

# An ICT architecture for Smart Local Councils: a Mauritian case study

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## Abstract

The purpose of this paper is to present the work done with regards to the development of an ICT architecture for Smart Local Councils in Mauritius (SLCs). This is in line with vision of the Mauritian government to convert the Mauritius into a Smart Island. Local councils play an important role in the delivery of services to citizen and their conversion to Smart Local Councils will contribute to the transformation of the island. The methodology used to develop the ICT architecture is presented. The components for each layer, based on architecture principles are discussed. The validation which include, validation against the architecture principles, validation through stakeholders' focus groups and also validation in terms of its contribution to smartness are discussed. This paper provides added value as it shows how the gaps for converting Mauritian local councils into SLCs can be addressed through the proposed architecture. It provides the main building blocks which can aid in designing the roadmap for ICT architecture for Mauritian SLCs.

**Keywords:** ICT architecture · Smart governance · Local E-government · Smart cities · Enterprise architecture

## 1 Introduction

Policy makers and public leaders worldwide recognize that smart technologies can effectively and efficiently provide public services to citizens, thus making cities become smart. Typical services include healthcare, education, transportation, building management, energy management, public safety and waste management [1]. The ICT architecture is the foundation of an IT infrastructure and is essential for its implementation. Studies discuss the development of ICT architectures especially for enterprise architectures [2–5] and there are several projects related to the development of ICT architectures for smart-cities [2]. Different Enterprise Architecture (EA) frameworks can be used for e-governance [4] or smart city projects [6]. Some of the most popular EA frameworks include Zachman [7, 8], the Open Group Architecture Framework (TOGAF), Architecture Development Method (ADM) [2, 8] and Federal Enterprise Architecture (FEA) [9, 10]. However, each city has its own requirements and thus, there cannot be a one-size-fits-all solution when it comes to ICT architectures. In many projects embarking on smart city transformation, the ICT architectures have been designed from scratch instead of using existing frameworks [11–14].

There is a definite need to investigate the current status of Mauritian towns and propose an ICT architecture to transform them into smart towns in order to make Mauritius truly smart. ICT architectures are synonymous to blueprints which are used to implement e-services within organizations. With the advent of smart cities, ICT architectures need to incorporate smart technologies and concepts related to them. In the case of Mauritius, the services are not necessarily similar to services being provided by smart cities in developed countries. For example, electricity and water supply are not handled by the municipal councils. Hence, an ICT infrastructure that best fits the Mauritian context is required. The ICT infrastructure will lay the foundation for the wave of innovation in Mauritian towns. The main aim of this study was the development of an ICT architecture that would contribute to the transformation of local councils into smart local councils. At present no such initiative has been taken and each Mauritian local council acts independently and has the flexibility to manage its IT budget. The proposed architecture in this paper lays the foundation for the use of e-services within local governmental bodies that provide for day-to-day services to Mauritian citizens.

The implementation of an intelligent ICT infrastructure based on the ICT architecture will enable convenient and accessible service, good governance and better quality of life. The ICT architecture has been modeled in such a way that other small island developing countries that share the same local government structure can use/re-adapt their proposed solution. The main contribution of this paper is as follows: (1) modelling of the ICT architecture specifically for the Mauritian Local Councils using ICT architecture principles; and (2) a threefold validation of the model. There is very limited work which discusses the implementation of ICT architecture for smart local governance and this paper is amongst them. It presents a framework that can be readapted to be used for any local council.

## **2 Case study: local councils in Mauritius**

The concept of smart cities is being promoted by the Mauritian Government through the creation of multiple smart cities over the island. With respect to this, eleven (11) sites have already been identified and investors are being actively sought [15–17]. Smart city initiatives will definitely accelerate technology adoption in the public sector [1]. However, if Mauritius is to be considered a Smart Island, setting up new smart cities is not sufficient as it will create a gap between these smart cities and existing towns and villages in Mauritius. Therefore, existing towns and districts should not be forgotten especially since previous reports show that the worldwide trend is the conversion of existing cities into smart cities, for example, London and Abu Dhabi [18]. The “smartness” of a city describes its ability to bring together all its resources, to effectively and seamlessly achieve the goals and fulfil the purposes it has set itself [19]. Based on this definition, it can be seen that Mauritian towns and their residents will benefit from the use of smart technologies for urban development, planning and delivery of services.

The government of Mauritius has provided e-government platforms for improving the services provided to its citizens. By definition e-government is the combination of the internet-based platform and series of ways that are used to provide for e-services [20]. It enables proper planning and government administration [21]. M-government is the delivery of services and information via mobile phones [22]. In Mauritius, e-services are provided through the use of the government portal and municipal websites. The e-services provided are discussed in [23].

