Digital Systems & Technology

A Practical Approach for Power Utilities Seeking to Create Sustaining Business Value with Analytics

The advent of smart meters, intelligent electronic devices and phasor measurement units has generated a wealth of data that can and should be more effectively mined and applied by global utilities to improve their operational performance and market competitiveness.

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A use-case prioritization approach coupled with cognizance of analytics maturity offers clear direction on business and technology strategy when building a use-case implementation roadmap.

Executive Summary

Amid an aging grid, power utilities are working feverishly to transform their underlying infrastructure to adapt to ever-changing market dynamics and customers' shifting requirements. Even as they struggle to replace 60% of their grid assets over the next decade,[1] many utilities are aggressively embracing smart meters and alternate renewable energy sources as consumers are becoming more energy conscious and digitally empowered to gain greater control and insights from their power consumption.

To sustain growth, industry leaders are focusing on ways to improve generation performance, optimize asset performance and longevity, transform customer operations and continuously boost operational effectiveness. Big data and analytics are playing pivotal roles in helping utilities to realize these business imperatives. Industry research suggests that utilities which apply customer analytics and big data to their decision-making are 23 times more likely to outperform their competitors compared with those that do not.[2]

Excited about the possibilities, many leading utilities are implementing stand-alone analytics use cases and continuing to realize proven benefits. But most remain skeptical about the large investments needed to improve their enterprise data management/analytics capabilities and generate the highest return on investment (ROI).

This white paper provides utilities decision-makers with a proven approach for optimizing business value from analytics programs. A use-case prioritization approach coupled with cognizance of analytics maturity offers clear direction on business and technology strategy when building a use-case implementation roadmap.

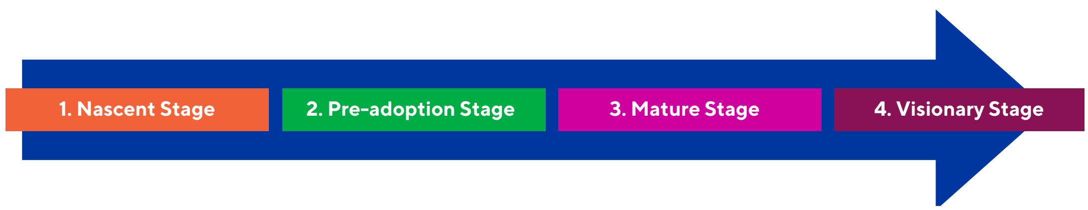
In our view, an analytics maturity assessment remains a critical activity, and the maturity levels will directly influence the speed of implementation for use cases. This white paper will detail how to approach these requirements.

Typical utility analytics maturity model

A majority of utilities with which we work have disparate capabilities and processes for analytics, which often differ by business functions. There are perfectly acceptable reasons for such disparities: Say the organization is behind the technology curve and needs to implement tactical solutions to maintain market competitiveness. As most business/IT managers understand, tactical solutions tend to gain a long-term life of their own (especially in the domain of business-critical analytics solutions), which inhibits the organization's ability to realize end-to-end benefits across the business. In our view, utilities that are able to leverage end-to-end analytics capabilities are best positioned to be market leaders.

A typical analytics maturity model showcases the journey a utility must take to maximize end-to-end business benefits from big data and analytics solutions. Most utilities have some level of analytics capabilities but it is important to benchmark these capabilities against a consistent maturity model to plan for the journey ahead. As Figure 1 depicts, we typically see four stages of analytics maturity.

Typical stages of analytics maturity



MATURITY LEVEL	DESCRIPTION
NASCENT (STAGE 1)	A utility at this stage has low awareness of analytics or its value across much of the value chain. It may have stand-alone dashboards and reporting capabilities and disparate analytics processes within each business area.
PRE-ADOPTION (STAGE 2)	A utility at this stage has conducted an initial assessment of data analytics and has some form of strategic plan in place. There are tactical capabilities and processes implemented within the departments to leverage smart meter and grid data. However, difficult obstacles remain, such as data integration, as well as tools and human resource skill-set shortcomings.
MATURE (STAGE 3)	A utility at this stage has strategic and scalable technical capabilities to deliver enterprise-wide analytics solutions across business areas that leverage smart grid, smart meter and customer data. There is a significant shift toward data-driven business processes and a redefinition of the operating model.
VISIONARY (STAGE 4)	A utility at this stage has generated significant business value from analytics by continuously focusing on sharpening its technological capabilities. The utility applies modern approaches such as intelligent automation and advanced machine learning technologies for grid automation and customer service to stay ahead of the curve.

