DO YOU THINK? OR DO YOU KNOW? PART II

The EA Value Chain, The Strategic Intent Domain, and Principles

INTRODUCTION

In the first of this series, the concepts of business intelligence and business analytics (BI/BA) were defined and presented as necessary ingredients for improving government operations. The terms *analytics* and *fact-based decision* making were the predominant terms used to describe the universe encompassing BI/BA. Those terms will continue to be used throughout NASCIO's series on analytics. Maturity models were presented that help describe the journey for ongoing learning and increasing levels of sophistication that should be anticipated. Recommendations were listed that focused on opening the discussion across government and assessing current capabilities.

In Part II of this series we continue to lay the ground work for thinking about analytics with additional foundational concepts. First, analytics must be *managed at an enterprise level*. An enterprise framework is necessary for achieving that end. Analytics has had a presence in state government for some time. However, it has been isolated, uncoordinated, disconnected and unmanaged from an *enterprise perspective*. This has led to isolated investment, point solutions and a disparity in process and tools. Diversity and complexity in anything will drive up the cost. This diversity in investment needs to be rationalized and optimized. The state CIO plays a critical role in leading such an effort and evangelizing the value of managing analytics as an enterprise-wide, shared capability. Proper use of analytics does not always involve additional investment in new analytics tools. For example, state government has in place one of the most important enablers of analytics—geospatial information systems (GIS). However that investment has not been fully exploited. Visualization of facts and outcomes can effectively communicate, develop understanding and inspire commitment.

NASCIO Staff Contact:
Eric Sweden
NASCIO Senior Enterprise Architect
esweden@AMRms.com

NASCIO represents state chief information officers and information technology executives and managers from state governments across the United States. For more information visit www.nascio.org.

201 East Main Street, Suite 1405
Lexington, KY 40507
Phone: (859) 514-9153
Fax: (859) 514-9166
Email: NASCIO@AMRms.com

NASCIO
Series on Analytics

As with any state government investment, investment in analytics must be founded on the state enterprise architecture. That architecture exists – whether it is documented, actionable, dynamic and up to date, agile, understood and exploited for effective government is another question. NASCIO has defined *enterprise architecture* as a *management engineering discipline that presents a holistic, comprehensive view of the enterprise including strategic planning, organization, relationships, business process, information, and operations. Enterprise-wide* initiatives must be managed within the framework of *enterprise architecture*. The NASCIO Enterprise Architecture Value Chain is provided as a tool for thinking about analytics at an enterprise level. To further describe this enterprise view, a rendering of the strategic intent domain is presented for the purpose of showing how analytics touches virtually every element that comprises the formulation and execution of government strategy. Secondly, an early activity that will drive an enterprise analytics program is establishing the *principles* that will guide the application and investment in analytics across the enterprise. Principles are foundational concepts that drive thinking and conduct. A list of candidate principles is provided which creates a starter list for state government. Principles are important elements of the business architecture layer of the state government enterprise architecture. Principles should be created very early in the process of developing the business architecture and operating discipline for any initiative *including* the development of an analytics capability.

Future issue briefs in this series will provide the connection to project management, discuss the "futures" for analytics, describe the architecture of the business intelligence competency center (BICC), and provide additional references to successful analytics programs.

There have been extensive conversations regarding the use of *analytics* across state government. The ongoing fiscal stress has prompted states to dig deeper into the data stores to discover hidden relationships and opportunities. One example of this is the Louisiana Statewide Fraud Detection System initiative which will employ predictive analytics, neural networks, social networking, data mining and text mining to uncover fraud and abuse. One of the benefits of the proposed system is increased amounts of revenues recovered. Initiatives like this are taking shape across the country as a strategy to reduce the cost of government by reducing the cost of fraud, waste and abuse.[1]

The advent of performance measurement, accountability and data transparency initiatives has added to the dialogue. Elected officials, managers and other decision makers are asking:

- "How can analytics help reduce costs of government services?"
- "How can analytics improve complex decision making in government?"
- "How can we leverage predictive analytics in public safety to stop disasters and crime before they happen?"
- "Will there be unintended consequences to using analytics?"
- "Now that we have citizen access to all of this data, what do we do with it?"
- "What can I hope to gain from analytics?"

Some government executives are skeptical, particularly those that have had some level of success using intuition. But intuition is hard to pass on to successors. And, intuition is less effective when the emerging issues and the current environment differ significantly from the past. A balanced combination of intuition, experience and analysis lead to better decisions than what might result from applying any one of these alone.

Part of the rationale for analytics is the new *"connectedness"* that exists today. No enterprise, government or individual can act independently without affecting others. There

is a new, strong interdependence that demands greater consideration of the impacts on others when evaluating decision alternatives. In today's world, problems are more complex; there is more uncertainty in the world; and there is increased volatility in events which can trigger other events.

In this respect, decision makers are facing the most challenging time in history. Decision makers have learned that oftentimes delivery of a solution to one problem can create or elevate many more other challenges and problems. For example, in considering the use of predictive analytics in public safety such as the use of predictive policing, additional issues are raised such as privacy. In order to promote acceptance and adoption of predictive policing, the citizenry must be convinced that it will be employed in good faith with the goal of being less intrusive, not more intrusive. The outcome sought with predictive policing cannot be fully achieved without the community understanding of what predictive policing is, and how to actively participate so it will be effective in predicting and stopping crime before it happens.[2]

We use the term "decision maker" sometimes as if that is some nameless, faceless, "somebody else." *Decision maker means everybody.*[3] *Everyone in the government enterprise is a decision maker. Citizens are decision makers.* In today's environment, decisions have short, medium and long term effects. So, decision makers must have the necessary capabilities to ensure those decisions are *the right* decisions. Options must be evaluated with all the facts that are relevant and available. And, because nothing is certain, options must be evaluated with some level of understanding of the associated probabilities.

LINKING ANALYTICS TO ENTERPRISE STRATEGIC INTENT

Analytics has proved itself as an effective tool for decision makers to apply and direct limited resources. This is particularly true when analytics is applied with direct "line of sight" traceability to the strategic intent of the enterprise. The following are examples of government employing analytics to support and fulfill the goals, objectives and outcomes established by policy makers and executive management. These examples will demonstrate the important connection between strategic intent and enabling capabilities in analytics.

The State of Florida Department of Juvenile Justice has the following mission.

