Understanding Business Analytics

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What is in a name? Operations Research, Business Analytics, Decision Analytics, Business Intelligence, Advanced Analytics, Data Science... to a certain degree, to label is to limit - if only intellectually. Parody ensues when one follows those whom one is leading. Just as it is difficult to move forward while looking backwards, there is a predictably, cyclic gyration as the government attempts to capture what industry is doing. By the time bureaucracies institutionalize it, industry has long since moved on. The real element of tragedy here is not that this is inefficient, but rather that it is entirely unnecessary. The semantics of distinction convey a difference which is seldom meaningful. One current manifestation of this general phenomenon can be observed in regards to the term Business Analytics.

> *"The limits of my language are the limits of my mind. All I know is what I have words for."* - Ludwig Wittgenstein

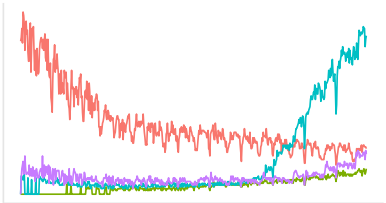

Figure 1: Google trending of daily searches for various analytic disciplines

Defining Business Analytics

One could say, if absolutes were appropriate, that making better decisions is an objective of *"every"* organization. But what exactly does this mean? Theoretically, better decisions will translate into improved organizational performance; however, it is often difficult to discern the underlying reasons for organizational performance. To gain insight into past execution and to inform future decision-making, organizations explore and investigate past performance by harnessing data and analytic techniques.

> *"Organizations – large and small, private and public, for-profit and not-for-profit – are using analytics to unlock the value in their data, model complex systems, and make better decisions with less risk."* - The Institute for Operations Research and the Management Sciences (INFORMS)

This scientific process of transforming data into insight with analytics for better decision-making has taken the form of various definitions. Regardless of the specific definition, they all revolve around the concept of aggressively leveraging data and analytic techniques to create evidence-based decision making. This concept of data-driven decision making has clearly been shown to improve organizational performance[1].

Although analytics have been used in organizations for a variety of reasons for quite some time; ranging from the simple (generating and

The following are examples of definitions for various business analytic disciplines:

Operations Research: the application of scientific principles to business management, providing a quantitative basis for complex decisions.

Decision Analysis: a systematic, quantitative and visual approach to addressing and evaluating important choices confronted by businesses

Business Intelligence: a variety of applications used to analyze an organization's raw data.

Advanced Analytics: a broad category of inquiry that can be used to help drive changes and improvements in business practices.

Data Science: the study of where information comes from, what it represents and how it can be turned into a valuable resource in the creation of business and IT strategies.

[1] see McAfee & Brynjolfsson (2012), Chen, et al. (2012), Brynjolfsson, et al. (2011), and Trkman, et al. (2010) to name a few

reporting metrics & scorecard performance) to the more advanced (mathematical & statistical modeling), many decision-makers still underutilize the available information and power of analytics because it is either not simple enough or arrives in an inconvenient form[2,3]. This highlights the fact that, historically, the link between an organization's analytic activities and decision-making has been obscure. With no defined process in place, quantitative approaches have been insufficiently integrated with the decision-making process.

As a result, Davenport[4] states that Business Analytics (BA) can be defined as the broad use of data and quantitative analysis for decision-making. It's the clearly defined process that integrates analytic techniques to make better decisions. It's the concept of using data and applying sound analytic methods to empower decision-makers in improving organizational performance. Multiple definitions of BA have been suggested and they all clearly state that BA is a process that methodically integrates the use of analytics and data in the decision-making process; it's the link between analytics and decisions.[5]

[2] Bartlet, R., 2013. "A practitioner's guide to business analytics: Using data analysis tools to improve your organization's decision making and strategy." McGraw-Hill.

[3] Davenport, T., et al., 2010. "Analytics at Work." Harvard Business Review Press.

[4] Davenport, T., 2010. "The new world of business analytics." International Institute for Analytics.

[5] The following are definitions of BA:

BA refers to the skills, technologies, practices for continuous iterative exploration and investigation of past business performance to gain insight and drive business planning.

