



Your Guide to Becoming a Digital Industrial

Use this guide to kick-start your transformation journey



The rapid explosion of sensors, ultra-low cost connectivity and data storage, together with powerful analytics, is transforming services and business models in the industrial sector.

Companies old and new are transforming themselves to extract value from traditional industrial sectors by delivering digital, data-rich services. By taking advantage of the rapid explosion of sensors, ultra-low cost connectivity, and data storage together with powerful analytics (commonly referred to as the IIoT—or the Internet of Things), these value-added services can produce business outcomes for customers and produce incremental revenue for the company. Indeed, customers are coming to expect not only best-in-class physical products from manufacturers but also new ways that they can drive increased levels of productivity and business impact.

Implementing this digital industrial transformation is not a simple task. Keystone Strategy recently conducted in-depth research with 75 companies that attempted their journey starting with an industrial IoT initiative.

When companies attempted the transformation by themselves—working to cobble together multiple software, hardware, communications, and cloud computing technologies to collect, process, and report on sensor data—results were very poor. Most projects took over three years to complete. And in spite of considerable efforts, just 5% were achieving significant business outcomes. Most projects instead merely established a basic level of “ping-response” with their connected devices and barely started reporting on backward-looking questions (i.e., “what happened?”). Many were struggling with how to store and process this new influx of data. Others described a one-step-forward-two-steps-back evolution where they began to collect data only to realize that they were not capturing anything truly valuable to the business.

Pitfalls of IIoT initiatives

A 2015 study from Keystone Strategy of 75 Industrial IoT initiatives shows dramatic differences in adoption performance and approach, with just 5% achieving significant business outcomes:

	Average	Best Practice
Time-to-value	3-years	3-6 months
Development	Waterfall	Agile
Equipment	Monitoring	Predictive
Perspective	Rearview	Forward looking
Results	Reporting	Outcomes

Without a purpose-built industrial platform, most initiatives so far have only at best produced incremental improvements rather than truly transformative experiences.



Even the most established and well-run companies often underestimate the challenges of making an important transition in technology or business models.

Digital industrial transformation will change almost every aspect of a firm's operating and business models. It will require new capabilities in software development and analytics. It will motivate the adoption—and nurturing—of new partners. It will drive towards new sales models and opportunities. It will change pricing schemes and approaches. Ultimately however, most transitions fail because they underestimate the complexity, pervasiveness, and organizational impact of the challenge.

Clearly a “go-it-alone” approach is not an easy undertaking. However, research has shown that platform adoption can drive massive new efficiencies for traditional firms managing complex business and technology transitions. Years of innovation research at GE have demonstrated the value of software platforms to accelerating innovation and managing disruptive change. For example, thousands of companies have improved their sales and marketing practices through the use of Salesforce without building their own customer relationship management (CRM) system from scratch.

Naturally, adopting a platform does not work in isolation. GE has distilled the best practices based on its own experience into three steps for getting started on the journey.

3 steps for getting started on the journey

01 **Create a roadmap with milestones and outcomes in mind**



02 **Build internal alignment and organize the right capabilities**



03 **Engage with customers in rapid, low-cost, iterative experiments**



01 Create a roadmap with milestones and outcomes in mind

Developing a digital industrial transformation roadmap is key to setting a clear vision for the long term that drives strategic alignment. A good roadmap should define the most impactful starting points as well as key milestones to progress over time. Additionally, the roadmap should provide a vision for how your company will differentiate itself through outcome-based services and how it will monetize these offerings at different stages of evolution.

Figure 1 sketches the basic structure of a digital industrial transformation roadmap. As you go from left to right, the scope of digital transformation increases, targeting increasingly

complex and diverse challenges, and driving increasingly important impact. As a first step, organizations will start by adopting increasingly ubiquitous sensors that begin to collect data to monitor the performance of their equipment. As a second step, organizations will begin to use this data to drive increasingly actionable decisions, perhaps to optimize equipment maintenance schedules or reduce equipment-operating cost. As a third step, the organization might begin to optimize product or service performance, creating substantial incremental business value. And as a final step, the data drawn from a much deeper understanding of products and services is used to drive new innovative applications, connecting across different ecosystem stakeholders and generating completely new business opportunities.

