EFESO
MANAGEMENT CONSULTANTS

DIGITAL TRANSFORMATION & MANUFACTURING

INSIGHT

FLEXIBLE FACTORY DESIGN

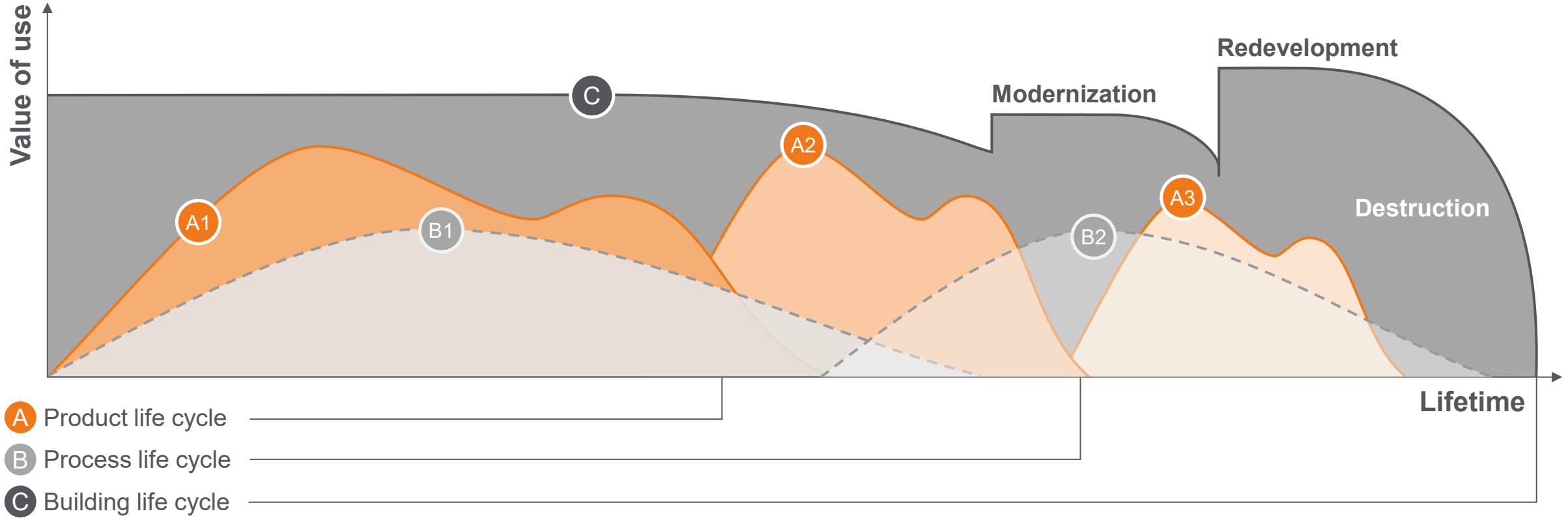
Why flexibility is becoming the key success factor in factory planning

From trends to transformation: the path towards a flexible factory design begins with strategic foresight

1. *Impact of product & process lifecycles*
2. *Drivers of flexible factories*
3. *Flexibility characteristics*
4. *Approach for factory planning*
5. *How we support our clients*

Aligning product, process, and building lifecycles to drive long-term value

Relevant life cycles for a holistic factory view



Factories must be flexible to keep up with fast-changing products and processes to stay efficient and competitive.