BA is the practice of iterative, methodical exploration of an organization's data with emphasis on statistical analysis and is used for data-driven decision making.

BA is the use of analytics, data, and systemic reasoning to make business decisions

Establishing a Business Analytics Process

The goal of a business analytics process is to turn data into information, information into insight, and then use this insight to make better decisions. But what exactly does this process entail?

> *"When business analytic capabilities are integrated into business processes, decisions are more repeatable, scalable, traceable and accurate."* - Gartner, Inc

Many view the process of analytics as a black box and are primarily concerned only with the end product. They view it as a back-office activity being performed by "quants" using overly sophisticated math. This common view leads to a polarized process in which interaction between analysts, domain experts, and decision-makers are sparse. This leaves the analysts with little understanding of how best to model the business problem at hand and leaves the domain experts and decision-makers questioning if the model really addresses their problem. To establish a true business analytics process an organization needs to understand the analytics process and analysts need to understand the business and decision-making process.

To understand better, we can segregate the BA process into two components: the scientific method of applying analytics and the integration of this analytic approach into the decision-making process.

How well these two components are orchestrated will determine the level of success an organization has in establishing a BA process.

> *"It is seen as an end-to-end process beginning with identifying the business problem to evaluating and drawing conclusions about the prescribed solution arrived at through the use of analytics."* - INFORMS

The Analytic Method

The analytic process is really just about applying the scientific method from a quantitative analysis perspective to help solve a problem. Every problem being addressed from an analytic perspective, regardless of size, complexity or sophistication, should follow an organized rhythm that embodies the seven basic steps that follow.

Step 1: Framing the business problem could be the most critical part of the process. This step requires full involvement of all key stakeholders to outline the business problem or decision being addressed, identify the constraints involved, define the insights that would benefit the decision-maker(s) the most, and identify how analytics and data could play a role (or if the problem is even amenable to an analytics solution). Most importantly, this step needs to gain a stakeholder agreement on the business problem statement outlining the above key points.

> *"Sound strategy starts with having the right goal."* - Michael Porter

Step 2: Now that the problem statement has been defined, this needs to be reformulated into an analytics problem statement. This process entails defining the key outputs required that will empower the decision-maker, proposing a set of drivers and relationships to the outputs, and outlining the assumptions. It's important that drivers and outputs defined in this step are based on the problem needs and not on current data availability.

> *"Business analytics starts with the business problem and then looks for the data. We must avoid a structure that shifts our business analytics' focus from seeking data based upon business needs to offering only solutions made possible by the data available."* - Randy Bartlett (A Practitioner's Guide to Business Analytics)

This step also needs to define key metrics of success. To truly understand if the analytic method applied resulted in improved performance an organization needs to define first how to measure and assess the results.

Step 3: The third step in the process is when the hands get dirty and the non-analytically charged tend to lose interest.

> *"Data! Data! Data! I can't make bricks without clay!"* - Sir Arthur Conan Doyle

Figure 2: The analytic Process

This step involves identifying and prioritizing data needs based on step 2, acquiring the data, assessing the integrity of the data by cleaning and preprocessing the data, and identifying initial trends and relationships. This step is fundamental in understanding the data and, although domain experts tend to become less interested as the technical analysis increases, it is paramount that they are involved to help put context around this data. This step should include documentation of the data extraction and early findings for reproducibility and also to share with domain experts who can provide more context around the findings. Step 3 can often lead the team to re-define the business and analytics problem statement.

Step 4: Now that firm understanding of the data underlying the business and analytic problem is in place, an analytic methodology that both fits the data and provides the outputs required by the decision-maker are selected.

Understanding, and even describing, all the analytic techniques available is an intimidating task. However, analytic techniques can be categorized into three broad buckets. No one type of analytic category is better than another and, in fact, they are often used as compliments to one another to provide a robust understanding of the problem.

Figure 3: Analytic categories

Descriptive analytics uses data aggregation and data mining techniques to provide insight into the past and answer: "What has happened?" This category primarily uses statistics and analytics[6] that describe the past and are often generated for reports and dashboards to create benchmarks and provide performance metrics.

