## Business Analytics & Intelligence

# An Introduction and Considerations for Getting Started

### **Durham County White Paper**

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# Contents

Section 1	.3
Executive Summary	.3
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Section 2	
What is Business Analytics (BA)?	
Benefits of Data-driven Decision Making with Business Analytics	3
The Basic Pillars of Business Analytics	4
The Four Basic Types of Analytics	5
Big Data Analytics	
Examples of the use of Business Analytics	
Section 3	.8
What is Business Intelligence (BI)?	.8
How can Business Intelligence Benefit My Organization	9
The Difference Between Business Intelligence and Business Analytics	9
The Stages of Business Intelligence	9
How does Business Intelligence Work?	10
Section 4	11
Getting Started with Business Intelligence	
Information Needs Assessing	
Data Considerations	
Business Strategy	13
Section 5	14
Conclusions	

### Section **1** Executive Summary

The concept of Business Intelligence (BI) has been around in various forms for more than a century and a half. And we have used the terms Business Intelligence (BI) and Business Analytics (BA) quite extensively here within the County over the last 12-months. We have also seen a few BI demonstrations and now have some departments that are piloting the Microsoft PowerBI tool. The intent of this White Paper is to provide an executive level "short and quick" overview of BI and BA to set a foundational understanding for those who may be new to this space and for those who may be thinking about how to become more data-driven given the performance management work we're doing with Managing for Results, utilizing BI and BA.

This paper provides some basic definitions for the terms BI and BA including a basic definition for Big Data. It gives examples of each along with explaining the difference. The paper describes different levels of BI/BA to help the reader/organization determine where they are in the continuum. It has been my observation that some business units are at the very beginner stage and others are more advanced. We also introduce a BI/BA framework that has been used in the industry by one of the major consulting firms to help guide the discussion around BI/BA.

And finally, the paper concludes with a section entitled, getting started with BI. The intent of this section is to provide some fundamental guidance on considerations that must be given to people, processes, and technology including data, when considering the utilization of BI. This is fundamental information that is provided to solely educate the reader on the fundamentals of Business Analytics and Business Intelligence. This paper does not attempt to endorse any particular products.



### What is Business Analytics?

Business Analytics in its most basic form, is the study of data through statistical and operations analysis, the formation of predictive models, application of optimization techniques, and the communication of these results to customers, business partners, executives, and others. Business analytics is about "anticipate and act" to drive Better Outcomes, Smarter Decisions, and Actionable Insights. Analytics is an umbrella term that encapsulates data collection, statistics, data mining, predictive modeling, and decision sciences.

#### Business Analytics Basic Building Blocks – Gartner's Four Pillars

The basic building blocks for BA must address data, people, process and technology, according to Gartner's Jamie Popkin. These building blocks, referred to as the four pillars of Business Analytics, helps to remind us of 4 key areas we must give consideration to when considering implementation of BA.

### Benefits of Data-Driven Decision Making with Business Analytics

Organizations use Business Analytics (BA) to make data-driven decisions. The insight gained by BA enables these organizations to automate and optimize their business processes. In fact, data-driven organizations that utilize Business Analytics achieve a competitive advantage because they are able to use the insights to:

- Conduct data mining (explore data to find new patterns and relationships)
- Complete statistical analysis and quantitative analysis to explain why certain results occur
- Test previous decisions using different forms of data analysis
- Make use of predictive modeling and predictive analytics to forecast future results

Business Analytics also provides support for organizations in the process of making proactive tactical decisions, and BA makes it possible for those organizations to automate decision making in order to support real-time responses.

In summary, BA provides support for strategic planning, delivers tactical value, and creates competitive advantage.

### The Basic Pillars of Business Analytics

Gartner, a major worldwide consulting firm, says BA must address data, people, process and technology. They call this the Four Pillars of Business Analytics as show in the diagram below. The intent behind the four pillars is simply to help ask better questions – and get better answers when developing business analytic applications.

A brief summary of each pillar is provided below:

 Information management foundation (Data) – the data pillar balances governance and access in the informationdriven enterprise. It requires connecting to disparate data sources – regardless of their type and location. Being able to harness all the data available and serving it up to the business user is a critical base component to a solid strategy.

