VALUE REALIZATION OF PHARMA 4.0

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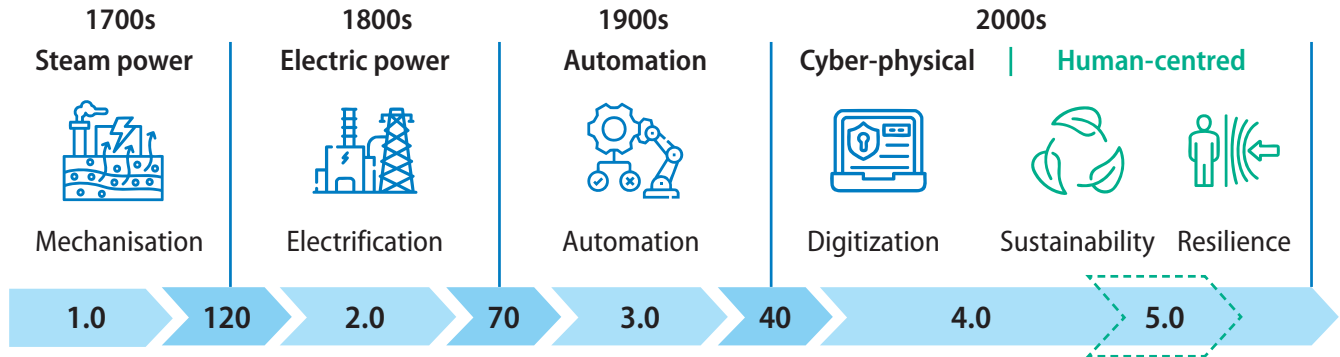
Industrial Revolution: An overview of 4.0 & 5.0

The world is witnessing a trend where companies no longer force products to the market. Instead, they focus on what individuals want. The real value of Industrial Revolutions, by definition, is human.

The manufacturing objective has shifted from a manufacturer-led to a customer-led approach with a human-centered design and production process to fulfil individual satisfaction.


1700s Steam power	1800s Electric power	1900s Automation	2000s Cyber-physical	Human-centred
Mechanisation	Electrification	Automation	Digitization	Sustainability · Resilience
1.0 — 120	2.0 — 70	3.0 — 40	4.0	5.0

Industry 4.0 is the digital transformation of industries offering automation and data exchange in manufacturing technologies, including cyber-physical systems, IoT, Cloud manufacturing, smart manufacturing, and intelligent manufacturing for further value creation.

While Industry 4.0 offers enabling technologies for mass personalization, Industry 5.0 demands mass personalization by further collaboration between humans, machines, and digital technologies for resilience and sustainability. Industry 4.0 focuses on "doing things right", while Industry 5.0 is concerned about "doing the right things", which results in sustainable development.

Blending human, technology, and machine from Industrial robots in Industry 4.0 to Cobots in Industry 5.0 for mass personalization
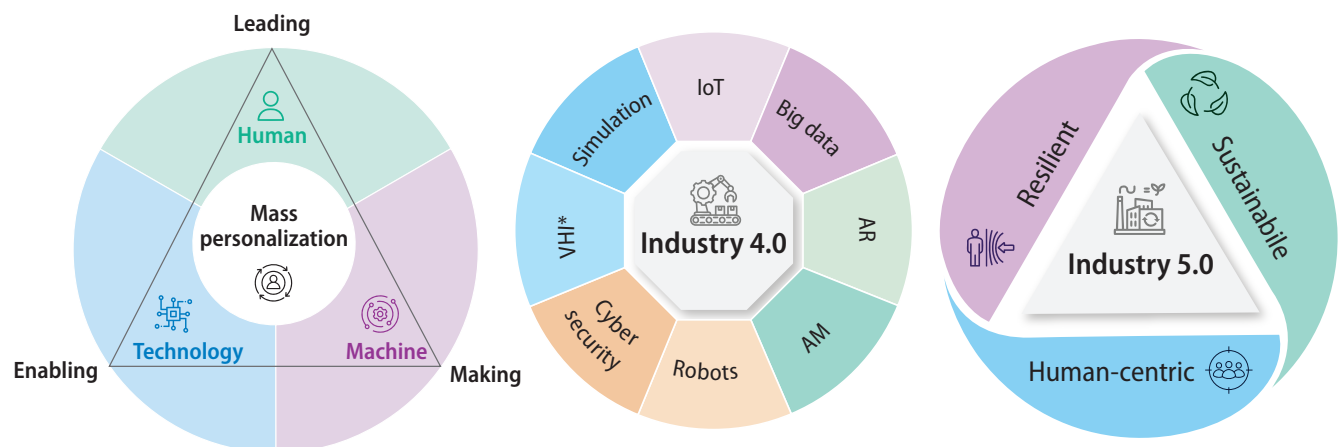
Interpretation of the Industry revolution to the Pharma Industry

The majority of the Pharma industry is currently undergoing integration of Industry 3.0 and 4.0, which means slighlty running behind in the actual industry revolution.

