Utilities

Transforming Your Approach to Utility Asset Lifecycle Management

INTRODUCTION

Without assets, utilities would have very little to do. They are arguably the most important component of the business operation (competing for top place with utility employees and their customers). Despite their critical role, the humble asset has not yet undergone the kinds of transformation in performance management seen in customer engagement or human resource management domains.

Approaches in asset management have evolved incrementally over time—with different people, processes and systems accountable for each stage of its lifecycle. This siloed approach results in lack of visibility and missed value at every stage.

From its ideation as a proposed capital project to its final retirement, there are countless teams across the utility enterprise who "touch" and make decisions about any asset. In the planning process alone, load and corporate planning, project management, regulatory, legal, accounting, and procurement teams are all involved.

Typically, the teams that span an asset's lifecycle do not operate in concert with one another, and often use business applications that are not integrated. This severely diminishes the ability for the teams to have visibility of the relevant data and collaborate in real time to make more proactive, cost-effective decisions.

A misstep in managing a capital project can result in high cost overruns, project delays, and even missed regulatory deadlines. For example, a Midwest U.S. gas utility was fined $400,000 for an unmarked gas line that caused a house fire when severed by an excavating company installing a water line.[1]

Missteps in operating and maintaining an asset can result in costly, reactive repairs, shorter asset lifespans, reliability issues, and even massive regulatory fines and lawsuits. After all three treatment pumps at a UK wastewater treatment facility failed at the same time due to a build-up of debris, resulting in a two-day discharge of untreated sewage within half a mile of shore, the utility was fined GBP 160,000.[2]

Oracle's solutions for assets span the entire lifecycle, as recommended in ISO 55000, allowing us to bring a unique insight into end-to-end optimization of asset management. We have prepared this exploration of the opportunities utilities have to develop their processes, systems and data, no matter what the initial maturity level.

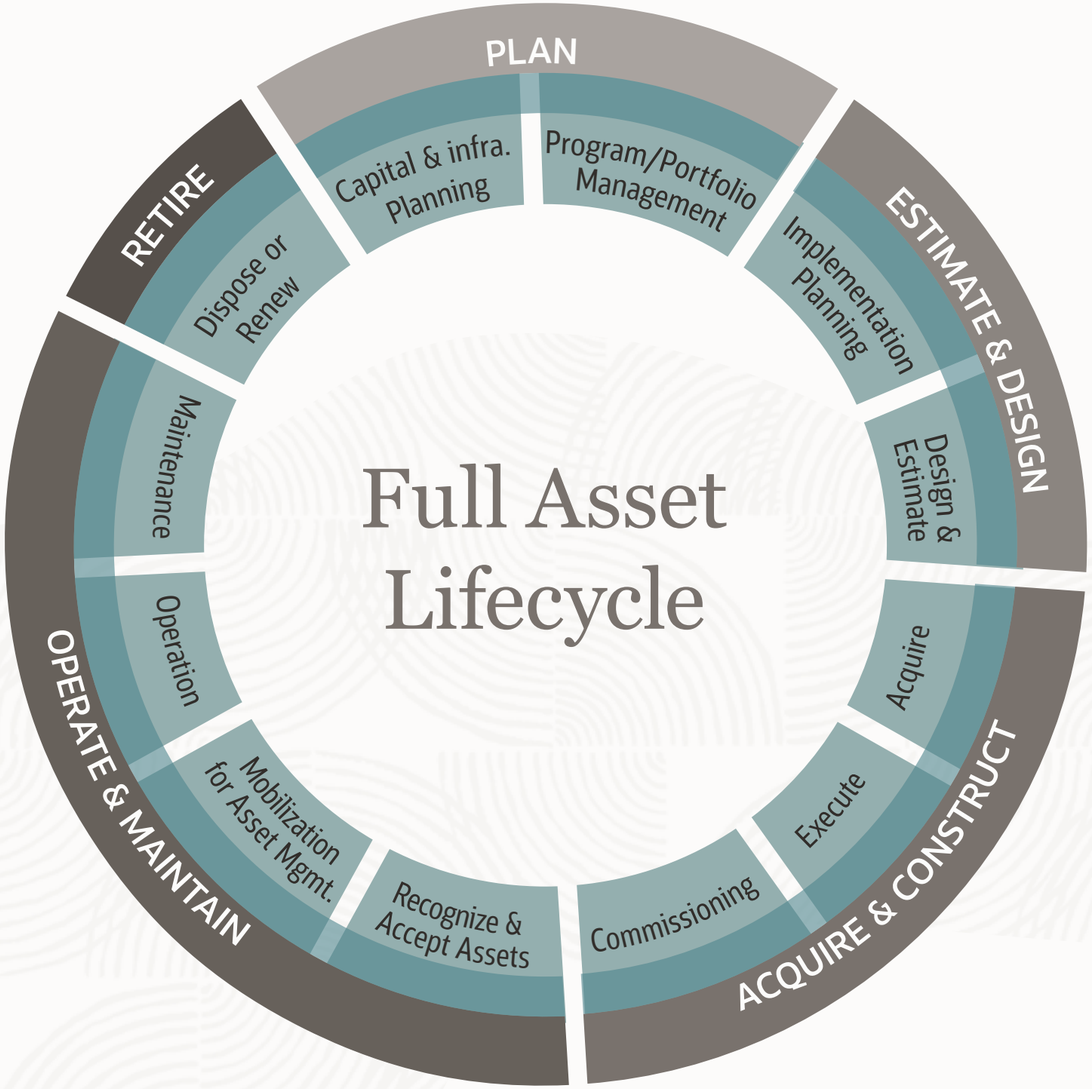
1. https://www.insurancejournal.com/news/midwest/2019/03/05/519651.htm
2. https://www.waterworld.com/municipal/technologies/pumps/article/16199566/uk-utility-southern-water-fined-for-major-sewage-pollution