This vision of progressive value creation is required to continue capturing value and expand business models. Customers become accustomed to the value at each stage of the roadmap. The longer-term vision is important because as you approach the limits of innovation in one stage, you need to have already aggregated the data and built the capabilities to be successful at the next stage or risk stalling out. GE has seen similar transformations in industries from machining to medical devices to the smart grid.

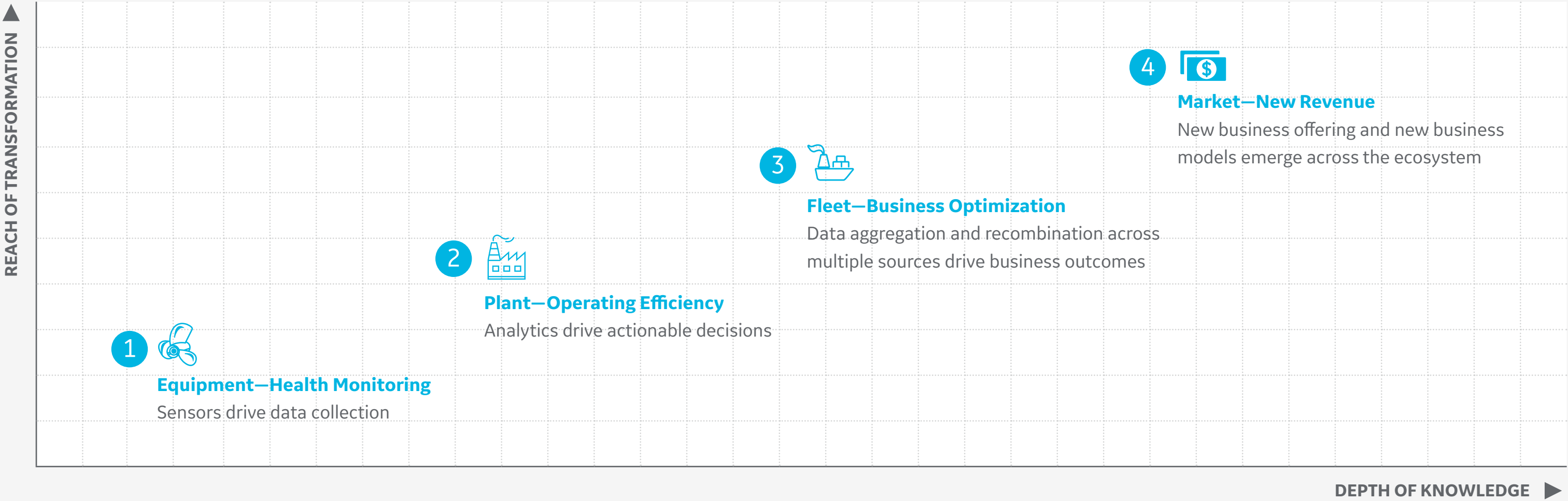



Figure 1: Digital industrial transformation roadmap



02 Build internal alignment, organize, and assemble the right capabilities

Providing transformed services will require new capabilities in areas like data sciences and software development. A successful approach will require integrating these new capabilities with deep product, operations, and business knowledge. Engineering, Service Operations, Sales, and Data Science should thus work together in an integrated fashion. But while initiatives should integrate across multiple business functions, it is also important to separate teams developing new product and services offerings and insulate them from the pressures and incentives of their traditional business. In start-up mode, it begins as a strategic project with a heavy-weight technology team. The project can be incubated within business development or the office of the CTO, or increasingly under the Chief Innovation or Digital Officer, and subsequently spun out. GE has, for example, established a new GE Digital business unit encompassing the company's software offerings. Within each of the other business units, GE has established Chief Digital Officers who report into the business and into GE Digital to drive progress along the roadmap.