- Organization (People) -- as Business Analytics moves away from a centralized model and towards a decentralized model via a more self-service design, the people need to be trained and empowered to know how to use the data.
- Fact-based decision making (Process)

   the process pillar requires having the right information at the right time to make better, faster decisions. Because different roles make different decisions, it's important to leverage the same data to support a variety of processes. For example, operational and executive users require dashboards; customers/citizens want statements, proposals and reports; and departments need performance scorecards.
- 4. Appropriate technology platform (Technology) – the technology pillar encompasses development and



Figure 1: Gartner's Four Pillars of Business Analytics

deployment, with systems that break down silos of capability. The main point here is for organizations considering BA, to build a flexible architecture that can be easily adapted to business needs.

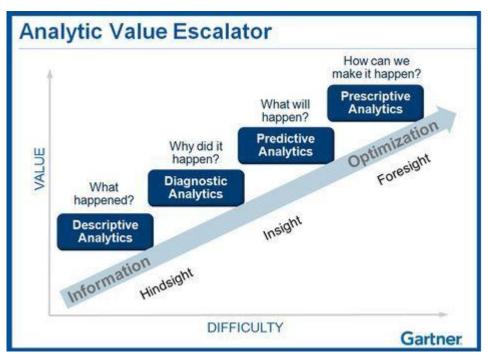


Figure 2: Analytics Value

### The Four Basic Types of Analytics

Gartner, also defines the four basic types of analytics as illustrated in Figure 1. Figure 2 shows the more complex an analysis is (base on the type of analytics), the more value it brings an organization/business.

The four basic types of business analytics can be defined as follows:

 Descriptive – Descriptive analytics answers the question of *what happened.* Descriptive analytics, the simplest form of analytics, means looking at historic data, ranging from 1 minute ago to years ago. It can be compared as looking in the rear mirror while driving. Ninety percent of organizations use descriptive analytics and often when people think Business Intelligence, this is what they're referring too`. For instance, a healthcare provider will learn how many patients were hospitalized last month; a retailer – the average weekly sales volume; a manufacturer – a rate of the products returned for a past month, etc. These findings simply signal that something is wrong or right, without explaining why. For this reason, highly data-driven companies do not content themselves with descriptive analytics only, and prefer combining it with other types of data analytics.

2. **Diagnostic** – A look at past performance to determine what happened and why, and is characterized by techniques such as drilldown, data discovery, data mining and correlations. The result of the analysis is often an analytic dashboard. Organizations go for diagnostic analytics, as it gives a deep insight into a particular problem. Let's look at some examples from different industries: a healthcare provider compares patients' response to a promotional campaign in different regions; a retailer drills the sales down to subcategories. And, in the healthcare industry, customer segmentation coupled with several filters applied (like diagnoses and prescribed medications) allowed measuring the risk of hospitalization.

3. Predictive – Predictive analytics means using all that data to make a prediction about where to go; it is the navigation that tells you how to drive and when you will arrive. It uses the findings of descriptive and diagnostic analytics to detect tendencies, clusters and exceptions, and to predict future trends, which makes it a valuable tool for forecasting. Despite numerous advantages that predictive analytics brings, it is essential to understand that forecasting is just an estimate, the accuracy of which highly depends on data quality and stability of the situation, so it requires a careful treatment and continuous optimization. Thanks to predictive analytics and the proactive approach it enables, a telecom company, for instance, can identify the subscribers who are most likely to reduce their spend, and trigger targeted marketing activities to remediate; a management team can weigh the risks of investing in their organization's expansion based on cash flow analysis and forecasting. And, some companies have gone one step further to use predictive analytics for the entire sales process, analyzing lead source, number of communications, types of communications, social media, documents, CRM data, etc.

4. **Prescriptive** – The purpose of prescriptive analytics is to literally prescribe what action to take to eliminate a future problem or take full advantage of a promising trend. This is the most valuable kind of analysis and usually results in rules and recommendations for next steps. Prescriptive analytics is the self-driving car, that knows exactly what the best route is based on infinite data points and calculations. Not surprisingly, Google's self-driving car makes extensive use of prescriptive analytics. And, in the health care industry, you can better manage the patient population by using prescriptive analytics to measure the number of patients who are clinically obese, then add filters for factors like diabetes and LDL cholesterol levels to determine where to focus treatment. The same prescriptive model can be applied to almost any industry target group or problem. Prescriptive analytics gives you a laser-like focus to answer specific questions.

