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INSPIRING TRANSFORMATIONS IN THE DIGITAL ERA

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THE FUTURE OF MANUFACTURING

The **Digital Revolution** is changing the rules of the game while the world is facing unprecedented challenges.

To reach top class performance and accelerate the continuous improvement efforts, manufacturers must **bring together** best in class **Production Systems** with **emerging technology.** As such, Lean Thinking has been evolving to cope with global trends, emerging practices, and technologies.

It is necessary to rethink the implementation model of digital projects so that they ensure alignment with the management solution, the **optimization of flows** and **change management**. To step into smart manufacturing, the focus should be on **people**, **processes**, and **data**.

How to match the technology advances with the evolution of the industrial organization?

DISCOVER WHAT TOP MANUFACTURERS ARE DEVELOPING TO BUILD A SMART FACTORY AND SEIZE THE POTENTIAL OF DIGITAL TOOLS

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AUTONOMOUS PRODUCTION

CHALLENGES:

Traditional plants enclose **rigid**, **inefficient,** and **erratic** processes.

Some common performance losses include layout configurations with **low flexibility, too many** hours spent on **manual, repetitive jobs, over-automation,** waste of transport, errors and over-processing, **low reliability** of resources, and an extended quality release time.

To tackle these problems, manufacturers need to think **autonomous** rather than **automated**.

KAIZEN™ SOLUTIONS:

- Configurable and **waste-free** factory and line **layout**
- Collaborative unfenced **in-line robots** performing repetitive, specialized, dull, or dangerous jobs
- **Standard work** to define optimal work sequence
- Quick **autonomous adjustment** of production parameters to optimize yield, energy, and throughput
- **Karakuri** to move objects automatically with limited or no electric, pneumatic, or hydraulic power sources
- **AI-supported workload balancing** based on real-time and historical data
- Digitally enabled **auto-quality means** to prevent and detect defects early

KEY OUTCOMES:

Agile factory

Efficient operations

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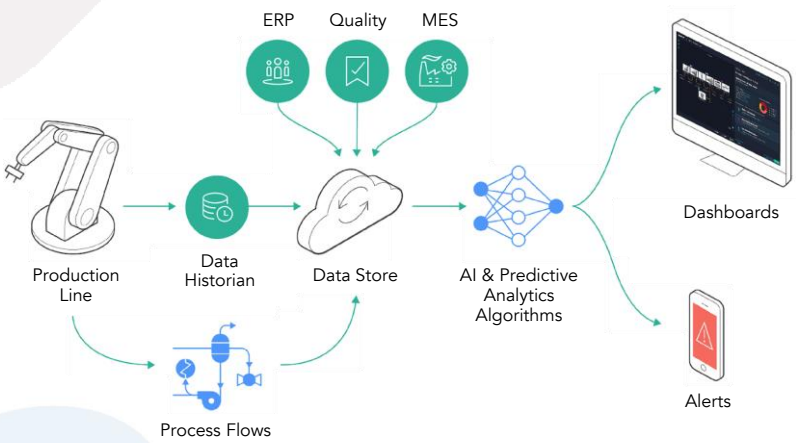
RELIABILITY-CENTERED MAINTENANCE

CHALLENGES:

Industries tend to invest in high-quality equipment and machinery with a long-life cycle which must be managed and preserved effectively. Every company wants to **remove the word "downtime"** from their vocabulary and their operations. However, 70% of companies still **don't have visibility** into when their equipment should be stopped and intervened to avoid unplanned stops.

An efficient strategy to optimize maintenance performance is to evolve the **TPM model** to apply **data-driven methods** so as to reduce downtime with a **reliable** and **cost-effective** approach.



KAIZEN™ SOLUTIONS:

- **Sensorization** and classification of every machine part's impact on equipment reliability
- **Advanced Analytics** and **Machine Learning** to predict the likelihood of failure
- **Computerized Maintenance Management System (CMMS)** to support maintenance activities, inc. work orders, spare parts management, KPIs, etc.
- **AIDC** for accessing machine information (history, handbooks) and tool tracking
- **Manufacturing Execution System** (MES) for machine data capture, alerts, and Autonomous Maintenance tasks management
- **Automated** tools and parts **inventory management**
- **3D printing** of spare parts

KEY OUTCOMES:

Assets reliability

Cost-effective maintenance

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SYNCHRONIZED INTERNAL LOGISTICS

CHALLENGES:

Logistics-related issues are the leading cause of production **delays** in manufacturing companies, with an average **impact** of more than 15% **on productivity**. Traditionally, companies tend to invest in storage space, complex automated systems, human resources, and quality checks.