Data is the common thread across the lifecycle

From better knowing the health of your assets and how much they cost to operate and maintain to ensuring delivery of best value through lower total cost of ownership, there is a clear, common thread underlying it all—the asset's life story from its origin to where it has traveled, what it has accomplished, and who has worked on it, all the way to the end of its life—and data tells us that story.

Of course the sources of data relating to your assets change over time. Asset technical data, weather data, and upstream/downstream data points that were previously unavailable are increasingly useful to utilities with the right analytics tools to leverage them.

The clear path for asset optimization through cost, performance, and health relies on fast, accurate, complete access to all of the relevant data across the business. A common data environment providing a single platform used to collect, manage and disseminate all of the information necessary for each step in the asset lifecycle is crucial to this process. Without a unified platform setting the knowledge standard, providing governance while quickly making the data accessible to the solutions that need it, your utility's portfolio isn't performing to its full potential.

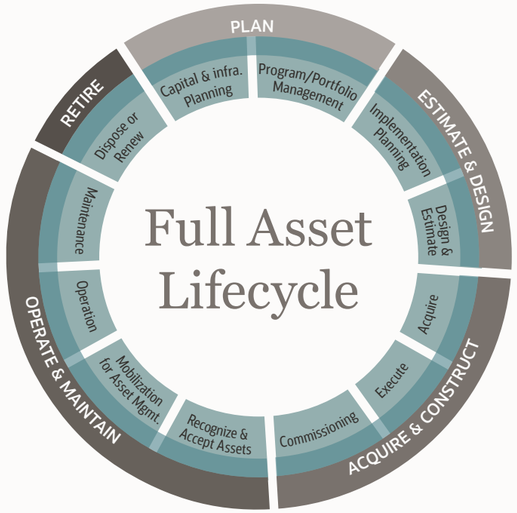


What if you could... Leverage a unique platform designed and built for access to every stage of the project and asset lifecycle to increase efficiency, minimize risks and optimize asset health?

From...	To...
Segmented systems limited by current knowledge and policy	Enterprise wide access on multiple devices with the latest available technology for your business
Monthly closing culture as the source of information	Online information and decision-making in real time
Critical information missing or hidden	Transparency and integration of information
Multiple management models (depending on geography)	Uniform management model applying best practices
Weak internal controls and vulnerable to fraud	Culture of high control and discipline
Single IT project for the set up of each new project	Plug & play model after minimal adoption
Large administrative burden and little time for analysis	More time available to your experienced team for analysis and adding more value

How much time is wasted recreating and maintaining separate records? Do you know?

What does full utility asset lifecycle management look like… and how mature is your current approach?



From initial ideation to final retirement, every utility asset follows a cyclical path, marked by distinct, connected lifecycle stages: **Plan, Estimate & Design, Acquire & Construct, Operate & Maintain, and Retire.**

Within each of these lifecycle stages, we have identified three ascending maturity levels that are enabled through technology.

