Reinventing utilities for a sustainable digital future

Electric and telecom networks have today become the backbone of economic activities, while water, oil and gas continue to be the mainstay for fulfilling basic industrial and human needs. Contributing 2.7% directly to India's GDP (2021-22), electricity, telecom, water, and gas utility services make a significant impact indirectly on the economic, social, and environmental fronts.

Utility challenges and priorities

While economic growth instantly triggers utility demand, changing lifestyles and consumer behaviors add pressure on the utility infrastructure to ensure the provision of their services. Increasing population and industrialization are constantly adding stress to utilities on the demand side, while the supply side continues to be constrained due to financial challenges and dependence on natural resources.

Utilities continue to be pitched against ageing physical infrastructure with poor operational efficiencies, limited avenues for revenue and digital savvy "prosumers" with rapidly evolving expectations. Most of the utility assets and networks are physically exposed and highly vulnerable to disruption by the act of nature or humans. Striking a balance between supply-demand, source-consumer, policy-regulatory environment and operational challenges, utility companies have been constantly striving to address the expectations of their stakeholders.

Rapidly changing dynamics of the industry, depleting natural resources, evolving consumption patterns, and the imminent need for agility and resilience in the backdrop of natural disasters are forcing utilities to adopt innovative ways to plan, design, operate, monitor, and manage at both strategic and operational levels. Some of the immediate priorities for utility CXOs are:

• Reduce the divide and widen the consumer base
• Improve asset monetization and resource sustain ability
• Optimize operational costs and improve margins
• Redefine consumer engagement
• Improve agility and strengthen resilience
• Explore new business models and revenue streams
• Prevent cyberthreats and ensure regulatory compliance

With changing times, utilities too are recognizing the need to address strategic and operational challenges through digital interventions by contextualizing supply-demand and understanding them in the context of source-consumer while ensuring compliance with regulatory requirements.

Going digital

It is no secret that digital transformations are ushering governance, businesses, and societies into a new era. As digital interventions continue to proliferate, dependence on digital solutions for sustainable economic growth becomes inevitable. Digitalization of infrastructures, smart meters, smart sensors, IoT devices and smart solutions are on top of the agenda for most of the utilities embarking on their digital transformation journey.

With increased automation, better accuracies and real-time information, these technologies are helping in improving productivity, efficiency, safety, compliance, and reliability. Followed by better asset management, planning, execution, and faster level of service with higher customer satisfaction. This is also transforming the way utilities interact with their infrastructure and customers.

As digital solutions find their way in, utilities are also staring at a web of direct real-time-intelligent devices and systems generating petabytes of data every passing minute, challenging them to unravel and demystify to make better sense. This large volume scattered across the ecosystem is a goldmine that utilities can dig into, to contextualize their business operations. And by not exploiting this hidden power, utilities are depriving themselves and their stakeholders of benefits. Once successful, utilities have numerous opportunities that can be tapped including graduating towards demand-based generation and distribution, while at the same time providing consumer centric tailored services.

Interestingly, as utilities try to navigate their way in the world of "digital transformation" every effort turns out to be a realization and a story to be told. Easier said than done, implementation of "Digital Utility Solutions" are laden with challenges and unknowns.

Heralding into a contextualized world

As utilities step into the digital future, decision-making at every strategic and operational step will have to be backed with data and insights in the context of the subject that is under review. Digital transformation initiatives also call for innovative approaches and technologies that not only harness the large volumes of data, but also are self-learning, able to analyze and reproduce insights and can be tailored to geographies and situations. By virtue of their inherent design, traditional technologies often pose limitations in looking beyond their boundaries and fall short of providing a holistic picture of the business processes and consumers.

While demand ushers growth and competitiveness, utilities are under constant pressure to respond rapidly to changing business landscape. For utilities to stay ahead, their strategies need to be contextualized and centric to consumer and their behaviors. And this can be only done by connecting assets, people, and processes. And thus, the need for enhanced situational awareness of their landscape with actionable intelligence for advancing their customer experience becomes more than ever.

One glaring commonality, often overlooked, is that more than 90% of utility enterprise has a context of location associated which can be easily harnessed for the greater good at a minimal cost. Be it supply-demand or source-consumer, the context of geography is the common binding factor that can help utilities reinvent themselves for a sustainable digital future.

By helping utilities to map a common ground, Esri's ArcGIS has been playing a pivotal role in supporting them to reinvent their journey into the digital future. Providing a robust platform with tools, utilities can geo-enable their environments with simplicity and leverage 3As (Access, Awareness and Analytics) to start with.

- **Access** by connecting everyone with maps and data facilitating improved availability of information on demand-supply, source-consumer, assets, plans, compliance issues, and future scenarios in one place.