To align incentives across different value chain participants, implementations frequently adopt outcome-based business models. In these settings, different participants will baseline current system performance and share gains from improvement. Such outcomes-based business models will drive new needs in Sales and Marketing. While complicated in scope, a typical customer service agreement (CSA) sale generally focuses on a narrow set of criteria. But with a new outcome-based service, a much broader knowledge of the customer's business and a more consultative approach to selling is required and often involves cross-functional customer stakeholders. This approach can transform the nature of a company's relationship with its customers from transactional equipment and services to a business model based on outcomes.

03 Engage with customers in rapid, low-cost, iterative experiments

Because of the intrinsically networked nature of the problem, transformation is most effective when it drives collaboration and experimentation across different stakeholders in the value chain. So sharing the roadmap and engaging with customers on joint data-driven experiments is crucial. Using a roadmap and simulation results help to test and refine the hypotheses. Align on pilot opportunities that leverage the data to go beyond what either party can do individually. Focus on new, quick wins that emerge from the collaboration. BUT don't boil the ocean!

Minimize the scope and time it takes to run experiments, and start delivering outcomes to customers. Doing this generates rapid feedback, which is essential. For example, a mailing manufacturer gathered new, practical insights into how a customer's plants operate on a daily basis. Also, an industrial tools manufacturer is gathering granular information on the "speeds" and "feeds" individual operators are using on their equipment in near real-time. Still another example is railroads that quickly gather daily operating data on locomotive performance to realize system-wide efficiency gains.

Contrast these examples with a healthcare diagnostic equipment manufacturer from the Keystone Strategy study that invested six months in developing a compressive digital enablement concept with a lead customer and then spent nearly two years instrumenting their equipment and developing the full digital stack solution. When they finally implemented the system in a real-world environment, they found they hadn't instrumented the right data to solve the customer's most important challenges. Similar stories can be heard over and over from very successful equipment manufacturers, and in almost every case, a better approach could have been known much earlier in the process through rapid, low-cost, iterative experiments with customers.