> To increase public safety by reducing juvenile delinquency through effective prevention, intervention and treatment services that strengthen families and turn around the lives of troubled youth.[4]

In achieving that mission, the department is working hard to reduce the recidivism of juvenile offenders. The department is employing business analytics and predictive analytics to evaluate individual juvenile offenders to determine what programs and interventions are most likely to be effective on a case by case basis. Predictive analytics are applied using a host of factors that accurately evaluate the likelihood of long term success in applying early

Analytics

Government organizations and agencies don't necessarily compete, but they use analytics to enable and drive their strategies and performance in increasingly volatile and turbulent environments.

– "Strategic Use of Analytics in Government"
T.H. Davenport, Babson College and S. L. Jarvenpaa, University of Texas at Austin [5]

intervention approaches. Past offense history, home life environment, gang affiliation and peer associations are evaluated in order to better understand and predict which youths have a higher likelihood to reoffend and which youths are highly likely to successfully reenter society without committing crime. The intended outcome is to reduce recidivism in the juvenile justice system, divert juvenile offenders from entering the adult corrections system, to ensure the state has done everything possible to help these youths become and remain law abiding citizens, and not compromise public safety.[6] The department is applying *analytics* to evaluate an existing situation, account for trends and the impact of those trends, and develop mission-aligned strategies that ensure long term intended outcomes.

In light of the current economic crisis, states are looking very seriously at early release programs.[7] However, states must also evaluate the risks associated with *each* individual inmate to determine the best candidates for *intervention* and/or *early release*. States must ensure that dangerous repeat offenders are not put back on the street. Early release programs must not include those who will strike again and eventually reenter the corrections system. Errors in judgment in identifying candidates for early release cannot be quantified in terms of the cost to society, current victims, and potential future victims of crime. Therefore, careful application of analytics and ongoing evaluation of those analytics, and the selection process is absolutely necessary to ensure states understand the factors that determine what candidates can be successfully reintroduced to society, and what individual assistance will be needed to ensure long term success. Once the process is established for evaluating and selecting candidates, it must be consistently followed. Bypassing, or short-cutting an effective evaluation process can have devastating effects on public safety and public confidence in an early release program.[8]

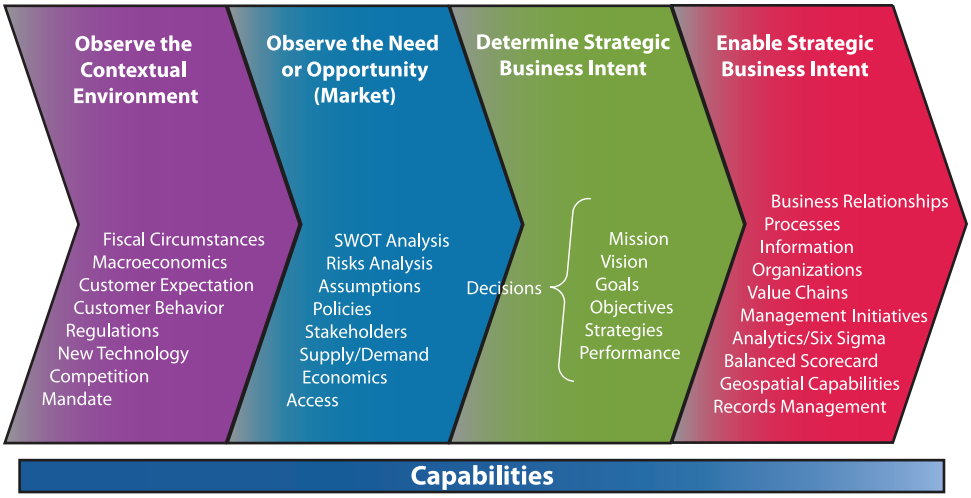
These are just a few examples of government effectively employing *analytics* and *fact based decision making*. These examples also demonstrate the importance these government entities place on *linking analytics to government strategic intent*. In the following pages we'll discuss linking business intelligence and business analytics to enterprise strategic intent.

THE ENTERPRISE ARCHITECTURE VALUE CHAIN

The NASCIO Enterprise Architecture (EA) Value Chain was referenced in **Part I**. *The EA value chain is one rendering of the thought process for managing the enterprise.* We'll employ this value chain in this *issue brief* as a framework for beginning to uncover *the guiding questions* state government must formulate and ask. Those questions will lead to identifying the key performance indicators state government must care about. Those key performance indicators can then guide the application of business intelligence and business analytics. Business intelligence (BI) and business analytics (BA) are relevant within every chevron presented in the NASCIO Enterprise Architecture Value Chain.

As described in this model, the enterprise architecture for any enterprise must be *fluid*. Therefore, the relevant business intelligence and applied analytics will be fluid as well. Each of the chevrons is dynamic – continually changing through time. The effects of the environmental context on needs and markets are continually changing. As needs and markets change, so do priorities which then affect *strategic intent*. Therefore, strategic intent is dynamic and must be continually evaluated for relevance and currency.

FIGURE 1: THE NASCIO ENTERPRISE ARCHITECTURE VALUE CHAIN[9]



EXAMPLE QUESTIONS STIMULATED ALONG THE EA VALUE CHAIN

1. OBSERVE THE CONTEXTUAL ENVIRONMENT [1st chevron]

- Reflecting on current circumstances in the world surrounding the enterprise, government strategists formulate questions that can guide the visioning and the modeling of their blueprint for the future enterprise.
- ***What is currently going on relative to:***
  - global economy
  - national economy
  - monetary policy
  - fiscal policy
  - state economy
  - national security
  - healthcare
  - education
  - employment
  - public safety
  - environmental health
  - weather
  - …?

2. OBSERVE THE NEED OR OPPORTUNITY (MARKET) [2nd chevron]

- Within the context of the relevant environment, seek to understand:
  - citizen needs
  - national security needs
  - market opportunities
- ***What is currently going on relative to:***
  - citizens in general
  - families
  - unwed mothers
  - orphans

Visual Analytics

"Visual analytics are valuable because the tool helps to detect the expected, and discover the unexpected. Visual analytics combines the art of human intuition and the science of mathematical deduction to perceive patterns and derive knowledge and insight from them. With our success in developing and delivering new technologies, we are paving the way for fundamentally new tools to deal with the huge digital libraries of the future, whether for terrorist threat detection or new interactions with potentially life-saving drugs."