Maturity Level One represents best practices—those basic steps all utilities need to be taking, or capabilities most utility technology providers currently offer, within that stage of the capital project/asset lifecycle.

Maturity Level Two focuses on advanced capabilities available with tools and technology offered by only a few providers—these are the tools and processes you want to be seeking out to take your asset lifecycle management beyond today's legacy approach.

Maturity Level Three embraces the art of the possible—what new tools and new technologies will offer for the future of utility asset lifecycle management.

Stage 1: Plan

Where a new asset begins

When beginning to plan for a new asset, you must consider both the risks and the projected return on investment (ROI) of each potential utility capital project. Effective project planning is crucial to selecting the projects that will deliver the greatest value for your investment. Further, a rigorous pre-planning process will reduce the volume of project proposals and speed up the selection process.

BEST PRACTICES

The genesis of asset planning is ideation—generating and then developing new ideas to solve a problem or to deliver a benefit or outcome—and it typically begins with a list, whether that is a Word document, a spreadsheet, or even a heat map outlining ideas to meet operating needs, product demands, or regulatory requirements. In current best practices, that list is then meshed up against capital planning data existing within other utility IT systems in order to make appropriate capital investment planning decisions.

ADVANCED CAPABILITIES

Good portfolio management focuses on collaboration, efficiency and flexibility. A comprehensive portfolio management tool—integrated with the rest of the utility capital project delivery system, from enterprise resource management all the way through to project controls and project management tools—utilizes reputable governance processes and consistent evaluation metrics, providing the means to analyze your portfolio to determine where CAPEX investments should be made.

It collates the appropriate high-level project data necessary to enable you to plan investments based upon your utility's strategic objectives, regulatory requirements, risk factors, potential ROI, and more; perform "what if" scenarios; and analyze performance progress.

The ability for data from one system to be used by another to make better planning decisions is a significant step. For instance, utilities with an advanced distribution management system utilizing real-time visibility and near-term forecasting can understand and pinpoint locations where assets are being pushed to their limits. Say, for example, electric vehicle installations in one specific neighborhood are causing a 25 kVA transformer to quite often serve 40 kVA of load, with other similar situations also identified on the same circuit, aggregating up to a substation power transformer, which is also becoming overloaded. When rolled up into the portfolio management tool, these data points become extremely valuable in justifying a substation expansion project.

Beyond data integration, visualization and optimization are also vital at this maturity level. Visualization aids in both internal and external stakeholder management, providing a clear picture of project investments to ensure alignment with your utility's strategic objectives. A solution that also provides standards to manage best practices and capture core project knowledge that can then be repeated on other projects optimizes consistency across projects and helps to reduce project costs. Further, a tool's ability to provide a structured, trackable process for promoting work from an idea or proposal to an actual project (with controls and

audit logs to ensure appropriate levels of authority are engaged) is central to being able to increase efficiency in this part of the lifecycle.

THE ART OF THE POSSIBLE

Looking to the future, continued integration and the automation of specific tasks will allow an increased number of stakeholders throughout your utility's lines of business as well as contractors to provide input to the ideation process within an integrated data repository, making it easier to move through the planning process with all the information necessary to make informed decisions about next best steps.

As building information modeling (BIM) methodology becomes more widely used, a BIM-centric digital twin—a virtual model or assembled aggregation of data and information from the planning stage forward, as well as the roles within and between participating teams and organizations—can serve to significantly save time and improve the delivery process. (As a BIM-centric digital twin continues to grow, you will be able to utilize it further along the asset lifecycle, as well.)

Finally, asset investment planning utopia will include an holistic view of business targets and desired outcomes supported by the optimization of all available and possible inputs, including consumer growth and preference, infrastructure needs, organizational needs (IT, transformation and training to utilize the latest and greatest in this ever-changing operational environment), cash flow, and resources. Essentially: given what you have available, what is the best way to utilize it for the best outcome for those you serve?

Does your current project or asset planning process allow data from one system to be easily used by another to make better planning decisions? Do you have a structured, trackable process for promoting work from an idea or proposal to an actual project?