**Big Data Analytics**Big Data has taken the world by storm. The intent of this white paper is not to discuss Big Data in detail but to give a basic definition for it since this term is also thrown around a lot. SAS (company located in Cary, NC) describes Big Data as "a term that describes large volumes of data – both structured and unstructured – that inundates a business on a day-to-day basis." Big data is characterized by three primary factors: volume (too much data to handle easily); velocity (the speed of data flowing in and out makes it

difficult to analyze); and variety (the range and type of data sources are too great to assimilate).

**Structured data** is comprised of clearly defined data types whose pattern makes them easily searchable; while **unstructured data** – "everything else" – is comprised of data that is usually not as easily searchable, including formats like audio, video, and social media postings.

What's important to keep in mind about Big Data is that the amount of data is not as important to an organization as the analytics that accompany it. When companies analyze Big Data, they are using Business Analytics to get the insights required for making better business decisions and strategic moves. Here are a couple of very basic Big Data analytics examples:

- **Fast food** and video. There is one company now training cameras on drivethrough lanes to determine what to display on its digital menu board. When the lines are longer, the menu features products that can be served up quickly; when the lines are shorter, the menu features higher-margin items that take longer to prepare.
- **Macy's Inc.** and real-time pricing. The retailer adjusts pricing in near-real time for 73 million (!) items, based on demand and inventory, using technology from SAS Institute.

### Examples of the Use of Business Analytics

As stated above, many organizations are utilizing analytics to improve business efficiency. Every day organizations collect data about their customers and industries, simply as an artifact of the act of conducting business. However, world-class organizations tend to leverage analytics 5 times more than other (MIT Research).

Analytics is growing exponentially in competitive segments like consumer marketing. For example, NetFlix mines its video rental history database to recommend rentals to individual customers. American Express can suggest products to its cardholders based on analysis of their monthly expenditures. A widely quoted example of predictive analytics insight is the Diapers and Beer sales corelation. A grocery chain uses Predictive Analysis to analyze local buying patterns. They discovered that when men bought diapers on Thursdays and Saturdays, they also tended to buy beer. Further analysis showed that these shoppers typically did their weekly grocery shopping on Saturdays. On Thursdays, however, they only bought a few items. The retailer concluded that they purchased the beer to have it available for the upcoming weekend. The grocery chain could use this newly discovered information in various ways to increase revenue. For example, they could move the beer display closer to the diaper display. And, they could make sure beer and diapers were sold at full price on Thursdays.

#### The Business Analytics Framework

As we think about the utilization of Business Analytics, we must give consideration to people, processes, and technology – especially if we're considering BI for the enterprise. Gartner, the consulting firm, defined a Business Analytics framework several years ago in order to provide a blueprint for success, particularly for small and midsize organizations getting started with BA. A key benefit of the framework is "to surface key decisions, integration points, gaps, overlaps and biases that business leaders may not have otherwise prepared for" when getting started with BA. The framework, without going into a lot of detail, defines the people, processes and technologies that need to be integrated and aligned to take a more strategic approach to business intelligence, analytics and performance management (PM) initiatives particularly when considering an enterprise approach. Gartner recommends that organizations should use the framework to develop a strategy and an implementation plan, and to surface key decisions, integration points, gaps, overlaps and biases that business leaders may not have otherwise prepared for. Gartner also points out, that a portfolio of information management, analytic and decision-making capabilities will be needed to meet the diverse requirements of a large organization.

Again, the intent of the framework is simply to illustrate graphically all of the components that must be considered including people, processes, and technology when considering Business Analytics. And, there is no single or right instantiation of the framework; different configurations can be supported by the framework based on business objectives and constraints.

