

# Collaborative Business Intelligence: A Case Study of the Dubai Smart City Strategy

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**Abstract:** This study investigates the concept of Collaborative Business Intelligence in general and specifically in three Dubai governmental entities, which are a part of Dubai Open Data Committee: namely Smart Dubai, Dubai Municipality and RTA, in an attempt to improve collaborative Business Intelligence between the three entities through a Smart City Project. A qualitative approach was used to collect data. Secondary data derived from academic articles, scholarly literature formulate the literature review and understand the concepts of business intelligence, collaborative business intelligence in general and how such business intelligence works at the three entities in specific. In addition, primary data was derived from interviews conducted with three senior employees from the top management of Smart Dubai, Dubai Municipality and RTA to help further gain in-depth understanding on how the three entities are collaborating with one another in Smart City Project. The results of the study have revealed that all three entities; Smart Dubai – Dubai Data Establishment, Dubai Municipality, and RTA are adopting business intelligence and collaborative BI. In addition, it is evident that the three entities are sharing data through Dubai Pulse for Smart City Projects. As well, the most used systems and software for analyzing and sharing data among all government entities to support decision-making process. The massive volume of data collected from different source required a huge investment in technology, process and people. In addition, because smart city project is still a new project under implementation and reconstruction, the project has reported few challenges with the implementation of BI, collaboration, and integration within the Municipality, RTA, and Smart Dubai, the key challenge is problem is with raising awareness among personnel and individuals working within in these three entities areas to embrace smart services, typical of collaborative business intelligence. As well as privacy and data security in which Dubai Data Establishment has adopted many strategies and policies to improve. Moreover, Limited research on best practice of BI and collaborative BI in UAE based organizations make it difficult to confirm if the organizations achieve the successful implementation of the collaborative BI and that make this assumption an area for further study.

**Keywords:** Collaborative Business Intelligence, Data-driven decision making, Smart City Project, Smart Dubai.

## I. INTRODUCTION

Recently, a new type of business intelligence has begun to grow: namely ‘collaborative business intelligence’, as it is the combination of several collaboration tools such as 2.0 technologies and social media. With these tools, sharing information and data has become easier than ever. Recent trends propose that many data is being created everyday

which offers opportunities for society, organizations and communities to become more connected and smarter (Khan et al., 2017). Cities around the world are putting in further efforts to move towards transforming into smart cities. In line with this trend, both private and public sector organizations are becoming more aware about the value of data and collaborative business intelligence in transforming to a organizations to become smart organization at the smaller level, and to a seamless, safe, and smart city at the bigger level. Moreover, while Dubai has accomplished evident technological advancements, the city had previously experienced various challenges that have hindered the speed on delayed its smart city initiative. As a result, the city has produced enormous amounts of unstructured data (Khan et al., 2017). In 2014, Open Data Committee (ODC) was formed to boost data integration between government entities and looked at how to make data available yet maintain data security in line with local government vision by transforming Dubai into a smart City (Emirates24/7, 2014). The ODC consists of eight organizations: Dubai Smart Government Department, Dubai Police, Road and Transport Authority (RTA), Department of Tourism and Commence Marketing, Dubai Municipality, Dubai Centre for E-Security, Department of Economic Development, and Telecommunications Regulatory Authority. This committee was later decommissioned and replaced with Dubai Data Establishment in 2015. Hence, the purpose of this study is to investigate and to make suggestions on how to improve the collaborative business intelligence concept between Dubai government entities through the Smart City Project. The entities are from ODC are Smart Dubai, Dubai Municipality, and RTA.

### A. RESEARCH OBJECTIVES

1. To investigate the Collaborative Business Intelligence concept across three local government entities
2. To identify the usage of Collaborative across three local government entities
3. To identify the roles and collaboration fields between the three local government entities
4. To identify the key challenges that face the three local government entities in the data collaboration field.
5. To make suggestions to develop better data collaboration between the smart governments in the city of Dubai

### B. RESEARCH QUESTIONS

1. To what extent does Dubai government (bearing in mind the three local government entities Smart Dubai, RTA and Dubai Municipality) use Collaborative Business Intelligence?