Rising internal and external pressures demand a new approach to factory design

EXTERNAL DRIVERS

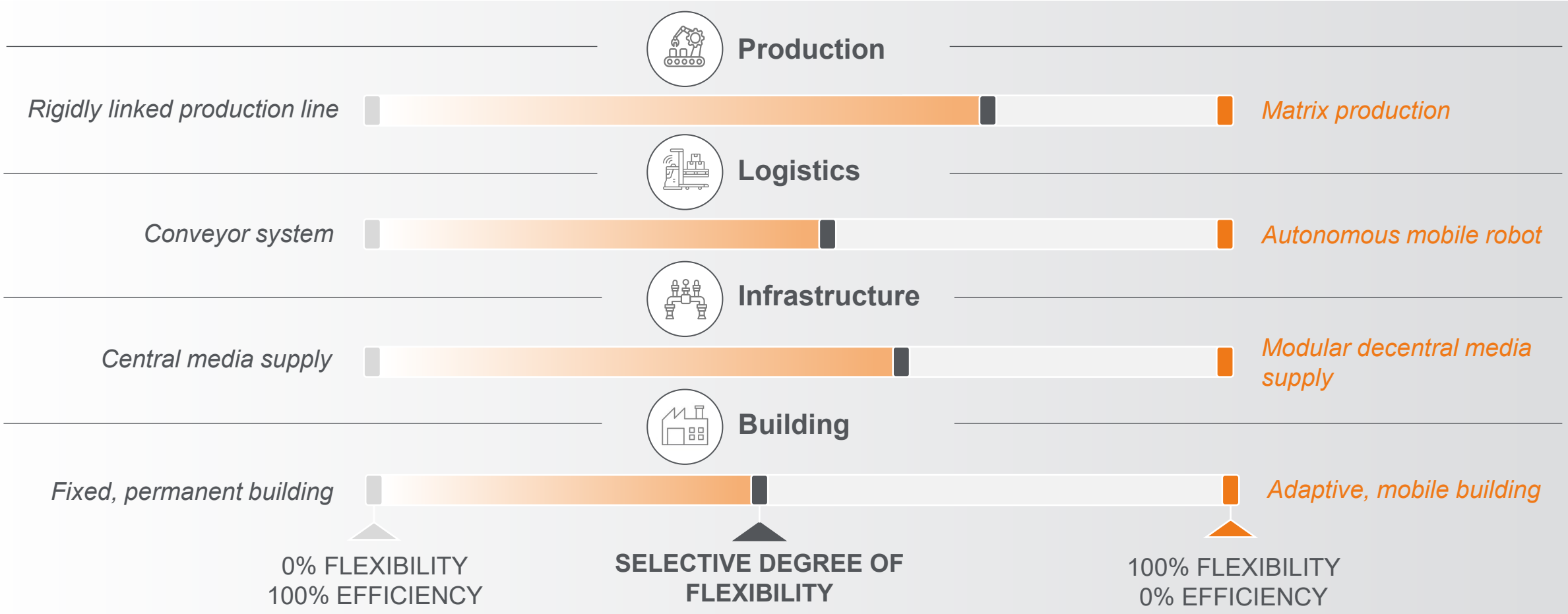
- Rapidly changing customer and market demands
- Global competition and increasing price pressure
- Technological disruption and fast-paced innovation
- Regulatory complexity and evolving compliance requirements
- Geopolitical instability and trade uncertainties

Factory design

INTERNAL DRIVERS

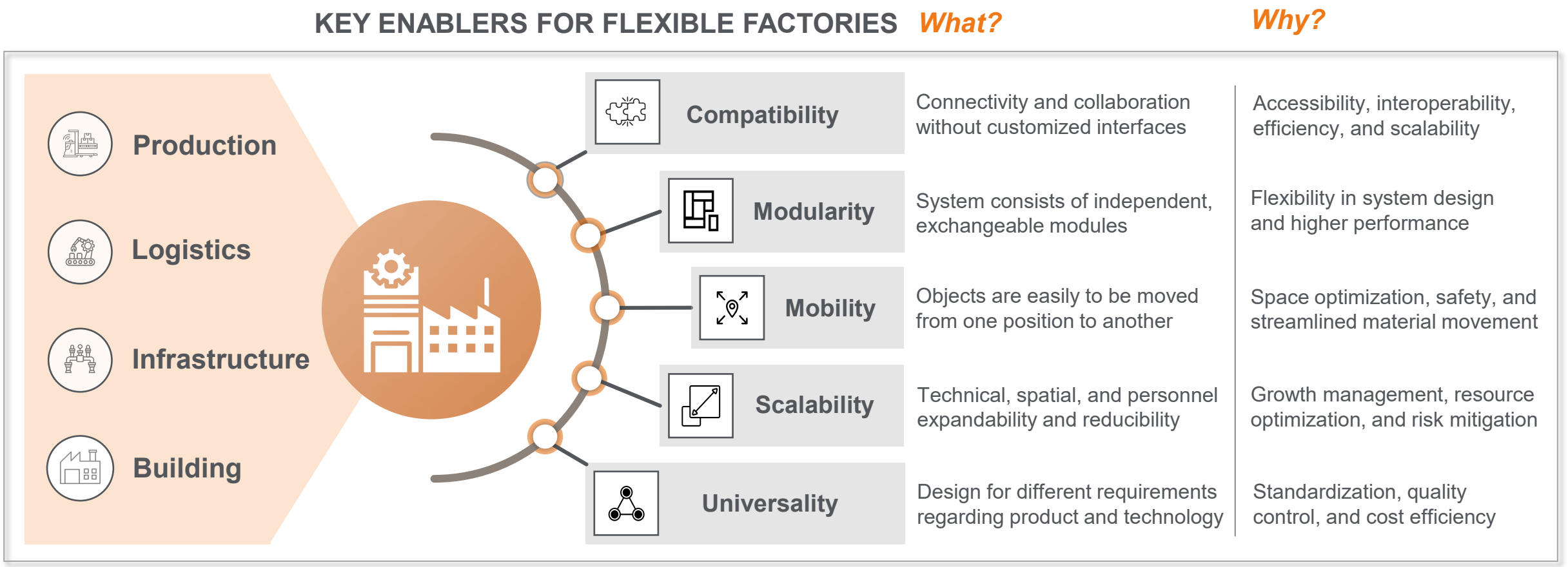
- Growing product and variant complexity
- Need for agile and future-ready production technologies
- Skills and qualification gaps within the workforce
- Capacity limitations in machines, sites, and infrastructure
- Organizational agility and leadership adaptability

