Egyptian Computer Science Journal (ISSN-1110-2586)
Volume 41– Issue 1, January 2017

Big Data in Smart Cites: Analysis and Applications in Arab World

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Abstract

Big data plays an important role in smart city. Big data analytics is one of the recent technologies that could enhance smart city services. It provides valuable insights from massive volume of data collected through various sources. The combination of big data and Internet of Things (IoT) supports urban decision makers and provides better services to the citizens. This paper is focused on reviewing the impact of big data on the smart city. It discusses big data challenges and benefits, its relationship with internet of things, selected smart city platforms and framework. In addition to it introduce big data applications in smart cities in Arab Nation. The results illustrated that big data analytics can provide a lot of benefits for smart cities and improve the quality of life, in spite of its challenges that should be addressed.

Keywords: *Big Data, Smart city, Internet of Things, Smart city platforms, Big Data Analytics*.

1. Introduction

Smart city is a high-tech intensive and advanced city that connects people, information and city elements using new technologies in order to create a sustainable, greener city, competitive and innovative commerce, and an increased life quality [1]. Being a smart city means using all available technology and resources in an intelligent and coordinated manner to develop urban centers that are at once integrated, habitable, and sustainable [2]. Smart city can also be defined based on three key characteristics: instrumented, interconnected, and intelligent. Instrumentation enables the integration and capture and of live real-world data through the use sensors and other data-gathering mechanisms. Interconnection means communicate and share information among the various city services. Intelligence refers to the complex analysis, modeling, optimization, and visualization of data that are collected from diverse group of regional and local agencies to make intelligent decisions [3, 4].

The smart city leads to an exponential increase in data through several of magnitude. Such enormous volumes of data or big data offer the potential for the city to obtain valuable insights from large volume of data collected through various sources [5, 6]. The top seven big data drivers are internet data, science data, finance data, sensor data, mobile device data, RFID data and streaming data. Using big data analytics could make sense of these increasingly large, heterogeneous, noisy and incomplete datasets collected from a variety of

sources [7]. The big data analytics will store, process, and mine smart cities applications' information in an efficient manner to produce valuable information to enhance different smart city services [8].

Problem statement in this research is to study and illustrate the impact of big data on the smart cities. The components of smart cities such as transportation, healthcare and governance generate numerous amounts of data that could be utilized to support the sustainability of these cities. The proposed methodology is depended upon collecting information about smart cities, big data and IoT. Then I use the information to demonstrate (1) the challenges and benefits of applying big data in smart cities, (2) the relationship between big data and IoT, (3) the software solutions that is used to develop smart city and their big data capabilities, and (4) the impart of big data applications in smart city through two case studies in Arab Nations. An important limitation in this research is no enough information that technically describe the smart city solutions or platforms and also no details about the big data analytics tools that are embedded in these smart city solutions.

The rest of this paper is organized as follows. Section 2 discusses the challenges and benefits of big data in smart city. Section 3 discusses the Internet of Things (IoT) and its relationship with big data. Section 4 provides examples of smart city platforms. Section 5 focuses on smart cities in Arab Countries and the implemented big data applications in these cities. Section 6 provides the concluding remarks.

2. Related Work

There are few research studies highlighted the importance of big data applications in the smart cities. These studies discussed smart city definitions, big data challenges and opportunities, technologies like IoT used in the smart city, the applications of the smart cities that use big data analytics as well as the proposed business model that can manage big data for smart cities [9-11]. The work of [12] reviews big-data projects and initiatives in the leading countries. It compares big data applications of leading e-government countries to serve as a guide for follower countries looking to initiate their own big-data applications. Another work of [13] presents the benefits of applying big data techniques over data originated by IoT- based devices deployed in smart cities. It also describes two big data applications for smart city components, which are the services of energy efficiency and comfort management in the buildings of a smart campus, and the public transport service of a city.

3. Challenges and Benefits of Big Data

Big data applications have many challenges and benefits in smart city. To recognize these challenges and benefits may help in developing a smart city that improve the citizens' quality of life.