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2. How effectively does Dubai government (bearing in mind the three local government entities Smart Dubai, RTA and Dubai Municipality) collaborate with one another to work on the Smart City Project?
3. What are the key challenges and limitations faced by the Dubai government (bearing in mind the three local government entities Smart Dubai, RTA and Dubai Municipality) in effectively unitizing data collaboration?

### C. HYPOTHESIS

1. Centralized Collaborative Business Intelligence is a must in Dubai Smart city strategy
2. Leveraging Collaborative Business Intelligence in Dubai Smart city strategy will leverage its effectiveness

## II. LITERATURE REVIEW

### A. Business Intelligence (BI)

Business intelligence specifically aims at improving timeliness and quality of inputs directed into the decision-making process (Foley, & Guillemette, 2010). As well, this is an approach to understanding the organization's available capability including trends, state of the art, future market directions, regulatory environment, as well as technologies (Foley, & Guillemette, 2010). Furthermore, it is a fast-hand tool for understanding competitor's actions and what such actions imply to the business. Therefore, business intelligence entails the tools, processes, and technologies necessary for turning data into information, which is then turned into knowledge as the knowledge is once again turned into plans for driving the business (Nerkar, 2016). It implies the integrated operational and decision-support processes along with databases to present business communities with inherently easy accessibility to business data (Nerkar, 2016). From these definitions, a comprehensive understanding of business intelligence is the ability that a business or organization has in reasoning, planning, predicting, comprehending, solving problems, engaging in abstract thinking, learning and innovating in ways that lead to increment in organizational knowledge, allowing effective actions, informing decision processes as well as helping with the establishment and achievement of business goals (Nerkar, 2016; Foley, & Guillemette, 2010).

### B. Collaborative Business Intelligence

Collaborative business, as a term which is considerably new within the business management, especially business intelligence as it concerns the collaboration of intelligence with technologies to support new notwithstanding improved decision-making environment (Berthold et al., 2010). For collaborative BI, the focus is on merging business intelligence software to work in harmony with collaboration tools like web 2.0 and social technologies for supporting improved data-dependent and driven decision-making processes (Dayal et al., 2010). Collaborative BI plays an integral role in enterprise-wide analytics and reporting to make the process of sharing much easier besides enabling efficiency in decision-making within teams (Tongzhu et al., 2017). Collaborative business intelligence deviates from the traditional approach to business intelligence as it relies on warehousing approaches for physically materializing integrated data, virtual integration, and peer-to-peer approaches (Rizzi, 2011). This approach creates and develops a platform for sharing business information to

enhance and foster the effectiveness of decision-making processes. Collaborative BI has its unique features including scalability, decentralization, and full peer autonomy (Rizzi, 2011).

### C. BI and Collaborative Business Intelligence in Smart Dubai, RTA, and Dubai Municipality

Limited research exists on how BI and Collaborative BI have been used by Smart Dubai, RTA, and Dubai Municipality. Moreover, collaborative BI exists in Smart Dubai through services inter-connecting all the government departments and Municipal entities. The Smart City project was launched under the Blockchain Strategy, a system that ensures to share information efficiently, safely, seamlessly and provides impactful experiences within the city (Smart Dubai, 2019). The Blockchain system is heralded as a safe, simple and secure tool, which is changing Internet technology. This ensures that Dubai Municipality is connected with Smart Dubai to provide seamless and smooth services in education, healthcare, and other municipal functions like vehicular traffic (RTA), environment along with other related areas. The Blockchain System supports the strategic focus on smart governance, a strategy, or approach that ensures that the government is providing more public services to all citizens through improved efficiency. On the other hand, the strategy or plan has been to ensure the integration of all databases, both private and public and informed or guided by the basic principles of cooperation, integration, and communication (Barakat, 2014).