On the other hand, the adoption of the **flow improvement model,** together with the **digitization of logistics,** enables companies to address customers' new requirements: **faster**, more **flexible**, more **granular**, more **accurate** and more **efficient**.

KAIZEN™ SOLUTIONS:

- **Autonomous Guided Vehicles** (AGVs) used to automate the Mizusumashi transport operations
- **RFID** for traceability inside and outside the factory
- **Autonomous warehouse management system** with real-time connection to production and customer data
- **Automated material storage** and **retrieval** systems
- **Flexible shelf management** with random location
- **Pick-to-light** and **voice systems**
- **Drone-based inventory inspection**
- **Digital twin** to design optimal warehouse operations by simulating different scenarios and technologies

KEY OUTCOMES:

Agile supply chain

Efficient operations

Accuracy

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SEAMLESS CUSTOMER EXPERIENCE

CHALLENGES:

Customers are more than ever demanding the **right product** at the **right time** via a **seamless**, **personalized**, and even **experiential experience**. Pressure is mounting for suppliers to **integrate** state-of-the-art **technologies** into their pre-existing operations.

This landscape calls for the **reimagination of business models**, spanning from supply chain operations to customer experience.

KAIZEN™ SOLUTIONS:

- **Customer Relationship Management (CRM)** to manage interactions with customers and track their data
- **Segmentation** using **analytics** to deliver valuable and personalized experiences
- **Customer experience mapping** powered by **machine vision** to capture emotions and **sensors** to monitor product utilization
- **Knowledge management software** to store and organize information, making it easier for customer-facing employees to find the answers to customer questions
- **Self-service portals** to allow customers to access information, such as order tracking and product availability, and complete tasks on their own
- **Voice of Customer** (RTVoC) system to gather and analyze customer feedback

KEY OUTCOMES:

★★★

Customer lifetime value

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DATA STRATEGY AND GOVERNANCE

CHALLENGES:

Organizations create billions of data points per day. However, most companies still answer with doubt or uncertainty to questions like: Are there **data gaps** or places of **overlap**? Do the data management activities **align with the enterprise's goals**? Is data being **used effectively and efficiently**? Some common challenges are incompatible, duplicate, or missing data; siloed initiatives that use the same data yet duplicate the efforts and costs; data activities that consume time and resources but do not contribute to overall business objectives, etc.

The increased use of data and the growth of data infrastructure brings not only significant benefits but also a big responsibility. Companies need to define not only a **data strategy**, i.e. a roadmap that ensures that all activities from collection to collaboration work together effectively and efficiently; but they must also define **data governance** policies and procedures to ensure that data is used correctly and consistently across the organization.

When it comes to data, it is better to act **strategically and proactively** rather than *ad hoc* and reactively.

KAIZEN™ SOLUTIONS:

- **Data requirements analysis** based on business objectives and stakeholder expectations
- **Data & systems architecture** to translate business needs into data and system requirements
- **Business glossary** to set a common vocabulary and understanding of basic concepts inside the company
- **Data quality rules** as a set of guidelines to ensure data excellence
- **Data security and privacy** procedures to secure data storage, access, and usage

KEY OUTCOMES:

Quality of data

Data protection

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DATA ACQUISITION & REPORTING

CHALLENGES:

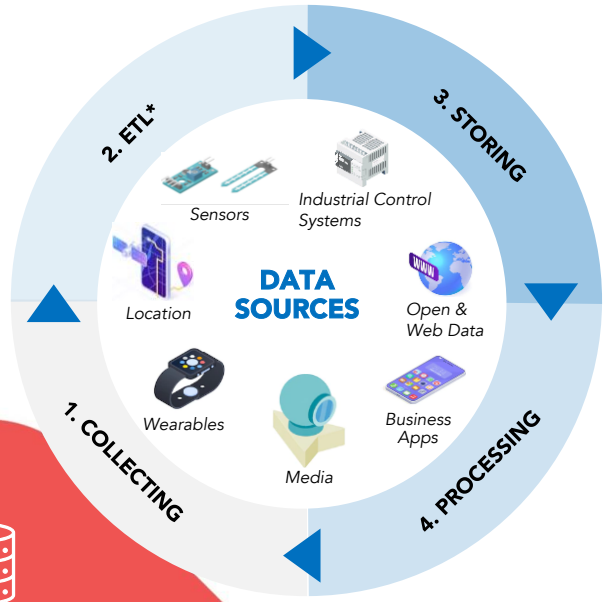
The industrial sector is one of the top 10 sectors with higher potential to use data analytics to increase its competitiveness. Data is collected on a **large scale** due to the increasing **number of data sources** and the use of advanced technologies such **IoT**, as almost all factory devices with internet access are permanently collecting information.