3.1 Challenges

There are many technical challenges affects the performance of smart city applications that relay on big data. Therefore, it is important to avoid or reduce these challenges that face the design, development and deployment of big data applications for smart cities [8]. Some of the key challenges are:

1- Big data attributes: There are 7 Vs. that make big data hard to manage: The main four Vs. are: Volume (the size of data being created from various sources), Velocity (the

speed of data that makes it too much to work with), Variety (the different types of data being generated), Veracity (the quality and truthfulness of data) [9, 6]. Other new Vs. were added including Validity (the correctness and accuracy of data with regard to the intended usage), Volatility (big data retention period; it becomes significant due to volume, variety and velocity of data), and Value (the desired outcome of big data processing) [6]. Considering smart city applications, big data difficulties arise in collecting the data by itself, which is complicated because of the multiple sources with different formats, types, and usage as well as access policies. Moreover, the unstructured nature of the data make then hard to categorize and organize [8].

2- Security and privacy: Another one of the important challenges using big data in a smart city is the security and privacy issues. The smart city entities have large volume of data that include personal and private information about individuals such as medical and financial records. Many view access to these data as a violation of a person's privacy. Some suggested solutions are legal provisioning on using the data and use of data codes to ensure safe travel of data over the networks [10, 8]. On the other hand, smart applications integrated together across agencies need high security since the data will move over various types of networks, some of which may be unsecure [6]. Thus, the security of data requires to be implemented at technological, government and business policy and public levels through legal terms and conditions [14].

3- Integrating data from multi-sources: Data integration represents one of the important challenges within the smart city. There are a wide variety of intelligent objects embedded throughout the city, which generate large volume of structured and unstructured data. Therefore, the vision of the smart city is to integrate such a massive amount of data from multiple sources [15]. Moreover, data quality is one of key difficulties in any data integration mechanism, especially if the data are incorrect, missing, and/ or incomplete [16].

4- Data processing: In a smart city, data generated from hundreds of thousands devices need efficient data processing. The data processing challenge must be addressed to increase citizens' quality of life and make their cities sustainable. For example, energy or water losses caused by faulty devices can be reduced through matching the consumption measured by users' meters with the one measured by other utilities' systems. Thus, novel processing of data becomes increasingly significant, whereas traditional approaches for storing and processing may no longer be appropriate [17].

3.2 Benefits of Applying Big Data in Smart Cities

Implementing big data analytics in smart cities enables them to gain many benefits such as better quality of life, efficient resource utilization, enhancing different smart city services and facilitating collaboration across applications and services. Big data also supports decision makers plan for any expansion in smart city services and resources [8, 18]. The big data applications can serve many sectors in a smart city, for example, healthcare can be enhanced by managing healthcare records, improving preventive care services and providing patient care. Another example is transportation sector that can benefit from big data through reducing the number of accidents by analyzing the history of mishaps and minimizing traffic congestion by providing alternative routes [18]. To achieve big data benefits and advance services in smart cities, they require investing in advanced technology, better development efforts and effective use of big data. There is also the need to articulate policies to ensure data accuracy, quality, security, privacy, and control of the data as well as the specification of

metadata and data documentation standards to provide guidance on the contents and use of datasets [19].

4. Internet of Things and Big Data

Smart environments, equipped with wireless sensor networks and widespread mobile ad hoc networks create a new technology called Internet of Things (IoT) communication platforms with a wide range of applications in different domains [20]. IoT is network of things or real world objects that are embedded with sensors and actuators. These smart objects have the capability to collect large amount of data from the environment with the help of sensors [21]. The aim of IoT is to make the Internet more pervasive by enabling easy access and interaction with a wide variety of devices such as home appliances, cameras, monitoring sensors, actuators and vehicles. Using IoT in smart cities makes them more connected, convenient, and intelligent [22]. Examples of intelligent applications are smart grids, smart healthcare, smart transportation, smart retail, smart homes, smart water, and smart energy [23, 24]. These applications make use of the potentially massive amount and variety of data generated by such objects to provide new services to citizens, companies, and public agencies. That represents the relationship between big data and IoT applications deployed in the smart city fabric. Therefore, extracting insights from the big data generated by the smart cities via sensors, devices, and human activities require both batch processing and streaming processing in order to handle the increasing volume, variety and velocity of data [25, 24].