Figure 1

Key parameters of an analytics maturity model

TOWERS	SUB-TOWERS		
1. Organizational Strategic Alignment/Use Case Approach	1A. Analytics Vision & Strategy	1B. Regulatory Readiness	1C. Customer Readiness
2. Data Quality/Governance	2A. Data Strategy	2B. Data Quality	2C. Data Governance
3. Technology/Infra/Internal Resource Capability	3A. Technology/Tools	3B. IT Architecture	3C. IT Infrastructure
4. Organizational Culture and Decision-Making Process	4A. Organizational Structure/Ops Model	4B. Decision-Making	4C. Human Resource Skills/Culture
5. Analytics Adoption	5A. In-Practice Capability	5B. In-Progress Capability	5C. Near-Future Capability

Figure 2

Our utility maturity model is based on evaluation of the parameters illustrated in Figure 2.

Progress across the analytics journey requires an unrelenting focus on a few critical success factors that allow the organization to achieve business benefits irrespective of its current stage of maturity. It is imperative that organizations drive home the need to embed these critical success factors within their in-flight or upcoming analytics programs.

Critical success factors for creating analytics program value

Successful analytics programs depend on various factors. For instance, utilities must consider the key success factors enumerated in Figure 3 to maximize the value generated for the organization. (Also see the Quick Take that underscores the importance of these critical success factors.)

A critical success factor framework for analytics

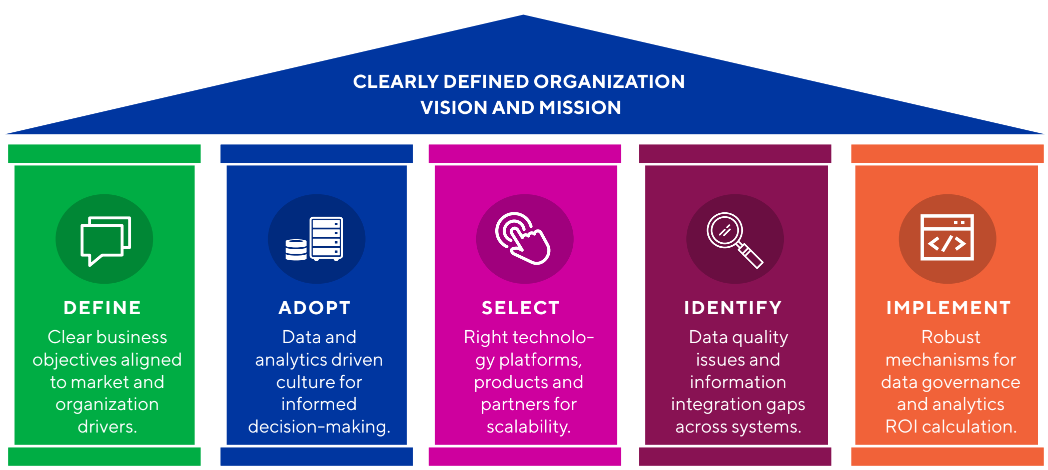


Figure 3

Quick Take

Having the Right Utility Business Objectives

A "vertically integrated utility" operating in a regulated market and a "retailer utility" operating in a "contestable deregulated market" will have different objectives for utility analytics.

A utility servicing a regulated market would need to create a strong rate case for utility analytics capital investment, and get it approved by the regulator by justifying customer and operational benefits. They would likely go for the big bang approach, with significant investments.

- **Define clear business objectives.** The analytics program must be driven by specific business needs and supported by meaningful and relevant ROI calculations. Utilities' business priorities vary based on market conditions – such as regulated vs. deregulated markets. A regulated utility may need to maximize its capital expenditures (CapEx), while a utility operating in a deregulated market may want to maximize net present value (NPV).
- **Adopt a data- and analytics-driven culture.** Creating a culture where data is treated as an asset is critical. All business units should leverage cross-functional data and make use of available tools for all analytics purposes. Quite often, utilities struggle to break corporate silos and suffer from ineffective collaboration and substandard analytics tool adoption.
- **Select the right technology platforms, products and partners.** Utilities should evaluate platforms and technologies that fit specific business requirements and data attributes. The platform must be capable of managing a data deluge, adapt to low latency and support advanced use cases for real-time analytics such as phasor measurement unit (PMU) optimization, micro-grid flexibility management, etc.
- **Identify data quality issues and information gaps.** Data quality is essential to an analytics implementation strategy. The millions spent on analytics can be worthless if the underlying data is of low quality. The ideal data set should be de-duplicated, cleansed, synchronized, enriched and updated.