GE's Predix

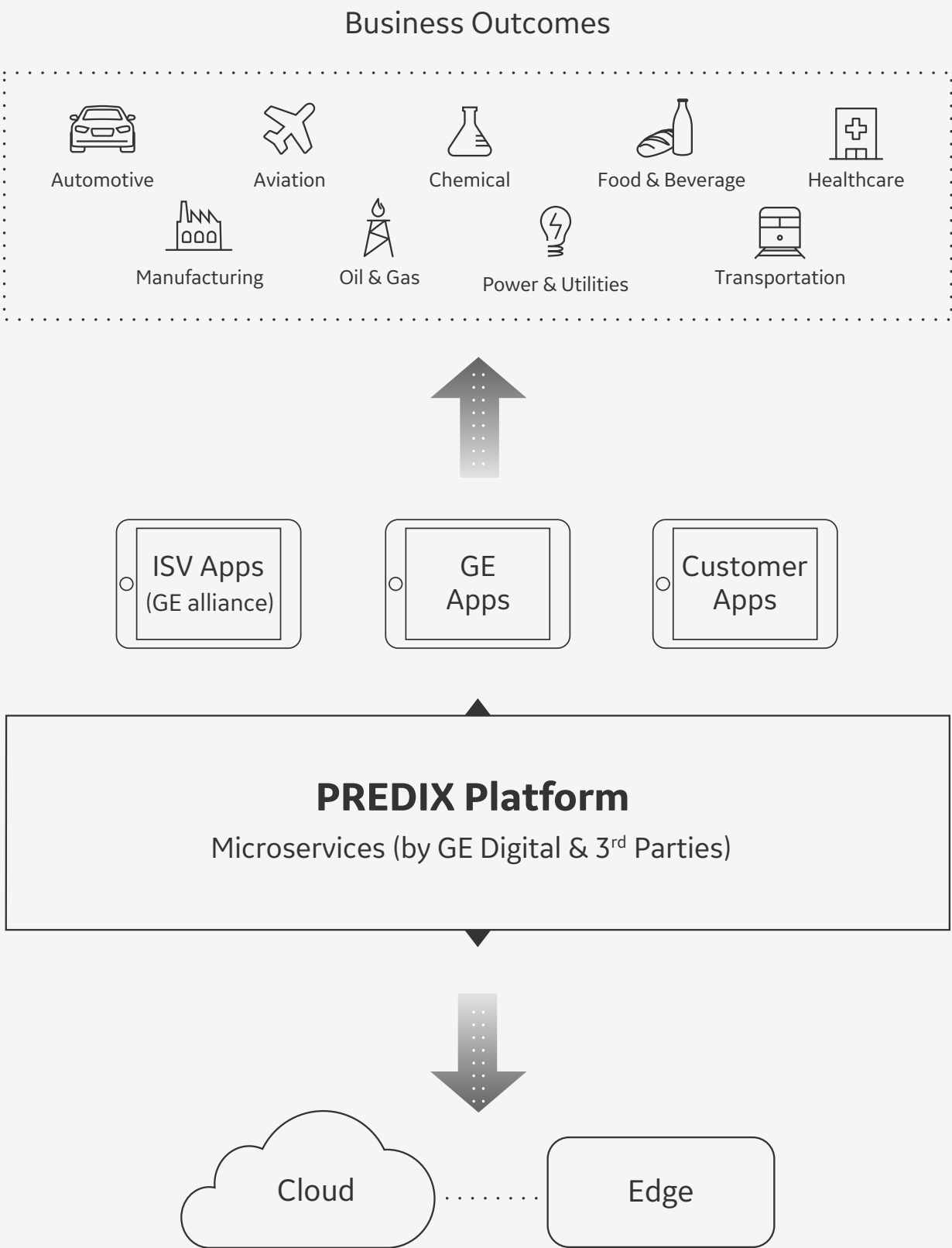
Packaging its own capabilities and transformation experience, GE has built a powerful, cloud-based platform as-a-service from the ground up aimed at guiding industrial companies through this complex technology and business transition. In contrast with other technologies that enable general purposed solutions for hosting and manipulating data, GE's Predix provides the full industrial stack needed for deriving specific industrial insights, and packages long standing investments in capability building, infrastructure, security, and partner development. GE has already connected an expansive ecosystem of GE and non-GE industrial devices to the platform, allowing individual organizations to benefit from the combined scale of a much larger base. Predix is built to rapidly derive industrial insights across the entire industrial stack, from sensors to networks to customer analytics applications, all the way to driving actions and real business impact.

Predix can enable even a highly complex and highly regulated business to carve out a manageable and measurable digital industrial transformation program. This enables a company to simplify its approach, leverage the experience and scale of GE and its ecosystem of partners, and focus on driving innovation in its traditional, trusted customer relationships.



For example, Predix:

- Enables an expansive ecosystem of GE and non-GE industrial devices, driving cloud updates to devices and analytics running locally, “on the edge,” significantly reducing the complexity of integration
- Incorporates Developer Operations (DevOps) tools and processes to allow for a continuous delivery model
- Supports an edge-to-cloud approach to cyber, information, and operational security that establishes the trust and visibility industry requires
- Is architected to facilitate tailored solutions from a broad network of systems integrators and software partners
- Is designed to accelerate time-to-value for new industrial services by combining deep domain knowledge and the latest technology



Predix in brief

Digital, data-rich services are transforming the industrial sector. Although many firms are struggling with this challenge, research has shown that platform adoption can accelerate innovation and enable traditional enterprises to manage this kind of highly disruptive change.

GE has packaged its broad experience into a comprehensive platform, built for deriving specific, industrial insights across diverse and highly regulated industrial sectors. More than a set of general-purpose technology building blocks that save time in building new solutions, the platform incorporates decades of capability building, deep investments in assets, infrastructure optimization and security, and a vibrant ecosystem of partners to enable successful digital transformation. Figure 2 highlights the industrial-grade capabilities of Predix.

