

Municipal Platforms: An investigative case study from a Norwegian municipality

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ABSTRACT

This research aims to investigate a Norwegian municipality, as a case study upon its use of digital platforms. Norwegian municipalities set citizens at the center of its operational areas, by the conduct of a transparent sustainable development, improved work practices and democratic conduct of public services. An empirical approach has been followed, to investigate the utilized municipal platforms to govern and achieve the united nations (UN) Sustainability development goals (SDGs), delivering a transformative action, and public service excellence. The research methodology comprised of conducting 1) a narrative review over the relevant literature and municipal strategic documents, then 2) semi-structured interviews were implemented with key decision makers, where 3) effective measures for improving its digital governance, investments and ownership formats were identified, discussed, and prioritized. The research provides a set of recommendations for improving municipal platforms, and an understanding of their functional use. The research mainly serves the sustainability development goal number 11, namely: "Sustainable Cities and Communities" by soliciting municipal stakeholders' opinions and professional governance practices upon various range of their adopted digital platforms.

CCS CONCEPTS

• **General and reference** → Document types; Surveys and overviews; Cross-computing tools and techniques; Empirical studies; Cross-computing tools and techniques; Measurement.

KEYWORDS

Governance, Platforms, Municipality, Smart city, Digital transformation, Sustainable development goals

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1 INTRODUCTION

Urban agglomerations, industrial shifts and innovation are drivers of change in smart cities. According to united nations sustainable development goal number (SDG-11) report, 70% of global population will be living in cities, being responsible of 80% of the planet's gross domestic product (GDP); thus, a need is set for sustainable development of cities and communities. While sustainable development goals mean a green shift towards realizing a smart sustainable city, endeavoring for a global thriving economy, it is crucial to conduct these developments with a focus on sustaining the planet resources and its people [1], [2]. To realize this prospect, various frameworks were developed systematically in the literature. Yet, a holistic understanding of the current governance practices, remains a niche for discovery, where empirical research is needed to release the knowledge on quality governance practices. At the same time uncovering potential innovations through governance digitalization initiatives.

The existing body of knowledge (on governing platforms) remains diffused and demands a technocratic investigation towards building a holistic assembly of the big picture; comprising it. Specially with a focus on municipal products and services [3], [4]. Norwegian municipalities work actively towards achieving smart sustainable cities and communities. Their role progressed in importance than any time ever before. Evolution in computing power, governance solutions and technological advancements all have accelerated disruption to traditional services, while empowering the need for a transformative leap of change. The changes set a demand for investigating digital and physical platforms utilization for decision making, and their effectiveness. Further, responsibilities set on municipal stakeholders as governmental decision makers has become more challenging, by the accelerating need for massive national investments in smart sustainable city initiatives.

To keep an abreast with the advanced pace of change, and in respect to global shifts towards smart sustainable cities [5], [6]. It is pivotal that digital transformation, is observed as a core enabler for realizing a quality public service. Henceforth, there is a need to investigate municipal digital platforms, to understand its capabilities towards achieving a smarter city [7], [8]. Municipal sustainability is also prospected to be based on its ability to obtain innovative solutions, digital tools and platforms, that enhance:

- The process of informed decision making,
- Raising excellence in public service provision,
- Monitoring and control of regional conditions; as of triple bottom line dimensions (social, cultural, and environmental).

This research serves an investigative necessity upon understanding the concept of smart cities, with focus on the adopted digital tools and platforms; being a backbone for a standardized reproduction and unification of municipal products and services. Thus,

there is a need to investigate the measures and considerations that a municipal policy maker prioritizes to manage strategic visions implementation, by acquirement of an enabling municipal digital platforms; in other words, investigating the municipal organizational capability to accelerate the essence within a global race towards a smarter city realization [9]. [10] discussed evaluation methodologies that can be used in research for dissemination and implementation of strategies in healthcare programs intervention by approaching knowledge experts within the field. This is to solicit comparisons of programs outputs, an approach of which this study has adopted one of its discussed methodologies to ensure systems efficacy. The approaches discussed were based on interventions aiming for sustainment of the strategies. The approaches varied as mixed design methods for implementation of research, being either a “within site designs”, “between sites design”, and “within and between sites comparison”. Thus, this research positions itself as an intervention on municipal systems investigation of features, functions and their efficacy; based on professionals’ feedback. [11] discussed the organizational dynamic capabilities, and the managerial approach of ambidexterity; where organizational leaders have the ability to reallocate resources for capitalizing opportunities through exploitation and exploration. Thus, this research aims to explore the existing platforms in order to exploit gaps in practice and ensure their sustainment collectively. The municipality as an organization being investigated in this research is an entity that reflects a proposition where its platforms can be questioned towards improvement of services.