Predictive analytic techniques[7] use knowledge, usually extracted from historical data, to predict future, or otherwise unknown, events. The goal is to understand the future and answer: "What could happen?".

Prescriptive analytic methodologies[8] not only look into the future to predict likely outcomes but they also attempt to shape the future by optimizing the targeted business objective while balancing constraints. Prescriptive analytics are used to advise on possible outcomes and answer: "What should we do?".

Although domain experts and key stakeholders will likely not understand the technical aspects behind the analytic techniques, it's still important that they remain involved in this step by understanding the basic logic of the possible analytic techniques and the outputs provided so that they can provide input into which techniques provide the decision-maker with the optimal insight to assist in the decision process.

Step 5: Once the analytic techniques are choosen, it's now time to develop the model(s). This step focuses on developing the model

[6] Includes sums, central tendencies, variances, percent changes, historical trends & patterns, correlations, etc.

[7] Includes parametric methods such as linear regression, hierarchical regression, activity-based costing, mathematical modeling; simulation methods such as discrete event simulation and agent-based modeling; classification methods such as logistic regression and decision trees; and artificial intelligence methods such as artificial neural networks and bayesian networks

[8] Includes optimization techniques such as linear programming, goal programming, integer/mixed-integer programming, and search algorithms; artificial intelligence optimization techniques such as genetic algorithms and swarm algorithms; and multi-criteria decision models such as analytic hierarchy process, analytic network process, multi-attribute utility and value theories, and value analysis.

structure; running, calibrating, and validating the model; and integrating the models if more than one is choosen and they feed into one another. A key component often overlooked in this step is to document the modeling process for reproducibility purposes.

Step 6: After the model has been developed to an adequate level of performance, the next step is to deploy the model to the user. The deployment process can take three general approaches:

1. Automated: Business rules and IT architecture is in place to allow for automated reporting. This is often the deployment process in place for descriptive analytics that provide automated reporting of sales, profits, complaints, etc.[9]
2. Cyclical: Models that are often used in a cyclical nature, or not requiring automated and real-time reporting, are often refined for production use. This usually includes creating a GUI[10] that allows the user to interact with the model in a simple fashion. These models are often used for what-if scenarios or in a continous manner by the decision-maker to analyze the identified issue.[11]
3. One-off: Many large investment decisions require an analytic model but are only used once. This can include re-location decisions, new product life cycle sustainment and cost forecasting. Often, these models are not deployed, rather, its only the results that need to be reported.[12]

[9] Air Force examples: REMIS reporting of flying hours & sorties, CRIS reporting of budget execution, D200 reporting of inventory levels

[10] General User Interface

[11] Air Force examples: ACS POM Prioritization model, Analysis of Mobility Platform (AMP) model, Customer Oriented Leveling Technique (COLT) model, Weapon System Enterprise Review (WSER) Dashboard

[12] Air Force examples: AF/IMSC installation selection, KC-46 cost estimate for POM decisions

Regardless of the deployment approach used, this step also includes delivering a report that provides background on the modeling process along with findings/results that provide the insights required by the decision maker as identified in step one.

Step 7: The final step is providing life cycle management of the model. If the model deployment approach was designed for an automated or cyclical approach then the model should be continuously reviewed for performance degradation, to quickly recognize and act on new opportunities such as new data or process options, and to determine when the model has outlived its original purpose.

Thinking of the analytic process in terms of these seven steps creates a comprehensive framework that enables more strategic thinking about analytics and how an organization can treat them as corporate assets. This framework focuses on the business problem to guide the analytic process and keeps the domain experts and key stakeholders engaged during the entire process.

The Decision Making Process

The second component required for the BA process is ensuring the analytic process is integrated into the decision-making process. To

truly put analytics to work in an enterprise, analytics needs to be an integral part of everyday business decisions and processes[13]. So although organizations will have a central department that specializes on analytics, more often organizations are starting to integrate analytic capabilities throughout their enterprise to make analytics part of their day-to-day processes in more domain areas.[14]

Although the Analytic process keeps domain experts and key stakeholders heavily involved, to become an analytical enterprise, analytics cannot be relegated to a few analysts in a central organization such as A9. Rather, analytical applications and tools must become pervasive throughout the Air Force enterprise. To achieve this, Gartner's business analytics framework[15] stresses the use of cross-functional teams throughout the enterprise. This is a common suggestion[16] that focuses on building "bilingual" teams with business/domain expertise along with highly trained analytic capabilities. These cross-functional teams have the expertise to develop the overall strategic plan and priorities for fitting analytics into the decision processes within their relevant business domain areas. They also manage the programs and analytic process that delivers the insights required, along with proper interpretation, for business decisions.