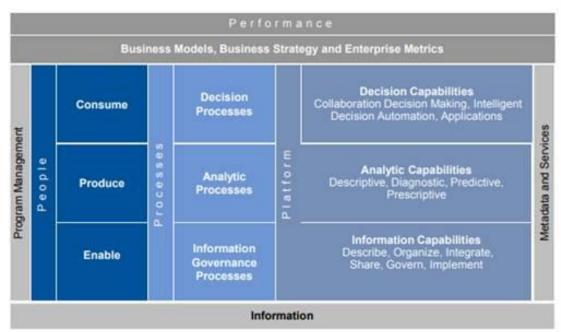


Figure 3: Gartner Framework for Business Analytics

### Section **3** What is Business

### Intelligence?



In its most basic form, Business Intelligence (BI) is the process of turning data into "actionable" results. BI is about understanding the facts – and the relationship between the facts – in a way that guides decision-making and action. Data is everywhere but unless it is motivating enough to take action, it is in essence, only informational and useless.

Gartner, the global IT consulting firm, defines "BI" as an umbrella term that spans the

people, processes and applications/tools to organize information, enable access to it and analyze it to improve decisions and manage performance.

With Business Intelligence, we can discover actionable trends that have been hiding amongst millions of data rows and business processes.

Business Intelligence:

- focus is on retrieval and delivery of data
- monitoring and identifying exceptions
- limited variability, ambiguity, uncertainty
- reporting, dashboards, scorecards...

Business intelligence (BI) software allows organizations to tap into their many databases and deliver easy-to-comprehend insight to management, employees, and other key stakeholders. BI software -- query, reporting, analysis, scorecards and dashboards — is already being used by thousands of companies to find new revenue opportunities, reduce costs, reallocate resources, and improve operational efficiency. The most widely used BI tool in the world is Microsoft Excel.

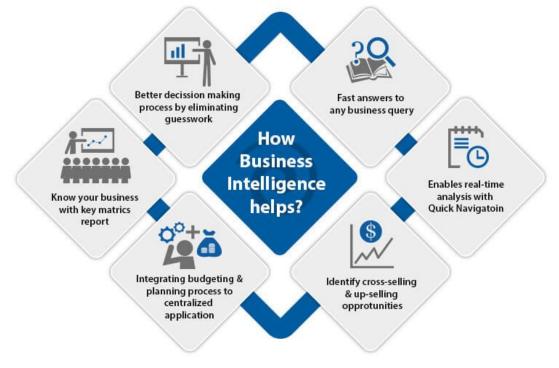


Figure 4: Benefits of Business Intelligence

And finally, BI allows us to do the different forms of Business Analytics discussed previously.

### How can Business Intelligence Benefit My Organization?

BI offers tools to manage the impossibly large amount of data available to an organization. This includes data previously isolated in silos across the enterprise. In addition, BI tools can now allow integration with data from and other sources *outside* the organization boundary. When properly implemented and understood as an organizational philosophy, BI enforces data standardization and integration, offering a view of the organization that is panoramic and that was previously unobtainable. With such a view, new insights into operations and performance can emerge and that may result in better decisions and eliminate problems such as:

- You can't make the best decisions to drive higher performance because you don't understand the Why behind current results.
- Meetings bog down in multiple versions and interpretations of the truth.
- Current reports are too complex for action; have too much data and not enough actionable information; tell inconsistent stories about your organization or business unit. Analyzing performance on key business drivers is near impossible.

In short, BI is about information analysis. A database pulls together information from the different parts of your business, then applications convert that raw data into reports, charts, and other analytical tools to provide insight. The benefits of this insight include:

- It's much easier to make informed decisions.
- It improves the efficiency of business operations.
- It can enhance the quality of customer service.

These are not small achievements. They are the key factors to business success and prosperity. Attempts to analyze data without BI can be clumsy. For instance, information is often tabulated on Microsoft Excel spreadsheets. It is time-consuming collecting the data and tedious putting it together in a way that's easy to grasp. What's more, the results are not always accurate or insightful. While Microsoft Excel has many excellent uses, it's like using a hammer when you need a jack hammer. For bigger tasks, like taking an organization to the next level, you may need bigger, better, faster, and more efficient tools.

#### The Differences between Business Intelligence and Business Analytics

Business Intelligence (BI) and Business Analytics (BA) are similar, though they are not exactly the same. Business Intelligence involves the process of collecting data from all sources and preparing it for Business Analytics. Business Intelligence is more of a first step for organizations to take when they need the ability to make data-driven decisions.