- **Awareness** by providing enhanced visibility of their subjects in the context of their geographical location whilst helping them to keep a pulse on supply-demand, source-consumer, real-time weather,

traffic, disasters, etc. arming them with the ability to respond rapidly to evolving situations.

- **Analytics** of all subjects on a unified platform revealing relationships, patterns, trends, and insights from volumes of disparate data for decision support in monitoring, managing, and predicting future scenarios.

Further by bringing in all the elements that are needed to contextualize and solve utility challenges on a common platform, ArcGIS powered geo-enablement arms utilities with 3Ss (System of record, System of engagement, and System of insights) in a language of maps that is understood by all and easy to use.

- **System of record** - ArcGIS gives utilities a design and build data models, providing ease of editing, expanding connectivity capability, and scaling to any size.
- **System of engagement** - ArcGIS integrates all types of data, gives all users access to the data they need for better collaboration, and supports digital transformation.
- **System of insights** - ArcGIS features real-time business intelligence (BI) dashboards and includes out-of-the-box analytics that uncovers never-before-seen patterns. It reveals secrets in the data and unnoticed trends.

Maximizing geographic potential

Globally, GIS has proved to be an irreplaceable tool for demystifying utility data and providing location rich "contextualized" insights. For addressing the complex challenges utilities are faced with, "Geo-Enabled Smart Utility Management" approach provides a bird's eye-view of the utility infrastructure with the ability to narrow down to individual asset and consumer.

Along with tools for analysis, visualization, modeling, and collaboration - GIS amplifies the digital utility operations multifold by enhancing situational awareness along with actionable intelligence for informed decisions both at regional and local levels. While helping to avoid "data traps" the context of geography aids utilities to discover, democratize and contextualize ever-increasing volumes of data by providing stakeholders with the power to see, visualize, detect, assess, and respond.

Benefits of harnessing geographic potential

- Provides a bird's eye view of utility infrastructure from source to consumer, with ability to drill down to finer details on click of mouse

- Access data that is contextualized, can be intuitively visualized, and analyzed for location specific temporal patterns and trends

- On-demand location specific operational picture and actionable intelligence for decision support

- Real-time, non-intrusive monitoring of resources and assets, improved prevention of pilferage and safety of assets

- Anywhere, anytime contextualized & real-time information for customers and other stakeholders

- Improved outage management and reduced down-times, and tailored predictive maintenance

- Optimized mobile workforce management, improved operational fleet management, optimized routing and fuel savings

- Targeted energy consumption management and costs, predictive modelling, and simulation

- Better disaster preparedness and emergency response

- Improved agility, adaptability, sustainability and resilience

With Esri's ArcGIS platform at the center-stage, Indian utilities have been increasingly harnessing the geographic potential in the last few decades. By geo-enabling their infrastructures, utilities capture, store, manipulate, analyze, manage, and present, data from disparate sources across networks on a unified platform. Thrissur Municipality, Orange City Water (Nagpur) and Municipal Corporation of Greater Mumbai (MCGM) have taken lead in geo-enabling automation of their water / wastewater utility operations.

Facilitating planning, design, monitoring and maintenance of networks, GIS technologies are becoming invaluable to utilities for strategic and operational decision support in the management of - land information, distribution, transmission, outages, workforce, revenue, compliance, network integrity, surveillance and

infrastructure protection and emergency response. In the power utility sector - Reliance Infrastructure, Sterlite Power, Tata Power, BSES Yamuna and many state owned discoms are leveraging ArcGIS to improve their operational efficiencies, reduce AT&C losses while providing enhanced services to their consumers.

Globally geo-enabled automations are proving to be irreplaceable tools for demystifying utility ecosystem intricacies while providing "contextualized" insights. In the telecom sector, Airtel and Reliance Jio rely on ArcGIS for their network operations, asset management, workforce management, marketing, and customer service improvement. And in the oil and gas sector ONGC, GAIL, IOCL, BPCL, Adani TOTAL GAS, Green Gas, BVRL, MNGL and many others have been leveraging ArcGIS for their operations and asset management.

Seamless flow of data and information from legacy systems, sensors, IoT and smart devices onto a common platform are enabling utilities to respond faster to strategic and operational contingencies. National Smart Grid Mission Project Management Unit (NPMU) and some utilities have taken a step forward by integrating their ArcGIS enterprise implementations with IoT, SCADA, SAP and other ERP systems and extending them to ArcGIS based field tools to leverage their investments for advanced distribution management operations.

These ArcGIS powered interventions have improved operational efficiencies, while significantly improving business continuity and uptime, while enhancing quality of services and resource productivity. Geo-enabled network mapping and asset mapping are enabling quicker detection of faults for faster response while at the same time achieving better management of their assets and resources. These utilities are now advancing towards harnessing location intelligence from all quarters for 360 degree contextualized insights to address strategic and operational priorities.