Balancing efficiency and flexibility – a strategic trade-off that must be managed



The degree of flexibility across the factory dimensions must be selected based on current and anticipated future needs.

What defines a truly flexible factory – and how to design it systematically



The five key enablers for flexible factories require a high level of technical, operational, and spatial standardization to be efficiently applied within the factory design.

Flexible factory designs succeed when tailored solutions meet specific needs across all dimensions

	Production	Logistics	Infrastructure	Building
Compatibility	Unified interfaces simplify component integration	Standardized material handling and transport interfaces	Standardized energy and media connections, doors, & gates	Standards for height, floor load, openings, building equipment, and compatible access & traffic routes
Modularity	Modular design to flexibly remove, add or replace process / assembly steps	Modular, scalable storage, and transport systems (e.g., AutoStore robots)	Zonal infrastructure, modular media supply points	Building modules with independent media supply, layout modules with optimal material flow
Mobility	Mobile machines & self-supporting constructions (no foundation)	Line supply on wheels & light-weight structures, mobile jib cranes, flexible AMRs	Infrastructure from the ceiling, mobile utility carts	Temporary buildings (tents, container), movable walls
Scalability	Expandable areas, flexible cells, adaptable speed	Scalable, flexible automated storage without fixed growth constraints	Larger fire zones via adequately sized sprinkler system, and over-capacity in central media supply	Expandable space, flexible layout, multi-story height, scalable offices
Universality	Oversized multi-axis machining center	Integrated storage with manual picking and universal transport	Grid-based connection points, factory-wide WLAN/5G	Minimal fixed structures, standard height, reinforced floors

Real-world examples from production, logistics, and building make flexibility tangible and actionable

Flexible production & logistics

Key challenge: SEW's line production reached its limits, being built for high volumes and low variety.

Solutions:

- **Flexible, autonomous production control** instead of rigid production lines
- **Modular production units** are standardized and can be easily reconfigured to produce different product variants
- **Digital twin** allows flexible order sequences and data-based production optimization

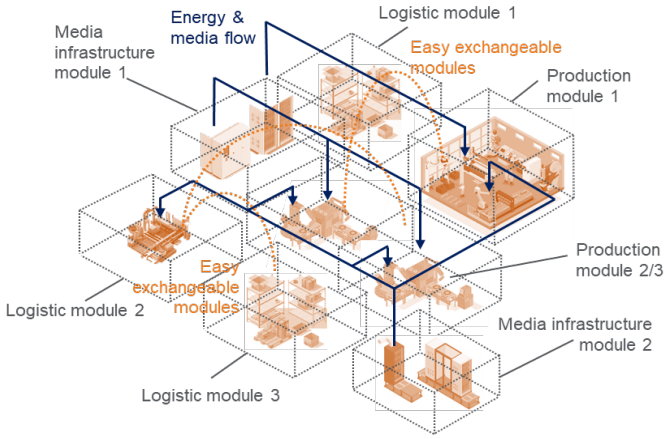
Matrix production at SEW Eurodrive

Modular media supply infrastructure

Key challenge: quick repurposing and high scalability of production areas.

Solutions:

- **Plug-and-play supply systems:** flexible connections for quick repurposing
- **Decentralized media supply:** self-sufficient units for scalability
- **Energy storage & smart grid:** battery storage and intelligent distribution
- **IoT-based building automation:** sensors for real-time monitoring and control



Functional structure of a modular media infrastructure

Adaptive building design

Key challenge: quick adaptation to new production requirements.