Stage 2: Estimate & Design

Taking the guesswork out of guesswork

| Stage 2: Estimate & Design

At the beginning of the estimate and design stage, conceptualization and feasibility studies bring more meat to the bones of the idea you have moved through the planning stage. Typically, by this point, you have narrowed your focus to two or three different approaches to be explored in more detail with the aid of detailed engineering studies.

BEST PRACTICES

The work you've done in project planning continues within this stage, as you clearly define project scope and the specific project goals, deliverables, features and functions, tasks, deadlines and costs documented. You have put a gated approval process into place, breaking the project down into distinct phases, separated by decision points. This allows for the authorization of specific, identified costs (for example, front-end procurement expenditures for shop or fabrication drawings, or larger costs such as engineering studies) within each phase, without the necessity of authorizing the entire project spend at the outset. At clearly defined decision points throughout this lifecycle stage, project continuation is decided based on available information and forecasts, including the business case, risk analysis, and availability of the necessary resources.

A drawing and document control system with traceability and auditability, as well as analytical capabilities, is also a must in terms of best practices, allowing you to analyze your turnaround time, identify where your drawings are, and be able to track who within the project teams has received what, and when they received it. Once the design stage has begun, schedule discipline is essential.

It is at this stage that an established change and risk management process also becomes necessary, reflecting the process your company requires as plans change from the original vision and scope. It should be auditable, and provide you with the ability to forecast where the project is headed when the changes are taken into account.

ADVANCED CAPABILITIES

Here again, the difference between current best practices and a best-in-class system is its integration and progress management capabilities. Advanced work packaging, enabled through the integration of data from your project scheduling tool and your project controls tool, then allows you to be able to set up earning rules, by which you can far more effectively measure the performance and progress of the project at any time once work has begun. The ability to integrate cost, change and contingency tracking is critical at this maturity level, so that your project teams can more accurately forecast where the project is headed from both cost and schedule perspectives.

At the same time, visualization is critical within this stage of the project/asset lifecycle in order to effectively manage both start-up planning and cost management. For the former, if you're not able to easily visualize how you're going to start up the project when you reach the construction stage of the lifecycle, you won't be able to adequately translate

that vision into progress. For the latter, visibility is imperative in managing how your contingencies are being depleted. As people make changes, including to rigor and process, you need to be able to effectively show the impact of those changes within your project cost management breakdown.

THE ART OF THE POSSIBLE

Looking ahead, better model reviews and walk-through 3D renderings will play fundamental roles in visualizing and informing project progress every step of the way. An integrated visualization tool that will allow you to take a drawing, document, or schedule—really any chunk of project data—and present it in multiple different formats for different groups of project stakeholders (engineering, construction, testing, or operation), breaks the art of the possible wide open for project design.

Further, as modeling capabilities continue to improve, it will become much easier to ensure your project schedule drives what your model shows. In other words, your project controls teams will have the ability to align their schedule activities with the model so that, during the execution of those activities, the model can be updated (usually by way of color codes) to show progress to teams, leaders and executives.

Are you able to easily visualize how you're going to start up your project when construction begins? If not, you won't be able to adequately translate that vision into measurable progress.

Stage 3: Acquire & Construct

From concept to concrete

| Stage 3: Acquire & Construct

Project design, by necessity, often goes on iteratively, with financial commitments coming in tranches as the design progresses. This often causes the estimate & design stage and the acquire & construct stage of any capital project, particularly a large one, to overlap.

BEST PRACTICES

When your utility moves into the acquisition and construction phase of a project—whether it be building a new asset or replacing equipment at an existing asset—disciplined bidding, with visibility and auditability, means all competing vendors for the project have the same information. At this stage, clear tracking—through RFID tags or other tracking tools—of the materials ordered for construction to begin is also an imperative for staying on track and on budget.

An important best practice within this stage of the asset lifecycle is being able to effectively track construction progress. A Level 3 schedule covering the entirety of the project, including all major milestones, as well as major elements of design, engineering, procurement, construction, testing, and start-up, is often used to do this tracking and feed a monthly progress report.

Finally, once construction begins, safety metrics join cost, risk and schedule metrics within any project control system, and need to sit in the same data repository as the other three sets of metrics.