Business Analytics, on the other hand, is the analysis of the answers provided by Business Intelligence. While Business Intelligence answers what happened, Business Analytics answers why it happened and whether it will happen again. Business Intelligence includes reporting, automated monitoring and alerting, dashboards, scorecards, and ad hoc query; Business Analytics, in contrast, includes statistical and quantitative analysis, data mining, predictive modeling, and multivariate testing. Today, when you hear the term Business Intelligence, it normally means all of the above capabilities.

### The Stages of Business Intelligence

We all use Business Intelligence concepts in one way or another, an everyday example being a financial report such as a bank statement. The level of Business Intelligence maturity depends on organizational goals for turning data into actionable results. In doing the research for this whitepaper, I came across the Affirma Business Intelligence maturity curve. Affirma is another BI consulting company. I like the maturity curve, because for some organizations as an example, application specific reports may be sufficient. However, what the curve illustrates, is that as an organization matures their Business Intelligence practices, the more benefits and investment return will occur.

The five stages of the Affirma Business Intelligence Maturity Curve are:

- 1. **Application-Specific Reporting** most business software applications have built-in reports to provide statuses and/or insights into actionable data. Example, the County's Human Resources (HR) Application has built into it a number of application specific reports including our SAP system
- Data Analysis Tool application-specific reporting is not sufficient to answer all business inquiries and additional analysis is required, often times through exporting data into a tool such as Microsoft Excel. As mentioned earlier, the most widely used BI tool is Microsoft Excel.
- 3. **Visual Data Analytics Software** data analysis is completed, but the information needs to be analyzed beyond the capabilities of the data analysis tool. A Business Intelligence solution such as Microsoft Power BI or SAS can help prepare intelligence visualizations and dashboards.
- Advanced Technology Implementation

   This Business Intelligence solution creates stunning data visualizations using

prepared data, but there is often an additional need for historical reporting, adhoc analysis, and scheduled automated refreshing of data. Adding some additional technologies provides the ability to analyze multiple perspectives or slices of data at one time.

5. Fully Integrated Business Intelligence System and Process – This Business Intelligence solution provides insights into your organization's data, but is essential when there is a need for self-service reporting. Employees want to analyze information on their own with minimal IT support, and advanced methods for storing changes to a centralized data repository – sometimes referred to as a data warehouse.

As an organization or department, you may use the graphic in Figure 5 to assess where you are on the maturity curve today and what are your business goals.

### How does Business Intelligence Work?

Business intelligence (BI) provides a spectrum of broad range analytical applications, including collaborative BI, mobile BI, open source BI, SaaS (software as a service) BI,

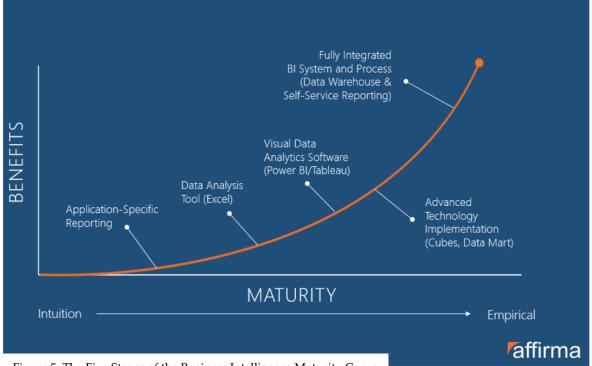


Figure 5: The Five Stages of the Business Intelligence Maturity Curve

operational BI and real-time BI. The technology is not just about gathering intelligence but about making sense of data in a way that can be quickly grasped.

This is accomplished through visualization applications for creating infographics and designing charts (see Figure 6). BI also offers dashboards, as well as performance scorecards. In essence, key performance indicators and business metrics are much easier to understand when displayed as visualized data.