– Jim Thomas, NVAC Founding Director[10]

- children in high risk situations
- gifted children
- high achievers
- low achievers
- unemployed
- under-employed
- elderly
- farmers
- blue collar workers
- white collar workers
- educators
- technology
- local economies
- rural communities
- urban communities
- weather
- …?

3. DETERMINE STRATEGIC BUSINESS INTENT [3rd chevron]

- Once government strategists have identified needs or markets, they must clearly articulate state government's *strategic intent* relative to those needs or markets and within the context of the relevant environment *(which continues to change)*.
- ***What are we going to do about what we've just learned relative to the role of:***
  - federal government
  - state government
  - local government
  - citizens
  - industry
  - nonprofits
  - …?
- ***What are we attempting to achieve relative to:***
  - outcomes sought?
  - ***How feasible are these outcomes:***
    - economically
    - technically
    - organizationally
    - culturally
    - …?

4. ENABLE STRATEGIC BUSINESS INTENT [4th chevron]

- Once government has decided on its intent, it must begin identifying those capabilities that must be employed or further leveraged to enable that intent.
- ***What will it take to accomplish what we think we need to do? What capabilities are required?***
  - How are those capabilities performing? Are they working?
  - Are these the right capabilities?
  - Do we need to make any changes related to:
    - organization
    - process
    - technology
    - partnering
    - …?

The elements in this strategic visioning and modeling cycle are fluid, dynamic, constantly changing. Consequently, *the EA Value Chain must be continually revisited* to **learn**:

- Are we right?
- Are we relevant?
- Has the environment changed? How does it affect us?
- Are there new external influences / vectors coming at us?
- Do we need to make a course correction?
- Might we trigger other events by making a course correction?
- How effectively are we responding to or influencing the contextual environment?
- Are looking far enough into the future?
- Are we adapting appropriately – both reactively and proactively?

There are a lot of questions that must be asked and answered. Guiding questions like these will stimulate the enterprise business strategists' thinking, visioning, and modeling that is required to *continually / iteratively* traverse the value chain. The government enterprise must indeed be a "fluid" that is adapting and changing itself, and even *influencing* the contextual environment. Elements in each of the chevrons are continually changing. Strategy then must be reexamined and adjusted to ensure that it is relevant. In order to behave fluidly, the enterprise must develop and evolve the necessary business intelligence and business analytics (BI/BA) to formulate and answer these and many other questions — from a *historical perspective*, and more importantly from a *predictive perspective*. As the enterprise anticipates and changes, so must the questions, and the necessary BI/BA to evaluate and answer those questions. As conditions change along the value chain, the answers become time dependent.

STRATEGIC INTENT

Within the "Strategic Intent" (3rd) chevron, there are associated BI/BA for virtually every element. Appendix D as an example rendering of a meta model for strategic intent. Appendix E presents an example of applying analytics. *Note: These renderings show only some of the significant relationships that exist.* A myriad of questions and metrics can be associated with virtually every element on this rendering.

The growth of information has added to the challenge. Fortunately, in parallel with more complex problems, and the proliferation of vast amounts of data, many new capabilities have emerged for harvesting information, evaluating circumstances, performing simulations, and predicting the future with a fairly high level of confidence. The more complex the circumstances, and the higher the impact of a decision, the more necessary it is to ensure that relevant business intelligence has been gathered. Further, it is necessary that the appropriate level of analysis has been applied to that intelligence to create the understanding required to evaluate choices and risks, decide on a course of action, and ultimately execute on that course of action.

Before management can begin to identify and sort out the relevant information, it must

- Determine and carefully articulate the *outcomes* it seeks
- Understand the *critical success factors* for those outcomes
- Identify the *key performance indicators* that describe the health of those critical success factors
- Evaluate the *risk* equation for potential outcomes.

As management evaluates desired outcomes, the critical success factors that ensure those outcomes, and the network of other influencers, it must articulate the *questions* that

Lassoing Unpaid Taxes in Texas

The state of Texas has established *Statewide Strategic Planning Elements* for State Government.[11] The state's *vision statement* presents the *goals* for state government service areas and requires the definition of metrics that describe the performance of those service areas. Since 1998, state agencies are required to demonstrate support of statewide goals in their budgets by clearly showing *traceability* from their *strategies* to one or more of these *goals*. The Comptrollers Office clearly demonstrates that traceability through its published strategic plan.[12] The office is responsible for closing the gap between taxes owed and taxes paid. The Comptroller's Office is employing *business analytics*, particularly *predictive analytics* to deliver on its agency *goal* Expeditiously manage the receipt and disbursement of state tax revenue. The agency employs analytics to identify non-permitted business as well as unpaid taxes. It has recovered over $400 million in unpaid tax revenues since the inception of its use of predictive analytics in 1998.[13]

management must be able to answer in order to accurately evaluate its options – i.e., where clearly it must make choices, and its mandates (where it is required to act).

- What are the relevant threats to the outcomes it seeks?
- What are the relevant opportunities that can be harvested or leveraged to help achieve the outcomes it seeks?
- What constitutes its portfolio of choices of markets and needs?
- What constitutes its portfolio of capabilities that must be employed?
- What is the potential for successfully achieving intended outcomes?
- What is the status of the critical success factors and influencers associated with those outcomes?

Evaluation of these questions will lead to identification of the information and the underlying *data* that management will ultimately need to access in order to make its decisions. This step leads to the development of *business intelligence*. Over time the outcomes may change, and the critical success factors and influencers for those outcomes may also change. That drives potential change in the necessary *key performance indicators* employed to judge progress toward strategic goals and objectives. Therefore the necessary information and underlying data will change as well, creating a dynamic, fluid reality for the decision maker. Because the various dimensions are indeed continually changing, *predictive modeling* of those changes becomes necessary. The level of sophistication of the decision model will typically reflect the number, the complexity, and the magnitude of the potential outcomes. *Predictive analytics* is used to test "what if" scenarios. It involves the creation of a model that is continually tested and modified.[14]

