City of Tshwane Business Intelligence Framework
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EXECUTIVE SUMMARY

The purpose of the Business Intelligence Framework is to outline the guiding principles and key structural elements for implementing Business Intelligence (BI) in the City of Tshwane, by developing an understanding of the types of data generated by the City, the frequency of data collection, its quality and reliability, its current use and the potential for its future use. The value of the BI project lies in its ability to identify the data collected by the City and the value of the data generated through transforming it into intelligence for the City.

The Framework will assist the City to institutionalise the mechanisms for the development and implementation of the necessary elements to realize City-wide Business Intelligence. The document also elaborates on the processes and possible reporting structure of a BI unit in the City. The creation and location of a BI unit should allow the unit to leverage off of the City’s IT infrastructure and strength, but also be afforded enough autonomy to effectively engage with businesses to create a business driven system as this is key to any BI system’s success. This project is a long term goal for the city and thus the mandated unit must be able to lead the development and be able to make and implement key decisions.

Data governance and data quality are key elements to any BI system as it assist in determining the parameters or variables, as well as the quality parameters to ensure that accurate and useful data is captured, transformed and that the resulting information is distributed to the appropriate ‘line of business’ or department in the City to enable evidence-based decision making. However, this should take place within a secured environment, as the City is the custodian of confidential information and this information should be protected whilst ensuring ease of access is enhanced as well. Therefore, it is clear that maintaining a balance is critical and should be carefully considered to ensure that such a system functions effectively whilst not placing the City at risk.

This document provides a framework that will form the basis of the Business Intelligence project in the City.
1 INTRODUCTION

The City of Tshwane, through its current systems, is aware of the value of retaining information securely, as is reflected in its ICT Security policy (2013). The City has gone to great lengths to ensure good user practices in the storage of data to ensure its integrity. According to Solove (2004), data collection and retention in databases by government started in the late 1800s and only intensified with the arrival of computerised information systems, and now in the digital age governments thrive on data collection and retention as it enables them to conduct their work more effectively.

With the dawn of the computer age, data generation and data use has grown exponentially. With the dawn of the technology age, data has become more valuable to organisations as it enables them – through the use of business intelligence – to generate information and turn it into profit (Ritacco et al., 2007). The statement by Ritacco et al. is appropriate in a local government context and can be phrased as follows: “...through business intelligence use information and turn it into service delivery and community welfare”.

According to Ritacco et al. (2007:6) Business Intelligence “…refers to the use of technology to collect and effectively use information to improve business effectiveness." The need for business intelligence has become more and more important as businesses enter the digital age and rely on enterprise systems, because very rarely is collected data converted into information.

Ritacco et al. (2007) indicate that business intelligence has tangible benefits for organisations by lowering costs, improving revenue generation, enabling the development of effective strategies and improving customer satisfaction.

2 BACKGROUND

The City of Tshwane as local government, face many operational challenges with strict budget and performance goals and reporting requirements, as well as diverse and demanding constituencies. Therefore, government agencies need information management solutions that allow them to make better (data-driven) decisions, keep tight tabs on their operation, and control information security.
Figure 2-1: Top pressure-points driving BI investment in public sector

![Diagram showing top pressure-points driving BI investment in public sector](image)

Source: Aberdeen Group, 2010

Figure 2-1 demonstrates that the public sector is largely challenged by lack of visibility into their key operating processes. Public sector organizations need to be innovative and do away with use of spreadsheets as primary analytical solutions. Spreadsheets have undeniable value as a general business tool, but organizations are increasingly looking for ways to discard statistical tools and methodologies in favour of customizable solutions that will grant tactical and strategic business visibility to users across the organization, regardless of technical ability.

Governments across the globe need to leverage off their large volumes of data and use this data to benefit the City by “riding the open data wave”. Berners-Lee (2014) has asserted that: “Data is a precious thing and will last longer than the systems themselves.” The role that data plays in our modern society is significant and easy access to data has become a lucrative and sought after service. McKinsey & Co. (2013) asserts that open data can assist in generating between $3.2 trillion and $5.4 trillion per annum when only taking “seven domains” within the U.S. into account, which include transport, healthcare, education and others. Indeed, this should be the next step to rigorously investigate, once the much required progress with respect to data collection for development has been made.

The City of Tshwane, as a key sphere of government where service delivery takes place, has vast amounts of data that is valuable and can be utilised to the benefit of the development of the City, not only by the City but also by other institutions. According to the showcase of fundraising innovation and inspiration (Longfield, 2011), data is priceless if it is

---

1 Own emphasis
utilised correctly, otherwise it is pointless to collect data. Current processes for obtaining internal data within the City are exceptionally laborious from a human capital perspective due to the fragmentation and disjointedness of current storage methods, often resulting in incorrect data provided, ultimately exerting an adverse impact upon future planning from a service delivery perspective. The benefits include enhancing productivity through digitizing the manner in which data is captured and shared across the City to ensure more meaningful reporting and analysis.

In addition, the lack of comparable city-level data results in disjointed urban research agendas and limits the ability of knowledge sharing amongst city economies. This will also enable better research into the selection and impact of large-scale infrastructure projects, amongst other elements. Aligned to the issues highlighted by the World Bank’s “Data for Goals Initiative”, it will also be critical to ascertain the types and reliability of data collected at local government levels and attempt to standardise these measures – this is critical in taking the city-agenda forward.

It is envisioned that in the future, cities will be able to leverage the open data wave. This should potentially result in advancing the economic interests of many city economies, by making the plethora of data collected available to external parties, albeit selected data as determined by the City.

According to Shehzad & Khan (2013), there is a definite positive relationship between Knowledge Management and Business Intelligence. Knowledge Management is the ability to select the right information at the right time from the right sources to obtain useful insight to ensure the maximisation of benefits for an organisation (Shehzad & Khan, 2013). By implication, Business Intelligence is representative of a lucrative opportunity to any organisation as it allows effective Knowledge Management to take place, which improves evidence-based policy decision making.

There are different ways of using Business Intelligence in an organisation (Williams & Williams, 2003), namely to:

- Improve management processes;
  - Planning;
  - Controlling;
  - Measuring;
  - Monitoring;
  - Adjusting processes to improve efficiency; and
  - Cost reduction.
• Improve operational processes;
  o Curb fraud;
  o Customer order delivery;
  o Sales campaign execution; and
  o Accounts payable.

• Relationship management;
  o Determine the characteristics of and value of customers.

Business Intelligence is a relatively new subject in local government and it requires focused attention. It is against this background that the City of Tshwane should explore the importance and role of Business Intelligence within its environment to support decision making in the City. The Smart City and Vision 2055 strategies envisage implementation of smart and innovative solutions and products and these can only be achieved if decision makers, both administrative and political management, have access to relevant and smart data to enable them to make smart decisions. An effective BI solution will enable the City to effectively share and analyse data, resulting in improved service delivery as information is presented in near real time.