ADVANCED CAPABILITIES

Visualization capabilities continue within this stage of the asset lifecycle to be important differentiators between generally agreed-upon best practices and a best-of-breed approach. An effective enterprise project portfolio management tool provides a graphic view into how team members are utilized across all programs and projects, and their forecasted future use. As well, all project team members are able to gain access to role-based project information and communicate activity status updates, issue resolution, scope changes, document revisions, and more. This approach not only improves and streamlines communication between all parties involved in the project—from vendors to utility executives—but also makes resource conflicts immediately apparent, greatly improving efficiency. As well, an effective enterprise portfolio management tool enables you to easily confirm what the information is that all vendors and/or stakeholders have received and when they received it, a key ingredient to dispute avoidance and resolution.

Mobility and the ability to collaborate are also important at this level of maturity. Being able to walk around the job site, take photos, and upload them along with applicable notes so that all pertinent project stakeholders can visually track construction progress provides higher efficiency and a new degree of flexibility to the construction stage of the lifecycle.

Finally, risk management is greatly improved by the ability to be able to integrate risk metrics with schedule and cost metrics to run conditional probability and impact scenarios and provide your planning teams with the most likely set of outcomes, including budget and expected in-service day for the completed asset.

THE ART OF THE POSSIBLE

Technology is driving rapid change across the project and asset lifecycle. Imagine leveraging the transformative power of developing technologies such as the Internet of Things, drones, autonomous equipment, augmented reality, artificial intelligence, machine learning, digital twins and more to create an environment for asset lifecycle management in which you could:

- In the construction phase, combine the output from construction site cameras with machine learning algorithms to monitor and predict safety incidents.
- Use smart glasses as a tool on the construction site to scan equipment labels and other appropriate data, and transfer that data off-site to automatically populate your BIM-centric digital twin.
- Leverage the collective data within a digital twin throughout all stages of an asset's life, from early planning, design and construction to training, troubleshooting and diagnosis of asset issues in order to make highly data-informed repair versus replace decisions.

Does every member of your project team have access to role-based project information? Can they easily communicate activity status updates, issue resolution, scope changes and document revisions so that this information is visible to all parties involved in the project?

Stage 4: Operate & Maintain

Maximize your asset's value

| Stage 4: Operate & Maintain

This is where the asset realizes its value. Once it is demonstrated that the asset is operating as designed in the original plan, estimate and design stages, it is turned over to utility operations along with its start-up records, calibration records, original equipment manufacturer (OEM) manuals, the spare parts list, maintenance requirements, and more.

BEST PRACTICES

Within best practices there are five key questions to be asking as you take operational ownership of a new asset:

1. Is the asset in our operating space and have we documented it? (This is the documentation for asset operation.) Do we have the DNA of the asset: How was it purchased? What is it? What are the asset details? Who designed and commissioned it? What is the warranty period?
2. Where is the asset's physical location? (This is usually documented via a system of record.)
3. Do we have the financial records for the asset?
4. Do we have plans in place to also support ongoing asset health monitoring, reporting, and inclusion in future O&M and capital planning?
5. Do we have maintenance plans in place, or the strategy with inventory, tooling, procedures and skills to support the asset?

Having all of this information documented allows you to take the next step of creating a history of the activities associated with the asset throughout its lifecycle.

ADVANCED CAPABILITIES

At this maturity level, smooth data integration from the project management tool to the operational asset management tool is important so that your operations team does not have to build the asset history manually, culling information from numerous resources. With a centralized, single go-to source now providing asset location, position, status, criticality, current operating environment, duty cycle, cost and output, you now have immediate visibility, control and outcome capabilities. You can analyze "what ifs" and define scenarios based upon changing resource, financial or operational perspectives—streamlining your decision-making process for operating, warranting and replacing assets.

But it's more than just having all the asset's data in one place. A comprehensive approach to asset health means also having the flexibility to weight all of that data—by category or by source—to build an overall asset condition score that is meaningful to your operations. How old the data is, and how frequently you collect it, can make big differences in how you weight it in order to give you the best indicator of each asset's health.

The ability to perform situational-based maintenance is also important at this maturity level. While asset maintenance intervals are initially set as a matter of course, if that asset's condition score drops, you are able to pivot your maintenance strategy to increase frequency. Essentially, you can reframe your maintenance strategy to more accurately reflect the asset's current and projected health. For example, in summer, all maintenance is high priority for a water utility, because the equipment and infrastructure is

being used far more regularly. In winter, however, water usage typically declines, and you can then pivot the maintenance schedule based on seasonality and condition of the asset.

