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COMPREHENSIVE ANALYTIC MATURITY ASSESSMENT

Assessing the Maturity of Your Analytic-Enabled Competitive Advantage

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INTRODUCTION

Strategy is best created by establishing synergy among a company's activities. The success of a strategy depends largely on integrating many activities well, as opposed to excelling at only one. Without synergy among activities, no distinctive or sustainable strategy is possible (Porter, 1998).

Systematic synchronization among several activities is cornerstone for creating and sustaining competitive advantage. Interconnection and coordination of several activities is simply more difficult for competitors to emulate. Put simply: A system of multiple activities affords higher competitiveness than one built on a single capability/activity.

Establishing a sustainable, analytic-enabled, competitive advantage requires a network of interrelated analytic-centric activities, including, but not limited to:

- Data Science (DS) – an inter-disciplinary field to unify statistics, machine learning, deep learning, big data, and data analysis.
- Machine Learning (ML) – the application of computer algorithms that improve automatically through experience. A sub-set of Artificial Intelligence.
- Business Intelligence (BI) – techniques and technologies used for data analysis of business information including the provision of historical and current views of operations.
- Big Data – a field focused on the analysis of data sets too large or complex to be dealt with by traditional data processing.
- Spatial Analysis – the application of statistical analysis and related techniques to data with a geographical dimension.

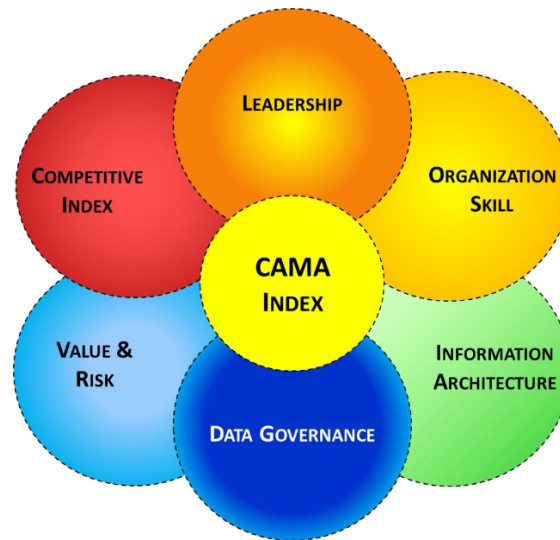
Companies that know how to leverage their analytic and IT resources gain a business analytic-enabled competitive advantage (Porter, 1980; Sambamurthy, 2000), which is the basis of our research. For the purpose of this guide, the term **analytics** represents a comprehensive view that encompasses the 5 analytic areas listed above and related topics.

The challenge, when creating an analytic-enabled business strategy, is to identify which activities to focus on. To that end, our research identifies factors of analytic-centric initiatives that significantly contribute to the overall maturity and success of a program (Gonzales, 2012). Building on this research, coupled with extensive practical application of maturity assessments for leading companies our Comprehensive Analytic Maturity Assessment (CAMA) creates an index that measures the analytic-enabled competitive maturity of an organization.

CAMA OVERVIEW

While this author refers to the maturity assessment as singular, the assessment is actually a culmination of six separate but interrelated models. These individual models are referred to as dimensions. Each dimension provides a unique measurement of maturity that when combined provide a comprehensive view of the overall maturity of an organization.

Figure 1 – Assessment Dimensions



CAMA DIMENSIONS

There are six dimensions to our assessment as illustrated in Figure 1. Each is designed to provide a unique perspective to the maturity of analytics in an organization. Many of the dimensions are tailored to the area under investigation. For example, quantifying the Information Architecture dimension contains measurements based on the technologies and techniques used for specific areas, e.g. Big Data requires different technologies than those associated with Spatial Analysis. Then there are other dimensions, such as Competitive Index, that are consistently measured irrespective of the area.

LEADERSHIP

It is well documented that leadership and management are significant to the success of an analytic-enabled corporate strategy. However, leadership and an effective management conducive to analytics must be fostered. While hiring new leadership may induce some success of analytics within an organization, by itself it likely is not sufficient. The leadership must evolve the culture of the organization, skill of its resources, and advance the necessary infrastructure. All of which require funding, sponsorship, support and championship up and down the organizational structure. These are aspects of an organization that require time and dedication.