In Mauritius, local councils are responsible for providing a number of services to the citizens, for example, land use and building permits, issuing trade licenses and collecting trade fees. An exploration of the structure of local councils in Mauritius shows that they each employ hundreds of people and provide a variety of services to their citizens. Local governance is ensured by district councils (rural areas) and municipal councils (urban areas), which will be jointly referred to as local councils in this work. Local councils in Mauritius are guided by the Local Government Act and they provide various services to people living in towns and villages. Local councils manage their business independently as long they are providing the required services. The different departments of local councils in Mauritius include the Administration Department, the Finance Department, the Land Use and Planning Department, Public Health Department and the Welfare Department. They manage their budget and not all the departments have the same degree of IT usage.

## **3 Methodology used to develop the ICT architecture**

A four phased approach was used to develop the ICT architecture and is shown in Fig. 1. This section describes each phase.

### 3.1 Phase 1: systematic literature review of existing work

Phase 1 consisted of a systematic literature review of existing work on ICT architecture for Smart Governance. The aim of the review was to identify works that discussed case studies related to Smart ICT architectures and also analysed proposed frameworks, architectures developed, and modelling artifacts used. Findings of the systematic literature review are found [12].

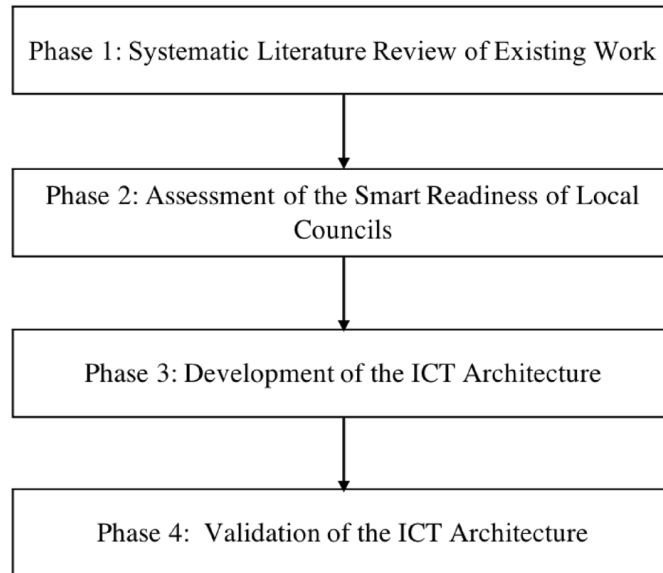


Fig. 1 Methodology used to develop the ICT architecture

### 3.2 Phase 2: assessment of the smart readiness of local councils

Before embarking on the development of the ICT architecture, it was important to do an assessment of the current status in each department through a series of focus groups. Therefore, during Phase 2, Mauritian local councils were evaluated in terms of their adoption of ICT and their readiness to use smart technologies. The findings are published in [24].

### 3.3 Phase 3: development of the ICT architecture

The ICT architecture was derived based on data gathered in Phase 2 using existing ICT architectures which have been developed following international norms and standards. The ICT architecture was developed based on the proposed definition in Phase 1 and from scratch, using a layered approach without the use of any framework. Models were used to represent the different layers. This ICT architecture was tailored for local councils in Mauritius, taking into consideration that local councils can vary significantly from other smart cities around the world in their delivery of services. For example, in many countries, local councils are responsible for managing the water and electricity supply of the residents whereas in Mauritius, this is done on a national level. The proposed ICT architecture is discussed in Sect. 4 of the paper.

### 3.4 Phase 4: validation of the ICT architecture

The proposed ICT architecture was validated using three approaches: (1) validation against the architectural principles; (2) stakeholders' validation during an interactive session and 3) validation was in terms of the contribution to smartness. The results of the validations are found in Sect. 5 of this paper.

## 4 Proposed ICT architecture for conversion to Smart Local Council

In this section the architectural principles used to develop the ICT architecture is first discussed and then the ICT architecture is presented.

### 4.1 Architectural principles

Architecture principles are essential for building any architecture. The principles describe what a good architecture should look like. They help to evaluate architecture decision points and assist in change initiatives and drive architecture governance. The principles (Table1) that have been identified for the setting up of a Smart ICT architecture for Mauritian Local councils are based on the architectural layers and the other components that were identified as important. The principles have been grouped together based on the main benefits they provide as per set strategies for smartness. Some principles may be relevant to more than one strategy. However, these principles have been categorized in the strategy that they are more relevant. All the set strategies have objectives to make local councils smart.