It is with this heavy focus of integrated analytics throughout the enterprise that creates an analytically focused organization basing decisions on data-driven evidence.

> *"If you can't measure something, you can't understand it. If you can't understand it, you can't control it. If you can't control it, you can't improve it."* - H. James Harrington

[13] Davenport, T., et al., 2010. "Analytics at Work." Harvard Business Review Press.

[14] For example, P&G has a statistics department but many of their statisticians are integrated into other departments to provide analytic support for decision processes (ie marketing department to build a tool to analyze increasing claim problems, R&D department to forecast new product profitibility potential, logistics department to create routing models, etc.)

[15] Chandler, N., et al, 2011. "Garnter's business analytics framework." Gartner, Inc.

[16] See Ayres, I. 2007. "Super Crunchers." Bantam; Provost, F. & Fawcett, T., 2013. "Data Science for Business." O'Reilly Media; Albright, S. & Winston, W., 2014. "Business Analytics: Data Analysis & Decision Making." Cengage Learning; Davenport, T. & Harris, J., 2007. "Competing on Analytics: The New Science of Winning." Harvard Business Review Press

Business Analytics in Industry

It is unlikely that many organizations have established an analytics nirvana that provides the perfect example of what Business Analytics should look like. However, examples are plenty to illustrate successful, and unsuccessful, integration of analytics into business decisions processes.

Successes

Successful integration of the analytics process in decision-making has countless examples. This is evident in numerous reports[17] that show that analytically focused organizations outperform those that rely less on analytics, conferences that focus on successful applications in business[18], and numerous advanced degree programs that focus on Business Analytics[19].

[17] McKinsey's analysis of more than 250 engagements over five years revealed that companies that put data at the center of the marketing and sales decisions improve their marketing return on investment by 15-20%. See footnote #1 for more examples.

[18] The "Successful Applications of Customer Analytics" Conference sponsored by Wharton School of Bus.

[19] Master of Science in Business Analytics at USC Marshall School of Business, NYU Stern School of Business, Kelley School of Business, etc.

Just a few examples of improved performance through Business Analytics includes[20]:

- Progressive Insurance began to incorporate analytic models in their underwriting process to predict the probability of accidents by customers. They found that consumers' credit scores was a surprisingly good predictor of the amount of accidents that a customer would have. This allowed decision-makers to provide more pricing options to customers, under-cutting the competition, and gaining market share of the personal auto insurance market.[21]
- Dell integrated driver analysis and competitive benchmarking to identify key factors that influence visitors' purchasing behavior. Through Bayesian modeling, regression modeling, and time-series forecasting, Dell created a more holistic buying experience for its consumers and increased conversion rates and order sizes leading to more than $140M in increased profit margin over two years.[22]
- Marriott International has expanded its optimization models originally used to optimize guest room prices to new areas such as conference facilities and catering allowing managers to maximize resource scheduling and pricing which has led to an increase in the actual revenues-to-maximum revenues ratio of 83% to 91%.[23]

[20] 100 more examples can be found at https://www.informs.org/Sites/Getting-Started-With-Analytics/Analytics-Success-Stories/Case-Studies

[21] Davenport, T., et al., 2010. "Analytics at Work." Harvard Business Review Press.