ORGANIZATION SKILL

Successful IT infrastructure, including analytic, is difficult to imitate and consequently is a barrier to competitors and a source of competitive advantage and success (Oh and Pinsonneault, 2007).

Infrastructure includes all hardware and software implemented in an environment to establish the platforms from which information is gathered, synthesized, and delivered to user communities to support operational and strategic decision making. The skill of the IT/analytic team refers to the expertise required to evaluate, select, implement, build, and support the use of the technical environment. From an infrastructure perspective this includes hardware, operating systems, networks, and user-facing applications. Technical skill is critical to the performance of IT and its ability to contribute to competitive advantage and subsequent success (Dehning and Stratopoulos, 2003; Bharadwaj, 2000). Skilled resources and capabilities contribute to the overall performance of an organization (Sambamurthy, 2003). Past research (Bhatt and Grover, 2005) also suggests that it may take several years to cultivate and nurture an effective organization with the necessary internal relationships for communication and coordination.

INFORMATION ARCHITECTURE

There exist opposing views on infrastructure. The analytic infrastructure is a factor for competitive advantage. Some researchers view the establishment of leading edge hardware and software as a differentiator that is difficult to emulate by competitors (Weill & Broadbent, 2000; Bharadwaj, 2000). Conversely, a few researchers have not been able to confirm the significance of infrastructure as a determinant for competitive advantage, based on the argument that IT hardware and software are widely available (Bhatt & Grover, 2005).

DATA GOVERNANCE

The merits of data governance are well known across industries. Those that have yet to provide adequate data governance only impede the successful consumption of data throughout their organization. The risk of poor data governance is only exacerbated by advanced analytics. Put simply: advanced analytics is dependent on a successful data governance program to ensure not only high-quality data, but to monitor and measure the value and impact of data science solutions on business.

VALUE & RISK

Advanced analytic development and success usually require a company with deep financial pockets. Limited budget of firms and total cost of ownership can prove to be obstacles in garnering analytic development (Pearlson and Saunders, 2012). For analytics to succeed it is important that managers are committed to development and application of analytics for the long term. For example, a previous research (Sedera and Gable, 2010) found that knowledge competence (the effective management of knowledge of value) is associated with IS-impact which may affect a firm's financial performance.

As stated in the Introduction section of this guide, *Strategy is best created by establishing synergy among a company's activities*. Put simply: Strategy is a system of activities. This is consistent with the concept that an organization represents a stable system of individuals working toward common goals (Rogers, 2003). The operative word in this case is, *stable*. Stability is achieved through the organizational hierarchy and structure. Therefore, CAMA provides another unique perspective of analytic maturity by exploring the leadership type, organizational structure, and existence of innovation champions.

COMPETITIVE INDEX

The Competitive Index (CI) dimension attempts to measure elements of the organization that are associated with competitiveness. This dimension is based on the established Market Value Approach

defined by Griliches (1981). CAMA focuses on the intangible assets only in order to reduce the overlap with other dimensions, e.g. Infrastructure and Value & Risk. We provide a unique maturity perspective by quantifying intangible, customary proxies like Research and Development (R&D), number of patents, number of trademarks, advertising expenditures as well as modern proxies of competitiveness such as social and traditional media content (Arslan et al, 2013).

It is important to note that the Competitive Index dimension is only available for the Enterprise Assessment.

THE CAMA MODEL

The purpose of any maturity model is to provide an evolutionary pathway, transforming from a current stage to a target stage. Each stage represents a unique level of maturity in both its description and characteristics (Lahrmann and Marx, 2010). To that end, the objective of CAMA is to estimate not only the overall level of analytic maturity within an organization, but to do so while providing prescriptive guidance and a roadmap to evolve to higher levels of maturity. Once the scores are quantified for each dimension, an overall Maturity Index is estimated on the maturity model scale. Refer to Figure 2. Shown are 5 levels to our analytic maturity model. Each reflects realistic, prescriptive level of maturity identified and defined by our expertise, tangible experience, and supported by industry research.