2 LITERATURE REVIEW

Several references were synthesized to develop a narrative review of the literature, by critically reading each of the references and fast skimming through their abstracts. Different academic databases and search engines were utilized to synthesize references that serve the questions of the research investigation, while ensuring a defined build up for a comprehensive grasp on smart cities governance, focusing on municipal ecosystems and platforms. Keywords used were “*Municipal platforms*”, “*Municipal ecosystem*”, “*Empirical research*”, and “*Governance*”.

2.1 Smart cities as enterprises, and business models

Smart cities are not just projects, they are an assembly of strategically planned deliverables emerging from different initiatives. Thus, competitions toward smartness of cities are evolving in an arbitrary manner. Worldwide classification organizations aimed to address organizational and technological perspectives for cities maturity. Yet, the international plate of smart cities remains a niche ground to address.

Cities can be state-owned enterprises, governments and research institutes are building coalitions to examine cases and improve its practices, as these enterprises are considered as a facilitator for public services, which can be emphasized traditionally in the areas of economic and social services and environmental development. Further, cities possess a potential ground for fostering new markets which support both regional and national growths [12], [13], [14].

The smart city as an enterprise accompanies different processes that formulate several systems. Thus, these systems formulate an external boundary which is entitled as an ecosystem, with a critical city infrastructure, that ranges to evolve its administration, transportation, education, healthcare, public safety, real estate, intelligent assets, and utilities. Smart cities can be considered as a multi-layered enterprise, which provide services, that are driven by researchers, entrepreneurs and professional experts, as pivotal stakeholders for its development. Thus, city management institutions, should be investigated and evaluated for improving its governance, increasing its citizens’ engagement, and value for public deliverables [3].

Enterprises are organizations that have structures, where these structures are formed to conduct specific services through systematic processes, which are allocated to individuals, whom their performance deliver the implementation of organizational goals; effectively. The individuals use tools, to process their knowledge and works and communicate with their organizational customers. The organizational structure serves several dimensions such as: strategic goals, social aspects, and cultural behaviors.

The international telecommunications union ITU defines a smart sustainable city as “an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, cultural and environmental aspects”. The utilization of information technology (IT) tends to unleash the complexity of the organizational endeavor; being a facilitator of their works towards delivering high quality services. Thus, enterprise architectures are utilized to model the various components of an organization, from different levels, as a powerful mechanism that supports a common understanding of its structure and behaviors [15]. In 2012, smart cities emerged as dynamic centers for investments, accounting for 240 billion US dollars; where solutions, products and expertise that are intra- and inter-changeably placed and exchanged [12]. [12] proposed four business models that are procedural to classify the openness of managing a city infrastructure towards smartness, namely:

- Private (where operations and maintenance are managed over a networked infrastructure),
- Exclusive (where management and operations of a private solicitor take responsibility over specific ICT network),
- Managed (where a private organization develops the ICT infrastructure, and then service is agreed upon by several providers), and
- Open (where multiple competent providers establish ICT networks in a public area, where subscribers facilitate its usage, based on their preference).

Barcelona have developed lighting poles that are equipped with LED and control sensors, serving for an eco-digital smart transition, while Amsterdam developed a climate street app to transform its streets sustainably into habitable commercial shopping hubs. Plenty of businesses have emerged in smart cities to evolve its social and technological experiences, thus, exploring city platforms, as a business facilitator, through cross-functional domains, serves to focus the capitalized investments of assets [3]. Further, smart cities as business models facilitate innovative sub-enterprises, which are

considered businesses that deliver state of the art services, for its citizens, and promote a smart environment in a sustainable manner [16], [17].

2.2 Smart city platforms

The green initiatives of smart cities are based on a wide infrastructure of networks, which utilizes web interfaces and mobile devices for data exchange. The advancement in technologies today, bring various typology of services and governance platforms. Ownership formats of these platforms range through public, private and crowd funded initiatives, they are usually citizen-centric, and serve to exchange information in an open eco-system. These formats serve to exchange venture capital investments, while increasing a city social value.

According to ITU smart city platforms are “digital components that aim to build capacity on top of standards, mechanisms, services, guidelines, and tools to enable interoperability. They deliver strong positive local impacts and are referred to as systems of systems”. Service platforms can range in contexts, such as: monitoring transportation, renting electric vehicles, charging stations, and applications of managing clean-tech renewables. These platforms serve to employ creators, developers toward economic growth while scaling up the business spheres. Urban openness is defined as the “assessment of smart city services and infrastructure, on whether service design is based on a platform in which people can interact with and participate in to foster civic engagement” [3], [8]. Thus, the more interactive and communicable are these platforms within a city the more open it is from an urban perspective.