Quick Take

Typical Pitfalls When Deploying Analytics

Focusing on a critical success factor framework would enable utilities to avoid common pitfalls when implementing analytics programs. The following are prime examples:

- **Lack of clear business objectives:**
  - One large utility successfully received approvals for CapEx analytics investments. Its IT team quickly ensured that all the right projects were up and running for data lake creation and master data governance (MDG). But the business team could not come up with the right set of prioritized use cases to create expected business value.
- **Lack of data & ROI validations:**
  - One large electricity supplier has implemented multiple smart meter event analytics applications, only to discover later that the continuously increasing number of smart meters in the field impacts benefits realization from analytics use cases. This was due to issues with real-time and batch-oriented data exchange between legacy systems and the real-time analytics solution, resulting in data inconsistencies and skewed analytics reports.
- **Lack of right technology platforms, products and partners:**
  - One large utility has selected a market leading analytics tool, only to find out later that the tool has a minimum data latency of 2-3 seconds, which makes it unsuitable for real-time analytics use cases.
- **Lack of data availability and data-driven cultures:**
  - One large electricity supplier maintained four databases for different business units. There were integration issues among the databases and applications due to poor data quality and duplication of data in different formats across systems. Data unavailability virtually ruled out the possibility of implementing some high-impact use cases.
- **Lack of data governance:**
  - One large utility tasted success with its analytics pilot projects. It has kept on adding additional analytics applications. But later it had to stop using pilot applications on account of poor data governance. There were no formal roles, processes or tools in place for managing, making decisions or enforcing how data is defined, changed, distributed, analyzed or consumed.

- **Implement robust mechanisms for measure and governance.** Utilities should establish an operating model and data governance mechanism to ensure the success of their analytics business applications. Data custodianship should rest with the business team. This includes setting up a governing body, special data steward roles, processes and procedures to ensure continuing data quality in business-as-usual processes.

Typical utility analytics use cases

Defining clear business objectives at a granular level within an organization's business areas is critical to create appropriate analytics use cases. In most cases, business objectives are influenced by the use cases that respond to imperatives drawn from the marketplace, internal efficiency targets, and/or future investments or trends. The first step is to identify the business pain points in each of the business functions and create an inventory of potential use cases or identify ways to solve the pain areas by applying analytics (see Figure 4, next page).

How to derive business value from analytics

The following examples provide guidance on the art of use case creation.

- **Electricity theft analytics:** U.S. utilities lose 1.5% to 2% of revenue due to electricity theft.[3] This means a utility with $1 billion in revenue loses $15 million to $20 million annually. Assuming 70% analytics accuracy to predict the electricity theft events, the utility could save $10.5 million to $14 million each year.
- **Call center optimization:** Reducing customer call volumes by proactively providing billing queries and self-service options is a meaningful use case. A reduction in call volumes further translates into significant money savings for the utilities by helping them optimize their labor and overhead costs. Additionally, an agent-handled customer call costs approximately 50 times more than using self-service.[4]

With the advent of smart technologies, utilities are exploring new analytics use cases that depend on legacy IT foundation systems as referential data sources. This, coupled with real-time data streams from smart technologies, would deliver end-to-end benefits across a utility's value chain – such as improved customer experience, reduced cost to serve, increased up-sell/cross-sell opportunities and improved brand loyalty. Many big data use cases are more aspirational, focusing on real-time analytics solutions.

Utility analytics use cases can be broadly classified into five categories, based on business areas:

- **Customer analytics:** Use cases directly impacting customer processes, experience and perceived customer value to the utility.