Figure 2. Analytic Maturity Level Model

Levels of Analytic Maturity				
Nascent	Preliminary	Tactical	Strategic	Disruptive
New to analytics, practiced on the desktop.	Small program that applies analytics for a limited number of areas.	Organization-wide program that applies analytics for mainly business optimization.	Large program where analytics is integral to the strategic direction of the enterprise.	Innovative application of analytics to create new market opportunities.

The maturity levels take into consideration the application of analytics within modern organizations and the markets in which they compete. Specifically, the maturity of analytics can be measured directly against the value and impact they bring to an organization. And that value and impact are directly correlated to the extent analytics is integrated with the organization, its short-term practice, and long-term strategies.

THE VALUE OF ASSESSMENT

Many organizations that invest in an analytic-centric assessment do so in order to establish an unbiased measurement of their organization and, more specifically, of their analytic program. And while this is an important task for any company focused on an analytic-enabled competitive advantage, it is only a fraction of the value that can be mined from this investment. There are four other success factors that should be leveraged in order to maximize your return on investment (ROI), including:

1. Establish performance metrics to measure and monitor your program
2. Periodically conduct the same assessment to measure and monitor progress
3. Create a roadmap for your analytic program improvement and evolution to higher levels of maturity
4. Ensure both business and IT are involved

Each is discussed below.

PERFORMANCE METRICS

An effective maturity study will measure multiple dimensions of your organization and its analytic program, including: leadership, organizational structure, user competencies, and other points. Each provides key metrics to both measure your current maturity level and monitor the program's progress.

ESTABLISH A REPEATABLE PROCESS

Organizations embark on analytic maturity assessments for several reasons. Whatever your motivation for conducting this type of study is, you should not use the assessment results as merely a one-time snap-shot and then shelve the expensive report. Instead, it should be used as a starting point, a baseline for your analytic strategy.

A baseline assumes there are subsequent measurements that will be conducted. To that end, you should establish an assessment schedule. Depending on the volatility of your ecosystem/organization, you may want to conduct the same assessment, internally, once every six to 12 months. Doing so achieves the following:

- Demonstrates real gains across quantitative points.
- Contributes to budget elements. If you can demonstrate significant maturity increases over several key metrics, the results will support your argument for budget increases in order to secure more staff, software, hardware, etc.

However, if you are going to conduct the same assessment periodically, you must insist on retaining the instruments used and methodology applied to arrive at the gauged maturity level. Some assessment services will simply not comply. It is this author's recommendation that you should not invest in any assessment process that contains black-box calculations/weights that are proprietary to the service provider. Frankly, if you do not have a white-box assessment, one that provides visibility to all aspects of how the assessment is derived, then it is not worth the price you will be asked to pay. Real value from these initiatives is derived when you can internalize the assessment instruments and processes to enable your organization to periodically conduct the assessment.

CREATE A ROADMAP

Assessments of value will expose a list of opportunities for improvement. But it is important that the opportunities are identified in terms that are actionable. For example, if the assessment informs you that the program is weak, but does not specify what aspects of the program are weak and what can be done to improve them, then the assessment is of little value. Actionable insights with clear objectives of how to improve your program should be the objective of a roadmap.

A roadmap will provide clear steps to improve your analytic initiatives. For example, if the assessment identified that your organization lacks technology standards, prohibits data exploration, and has no consistent definitions for key reference data, such as customers or products, then the roadmap could specify the creation of a data governance program, technical architecture standards, an exploratory (sandbox) platform, and the implementation of a customer Master Data Management (MDM) program, including the steps necessary to achieve each objective.

GAIN ORGANIZATIONAL COLLABORATION AND BUY-IN

An effective assessment project provides an excellent opportunity for an organization to foster collaboration between business, analytic, and IT teams. When selecting members for the assessment team, there must be some members from the assessment firm and others from your organization. And of those representing your organization, you should select individuals associated with the business, analytic, and IT sides of your company. This means that not only is your company actively involved in the assessment process but you've also ensured that your team affords an unbiased assessment of your company, from multiple, internal dimensions. Some assessments are sponsored by business, often because they feel the analytic team(s) or IT has not been responsive. And sometimes an assessment is sponsored by the analytic team(s) or IT in order to measure their internal capabilities to deliver analytics or to serve as a means to make arguments for more funding. This author has found that the most effective method for conducting enterprise assessments that provide clear, unbiased findings is to involve members from the areas mentioned above.