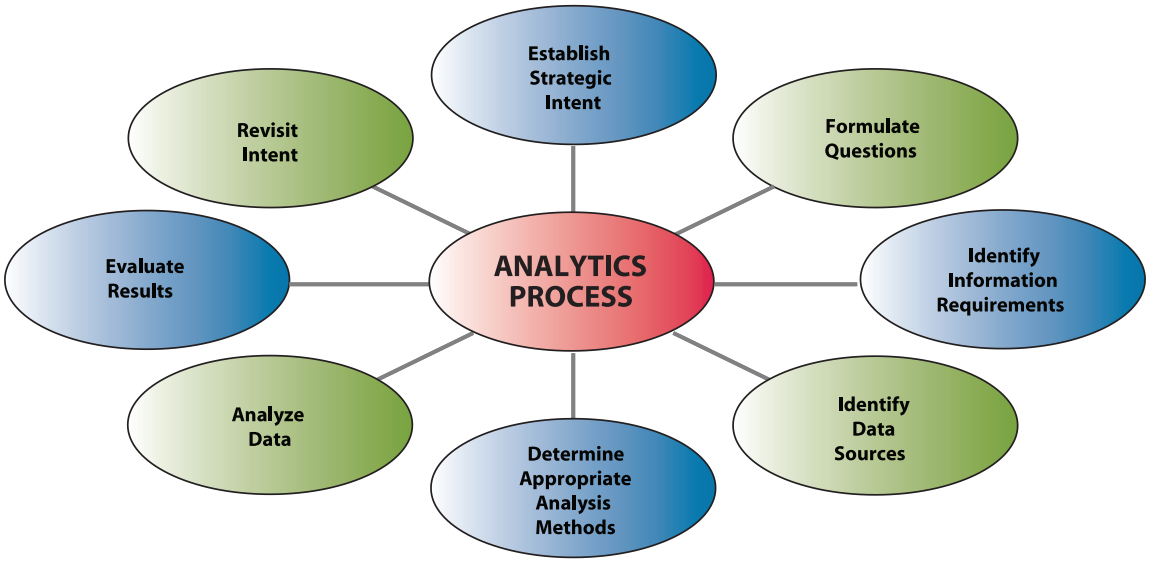
Day-to-day routine decisions do not require highly sophisticated decision models. When relationships and influencers are linear or are relatively close to linear, then simpler decision models can be employed. More sophisticated models are necessary when encountering:

- nonlinearity,
- high complexity,
- increased number of possible outcomes,
- increased magnitude of outcomes – *both good and bad*,
- number of influencers,
- variability of influencers,
- number of secondary impacts / effects.

Higher levels of sophistication include stochastic models where individual factors have associated probability distributions. The more factors with such distributions, the higher the complexity of the decision model. Decision makers must be able to assess the complexity of a situation and the associated outcomes in order to determine what level of BI/BA is appropriate. Decision makers must also be able to judge *what tools* are most appropriate for each circumstance. This may require employing expert assistance to determine what methods, procedures, and tools should be used.

Not all questions or issues warrant high levels of analysis. Some questions can be evaluated intuitively, or may warrant more of a "back of the envelope" analysis in evaluating alternatives and selecting a course of action. Analysis

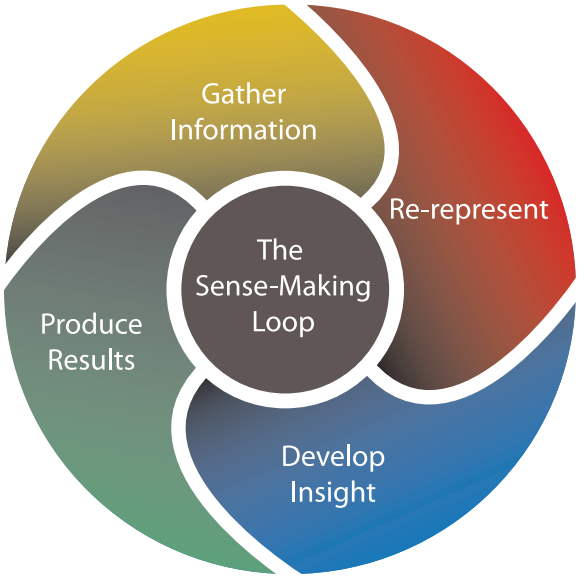
FIGURE 2: ANALYTICAL PROCESS



paralysis must be avoided. Just because something *can* be analyzed with sophisticated tools doesn't mean it *should* be. Judgment must be applied in evaluating, prioritizing, and optimizing the application of the vast array of analytical methods and procedures.

Whether sophisticated tools are used, or more intuitive approaches are applied, the general process of decision making is well presented by the National Visual Analytics Center (NVAC) as follows.[15]

FIGURE 3: THE ANALYTICAL REASONING PROCESS (NVAC)



Memphis Blues on Analytics is No Jive

The city of Memphis has established its mission *to provide responsive and cost effective services through the enhancement of employees, neighborhoods, youth and business development*. The city's defined vision is *to be recognized globally as the City of Choice in which to live, learn, work and recreate.* This vision and mission are presented by the city's executive management as the primary drivers for operations and budgetary decisions and priorities. Its strategies are developed to match today's economic environment.[16] Public safety is a high priority for Memphis and is a significant contributor to its mission and vision. Achieving that *strategic intent* has included the use of *predictive policing strategies*. The city of Memphis has demonstrated the effective use of predictive analytics to determine where crime is most likely to occur and to assign officers accordingly. The program titled Blue CRUSH (Criminal Reduction Utilizing Statistical History) began as a pilot in 2005. Utilizing *predictive policing*, the city has been able to reduce violent crime and property crime by almost 16 percent *without* increasing its staff of police officers. The city's predictive policing initiative has reported a return on investment of 863 percent and average annual savings of $7 million.[17,18] These are impressive numbers especially in view of the current economic down turn. In these challenging economic times, the city of Memphis has demonstrated effective deployment of limited resources using analytics.

DATA AND MORE DATA – BUT HOW MUCH IS REALLY USEFUL?

The feedstock for analytics capabilities is *data and information*. Some information is valuable to the decision maker. Other information will contribute nothing to understanding a particular problem – *and may actually confuse the process.* The decision maker must be able to *sort and pull* the information that is valuable, and recognize what information is irrelevant. This exercise most often requires expert help. Having a lot of information, or access to a lot of information, will not of itself ensure quality decision making. And *quality decision making* is exactly what government must achieve.