Compliance and program management, too, play vital roles in the success of any asset-intensive operation. At this maturity level, you are able to easily view and monitor how well your assets, resources, and suppliers are performing against a stated objective or desired outcome, and continuously improve asset and department value both to your organization and to the constituents you serve.

THE ART OF THE POSSIBLE

In general, in the world of work and asset management, the new mix of integrated asset data accessible to the business will continue to reveal a wealth of previously unseen opportunities.

Autonomous decision-support tools will change the way you maintain your utility assets. Using these tools, as the system collects and analyzes asset health data, it will flag emerging issues, pivot to situational-based maintenance, and initiate the relevant work activity responses. Say your utility is monitoring the performance of your customers' rooftop solar arrays, and the system flags within the maintenance schedule an underperforming array. The system could then dispatch a drone to take a photo of the array and a description of its current state (in comparison to a clean solar array) to provide to the customer along with choices about how to repair it. Would they like to clean it themselves, have you do it for them, or shop from a list of maintenance contractors you can provide?

In the digital twin world, using IoT-enabled infrastructure combined with usage, demand, weather, price and a trove of other data, your utility could operate, manage and maintain owned, leased, customer or service-provided assets on a just-in-time or near real-time basis.

For example, an augmented field application that displays real-time sensor data could aid field workers through the steps needed to safely fix or maintain assets, and provide suggestions about additional tools to order or parts to print. The same app could also allow workers to review digitized manuals while still in the field, and provide the ability for live collaboration with colleagues back at the office to solve problems quickly and safely.

Generating an accurate digital twin will enable the future of the increasingly asset-centric utility world, driving down cost while improving the reliability of your service based on actual performance and condition rather than your annual budget.

> When you take operational ownership of a new asset, is your operations team having to build that asset's history manually from numerous resources? How long does that take? What are you missing?

Stage 5: Retire, Dispose or Renew

Completing the circle

| Stage 5: Retire, Dispose or Renew

The decision to retire, dispose or renew a utility asset isn't the end of a linear path for the utility. Asset retirement decisions feed directly back into new planning, with new project execution and cost accounting to be undertaken. On a small scale, a distribution transformer or water meter cannot simply be disposed of, but must also be replaced. That is true on the large scale, too: as a utility retires a coal-fired generation plant, for example, it must replace that generation capability and voltage support in an alternative way. New projects have their genesis in this final stage of an asset's lifecycle, and their cost implications must be visible and accounted for properly.

BEST PRACTICES

In the past, the utility best practice for retiring, disposing of or renewing an asset was purely date-based: you knew the life expectancy of the asset or the regulatory requirements necessitating its retirement, and made plans to replace it at that time. While digital technologies and analytics have changed that approach in recent years, utilities are still at differing levels of maturity with regard to their approaches to asset performance management and repair-or-replace decisions. Some use the old approach, some look at asset health but don't tie it to their asset maintenance strategy, and some prioritize asset health and use predictive analytics to drive a preventive, right work/right time approach to asset management.

2 ADVANCED CAPABILITIES

Just as asset health-based maintenance can lengthen the life of an asset, rather than simply running it to failure, the history of an asset's health, as well as its situation, dictates the best approach to a repair/replace or dispose/renew decision. Being able to look at the energy consumption of any particular asset—is it steadily increasing, and how does that increase affect operating expenses—provides an important, additional step up in the repair/replace decision.

In utility operating plants it is not uncommon to see 30 percent of the operating budget going to energy consumption. In a large water treatment plant, for example, that energy drives a series of large industrial pumps. In the past, as long as water flowed, and the flow was reasonable, there was no driving need to repair or replace the pump. But as a pump continues to deteriorate, it uses more and more energy to run, skewing the cost curve. If, then, you have the ability to monitor the energy consumed against the output, it becomes much easier to define the optimal time to repair or replace a motor.