### 4.2 Proposed ICT architecture

The different layers for the ICT architecture are based on the layers identified during the systematic literature carried by the team [12]. The architecture consists of the following layers:

*Business layer:* includes all the different business processes within the departments across all councils.

*Application layer:* handles the interactions amongst the various applications that will be used by all stakeholders across the councils through the Application Controller that will decide which domain logic will be run and how the information will be presented to the users. This layer will be instrumental to provide loose coupling, whereby the individual applications can be updated/upgraded without impacting other applications.

*Data layer:* The layer integrates the different types of data from different sources and is responsible to retrieve, clean and manage internal and external data to ensure it reaches the required destination while at the same time providing access control and security mechanisms as depicted in Fig. 2.

The *Aggregator* will send the data to the information systems of the local councils and to the Big Data Analytics framework to perform Business Intelligence and Analytics.

*Physical layer:* The physical layer consists of all the hardware and physical installations. The three main components are the Servers (cloud and on-premise), Network (intranet, extranet and wireless) and Input and Output devices (Sensor, GPS, Mobile phones and desktop kiosks).

*Security layer:* Layer needs to be enforced at the different levels of data traffic through different devices and communication channels.

Table 1 Architectural principles used to develop ICT architecture for Smart Local Council

<b>Principle</b>	<b>Description</b>
Business architecture principles	Focuses on the promotion of innovation for smartness in business process of the local councils
Application architecture principles	Focus is on services and this can be achieved by having a loosely coupled modular approach which maximizes reuse. Applications are centralized
Technology principles	Technical standards and use of automatic monitoring should be formally adopted; non-compliance needs should be justified and explained
Principles for users	Citizen-centric services which are inclusive and accessible. Capacity building for staff and locals is also required. Citizen crowdsourcing and use of Kreol Morisien is also very important to get feedback and increase quality of service delivered
Principles for interoperability	Organizational, semantic, technical and legal interoperability initiatives need to be adhered to
Quality principles	Quality principles have to be adhered to through the development process. Citizens should have the assurance that the services being provided to them through digital means are error-free
Information/data architecture	Ensures data access and security and promotes the use of data for prediction as well as openness of data
Service oriented architecture principles	Services are internally consistent, self-contained and independent from each other, interoperable and understandable
Security principles	Deals with accountability, protection mechanisms to be implemented at different layers, transparency and discovery of insecure communication
Environment principles	The virtualization of infrastructure and use of thin clients helps in decreasing the operational cost. Efficient capacity planning should be carried out
Principles for public/private partnerships	Public and private partnerships play an important role for ICT related development. Market-leading products or bespoke components which are most appropriate are developed by the private sector which are then implemented