This project will support all six outcomes in Tshwane Vision 2055 but in particular Outcome 5 of the vision which reads as follows: “An African Capital City that promotes excellence and innovative governance solutions”

In terms of the current IDP, the project addresses the following strategic objectives:

**Strategic Objective 6: Continued organisational development, transformation and innovation.**

Through the process of engagement with stakeholders, a clear understanding of data availability, quality and characteristics can be obtained. Thus, by profiling the data in this nature, BI will assist in converting the data into information and identify quality control measures to be implemented in future to improve data quality. Besides the above mentioned strategic objective, the following strategic objectives have been identified as positive externalities of this project as this forms part of a larger project.

**Strategic Objective 1: Provide sustainable services infrastructure and human settlement management**

Access to required data is the foundation of any business intelligence enterprise in any organisation and this is no different for the City. Ritacco, Carver & Bendel (2007) assert that providing staff with the means to make better-informed decisions creates an agile
enterprise with cost effective solutions. Ritacco et al. (2007) further states that strategic information allows employees to make decisions that move the organisation closer to its goals.

**Strategic Objective 3: Ensure sustainable, safer city and integrated social development**

The collection, evaluation and conversion of available data in the City of Tshwane will lead to an increase in valuable information to its stakeholders allowing the City of Tshwane to be more readily equipped to develop a sustainable, safe and integrated city.

Analytics solutions, such as business intelligence and performance management software and services, can help local government departments save millions of Rands in costs while improving efficiency by 10-15 percent, whilst reducing process times by as much as 80 percent. For example, with an IBM business intelligence and modelling solution, the US Social Security Administration (SSA) reduced processing time for claims and saved significant costs for disability benefit renewals.

### 3 BI ORGANISATIONAL STRUCTURE

Business intelligence (BI) supports an organisation by delivering important information for decision-making and management processes. To ensure successful implementation, an organisation needs to address technical concerns (i.e. integration to various sources) and business concerns (i.e. high level overview of indigents per region, etc.). Information that informs decision making is compiled by use of BI tools, which are software types designed to retrieve, analyse, transform and report data. The tools generally read data that have been stored, often though not necessarily, in a data warehouse or data mart.

Given the rise of the information age and the focus of developing Business Intelligence within organisations, the need for a tailor made BI unit that fits within the organisational structure is crucial. There are various business intelligence models when it comes to the deployment of business intelligence tools. These models will be discussed in this section. The selection of the correct model is paramount to ensure the effective operation of BI within the city.
3.1 Decentralised or Distributed Model and Overlapping Disparate Islands of BI

Research has shown that many companies in the past have deployed BI applications as departmental solutions, and in the process, have accumulated a large collection of disparate BI technologies as a result. In this kind of BI environment, every business unit handles its own BI requirements without corporate involvement. Each distinct technology supported a specific user population and database, within a well-defined “islands of BI” and to a certain extent overlapping disparate islands of BI. Each business unit has dedicated BI personnel or BI experts to build its own applications to meet business unit needs. It is said that BI deployments in such kind of a set-up would generally be quick, affordable, and highly tailored to end-user requirements while also allowing some flexibility. Due to the isolated nature of BI in each business unit, BI expertise would vary significantly across the organisation.

The challenge with this kind of model is that the organisation is getting conflicting versions of the truth through the multiple disparate BI systems, and this makes it difficult to harmonize without an extraordinary, continuous and manual effort of synchronisation. Equally problematic is the fact that business users are forced to use many different BI tools depending on their data needs and requirements. This is the current situation that the City of Tshwane is facing and to harmonise this system, it will require a thorough analysis and best approach to have an overall organisation view of data and information that is created.

In addition, the disadvantage of this model is that there is considerable redundancy in BI software, staff and applications across the business units. Key metrics and dimensions are not defined in the same way in the various business units which creates a problem in terms of the need for unified reporting, standardisation and control. The BI strategy in place is localised to the business unit or department and only addresses the business needs. A schematic representation of a distributed or localised BI Model is shown below:

![Figure 3-1: Localised BI within a Business Unit](image-url)
3.2 Centralised Model - Business Intelligence Competency Centre

A centralised business intelligence model is a shared service or what is known as a Business Intelligence Competency Centre. There is one BI team and an enterprise data warehouse that supports all business units and users. This assists in streamlining redundancies, reducing overhead costs, improving service delivery and delivering more timely, accurate and comprehensive views of organisational performance to senior management. A corporate or enterprise BI delivers a single version of the truth through a single user interface to all users across the enterprise.

The following figure depicts a centralised BI environment:

![Figure 3-2: Centralised BI through Enterprise Data Warehouses](image)

In this particular environment, the idea is to create an organisational view of information. A centralised BI team is responsible for developing and managing an enterprise data warehouse (EDW).

3.2.1 What is a Business Intelligence Competency Center?

According to the Gartner Group (2001), a BICC is "a cross-functional team with a permanent, formal organizational structure. It has well-defined specific tasks, roles, responsibilities and processes for supporting and promoting the effective use of BI across the organization." A BICC will involve a team of people who, in its most fully realized form, is responsible for managing all aspects of an organization's BI strategy, projects and systems, to deliver outputs to various departments within the organisation. A BICC is an organizational structure that groups people, with interrelated disciplines, domains of knowledge, experiences and skills together for the purpose of leveraging the expertise throughout an organisation to ensure that a BICC is able to carry out its mandate across a diverse organisation.
However, in some organisations a BICC might be a virtual team representing many different departments (Business Application Research Center, 2008). According to BearingPoint (2011), organisations with less mature BI utilisation, typically create a “virtual” BICC with personnel dedicated only part-time to the BICC. Organisations with a more mature approach to BI have an established and specialised BICC unit with personnel dedicated to carrying out their BICC duties.

It should be clear that when an organisation takes a decision to implement business intelligence, it needs to develop a vision and clearly define what BI will do for the organisation. The idea is to think big, but start small.

3.2.2 Primary Role of a BICC

The BICC’s primary role is to maintain the organisation’s BI strategy; align the BI strategy with the organization’s business strategy and establish that any investment in BI technology adds value to the organisation and helps the organisation meet its strategic goals. Hence, the purpose of BICC is to implement a BI strategy that synergises with the organisational structure to promote and enable the effective use of an organisation-wide BI solution in a way that generates and delivers information aligned with the business strategies.

The BICC typically serves as a program office for new BI initiatives, coordinating efforts between different projects, facilitating knowledge sharing among all personnel working on BI initiatives, and playing an active role in BI system development, both as an advisor and as a participant in producing deliverables. One of the key functions of a BICC is to help corporate executives and business managers to better understand the potential benefits that BI can provide in managing business operations which, in turn, can help the BI team gain executive support and funding commitments for BI projects.

A crucial role of a BICC is being responsible for developing plans, identifying priorities, infrastructure and competencies that the organisation needs to take forward-looking strategic decisions by using BI and analytical software capabilities. BICC also plays an important role of facilitating interaction among the various cultures and units within the organisation. BICC ensures that information and best practices are communicated and shared through the entire organisation so that everyone can benefit from successes and lessons learned. BICC provides a body of centralized knowledge and best practices necessary to make broader
business optimization goals a possibility. Finally, the BICC plays a major role in promoting the existing system portfolio and BI initiatives to the rest of the organization and should offer training and support to all BI business users. Figure 3 and Figure 4 below illustrate the core functions of a BICC.