As stated in "Part I" of NASCIO's series on analytics, the amount of information is growing so fast that the challenge is not only access to information, but the challenge of evaluating what information is most relevant and useful. It is forecasted that the amount of information traveling across the internet will reach 667 exabytes by 2013.[19] (An Exabyte is 10^{18} bytes. 5 exabytes = all the words ever spoken by human beings.[20]) For example, in predictive policing, how much information can police officers realistically absorb and analyze in order to effectively predict where crime may occur next.[21]

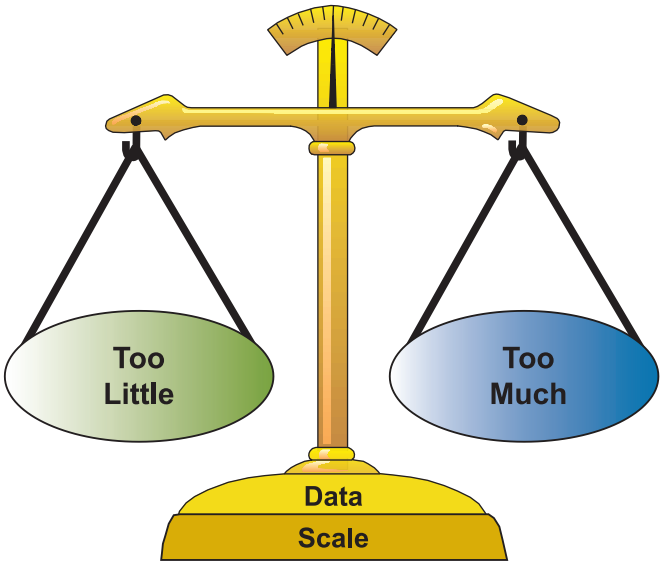
Data is the representation of facts as text, numbers, graphics, images, sound or video. Technically, data is the plural form of the Latin word datum, meaning "a fact."

Information is data in context. Without context, data is meaningless; we create meaningful information by interpreting the context around data. This context includes business meaning, format, timeframe, and relevance to the given purpose.[22]

Management must be able to envision and articulate the *outcomes* that it is trying to achieve, and the *critical success factors* for those outcomes. Otherwise, analytics and analytics software tools will be of little value. Management must also be able to identify the *key performance metrics* that will measure what it defines as success. An early question in the BI/BA process is: Can management currently identify its top key performance indicators (KPIs) which are tied to its strategic objectives? If not, then business analytics and executive dashboards will do little to help the organization evaluate its progress and success in achieving the goals and objectives under its mission.[23]

Early efforts at business analytics might focus on enhancing existing / historical reports with visualization such as graphs, charts, maps, etc. Early efforts at identifying KPIs might focus on reporting only what is *easiest to measure*. These may be acceptable beginnings that build experience while enhancing existing reporting. However, they fall short of the purpose of business analytics and do not provide its full benefit. To be of use and value, KPIs must be those metrics which most impact decision making and the resulting business performance. Visualization of existing reports only *enhances existing reports* and *may* provide better communication of historical results. The question for management is, **"Are these the right reports?"** Effective application of business analytics will ultimately uncover what

FIGURE 4: THE DATA PARADOX



constitutes the *right* reports. This is a function of defining and asking the *questions* that are necessary for evaluating progress toward achieving the organization's strategic intent.

In developing proper analytics, management should follow this sequence:

1. Identify the *outcomes* it seeks.
2. Identify the *questions* that must be asked to evaluate progress toward those outcomes.
3. Identify the *information* it needs to conduct an evaluation.
4. Identify the underlying *data* it needs to develop *relevant* information.

All of these relationships are intended to evaluate the organization's performance in achieving desired outcomes. Further, influencers (contributing factors) must be continually evaluated as well. *Analytics are iterative. One question / answer cycle leads to another.* This is a natural way to expand the portfolio of analytical models for state government. As stated previously, the relevant contextual environment is continually changing. That dynamic has an impact on understanding the need or market, which in turn affects the relevant government strategy. Therefore, the various inputs of relevant information will change, and the frequency of those inputs can change over time. There will also be increasingly more sophisticated methods for analyzing data and information to achieve better understanding, and more accurate predictions. These dynamics must continually be managed through proper *change management* that involves all stakeholders.

Data Paradox

"The situation is paradoxical: at the same time people complain about too little and too much information. We cannot solve the first problem by simply producing 'more' information because this would increase the second problem. Nor can we simply cut down on the amount of information produced because this would increase the first problem. So where do we find the solution? The answer is structure. Information is only valuable to the extent that it is structured. Because of a lack of structure in the creation, distribution, and reception of information, the information often does not arrive where it is needed and, therefore, is useless."

– Koniger, P. & Janowitz, K. (1995)[24]

Leadership

"Leadership is based on inspiration, not domination; on cooperation, not intimidation."

– William Arthur Wood [25]

PRINCIPLES

Most effectively implemented initiatives begin with a *clear vision*. That vision includes the articulation of *foundational principles* used to guide and govern the initiative. The same holds true for effectively planning and implementing BI/BA capabilities.

Candidate principles for establishing capabilities and capacity for BI/BA:

- All data is not necessarily useful data. Relevancy of data must be evaluated. As well, some data that may not be relevant to the current analysis, but it may uncover new necessary analysis. For example, outliers, or data values out of range in a data distribution may indicate new influencers or new effects. The analysis must include asking why these circumstances exist in the data.

- At the highest level of abstraction, data must be viewed as a state government asset that is *owned by the state*. Maintain an enterprise view of data and information. Government is the keeper and maintainer of the data. Ownership roles and stewardship roles must be defined relative to data sets in order to establish accountability for data quality. At the same time, data must be appropriately available to the entire enterprise.[26, 27]

- Measure what is *important*, not necessarily what is easy to measure.

- Analytics must be driven by the *questions* that ultimately map to *strategic intent*.

- Predictive capabilities that enable government to *prevent* undesirable circumstances is far and away more valuable than even the ability to efficiently *react* to undesirable circumstances. At the same time government must evaluate risks and the technical and economic feasibility of prevention capabilities with intended outcomes.

- Maintain objectivity. Different analyses of the same data can provide contradictory conclusions and recommendations – *without error or malicious intent*. It is extremely important to carefully apply analytics that are free of bias and to take account of confounders.[28]

- Analytics is only as effective as the quality of the underlying data and information feedstock. The quality of the analysis inherits the quality of the underlying data.

- *Organizational excellence* is dependent on *management excellence*. Management excellence is dependent on *effective decision making*. Analytics supports, but does not create, effective business processes and effective decision making.