### D. Roles of Smart Dubai, Dubai Municipality and RTA in the Smart City Project

#### 1) The Role of Smart Dubai

The role of Smart Dubai is to act as the digital technology arm of the project for monitoring and carrying out how digital services are executed along with the implementation of smart infrastructure (Smart City, 2017). Smart Dubai was established with the consideration that modern cities require increased efficiency in their existing, new infrastructure in addition to services. Therefore, it plays a role in integrating infrastructure management and all the involved operations. Smart city helps in capturing data. This follows the role of smart cities in capturing data from different avenues like the sensors placed along the road for collecting information regarding road conditions and traffic conditions or even the smart meters fitted in offices and houses to dynamically track electricity consumption (Fourtane, 2018). Smart Dubai facilitates the digital transformation of the city of Dubai through providing and facilitating the usage of technology with all partners in the government of Dubai. We don't "install devices..." Smart Dubai's role in managing infrastructure stems from the installation of devices across the city and consolidating data need for streamlining infrastructure management. In addition, this is done through improved communication because for the smart infrastructure and devices, there is the inherent need for communicating between control centers and services.

Hence, Smart Dubai provides the communication layer for facilitation and connection of various devices while maintaining integrity, interpretability, privacy, and scalability. Smart Dubai provides an integrated communication for connecting the service providers, communication infrastructure providers, Dubai Municipality, and IT vendors (KPMG, 2015). Since Smart Dubai consolidates and communicates data, the information is used in making decisions about regulations and standards of using smart data (Fourtane, 2018). For instance, this can be made on the basis of using the traffic database to manage the city's traffic in liaison with the RTA. Smart Dubai also provides and has in place a set of shared international reference architecture and standards for safeguarding the integrity of devices connected to the smart system, improving communication, as well as providing a better understanding between corporations and people involved in managing Smart Dubai (KPMG, 2015). Smart Dubai's role is also for providing regulations for safeguarding the privacy and security of data among the residents. Specifically, it provides regulations on privacy governance policies for clearly laying out how data should be collected and stored, those authorized to view the data and the specific data with the rights as well as protection afforded to all involved in the smart city project (KPMG, 2015). Smart Dubai, therefore, provides the infrastructure for making regulations to Telecom providers on making certain that they have sound security policies notwithstanding risk management framework, security controls, risk assessment, and vulnerability management incentives for managing security and privacy (KPMG, 2015).

## 2) The Role of RTA

RTA, on the other hand, plays a significant role in providing and ensuring advanced transportation, included driverless Dubai Metro; taxis fitted with Wi-Fi and automated Salik tolls (Smart City, 2017). This is to aid with proper traffic management as well as ensuring personalized services in smart parking. The Roads and Transport Authority (RTA) reported an increase of 8.2% in the number of vehicles in the country between 2006 and 2014 (KPMG, 2015). This is considered the highest increment in worldwide hence the focus on smart transportation alternatives for dealing with the ever-increasing demands of the country's transportation infrastructure. RTA has been coming up with various incentives for developing intelligent transport systems. All these are intended for the enhancement of transport network including the relevant services for delivering integrated transportation for the residents. The role of the body is for integrating various transport modes as considered crucial in ensuring seamless transportation to enjoy smart driving. The body does so by ensuring multi-agency, multi-modal integrated command and a control center for the smart city. RTA has ensured a smooth transition of services to smart apps using the help of around 9 apps to deliver around 173 services to the residents (KPMG, 2015). RTA is also using the latest technologies to provide autonomous cars. Therefore, RTA has the role of infrastructure development and the introduction of practices for automating ground transportation along with the provision of an efficient and integrated public transport system.

## 3) The Role of Dubai Municipality

Dubai Municipality also monitors the implementation of the project but focuses on the budget of government agencies along with the necessary policies for ensuring smooth smart transition or transformation or inherently supporting strategies necessary for easing up the process (Smart City, 2017). The Municipality has a key role in planning for resource use and how smart city goals and objectives are to be implemented. For instance, the Green Building Council (GBC) enlisted UAE 9<sup>th</sup> in terms of LEED standard use and energy efficient buildings (KPMG, 2015). In 2010, Dubai Municipality had in place various codes for energy saving systems, green building materials, and natural lighting systems. For example, Dubai Municipality has the Integrated Energy Strategy aimed at reducing water and energy demands by approximately 30% in 2030 (KPMG, 2015).