As the pharmaceutical industry evolves, there is a noticeable convergence of Industry 3.0 technologies (automation, digitization, and centralized data systems) with the transformative capabilities of Industry 4.0, which focuses on smart technologies, Internet of Things (IoT), Artificial Intelligence (AI), and Machine Learning (ML). The interaction between these two technological levels has the potential to create more agile, efficient, and data-driven processes that enhance drug discovery, manufacturing, and delivery systems.

Interaction between hierarchies Levels in Industry 3.0 and Industry 4.0

Industry 3.0
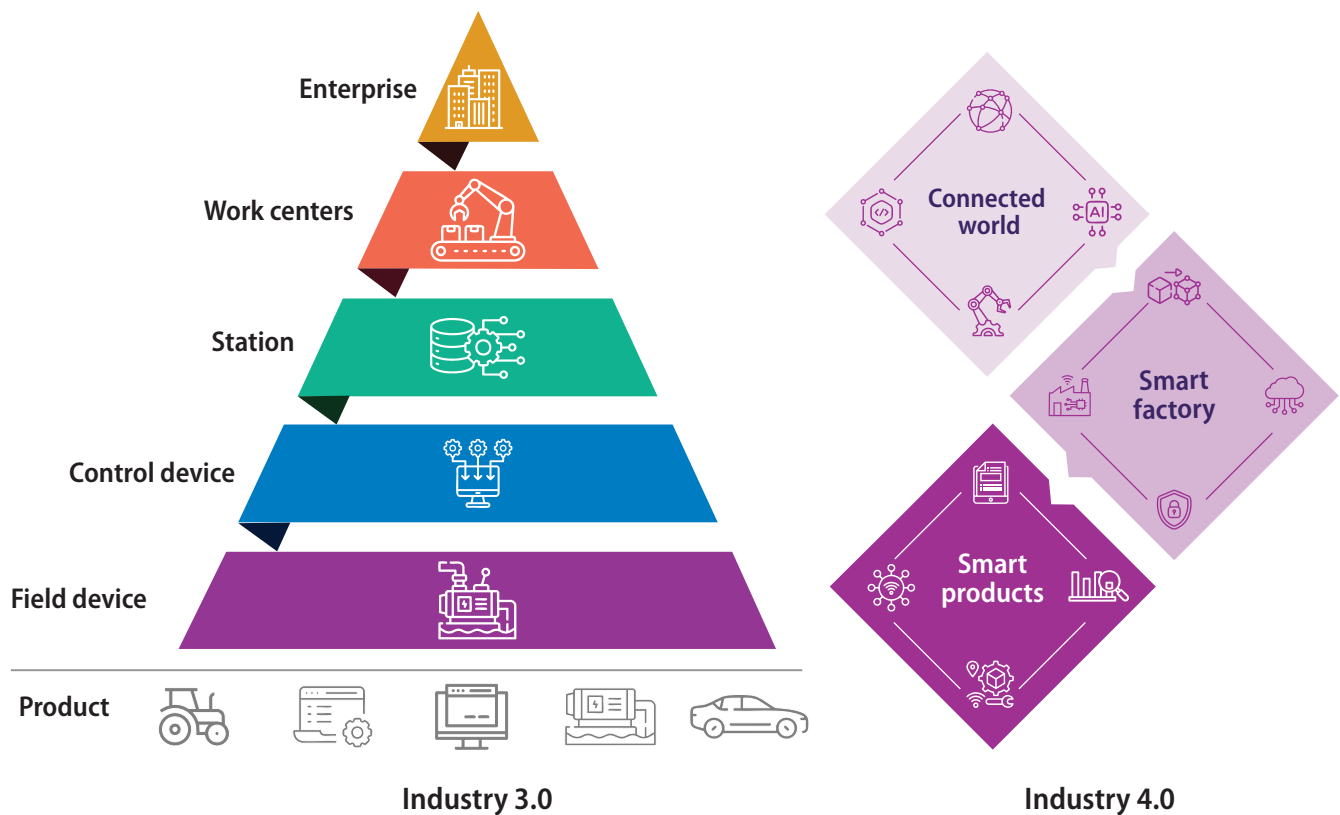
Industry 4.0

Source: Platform Industrie 4.0 - Reference Architectural Model Industrie 4.0 (RAMI4.0) - An Introduction

While Industry 4.0 is a broad framework that encompasses the integration of cyber-physical systems, IoT, cloud computing, and AI across industries, Pharma 4.0 refines these principles to meet the highly regulated, patient-centric, and quality-focused needs of pharmaceutical manufacturing and development.