- *Tools* are not the starting point for business analytics. Effective analytics is not dependent or driven by technology. It is driven by how well management and the culture embraces *fact based decision making*.

- Effective analytics is a *learned capability*. Organizations that embrace analytics must also embrace the expectation that their mastering of analytical skills will be iterative and progressive. An effective analytics program is grown by the community that *uses* the analytics, rather than being imposed from the outside.

- A simple model that the audience understands *will be used* and *will provide value*. In contrast, a more "correct" model that is more complex, and that the decision maker does not understand — *and therefore does not use* — will never *provide value*. Start with simple questions and limited scope. Expand over time.

- *Every* organization requires BA/BI capabilities. The sophistication of those capabilities depends on the complexity of the challenges it faces.

- Not all business / government issues require or warrant the same level of analytics. Avoid analysis paralysis. Oftentimes "back of the envelope" analysis is sufficient.

- *Executive support* is essential to initiating and sustaining an analytics capability. Anticipate that analytics is resource intensive.

- Secure the support of business subject matter experts. Commitment from subject matter experts is necessary to ensure the correct data is made available and is understood and analyzed properly.

- Human recognition, understanding and decision making is greatly enabled through *visual* means. Visual approaches should be exploited as much as is possible.[29]

- Data must be managed within established data management ethics. Those ethics must be defined to protect individuals, government, and industry. For example, established ethical standards will help prevent unauthorized international movement of data; help prevent unintended, unauthorized data recombination; and encourage social and political accountability.[30]

- Performance metrics should be used to inspire not punish. Organizations motivated by inspiration will sustain a long term growth. Punitive metrics will work only *a little* for a *short time*, and will create an environment of mistrust. Without mutual trust, the enterprise will eventually fail. An inability to inspire is a management issue, *not* a workforce issue.[31]

CALLS TO ACTION FOR THE CIO

- Obtain *executive partner sponsorship* so that a state government initiative carries executive support from the state CIO and other high ranking government executives.

- Build a *business case for BI/BA* that highlights how outcome reporting can bring more focus to how government operates. Present simulations that demonstrate the use of predictive analytics in public safety, environmental protection, public health, economic development, education, transportation, or revenue. Show how predictive analytics can provide government with the information it needs to enable an appropriate spending mix to achieve desired outcomes.

- To ensure state government BI/BA gains adoption, investment and application, establish a *governance, risk assessment, and compliance structure* for managing business processes for BI/BA. The governance should included decision rights, defined outcomes, critical success factors, key performance indicators, and risk management. Decisions related to business process automation

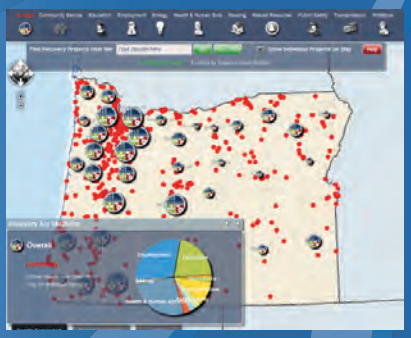
Making the Queen City Safer through Analytics

Each year, the Charlotte City Council has the overall intention of maintaining and enhancing the quality of life for its citizens. In that effort it establishes priorities for focusing the investment of the city's resources. There are currently five *Focus Areas*, which become the basis for budget decisions and operational programs. The City establishes *Focus Area Plans* to support these *Focus Areas*. Focus areas are reviewed annually for accountability and relevancy to the needs of the community. The Charlotte-Mecklenburg Police Department (CMPD) has primary responsibility for the *Fiscal Year 2010/11 Community Safety Focus Area*. *Governance* for this focus area includes the City Council Community Safety Committee. Strategies for delivering on this focus area include organizational collaboration with city, county, state and federal agencies; proactive intervention to reduce loss of life and property; and partnering with the citizens of Charlotte and Mecklenburg County to stop crime before it happens. Capabilities to support these strategies include information technology, geographical information systems (GIS), and *predictive analytics*.[32] Any initiatives undertaken by the CMPD are traceable back to its department strategies which were formulated to support the focus areas established by the City Council. The CMPD continually monitors leading indicators, information from neighborhoods, and reports from field officers to continually evaluate placement of resources. CMPD monitors established *key performance indicators* such as crime incidence statistics to evaluate effectiveness in delivering its public safety services.[33] CMPD continues to review and evaluate technologies and business disciplines that will support its public safety strategies which are linked to the city's priorities.

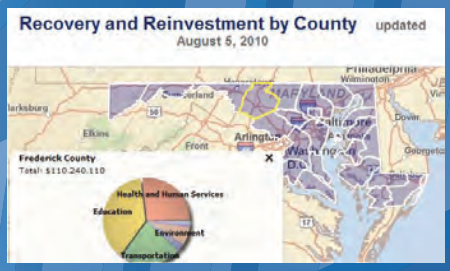
Mapping the Recovery Funds in Maryland and Oregon

The states of Oregon and Maryland are employing GIS and business analytics to report the allocation of funds it has received through the American Recovery and Reinvestment Act of 2009.[34, 35] Oregon is employing GIS and analytics to provide detailed reporting by location on funds allocated and funds actually spent. This provides transparency, accountability and line of sight traceability from recovery funds expenditures to the state's project categories.

State of Oregon "Track The Recovery Funds" Web Tool



State of Maryland StateStat Website Provides Interactive Reporting



and enhancement will require endorsement and commitment from state agencies.

- Use the attached meta model of the Strategic Intent domain, or a similar model, as a *visual communication tool* in working with business and information technology stakeholders to develop an enterprise direction and investment strategy for BI/BA. Work with your enterprise architect to develop the relevant strategic intent meta model for your state. Populate and maintain that model.
- Evaluate other *organizational and process models* to determine where business analytics could be used to enhance existing processes.
- Adopt business analytics and performance metrics internally following the principles outlined in this issue brief.
- Establish an enterprise expertise center – a *Business Intelligence Competency Center* (BICC) – to sustain and evolve the practice of business analytics.
- Work with your enterprise architect to *evaluate process and data architectures* to uncover areas in government that could benefit from BI/BA.
- Take account of the potential for BI/BA when *valuing* data, information and knowledge *assets*. Evaluate the potential for repurposing of these assets for consumption by other agencies and citizens.
- Work with stakeholders to establish *principles* for BI/BA. Review the principles presented in this issue brief as a starting point. Principles should include appropriate ethics for managing data and application of analytics.