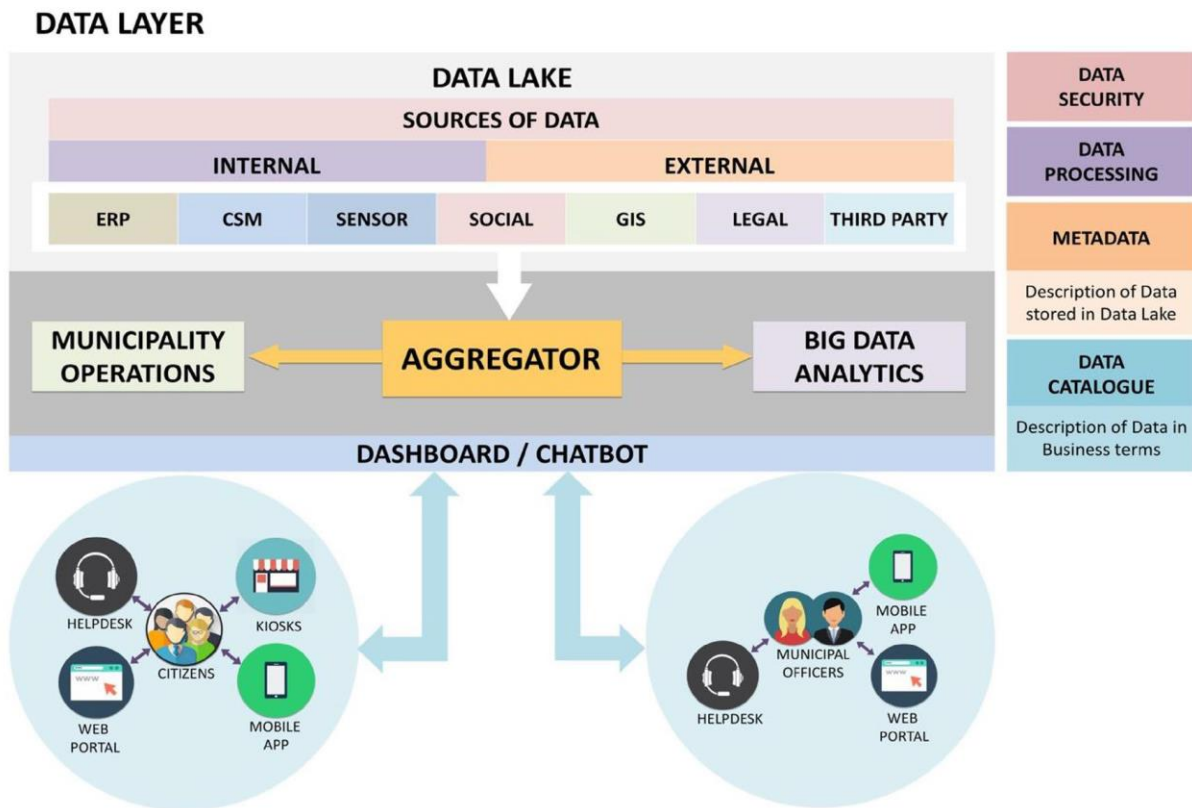


Fig. 2 Data layer of ICT architecture for Smart Local Councils

Figure 3 gives an overview of the proposed architecture. On the left and right sections of the diagram, different types of users, namely, local council officers and citizens, are shown. The interfaces through which the users are expected to interact such as chatbots, helpdesks and dashboards are depicted. The central section emphasizes the underlying data sources, technologies and frameworks that can support the provision of smart services to users.

The data that will be captured and processed will not be restricted to internal subsystems within the various council departments. The ICT Architecture for Smart Local Councils (ICTSLC) will be capable of interfacing with external portals and systems such as the Citizen Support Unit (CSU). In addition, the different information systems that will support the operations of local councils are:

- *Citizen service management*: to support citizen applications and notification services such as automatic mobile alerts
- *Council event management*: to manage different events of local councils
- *Resource scheduler*: to perform smart management of resources such as equipment and municipal officers
- *Enterprise resource planning (ERP)*: to support the generic processes of local councils such as inventory, procurement, accounting and finance, human resource, asset management and project management. Following the feedback received from local councils, it was noted that an ERP system (Oracle) was already being used to support council activities such as procurement, accounting and finance. This ERP could be extended to provide support for other business processes.