The following aspects are initial and foundational attributes that aim to evaluate the platforms of a city: multi-device considerations, and data center availability. There is a balance and limitation between the number of devices available in a city and the services offered in the form of platforms. To improve quality of life, public administration institutions are expected to take the role of coordinating and ensuring a quality systemic set of services to its citizens. While these solutions range and differ, they are not limited to welfare, healthcare, transportation, education, and safety. There has been extensive development of systems and e-services, by research and in reality, that requires a collaborative effort from both the public and the private sectors to formulate a joint solution of systems. This sets a requirement for a new clear and transparent procurement schemes and policies, partnering for smarter and more sustainable cities [3].

Further, [18] discussed the fragmentation of cities data, being collectively developed over several technological generations. This fragmentation has become a burden for cities to optimize their expenditures as well as ensuring an integral capability for addition of new value-added services. Thus, [18] proposed a framework for ensuring several domains that must be considered for smart city infrastructure development, namely:

- Service domain (formation of data to serve specific value for users and businesses),
- Technology domain (considerations for a long-lasting selection of mutually agreed upon infrastructure),
- Organizational domain (reserving stakeholders’ value as a network of effective collaboration),

- Value domain (ability for utilization of available data, and its potential for fostering, and creation of new businesses), and
- Governance domain (the umbrella in which management of all domains takes place, while being measured, accelerating city growth).

[19] proposed a smart city platforms architecture based on a state of the art literature review, the research study described different city types, mainly: digital city (a city that comprises of complex systems that are open and adaptable, comprising of networks that collects urban information fostering a virtual space of a city), smart city (as a city that performs several functions that aim to serve its citizens, improve their participation, based on an intelligent infrastructure) and intelligent city (where a city is based on an integrated networks of real time data collectors, using sensors, applications and mobile devices that are to be analyzed using digital platforms; with visualization and operational capabilities). City intelligence is based on three main characteristics: 1) effectiveness of public, and private services, 2) environmentally sustainable, 3) innovative adoption of services and technologies [8], [19].

A city public value can be based on creating a quality living environment, while ensuring an economic and social values are all compatible with the different partnering modes of stakeholders. These values can be domain-based such as: 1) natural resources and energy (e.g. smart grids, smart street lighting, renewable energies, waste and water management, food and agriculture), 2) transportation and mobility (e.g. city logistics, mobility information, commute modes for citizens, district information models such as geographical information systems (GIS), Building information modelling (BIM) and systems information models (SIM)), 3) smart buildings (e.g. facilities management, construction services and quality housings), 4) daily living (e.g. entertainment, enhancing hospitality, inclusiveness, air quality monitoring and control, public safety and security, health, welfare and optimal use and management of public spaces), 5) Governance (e.g. e-government, e-democracy, and authorities transparency), 6) economy and society (e.g. cultural heritage, innovation, entrepreneurship, e-learning, and human capital development) [19].

[20] discussed the emergence of platforms as a shift in service provision, and their centrality to meet a coevolutionary benefit to their accompanying ecosystem. The research introduced impactful favoritism of collective software development over traditional individualistic development of platforms. The authors defined the term platforms as “an extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it and the interfaces through which they interoperate”. Additionally, defined that the modules which combine functional platforms as an ecosystem that can create a rival advantage over traditional platforms that are standalone (designed separately). Then as ecosystems mature they can be unique and competitive, by forming a group of unique platforms, presenting a unique interface, in its subset, and in comparison, to each other. The authors then explained the difference between a platform, ecosystem, a module (an add on that provides an added functionality into a platform), interface (a specification in which a platform adapts to for exchanging information with modules and other platforms) and

an architecture (which represents a conceptual blueprint of different platforms, and modules that are relatively stable and connected; describing how an ecosystem is apportioned). Further, the authors discussed that platforms coevolute serving endogenous needs of the organization and the exogenous demands of the consumers (citizens in this context/ or municipal employees). The platforms architecture success is dependent on modularity, ability to evolve, functional decomposition of its parts and malleability of its design rules. A platform can be proprietary (development enclosed to specific developers) or shared (as an open source for different developers) influencing its evolution behavior.