5. Emerging Technologies for Solving the Problem

The previous sections illustrate the problem that should be addressed, which is generating big data from smart environments through sensors and actuators. This big data has a lot of challenges in designing, developing and deployment. To overcome these challenges, the novel technologies for big Data storage, processing and analysis is required to handle large amounts of data that are generated within a Smart City. The smart city platforms represent new technology that offer sensing, communications, integration and intelligent decision making. The internet of things is central to this structure to manage different devices and enable different applications and services for many systems of the city [26]. Moreover, the smart city framework is another solution that helps public and private sectors effectively planning and implementing smart city initiatives [27].

6. Smart Cities Solutions

This section will discuss some selected smart city solutions and the comparison among them is shown in table 1. The solutions or platforms are Oracle's Smart City, Citypluse, IBM Smarter City, Smart Nation and SCOPE "see Figure 1".

6.1 Oracle's Smart City Platform

Oracle offers smart city platform a comprehensive range of solutions includes three key platform components: Smart innovations, smart processes and smart infrastructure. Smart Innovations platform integrates multichannel services. Smart processes platform is an intelligence and enterprise operations platform. Smart Infrastructure platform enables better integration and interoperability with the city's existing soiled legacy IT infrastructure [28, 29].

Oracle's Smart City Platform has six functional areas, which are city service, citizen empowerment, city operation, business productivity, city infrastructure and sustainable city as shown in table 1. City service provides clear responses to citizens' requests through offering

a variety of functional capabilities supporting multi-channel interaction in the front office. For citizen empowerment, the Platform offers two-way interaction for closed loop feedback interaction between the city and the residents. City Operation offers standard business applications for generic operational business processes, fiscal & revenue Management, instruments to control inspections and also enabling the city to get operational insight in the quality of life. For business productivity, the Platform offers an open infrastructure for automated integration between processes of cities and businesses to allow cities to be open for business. City infrastructure is a platform on itself providing the multimedia information management capabilities, the security of data and applications, the internal and external connectivity between processes and people as well as the means to search, match, access and analyze information. For sustainable city, the platform offers the means to gather all types of feedback from citizens, business and measuring devices. Interpret the flow of data and transaction in real-time allow cities to take immediate control of what influence the sustainability of a city [29].

Oracle's Smart City Platform is the host for Big Data. It manage large volume of structured data, handling multimedia contents, supporting geographical and spatial data tagging, streaming traffic from social networks and mastering data amongst multiple data providers. Oracle's Big Data capabilities turn these large datasets into nuggets of useful information for city administrators and citizens to consume. Oracle's Smart City Platform provides the connectivity to unpredictable range of IoT. The integration technology provided with the platform will connect the variety of city networks into a network of networks. The platform provides embedded technology in sensors, application servers and intelligent devices in measuring equipment based on open Java standards, using RFID or other mechanisms to sense [29].