[22] https://www.informs.org/Sites/Getting-Started-With-Analytics/Analytics-Success-Stories/Case-Studies/Dell

[23] Davenport, T. (2006). "Competing on Analytics." Harvard Business Review. Retrieved from http://www.instare.com/pdf/Competing%20on%20Analytics.pdf

Failures

The goal of an organization should not be to just create an enterprise focused on analytics but, rather, to create an enterprise focused on doing analytics well. The same process and logic errors that cause people to err without analytics can creep into analytically-based decisions. The following are examples of errors caused by not methodically applying the analytic process previously discussed:

- A series of faulty assumptions in the analytical models used in the financial industry was a significant contributor to the recent financial crisis of 2007-2008. Mortgage lending models and credit default models were based on faulty assumptions of continuous increases in housing prices, liquidity in credit markets, and overrated securities. Countless investigations identified multiple problems with the analytics behind the financial industry at this time to include a lack of understanding of the models by top decision-makers, faulty assumptions biased by profit seeking, and lack of model validation[24]
- In 2003 NASA's space shuttle Columbia exploded upon re-entry. Although this accident was linked to physical damage to the shuttle, the Columbia Accident Investigation Board[25] identified "several intellectual failures in engineering analysis". First, they re-

[24] Lewis, M. (2011). "The big short: Inside the doomsday machine." WW Norton & Company; Hansell, S. "How wall street quants lided to their computers." New York Times. Retrieved from http://bits.blogs.nytimes.com/2008/09/18/how-wall-streets-quants-lied-to-their-computers/.

[25] Columbia Accident Investigation Board, Report, volume 1 (August 2003), p. 191.

ported that reliance on past success was often used as a substitute for sound analytical practices. Second, over-optimistic assessments were made with lack of reasonable analytic evidence. Finally, as information gets passed up the NASA organization hierarchy, from people who do analysis to mid-level managers to high-level leadership, key explanations and supporting information is filtered out by using insufficient reporting methods. Edward Tufte further explains this by illustrating the over reliance of PowerPoint reporting in the NASA organization rather than properly documenting the analytic process through technical reports.[26]

- In addition to the above process errors, excessive use of spreadsheet models can pose significant risks from human error as well. Examples include Fidelity omitting a minus sign on a net capital loss of $1.3B when cutting & pasting to a separate spreadsheet leading to an inaccurate end-of-year distribution announcement, a cut & paste error in a TransAtla spreadsheet that led to an over expenditure of $24M on hedging contracts, and a typo in a spreadsheet formula by the University of Toledo over-projecting enrollment along with $2.4M in unrealized tuition funding.[27] These errors help to emphasize the need for proper analytic processes which include significant technical review, validation, and a focus on reproducible analyses.

[26] Tufte, E. (2003). The Cognitive Style of PowerPoint. Retrieved from `http://users.ha.uth.gr/tgd/pt0501/09/Tufte.pdf`

[27] more examples exist at `http://www.cio.com/article/2438188/enterprise-software/eight-of-the-worst-spreadsheet-blunders.html`

Business Analytics in the Air Force

Business analytics is not new to the Air Force, we've just referred to it by different names... primarily just one... Operations Research. Operations Research was conceived in 1938 for the sole purpose of defending Britain against Germany air attacks but the scope and activities have since greatly expanded and in many cases resemble Business Analytics.

> *"[T]rained in the scientific approach and with the abilities to observe, to reason from observation, to practice with strict scientific integrity, and to relate cause to effect - fell the role of elucidating the facts of a situation and of offering advice."* Harold Larnder[28]

[28] Larnder's defined role of the first Operations Research analysts. Larnder, H., 1984. "The Origin of Operational Research." Operations Research. Vol. 32, No. 2

Historical Applications

The turning point of applying Operations Research to the wider scope that is military business operations occurred in 1940. During the French and German battles, Britain provided offensive military support. During this time, losses of British fighter aircraft assets were running at high rates and the French leadership was asking for more

fighter squadrons to provide support, which Churchill was likely to approve. British Air Chief Marshal, Sir Hugh Dowding, asked his handful of Operations Research analysts for any scientific analysis that could help inform this decision. A study was performed that analyzed the current daily losses and replacement rates to show how rapidly the fighter air power was being diminished; and that any increase in the loss rate would quickly reduce the fighter aircraft capability and strength to an unacceptable level. These findings were transferred to graphical form and presented to Churchill dissuading him from providing reinforcements to France.[29]

[29] Larnder, H., 1984. "The Origin of Operational Research." Operations Research. Vol. 32, No. 2

Since this time, the scope and practices of Operations Research have greatly expanded throughout the Air Force. Simply assessing historical applications within AFMC provides an appreciation of the scope of business functions analyzed and it also confirms that much of what HQ AFMC/A9A does can be considered Business Analytics.