Read more about the assessment team in the *Assessment Team* section of this guide.

THE ASSESSMENT TEAM

When conducting a maturity assessment, it is important to keep in mind the following:

1. Your organization must not only actively participate in the initial assessment process, but must also learn how to conduct the assessment for subsequent progress reports.
2. The assessment represents a great opportunity for collaboration between business, analytics, and IT.

These two points dictate what you should expect to contribute to the process and the role the consulting firm that provides the assessment effort.

From the numerous assessments this author has conducted, there are at least 8 key groups that can contribute to the overall effort as defined in Table 1. The number of groups you have involved in the effort will be determined by the scope of your study.

Table 1. Team Roles and Responsibilities

Group	Role	Responsibility
Consulting Firm	Lead Assessment Process	Provide the necessary plan, process and related instruments to conduct the assessment. This is true for the 1 st time you conduct the assessment. Assuming knowledge transfer was successful, subsequent assessments can be conducted without outside consultants.
Analytic/IT Stakeholders	Assessment Team Partners	With the guidance from the consulting firm, Analytic/IT stakeholders must be actively engaged in the assessment process. It is important that these individuals have intimate knowledge of the analytic program.
Business Stakeholders	Assessment Team Partners	Same as Analytic/IT Stakeholders.
Executives	Interview Participants	Make time available on your schedules to give a 1 to 2-hour interview. Be frank and as complete as possible in your responses.
Business Subject Matter Experts (SMEs)	Survey Participants	Business SMEs represent those individuals that are constantly attempting to leverage the analytic-centric ecosystem of your organization.
Analytic/Technical SMEs	Survey Participants	Same as Business SMEs.
Non-Managerial Users	Survey Participants	These individuals should represent the broad user communities that are consumers of your analytic ecosystem. While they are not experts, they do have to use the results of the analytic environment.
3 rd Party Experts	Ranking/Matching Participants	Between 2 to 5 external experts should be identified to participate in the assessment.

Enterprise efforts whose goal is to accurately measure level of maturity for the organization will likely leverage all the groups defined in Table 1. Smaller or more focused assessments may choose to use only those groups most relevant.

ASSESSMENT DESIGN

You should insist that the assessment consulting company you hire will have an assessment design, including methodology and instruments. However, you can create your own assessment as outlined in this section or at the very least, measure the type of assessment your consulting team plans to execute.

UNDERSTAND THE SCOPE OF THE ASSESSMENT

Not all analytic assessments are the same. This author has worked on assessments where sponsors would only allow a few executives to be interviewed and no end-users were to participate. Other clients have opened their entire organization with the objective of gaining unbiased, enterprise perspective of the analytic program. The scope, however, will dictate the questions to be asked and type of instruments to be created.

ASSESSMENT INSTRUMENTS

There are 4 instruments used in CAMA, including:

1. Executive Interview
2. SME Survey
3. Sentiment Survey
4. Analytic Ecosystem Inventory

Each is discussed in the following sections.

EXECUTIVE INTERVIEWS

Conducted correctly, executive interviews provide valuable insight into the vision and direction of your organization and the impact that analytics have on its ability to compete. The operative word is 'correctly.' Many assessment efforts, including those from high-end business consulting firms, conduct executive interviews almost as ad hoc, information trolling efforts. And once complete, all the notes scribed during the interviews are consolidated (assuming a scribe was dedicated to the effort), interviewers cull through the notes and provide their maturity assessment in a black-box approach. This approach reduces executive interviews to anecdotal guidance regarding the challenges facing the organization, but little else. Structured executive interviews are the only professional approach.

STRUCTURED INTERVIEW INSTRUMENTS

The worst use of an executive's time is conducting an ad hoc interview. Executive interviews must be planned and scripted. To that end, there are three types of questions that must be crafted in a single interview to extract the maximum value of the executive's time and insight.