## Key Challenges

The Smart City Strategy, under which is the Smart City project is still a new project under implementation and reconstruction. Although the project has reported few challenges with the implementation of BI, collaboration, and integration within the Municipality, RTA, and Smart Dubai, the problem is with raising awareness among personnel and individuals working in these three areas to embrace smart services, typical of collaborative business intelligence (KPMG, 2015). Therefore, user adoption is a concern in adopting BI and collaborative BI smart city projects like Dubai. Using business intelligence to consolidate data and information also brings about the challenges with proper management of resources. Efficiency in distributing resources is hindered by the complex system of sharing information between the public sector and Smart Dubai, which is a characteristic of collaborative business intelligence. Furthermore, the collaboration among the three entities or systems requires data integrity but security and privacy issues are still under development in Smart Dubai as a new project (KPMG, 2015). It is challenging task ensuring and safeguarding the integrity of data across the different entities by providing, current, clean, and consistent data from the different entity systems. The challenges with data privacy issues have led to the introduction of ethical guidelines based on principles for safeguarding privacy and integrity of data by the Dubai Data Establishment in 2015. The Smart Dubai's ethical guidelines focus on the principles of transparency, accountability, fairness, and honesty (Smart Dubai, 2019). For example, accountability within the system involves the establishment of accountability measures necessary for risk mitigation along with contingency plans for risk response. To address these challenges, on 20 December 2014, a cross-governmental committee was formed under the name of "Open Data Committee" (ODC). It was tasked with "striking the balance" between making data openly available and maintaining privacy and security of city's data. The committee's mandate was not limited to government, but also to developing the regulatory infrastructure for making data readily available for all stakeholders of the city and to foster practices of data sharing.



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More specifically, the committee was to define the scope of open data, set the classification measures and develop mechanisms for cross-city data sharing.

## III. RESEARCH METHODOLOGY

The purpose of this study is to investigate and help to improve collaborative business intelligence concept between the three Dubai government entities through the Smart City Project, those entities being Smart Dubai, Dubai Municipality, and Road and Transport Authority (RTA). To conduct this research, qualitative approach was used and both secondary and primary data were involved. Secondary data was mainly used to conduct the literature review in which various resources were utilized such as academic articles and scholarly literature, in order to understand business intelligence and collaborative business intelligence concepts in general and at the three entities in specific. This was helpful in understanding how collaborative business intelligence is used at each entity and what is their role in the Smart City project. Furthermore, to gain in-depth understanding, the three entities were approached in order to attain an approval to conduct interviews with the concerned employees in regards to the research topic. The interview questions were 15 in total covering three aspects of the research topic, which are business intelligence, collaborative business intelligence, and the collaboration between Smart Dubai, RTA, and Dubai Municipality in Smart City Project. Moreover, the questions were derived in relation to the literature review and the research objectives that this study is aiming to achieve. Although the aim is to conduct face-to-face interviews to attain as much information as possible, yet, the interviewees preferred to share the interview questions via e-mail due to time restraints, workload, and the internal procedures to attain approval, which are also time-consuming processes. The interviewees were senior officers at all three local government entities..

## IV. DATA ANALYSIS

According to the interviews that have been conducted with the three Dubai government entity representatives a number of key findings. Salem Al Bedwawi, Smart Transformation Section Manger at Dubai Municipality (DM) has stated that DM has a defined business intelligence strategy that focuses on using ARIS and Key Performance Indicators (KPIs) strategies in all levels. In addition, DM uses Open Text as a tool to measure and report performance management strategy. On the other hand, Hamda Bin Demaitan, Head of Strategy & Policy at Dubai Data Establishment has reported that within Dubai Data Establishment they have a Data Science Unit with a plan on exploiting the city's data. However, Dubai Data Establishment is currently working with IBM (a computer hardware company) to create and develop a data science lab that aims to identify use cases where value can be created. On the same, Abdulrahman Al Janahi, Director of the Smart Services Department at RTA has mentioned that the authority has a well-defined digital strategy that describes data management and BI initiatives. As for the entities purpose for adopting BI tools, Dubai Municipality, as stated above, is using software such as ARIS and another tool called Tableau. ARIS is a tool for process

modeling and linking the process from strategy, objectives and KPIs, and implementing Tableau as a tool for dashboards and BI integrated to different systems. While Dubai Data Establishment is using BI for various purposes like operating, reporting, analyzing, and optimization by using warehousing, Data Analytics and Visualization software, Abdulrahman from RTA has spoken about 'Microstrategy Software' which is used for daily reporting to support decision makers, generate alerting reports for information security, share dashboards to optimize the operation for taxi, metro and different modes of transport.