Solutions:

- **Modular and scalable structures:** prefabricated modules for grid-based factory halls
- **Reusable precast concrete parts:** lightweight walls for quick adaptation
- **Raised and cavity floors:** flexible cable routing for clean rooms and IT environments
- **Load-supporting floors:** each module's floor supports maximum load

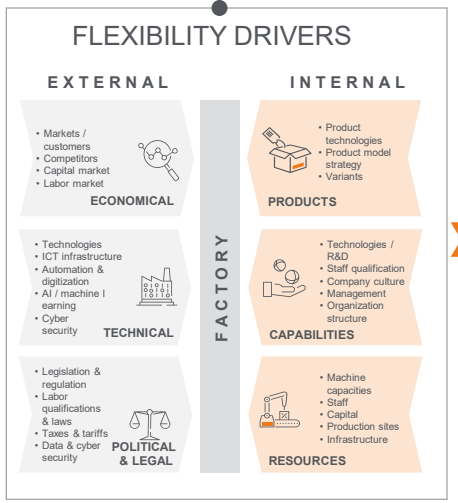
Examples for adaptive building design

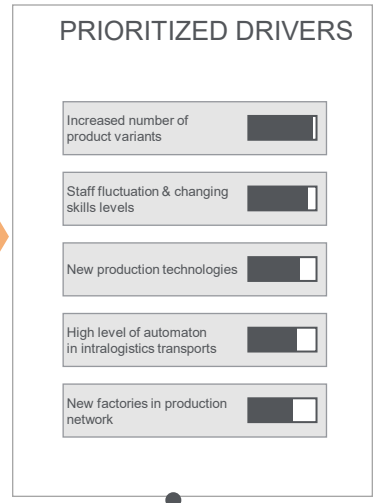
A structured approach – from assessing the current situation to successfully implementing flexible factories

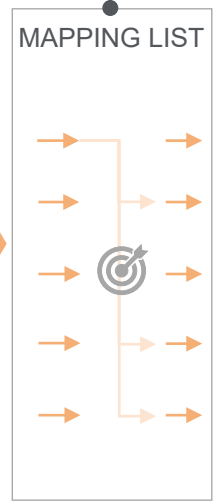
1 Assess situation
- Determine the primary factors driving the need for flexibility / adaptability in the factory

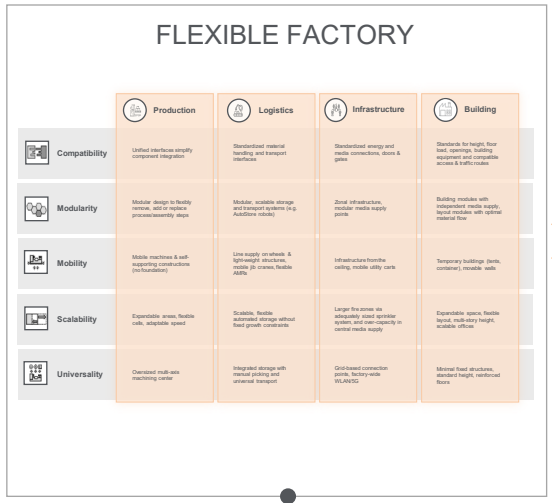
3 Mapping drivers to enablers
- Cascade drivers to enablers for flexibility
- Derive concrete technical solutions

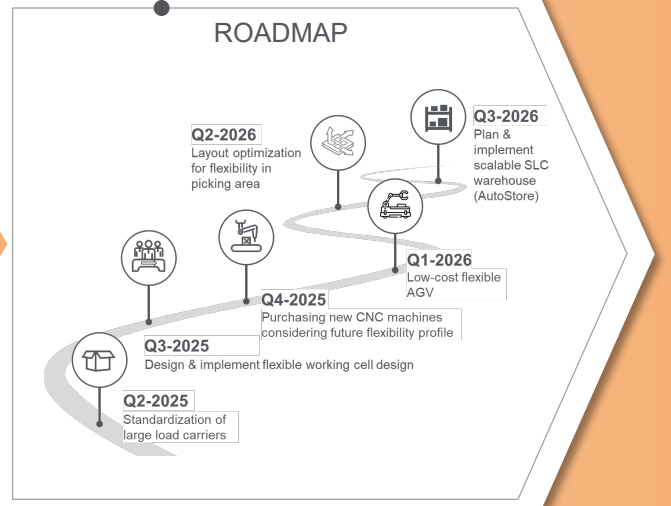
5 Define roadmap
- Set-up of activities & milestones
- Define responsibilities, timeline & resources