3 THE ART OF THE POSSIBLE

In the final stage of an asset's lifecycle, embedded decision support tools such as artificial intelligence and machine learning will continue to play an important role in completing the circle, making data correlations and flagging issues you may not have been looking for. Being able to make more definitive decisions about asset health and reliability—how you're operating the asset, what its duty cycle is—comes from the ability to also integrate your network model data, including weather patterns, usage, and other variables, to be able to create an even more accurate picture of the asset and network to deliver a service or product to the customer.

| Stage 5: Retire, Dispose or Renew

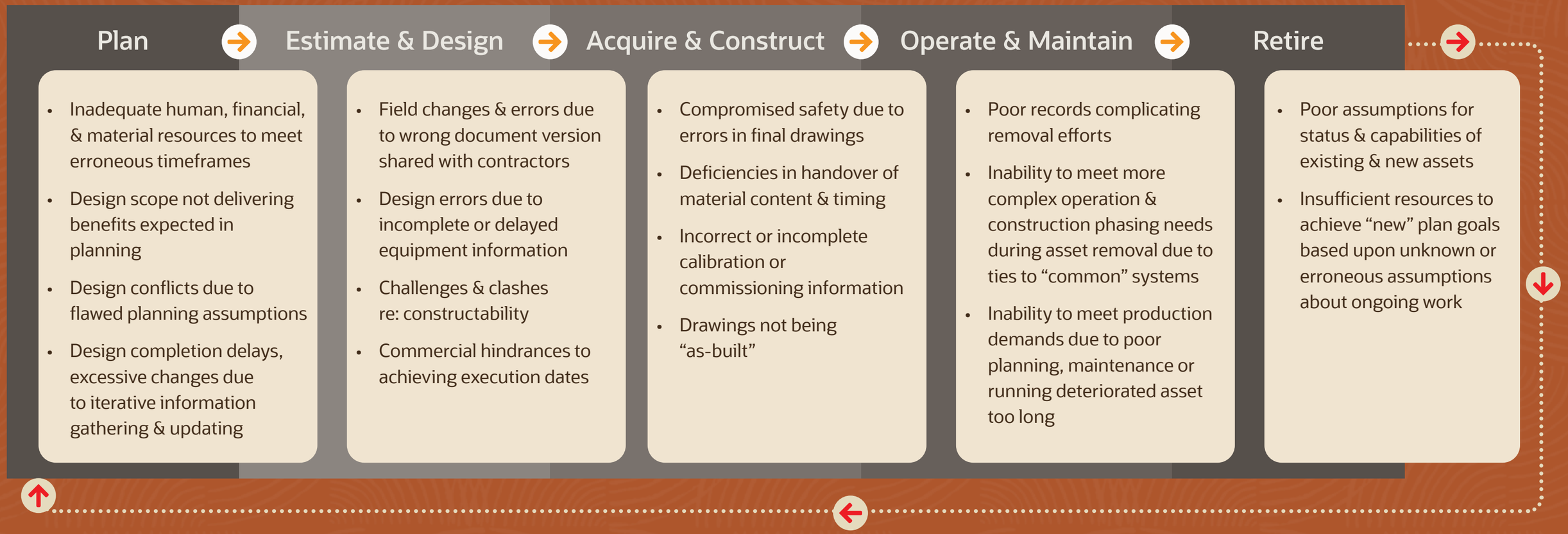
Based upon an asset's health score and its current history, as well as planned replacement schedule data, the asset management system itself will be able to autonomously recognize the best approach to a repair-or-replace decision, and provide suggestions and scenarios for decision-making purposes.

And this will not be limited to short time-frame planning, but could be modeled to include long-term financial planning, too. For example, you may be asked to cut your asset planning or asset maintenance budget. Being able to model within a digital twin a variety of scenarios to make that budget cut, you will be able to actually see the impact of each modeled outcome.

What is your current approach to asset performance management and repair-or-replace decisions? What factors do you include in determining the optimal time to repair or replace an asset?

Identify and eliminate cross-stage data challenges

Managing an asset's lifecycle within silos creates challenges especially as each stage moves into the next. These typically include the following:



Taking an integrated, enterprise-wide approach to asset lifecycle management, with asset data and information flowing with the asset from one stage to the next, irrespective of the solution using it, can eliminate these legacy challenges.

Are you ready to move **beyond best practices**?

Three questions to ask yourself when evaluating your approach to asset lifecycle management

q1

Does my utility increasingly find that our ERP system by itself is unable to cope with the growing complexity, data and processes involved in managing the entire lifecycle of our utility assets?