![Figure 3-3: Functions of BICC (Source: SAS)](image)

![Figure 3-4: BICC Core Functions (Source: RCI)](image)

**Table 3-1: Components and functions of a BICC**

<table>
<thead>
<tr>
<th>COMPONENTS AND FUNCTIONS OF A BICC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BI Program</strong></td>
</tr>
<tr>
<td>• Manages and coordinates all the activities of the BICC and its interface with the business units;</td>
</tr>
<tr>
<td>• Defines the goals and strategies of the BI</td>
</tr>
</tbody>
</table>
## COMPONENTS AND FUNCTIONS OF A BICC

<table>
<thead>
<tr>
<th>Data Governance</th>
<th>License and Contract Management</th>
</tr>
</thead>
</table>
| • Responsible for managing the availability, usability, integrity and security of the data employed in the organisation;  
• Responsible for guaranteeing the continuity of the Data Warehouse model based on changes of origins and needs;  
• Manages technical metadata in a way as to guarantee alignment with business metadata;  
• Responsible for data standardization, quality and governance;  
• Manages the integration of information with the BI environment. | • Responsible for managing contracts with suppliers, be they software, hardware or consulting;  
• Responsible for managing licenses in use in the organization;  
• Manages compliance of outsourced services in order to guarantee efficient support to the BICC Program;  
• Interface between purchasing and legal areas in order to maintain existing contracts or expand to new products and services. |

<table>
<thead>
<tr>
<th>Change, Culture and Communication Management</th>
<th>Training</th>
</tr>
</thead>
</table>
| • Responsible for providing knowledge in the use of BI applications to all the organisation’s business units;  
• Responsible for managing changes of process in both technological and business areas so that the BI actions can be integrated with the business needs;  
• Disseminates the BI culture through Coaching and Mentoring activities with the user community;  
• Publicizes existing information as well as new projects and new functionalities;  
• Its main function is to encourage the use of information and the construction of a BI culture in the entire organization | • Responsible for training users and internal developers;  
• Delivers specific trainings of products and modules;  
• Responsible for the elaboration of customized trainings to meet specific needs;  
• Carries out orientation workshops for the application together with the Culture and Communication area. |
## COMPONENTS AND FUNCTIONS OF A BICC

<table>
<thead>
<tr>
<th>Support</th>
<th>Best Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Responsible for the continuous operation of the applications with effective monitoring of programmed executions;</td>
<td>• Responsible for establishing best practices in the use of tools;</td>
</tr>
<tr>
<td>• Responsible for opening and monitoring calls made to Hardware and Software suppliers;</td>
<td>• Establishes the construction standards of the BI applications;</td>
</tr>
<tr>
<td>• Support and assistance to problems or doubts related to the running of the environment and tools;</td>
<td>• Perform Quality Assurance procedures in the delivered applications;</td>
</tr>
<tr>
<td>• Second-level assistance to final users;</td>
<td>• Identifies possible improvements in existing applications, based on the use of applications and new technologies.</td>
</tr>
<tr>
<td>• Performs as a receptor of the different solicitations of final users, which are then directed to specific areas within the BICC.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Management Office and Software Development</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Identification of new projects;</td>
<td></td>
</tr>
<tr>
<td>• Requirement survey with users;</td>
<td></td>
</tr>
<tr>
<td>• Test monitoring;</td>
<td></td>
</tr>
<tr>
<td>• Project documentation;</td>
<td></td>
</tr>
<tr>
<td>• Development of new applications;</td>
<td></td>
</tr>
<tr>
<td>• Validation with Users;</td>
<td></td>
</tr>
<tr>
<td>• Installation of the applications in different environments.</td>
<td></td>
</tr>
</tbody>
</table>

### 3.2.3 How BICCs are structured and various competencies required

Research shows that an IT-driven BI rarely reaches higher levels. It is important that BI in the organisation is business-driven which often ensures that it will be adopted and utilised as the BI solution meets the needs of the organisation. As a result, a collaborative approach to BI is crucial and roles and responsibilities needs to be clarified. Figure 5 illustrates the different roles and functions within a BICC.
3.2.4 Business Intelligence Steering Committee

The BI Steering Committee acts as a governance structure and will comprise of heads of business units or departments charged with the responsibility of determining the overall BI program, strategic priorities and funding allocation.

3.3 Hybrid Model or Federated BI Model

This model is a combination of the centralised and distributed BI Models. This would entail the corporate BI team (BICC) to open up its data warehousing environment to the business units. Each business unit would be given a dedicated partition in the EDW to develop their own data marts and reports. By applying this kind of approach, it would assist the business units on how to use the corporate ETL (Extraction, Translate and Load) tool and also to blend local data or business unit data with corporate data inside the enterprise data warehouse partition. This kind of model can only be applicable in cases where there is existing BI expertise within the business units.

The diagram below depicts a hybrid BI model:
3.4 Models applicable for the city of Tshwane

3.4.1 Hybrid Model

With regard to the current situation or BI model that exists within the City of Tshwane, there is a distributed, isolated and overlapping islands of BI Model and as a result this creates a problem in that the organisation is not getting a single version of the truth. There are many data or BI related applications that are not aligned. Some applications are accessible to only a certain user population.

Deploying a hybrid BI model would involve blending the top-down and bottom-up approaches. However, deploying this kind of model within the City of Tshwane would be a challenge because there is limited BI expertise within Group ICT and within departments. As a long-term strategy the City of Tshwane could invest in human capital through:

- Building capacity and support for the existing employees that already perform some form of BI related work, data analytics and reporting on behalf of their departments. However, the existence of the SAP Centre of Excellence within the City is acknowledged. It should be possible to widen the scope of the centre to an enterprise BI and also build capacity.
3.4.2 Centralised Model

Another approach is to establish a BICC and appoint BI specialists, Data Analysts, BI developers, BI Analysts and Project Managers to build, deploy and provide BI support to the entire organisation. The Organisational Efficiency and Improvement Division would need to conduct an organisational study to determine where the structure could be placed within the City of Tshwane.

The key to both approaches is that the unit should have access to all the required expertise as well as sufficient institutional authority and memory to effectively develop the BI system within the City. The challenge is the resistance to change and how to overcome that resistance. This unit also needs the appropriate level of autonomy to ensure it is able to do what is best for the organisation in the long run.

3.5 City of Tshwane Business Intelligence Unit

3.5.1 Purpose

Given the proposed structure, the unit to be established will be responsible for implementing business intelligence in the City of Tshwane and ensuring that the system is constantly updated, running and meeting the needs of users. Thus, the key purpose of the unit besides the development of the BI solution, is ensuring that it remains relevant, effective and instrumental to the organisation achieving its overarching mandate as set out in the Constitution Section (152).