[21] discussed the need for an integrative framework for managing governmental platforms, from a technological engineering design and economic perspectives. The researchers distinguished that both lenses justify the use of platforms and its developments being a market catalyst and innovation fostering technology. The platforms are viewed as internal twin of a hierarchy, while at the same time they enable a leaner supply chain of added value services, forming an industrial ecosystem that must be governed towards achieving strategic goals. The platforms innovation and competition model presented details where open interfaces promote a market for collaboration, while closed interfaces serve internal processes. The managerial implications of adopting platforms are vast and must be dynamically evaluated towards an organizational works evolution. [14] discussed the platforms potential capabilities of transforming governmental services, and provide participatory solutions that solve collective problems of a city.

2.3 The human component of a smart city

Human-centric models of cities serve to satisfy and correlate stakeholders and inhabitants needs to its services, (e.g. employees, citizens, visitors, and transits), such approaches of smart cities serve to be at the highest sustainable goal; top of the pyramid. Servicing them, should follow a participatory role, following different approaches, to satisfactorily balance between its people activities and management of services (e.g. work, play, entertainment, living, health, civic engagement and education). Democratic innovation in the smart city domain has to be driven by the availability and accessibility of open data for its people [3]. [22] investigated the status of communication platform for evolving a smart city and development of its infrastructure and services. The availability of comprehensive data allows platform developers and innovators to intervene with technological solutions that facilitate services for the inhabitants, that are unprecedented, based on evidenced data [22]. Governments seek innovation through utilization of new methods, tools, and practices by taking deliberate changes in operations. Lean operations of processes in service provision provides a streamlined transformation from a macro perspective.

Thus, gradual experimentation and exploration on platforms as e-government enablers are considered as transformational orchestration, while increasing customers centrality in design (as citizens in this research context). The component of providing citizens with smart services can be optimized through prospects and consideration of a lean governance mechanisms, in which platforms are core enabler for its implementation, by increasing innovation output and reducing costs expenditures. The researchers introduced

an explanation of governance over three typologies, shifting from electronic government (e-government) in which ICT enables faster service delivery, progressing into transformational government (t-government) which aims to transform services from bureaucracy to a more transparent form of services, and reaching lean government (l-government) in which the government can perform more services with less processes and resources. In that essence it is proposed that a key enabler for l-government lies within the innovative use of platforms [13], [21].

2.4 Investments formats: Public-Private Partnerships (PPP) and mono modelled forms for smart cities

While governments try to capitalize their investments to evolve cities strategically towards a sustainable economic growth, services are shifted in a manner, from being publicly funded to privately invested on; this can be realized from the Chinese state-owned enterprises and the Greeks, alternatives for energy production and communication; throughout the life cycles of their underlying systems. The ownership of smart cities is questioned, where new forms need to be introduced. A gap is identified, where a need to address has been positioned, through the international evolutionary competitiveness, where private, public, non-governmental organizations (NGO), crowd-sourcing and municipal agency formats need to be adopted; serving a trade-of being an international or national competitor [12]. The European Union invested in metropolitan cities with projects that aim to evolve their smartness and approaches for a better livability; that is a regional format. The tendency of ownership investigations serves a single perspective rather than being holistic in literature. Thus, its required to investigate institutional and governing bodies of cities approaches of ownership mechanisms, all while evolving citizens approach in city development. Partnership formation is defined as “*examination of service diversity or focus, driven either by the city itself or outside providers using open data*”, thus two factors play a vital role in determining ownership schemes which are: regulatory capabilities, and available sources of funding [3].

3 RESEARCH METHODOLOGY

This research is designed to follow an empirical approach [23], to investigate the used platforms in a Norwegian municipality. The research questions were as follows:

RQ1 What measures, are the needed to prioritize investments on municipal platforms?

RQ2 What platforms do the case study municipality use for its public services towards governing a smart sustainable city?

RQ3 What are the focus areas required to improve municipal performance and services?

RQ4 What are the ownership formats preferred by the case study municipality?

The research methodology comprised of the following activities:

- Conducting a narrative review of the literature on smart sustainable cities, and state of the art municipal platforms.
- Development of a semi-structured questionnaire based on United Nations sustainability development goals (UN SDGs),

Table 1: respondents' positions and years of experience

Years of experience	Positions ^a
1 – 3 years a	1 x Technology and Innovation department
5 – 10 years a	1 x Technology and innovation department 1 x Procurement and purchasing department 1 x Documentation center 1 x Geographic information (GIS) department
> 10 years a	1 x Strategic management department 1 x Human resources, and communication department 1 x Culture and citizenship department 1 x Municipal director staff 2 x Environmental, and urban development department

^a Out of 11 respondents

to gauge the municipal systems effectiveness and professionals' opinions [24].

