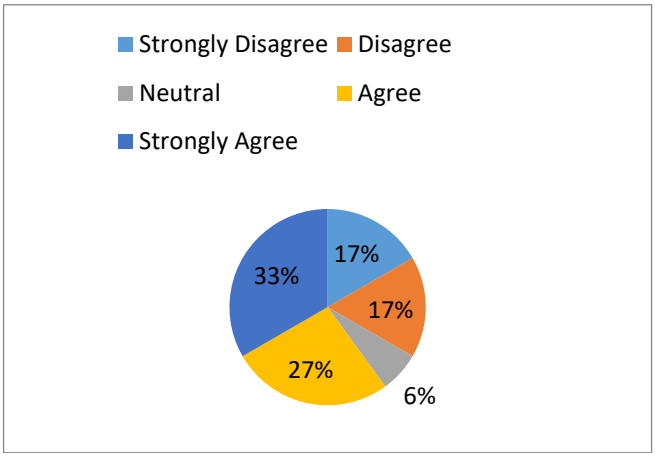

Figure 9

Analysis: Out of total respondents 67% of the respondents stated that current governance system in the smart cities lacks in digital education of the stakeholder. Only 30% of the respondents stated that current governance system of their smart city is somehow educating the stakeholders about energy saving and maximum use of resources.

Q10. Implementation of the ICT in the governance system will help the city functions well and use the optimum resources?

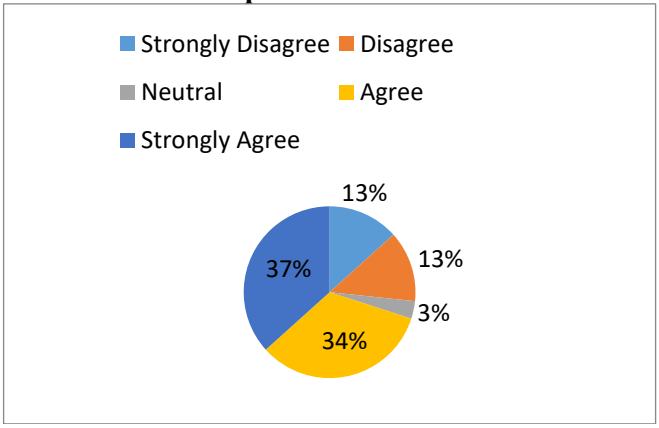

Figure 10

Analysis: Out of total respondents around 70% of the respondents agreed with the fact implementation of the ICT in the governance system will help the city functions well and use the optimum resource

Q11. Do you agree with the fact that maximum utilization of resources can be achieved through incentivize collaboration between the municipalities?

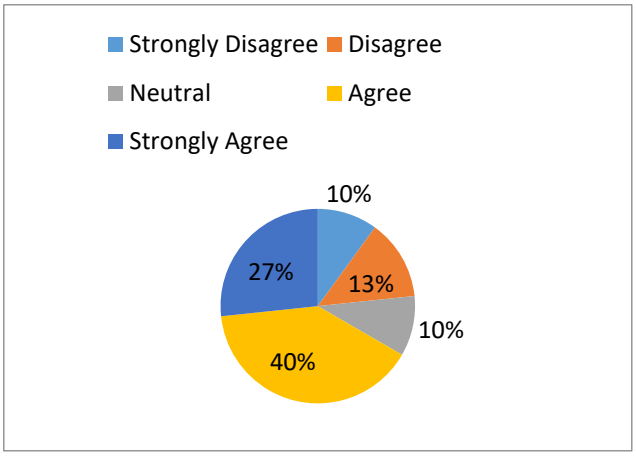

Figure 11

Analysis: Out of total respondents 2/3rd of the respondents stated that maximum utilization of resources can be achieved through incentivize collaboration between the municipalities while around 22% of the respondents did not agreed with this fact.

Q12. Does the implementation of the ICT in the governance system will give the opportunity to the entrepreneurs to use the data to create businesses and solve city problems?

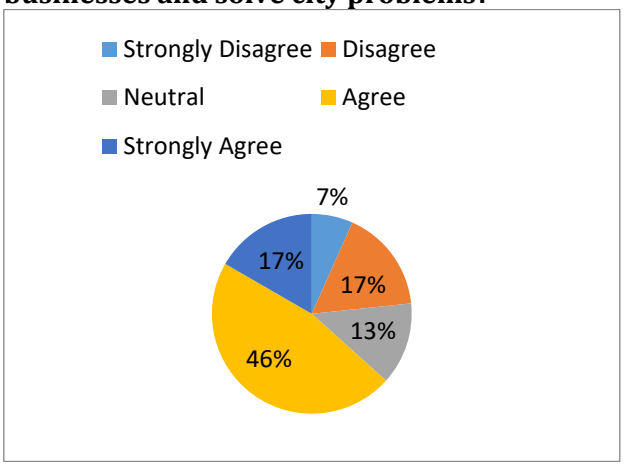

Figure 12

Analysis: Out of total respondents around 2/3rd of the respondents showed their approval to the fact that the implementation of the ICT in the governance system will give the opportunity to the entrepreneurs to use the data to create businesses and solve city problems.

Q13. Do you agree with the fact that matching digital education with business needs is crucial for fast technological development?