3.5.2 Mandate

Develop, implement and manage Business intelligence in the City of Tshwane to ensure that the BI system is tailor-made to address the needs of the City as a whole and the needs of each department that the city comprises of. This role includes key tasks such as:

- Policy development and maintenance – ensuring the policy remains relevant
- Developing an appropriate BI solution
- Implementing and maintaining the BI system
- Managing the Data Warehouse
- Ensuring the system and its elements is always current and relevant
- Being the key contact and driver of Business Intelligence in the City of Tshwane
- Identifying and adapting the system to changing user needs.

3.5.3 Governance

The unit will likely have the governance structure as outlined in Figure 5. However, it has to be noted that a final governance structure will be subjected to expert review to ensure
relevance. A hypothetical structure is provided below. This unit will need the support and authority of both the City Manager and Executive Mayor to ensure effective, autonomous operation within the City.

_Theoretical Reporting Structure_

![Image of the theoretical reporting structure]

### 4 BI FRAMEWORK

The Business Intelligence Framework that is suggested is the Gartner's Business Intelligence, Analytics and Performance Management framework. This framework is founded on three pillars. According to Gartner (2011:1)\textsuperscript{x} “This framework defines the people, processes and platforms that need to be integrated and aligned to take a more strategic approach to business intelligence (BI), analytics and performance management (PM) initiatives.”
4.1 People

The role of people in the development of a BI system is crucial. These roles are defined as follows according to the Gartner model:

- **Consumers**
  Users consume the information, analysis and insight produced by applications and tools to make decisions or take other actions that help the enterprise achieve its goals.

- **Producers**
  Traditionally, organizations have employed analysts in specific roles to define and explore business models, mine and analyse data and events, produce reports and dashboards, provide insights into the organization's performance and support the decision-making processes.

- **“Prosumer”**
  Rather than the discrete roles for consumers/producers that best represented the traditional business-IT relationship, newer forms of analytics and PM surpass these distinctions. Hence, a business analytics user can easily be involved across produce, consume and enable activities.
• **Enablers**
  This group includes the external vendors, IT professionals, members of a BICC and others who help design, build and maintain the systems that users and analysts use.

Furthermore, according to Gartner (2011:8):

> “The need to establish a collaborative work environment between IT and the business cannot be underestimated. Traditional approaches in which IT considers the business as its customer sound good, but inevitably lead to suboptimal results because of a lack of communication and a rigid development process. Creating new styles of workgroups that blend IT skills (for example, data modelers and report writers) with subject area domain expertise and analytic modeling into a single team for faster prototyping is common characteristic of Gartner’s BI Excellence Award finalists.”

This highlights that a continued integration between user and producer is essential for optimal results. Given the required strong relationship between business and IT in order to develop an effective Business Intelligence system, interaction with other teams are crucial. This communication/interaction is crucial to ensure the success and use of the BI system within the organisation. These interactions can be defined as follows:

• **Technical support on the SAP BI system:**
  o Database and Infrastructure support is necessary to ensure database integrity and infrastructure stability and dependability. This is the responsibility of the SAP Basis Team.
  o The user access to the BI System provides the user access to a certain set of reports. These report sets can also be combined according to specific requirements. The maintenance of this access to the system is the responsibility of the SAP Security Team.

• **Functional support:**
  o Due to the complexity and diversity of the different source systems being utilised within City of Tshwane, it is imperative that functional support also be provided, not only to the user community, but also the BI Team. This support will be provided by the different functional teams from the various systems.

• **Business support**
  o Business super users
    ▪ These users will provide first line BI support to the business user community and will form the contact point for that area to the BI Team.
4.2 BI Processes

When looking at BI holistically, the science behind the management of Business Intelligence (Reporting, Analytical and Dashboards), can be divided into the following different processes.

**Figure 4-2: Business Processes**

![Business Processes Diagram]

### 4.2.1 Business and Decision processes

Business process is a standardized set of activities that accomplish a specific task, such as processing a customer’s order. As these business processes are being executed, transactional data is being captured and stored as entrusted information throughout the process that will be used to understand and manage the business. Decision process is the decision-making process used by consumers/business users before, during, and after the provision of a product or service. Business processes can be optimized only if they incorporate decision processes. Business Processes without decision points are inflexible, static and inefficient. In addition, when BI and Analytic capabilities are integrated into business processes, decisions are scalable, traceable and accurate.

### 4.2.2 Information Infrastructure processes (Data Extraction and Warehousing)

The information infrastructure comprises of interfaces with other parts of the organization and allows the automated exchange of data, documents and other forms of content. The BI system interfaces with the various operational systems in order to bring the relevant data.
into the enterprise data warehouse, from which the analytical reporting is performed. The processes involved in creating a solid base for BI include the following:

1. Infrastructure technologies that cut across the entire organization like networks, servers and storage

2. Data Sourcing from unstructured and structured data
   a. Various forms of unstructured data will be filtered from different sources, e.g. System logs, multimedia and email communications.
   b. Structured data will be filtered from, e.g. ERP, CRM and others.

4.2.3 Analytic Processes

Analytic processes are methods used to perform an analysis of an event or situation with the intent to make a fact-based decision. Analytic processes utilise BI Capabilities and Analytic applications. BI capabilities assist organizations to learn from and understand their daily operations. Analytic processes consist of predefined data and process workflows, delivery and analysis capabilities. The processes involved in Analysis and discovering trends include the following:

1. Data/Text mining to find patterns and group sets of data. This is achieved through mining data from the OLAP (Consolidation, drill-down, and slice and dice).
2. Analyse and draw connections between data. This can be achieved by using different forms of analytics, e.g. Business Analytics (Decision and Predictive), Usage Analytics, and Web Analytics.

Utilising analytical processes allow the business user to slice and dice through the specific data mart’s information in order to view the information at different levels of detail, and by obtaining different views and perspectives on the same information. This will enable business to make fact-based decisions.

4.3 Applications and Tools (BI Architecture) - Platforms

4.3.1 Business process applications

The Business Process applications include all the operational and transactional processing applications being utilised within the City of Tshwane. These systems are used to capture
operational data during the daily course of business and include systems like SAP ECC, PowerMap, Ibis and Genesys. These different systems will form input data sources for the BI system.

4.3.2 Analytic applications

Analytic applications package BI capabilities for a particular domain or business problem. These applications consist of predefined data and process workflows, and sets of predefined models, analysis and delivery capabilities. These applications require integration with the business processes, and thus integration is impacted by various factors, such as the complexity of the analysis required and the variability and time sensitivity of the business processes.

Within the City of Tshwane a single BI platform will be utilised that will deliver the required BI capabilities to the City of Tshwane, at the required level of complexity, variability and time sensitivity.

4.3.3 BI capabilities

BI capabilities build applications that help enterprises learn and understand their business. A BI platform provides three categories of functions: integration, information delivery (e.g. reporting and dashboards) and analysis (e.g. online analytical processing [OLAP], predictive modelling and data mining). Capabilities such as intelligent decision automation will optimise decision-making in structured, well-known decision-making scenarios. Other capabilities will be required to support more flexible, iterative and less hierarchical decision-making requirements. Applying BI to decision making will require IT enablers to work more closely with business users to understand and model business decisions.
4.3.4 Information infrastructure including data portal and BI reporting

The diagram displays the architecture provided by the City of Tshwane’s BI system.