Analytics use cases across the value chain

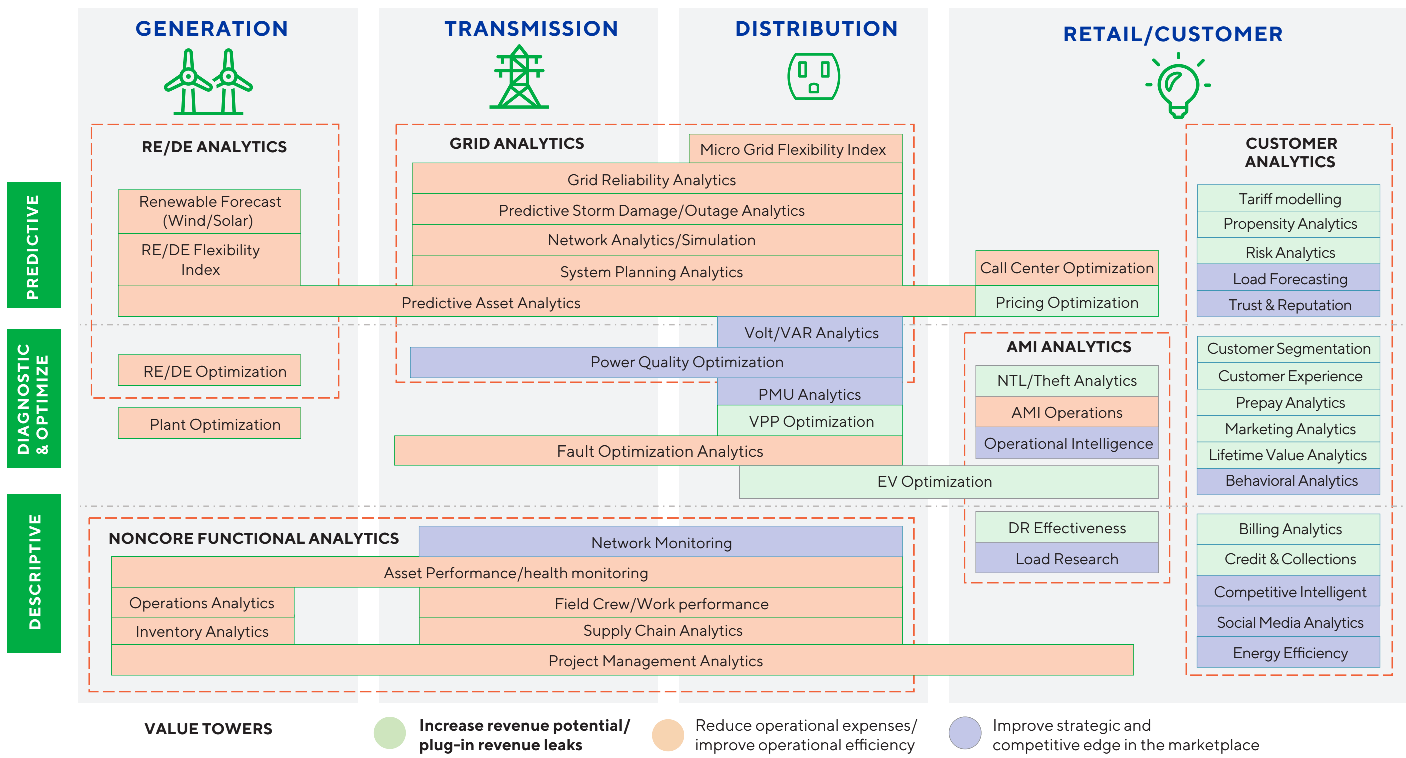


Figure 4

- **Grid analytics:** Use cases directly impacting transmission and distribution network operations including asset management.
- **Advanced metering infrastructure (AMI) analytics:** Use cases leveraging smart meter/ sensors data to improve AMI operations.
- **Renewable/distributed energy (RE/DE) integration analytics:** Use cases supporting virtual power plant (VPP) and nontraditional generation source integration to the grid.
- **Noncore functional analytics:** Use cases to improve noncore functions such as supply chain management, project management, etc.

High-level use cases identified here can also be categorized in three value towers (see Figure 5, page 10):

- Increase revenue potential/plug revenue leaks.
- Reduce operational expenses/improve operational efficiency.
- Improve strategic positioning and competitive edge.

Utilities must create a robust framework to prioritize use cases in light of their analytics maturity. A periodic evaluation of a utility's analytics capabilities, with a lens on specific business and technical areas, is needed to successfully prioritize and implement analytics use cases. It is also important to note that the required analytics maturity level is heavily dependent on the business drivers and value realization targets defined by various business units within the utility.

Quick Take

Having the Right Data Quality

Utilities traditionally manage multiple legacy systems and databases to service different departments, which often creates duplicates and unsynchronized data across the organization. These critical information gaps hinder the utility's ability to effectively leverage the available data for getting real business insights.

A periodic evaluation of a utility's analytics capabilities, with a lens on specific business and technical areas, is needed to successfully prioritize and implement analytics use cases.

Quick Take

Having the Right Mindset: Start Small, Fail Fast

It is crucial that utilities have a robust mechanism to continuously innovate and optimize the analytics models built by running ROI calculations and feasibility studies. A success mantra here is to adopt a "start small, fail fast" mindset, thereby keeping time-to-market and cost-effectiveness measures in check.