Table 2. Executive Structured Interview Questions

Executive Structured Interviews			
Question Type	Purpose	Example	Cross-Correlation to Study

Short Answer	Get each executive's perspective on specific topics relevant to the assessment.	What are the critical success factors for analytics at your firm?	Compare and contrast responses between executives from different BUs, FUs, or geographical regions.
Open Response	Provide a means for each executive to voice their hot issues or re-emphasize points raised.	What else do you think we need to know about analytics and its ability to serve the mission of this company?	Isolate unforeseen issues and compare and contrast the key concerns between participating executives.
Single Answer	Ask direct questions whose responses are single answer.	We view analytics as a competitive advantage for our company?	Ask similar questions to all other participating assessment groups. This gives us insight between what executives think vs. SMEs vs. end users.

Shown in Table 2 are the three types of questions that should be a part of any executive interview: Short Answer, Open Response and Single Answer. The questions provide executives an opportunity to share information, but in a structured, guided format. If your assessment consulting firm suggests a few leading questions are necessary to get an interview session started and then let the executive ramble on and share whatever is on their mind, fire them!

Our objective is to gain the insight and perspective of the executive office with regard to analytic-centric issues and their impact on the company's goals and objectives. Moreover, our interview should be conducted in a style that ensures a means to quantify comparisons between executives as well as contrast the executive office with other important user communities.

SME SURVEY

The SME survey will always be the most comprehensive. This user community represents those with the most intimate knowledge of the analytic ecosystem and the data. Consequently, surveys crafted for this group should be comprehensive, covering a broad range of topics.

This author recommends executing online surveys, which in this case contain single response questions and statements that participants are asked to respond. The SME survey is the most comprehensive self-assessment survey. It represents the scope of relevant questions/statements that are correlated between all survey participants.

IDENTIFYING SME PARTICIPANTS

The assessment team should select the participants for the SME survey. Since this is a comprehensive questionnaire, it can only be submitted to individuals intimate with many aspects of the analytic program. Consequently, the audience will be small, less than 20. Many of the assessment team members from the organization will likely be candidates for this survey.

SENTIMENT SURVEY

Sentiment surveys are intended for non-management or front-end user. These participants represent the consumers of analytic program(s). This user community can help assess the value of the reports they receive (in terms of content, quality, and timeliness) as well as the provided training and support.

As with other surveys, this author recommends executing online surveys. The content of this survey must be reduced to a handful of questions that you expect end user communities to be able to answer. While

these questions/statements are taken from the SME survey, they must be selected and reworded for easy understanding by any end user consumer of analytic-centric reporting or analysis.

IDENTIFYING PARTICIPANTS USING SAMPLING

This is unique to non-management surveys. Since end users potentially represent the largest consumers of analytic-centric output, it is often difficult or impractical to survey the entire population. For example, your program might have 20,000 registered users across multiple global regions and encompass several business and functional units. Consequently, the assessment team must leverage statistical methods to ensure a representative group of this large community is identified to participate.

To that end, this author recommends that the assessment team selects participants based on the following steps:

1. Company team members must identify the total population of non-management users who are consumers of the analytic program output. For example, we need to identify those who receive one or more of the reports produced by the analytic program. Or, the program publishes a sales dashboard to 5,000 sales representatives, covering 3 geographic regions including North America, Asia, and Europe, and encompassing our manufacturing and distribution business units.
2. Once a total population of non-managerial consumers of analytic-centric output is quantified, a stratified, random sample should be executed. This sample must include consideration for the following:
 - a. What are the strata we want to consider in this assessment? This is a company decision. The company might have a heavy presence in a single geographic region or most of their revenue may be represented in a single business unit. All these aspects define your organization and must be considered when identifying the strata to be represented in the assessment.
 - b. Once you've defined the strata, the total population of end users can be identified and serve as the basis of a random sample.
 - c. redacted list of the total potential survey respondents is consolidated into a file that contains the geographic region, Business Unit, and Functional Unit in which each respondent works.
 - d. Using a tool such as IBM SPSS Statistics, a random sample is executed with the final survey participants selected.
3. Identified participants are invited to a pre-survey workshop.

Stratified random sampling is not a trivial process, assuming you want to have some confidence in the inferences made on the survey responses. From this author's perspective, if the assessment team does not have the skill to properly conduct this sampling, the team must reach outside the group to ensure a skilled resource can assist.