> *"Our mission is to conduct Operations Research studies and analyses to quantify and add insight into resource issues of significant importance to the Air Force Materiel Command and the Air Force."* - Curtis E. Neumann, Chief of Management Sciences Division[30]

[30] HQ AFMC, Management Sciences Division. (2001). Fiscal Year 2001 Annual Report. Retrieved from O:\A9A\03 - Reading File\03-01 - Annual Reports

Just a few of the analyses resembling Business Analytics includes:

- Assessing whether demands for aircraft recoverable spares are either a function of flying hours, sorties, landings, or some combination of the three using regression analysis. This analysis helped decision-makers understand at what level these operational variables influence demand levels, which in turn helps to better plan inventory needs based on planned operational activities.[31]
- Evaluating the readiness implications of Asset-based versus Rqmts-based inventory approaches by applying a simulation model. This analysis identified how supply policy impacts asset leveling and availability at bases and provides decision-makers with an understanding of the pros and cons of each policy approach.[32]
- Developing an interactive tool that assisted supply chain managers in forecasting and establishing metrics for issue effectiveness, stockage effectiveness, and expected wholesale backorders. This provided supply chain managers with a tool that enabled them to develop well-founded forecasts for defensible metric targets.[33]
- Developing and deploying spares optimization algorithm models at two test bases resulting in a 60% decrease in MICAP hours. This led decision-makers to approving the expansion and implementation of this model to 13 additional bases across 6 MAJCOMs.[34]
- Providing AFMC leadership with a civilian pay and budget execution dashboard to track $2B civilian budget. This tool helped to

[31] HQ AFMC, Management Sciences Division. (1994). Fiscal Year 1994 Annual Report. Retrieved from O:\A9A\03 - Reading File\03-01 - Annual Reports

[32] HQ AFMC, Management Sciences Division. (1998). Fiscal Year 1998 Annual Report. Retrieved from O:\A9A\03 - Reading File\03-01 - Annual Reports

[33] HQ AFMC, Management Sciences Division. (2001). Fiscal Year 2001 Annual Report. Retrieved from O:\A9A\03 - Reading File\03-01 - Annual Reports

[34] HQ AFMC, Management Sciences Division. (2004). Fiscal Year 2004 Annual Report. Retrieved from O:\A9A\03 - Reading File\03-01 - Annual Reports

focus leadership on possible problem areas and led to decisions that improved execution by 6%.[35]

- Developing, deploying, and applying a Weapon System Sustainment risk model to the $15B WSS portfolio of 100+ programs. This objective risk assessment provided insight to decision-makers through multiple "what-if" scenarios in regards to $390M in budget cuts.[36]

[35] HQ AFMC, Studies and Analyses Division. (2009). Fiscal Year 2009 Annual Report. Retrieved from O:\A9A\03 - Reading File\03-01 - Annual Reports

[36] HQ AFMC, Studies and Analyses Division. (2013). Fiscal Year 2013 Annual Report. Retrieved from O:\A9A\03 - Reading File\03-01 - Annual Reports

Current Applications

Recently, the concept of Business Analytics appears to be catching on with organizations throughout the AFMC enterprise. As is often the case, outside organizations are requesting analytical support from HQ AFMC/A9A; however, what appears to differ is that these organizations know and understand that they want to develop their own analytic capability to integrate into their day-to-day processes but they don't know how. As a result they are asking for support from HQ AFMC/A9A to outline, develop and organize the protype of this organic analytic capability. Three examples help to illustrate:

The Air Force Installation Contracting Agency (AFICA) manages installation support contract spend totalling $10B in fiscal year 2013 across an enterprise of 161 installations. AFICA wants to establish a Business Analytics cell termed Business Intelligence Competency Center (BICC). The principal purpose of this center is to support contract spend category definitions, category analyses, category sustainment and post-initiative improvement activities, and on-going support activities. The AFICA BICC will be integrated into the strategic sourcing decision-making process and will provide the analytic process for installation-level contract spend analysis, benchmarking, metric development and analysis, and advanced cost analysis to relate contracted spend to causal factors and compare to industry standards.