Although this data is crucial for companies, so far, the focus has only been on its collection – without any processing or direct use – of **industrial big data**. This vast amount of information becomes more relevant the more efficiently and assertively it is **collected**, **prepared**, **stored** and **analyzed**.

The data used by the company must clearly demonstrate four characteristics: **Findability** (data is easy to locate), **Accessibility** (data is stored and qualified users know how to access it), **Interoperability** (data can be used in multiple systems and be integrated with other data), **Reusability** (data is correct, reliable and can be replicated in other scenarios).

KAIZEN™ SOLUTIONS:

- **Smart sensors**, **actuators**, or **machine vision** systems to collect data from machines
- Assets management and tracking parts/ products throughout the value chain with **AIDC devices**
- Vertical and horizontal **data integration** in Manufacturing Operations Management (MOM) and Business Applications (ERP, CRM)
- **Cloud storing and computing**
- **Data mining** techniques to get knowledge from **big data**
- **Reporting and dynamic dashboards** to analyze, extract and visualize data to provide **business intelligence (BI)**



* *Extract, Transform and Load*

KEY OUTCOMES:

Data availability

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ADVANCED ANALYTICS

CHALLENGES:

Decision-making is a constant process in the day-to-day life of organizations, but despite being so common, it is a potentially **time-consuming process** with **high inefficiencies**.

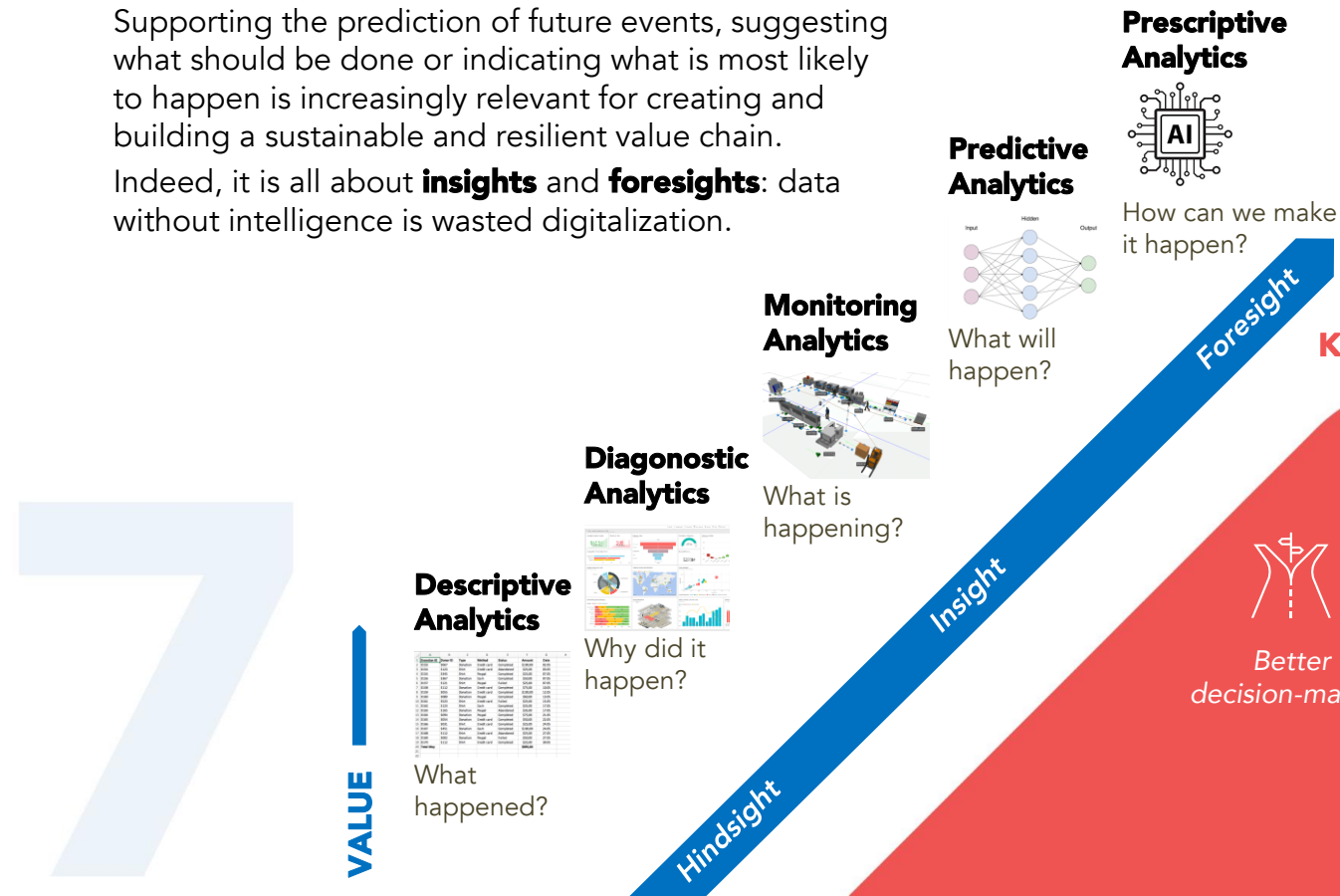
As the business world becomes more complex, it is more complicated to make an effective choice that considers all the surrounding variables and scenarios. The **transition from intuition to data-driven decision-making** can be a winding path. It requires a **cross-disciplinary approach** to data, both past and future, moving from a paradigm of informing only, to one where the goal is to drive decision-making.