It is noteworthy that only a small part of the available geographic potential is being currently tapped. With still a lot of potential available that can be leveraged, utilities are gearing up for advancing their geo-enablement efforts for a sustainable digital future. By leveraging machine learning and artificial intelligence, utilities are now aiming to exploit the advanced capabilities for predictive modelling and simulation.

Advancing into a sustainable future

For advancing into a sustainable future, utilities need a robust framework that can contextualize their processes, systems and resources for actionable information while ensuring a safe working environment, delivering reliable services, and maintaining a focus on customer support. Utilities need solutions that can serve as the system of record for the assets and provide information about the past, present, and planned future state of a utility network system. And that is accessible and available anytime-anywhere to all stakeholders.

Some of the technological advances that are at the disposal of utility CXOs to make better contextual sense from the exponentially increasing data volumes for advancing into a sustainable future are:

• Faster computing available at lower costs and their ease of integration with non-spatial enterprise systems with ever increasing volumes of geo-data from UAVs, satellites, LiDAR, and other IoT sensors, along with crowdsourced data.

• Developments in image recognition and feature extraction, coupled with reduced storage costs, are fostering faster data capture and geospatial content creation. Enhancing the quality and accuracy of High Frequency Indicators (HFIs) for constant monitoring and iterative adaptations for dynamically evolving situations.

• "Digital twins" and "virtual utility models" offering an immersive experience and newer opportunities for businesses to access the metaverse in multiple ways, transforming the way utilities interact with their physical assets and infrastructure.

• Emerging cloud based geospatial data/content management tools and capabilities revolutionizing capture, maintenance, and management. Helping utilities to take away the burden of managing the infrastructure and associated challenges.

• Geospatial information combined with other statistical data providing ability to utilities to address ESG challenges with ease. Helping them in regulatory compliance.

• Spatial modeling and analytics, artificial intelligence, machine learning and deep learning.

• Geoinformation driven experiences through mobiles transforming consumer behavior and triggering demand for dynamic, proactive, and even prescriptive, location specific personalized utility services.

And to siege the opportunities they present; utilities need to be ready with next generation information systems that provide advanced spatial capabilities for contextualization by harnessing massive datasets at every scale of resolution.

Such solutions need to be:

• Industry focused and can be configured for any utility (municipality, or organization with linear assets (electric, gas, and water utilities, architecture, engineering, construction (AEC), and telecommunications).

• Allow utilities to model operation and structural networks in an integrated fashion with network rules to build networks that suit business requirements.

• Are scalable and drive better decision-making with high-quality data with right tools for data collection modeling, and analysis.

ArcGIS Utility Solutions are making access to contextualized information easier than ever helping utility CXOs to address their priorities better than before. They are helping organizations to stay agile in the changing times and drive innovation. Making it easier, faster, and cheaper than ever, ArcGIS is providing an opportunity to utilities to proactively interact with every asset and consumer.

By augmenting existing frameworks with **ArcGIS Utility Network**, utility CXOs can enhance their business value delivery while optimizing operations for improved efficiencies and increased customer satisfaction, paramount for a sustainable future. Designed to be the next generation spatial information system, **ArcGIS Utility Network** provides a comprehensive solution for a smooth transition of utilities to be future-ready.

Reinventing geospatially

As a force multiplier, geo-enabled smart utility management is helping utility CXOs to reinvent their business processes in newer ways, like below, for a sustainable digital future.

1. **Next generation data management** – is improving data quality and support analytics to detect patterns and reveal trends for data-driven decision-making.

2. **Real-time communication and collaboration** – is helping in improving efficiency and providing information when it's needed the most.

3. **Data-driven decision making** – is helping CXOs to devour underutilized data with world-class analytics leveraging spatial analysis, machine learning, big data analytics, and image processing and

4. **Digital twin technology** – is helping to connect information, systems, models, and behaviors with spatial context, creating holistic 3D digital representations of environments, assets, networks, and cities.

Enhanced contextualization provided by ArcGIS is enabling digital transformation of utilities, while at the same time positioning them better to progress towards a demand-based generation/distribution and consumer centric tailored services. As an extensive information system that enables new results—solutions that devour underutilized data, harness analytics, and run on any device, ArcGIS based smart utility solutions are helping utilities to reinvent geospatially. ArcGIS catalyzes the improvements utilities desperately seek today and will be seeking tomorrow.

Taking advantage of combined power of computing and the cloud, ArcGIS's cloud-based offerings provide scalable computing, storage of large datasets, big data computation, and the ability to surge resources during critical events such as emergency response. The geospatial cloud strategy allows quick integration and analysis of large datasets and imagery at scale for even the largest utilities in the world. The combination of advanced spatial analytics and new AI tools helps model and visualize complex patterns, relationships, and situations.