Both DM and Dubai Data Establishment have agreed that the main advantages of using BI system are tracking progress, measuring KPIs, and improving operations. Al Bedwawi has added that BI has an effect in the project performance. He said that business intelligence tool is very advance methods to analysis data, visualizing data and reporting including KPIs. It helps DM to combine set of data for deep analysis and creating critical reports for decision making. Similarly at RTA, the advantages of BI system were generating insights that support in planning, understanding customer needs, improving operations, increasing customers' satisfaction, and optimizing operations. As for the limitations of using BI, Al Bedwawi believes that there are no limitations of BI, however, he added that the data should be well structured in a way that BI can dose deep mining and analysis and must be integrated internally and externally while having a big data sets repository where data is associated, rationalize with structured relationships. On the other hand, Hamda Bin Demaitan from Dubai Data Establishment has summarized the limitations as being hardware performance limitation, technology dependent, customization, conflicting policies, and issues with data availability. Abdulrahman from RTA has listed some BI limitations, as BI is costly in terms of money and time to integrate, merge, prepare and clean data, as well as building dashboards and analytics require specialized skillsets. Also, BI requires analyzing complex and large datasets and analyzing huge datasets, which requires large infrastructure with high processing capabilities. Lastly, unstructured data; BI is mainly performed on historical data residing in the data warehouse as BI tool cannot directly analyze unstructured Data. Coming to the wider use of BI in the organization and if it is limited to a specific department or not, at DM, BI is used for DM business units in connection to other governmental entities like Dubai Smart Government and Dubai Data Establishment, which is providing BI tool as a shared service where it provides almost all of Dubai government entities programs and projects that facilitates sharing data among them and also having such initiatives for open data to the public. In Dubai Data Establishment and RTA, BI is widely used in many departments but in RTA it is govern within one department that is overseeing all BI implementations. In terms of collaborative business intelligence adoption, DM has data collaboration with RTA, DEWA, Dubai Custom, DP World, Dubai Police, DHA, Civil Defense, DED and Dubai Land.

As well, Dubai Data Establishment has achieved considerable success in engaging data providers; a total of 31 data providers from government including DM and RTA, semi-government, and private organizations. Similarly, RTA is collaborating, sharing insights and data with more than 10 government entities like Dubai Statistics Center and DM.

As for the collaboration systems used between Dubai government entities, DM shares data by Dubai Data Establishment through a shared platform called Dubai Pulse that is managed by DSO and Du. Hamda Bin Demaitan has elaborated, Dubai Pulse is a centralized platform consisting of an infrastructure, data, and applications layer. Dubai Data Establishment has worked with many government entities to identify all their data assets and created a repository of the city data. Both open and shared data is ingested on the platform and then shared with public users as open data or government users who have to log-in for shared data. RTA, instead, has a centralized data warehouse that gather data from many internal systems and these data are analyzed and presented as dashboards and reports on MicroStrategy with different stakeholders. Returning to the role of Smart Dubai through the Dubai Data Establishment, DM and RTA in Smart City Project, Firstly DM is involved in many projects within smart city road maps, one-one initiatives and projects with other government and semi-government entities. As an example, DM has a big project with Dubai Custom, Dubai Trade and DP World to facilities the exports and imports of materials and products for Expo 2020, by the guidance of Dubai Smart City and City Maker Program. Moving to the core of the Smart City Project that is Dubai Data Establishment, it has given the mandate of governing the publication and exchange of data in the city. Dubai Data Establishment is the backbone of smart transformation in the city, and its flow creates opportunities for all parties involved. Currently the establishment is working with more than 50 government entities to ensure that the publishing of open data for public use, and the ability to exchange their shared data to allow a seamless, paperless city experience. In addition, it monitors government entities compliance to Dubai Data policies and standards to ensure that the establishment is balancing data publication and use while safeguarding rights of data subjects. As for RTA, it is playing a major role in smart city project and with a great focus on advanced mobility such as driverless Metro, automated Salik toll gates, smart parking, automated fares collection system and working toward driverless transport. Talking about the system used to collaborate among the three entities in Smart City Project, DM has collaborated with RTA through Smart Dubai Programs and Smart City Strategy road map or City Maker Program. As well, there is a constant engagement between DM, Dubai Data Establishment and RTA through using a shared platform mainly Dubai Pulse and GSP (Government Service Bus) and in some times point-to-point systems integrations. Dubai Pulse is said to be the common system of the three entities that demonstrates the value of combining data from different sources to solve city problems like crowd management. RTA as well, uses Dubai Pulse to share data with the public and other organizations specifically DM and DD. In addition, RTA has collaborated in many projects with DM and Smart Dubai such as Carbon Footprint, Smart Parking, and Green City. Furthermore, the