Value Tower 1: Sample use cases to increase revenue potential/plug revenue leaks

Analytics	Description	Associated KPIs	Key Business Outcomes
VPP Optimization	▪ Real-time renewable energy (RE)/DE selection. ▪ RE/DE revenue impact prediction. ▪ RE/DE risk analytics.	▪ Cost of electricity. ▪ Supply-plan adherence. ▪ Revenue risk.	▪ **Better grid balancing.** ▪ **Low cost of power.** ▪ **Improved revenue predictability.**
EV Optimization	▪ Electric vehicle (EV) battery optimization. ▪ EV demand response (DR) enablement. ▪ EV charging detection.	▪ Peak demand. ▪ DR load curtailment. ▪ EV charging cost.	▪ **Better demand response.** ▪ **Lower EV charging cost.** ▪ **Grid stability.**
Program Propensity/ Effectiveness Analytics	▪ Evaluate energy efficiency (EE)/DR/demand side management (DSM) programs. ▪ Program cost/benefit analysis. ▪ Design new programs.	▪ Program enrollment. ▪ Program participation. ▪ Program NPV.	▪ **Greater program adoption.** ▪ **Achieve program objectives.** ▪ **Maximize program NPV.**

Value Tower 2: Sample use cases to improve operational efficiency/energy efficiency

Analytics	Description	Associated KPIs	Key Business Outcomes
Micro Grid Flexibility Analytics	▪ Real-time grid flexibility index. ▪ Incentive optimization for RE/DE. ▪ Pricing vs. flexibility analytics.	▪ Grid reliability. ▪ Grid flexibility index. ▪ RE/DE on-demand availability.	▪ **Better grid balancing.** ▪ **Improved grid reliability.** ▪ **Right price incentive for RE/DE.**
Renewable Forecast	▪ Renewable forecast (solar/wind). ▪ Demand dispatch decision support.	▪ Dispatch plan adherence. ▪ Revenue risk.	▪ **Improved revenue predictability.** ▪ **Trading optimization.**
Storm Damage Analytics	▪ Storm path tracking. ▪ Predictive damage assessment. ▪ Outage restore optimization.	▪ Time to restoration. ▪ Planned vs. unplanned outages.	▪ **Improved reliability.** ▪ **Customer satisfaction.**

Value Tower 3: Sample use cases to improve strategic positioning and competitive edge

Analytics	Description	Associated KPIs	Key Business Outcomes
Competitive Intelligence	▪ Customer interest in similar products. ▪ Online performance of competitive products and services.	▪ Product success rate. ▪ Market share. ▪ Product lifecycle cost.	▪ **Improve product lifecycle.** ▪ **Better product design.**
Trust and Reputation	▪ Public image analytics. ▪ Campaign design/proactive image-building.	▪ Brand perception. ▪ Brand liking.	▪ **Effective public relationship programs.** ▪ **Improved customer enrollment.**
Social Media Sentiment	▪ Social media activity and responses. ▪ Identify & analyze influencers/trends.	▪ Percent positive/negative impressions. ▪ Online impressions.	▪ **Effective marketing programs.** ▪ **Effective public relations programs.**

Figure 5

A framework for prioritizing use cases

Identification of use cases within utilities can lead business/IT managers to adopt similar types of business cases with apparently similar business benefits. This leads to challenges in prioritization, which is especially true of utility organizations that are at the initial stages of the analytics maturity cycle. Use-case prioritization should be based on business value potential and data/analytics readiness. To do this, decision-makers must consider multiple parameters (and their weights) to derive a quadrant view of different priorities for analytics use cases.

- **Business value potential** typically depends on parameters such as:
  - **Business strategy alignment:** Use cases should fall in line with overall business strategy. For example, when the immediate focus is to improve customer service, the utility shall prioritize the customer analytics use cases.
  - **Volume of customers affected:** The customer is core to utility operations. The analytics use case that impacts a large number of customers should therefore be prioritized.
  - **Strategic/top-line/bottom-line impact:** The implementation must bring strategic advantage, revenue enhancement or reduction in operational expenses.
- **Data/analytics readiness** depends on parameters such as:
  - **Data quality/availability**: Quality of data is the most important element of a successful analytics use case. The higher the data quality and availability, the easier the implementation.
  - **Analytics method complexity**: Descriptive analytics is easy to implement. However, real-time/prescriptive analytics use cases require diligent model-building and complex analytics tools.
  - **Human resource/skill sets**: The utility needs access to human resources with proven analytics skills. A utility must develop an internal pool or establish a strategic partnership with vendors.

Figure 6 reveals the typical framework for prioritizing analytics use cases.