Supporting the prediction of future events, suggesting what should be done or indicating what is most likely to happen is increasingly relevant for creating and building a sustainable and resilient value chain.

Indeed, it is all about **insights** and **foresights**: data without intelligence is wasted digitalization.

KAIZEN™ SOLUTIONS:

- **Simulation** modeling to test new scenarios and environments
- **Digital twin** of a physical counterpart that works in a closed-loop feedback
- **Process mining** based on event logs
- **Statistical** and **machine learning** algorithms to provide recommendations and answers to futuristic questions (e.g., regression, clustering, forecasting, etc.)
- Mathematical representations of business problems that rely on powerful **optimization solvers** and **metaheuristics**



KEY OUTCOMES:

Better decision-making

Optimized operations

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INTELLIGENT SYSTEMS

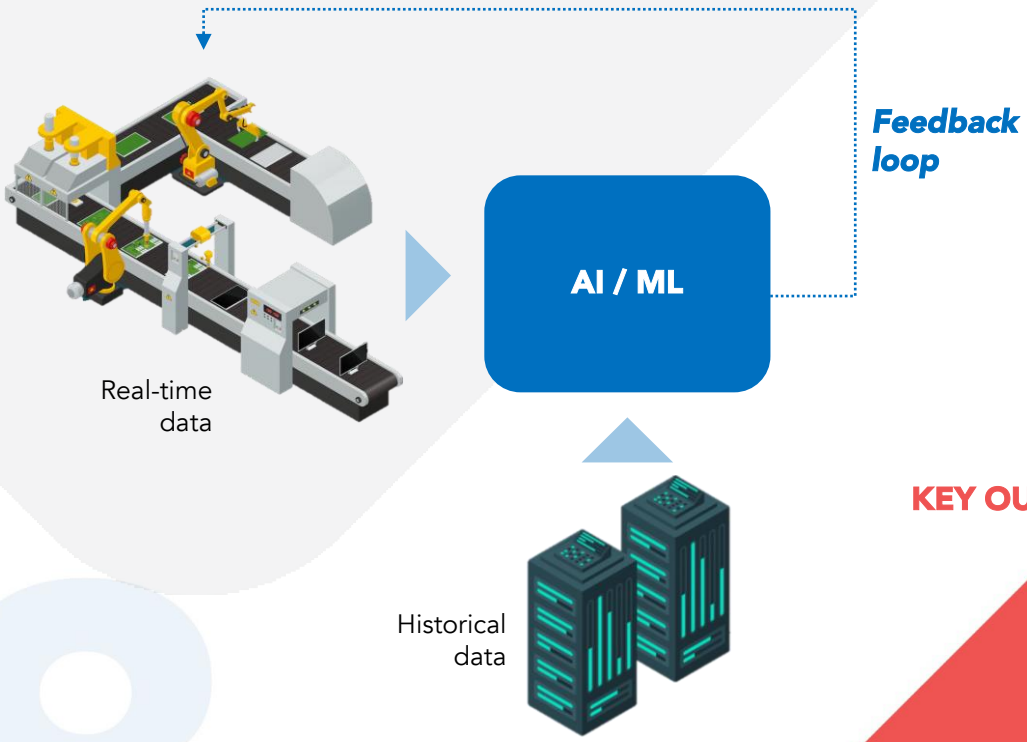
CHALLENGES:

In Industry 3.0, data is used to inform decision-making, but the final decisions are still often made by humans. In **Industry 4.0**, the use of advanced analytics and AI allows for **decisions to be made automatically by machines**.

This is a **guiding principle** for the **factory of the future,** although it has yet to be proven that it will be possible to have a fully automated intelligent factory without humans.

KAIZEN™ SOLUTIONS

- **Autonomous processes**, with the ability to decide automatically based on Advanced Analytics
- **Closed-loop systems** that self-adjust based on captured real-time data



KEY OUTCOMES:

Readiness

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DIGITAL DAILY MANAGEMENT

CHALLENGES:

Organizations need **new ways of working**, learning, and implementing new practices and technologies that go beyond the outdated management model, where firefighting is very common.

Visual management makes people accountable, promotes predictable and effective work, improves alignment, and helps achieve and sustain breakthrough results consistently.

The **technology layer** on top of traditional visual management systems brings **speed** and offers possibilities for **collaboration** that were not possible before.

KAIZEN™ SOLUTIONS:

- **Digital Obeya-room** dashboards to support team meetings focused on monitoring people and their performance
- **Real-time** tracking of **KPIs** displayed in Andon
- **Continuous improvement system** powered by an **app/platform**
- Early detection of critical parameters deviation combined with an **automated help chain** system

KEY OUTCOMES:

Transparency | *Connectedness*

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AUGMENTED WORKER

CHALLENGES:

Over the last years, the declining automation cost led many companies to fall into the **over-automation enticement** as labor costs have increased due to skilled workforce scarcity. Besides, the **aging of the active population**, and the **demands of the new generations** are pushing employers in opposite directions.

To tackle these problems, companies need to **augment**, **instead of replace**, their workers. They should deploy technologies that allow the employees to **focus on the most value-adding activities**, where the unique human skills of decision-making and adaptability to new situations bring the most value and, at the same time, create a **more attractive workplace**, where employees enjoy a working routine that is less repetitive but more interesting, diversified, and productive.

KAIZEN™ SOLUTIONS:

- **Digital SOPs, documentation**, troubleshooting guides, and checklists available at the 'point of use'
- **Augmented reality** to assist workers remotely and train them in the flow of work
- **Virtual reality** to train workers on new equipment or processes, allowing them to learn in a safe and controlled environment
- **Digitized process confirmation** system to reinforce work habits using mobile solutions such as tablets
- **Intelligent Assist Device** (IAD), such as exoskeletons, to provide human strength amplification, guiding surfaces or both
- **Environmental and bioinformatic sensors** that monitor ambient conditions and workers' health in real-time
- People empowered to solve complex sporadic problems using **advanced analytics**

KEY OUTCOMES:

Reliability

Upskilled workforce

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ARE YOU READY TO BUILD A **SMART FACTORY?**

Autonomous production	Data strategy and governance	Digital daily management
Reliability centered maintenance	Data acquisition and reporting	Augmented worker
Synchronized internal logistics	Advanced analytics	
Seamless customer experience	Intelligent systems	

HOW TO START?

Digital tools are bringing great value to companies by providing **disruptive solutions** to **transform their processes.** Still, it is essential to have an **implementation plan** that is integrated with the company's strategy and process transformation vision.

The KAIZEN™ approach starts with an end-to-end analysis of the entire value chain.

This analysis leads to a **customized solution design and implementation plan** based on a **KAIZEN™ Process and People Transformation Plan and on a Digital Transformation Plan**, both aligned and oriented to achieve the same goals.