2 Prioritize flexibility drivers
- Assess driver impact on operations and infrastructure
- Prioritize by relevance and urgency

4 Apply design principles
- Design of flexible factory blueprint
- Consideration of all factory areas: production, logistics, infrastructure, building

EFESO supports in every phase of your journey toward a future-ready factory

Our vision and guiding principles for the FUTURE FACTORY

- Integration in value networks
- **Flexible factory design**
- **Modular equipment & reconfigurable processes**
- Advanced logistics
- Smart robotics & automation
- Green building
- Sustainability inside
- Data-driven factory mgmt.
- ONE digital twin
- Application landscape
- IT infrastructure
- Holistic cybersecurity
- Augmented talents

EFESO's 'one-stop-shop' capabilities and service offerings* for FACTORY REALIZATION

I. STRATEGY & FOOTPRINT

- 360° strategic view
- Factory role / site view
- Supply chain view
- Network design
- Business case

II. PLANT CONCEPT

- Factory concept
- Location search & selection
- Incentives & subsidies
- Building design & permits
- € CapEx / OpEx

III. FACTORY DESIGN

- Production
- Material flow & warehouse
- Digitalization & automation
- Work concept & offices
- Green building

IV. REALIZATION SUPERVISION

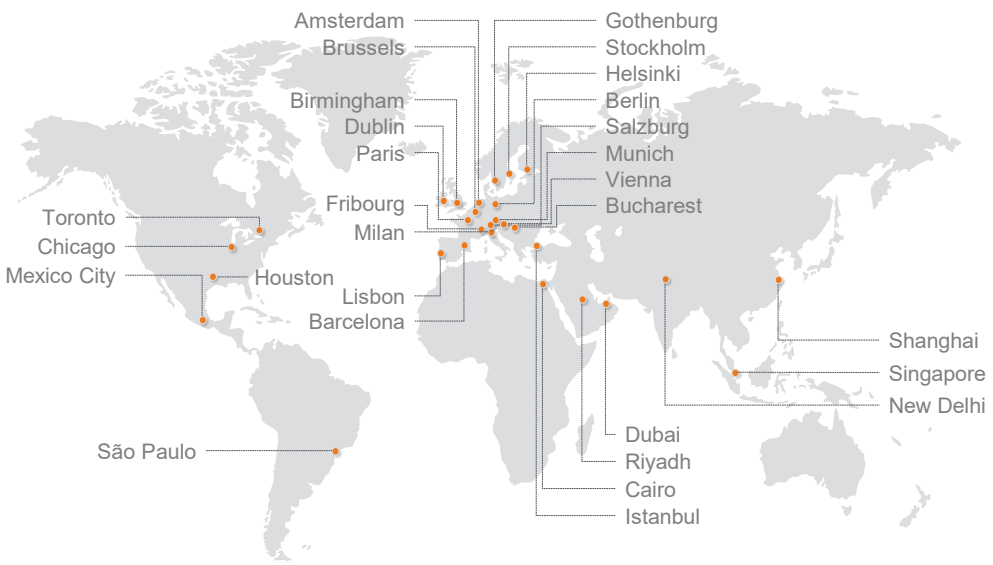
- Project design
- Execution preparation
- Site supervision
- Contractor management
- Permanent check & control

V. INDUSTRIALIZATION & RAMP-UP

- Organization blueprint
- Executive research
- Training & qualification
- Relocation & ramp-up mgmt.
- OEE stabilization

*We support our customers holistically or in every phase in which our customer currently finds himself
OEE = Overall Equipment Effectiveness

We are the leading global pure player in operations strategy and performance improvement



- A **fast-growing pure player in operations consulting,** that operates **globally**
- Serving **a broad range of industries** and **Private Equity**
- Offering **E2E operations services** – from operations strategy & transformation to manufacturing, supply Chain, procurement, R&D and product, Capex, Lean Lab, Transaction & Turnaround.
- Integrating transversal capabilities: **Industrial AI, automation & digital, industrial sustainability and people & organization**
- Delivering '**Real Results, Together**' with our clients
- Leveraging our **global reach** and **cross-industry experience** to deliver tailored **best-in-class solutions** for your regional and sector-specific challenges

+1,000
Results-oriented Operations specialists with hands-on industry experience

+1,500
Projects in **>75 countries** annually

45
Nationalities in **>30 offices** worldwide

x10
Average Return on Consulting fees

Some of EFESO's **recognitions**

… and many more.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