A framework for prioritizing analytics use cases

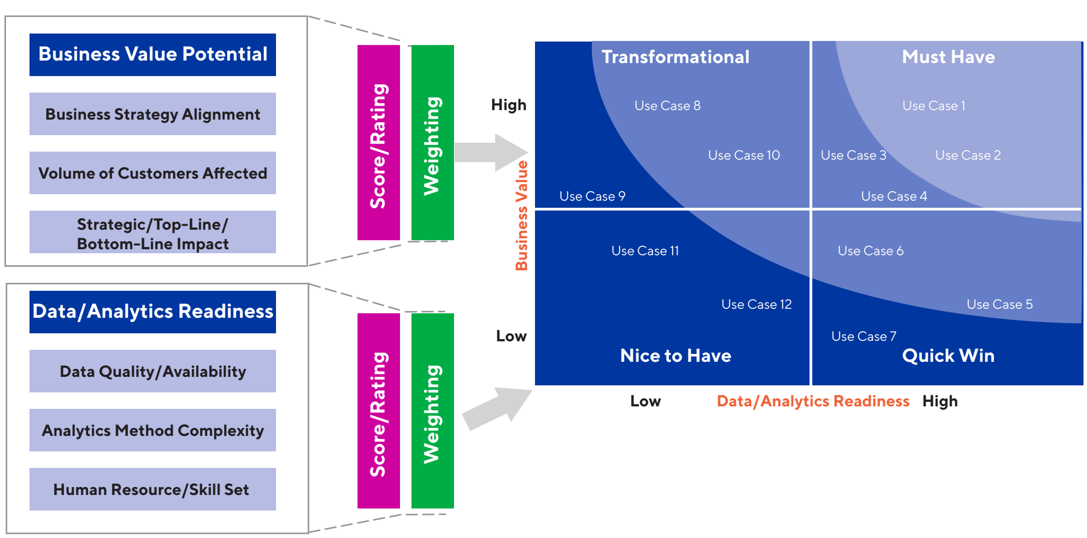


Figure 6

The applicability and importance of specific use cases depends purely on individual business scenarios. For instance, product/pricing analytics will provide greater benefit to a deregulated utility compared with a regulated one.

Our suggested prioritization framework provides the following classification scheme for use cases:

- **Must have:** Easy-to-build analytics use cases (e.g., those that require low effort/incremental investment/little or no data cleansing), which bring large business benefits to the utility.
- **Quick wins:** Easy-to-build use cases with low to medium benefits and which need minimal efforts for improving data/analytics readiness.
- **Transformational:** Use cases that are difficult to build but bring large business benefits to the utility (e.g., significant effort is required to improve data/analytics readiness).
- **Nice to have:** Difficult-to-build use cases that bring low to medium business benefits to utilities that need data/analytics readiness improvement.

Analytics use cases prioritized as "must have" need to be implemented with immediate effect; this is where an organization's inherent and already established analytics capabilities are tested. Transformational use cases require a greater technical focus to improve the data/analytics capabilities within the organization that will deliver long-term benefits. Organizations that combine their use-case prioritization with clear understanding of their analytics maturity can make informed decisions when creating a roadmap for prioritized use cases.