Figure 4-3: City of Tshwane BI Architecture

The data will be extracted (collected) from source using the ETL (Extraction and Transformation and Load) tools in the BI system. One of the key advantages of using a BI solution is that one can source data from different systems and merge the data into a single, consolidated data set for an overall bird’s eye view. It will then be stored in its raw format. The data sources will be system specific, and optimised for load performance.

Both the data acquisition and propagation layers in the above model are part of the Enterprise Data Warehouse (EDW) area of the BI system. The data in the EDW is stored in a detailed format, and is stored for a long period (up to 10 years plus), often referred to as the “Corporate Memory”. To ensure that the data in the EDW layer is optimal, extensive harmonization and integration of data is effected here.
Data in the reporting and virtualisation layer will be report optimised, and effectively reflect the reporting requirement as defined in the functional design document. Separation of data, partitioning and domains will be implemented here to ensure the data is stored in a manner that will improve the reporting performance of the final reports. Multi-providers will be used here to service the reporting layer and can further subdivide and group data as required.

In line with the City of Tshwane’s strategic direction, the presentation layer includes SAP BusinessObjects. This layer provides the tools and capability to deploy information to the user community in a number of formats in order to address strategic, tactical and operational requirements. The determination of which tool to use for which purpose, can be identified in accordance with the report requirements. In this environment, a culture of self-help can be encouraged due to the variety of technologies and content available, from static/highly formatted reports and dashboards to highly interactive/analytical requirements. In addition, this layer can provide automated report distribution functionality, currently not used in the City of Tshwane.

5 DATA GOVERNANCE

Data Governance is defined as an internal business function charged with the creation of policies, processes and standards to optimize the value data can deliver to an organization. It involves the specification of decision rights and an accountability framework to encourage desirable behaviour in the valuation, creation, storage, use, archiving and deletion of information. As with other business functions, it requires people, policies and processes with a clear way to measure success, compliance and organizational effectiveness. This implies that although data governance relies on technologies such as data integration, data quality, master data management, metadata management, data masking, data security, data archiving, and business intelligence software, data governance itself should not be considered a technology or a technology market but a business function. Informatica (2013:5)

Effective data governance does not come together all at once. Before adopting an approach, it is important to assess the current state maturity of the data governance capability. Below is a diagram that illustrates typical Data Governance Maturity models with six crucial milestones that entities should be evaluated against, according to Oracle (2011).
Figure 5-1: Oracle Maturity Model

Level 0 (None)
  i. No formal governance process exists, data is by-product of applications.

Level 1: Initial
  i. Authority for data exists in IT but wields limited influence on business processes.
  ii. Business and IT collaboration is inconsistent and heavily reliant on individual data-savvy champions in the business in each Line of Business (LOB).

Level 2: Managed
  i. Ownership and stewardship may be defined in individual LOB.
  ii. Loosely defined processes exist around key applications in LOBs, and data problems are typically dealt with reactively without systematically addressing the root cause.
  iii. Standardized processes are in early stage among LOBs.

Level 3: Standardised
  i. Organisation is engaged, a cross-functional team is formed and data stewards are explicitly appointed with clear responsibilities.
  ii. Standardized processes and consistency are established across LOBs.
  iii. A centralized and easily accessible repository of data policies is established, and Data quality is regularly monitored and measured.

Level 4: Advanced
  i. The organizational structure for data governance becomes institutionalized and viewed as critical to business across all functions.
ii. Business takes full ownership for data content and data policy making.

iii. Quantitative quality goals for both process and maintenance are set.

**Level 5: Optimised**

i. Data governance is a core business process and decisions are made with quantifiable benefit-cost-risk analysis.

ii. Quantitative process-improvement objectives for the organization are firmly established and continually revised to reflect changing organisational objectives, and used as criteria in managing process improvement.

While level 5 of the maturity model is a worthy target, it may not be achievable in the near future given internal political, financial and organizational realities. Instead, it is paramount that one should identify a goal level of maturity that can deliver business value while remaining realistically attainable and sustainable in the short and medium term. As the governance scope grows and expands, the maturity level also steps up. It is accomplished most effectively as an on-going program and a continuous improvement process. However, the first and most crucial stage that an organisation must take is an assessment of its maturity level – as this will also contribute in mapping out an appropriate data governance programme.

### 5.1 Data Governance Framework

A data governance framework is an overarching approach to how you collect, manage and archive data in your enterprise. The data governance framework touches on practically every part of your data management process down to the individual technologies, databases and data models. The framework also affects the processes people use to create and retain data – and how you can replicate these rules within applications to help you make smarter decisions faster. A data governance framework is sometimes established from a top-down approach, with an executive mandate that starts to put all the pieces in place. Other times, data governance is a part of one (or several) existing business projects, like compliance or MDM efforts. From a bottom-up approach, you can synthesize these efforts into a more cohesive enterprise-level data governance framework.

A data governance framework adopted by Informatica (2015) provides context to understanding the fundamentals necessary in building an effective data governance competency within an organization. It helps to identify strengths an organization can leverage for early value and momentum as well as areas for potential improvement and investment to mitigate organizational obstacles and risks. The figure below indicates ten complementary facets adopted by Informatica for an effective data governance programme.
5.1.1 Vision and Business Case

The vision and business case must clearly articulate the business opportunity, both the broader strategic objective and the specific business opportunities on which to focus efforts. A vision statement is used to set an ultimate destination, but the business case must outline the journey to get there.

5.1.2 People

The right people are required to support, sponsor, steward, operationalize and ultimately deliver a positive return on data assets. Organizations commonly form an executive steering committee to coordinate communication, prioritization, funding, conflict resolution and decision making across the enterprise as in the case of the City of Tshwane. With the right executive sponsorship, a steering committee can be created early, but grassroots efforts might require some momentum before senior leaders are willing to commit their support.
5.1.3 **Tools and Architecture**

- Upstream on-premises transactional/operational applications, systems, and processes that create, update, import, or purchase data.
- Downstream on-premises analytical applications, systems, and processes that consolidate, reconcile, deliver, and consume data.
- Growth of off-premises sources and targets of data, including cloud-based applications and platforms, social data, mobile devices, third-party data feeds, sensor data and Hadoop\(^2\) analytic environments.
- Supporting data management infrastructure investments that enable and ensure compliance with the organization’s unique requirements for delivery of “the right data at the right time with the right latency of the right quality and security in the right context.”
- Assessment and delivery of the shared capabilities that must be made available across the enterprise data architecture, not confined within specific applications or tools. A common approach includes an Integration Competency Center with responsibility for a unified data management platform.

5.1.4 **Policy**

Business policies and standards are critical for any data governance function. Common policies that must be agreed upon, documented and complied with include data accountability and ownership, organizational roles and responsibilities, data capture and validation standards, information security and data privacy guidelines, data access and usage, data retention, data masking and archiving policies.