The diagram below attempts to summarize in a very simple pictorial how BI works starting with the different data sources on the left (data moves from left to right). Data from disparate sources is *extracted*, *transformed* and *loaded* (data preparation) into different technologies (data infrastructure) where it is at the beck and call of users via a friendly intermediary BI software layer (right most block) that provides the actionable intelligence needed (via reports, dashboards, etc.) to make data-driven decisions (example the Budget Dashboards that have been produced by the Budget Office using a tool called PowerBI). The goal being where users across the enterprise access the same store of uniform, transformed data,

Data	Data	Data	Business
Sources	Preparation	Platform(s)	Intelligence
Data ERP CRM CRM CRM CRM CRM CRM CRM CRM CRM CRM	Data Modelling     Data Analysis     System Analysis       Meta Data Repository     Data Architecting       Z O 너 너 첫 실 Ω 더 너 Z I     첫 너 것 U	Data Warehouse Data Warehouse Data Mart Data Mart	Dashboard   Dashboard   Dashboard   Data   Data   Reporting   Big Data Analytics Big Data Data District Control D

Figure 6: Components of Business Intelligence

enabling better insight and action. This uniform, transformed, consistent data requires data governance. Data governance will be discussed in more detail in a future white paper.

### Section **4** Getting Started with

**Business Intelligence** 

Business Intelligence (BI) is not a single piece of software or even a suite of software to crunch data (or big data sets). Instead, it is an umbrella term that includes best business practices, software, infrastructure, and any other tools to optimize decision making and enhance performance. Now that you are familiar with BA and BI, the stages of BI, and the different types of business analytics, you may be asking the question, how does my organization leverage BA and BI to become more data-driven in order to drive effective decision making.

> The intent of this section is to provide some very basic information to help guide the thinking around the use of BA and BI, starting with an assessment of your information needs, some basic data considerations to keep in mind, and concluding with some important thoughts around business strategy.

### Information Needs Assessment

Any of the following signs could indicate that information needs and opportunities in your organization are outstripping the solutions currently at your disposal:

 Your organization has lots of data, but little information. Information is data that has been converted into useful insights, forecasts, and recommendations.
 You are not getting what you need from the Application Specific reporting capabilities from the systems being used within your organization.

3. You have hit a spreadsheet wall. Many organizations start with Excel or another spreadsheet application to hold and analyze their data. However, this

approach can rapidly become unmanageable, as larger datasets and files start to choke the spreadsheet software. Attempts to break datasets down into smaller chunks may simply push organizations into departmental data silos that prevent good business insights from being generated or shared-across the enterprise.

- 4. Joining data from different sources is a headache. Even simple differences in the way two departments fill out spreadsheets with similar, but not identical data (for example, HR and Finance each with their own subsets and formats of employee information) can make it hard to combine the spreadsheets for analysis.
- 5. Your data visualization lacks insight. To tell a useful story, data visualization must use metrics and indicators that are directly relevant to a business. Simply totaling rows or columns and making a bar chart or a pie chart may not be enough to tell you if your organization or the enterprise is doing well or at risk, or may lack the intuitive impact of key performance indicators that a good business intelligence solution can produce.

### **Data Considerations**

If you're strictly looking at utilizing a BI solution just for your departmental data, understanding data complexity (data structure, data size, data type, data sources, etc.) is very important. Example: let's say you're only looking at Risk Data and you would like to get some visualizations, dashboards, and more advance reporting capabilities, then the considerations here may not be as complex as if you were looking to combine data from multiple sources.

If however, the organization is looking at building an enterprise BI solution, a fully integrated BI Solution and Process (see Figure 1), which is the long-term goal of Durham County Government, then many of the criteria identified above (data structure, data size, ...) must be considered in mapping out an approach to BI.

Understanding and evaluating the complexity of the data is a key step in mapping out an approach to BI. Below are some examples to explain what we mean by evaluating the complexity of the data.

- 1. **Data structure**. Data from different sources relating to the same subject may be structured differently. In the example above of the HR and Finance departments holding employee information, HR might use several spreadsheets for employee personal details, job responsibilities, and qualifications, where Finance only uses one to record insurance, benefits, and similar data. In the different spreadsheets, employees might be listed by grade, or by department, in overall alphabetical order, with initials only, or with both given and family names, and so on. This is a simple example. Other differences in data structures between business groups can be significantly more complex.
- 2. **Data size**. Data may come in gigabytes, terabytes, or petabytes. However, overall volume is not the only consideration. Data may also be organized into thousands or millions of rows, columns, and other dimensions, needing correspondingly powerful solutions to analyze and compare, dimension by dimension.
- 3. **Data sources**. The more data sources there are (see Figure 6), the higher the chance of differences in internal data structures and formats, or of data that has no specific format. Data from the different sources must be brought together and harmonized in one location to ensure comparisons and analyses are "like to like".