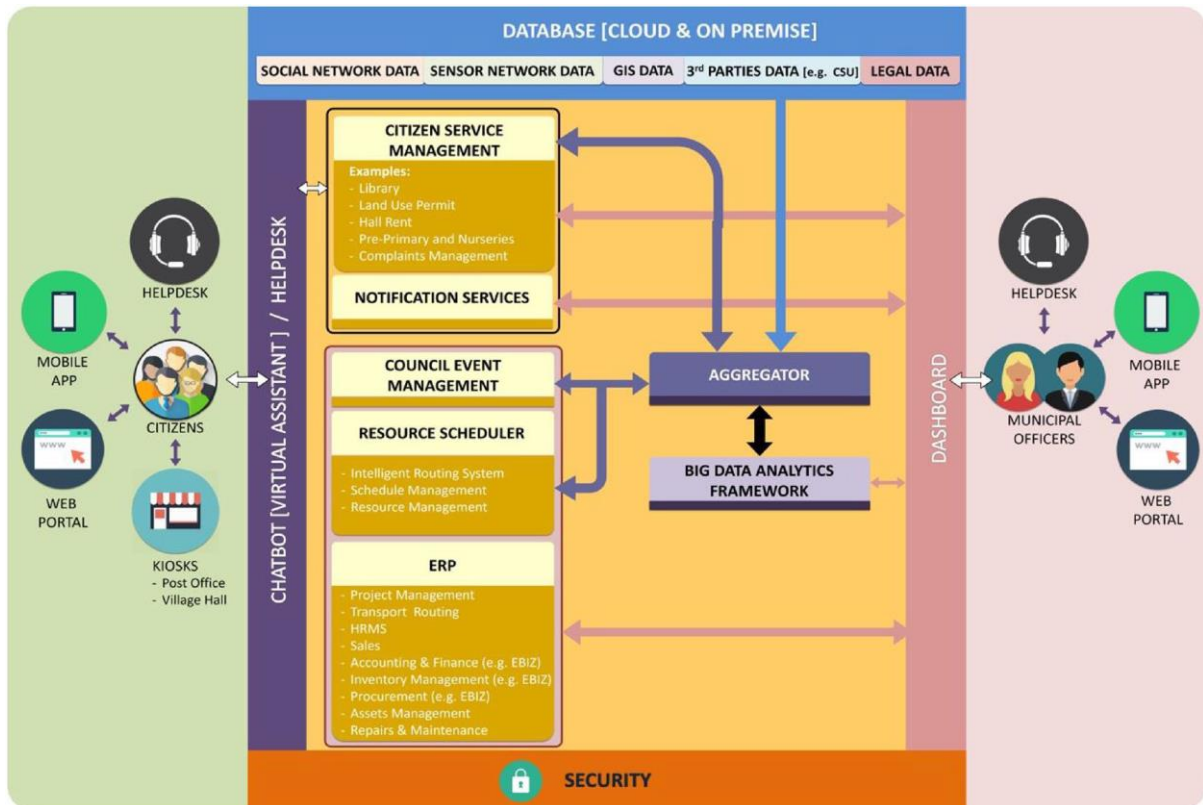


Fig. 3 ICT architecture for Smart Local Councils (ICTSLC)

Table 2 Architecture principle vs ICTSLC component (part 1)

Architecture principle/layer	Business	Information/data	Application	SOA	Technology	Security
Business layer	✓	✓	✓	✓	✓	✓
Application layer	✓	✓	✓	✓	✓	✓
Data layer		✓	✓	✓	✓	✓
Physical layer		✓	✓	✓	✓	✓

Table 3 Architecture principle vs ICTSLC Component (part 2)

Architecture Principle/layer	Users	Environment	Interoperability	Public/private partnership	Quality
Business layer	✓		✓	✓	✓
Application layer	✓	✓	✓	✓	✓
Data layer	✓	✓	✓	✓	✓
Physical layer	✓	✓	✓	✓	✓

## **5 Validation of proposed ICT architecture**

In this section the three validations carried out are presented.

### **5.1 Validation against architecture principles**

Tables 2 and 3 presents the various layers that have been proposed in the ICTSLC architecture in line with the set architectural principles. As can be seen all the principles have been met and Service Oriented Architecture (SOA), Technology, Security and Quality principles are followed in all the four layers.

### **5.2 Validation by stakeholders**

The proposed ICTSLC was validated by a focus group approach. The aim of the focus groups was to seek feedback on the proposed architecture to identify any gaps with regards to services provided by the local councils. Each focus group was targeted to specific individuals and organizations representing officers from each department.

Two focus group sessions were conducted to validate the proposed architecture as well as the services. The first focus group was attended by nine council officers from the Public Health Department, Public Infrastructure Department and the Land Use and Planning Departments (three officers per department). The second session catered for the Public Welfare, Administration and Public Finance departments and comprised five council officers.

The focus group was initiated by a welcome speech followed by the introduction, architecture diagram, and poster presentations for each department. The introduction specified that the current focus group is a follow up of the previously conducted session whereby details of each process within the council was collected. The architecture diagram was introduced with a high-level overview of the proposed system and the function of each component was elucidated and discussed. The project team members were separated into various groups to explain the proposed solutions for each department which was followed by a discussion. This interaction included the appreciation and feasibility of the proposed solution as well as proposals for improvement.

#### *5.2.1 Administration department*

The focus group vetted the components that were proposed for the department. In the initial phase of this project, the administration department had a low score on smart readiness and thus, several automated processes were proposed. The outcomes revealed that the components recommended for human resources would automate various processes such as leave management, staff management amongst others. They expressed their appreciation for the electronic document management system. However, they stressed that there needs to be a link with several other departments so that relevant information and complaints relating to this department could be captured. The project team presented the information service center which could track the complaints, and this was highly appreciated. They further added that the automated processes designed for the library system would facilitate their tasks and would lead to better management of books and magazines.

#### *5.2.2 Land use and planning department*

Participants informed of an automated system have been implemented since December 2018 for various councils. This system comprises the various features already being proposed. However, the current system is not user-friendly, employees do not have the required skills to make use of the



system and the council does not have the required resources to use the current system. The system limits the file upload size and upload format to PDF. Citizens' complaints are not categorized per department and screening of documents is not available. The proposed architecture caters for these limitations by allowing several files format and size upload, enabling mobile payments to be done and channelling complaints per department. In addition, council members had a positive approach towards the proposed features such as auto-generated emails, data analytics system, mobile payment system, status tracking, auto status update, Autotask allocation, GIS system, and picture and video upload. Participants suggested that the implementation of the proposed architecture would facilitate their job, but appropriate resources and training should be provided.