A data governance initiative will be responsible for documenting and maintaining policies that primarily cover:

- Data accountability and ownership: These policies indicate which senior business leaders or groups (e.g., a steering committee) are accountable for the overall governance of data and respective systems. Furthermore, the policy can also provide a framework outlining what ownership actually means, defines the rights and responsibilities of the owners and indicates whether and how those responsibilities are anticipated to change over time.

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\(^2\) Hadoop is an open-source software framework for storing data and running applications on clusters of commodity hardware. It provides massive storage for any kind of data, enormous processing power and the ability to handle virtually limitless concurrent tasks or jobs.
• Organizational-wide roles and responsibilities: These policies must document and make clear the responsibilities of business across board e.g. IT data stewards, the data governance leader, and other dependent stakeholders.

• Process guidelines that specifically include data capture and validation standards, data access and usage, arbitration and adjudication and data retention: These policies define minimum required standards and reference data rules. The goal is to ensure that the people, processes and systems that capture, import, update, transform or purchase critical data do so in a consistent, standardized manner with a focus on quality that ensures fitness for enterprise use.

5.1.5 Organizational Alignment

Organisational alignment is linking strategy, processes, people, leadership and systems to best accomplish desired or defined outcomes (Jackson and Tosti, 2001). Organisational alignment occurs when strategic goals and cultural values are mutually supportive and compatible. Furthermore, organizational alignment in a data governance programme should focus on building effective working relationships through aligning and managing expectations of all stakeholders in the organisation. This component catalyses the implementation of the data governance programme.

5.1.6 Measurement

Data governance must be measured at three distinct levels. First, at the program level, the organization must identify and highlight the qualitative level of organizational influence and impact the data governance efforts deliver. Next, stewards need operational data monitoring to evaluate how the data is behaving against expected policy and validation baselines. Last, and most importantly, sustaining data governance momentum requires quantitative business value measurement that links data management efforts to real business value such as revenue growth, cost savings, risk reduction, efficiency improvements and customer satisfaction.

5.1.7 Processes

An organization cannot fully govern its critical enterprise data until it understands the entire lifecycle of the data. Downstream operational and analytical processes that consume and derive insight and value from data are usually top of mind and often form the basis of the business case for data governance. However, to deliver trusted, secure data, organizations must also understand the upstream business processes that create, update, transform,
enrich, purchase or import data. These upstream processes often create a significant percentage of the “garbage in/garbage out” problems that the data governance effort is chartered to resolve.

Processes are categorized into three broad areas: upstream processes, stewardship processes and downstream processes.

- **Upstream processes**: these are the business processes that capture, create, import, purchase, transform or update data and introduce it into the organization’s information ecosystem.

- **Stewardship processes**: in the lifecycle of physical data itself, the stewardship process stage involves applying the data policies, business rules, standards and definitions created as part of the data governance program. In a more human-centric workflow, stewardship processes facilitate the manual identification, notification, escalation and mitigation of exceptions to the automated rules and policies.

- **Downstream processes**: these are the operational and analytical processes that consume, protect, archive, purge and otherwise extract insight and value from data. Delivering significant business value and ROI against these downstream processes is the way to persuade executive sponsors to support changes to upstream processes, systems and organizational behaviours—and to allow investment in the organizational and technology improvements that enable the stewardship processes.

An effective data governance organization will accept responsibility for assessing and improving all of the processes that touch the data and influence its usability.

5.1.8 **Change management**

No matter how compelling the vision and business case, making data a true corporate asset is a major culture shift for most organizations. Accomplishing this shift will likely require significant behavioural change across the workforce (and possibly in the partner/supplier ecosystems) to create an organizational culture that values data appropriately. Support for these organizational, business process and policy changes must include training, communication and education, with a “carrot and stick” performance management program to incentivize good data practices while discouraging past undesirable behaviours. Data
governance programmes must also include time, resources and a commitment from management to invest in necessary change management.

5.1.9 Programme management

Whether through an official program management office (PMO) or a team of program drivers, data governance efforts need skilled project/program management professionals to coordinate the complex interactions, communications, facilitations, education, training and measurement strategy. Effective program management can ensure adoption, visibility and momentum for future improvements. It is important to recognize the significant amount of coordination, facilitation and communication necessary to evangelize, prioritize, measure and evolve data governance from a pilot project to a foundational way of doing business. Ultimately, this must be someone’s full-time job. Although the business must own and accept accountability for data governance and the resulting policies, rules and standards, the most significant leadership roles will likely end up with IT, which typically offers the strongest program/project management skills within an organization.

6 DATA QUALITY

Statistics South Africa, in the South African Statistical Quality Framework (SASQAF), defines data quality in terms of data’s fitness of use. That is, data quality is defined according to acceptable (by StatsSA) data quality dimensions i.e. relevance, accuracy, timeliness, accessibility, interpretability, coherence, methodological soundness and integrity. These dimensions are further represented in the table below.

Table 6-1: Statistics South Africa’s SASQAF Data Quality Dimensions

<table>
<thead>
<tr>
<th>Quality Dimension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>Reflects the degree to which statistical information meets the real needs of stakeholders. It is concerned with whether available information sheds light on issues of crucial importance to users.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Reflects the degree to which the output correctly describes the phenomena it was designed to measure. It relates to the closeness between the estimated and the true unknown (unknown) values. Accuracy is measured by means of two major sources of error,</td>
</tr>
<tr>
<td>Quality Dimension</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Timeliness</td>
<td>Refers to the delay between the reference points to which the information pertains, and the due date on which the information becomes available. It also considers the frequency and punctuality of releases. The timeliness of data and information influences its relevance.</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Refers to ease within which data and information can be obtained from a reporting Department/Division/Specialist Unit. This also includes the ease with which the existence of information can be ascertained as well as the suitability of the form or the medium through which the information can be accessed.</td>
</tr>
<tr>
<td>Interpretability</td>
<td>Refers to the ease with which users can understand statistical information through the provision of metadata. This information normally includes the underlying concepts, classifications and methodology used in data collection and processing, and indicators or measures of accuracy of the data and information.</td>
</tr>
<tr>
<td>Coherence</td>
<td>Reflects the degree to which data and information can be brought together with other statistical information within a broad analytical framework and over time.</td>
</tr>
<tr>
<td>Methodological soundness</td>
<td>Refers to the application of international, national or peer-agreed standards, guidelines and practices to produce statistical outputs. Application of such standards fosters national and international comparability.</td>
</tr>
<tr>
<td>Integrity</td>
<td>Refers to the values and related practices that maintains users’ confidence in data and information produced by the Department/Division/Specialist Unit.</td>
</tr>
</tbody>
</table>

*Source: Adopted from SASQAF, 2010*iv

The South African Statistical Quality Framework (SASQAF) outlines a framework for evaluating and certifying data generated by organs of state and non-government organisations in certain instances. In line with SASQAF, this section is premised on the standard assessment criteria employed by the Statistics South Africa's Data Quality
Assessment Team (DQAT) when vetting data for the “official statistics” status. SASQAF draws distinction between official and national statistics. SASQAF covers various quality control facets within the statistical value chain i.e. need, design, build, collection, processing, analysis and dissemination. It is in this light that SASQAF forms a fundamental basis for the City of Tshwane’s data quality control element in the BI Framework. Annexure A provides a detailed data quality assessment framework as contextualised in SASQAF. Furthermore, data quality assessment levels relevant for the City’s BI framework are specified in the figure below and Annexure A.