Leveraging services-based architecture, ArcGIS Utility Network is a next generation network management framework designed to modernize utility networks with the right tools for data collection, modeling, and analysis and provide secure data access for users across every platform for informed decisions.

Doing away with silos to manage domain specific requirements, ArcGIS Utility Network equips utilities with a comprehensive framework for modeling contextualized utility systems (electric, gas, water, storm water, wastewater, and telecommunications) and allows to build real-world behavior into modeled networks. Configurable for any utility or organization with linear assets, ArcGIS powered smart utility infrastructure is engineered to work well in cloud environments, in on-premises infrastructure, and in hybrid environments.

Acting as a force multiplier, ArcGIS powered utility solutions are enabling utilities to migrate to a real-world model of their assets, building a stronger system of record, liberate information for all stakeholders – internal and external—creating a dependable system of engagement and capitalize on analytics, growing a system of insight. Facilitating better decision making and providing new and flexible ways to deliver the capability utilities need—where and when it is required.

Benefits of using ArcGIS Utility Solutions

Reduce divide and widen consumer base

Utility networks are trans-geographical with multiple dimensions and stakeholders. Till the digitalization curve matures, understanding the existing and future consumers and scenarios is critical to designing a successful digital utility strategy. With the ability to communicate in a simple language of maps ArcGIS fosters enhanced situational awareness, larger participation, and increased collaboration – reducing digital inequality, while at the same time helping utilities to widen their consumer base.

Improve asset monetization and resource sustainability

Efficient asset monetization relies on asset visibility, asset utilization, and data-systems environments for a better understanding across the entire asset life cycle. ArcGIS powered spatial intelligence enables a holistic approach with fresh insights about asset performance, risks, resources, and costs. Using location, utilities can discover patterns and trends that conventional asset reporting cannot detect. With the ability to build accurate, real-world models of the entire network, GIS provides greater insight into assets – in relation to both their surroundings and their threats.

Optimize operational costs and improve margins

Understanding spatial relationships enables utility organizations to identify, evaluate, and mitigate risks. Dashboards display operational views of work—specific to the user's needs. Seeing field activities in real time improves workflows, resulting in more work completed in less time while optimizing costs. Analytics determine why assets failed, identifies patterns, and trends, and helps focus investment where it is needed most. ArcGIS helps manage data, share information, and visualize system status by providing all the key facts in one place, avoiding confusion, saving time, and providing insight into live operations for timely tactical responses and improved margins.

Redefine consumer engagement

Understanding consumer demographics vis-a-vis consumption patterns, critical assets, and utility projects increases the ability to communicate and engage with them. ArcGIS integrates business systems, providing a holistic view of consumer information in one place. Empowering consumers to access the information they want, when they want it, increases consumer satisfaction. ArcGIS provides better access to the information consumers need (real-time data on service outages, restoration, maintenance, etc.), resulting in more informed, knowledgeable, and satisfied consumers.

Improve agility and strengthen resilience

The advanced capabilities of ArcGIS support utility project planning and management with simplicity, efficiency, and intelligence, improving the agility of utilities. State-of-the-art visualization brings these ideas to life while sophisticated data management and powerful analytics make them real. ArcGIS brings exceptional value to every utility's engineering, planning, design, and construction practice by supporting real-world modeling. Delivering rich visualization and analytics with artificial intelligence (AI), ArcGIS enables immediate coordination and collaboration with stakeholders. By placing the right information in the right hands at the right time, ArcGIS provides all the elements needed to meet planning and engineering challenges and strengthen resilience.

In closing

Overcoming the challenges facing utilities today seems overwhelming at times. As utilities struggle to remain relevant and strive, changes in the utility environment and the explosion of data demand vastly better ways of managing, examining, and communicating utility information.

Owing to the trans-geographical nature of utility ecosystems and their multiple dimensions (political, economic, social, and environmental), just focusing on the assets and/or consumers in isolation is not enough. There is a need for a bird's eye-view that provides us with spatial and temporal understanding of the expanse, dependencies, and linkages at a regional scale. At the same time, there is also a need for minute details at a local scale that provide intelligence for action on the ground, which only GIS provides.

Only geo-enabled smart utility networks can ensure reliability and strengthen the network resilience to bounce back in the event of disruptions. By reinventing their processes geospatially, utilities can not only improve their own operations, but also provide their customers with greater flexibility, transparency, and choice over their services. With the profound impact current utility operations have on the future generations, sooner utilities reinvent themselves geospatially, the faster they can gear up for a sustainable and resilient digital future.