### *5.2.3 Public health department*

The focus group suggested the implementation of various services which were missed out in the proposed solution and modifications to the existing proposal. The first proposal was to have a contract management module to allow management and renewal of suppliers' contracts since monitoring of these contracts is critical to the council. Secondly, to propose an enforcement unit which will ensure abiding to environmental laws and regulations. It has been suggested that the enforcement unit should comprise a prosecution unit and should manage public lavatories, new traffic centers and procurement of departmental goods and services. Thirdly, to have an administrative section for the health department to cater for employee's payment (such as overtime and traveling claims), procurement procedures and service provider claims.

Participants suggested improvements for the fee payment, cremation services, monitoring of bare lands, refuse collection, cleaning of rivers, drains and canals, and citizen management service. Those improvements are:

- Fee payment: include rental fee collection for shops, payment for ad-hoc refuse collection, trade fee payment on a 6 month or yearly basis and burial and incineration fee.
- Cremation services: propose an online portal to allow citizen to apply for this respective service, include consideration for late night burial or cremation.
- Monitoring of bare lands: include reporting facilities, fetch information from the registrar of lands or ministry of housing and lands and consider upkeep of green spaces and parks.
- Refuse collection: (1) consider implementation of a portal to campaign for bulky waste collection, post cyclonic waste collection, ad-hoc refuse collection, and e-waste collection, (2) Propose the use of smart bins to allow the refuse collection team to do planning accordingly and (3) Propose use of different bins such as recycle bins.
- Cleaning of rivers, drains and canals: (1) consider rodent control, herbicide facilities, and reporting facilities for the number of premises cleaned and (2) Propose to merge refuse collection and cleaning of rivers, drains and canals.
- Citizen service management: (1) include filtering of complaints to appropriate departments and (2) connect each department to the complaints management system.

### *5.2.4 Public infrastructure department*

The focus group suggested that the auto-task scheduling should be implemented as an independent component related to the administration department. Moreover, it was reported that municipal councils had mechanical workshops whereas the district councils consisted of only general workshops. Also, highway and land surveying departments were not part of the councils. It was proposed that citizen service management should be connected to the Administration department whereby details of all complaints should be recorded, following which these complaints would be channelled to the appropriate departments. The focus group participants highly appreciated the proposal for street

lighting which would facilitate their task in identifying faulty streetlights. It has been pointed out by the council members that the works and building section also comprises the village halls and recreational center. There was a positive response among council members for the usage of drones to conduct several monitoring activities.

### 5.3 Evaluation of contribution to smartness

In order to evaluate the contribution to smartness of the proposed ICT architecture for SLCs, components of smartness from recent papers have been used. This section explains how these components were used and how the proposed architecture has been evaluated.

#### 5.3.1 Deriving components for evaluating smart local council governance

Papers related to smart governance [25, 26] as well as smart city governance [27] have been used as a baseline to formulate the components for evaluating SLC governance. The main components from these papers which were relevant to SLC were identified and similar components were regrouped. The components for evaluating SLC governance were then defined and explained. This process is summarized in Table 4.

Table 4 Deriving components for evaluating smart local council governance

Identified components from literature	Components for evaluating SLC	Description of the components
Commitment—governmental organization [26]	Commitment of government	Relates to the vision, aims and objectives of the local councils towards provisioning of services to citizens, as per the Local Government Act
Responsiveness—governmental organization [26]	Responsiveness of government	Relates to the strategies that can be adopted by local councils to become increasingly receptive to their citizens, through the use of mechanisms such as e-participation programs and online collaborative platforms
Operational management—governmental organization [26] Smart internal coordination [25]	Smart management	Entails the use of ICT-supported mechanisms to enhance the management of processes within councils and to foster the collaboration between public and private stakeholders for the co-creation of innovative and robust e-services
Citizen participation [26]	Citizen Participation	Essential component as it relates to the mechanisms through which citizens can

Collaborative open and citizen-centric forms of governance [27]		participate and contribute towards policy decisions at the council level. Diversity of citizens, in terms of their ability or willingness to participate in such endeavors, needs to be considered
Use of technology [26] Smart ICT [25] ICT -promoted transformation (internal and within the society) [27]	Smart ICT Usage	Relates to the use of ICT-related technologies for enhancing service delivery and improving citizen participation. ICT-related technologies can provide different types of communication strategies
Smart external collaboration and participation [25]	Smart external collaboration and participation	Entails the use of technology-based collaboration strategies across council departments, ministries and communities to foster opportunities for economic growth and for re-engineering e-services into citizen-centric services
Smart decision-making processes [25] Data and evidence-based policymaking [27]	Smart data and evidence-based decision making	Emphasizes the use of ICT solutions for analyzing and processing large amounts of data which may be available from multiple varied sources including governmental open-data portals. The data will enhance policy decision making as well as planning at various levels (strategic, tactical, operational) in local councils
Smart e-administration [25]	Smart e-administration	Includes the ability of local councils to interact with their citizens and the public at large using online channels of communication with a view to widen access to services and increase responsiveness
Smart outcomes [25]	Smart outcomes	Relates to outcomes that are desired and sustainable for instance, social inclusion, citizen-centric services,

		ecological sustainability and increased efficiency in service delivery and administration
Improving the quality of life in cities [27]	Improving the quality of life of citizens	Includes the development of policies and provisioning of services that will enhance the quality of life and well-being of citizens