interviewees made few suggestions to boost BI at their organizations, Al Bedwawi has suggested that BI should to be implemented in cross function data sets internally and externally to gather and analyze more data and outputs, which would be of more value for decision-making and strategy planning. In addition, Hamda Bin Demaitan has also recommenced adding BI Alerts and Subscriptions features to improve the system at Dubai Data Establishment, while RTA is currently working on creating additional features that aim to integrate additional data from social media to get better insight into RTA services. Regarding the barriers or limitations that face the three entities in data collaboration regarding Smart City Project and the entities developments plan to overcome them , DM noted that they should be to viewed as challenges rather than barriers as its challenging and beneficial at the same time as its challenging when all government entities are asked to share their data of value for business cases to be used in order to get the real the value of all the data collection and bring it in real-time and address the final outcomes and benefits for improving quality of life and City Happiness Index. At the Dubai Data Establishment, privacy and security concerns are the most pertinent of challenges. It has standardized data classification in Dubai Government so it has a common criterion in classifying data and a common language around data access rights. To overcome these concerns, Dubai Data Establishment has issued policies that address protection of data privacy and intellectual property rights. These policies contain provisions governing opening and sharing government data. In addition, it has also worked closely with the Dubai Electronic Security Centre to ensure that all security consideration have been considered when data is exchanged, and within the platform of Dubai Pulse. Whereas RTA believe that it is expected for large organizations to face some challenges while working with large volumes of data that is generated from multiple sources, and the best way to overcome such challenges is to invest in Technology, Process, and People. Data is what wires a smart city and fuels its machinery. One key element that defines a “smart city” is its technical and organizational capacity to generate, consume and analyze data for timely and efficient planning and decision-making. Governance in a smart city entails applying “data-driven innovation”; or advanced analytics to enable innovation towards growth and wellbeing (OECD, 2013).Regarding data privacy issues that have led to the introduction of ethical guidelines based on principles for safeguarding privacy and integrity of data, Al Bedwawi sought that this is subjective to Dubai Data Law where all type of guidelines, policies and instructions are defined and well structured. In addition, Smart Government, Dubai Electronic Security Center (DESC), and TRA have established strong systems and policies to create safe and secure data environments across all sectors locally and at federal level. Furthermore, Hamda Bin Demaitan explains that all government entities classify data as either open or shared. If they are classified as shared, they have to further classify it as confidential, sensitive or secret.

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Therefore, access to data is determined based on its classification. In addition, Dubai Data Establishment has issued standards to unify how data is managed in the city. These standards help entities in identifying their data, setting up data teams within their organizations, describing and cataloguing it, classifying it, ingesting it on the platform and then publishing it as open or shared data. As for RTA, it has considered data privacy and information security as a top priority and to overcome this challenge, it has incorporated advanced security models and all regulations have been implemented. In addition, employees in RTA are well aware and trained to adhere to the compliance standards, as well as the data classified access are restricted and monitored. Despite the levels of technological advancement in the UAE, as evident in international indicators, the country was lacking the infrastructure and frameworks that govern government data. For example, the UAE ranked 52nd among 86 countries on the Open Data Barometer which measures steps taken by governments to make their data open for better governance and development (Davies, 2015). Clearly, there are numerous barriers to streamlining the use of government data across government and society. For example, in a study conducted across the UAE Federal government, the challenges to making government data available were found to be linked to technological barriers, lacking regulations, human capacity and limited understanding of economic feasibility by government entities. These challenges are shared in Dubai.