**Figure 6-1: DQAT Data Quality Assessment Levels**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 4: Quality Statistics</strong></td>
<td>• These are statistics that meet all quality requirements set out in SASQAF. They are designated as quality statistics to the extent that deductions can be made from them, they are ‘fit for use’.</td>
</tr>
<tr>
<td><strong>Level 3: Acceptable Statistics</strong></td>
<td>• These are statistics that are designated as acceptable to the extent that, despite their limitations, deductions can be made and are ‘fit for use’ for the purpose which they are designed.</td>
</tr>
<tr>
<td><strong>Level 2: Questionable Statistics</strong></td>
<td>• These are statistics that are designated as questionable to the extent that very limited deductions can be made from them, they are therefore ‘not fit for use’. However, this level highlights the developing nature of activities and/or statistics.</td>
</tr>
<tr>
<td><strong>Level 1: Poor Quality</strong></td>
<td>• These are statistics that meet none of the quality requirements stipulated in SASQAF. No deductions can be drawn from these statistics, they are ‘not fit for use’. Activities/statistics in this regard are underdeveloped.</td>
</tr>
</tbody>
</table>

*Source: SASQAF, 2010*

7 **DATA CONTINUITY (LIFE CYCLE PRACTICES)**

Data continuity or life cycle in this context can be defined as the process of managing business information throughout its lifecycle, from requirements through retirement. The lifecycle crosses different application systems, databases and storage media. By managing information properly over its lifetime, organizations are better equipped to deliver competitive offerings to the market faster and support business goals with less risk.

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3 Official statistics refers to statistics that has been certified by the Statistician General as official in terms of section 14 (7) (a) of the Statistics Act (1999).

4 National statistics refers to statistics used in the public domain but which the Statistician General has not certified as official statistics.
1. Plan:
Plan is intended to assist in assuring consideration of all activities related to the handling of the data assets, from project inception to publication and archiving. This involves approaches, required resources (including funding and personnel) and intended outputs for each stage of the data lifecycle. In case of the City of Tshwane’s data, it will be assessed by the governance body (BI Steering Committee) and high-value sets will be identified for sharing with the public, as well as for internal usage. The identification of data sets will be done by the BI working group. The governing body should then decide on the quality level, method for measuring quality and how often the quality should be evaluated.

2. Collect:
The second element represents the activities through which new or existing data are collected, generated or considered and evaluated for re-use. Data will be collected by different departments and be sourced into the BI source systems which provide data in a specified file format, and then deltas are managed by source record tags in the specified file format.
3. Integrate and Transform:
The BI System will then integrate the raw data that were collected and add value through various means, including input from individual programmes and scientific research projects. The data are transformed from their initial state and stored in a value-added state, such as through web services.

4. Analyse
This element represents the activities associated with the exploration and interpretation of processed data, where hypotheses are tested, discoveries are made, and conclusions are drawn. Analytical activities include summarization, graphing, statistical analysis, spatial analysis and modelling, and are used to produce scientific results and information. In this element new data are generated, versions are tracked and processes are documented. Data management during analysis improves the efficiency of data analysis activities, preserves documentation that is critical for scientific integrity and creates a foundation for future research. The outputs of this element are interpretations or new datasets, which often are published in written reports or machine-readable formats such as map layers or numerical modelling results.

5. Preserve
This element represents the activities associated with storing data for long-term use and accessibility. Preservation often is not considered until the end stage of a project, when it might be neglected because of the pressure of project budgets and timetables. The intentional placement of this element ahead of Publish/Share in the Model is a reminder that BI project must plan for the long-term preservation of data, metadata, ancillary products, application-neutral storage formats and any additional documentation, to ensure availability and re-use.

6. Describe (metadata, documentation)
This highlights the importance of step-wise documentation throughout the data lifecycle. Beginning with the data management plan, this element emphasizes documentation of every lifecycle stage in sufficient detail that can validate research outputs through replication, evaluate the validity of the results and determine the usefulness of the data for future research. Recording this information at each stage of the data lifecycle—rather than at the concluding stages of the project—helps to ensure accuracy and comprehension of the science data created, compiled, processed and shared. Standards-based metadata and
documentation such as software code comments, data models and work flows facilitate indexing, accession, understanding and future uses of the data. Although misinterpretation or misuse of data cannot be prevented, well-documented data can help to expose and correct such errors when they occur.

7. Backup and secure
This involves managing physical risks to the data throughout the data lifecycle while also ensuring that the data are accessible. This element reminds that routine backups are critical to prevent the physical loss of data because of hardware or software failure, natural disasters or human error before the final Preservation of the data. Loss-prevention measures apply to the raw and processed research data, original science plan, data management plan, data acquisition strategy, processing procedures, versioning, analysis methods, published products and associated metadata.

8. Publish:
This element in the Model combines the peer-reviewed publication with the distribution of data through web site, data catalogues, social media and other venues. Data will be prepared for publishing for internal and external use. Data will be reviewed and confirm access permissions.

8 RISK MANAGEMENT

The City of Tshwane’s BI will protect individuals and organizations from the risks of BI while also advancing open data’s potential value. Risks include those that fall largely on individuals, such as privacy, security and personal safety, and those related primarily to organizations, such as confidentiality, liability and intellectual property.

*Figure 8-1: Data Risk Management*
8.1 Individual risks: Privacy, security, and safety

BI can improve accountability in government, make businesses more competitive and help public-sector leaders debate issues and identify sound policies. But total information sharing without safeguards or limits can put individual privacy and security in harm’s way. The City therefore needs to exercise caution. This implies that the City cannot publicly reveal personal-level information. As sharing of data become increasingly important, ensuring cyber-security will be an even more challenging task. For example, criminals could commit fraud or identity theft if they obtain personal identification numbers or financial data about the City’s residents. The BI policy will address the security challenge by establishing limits on data access or usage (such as stipulating that some personal information can only go to law-enforcement officers) or prohibiting the release of certain information. To reduce risk, the BI policy anticipate potential uses for newly released information, focusing on the insight it offers and parties that might be interested.