ANALYTIC ECOSYSTEM INVENTORY

The focus of the Analytic Ecosystem Inventory (AEI) is to collect, document, and quantify the current level of analytics being executed and consumed in the organization. While other assessment instruments collect opinions from a broad range of analytic consumers, the AEI is designed to gather quantitative metrics related to employed analytic applications, the technology and data on which they are implemented, and the communities they serve.

Specifically, the inventory includes:

- Antecedents - Any antecedent related to analytics being conducted, their standards, and corporate objectives
- Applications - Analytic applications, the size of user communities they serve, and their life stage
- Technologies - Analytic technologies on which these applications are based
- Data - Profiles of the data sourced by these applications, including size, number of sources, and data type

An instrument is best to ensure consistency in the collection of information across the ecosystem, even if multiple team resources are used to conduct the inventory. A spreadsheet can readily be crafted to include columns of information outlined in Table 3, including the dropdown menus that include the options available for the investigator.

ANTECEDENTS

In general, antecedents are any relevant, formal documentation for assessing dimensions of maturity. For example, a business strategy document with content incorporating analytics provides evidence of analytics being leveraged for competitive advantage. Which represents a critical sign that analytics is being embraced by the enterprise.

Few resources are needed to gather antecedents. The assessment team simply requests any relevant documents from the client. This can be done during the kick-off session, coupled with feedback/suggestions from assessment team members, and followed-up with an email providing examples of documents, if not actual document titles (if given by team members).

TECHNICAL, DATA, AND APPLICATION EXAMINATION

An Excel spreadsheet can be constructed in order to provide guidance in the gathering of fundamental information regarding the technology licenses, the data used, user communities supported, and applications based on that technology.

For brevity, outlined in Table 3 are the specific columns of the inventory spreadsheet.

Table 3 – Architecture Inventory

Category	Column Name	Description
Identification	Analytic Application Name	This can be a formal project, initiative name, or simply the name of the lead analyst. The key is that the name must uniquely identify and reflect the use of analytics.
	Business Unit	Given the breadth of many organizations, the purpose of this identifier is to better isolate the communities currently using analytics.
	Department	The department name is meant to target specific areas within business units leveraging analytics. The department name, if not available or relevant, can be the team using analytics, a specific lead analyst, or sponsor.
Application Footprint	Application Maturity Stage	Using common stages, we want to identify what stage the application is on. The options are in a dropdown list, including: Unknown, New, Expanding, Mature, Legacy, and Sunset.
	How Frequently is Application Executed	Here we are documenting how often the application is executed, specifically: Real-time, On-Demand (non-periodic), Inter-Daily, Daily, Weekly, Monthly, Quarterly, Yearly, Other, or Unknown. If Other, it should be entered in the notes.
	Max Concurrent Users	How many concurrent analysts/users can execute the analytic software associated with the application?

	Num. of Consumers	How many consumers use the output/results of the analytic application?
Analytic Technology	Analytic Software and/or Tools	Here we want to document the primary analytic software used to support the analytic application. A dropdown would include the possible analytic software options within the ecosystem. This list can include any possible combination of software/tools such as: R, Python Scikit, SPSS Modeler, Base SAS, Cognos Analytics, MS Analytics, Matlab, etc.
	Software Version	This is a freeform cell. Enter the actual version of the software and/or tools.
Data Profile	Num. of Data Sources	We want to approximate the number of data sources used in the application.
	Latency of Data	How often the data is sourced is recorded here. The dropdown options include: Real-Time, On-Demand (non-periodic), Inter-Daily, Daily, Weekly, Monthly, Quarterly, Yearly, Other, or Unknown. If Other, it should be entered in the notes.
	Data Retention	Once the data is used in the application, how long is it retained? Specific options include: Daily, Weekly, Monthly, Quarterly, Yearly, Other, or Unknown. If Other, it should be entered in the notes.
	Storage	How much data storage is used for the application is recorded in this cell. Specifically: < 100 GB, 101 to 500 GB, 501 GB to 1 TB, 1 TB to 10 TB, > 10 TB.
	Primary Data Type	We want to document the most common or primary data types. A dropdown could include: Structured, Unstructured, Semi-Structured, Structured & Unstructured, or All 3 Types.
NOTES	Additional Notes	This is reserved for the analyst conducting the inventory. This column is reserved for information not captured elsewhere.

APPENDIX A - REFERENCES

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