- Investigating several municipal documents to understand its organizational structure and behavior.
- Interviewing eleven municipal employees upon their use of digital platforms. The survey was adopted to quantitatively evaluate their feedbacks. The interviews were recorded, stored, transcribed, and qualitatively reviewed.
- Then, a set of recommendations are introduced through observations noticed by the author during the research process.

This study aimed to focus on specific platforms, which were introduced to the researcher by the municipal professional staff. Table 1 illustrates the interviewed professionals' positions and years of experience.

A 5-points Likert scale ranging from “Strongly disagree” to “Strongly agree” was utilized, to evaluate the respondents' perspectives upon the effectiveness of the discussed platforms. Then, a relative importance index (RII) was calculated to rank the areas, that require most investments focus for future platforms development as follows:

$$RII = \frac{(5W_5 + 4W_4 + 3W_3 + 2W_2 + 1W_1)}{(A * R)} \quad (1)$$

Where:

W_5 Number of responses for “Strongly agree”.

W_4 Number of responses for “Agree”.

W_3 Number of responses for “Neutral”.

W_2 Number of responses for “Disagree”.

W_1 Number of responses for “Strongly Disagree”.

X is the highest weight and equals 5, and R is the total number of respondents = 11.

4 FINDINGS

4.1 Case study municipality

The case study municipality is located at west coast of Norway. It has adopted an inhabitants-centric model for its governance, that aims toward achieving its aspired organizational goals, the core areas of governance are mainly: innovation and technology, culture and citizenship, welfare and employment, healthcare, technical services and children and family integration.

4.1.1 The municipal enterprise. The municipal areas are conveyed through an organizational structure which facilitates the realization of the aspired integration. Figure 1 illustrates its structure [25], as follows:

The municipality as an enterprise consists of three administrative levels, namely: political level, steering levels 1 and level 2. The political level is accountable for preparing proposals and review cases that are transmitted to the county government, as well as being elected in four years cycles to represent the civic engagement and administration over municipal public services. The council is decisive upon municipal issues, aiming for formulating a planning strategy that can be executed by the leadership of the chief of staff, whom is a mediator between the political level and the steering level 1.

The purpose of the municipal planning strategy is to clarify what planning functions the municipality should initiate or continue in order to facilitate the desired development in the municipality [26]. The managerial steering level 1 is a management level with a responsibility to follow up municipal activities, through formulating managerial documents, that take into consideration the citizens perspective. Municipal services must ensure equality, in the making, based on the formulated political decisions. It is of utmost priority to use best technological solutions that enhance collaboration across municipal departments. The councilor and power of attorney (that act on behalf of the councilor) municipal managers constitute this level. Each municipal manager has a supporting group of professional staff / advisors that have the capacity to coordinate business wide tasks and challenges. Moreover, citizens are prioritized to have digital solutions offered by the municipality for the conduct of its services. Considering citizens co-creation in digital services is a must, for ensuring a participatory rule when services are established or changed. This is a consideration that is strategically must be taken into at all levels of the organization, to ensure an effective citizens' engagement; a concept referred to as partnership (between the municipality and citizens as users for the municipal enterprise). A clear set of responsibilities is set between the staff and their managers while ensuring cooperation across its hierarchy. Each unit has a distinct and clear rule to facilitate each of the areas namely: finance and business management, staff and organization, technology and innovation and strategy, society, and