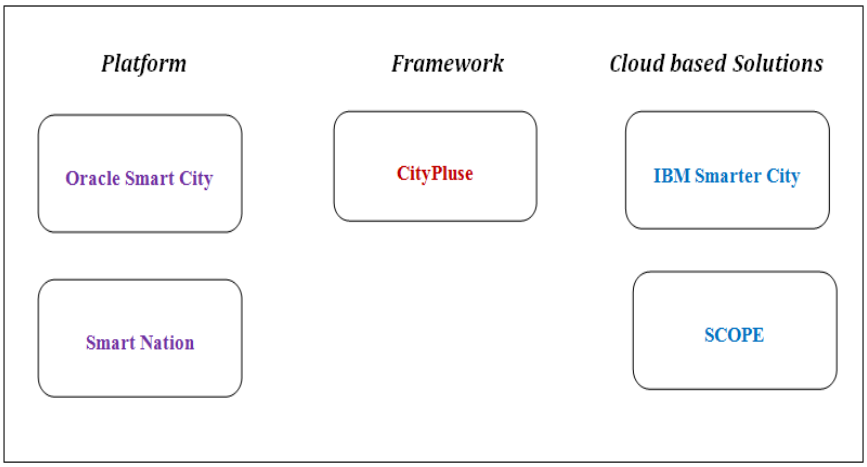

Figure 1: Smart city Solutions

6.2 CityPluse framework

The CityPulse framework builds on a strong competence in ICT, complex event processing, data analytics, semantics and knowledge-based approaches, testing and platform engineering [30]. The CityPulse framework consists of three iteratively applied processing layers. These layers are: (1) real-time information processing and knowledge extraction, (2) large-scale IoT stream processing, (3) federation of heterogeneous data streams. CityPulse integrates knowledge-based methods with reliability monitoring and testing at all stages of the

data stream processing and interpretation in order to achieve reliability. CityPulse will enrich data streams from physical and virtual sensing devices with semantic annotations, enabling adaptive processing, aggregation and federation of data. Functionalities for aggregation and federation assure a scalable framework for processing large-scale IoT data streams. Reliability testing methods provide performance evaluations and contribute to scalable IoT based solutions for dynamic smart city environments.

The key issues addressed in this framework includes semantic annotation of heterogeneous data, large-scale data analytics, on demand integration of heterogeneous Cyber-Physical-Social sources, real-time interpretation and data analytics control, user centric decision support, reliable information processing and application programming interface for rapid prototyping. CityPulse could handle big data through providing large-scale stream processing solutions to interlink data from IoT and relevant social networks to extract real-time information for smart city applications.

Table 1: Features of smart city solutions

Solutions / Features	Oracle Smart City	CityPluse	IBM Smarter City	Smart Nation	SCOPE
Initiative	Oracle Corporation	European Union Project	IBM Software	Singapore's National Effort	NSF PFI project at Boston University
Infrastructure	Platform	Framework	Solutions run on IBM SmartCloud	Platform	Cloud Platform
Architecture or Functional areas	- City service - Citizen empowerment - City operation - Business productivity - City infrastructure and - Sustainable city	-Real-time information processing & knowledge extraction, - Large-scale IoT stream processing, - Federation of heterogeneous data streams.	IBM intelligent operations center to integrate data and manage city-wide events and services	- Sensor management - Data exchange platform - Data fusion and sense-making platform	Open Cloud eXchange (OCX), a plug-and-play architecture.
Big data Analytics	Has big data capabilities to turn large volume of data into nuggets of useful information	Support dynamic IoT-enabled data streams and social media streams Provide methods for big IoT data analytics	Provide Analytical solutions to deal with big data and real-time data steams such as predictive models	Provide both batch based approach and near-real time processing to handle the volume and velocity of big data	Big data technologies Tools for mining of large datasets
IoT	Using RFID		IBM Watson	Sigfox's IoT ecosystem	

6.3 IBM Smarter City solutions

IBM offers Smarter City Solutions on the cloud, which run on the IBM SmartCloud Enterprise [31]. It is a public cloud platform designed for cities of all sizes to manage their operations and facilitate collaboration between multiple agencies. IBM offers range of cloud deployment models from traditional licensed models to hosted solutions and public clouds. SmartCloud Enterprise provides consistent level of service for each deployment attribute considerations such as process transformation and network & reliability. To fulfill the Smarter Planet vision, IBM Smarter City Solutions can make cities more instrumented, integrated and intelligent. It can observe and collect real-time data from various sources using sensor-based systems, communicate and share information gathered with other agencies and analyze the data collected from regional and local agencies to provide deep insight into city events.