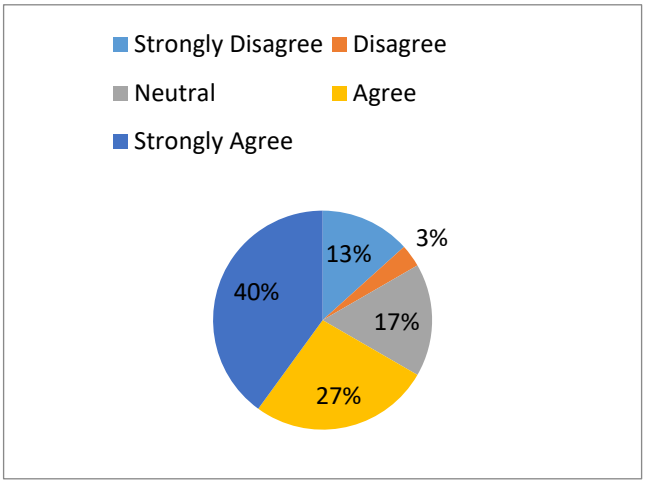

Figure 13

Analysis: Out of total respondents 2/3rd of the respondents agreed with the fact that matching digital education with business needs is crucial for fast technological development.

Correlation Analysis between the dependent and independent variables

Correlation analysis is a technique for investigating the relationship between the two quantitative, continuous variables and it also measures the strengths of the association between the two variables. This study prepared a total of ten hypotheses to measure the level of relationship of the five independent variables with two dependent variables.

Correlation between Quality & Innovation in governance in Smart Cities and wise use of resources in the smart city

H1 asserted that Quality & Innovation in governance in Smart Cities leads to wise use of resources in the smart city

Table 1: Correlation: Quality & Innovation in governance in Smart Cities and wise use of resources in the smart cities

	Quality & Innovation in governance in Smart Cities	Wise use of resources
Quality & Innovation in governance in Smart Cities	1	
Wise use of resources	0.823276	1

The above table shows the relationship between the two variables named Quality & Innovation in governance of Smart Cities and optimal use of resources. The analysis demonstrated that there is a positive correlation between Quality & Innovation in governance in Smart Cities and Wise use of resources (r= 0.82, n=30). Hence, null hypothesis is rejected and the alternate hypothesis is accepted. The moderate strength of the linear relationship between Quality & Innovation in governance in Smart Cities and Wise use of resources indicated a high positive correlation, suggesting the level of relationship as strong. It means if ICTs and incentivize collaboration between the municipalities is established effectively then, smart cities can maintain wise use of resources.

Correlation between Quality & Innovation in governance in Smart Cities and Quality of Life and Sustainability

H2 asserted that Quality & Innovation in governance in Smart Cities leads to quality life and overall sustainability of the Smart Cities.

Table 2: Correlation: Quality & Innovation in governance in Smart Cities and Quality of Life and Sustainability

	Quality & Innovation in governance in Smart Cities	Quality of Life and Sustainability
Quality & Innovation in governance in Smart Cities	1	
Quality of Life and Sustainability	0.712878	1

The above table shows the relationship between the two variables named Quality & Innovation in governance in Smart Cities leads to quality life and overall sustainability of the Smart Cities. The

analysis demonstrated that there is a positive correlation between Quality & Innovation in governance of Smart Cities leads to quality life and overall sustainability of the Smart Cities (r= 0.71, n=30). Hence, null hypothesis is rejected and the alternate hypothesis is accepted. The moderate strength of the linear relationship between Quality & Innovation in governance of Smart Cities and overall sustainability of the smart cities indicated a high positive correlation, suggesting the level of relationship as strong. It means if ICTs and digital education established effectively then, smart cities can maintain the quality life with overall sustainability.

5. DISCUSSION OF RESULTS

According to the statistical findings, it has been found that current level of involvement of the stakeholders in the smart city governance is very low and as per the previous studies (El Khatib and Ahmed, 2018), the involvement of the stakeholders should be high in the governance of the smart cities to utilize the resources at max and to facilitate the quality of life to the people living in the smart city. The study results supported the fact that quality and innovation in the governance in the smart cities leads to the wise use of resources. The previous studies also supported this fact and advised to implement ICT and guidelines on the policies and standards to address the issues and concerns of the stakeholders (Aljumah et al., 2023). Further, the results of the study supported the fact that quality and innovation in the governance of the smart cities leads to the quality life of the people through overall sustainability attainment. This fact is also supported by the previous study by stating that smart cities whose governance is innovative in terms of educating their people and engaging their people to develop new business and provide solution to the problem are more sustainable (Nuseir and Elrefae, 2022). So overall, the results of the study are supported by the results of the previous studies and researchers.

6. CONCLUSION AND RECOMMENDATIONS

On the basis of the overall analysis and discussion of the results it can be concluded that current governance approaches of the smart cities of UAE are not much effective to cater to the current challenges of the smart city such as maximum use of the resources and attain sustainability. The governance approaches of the smart cities of UAE has not been modified or upgraded from a long time and that's why they have been outdated to cater to the current problems of the smart cities. There is need to upgrade or innovate the approaches of the governance to achieve wise use of resources and provide quality of life through sustainable development.

The study recommended some suggestions to the management of the smart cities through which they can make their governance innovative to achieve the vision of the smart city.

- The governance of the smart cities should implement Information and Communication Technology at each and every phase as it will facilitate the people to learn, educate and provide solution at single platform. Flow of information through ICT systems will enable the people to know how to maximize the use of resource and minimize the waste.
- Further, the governance of the smart cities should establish digital leadership, digital learning platform and collaboration between the municipalities to enhance the quality of life of the people living in the smart city. Overall sustainability can be achieved when all the stakeholders come together and become the part of smart governance.

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