APPENDIX A – ACKNOWLEDGEMENTS

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APPENDIX B – RESOURCES

The National Association of State Chief Information Officers (NASCIO)

NASCIO's mission is to foster government excellence through quality business practices, information management, and technology policy.

Founded in 1969, the National Association of State Chief Information Officers (NASCIO) represents state chief information officers and information technology executives and managers from the states, territories, and the District of Columbia.

NASCIO provides state CIOs and state members with products and services designed to support the challenging role of the state CIO, stimulate the exchange of information and promote the adoption of IT best practices and innovations. From national conferences, peer networking, research and publications, briefings and government affairs, NASCIO is the premier network and resource for state CIOs.

References are available at:
www.nascio.org/publications

Enterprise Architecture & Governance Committee resources and links at:
http://www.nascio.org/committees/ea/

Balanced Scorecard Institute

The balanced scorecard is a strategic planning and management system that is used extensively in business and industry, government, and nonprofit organizations worldwide to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals.
http://www.balancedscorecard.org

The DAMA Guide to the Data Management Body of Knowledge (DAMA-DMBOK)

The "body of knowledge" about data management is quite large and constantly growing. the DAMA-DMBOK Guide provides a "definitive introduction" to data management. It defines a standard industry view of data management functions, terminology and best practices, without detailing specific methods and techniques. The DAMA-DMBOK is not a complete authority on any specific topic, but will point readers to widely recognized publications, articles and websites for further reading.
http://www.dama.org/i4a/pages/index.cfm?pageid=3364

The W. Edwards Deming Institute

The W. Edwards Deming Institute® is a nonprofit organization that was founded in 1993 by noted consultant Dr. W. Edwards Deming. The aim of the Institute is to foster understanding of The Deming System of Profound Knowledge™ to advance commerce, prosperity and peace. http://deming.org/

The Government Accounting Standards Board

The GASB is the independent, not-for-profit organization formed in 1984 that establishes and improves financial accounting and reporting standards for state and local governments. Its seven members are drawn from the Board's diverse constituency, including preparers and auditors of government financial statements, users of those statements, and members of the academic community. More information about the GASB can be found at its website www.gasb.org.

Strategy Driven Execution Blog by Nenshad Bardoliwalla

Blog by thought leader Nenshad Bardoliwalla, co-Author of Driven to Perform: Risk-Aware Performance Management From Strategy Through Execution. This blog focuses on analytics, business intelligence, enterprise performance management, governance, risk, and compliance. Mr. Bardoliwalla also participates in a multiple thought leader blog space titled **Enterprise Irregulars**. The specific blog cited below presents a multi-part series on the Unified Performance, Risk, and Compliance Process Model.
http://bardoli.blogspot.com/2010/01/unified-performance-risk-and-compliance.html

The National Visualization and Analytics Center

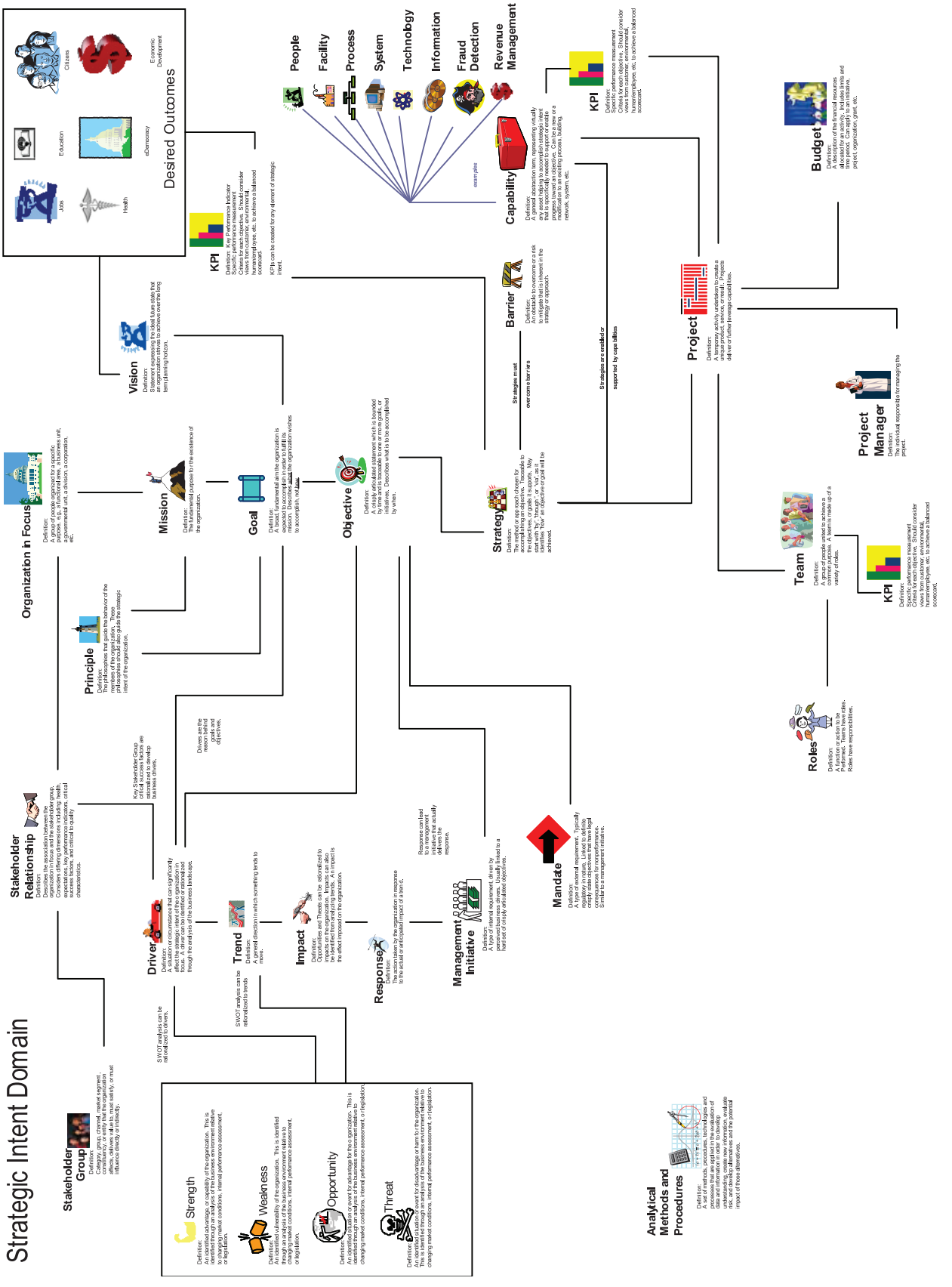
The National Visualization and Analytics Center is a national and international resource providing strategic leadership and coordination for visual analytics technology and tools. NVAC supports the Department of Homeland Security's mission to secure our homeland and protect the American people.
http://nvac.pnl.gov/