### V. DISCUSSIONS

Based on the literature review and the results derived from the interviews, it is noted that business intelligence is a valuable technology for entities that are aiming to acquire accurate outcomes and an opportunity to gain best practices especially in current world development. All interviewed entities have demonstrated the openness and the competitiveness to adopt better systems and software. The literature review done by Foley and Guillemette (2010) is aligned with Dubai Data Establishment, DM, and RTA insights regarding BI importance where it has been of help in tracking progress, model and linking the process from strategy, objectives and KPIs in addition to improving daily reporting that helps in better decision-making. Also, DM has explained that BI has helped in combining set of data for analysis and in return creating critical reports to develop performance measurements for the organization vision and achievements which demonstrates the literature conducted by Nerkar, (2016), listing the advantages of BI which are turning data into information and plans for driving the business, organizational knowledge, allowing effective actions, informing decision processes, helping with the establishment and achievement of business goals. The three government entities that have been the focus of this study were the ideal examples of collaborative BI. Referring to the literature conducted by Tongzhu et al., (2017), collaborative BI makes the process of sharing much easier along with enabling efficiency in decision-making within teams and entities. The three entities are sharing data among each other using Dubai Pulse and Microstrategy software. Hence, these sharing platforms are enhancing and fostering the effectiveness of decision-making processes. Collaborative BI has its unique features including scalability, decentralization,

and full peer autonomy (Rizzi, 2011). Unfortunately, there is little literature that has looked at how entities in general and specifically government entities in the UAE are adapting and collaborating with one another using BI and collaborative BI. However, in this research the engine that connect all entities together is Data Dubai Establishment; an establishment under the umbrella of Smart Dubai. The results have shown that establishment has worked in the past not only with DM and RTA, but also with multiple entities as well to use cases that demonstrate the value of combining data from different sources to solve city problems such as crowd management. Smart Dubai (Dubai Data Establishment) is the backbone of smart transformation in the city and supported by an article at Fourtane (2018) in which Smart Dubai is viewed as Dubai AI as it is being integrated into all city experiences and government services. As this study is focusing on the three entities adaptation of collaborative BI among one another and their role in Smart City Project, all of the initiatives that have been lurching between time to time for Smart City Project from DM and RTA are done through Smart Dubai – Dubai Data Establishment which is the digital technology arm of the project for carrying out digital services and monitoring how they are executed and the implemented on smart infrastructure (Smart City, 2017). It is necessary to mention that with the aid of Smart Dubai –Dubai Data Establishment, DM has done many successful projects and the most recent one is a big project with Dubai Custom, Dubai Trade and DP World. Similar for RTA which has lunched initiatives with aid of Dubai Data as well as DM such as driverless Metro, automated Salik tollgates, smart parking, automated fares collection system and working toward driverless transport (Smart City, 2017).

### VI. RECOMMENDATIONS

This study recommends that further research is required to explain how public and private sector organizations in the UAE are adopting collaborative business intelligence and how they are collaborating with one another in general and in common projects as well. In addition, it would be great to have further research that compare and contrast collaborative business intelligence usage in United Arab Emirates in comparison to international organizations around the world. Furthermore, due to the popularity of smart cities, it is recommendable for all other Emirates in the United Arab Emirates to learn from some of the good practices taking place in Dubai and take the first step towards transforming into a smart city. As well, to encourage the adaptation of collaborative BI throughout all public and private sectors in UAE-based organizations at the macro level and within the organization itself at the micro level. In addition, it is important to note that because Smart Dubai - Dubai Data Establishment is given the mandate of governing the publication and exchange of data in the city, yet it was noticed that the three entities were only sharing data through Dubai Pulse rather than actually collaborating and coordinating with one another in the collaboration of data and information.