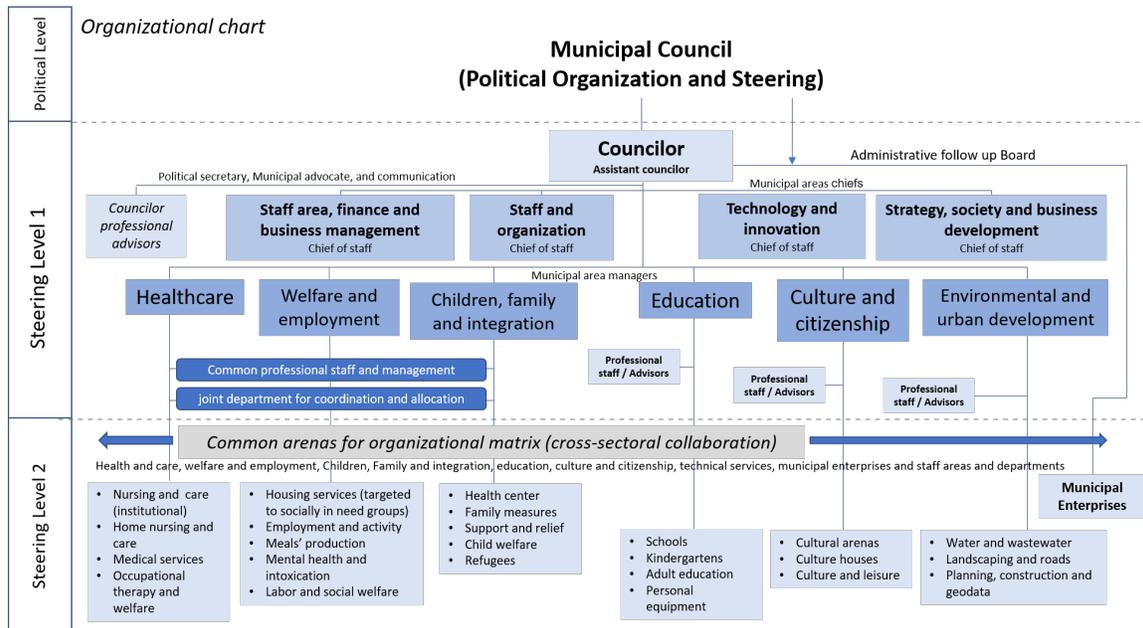


Figure 1: Municipal organization chart

business development. The managerial steering level 2 structure sub-municipal areas that have specific set of activities to perform. Each department has a set of sections that has work team groups. Where they report to professional staff / advisors in steering level 1, who act to report to the municipal area managers. For each area, the municipal staff are assigned to specific positions, with specific codes, which employs a percentage workload based on their participatory tasks of activities over set of sections or departments. The total staff are counted to employ man-years, which is unit of measurement for the amount of work done by each; throughout the entire year. The structure represents leadership behavior and a dynamic role of each actor rather than being solely authoritative or holding a traditional managerial style of works conduct. In other words, this is formulating a top bottom and bottom-up relation that is facilitated by the shown hierarchy in Figure 1

4.1.2 *The municipal business enterprises.* The case study municipality, have an administrative board for managing its sub-enterprises, these enterprises facilitate activities such as: real estate development and operations, fire brigade, waste management, port management, environmental station, and parking management companies. All are interfaced with the environmental and urban development department. These businesses aim to provide innovative solutions while managing their works area with focus of specialty.

4.2 Measures for improving municipal smart platforms

The municipal professional staff were interviewed to investigate the most prior areas for investments, three main focus areas were questioned, namely: digital transformation of (processes, services, coordination, and communication), Citizens' engagement (for decision making, community collaboration and cultural participation),

and improving the municipal structure (hierarchy of departmental works and staff). The survey was used to investigate their opinions on the most challenging areas in municipal governance scheme, where the need for investing on digital transformation was identified quantitatively to be the most critical area that needs improvement. Where the municipal services seemed to be vast and being conducted using manual efforts of the staff rather than having a fluid process between staff and municipal clients for conduct of works. (6 out of 11) 55% of the professional staff chosen digital transformation, the documents identified the need for a clear workflow between the different systems that the municipality use for conducting its works, the linkage between a system A to system B should be elaborated and described in detail to automate routine works and eliminate duplicated or overlapping tasks in different departments. The procurement professional staff indicated that there many small systems that the municipality adopts for conducting routine works; a better integration of these systems may lead to a more consistent workflow and reduce financial expenses in a viable magnitude. Furtherly, (3 out of 11) 27% of the interviewed staff indicated that citizens are lacked in the decision-making process, they are usually represented by the political elected personnel but a better engagement, by enrolling the citizens, in the formulation of the municipal new innovative services must be prioritized. Table 2 illustrates main strategic areas that the municipality needs to focus on strategically to improve its service and work platforms.

The interviews were synthesized, based on the analyses of the semi structured survey findings, as illustrated in Table 3. The identified measures aim to set a list of dimensions that should be considered by the municipality strategy, in every initiative. The relative importance index (RII) serves to rank the areas that would lead to a more effective governance performance.

Table 2: Focus areas (digital transformation, citizens engagement, improving municipal infrastructure)

SN#	Focus areas for improving municipal governance		
	Focus area	Count ^b	Percentage
1	Digital transformation	6	55%
2	Citizens' engagement	3	27%
3	Improving Municipal structure	2	18%

^b Out of 11 respondents

Table 3: Measures of the municipal system effectiveness (focus areas for improving municipal governance)