The trajectory of analytics use cases

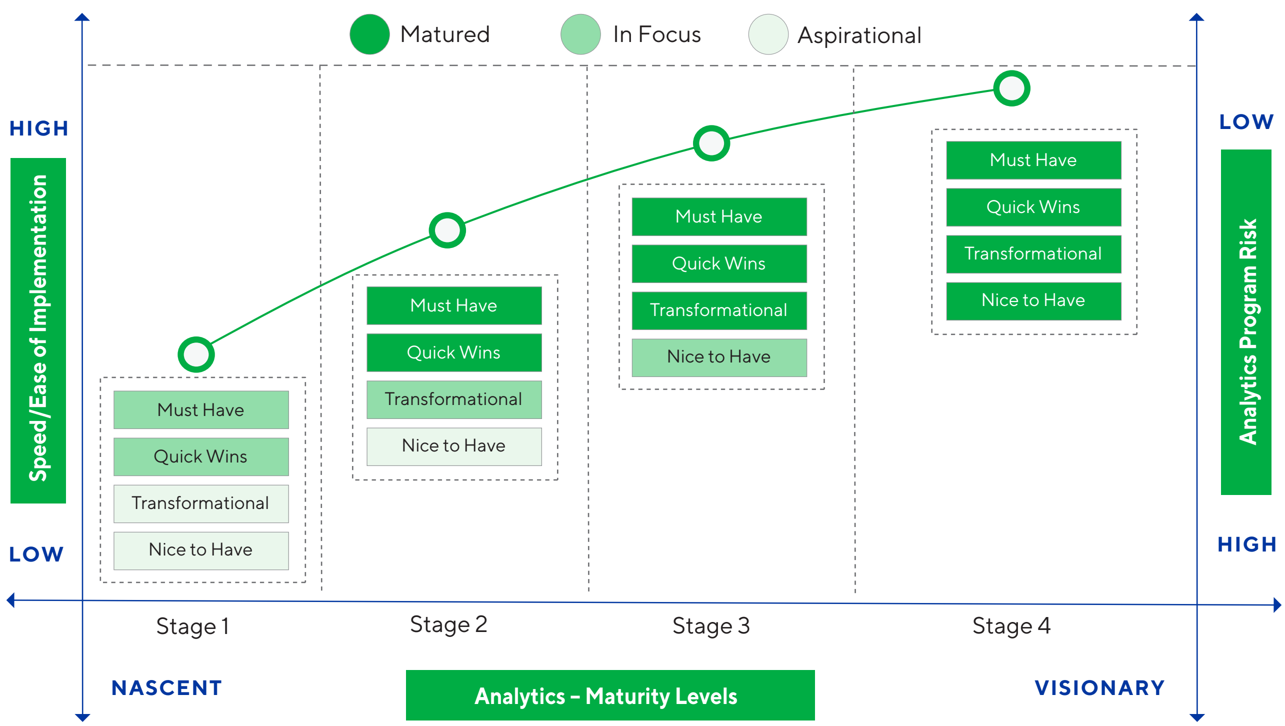


Figure 7

Smart technologies and the ever-increasing digital shift has raised the bar on organizational agility for delivering business change at unprecedented speed.

A utility analytics roadmap: creating agility regardless of maturity level

Utilities can identify analytics use cases, prioritize them and – based on their organizational maturity – define projects to deliver the must have and transformational impact. These projects, if focused on critical success factors discussed earlier, will deliver the required benefits. But the challenge in the new-age analytics world is the speed at which these solutions can be delivered and how agile or favorable to change these solutions are in today's digital world.

Smart technologies and the ever-increasing digital shift has raised the bar on organizational agility for delivering business change at unprecedented speed. Utilities have tried their hand at a bimodal IT model[5] that combines legacy technologies with new-age, flexible-to-change technologies, but recent developments indicate that when it comes to analytics capability, this model is insufficient.

Two variables are affected by the maturity of an organization's analytics capabilities: speed/ease of implementation and analytics program risk.

Figure 7, previous page, illustrates a roadmap that organizations typically follow as they traverse analytics maturity stages and improve on speed/ease of implementation as well as in reducing risks that undermine analytics programs.

Figure 8 provides high-level recommendations for accelerating the analytics maturity journey.

Ways to accelerate analytics roadmap progress

MATURITY LEVEL	RECOMMENDATIONS
NASCENT (STAGE 1)	Focus on building capabilities that lead to improvements in speed/ease of implementation of "must have" and "quick win" analytics use cases, as these are often critical to business survival.
PRE-ADOPTION (STAGE 2)	Focus on building capabilities that lead to improvements in speed/ease of implementation of "transformational" use cases while maintaining the momentum on "must haves" and "quick wins."
MATURE (STAGE 3)	Focus on building capabilities that lead to improvements in speed/ease of implementation of "nice to have" use cases while ensuring that a continuous innovation culture is reinforced within the organization.
VISIONARY (STAGE 4)	Focus on building truly agile capabilities in utility analytics use-case implementation and explore identifying the next big trend/transformation in the market. Continuous innovation and reinforcement of visionary principles within the organization is required to maintain market advantage.

Figure 8

Looking forward

Amid utilities' increased pressure to transform and the resultant market disruptions, analytics will continue to be the key for determining the future of utilities in both regulated and deregulated markets. Hence, it is crucial for all utilities to adopt best-in-class analytics strategies in order to truly maximize their returns.

As in most cases, there is no one-size-fits-all approach for analytics. Depending on the current business and IT landscape, utilities should adopt a tailored approach that is feasible and well aligned with their business and organizational objectives. It is imperative that maturity model principles and underlying parameters are revisited every few months (more than annually) to ensure that the measurement scale is in step with the latest market trends.

As a starting point, we believe the maturity model/frameworks provided in this white paper will be helpful for all utilities to assess their current analytics capabilities and enable them to formulate their future strategy for generating sustainable business value. As utilities move forward with their analytics transformation journeys, we recommend that they:

- **Focus on return on investment:** Calculating ROI for analytics investments can be pretty tricky, especially when implemented in silos. Hence, organizations need to periodically calculate and measure the tangible and intangible benefits delivered from all analytics investments/initiatives. Even more critical, utilities should carefully assess the synergies and long-term value derived from incremental analytics deployments.
- **Build strong partnerships and alliances:** In most cases, utilities will struggle to have enough in-house expertise to effectively build and scale their analytics capabilities. Therefore, they need a strong partner ecosystem with a suitable mix of research institutes, third-party analytics product vendors, system integrators and consulting groups.
- **Foster a continuous focus on innovation and growth:** The Internet of Things (IoT) and digital advancements continue to reduce the barrier of entry for new players and redefine the role of incumbents. Given this, utilities can't be complacent, and should seek to improve their market position and analytics maturity level by challenging themselves to improve, innovate and build newer capabilities/models to help secure future relevance and stay ahead of the competition.