### 5.3.2 Evaluating smart local council governance

The different departments have been evaluated against the evaluation components derived as shown in Table 5. It can be observed that all components align with the different departments since the proposed solution is based on an ideal architecture. These components will have to be evaluated in a real-life scenario to assess their sustainability and relevance. A discussion follows in this section highlighting the relevance of the evaluation components against the different solutions proposed in the ICT architecture.

Table 5 Evaluating smart local council governance

<b>Component for evaluating SLC governance</b>	<b>Administ ration</b>	<b>Land use and planning</b>	<b>Public health</b>	<b>Public infrastructure</b>	<b>Welfare</b>
Commitment of government	Y	Y	Y	Y	Y
Responsiveness of government	Y	Y	Y	Y	Y
Smart management	Y	Y	Y	Y	Y
Citizen participation	Y	Y	Y	Y	Y
Smart ICT Usage	Y	Y	Y	Y	Y
Smart external collaboration and participation	Y	Y	Y	Y	Y
Smart data and evidence-based decision-making	Y	Y	Y	Y	Y
Smart e-administration	Y	Y	Y	Y	Y
Smart outcomes	Y	Y	Y	Y	Y
Improving the quality of life of citizens	Y	Y	Y	Y	Y

### *5.3.2.1 Administration*

The use of smart ICT solutions will boost these internal services which have a long history of being paper-based, mis-managed and inefficient. For example, under the proposed architecture, the Human Resource and Registry will be revamped to provide local council employees with efficient services. Under these plans, employees should be able to apply for leaves, manage and transfer documents using smart ICT systems. These services will contribute to the smartness of the local councils through smart management, e-administration and smart decision making. External services within this department deal with citizens through the provision of library services. Data gathered from initial focus groups showed that these libraries are mostly run traditionally and with the evolution of technology, in order to maintain citizen participation, local councils will have to innovate in their provision of services. As such, it is proposed that local councils provide smart library services through the use of smart library cards, online reservations, mobile payments, click and collect services as well as delivery services. This will undoubtedly improve citizen participation and collaboration and directly impact on the quality of life of citizens.

### *5.3.2.2 Public welfare*

The quality of life of the citizens is a major component of smartness. The proposed systems for this department employ smart ICT usage through the use of online applications, payments and notifications to allow citizens to fully benefit from services with no need to physically visit the local council offices. These online systems will also allow smart management and smart decision making by the local council and ultimately will improve the responsiveness of the government to the needs of the citizens. These systems will improve transparency, which is a key factor in encouraging external partners such as sponsors within the private sector to contribute to events and activities organized by the local councils. Through smart ICT usage such as event polling and automatic scheduling of classes, local councils will be able to meet the real needs of the diverse population of citizens while optimizing the use of their resources. The provision of such citizen-centric services will undoubtedly improve citizen participation, helping to bridge the gap between the different segments of the population.

### *5.3.2.3 Public health*

Commitment and responsiveness of government is important to ensure that the activities related to public health (such as cremation, cleaning of rivers, refuse collection, market stall allocations, monitoring of bare lands and payments) can be sustained. This includes smart management of operations inside and outside the organization. Smart ICT usage, by both internal local council staff as well as external parties (such as citizens and other government bodies), is important to ensure the seamless flow of information which will aid in Smart data and evidence-based decision-making. This includes connecting with external applications such as the CSU and Safe City. While some councils incorporate a degree of smartness in their activities, other councils are still far behind in this endeavor although some facilities are available. For example, some councils are using Global Positioning Systems (GPS) and GIS to monitor waste collection lorries while others use WhatsApp to send pictures to health inspectors while monitoring unoccupied lands and for solid waste management. Further extending on smart ICT usage in the proposed architecture, the use of GIS, automatic notifications, mobile payment, auto task scheduling, fuel management as well as AI-enabled virtual assistant, are proposed. Among the different stakeholders, citizen participation is a must such as for cremation and market stall allocation. They need to make use of the online applications, mobile payment and use AI agents for support. Smart outcomes can be measured by the degree of improvement in the provision of the different services of this department. If there is the commitment from the different stakeholders, this is expected to improve the quality of life of citizens. The proposed framework elaborates on the ICT

enablers for smartness but the participation and commitment from the different stakeholders is crucial to sustain true smartness of the solution.