Focus areas for improving municipal governance		
Measures of the municipal system effectiveness	Relative importance index (RII)	Rank
Need for introducing new municipal products and services	78%	1
Need to avoid overlapping of smart city and municipal development initiatives	76%	2
Need for a streamlined internal process	75%	3
Need for solutions that anticipate surprises and crises (e.g. fires, landslides and public safety, pandemics)	73%	4
Need for enhancing departmental association with international changes of smart cities	73%	4
Need for departmental alignment with smart city initiatives	73%	4
Need for improving new innovative services towards better engagement of citizens	69%	7
Introducing a new scheme, for communication between the municipal departments	69%	7
Need for addressing emerging societal changes (e.g. ageing society, increasing birth rates, expanding welfare technology)	69%	7
Need to develop new services based on citizens demands	65%	10
Need for identification of new business opportunities to improve the city economy	58%	11
Need for decreasing response times for citizens' complaints about services and requests	53%	12

4.3 The investigated municipal platforms

Through interviews with the municipality professional staff as illustrated in Table 1 were questioned about the platforms being used to conduct the following functions, as illustrated in Table 4:

4.4 Norwegian municipalities: investment and development formats

Public-Private Partnerships (PPPs) is observed to be the format which will allow the municipality to procure long-term smart city services, especially in collaboration with local and international private providers, to outsource and mitigate the risks of developing, financing, and managing infrastructure assets and platforms by themselves. As this would allow a better focus, while improving the economy of the case study municipality. There has to be an alignment between the public and private interests and institutional processes for long term service contracts. It requires hard focus within economic and political contexts to overcome the identified significant governance challenges in the municipality. Thus, the case study municipality created a physical platform for interaction between interested private local and international entities to foster a newer perspective for its future development and investment. Yet, it is evident that there is a lack of a platform for crowdfunding by the

citizens, the availability of such platform would enable citizens to critically invest in their prioritized development areas within their community, or municipality. 82% (9 out of 11 respondents) agreed on public-private partnerships being the driver for the municipal transformation towards realizing and maturing the smart sustainable city behavior. A respondent stated that "*The public should act private and the private should act public, in means of freeing the behavioral boundaries between both, through ensuring a corporate social responsibility (CSR)*". The municipal vision aims to drive a holistic planning of overall procurement activities, work strategically towards partnerships, strengthen regional development of businesses and innovations, and enlarge its capacity for strategic acquisition of products and services. The purchasing and procurement manager have the authority to set contracts and agreements on behalf of the councilor for all types of municipal procurement. Each municipal area manager has the sole responsibility to ensure a budgeted tendering offering prior for formulating purchasing agreements and contracts. The agreements represent a group of contracts that are provided by the same supplier.

Table 4: Investigated municipal digital platforms

SN#	Platform	Function ^d
1	Strategic planning and management	It provides an annual, and monthly information about the holistic strategy areas of the municipality. It's a clear tool for analysis, planning, budgeting, reporting and business management and political integration for auditing (Managing the execution of political follow-ups).
2	Geographical information systems	Web-based mapping system with archive, for management of GIS data and other required duties for national services integrations, especially with the cadastral databases. As well as a platform that provides a complete solution for map management and geographical information systems, serving surveying, and planning functions.
3	Citizens' engagement, communication, culture and collaboration	Web-based initiative system that is managed by the municipality to organize communal and social activities (either voluntarily or entertainment).
4	Municipal Archive – Basic case work / (building permits, health, other municipal areas)	A software that provides logging and storage as well as collaboration abilities to document municipal cases, mainly for building permits applications and more. Among other things, used for following up and evaluation (e.g. urban development). The frequent uses are: record keeping, archives, case processing meeting treatments and committee matters
5	Quality insurance and auditing	Web-based repository, for knowledge collaboration and reporting by different municipal stakeholders to establish a data base for the forms and tasks required for municipal tasks processing. Furtherly, a tool for implementing risk assessments over the wide municipal areas.
6	Knowledge sharing and knowledge workers development	Web-based platform for sharing, educating, standardizing forms and training staff, for the purpose of sharing the knowledge, on municipal works and tasks, among all municipal departments and areas.
7	Human resources management (HRM)	personnel management includes a structured system for handling competence, employee interviews, CVs, handbooks, HSE, sickness, absence follow-up, resource planning, shift planning and payroll. That some of the platforms are integrated with the archive system, while others need to be.
8	Crisis management platform	A web-based crisis management system, that carries out risk analyzes, reporting locally, regionally, and nationally, organizing and reporting routine tasks, manages position-based warnings during incidents, for example during floods and natural disasters. Main functions include risk and vulnerability assessment, contingency planning, education and training on response, media handling for informing, evaluation and follow-up of incidents and crises.
9	Procurement and purchasing	Various web-based platforms/solutions for tendering, depending on project scale a certain range is handled with invitation to tenderers. Managing vendors, suppliers, public purchases, and tenders in compliance to regulations that is either; local, national, and European regulations. Managing services hourly payments. Ordering and invoicing analyses. Where Doffin is the national public procurement database.
10	Municipal website	Wide range of services, integration with citizens profile and local utilities companies for invoicing. News update and chat bot for collecting and filtering of citizens complains and queries. Information about municipal hierarchy, contacts of departmental staff and a channel for sharing public domain documents and reports by the municipality.
11	Enterprise system	A web-based system that handles, the municipal enterprise economy, HRM, business intelligence, invoicing and interdepartmental agreements and requests.
12	Intranet system	That is the internal web-based platform for sharing information, news within the municipality. Also, for routing to different services and managing employee related information.
13	Communication and collaboration	Its multifaceted applications, used for email, meetings, automatic forms generation and routing (digitize workflow processes), partial integration with the archive system.
14	Facilities management platform	Combines several functions that serves municipal assets, facilities, properties, and their hard and soft management services, as well as projects and space management