Therefore, a further recommendation is to strength the role of Smart Dubai in providing an integrated plan to be followed by all entities and to formulate a committee in which a representative from each entity can be involved in the regular meetings to gauge the collaboration of data and constantly be up-to-date in regards to the generation and sharing of data. Further research is also recommended to involve more organizations from both the public and private sector such as Dubai Police as it is concerned with the security and safety of the city, Department of Tourism and Commence Marketing concerning the marketing of Dubai as a smart city for tourism, Dubai Centre for E-Security, Department of Economic Development, Telecommunications Regulatory Authority, Etisalat, and Du. All of these entities play an important role in transforming Dubai into a smart city. Moreover, despite the visible and tangible efforts from the various entities to establish strong systems and policies to create safe and secure data, it was evident that all three entities had concerns about data privacy and security. Therefore, more restricted policies and actions would need to be implemented to ensure data safety alongside new strategies and software that would be applied and evaluated to ensure data security.

## VII. RESEARCH SIGNIFICANCE AND LIMITATIONS

Collaborative Business Intelligence is considered as one of the hot topics that are currently gaining strong attention across the world. The findings of this research will help other organizations to determine their maturity level regarding BI adoption and measure their readiness in moving toward Collaborative BI. Addressing the challenges that were faced during collaborative BI implementation among different organizations have an impact on saving a country's resources through streamlining the efforts to find better ways of handling data and accelerate the wheel towards building powerful collaborative BI system. (Mayer-Schönberger and Cukier, 2013, OECD, 2015b, ITU, 2015, Turner et al., 2014, Regalado, 2014). Moreover, identifying the strengths, challenges and limitations of implementing collaborative BI in smart city project will also help other organizations to successfully handle collaborative BI and draw a road map for their journey in the transformation to smart organizations. On another note, only three governmental entities have been included in this study as being part of ODC and due to the key roles that they played in smart city project and their advance level in the implementation BI and collaborative BI. Moreover, when writing up the study, few limitations were noted, mainly being time restraints and challenges to gathering the required information. For example, it was difficult to reach out to the entities and conduct meetings with the professionals in the field due to their busy schedules and time restraints, which has influenced their ability to be entirely cooperative and transparent in sharing all the required information. In addition, limited studies in the region were found that looked at the best practices of collaborative BI.

## VIII. CONCLUSION

Nowadays, an organization's success is determined on its ability to use all available information and knowledge efficiently and effectively. Moreover, increasing information volume and best use of knowledge has become the new source of an organization's power that will support the transformation toward smart cities. Consequently, adoption and implementation of business intelligence and collaborative business intelligence seems as the driven force in this trend.

The aim of this study has been to offer a closer look to business intelligence and collaborative business intelligence implementing in three key Dubai Government entities in order to improve collaborative business intelligence concept under the umbrella of Smart City Project. The main conclusion of this study is that the assessment of collaborative business intelligence in the three entities in which we would like to describe as "intermediate". Nevertheless, keeping in mind that the smart city project is still a new project under implementation and reconstruction, yet, rapidly and effective efforts have been seen from the three entities in terms of data-collaboration in comparison to other smart cities around the world. Moreover, BI has many advantages in the three entities such as tracking progress, measuring KPIs and improving operations, which advocates that BI makes information easy to access, use and lead to intelligent business decisions. In addition, collaborative BI makes data sharing more efficient and easier among different entities. However, interviewees argued that sharing data are not an easy task. The massive volume of data collected from different source required a huge investment in technology, process and people. In addition, because smart city project is still a new project under implementation and reconstruction, the project has reported few challenges with the implementation of BI, collaboration, and integration within the Municipality, RTA, and Smart Dubai, the key challenge is with raising awareness among personnel and individuals working within these three entities to embrace smart services, typical of collaborative business intelligence. As well as privacy and data security in which Dubai Data Establishment has adopted many strategies and policies to improve. Moreover, Limited research on best practice of BI and collaborative BI in UAE based organizations make it difficult to confirm if the organizations achieve the successful implementation of the collaborative BI and that make this assumption an area for further study.

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