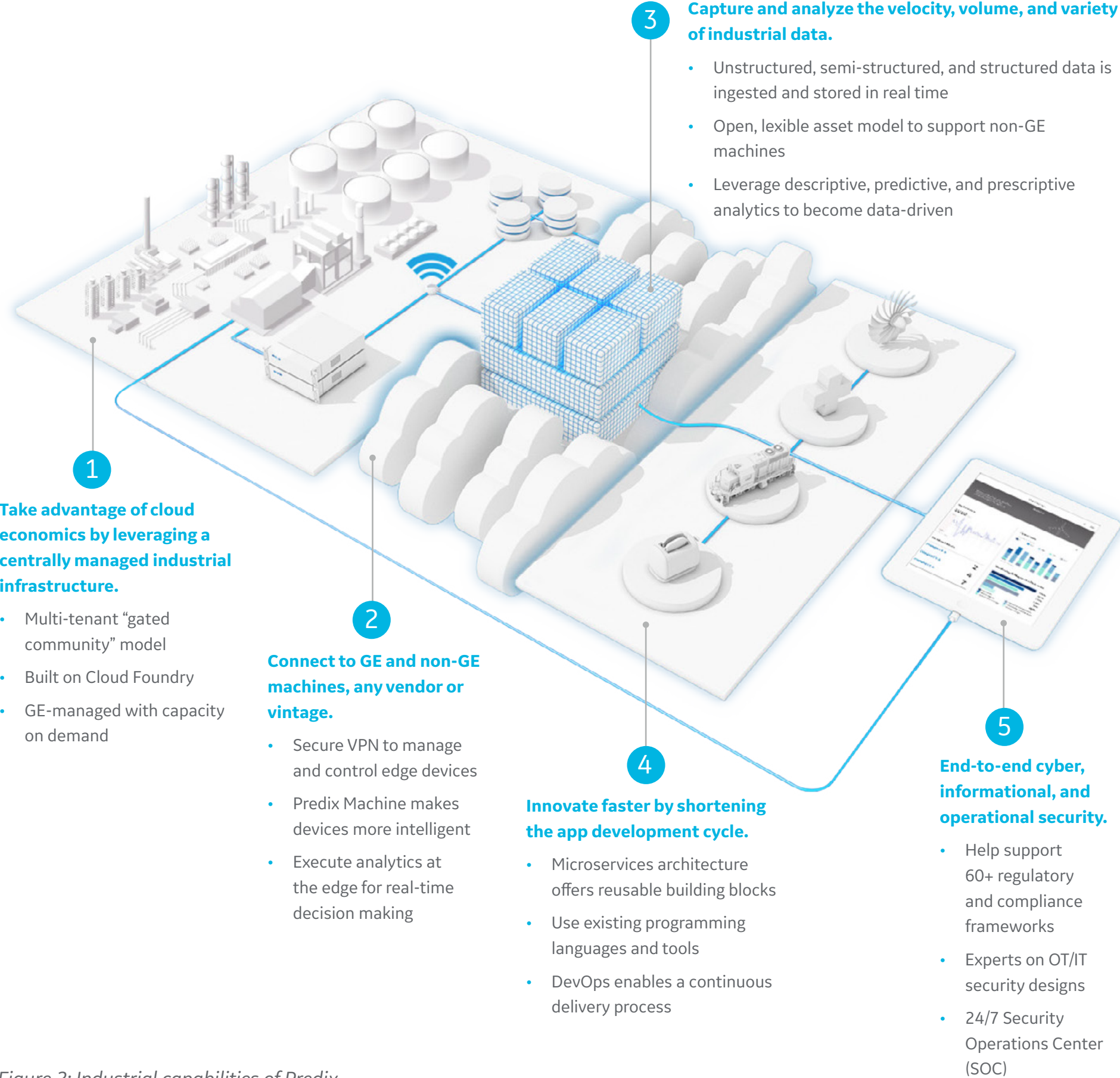
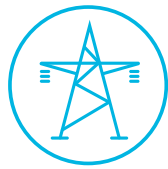


Figure 2: Industrial capabilities of Predix

By building on Predix, it's possible to drive value very quickly. By rapidly executing focused experiments, you can jump-start your digital industrial transformation journey.



Power

GE's Digital Power Plant is a robust industrial stack of digital analytics solutions to optimize equipment assets, plant operations, and business operations of power generating utilities. It provides a single interface for plants to make coordinated, holistic operational and business decisions with the potential to deliver up to \$50 million in new economic value per plant.