^d Information collected from interviews, platforms providers websites and observation.

5 DISCUSSION

The case study municipality have been working extensively to adopt various solutions and meet national and international requirements. Furtherly, the joining of the surrounding 5 municipalities have set more challenges, on the municipality as an organization. It is evident that the municipality have made a holistic change management to its processes and departments through the creation of a new bigger municipality. Yet, there is a lot of developments needed on its digital governance, through the use of its existing platforms. There are variety of services that are offered to the public that are very diverse, that cannot be summed in this research, but it is on a continuous growth, but with economic restraints. Thus, there is a need to introduce new services and products, while avoiding overlapping initiatives by streamlining its processes and digital solutions. A joint governance platform would be a viable solution, to make the aspired digital transformation of its governance, increase collaboration and coordination between its departments; while provide a collective intelligence ability for the decision makers to foster strategies based on informed decision. The archive platform for example, lacks integration to old and historical data that is managed and viewed in another different simpler platform, that is in manual format, these documents need to be digitized and transferred under one archive umbrella that links all departments all together. There is high potential of integrating new services especially in the GIS platform, but as informed that its potential is not fully utilized by other departments, there is a need to dictate each department needs and accustom a linked user interface to fit their requirements. Many systems are procured and have great potential with sophisticated integration, but the data flows need to be well structured, and modeled to increase their output benefits and quality use. This is serving the municipal development of a unified ecosystem for its platforms. There needs to be a link between the business layer and application layer, for realizing a unified and effective governance platform, while reducing and eliminating the digital divide among these platforms.

6 CONCLUSION

This research aimed to investigate the current practices on the use of municipal platforms. The case study municipality has novel strategic documentation and experienced professional staff, that are working effectively to transform the municipality services in alignment with the SDGs. Future research must continue to investigate the creation of a unified platform following the municipal hierarchy, and the use of IoT sensors to collect more reliable field data. This research introduced and discussed the investigated municipal platforms, realizing a behavioral map in formulating a digital transformation, serving a national and local need for a unified municipal platform (not a digital twin but a comprehensive governance solution; they can be integrated). The research study presented a background, a synthesized narrative review of the literature (on smart cities from different perspectives that are found to be aligned with the municipal organizational structure and behavior) and discussed several types of ownership formats. Furtherly, the methodology followed a systematic information system research approach towards investigating the municipal governance, in line with the SDGs perspective. The research incorporated interviews

with 11 key stakeholders who are considered as subject matter experts, to investigate the used platforms, identifying a diffused occupation of solutions towards achieving a smart sustainable city. Furtherly, measures for improving municipal platforms were investigated quantitatively, to ensure an exploratory investigation of the municipal staff perspectives, further complimentary investigation would be applied on the case study municipality employees, to follow a synchronized top-bottom and bottom-up approaches. Digital transformation is identified to be the most important aspect towards improving the municipal governance, while a need for eliminating the digital divide in its platforms' adoption is needed (many of the platforms are well integrated already but others are not, thus a holistic remake would unleash a new seamless digital governance over the municipal work). The investigated platforms were tabulated, to introduce the diffusion in adoption of these systems. In addition, investment development formats were discussed accordingly to enable the creation of the unified municipal platform, through adopting an alignment between the public and private sectors. Imagine the gains from realization of such unified platform enabling municipalities in Norway to conduct their workflows and processes seamlessly with highest attention to its social workers' needs (through dynamic and unique visualization capabilities), while engaging politicians and citizens towards a democratic digital governance, formulating coordinated efforts towards an effective informed decision making with greatest attention to the SDGs in the making. A proposed action plan is to formulate a consortium of the platforms service providers to initiate the realization of this solution. Furtherly, investigating the global applicability to utilize it as Platform as a service for municipalities world-wide through the UN and ITU.

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