8.2 Organizational risks: Confidentiality, liability, and intellectual property

The BI working group together with the steering committee will actively manage certain risks that occur when we release potentially sensitive data. For example, there are concerns that opening performance data to third-party analyses could inadvertently discourage positive change, appropriate risk taking and innovation. The BI team will balance the public’s desire for information with the stakeholders’ need to avoid undue criticism, for instance, by instituting regulations that limit liability.
Another organizational concern relates to questions about intellectual property: who owns rights to the underlying data, who owns rights to the tools used to extract insights from the data and who owns rights to any products or services created from the data. Permission rights to use open data vary greatly depending on the source. People interested in accessing sensitive data must submit a proposal and agree to share their research findings. Applicants who seek data purely for commercial or legal purposes are denied access. This will ensure that researchers will only use the data to contribute to overall scientific knowledge, thus balancing intellectual property rights with societal benefits of open data.

8.3 External stakeholders in BI programmes

The City of Tshwane’s BI will involve multiple external stakeholders who have different roles, needs and concerns, as well as varying strategies for learning about data, mitigating risks and advancing their agendas.

Figure 8-2: External Stakeholders

Source: Mckinsey, 2015

8.3.1 Citizens and consumers

The City’s citizens and consumers stand to gain the most from the BI. For instance, they will be able to make more informed purchase decisions since they will have greater price transparency, thereby saving money. They will also have better insights about the City’s administration, which can help them make informed choices. The BI team will consider engaging citizens by holding public forums that illustrate how BI can improve services. In all cases, BI team will emphasize that private data will be protected, since citizens are often concerned about confidentiality issues.
8.3.2 Businesses

Many businesses can create innovative products and services based on open data. It may be helpful to publicize examples of some of the more successful creations, since other companies may be more inclined to use open data if they see the economic potential. Business leaders might consider sharing data with other stakeholders or collaborating with them to develop innovative offerings that leverage open data.

8.3.3 Media

In all formats – including print, radio, TV, online video, tweets and blogs – media outlets use and interpret open data. Many journalists use open-data sets to identify trends, patterns and behaviours that deserve attention, a trend known as data journalism. For example, they could use open data to highlight the time of day when most traffic accidents occur or to illustrate crime patterns within a City. Articles on such topics may serve as catalysts that spur officials or private citizens to take action. Acknowledging the importance of open data, newspapers and other media sources are dedicating increased resources to the creation of info graphics based on open-data sets.

8.3.4 NGOs

Non-Governmental organisations (NGOs) can help government develop common standards that improve data availability. With access to information from multiple governments and constituencies across the globe, NGOs (including universities, advocacy groups and think tanks) represent some of the most active collectors, disseminators and users of open data today.

9 BUSINESS INTELLIGENCE DATA SECURITY CONSIDERATIONS

As with many other systems, security is an important consideration in developing and administering a Business Intelligence System. When business intelligence is deployed on environments with multiple users, an organisation will usually want to prevent end-users from seeing restricted data and control which functions they may or may not have.

In the ISO 7498-2 standard, produced by The International Standards Organisation (ISO), Information Security should cover a number of suggested themes. Business Intelligence security should also be guided in this regard in order to become an effective and secure technology solution.
10 SECURITY REQUIREMENTS

10.1 Identification & authentication

Depending on the type of system as well as the delivery model, specified users must firstly be established and supplementary access priorities and permissions may be granted accordingly. This process is targeting at verifying and validating individual system users by employing usernames and passwords protections to their profiles.

If the City uses multiple application authentication sources, for instance, the CRM system might authenticate users against one user table, while the email system might use a completely different authentication source, BI software and system must provide flexible authentication options—letting the user authenticate his applications using whatever authentication sources the City already has in place.

BI software offering flexible authentication options will save the City from changing its current authentication methods or creating and maintaining yet another user table as it lets you take advantage of the authentication methods you already use.

10.1.1 Authorisation/ Row-level (or multi-tenant) security

Authorisation is an important information security requirement in business intelligence systems to ensure referential integrity is maintained. It follows in exerting control and privileges over process flows within complimentary systems. Authorisation is managed and maintained by the system administrators. In the business intelligence system, administrators can be given the rights to create accounts so that the user can only use a certain part of data dynamically with session variables and application roles that can be granted to these users. As illustrated in the image below, this means that multiple users access the same application, but view different data.

*Figure 10-1: Multi-tenant security*
10.1.2 Confidentiality

Confidentiality will play a major part, especially in maintaining control over the City’s data situated across multiple distributed databases. It is a must when employing business intelligence systems due to the complexities of their nature. Asserting confidentiality of clients’ profiles and protecting their data, that is virtually accessed, allows for information security protocols to be enforced at various different layers of the system applications.

10.1.3 Integrity

The integrity requirement lies in applying the due diligence within the business intelligence system domain mainly when accessing data. Therefore ACID (atomicity, consistency, isolation and durability) properties of the systems’ data should without a doubt be robustly imposed across all source systems.

10.1.4 Application activity auditing

Application activity auditing allows developers to log end-user activity for sign-on/sign-off activities. This lets IT departments monitor when users log in, which applications they access, and when they log off. Monitoring log-in/log-off activity helps IT departments manage application security. On a non-security note, activity auditing will also help the City to track the most and least-used BI applications and reports.
11 LEGISLATIVE FRAMEWORK

The framework is in accordance with applicable legislation governing the access to and control of information, the most important of which are the following:

- The Constitution of the Republic of South Africa, 1996. Section 32(1) of Constitution, provides that everyone has the right of access to records or/and information held by the state and any information held by another person and that is required for the exercise or protection of any rights. This section affirms the fundamental right of access to information and seeks to promote a culture of transparency and accountability in the private and public sector. Section 32(2) of the Constitution provides for the presentation of a national legislation to give effect to this fundamental right. The act provides a similar statutory right of access to records held by private bodies.

- The Promotion of Access to Information Act, 2 of 2002 (PAIA / Act) was legislated to give effect to the constitutional right of access to information held by the state or by any other person, where such information is required for the exercise or protection of a right. The purpose of PAIA is to promote the right of access to information, to foster a culture of transparency and accountability in South Africa, and to encourage an open democracy where individuals from all walks of life are empowered to engage with government and participate in decisions which affect their lives. (Annexure B: City of Tshwane Section 14 of PAIA)

- Spatial Data Infrastructure Act 54 of 2003. The aim of the Spatial Data Infrastructure Act, 2003 (Act No.54 of 2003) is to provide for the establishment of the South African Spatial Data Infrastructure (SASDI) in order to regulate the collection, management, maintenance, integration, distribution and use of spatial/geographic information. The Act promotes the efficient and effective use of the State’s spatial/geographic information resources by the sharing of the information, constitutional right of access to information held by the State, as well as information held by other persons, if the information is required for the exercise or protection of rights.
12 CONCLUSION

The framework set out in this document aims to enable the City to develop its BI strategy and implementation plans to facilitate the roll out of BI across the City. Furthermore, by addressing all the key areas of Business Intelligence and providing a theoretical base from which to work, will not only assist the City in developing a robust policy but also to address and cater for the unique needs of the African City of Excellence.

13 ANNEXURES

A. Data Quality Assessment Framework
B. City of Tshwane Section 14 of PAIA
REFERENCES


v C., Longfield. (2011). Data is gold. But only if you can get to its real value. Available at: http://sofii.org/article/data-is-gold-but-only-if-you-can-get-to-its-real-value