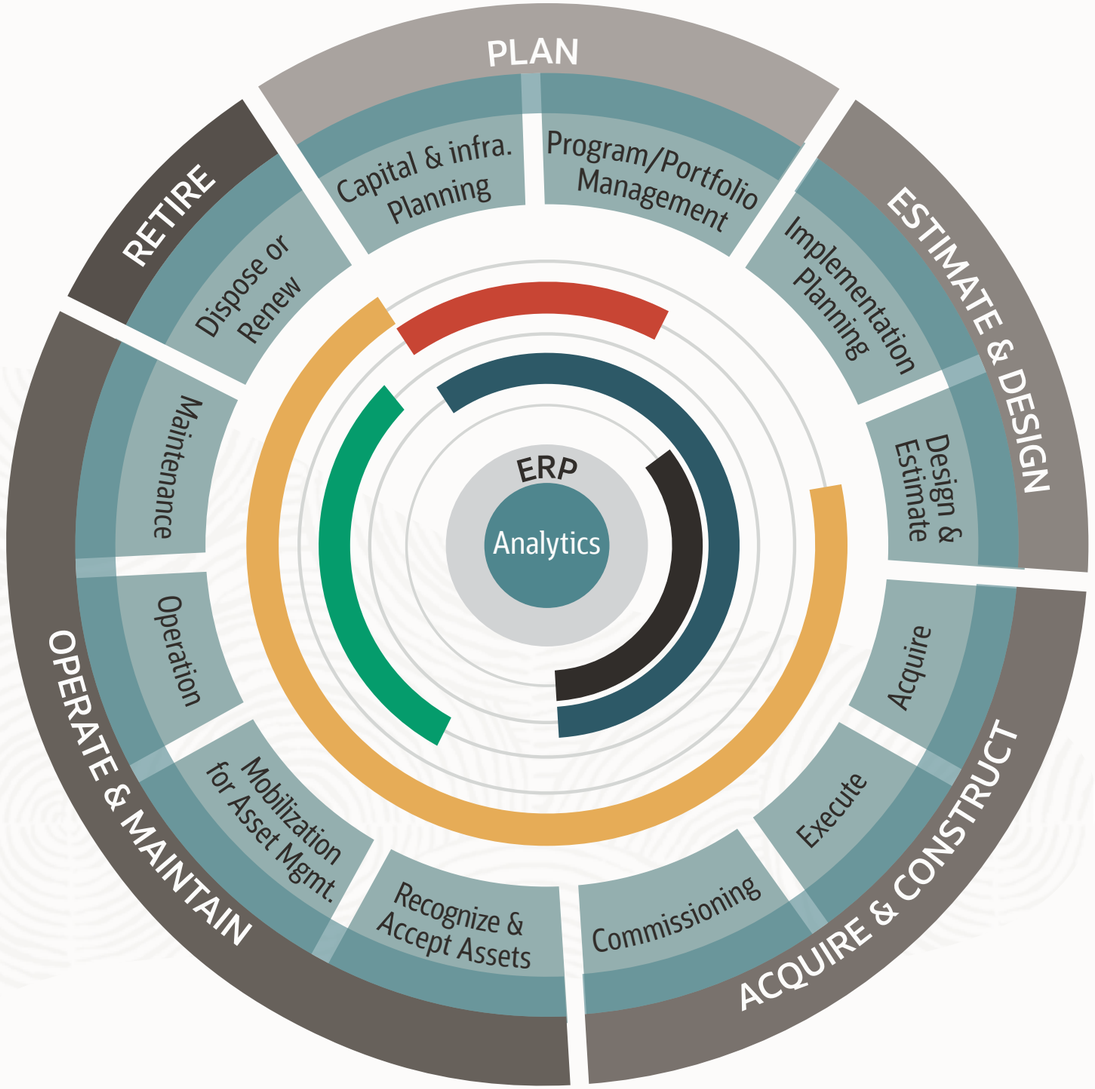
q2

Does my utility's approach to asset lifecycle management cover every stage, from initial planning to final retirement, with best-of-breed, integrated technology, or are we having to piece together disparate systems that do not easily speak to one another?

q3

Does my technology partner have cross-industry expertise from ERP through construction and engineering to utility operations, as well as the technology solutions necessary to break down the legacy silos related to utility asset lifecycle management?

End to end, Oracle is the only technology partner able to help you to answer all three questions with a resounding “Yes!” The means to meet and exceed end-user expectations depend on our being able to provide utilities with the tools to reliably operate, support and accomplish the journey. With our deep-seated experience, from ERP through construction and engineering to utility operations, and an integrated platform that encompasses the entire asset lifecycle, we can simply solve your best-of-breed problems with a platform and integrated solutions that are best in class.



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