The above are just a few data considerations that must be taken into account. Others include data type, query language, data detail, and data growth rate. This should also include creating a plan for data storage. Are the data sources going to remain disparate? And lastly, clean data in, clean analytics out. It's that simple. Cleaning your data may not be quite as simple. But it will help ensure the success of your BI.

Summarizing, the need for utilizing a business intelligence solution to handle complex data may become obvious in simple ways. A current lack of actionable insights and difficulties in combining multiple spreadsheets are just some examples. And understanding and evaluating the complexity of your data against the right criteria will help to determine business requirements, capabilities, and resources required to get started with Business Intelligence.

#### **Business Strategy**

Clearly defined business strategies and objectives are critical to the success of any BI and analytics initiative. Below are 5 key points (and there are many others) to consider and keep in mind:

- 1. Organizations should know or have some idea of what business insights they want, and which ones are most important.
- 2. It is highly recommended that organizations focus on the business problem first, then on data. Identify a clear business problem first, what metrics you want to analyze, and then where to get the data.
- 3. Ensure key stakeholders are involved from within and across the organization (if building an enterprise BI solution). By involving a range stakeholders you can ensure you cover the three broad classes of business intelligence users: strategic, tactical and operational. These different users' types will need customized solutions. Understanding who will use the data and for what purposes can show the type of information needed and its frequency, and help guide your decision making.
- BI is not just a technology solution. IT should be involved to ensure governance, knowledge transfer, data integrity, and the actual implementation. But every stakeholder and their respective business areas should also be involved throughout the process.

5.Go into the process with eyes wide open. When you have the right BI solution, it is easy to identify trends, pitfalls and opportunities early on. But implementing the right solution isn't always easy. Actually, it usually isn't. We are going to be honest here, even the best BI software needs some initial heavy lifting to maximize its potential. If you go in with the right mindset you will be prepared to address issues like complicated data problems, change management resistance, waning sponsorship, and user adoption challenges. Reminding stakeholders, and yourself, of the pain points that necessitated BI will encourage the process forward. It will be worth it.

Again, we've provided some very basic considerations that must be taken into account when considering BI and analytics. These are important to ensure an organization does not end up with data silos.

The graphic below, Figure 7 attempts to summarize from left to right, with a bit more detail, our attempt here to identify some key considerations when considering BI and analytics.

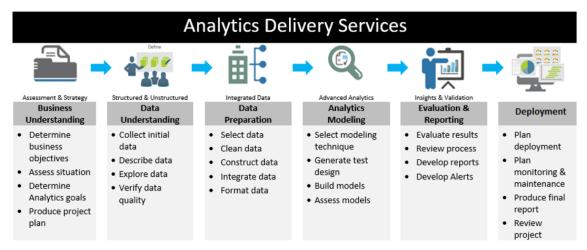


Figure 7: Analytics Delivery Services



The intent of writing this white-paper was to provide a short 3-to-5 page introductory-level overview of Business Analytics (BA) and Business Intelligence (BI). As you can see, the paper turned out much longer than planned however I hope the paper provided an understanding of the basic fundamentals of BA and BI, and some basic considerations for thought when thinking about BI readiness, whether within your organization or across the enterprise.

If you have read this whitepaper and would like to sit down with someone to talk further about how you get started with Business Intelligence, please do not hesitate to reach out to me or submit an IS&T project request form through the IS&T service desk. Our goal is to empower individuals and departments with the tools necessary to conduct their own BI, referred to in the industry today as selfservice BI. Self-service analytics allows organizations to bring business intelligence capabilities to users at all levels. Even with Self-Service BI however, it requires the right guidance as indicated in this paper to build-out a successful BI approach.

And finally, I want to thank all of those who contributed to this whitepaper including our Budget Department who is leading with turning data into information through the work they are doing with business intelligence. They are also a good resource here within the County to talk with regarding their approach to BI.

Thank you for taking the time to read this paper.