Currently, the HQ AFMC/A9A office is working with AFICA to develop prototype research designs and analyses that will help define the type of analytic work that the BICC should perform to help inform AFICA decision-makers. This includes:

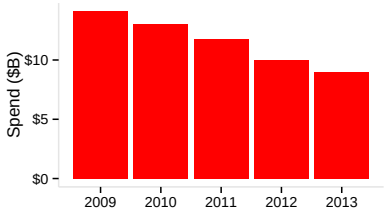

Figure 4: Obligations by Air Force installation-support contracting office

- **Frequency Analysis:** Develop a text data mining algorithm that analyzes contract descriptions and identifies the most frequent descriptors. This allows AFICA decision-makers to categorize and analyze their contract spend with more fidelity.[37]
- **Benchmarking and Performance Metrics:** Develop prototype benchmarking and performance metrics that allows AFICA decision-makers to compare contracted spend across Air Force installations

[37] ie: Rather than simply categorize contracts as "Vehicles", we can categorize Vehicle contracts for more specific purposes such as "Trailers", "Mobile Generators", "Trucks", "ATVs", etc.

and also against industry standards.

- **Predictive Analysis:** Identify potential drivers of contract spend categories and test for statistically significant relationships. This allows AFICA decision-makers to understand what is influencing contract spend and the cost savings that could be realized if these drivers can be controlled.
- **BICC Process Definition:** HQ AFMC/A9A will help to define the resources and competencies required to expand the prototype analysis into a fully sustained operation along with outlining a schedule of analysis and the business processes involved with the analytic cell.

The Centralized Asset Management (CAM) office manages a $15B portfolio of weapon system sustainment requirements across 100+ weapon systems. The requirements are developed by individual program offices in conjunction with the respective Lead Commands. CAM's role is to validate and fund the requirements, aligned to Air Force strategic priorities across 12 Service Core Functions. Today's CAM processes tend to have a program-centric focus, without the detailed analytic expertise and quantitative tools to optimize funds across the total enterprise. A Business Analytics cell would enable CAM to efficiently analyze a vast amount of historical and future data in order to generate insights which would inform decisions-makers at Air Staff on WSS support recommendations.

HQ AFMC/A9A has already been heavily involved in defining the resources required to sustain and manage this Business Analytic capability along with identifying the decision points that can be influenced by an integrated Business Analytics process. Currently, the HQ AFMC/A9A office is working with CAM to develop prototype research designs, analyses, and tools to help aid WSS support decisions and to establish an integrated Business Analytic capability. This includes:

- **POM:** Develop standard, repeatable process for analyzing WSS requirements in the POM and out-years, to include specific areas of notable growth by Program Group, weapons system type and commodity, along with a detailed comparison of similar systems. This analytic foundation will inform AF Senior Leaders of any foreseeable problems or notable trends that may impact the ability of the AF to continue to effectively sustain weapon systems in the future.
- **Execution Plan:** Develop a real-time, responsive analytical capability to assess the viability of the planned execution of WSS dollars in the near term execution plan. This will allow CAM to

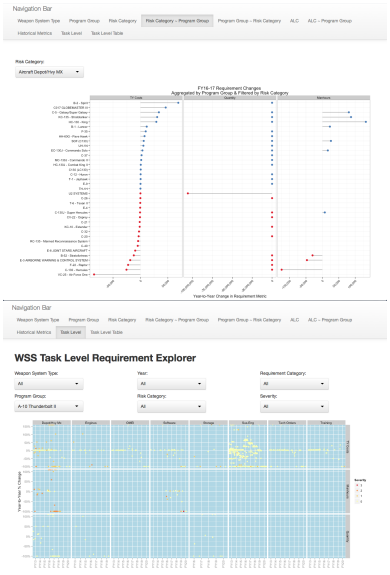

Figure 5: Snapshot of HQ AFMC/A9A's interactive CAM data mining prototype tool

proactively respond to any foreseeable issues/gaps in the execution plan by realigning funds to meet the most critical needs, potentially averting unmitigated disasters in the year of execution.