The solution's implementation is executed by teams composed of recommended technology providers and KAIZEN™ specialists, together with the company's in-house teams. This will **enhance the internal knowledge and expertise** of the teams. Agility is ensured through **intensive working sessions involving all stakeholders.**

Define the Roadmap
COMPLETE BUSINESS DIAGNOSTIC

Implement the Roadmap
PRACTICAL IMPLEMENTATION

Achieve the Results

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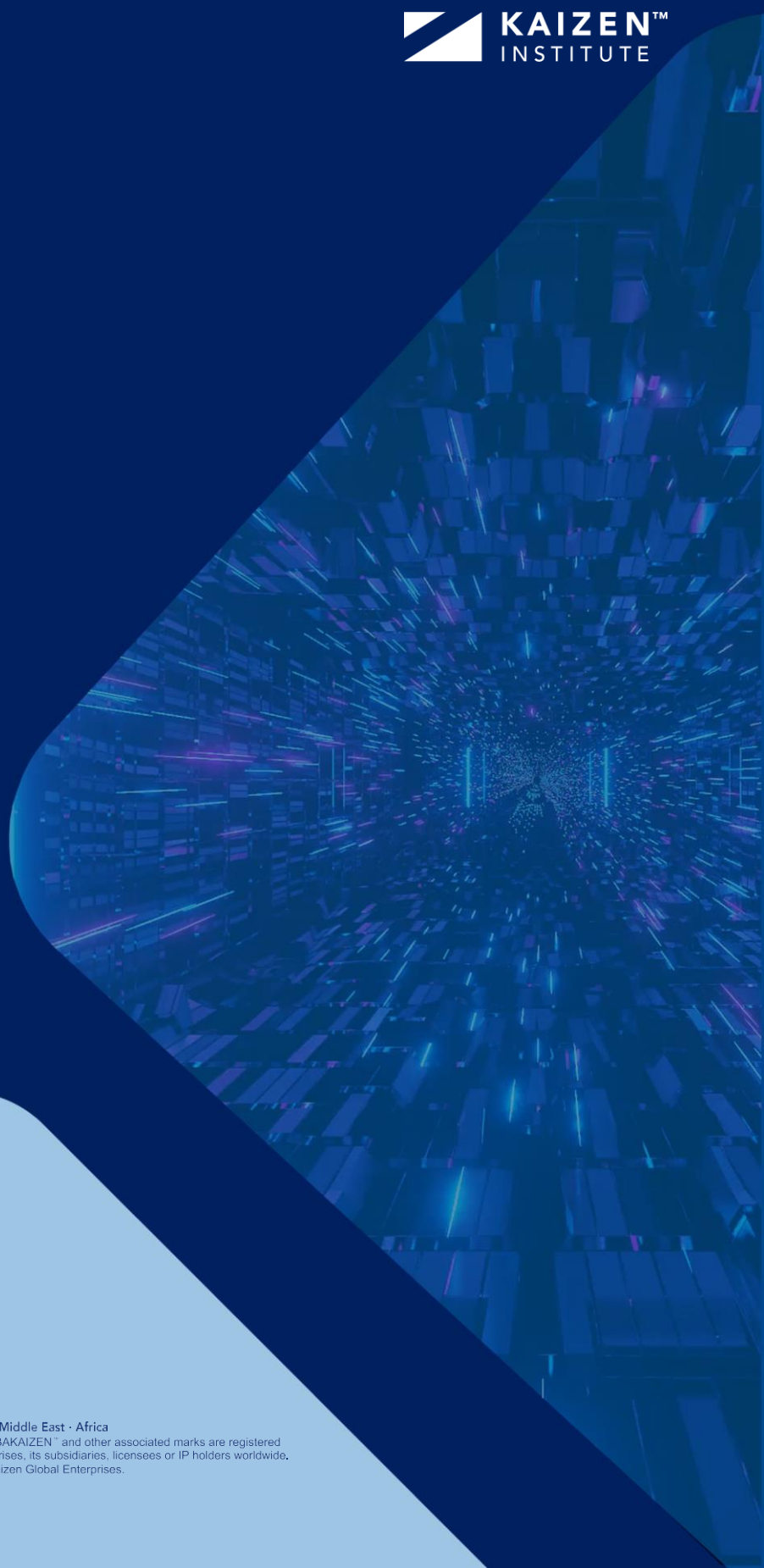

About Kaizen Institute

We are a global pioneer and knowledge-based organization that provides consulting and transformational services in Business & Operational Excellence to companies in Europe, Asia-Pacific, Middle East, Africa, and America.

We help modernize operations by building hyperflexible, self-adapting manufacturing capabilities across the value chain while optimizing flow to ensure sites meet their safety, quality, cost, customer service, agility, sustainability, and talent objectives.

For more information contact us on:

uk@kaizen.com

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