The Intelligent Operations Center provides a software platform and roadmap to implement IBM Smarter City Solutions. It offers access to pre-integrated software, hardware and industry-specific extensions to manage city services and events. IBM Intelligent Operations Center is designed to help city agencies share a range of information, such as events, metrics, and processes, and collaborate in real time. By sharing information, cities can deliver exceptional service to their citizens, coordinate and manage response efforts and enhance the ongoing efficiency of city operations [32].

6.4 Smart Nation platform

The Smart Nation Platform (SNP) is used to support Singapore's vision to be a Smart Nation. The aim of SNP is to bring together a nationwide sensor network and data analytics abilities, provide better situational awareness and share of collected sensor data efficiently. A Smart Nation allows integration and collaboration across multiple domains in city systems through SN- operating system. The key components of SN-operating system are: (1) Sensor management to manage both video and non-video sensors, (2) Data exchange to provide a secure platform for facilitating the timely exchange of sensor data across public agencies and also from private enterprises to public agencies, (3) Data fusion and sense-making platform to use multiple datasets and cross-connect subsystems of the nation to link silos of information that may not work together currently [33].

Smart Nation operating system has seven functional layers. These layers are sensor management (both video and non-video sensors), interfaces, event handling, data store, data preparation and transformation (using batch mode and real-time streaming techniques), data analysis and modeling and data presentation. The SN-operating system also includes centralized system functions to address data quality, privacy security and general system management functions. Big data architecture includes two key paradigms: batch based approach and near-real time processing. Both paradigms achieve volume and velocity of big data [33].

6.5 SCOPE

SCOPE is a National Science Foundation Partnerships for Innovation (NSF PFI) project at Boston University. The aim of SCOPE (Smart-city Cloud-based Open Platform and Ecosystem) is to use cloud and big data technologies to improve transportation, energy, asset management, public safety and social services in the city of Boston and across Massachusetts. SCOPE is cloud platform based on Open Cloud Exchange (OCX) model. OCX integrates key capabilities including data quality management services, security and integrity services,

privacy services and software stacks in support of cyber-physical system infrastructure. OCX can also deal with the volume, variety, velocity and veracity of big data [34].

SCOPE targets smart city services including (a) transportation and mobility services to reduce traffic congestion and pollution, save time and wasted fuel, (b) public safety and security services for big-data-driven dispatch of police and traffic details, coordinated scheduling of public works and municipal repairs, (c) energy and environmental services that monitor greenhouse gas emissions for congestion management and coordination of smart grid energy demand-response solutions, (d) tools for managing city assets through mining of large datasets, (e) Institutional, social and behavioral mechanisms to facilitate adoption of new services like incentive programs that promote transparency and sustainability data [34].

7. Smart City Applications and Big Data in Arab World

The Mercer's18th annual Quality of Living survey includes 230 cities. Dubai (75) continues to rank highest for quality of living across the Middle East and Africa, followed by Abu Dhabi (81) [35]. On the other hand, Morocco is engaging as IEEE Core Smart Cities [36]. It becomes a leading force in the field of smart cities in Arab Nation. This section will focus on smart cities in two countries UAE and Morocco. Table 2 shows the summary of the smart city applications in both countries.

7.1 United Arab Emirates (UAE)

UAE has two smart cities Dubai and Masder Abu Dhabi. The smart components such as smart health care, smart transportation and smart grid will be discussed as the following. The smart city components or applications in Dubai are:

(1) Smart Transportation: Dubai's Roads and Transport Authority (RTA) develop intelligent transportation systems and smart government mobile applications. It offers 173 services across online and mobile platforms to road users, public transport users, and the business sector [37]. According to RTA, 408 signalized traffic junctions have been linked to a traffic control system equipped with smart sensors. The system calculates the volume of traffic congestion on main roads and highways, detects abnormal traffic patterns and reveals the congestion generated by high traffic volumes [38]. Dubai's RTA also launched a smart parking application. Smart parking helps reduce the waiting time for users and increase the utilization of the available parking slots [37].