#### *5.3.2.4 Land use and planning*

In the Land Use and Planning department, ICT can be used to auto-generate emails, perform data analytics, help to effect payment through mobile payment, track status, auto update status of applications, perform auto-task allocation, facilitate GIS system and enable picture/ video upload for the concerned region amongst others. These proposed enhanced processes will allow the local councils to engage in sustainable development through the use of ICT. On the other hand, Responsiveness along with smart external collaboration and participation are factors that help to maintain a good relationship with the citizens and other stakeholders. In this work, these factors are present in terms of obtaining the status of applications that can be tracked and the response that can be received instantaneously through auto-generated emails. In our work, the smart monitoring service that is driven by various technologies including GIS and virtual assistants along with the recommended web portal/ mobile application designed for employees and citizens to access all the services in real time, will lead to smart decision making, providing smart outcomes and improving the quality of life of the citizens.

#### *5.3.2.5 Public infrastructure*

The Public Infrastructure department is committed towards the main processes namely Works and Building Maintenance Section, Street Lighting, Land Surveying and highway. Through commitment and use of ICT, the workload of maintenance staff will be automatically scheduled and balanced. The field supervisor can monitor ongoing tasks via the dashboard. In addition, the GIS system can be used to monitor maintenance and repair progress of street lighting leading to smart e-administration. In addition, for smart-decision making, each supervisor can access a dashboard and can visualize the map of the town/village which indicates the status of work; pending, in progress or completed. An AI-enabled virtual assistant proposed for land surveying could be used to check whether a citizen is eligible to make an application for subdivision or excision of land. Several questions can be asked by the system through the web portal and based on the answers, the system determines whether the citizen is eligible to make the application. This proposed process would lead to smart management and provide smart outcomes instantaneously. During the application process the citizen will be able to view the location of land using the GIS. The system that we proposed for this department will check for the completeness of application. Once the application is submitted, an application number will be generated and sent to the citizen to track the status of the application. This enhanced process will allow more interactions with the citizens and definitely improve the quality of life of the citizens. On the other hand, the council's infrastructure such as drains, roads, potholes and gutters could be equipped with sensors which transmit information in real time to the system. Any damaged infrastructure can be easily detected by the information received from the sensor. Citizens can complain about faulty infrastructure via the web portal which are automatically sent to the appropriate municipal staff by the system. In doing so, smart decision-making processes are triggered.

## **6 Conclusion**

In this paper, we described the methodology used to develop an ICT architecture for local councils in Mauritius. We proposed a comprehensive methodology based on three phases namely: Preliminary Investigation, Development of ICT Architecture and Validation of the Architecture. Following the initial investigations within local councils, an ICT Architecture for Smart Local Councils was developed. The layers of the proposed architecture are: Business Layer, Application Layer, Data Layer and Physical

Layer. Within each layer, components were identified to take into consideration the needs of the local councils as well as the most recent technological developments. A three-fold validation strategy was employed, namely, validation against set architecture principles, validation with stakeholders and evaluation of contribution to smartness. In the first part of the validation process, the components of the proposed architecture were shown to be in line with previously identified architecture principles. During the validation with stakeholders, interactive sessions were organized in order to obtain feedback from local council employees from different departments regarding the delivery of services being proposed as per the architecture. Findings from these discussions allowed the refinement of the proposed architecture. In the last part of the validation process, an evaluation of the contribution to smartness was conducted for each department in the local council. This evaluation process allowed a reflection on how components proposed under the ICT architecture will really contribute to smartness in real-life circumstances taking into consideration factors such as citizen participation, quality of life, smart ICT usage among others.

This work has established the blueprint for smart local councils in Mauritius. The next step is to re-engineer the existing business processes in the different departments in order to transform them into smart services. Additionally, a citizen-centric approach needs to be adopted for implementing the architecture and it is also important to empower internal stakeholders. Investment in terms of infrastructures and training and policies, are essential to promote the usage of technology and development of innovative services. Future work will focus on establishing a roadmap for implementing the proposed ICT architecture. Mauritius needs to have a paradigm shift towards use of technology, which should not be restricted to mere computerization. The proposed ICT architecture (ICTSLC) is a step forward. It is expected that the findings of this study will bring to light existing issues within local councils in Mauritius and guide the incremental transformation of local councils in the provisioning of smart services to local citizens. Future works include implementation of the proposed model in one specific local council as proof of concept and then replicating the solution.

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