- **Risk Assessment:** Undertake a comprehensive analysis of the inputs, outputs and calibration of the WSS Risk Assessment model, to ensure that reported assessments accurately reflect the true risk being assumed in the weapon system sustainment portfolio. A detailed tracking of WSS risk from inception (POM) through planning and execution will provide CAM leadership with the information required to inform AF senior leaders of current or foreseeable issues and trends related to the ability of the AF to sustain weapon systems in the near and long term.
- **Fund Spread:** Use the Risk Assessment model to develop and assess the allocation of initial funds across the 100+ Program Groups within CAM. This will help ensure a reasonable, risk-based funding outcome aligned to AF priorities across programs and Service Core Functions, and will minimize the subsequent funding adjustments that may be required in the year of execution to mitigate foreseeable problems.

The Business and Enterprise Services Division (AFLCMC/HIC) coordinates the strategic sourcing of information technology (IT) services along with supporting IT governance policies. In May 2014 the Secretary of Air Force directed SAF/AQ to conduct a bend-the-cost-curve (BTCC) initiative on IT. Led by Maj Gen Craig Olson and Mr. Robert Shofner, market analysis revealed three primary recommendations, one of which stated that Business Analytics is the #1 way to reduce costs. As a result, they are attempting to establish a Business Intelligence IT Center of Excellence (BI²TCoE) to provide this Business Analytics capability with a goal of reducing IT spend by 10% by the fiscal year 2018 POM.

Currently HQ AFMC/A9A's role is as consultants to help AFLCMC/HIC establish this Business Analytics capability. AFLCMC/HIC has identified several areas of focus identified below. In addition, little information has been revealed on how the Business Analytic process will be sustained, managed, or integrated into the AFLCMC/HI business process; this is another areas where HQ AFMC/A9A's expertise could influence AFLCMC/HIC.

- **Data:** Identify the various sources of data available to feed into the analytic process. In addition, address any data quality and integrity issues. Thoroughly understanding the data available allows decision-makers to begin aligning currently measured information, and its insights, to key AFLCMC/HIC decision points.

- **Historical Trend Analysis:** Develop analytic process to understand historical demands, costs, and refresh cycles for IT acquisitions and services. This allows decision-makers to benchmark and compare across the enterprise to identify potential waste and efficiencies which provides target cost levels to bend the cost curve towards.
- **Trade-off Decisions:** Develop appropriate analytic processes to feed the governance process for trade-off decisions. Although vague at this time, this focus area could target similar analyses as the CAM Business Analytic process in which analytic processes allow for responsive capabilities in analyzing POM versus execution requirements, assessing risks, and optimizing current year funding profiles across the enterprise.

Towards an Analytical Enterprise

So, is this concept of Business Analytics really new to the Air Force enterprise. . . no. After all, we've been applying the analytic process to inform operational decisions since World War II, just under a different name. What is new is the interest of analytics being integrated into more areas of the Air Force enterprise. Rather than relying on a central department to be the sole analytic resource for the enterprise, individual Air Force domain areas see the value of integrating analytic capabilities into their own decision processes.

What is important is that, as an enterprise, we establish a common understanding of what this analytic process is and what it represents. That, as an enterprise we employ objective data and analyses as the primary guides to decision-making and that this requires a scientific method that is integrated into business processes. Although we must acknowledge that providing analytic facts does not necessarily lead to purely fact-based decisions void of intuition, gut feeling or hearsay; it's undeniable that creating an analytic culture that embeds the analytic process into its decision processes creates a much greater probability that future decisions will be more informed and, hopefully, better.

As the central organization that has decades of experience in the analytic process and has seen the successful and unsuccessful use of analytics in the decision process, HQ AFMC/A9A has the opportunity to play a critical role in establishing this analytic culture across the Air Force Materiel Command and the greater Air Force enterprise. We have the opportunity to define this process and provide the direction required for action. Ultimately, we have the opportunity to be the compass and conscious for creating a Business Analytics culture across the enterprise.