(2) Smart Grid: Dubai's Electricity and Water Authority (DEWA) is deploying 200,000 smart meters and smart grid. Smart meters transmit the usage information in real-time to smart grids. A smart grid collects, and acts on real-time information from both energy consumers and suppliers. It allows citizens to monitor and control their electricity and water consumption online or on their mobile devices to reduce the wastage [36]. DEWA has also another project to build a smart grid station that connects smart grids to smart buildings. The data generated from the smart grids help improve energy and water efficiency [39].

(3) Smart public safety & Security: Dubai Police offers safe city solutions for reducing and preventing crime and improving road safety. These solutions use IoT, cloud-based intelligent surveillance, social media technologies, big data analytics, facial recognition and number plate tracking [40]. Dubai Police has introduced smart services, which permit citizens to locate high-traffic locations, report accidents, and issue fine payments, among other things. Moreover, Dubai Police has deployed external closed-circuit television

(CCTV) cameras to monitor commercial locations and mobile cameras on police cars to monitor traffic. Analyzing the generated data from these cameras and also from mobile devices helps improving police efficiency and reducing the amount of time taken to resolve cases or emergency situations [37].

(4) Smart Health: In 2013, Dubai launched a smart healthcare project that uses a network of smart sensors to monitor health information. Dubai Health Authority (DHA) offers automated self-assisted kiosks and self-check booths under its smart health initiatives [40]. DHA was also disbursing more than 3,000 Android tablets across all its health centers. These tablets help patients to browse information and benefit from services such as physiotherapy [41]. Moreover, Dubai Health Authority integrates all public and private healthcare facilities to provide a single electronic file for each resident. DHA provides shared patient data between public and private hospitals to ensure personal safety and quality of life for all individuals [42].

(5) Smart Governance: Dubai has rolled out around 2,000 eServices and offers 50 smart services through mobile applications under its smart governance strategy to increase convenience and remove the need for paper work. The law of open data also allows the use of available government data through various government departmental portals to involve people in strategic initiatives, decision making and policies. The UAE's Telecommunications Regulatory Authority (TRA) offers a secure cloud-based network, called Federal Government Network to interconnect all government departments and use m-Government services and Big Data services [39].

Abu Dhabi Masdar city provides a successful model for smart urban development regionally and globally. In Masdar City, the focus is on renewable energy and smart buildings as well as smart transportation.

(1) Smart Building and Grid
Masder city manages sustainable life for residents through a number of smart technologies and integrated services. The operation of smart buildings involves the integration of buildings and all kinds of smart and sustainable utility and infrastructure services as well as their associated systems across the entire city. Masdar is able to manage and control energy efficiently, and use renewable ones in order to protect the environment. The smart energy management includes low-energy lighting specifications, installing smart appliances, smart meters and smart building management systems. Such efficiency is also used in water-use reduction through proper technologies (like smart water meters) and systems to treat wastewater and recycle it for use in landscaping [43]. Sensors are installed with infrastructure to monitor water and waste around the city, informing decisions about flow, usage and maintenance. This provides analytics built in that use predictive models as one of the key contributions of big data to urban asset management [44].

(2) Smart Transportation
Masdar provides fully integrated transport system. The aim is to provide a complete integration of waking and cycling with public transportation systems within and outside the city to deliver a co-ordinated sustainable transport system. The public transportation systems include Metro, E-taxis, Group Rapid Transit (GRT), Light Rapid Transit, and Personal Rapid Transit (PRT). The generated vehicular traffic depends on the public transportation network and mobility management. Based on Abu Dhabi mobility rates,

the predicted peak hour determines the traffic flows, which estimated to be less in the afternoon and evening compared with the morning [45, 43].