A Periodic Table of Visualization Methods

The Periodic Table of Visual Methods, Version 1.5, provides a listing of various analytical methods with examples. This is comprehensive reference with examples of every tool listed.
http://www.visual-literacy.org/periodic_table/periodic_table.html

APPENDIX C – THE STRATEGIC INTENT DOMAIN META DATA MODEL

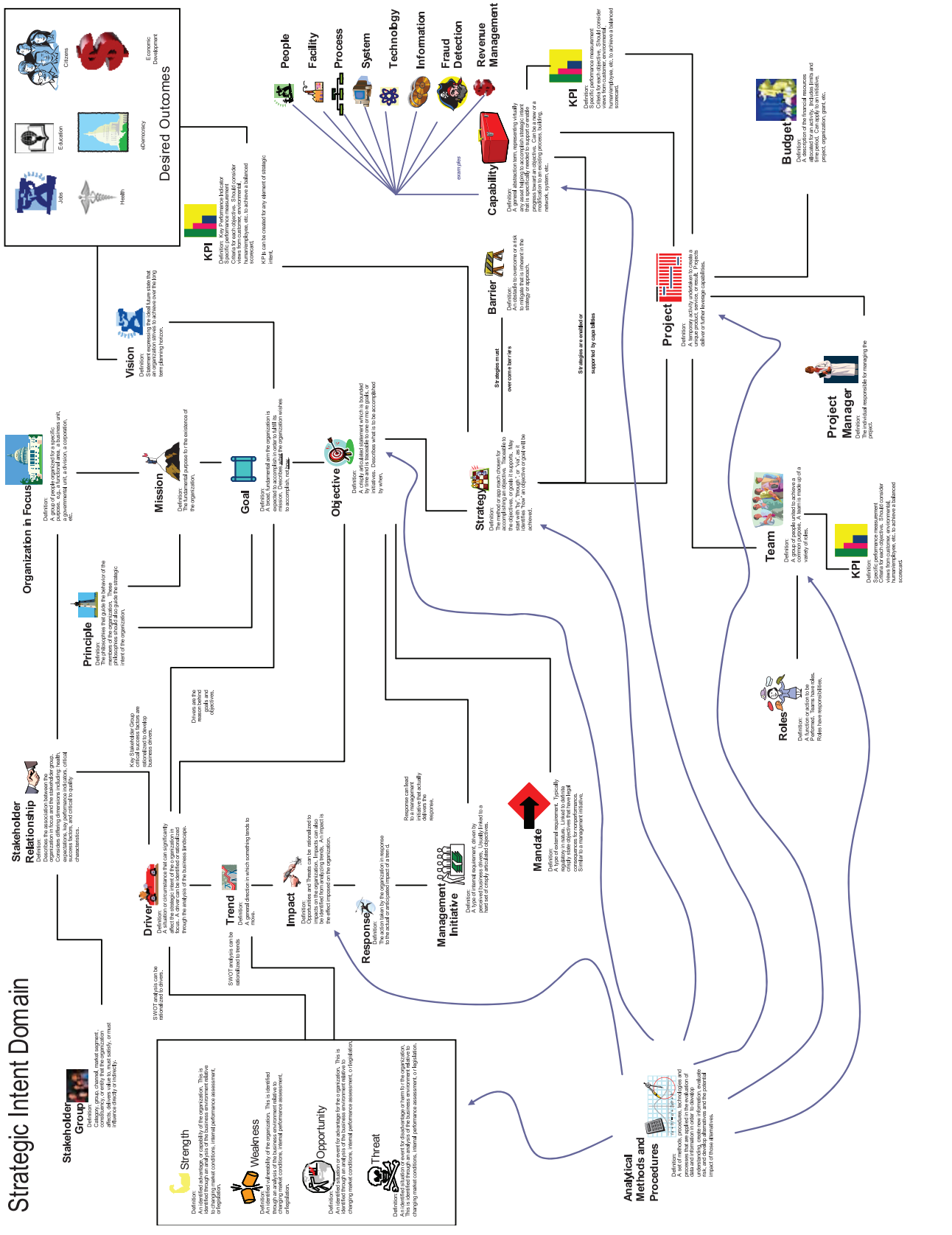
CONCEPTUAL REPRESENTATION ONLY



APPENDIX D – THE STRATEGIC INTENT DOMAIN META DATA MODEL

EXAMPLE TOUCH POINTS WITH ANALYTICS

CONCEPTUAL REPRESENTATION ONLY



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> ***Bias*** *- Bias is a term which refers to how far the average statistic lies from the parameter it is estimating, that is, the error which arises when estimating a quantity. Errors from chance will cancel each other out in the long run, those from bias will not.*

Example: The police decide to estimate the average speed of drivers using the fast lane of the motorway and consider how it can be done. One method suggested is to tail cars using police patrol cars and record their speeds as being the same as that of the police car. This is likely to produce a biased result as any driver exceeding the speed limit will slow down on seeing a police car behind them. The police then decide to use an unmarked car for their investigation using a speed gun operated by a constable. This is an unbiased method of measuring speed, but is imprecise compared to using a calibrated speedometer to take the measurement.

Morton, R.F., Hebel, J.R., McCarter, R.J., A Study Guide to Epidemiology and Biostatistics, Aspen Publishers, Gaithersburg, MD, 1989, ISBN: 0-8342-0157-7. p.22.

Confounding *- Confounding is a general term for the effect of a "third variable" that has not been taken account of in the statistical analysis. Confounding occurs when this third variable is distributed differently across the levels or strata of a factor of interest. When it occurs, techniques must be employed to separate out the effect of the confounder from the effect of the factors of interest.*

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