Endnotes

1 http://www.harriswilliams.com/sites/default/files/industry_reports/ep_td_white_paper_06_10_14_final.pdf

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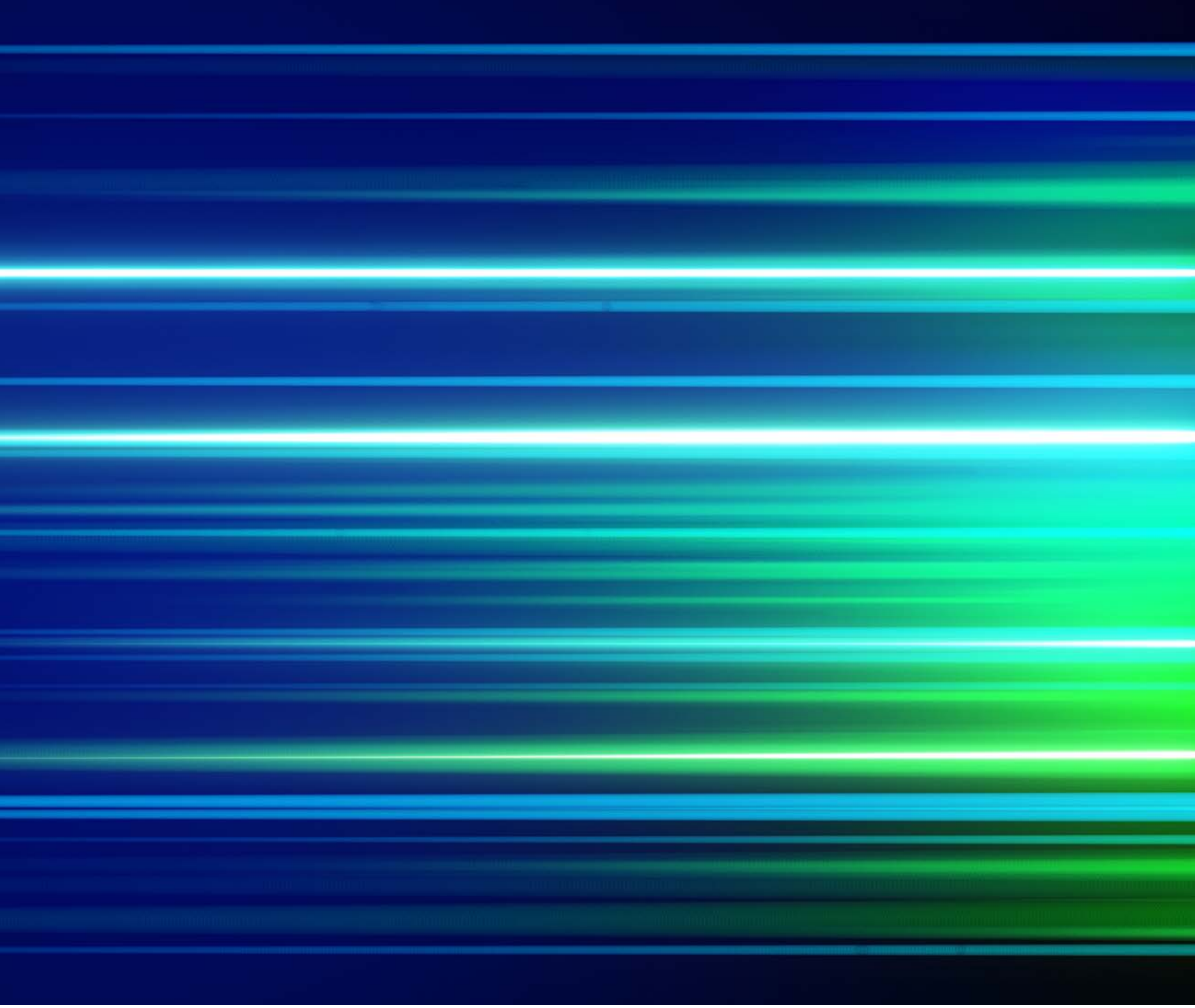

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