Table 2: The summary of the smart city applications

Country	City	Smart Application	Big Data Analytics	Benefits	Challenges
UAE	Dubai	Smart Transportation	The traffic control system equipped with smart sensors to detect the volume of traffic on roads	Improve the progression of traffic and reduce congestion	Disconnected network can cause accidents
		Smart grid	Analyze big Data collected from smart meters and smart grid environment to allow citizens to control and monitor their electricity & water consumption in real-time	Help improve energy and water efficiency and reduce wastage	Difficult to manage smart grid data and assets
		Smart public safety	Control center analyzes large volume of collected data from surveillance cameras and mobile devices and other devices using cloud and big data solutions	Improving police efficiency and road safety Reducing and preventing crime	Disconnected network can cause lack of safety and security
		Smart Health	Accessing, analyzing and sharing datasets that are collected from different healthcare sources such as sensors and medical & insurance records	Improve clinical decision making and ensure quality of life for all citizens	Unable to access the entire population at the right time and to the right level of care
		Smart Governance	Analyzing large datasets covering healthcare , transportation, education economy, and social care and other data source.	Help Dubai government establish and implement satisfactory policies	Difficult to collect and analyze the huge amount of data
	Masdar	Smart building and grid	Provide analytics built in that use predictive models to urban asset management	Reduce water & energy use Manage water and energy efficiently	It is costly and difficult to manage data and assets
		Smart Transportation	Implement a smart traffic flow using network sensors, traffic lights, and others.	Minimize traffic congestion	Disconnected network can cause accidents
Morocco	Casablanca	Smart Transportion	Big data analytics is used to analysis huge amounts of data such as ticketing data	Provide information on the changes in mobility behavior and alleviate traffic	Disconnected network can cause accidents
		Smart Grid	Using data acquisition/ distribution management system in several control centers	More efficient power, reducing consumption & adapting production to demand	Difficult to manage smart grid data and assets

7.2 Morocco

Casablanca is the largest city in Morocco and also one of the largest financial centers in African. e-Madina for Casablanca smart city puts citizens at the center of the transformation process, creating a public-private-people partnership. e-Madina cluster helps transform Casablanca into a smart city through a pragmatic and realistic approach. Sharing values through partnership and collaboration among the cluster members provide citizen commitment to a better city [46]. Examples of smart components in Casablanca are discussed below.

(1) Smart Transportation

The telecommunication facilities supported public transport through optimization solutions effectively connect the different urban areas and alleviate traffic. CASATRAM is a Casablanca tramway operator CASA that was provided by CASA TRANSPORT, the local public transport authority (PTA). It operates IT Systems such as ticketing and CMMS (computerized maintenance management system). The machines on the stations platforms generate data from operations log book which describes the real position of trams compared to timetables and from validation of smartcards at every station. The ticketing data involves more than 300,000 lines daily and more than 100 million lines per year in Casablanca databases. Big data analytics is used to analysis these huge amounts of data to provide information on the changes in mobility behavior caused by disturbed operation conditions, special events and rain or overly hot weather [47].

(2) Smart Grid

The Morocco has taken several initiatives toward electrical smart grid. The Electrical energy in Morocco is generated, transmitted and distributed by the National Office of Electricity and Water (ONEE). The ONEE has adopted, a new modern and efficient national distribution control center called “Dispatching”. This new system is also located in Casablanca city. In 2014, the ONEE continued the establishment of 230 smart meters and prepaid post in Casablanca, this operation was initiated on July 2012. The government effort focus on automation distribution using supervisory control and data acquisition or distribution management system in various control centers to improve the dispatch and the installation of advanced metering infrastructure for greatest users to manage demand response [48].

8. Conclusion and Future Work

Big data in smart cities is one of the hot topics because integrating big data analytics in smart city applications improves quality of life, manages resources and reaches sustainability. The aim of this paper is to offer a detailed discussion about big data and its applications in a smart city. In this context, I identified big data and smart city concepts and the challenges and benefits of applying big data in smart cities. The smart city platforms and framework with comparison were also proposed, and the applications of big data for smart cities in Arab Countries. The two case studies are UAE and Morocco. The smart applications in these countries such as healthcare, transportation and governance gain a lot of benefit from applying big data analytics. The future research work will focus on performance criteria and standards to measure the quality of services provided by smart city applications.

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