Mail

Pitney Bowes' equipment and operations turn out most of the 150 million pieces of mail that are printed and sorted each day in the U.S. Pitney Bowes started on its digital industrial transformation, adapting both its capability base and business model to a new vision of how sensors, data, and analytics can power new, revenue-generating services for its industrial-scale mail equipment customers.



Transportation

GE's transportation journey started with optimizing efficiency for an individual train, but has evolved to growing revenue for the entire railroad and exploring value creation across the entire rail ecosystem with billions of dollars in value creation potential. As the services transformed, GE's business model has also advanced from a cost-plus sale of equipment model to maintenance contracts, and now to outcome-based software and services pricing.



Aviation

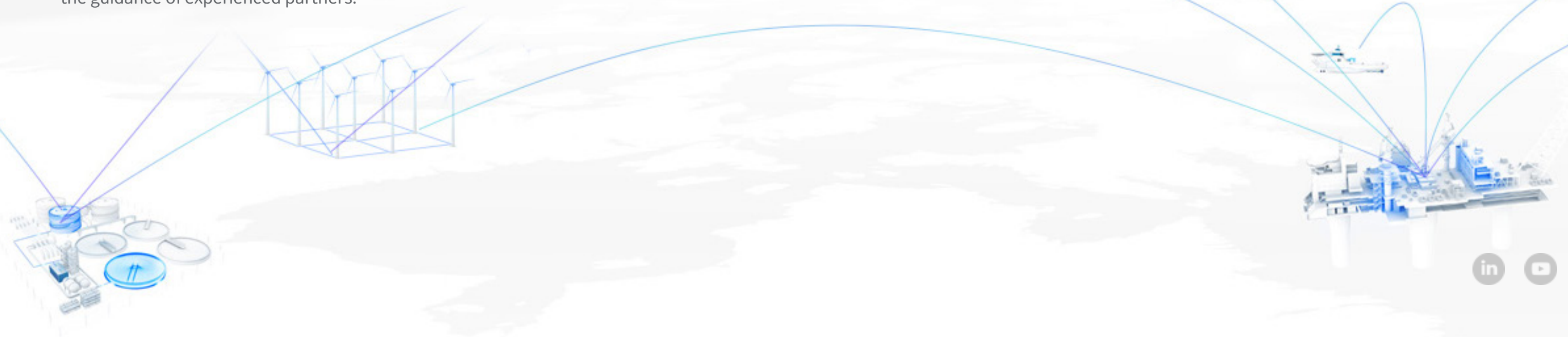
GE produces aircraft engines for more than 200 different airlines, powering over half the world's large commercial planes. GE worked closely with Air Asia to develop a sophisticated analytics solution to help address these challenges and make informed, smarter business and operational decisions.

Conclusion

When faced with such massive disruptive industry and technology transitions, established companies can no longer sit on the sidelines. Platforms that are built for industrial needs can provide them with a highly effective way to renew themselves, and to experiment to drive new business and operating models.

Predix is drawn from GE's billion-plus dollar investments in its own digital industrial transformation and is designed for modular and agile deployment. But rather than taking on the entire transformational burden, customers can now build on its sophisticated infrastructure, draw from its capabilities and lessons learned from its industrial experts, and drive towards a rapid and impactful transformation. Predix also opens up a broad ecosystem of initiatives and partners, driving a wave of change across the industrial sector.

A platform alone will not drive the necessary changes for positive outcomes. Providing transformed services will require new capabilities, organization structure, and business models tightly coupled with traditional product and customer knowledge. Successful firms will adopt a startup-like culture of experimentation and rapid iteration, while also incorporating the guidance of experienced partners.





About GE

GE (NYSE: GE) is the world's Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive and predictive. GE is organized around a global exchange of knowledge, the "GE Store," through which each business shares and accesses the same technology, markets, structure and intellect. Each invention further fuels innovation and application across our industrial sectors. With people, services, technology and scale, GE delivers better outcomes for customers by speaking the language of industry.

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