Pharma 4.0 is about harnessing the full potential of Industry 4.0 technologies to transform pharmaceutical manufacturing and healthcare delivery, making it more efficient, flexible, data-driven, and patient-centric. The implementation requires alignment of expectations, definitions, and interpretation, with global pharmaceutical regulations.

Implementing Pharma 4.0 Framework

By adopting a structured framework, pharmaceutical companies can unlock the full potential of Pharma 4.0 and drive industry innovation. The framework addresses var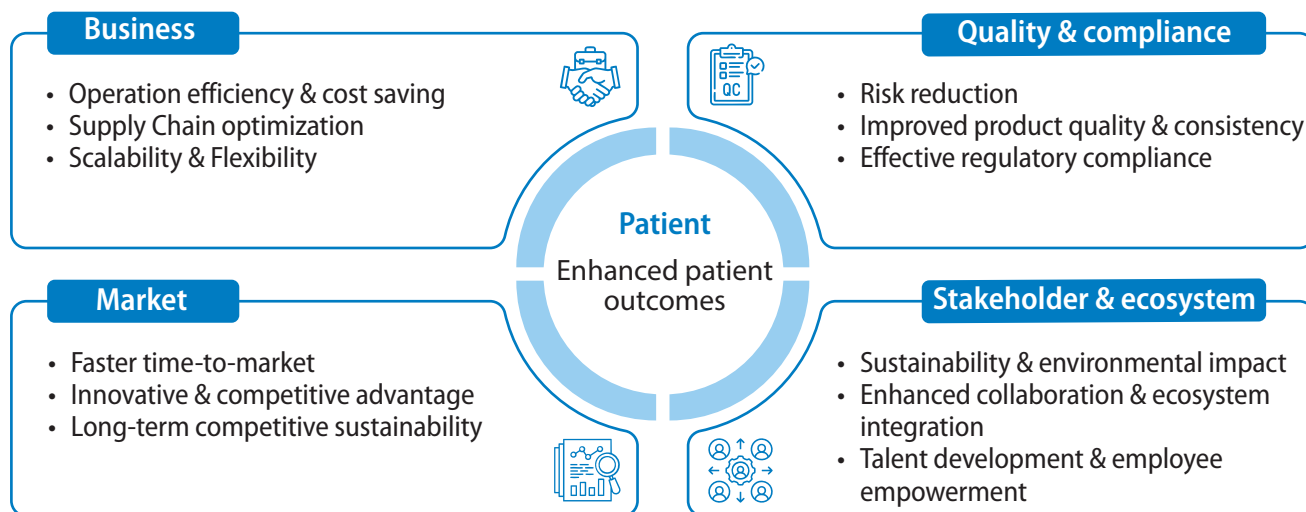ious facets of the pharmaceutical value chain, from drug discovery and development to manufacturing, distribution, and patient care. The representation below summarizes the areas in the Pharma 4.0 framework categorized under the appropriate organizational units.

Lifesciences industry unit

- Patient-centric Focus
- Regulatory Compliance & Risk Management
- Process Optimization
- Continuous Monitoring & Improvement

Leadership

- Strategic Vision & Planning
- Collaboration & Ecosystem Integration

Technology unit

- Technology Adoption
- Data Strategy Management

Human resources unit

- Workforce Transformation & Training

Value Realization of Pharma 4.0

The value realization of Pharma 4.0 comes from the tangible and intangible benefits that pharmaceutical companies can achieve by integrating Industry 4.0 technologies into their operations. These technologies enhance efficiency, quality, compliance, and patient outcomes, while also enabling greater flexibility and innovation. The below representation summarizes the key benefits:

Business
- Operation efficiency & cost saving
- Supply Chain optimization
- Scalability & Flexibility

Quality & compliance
- Risk reduction
- Improved product quality & consistency
- Effective regulatory compliance

Patient
Enhanced patient outcomes

Market
- Faster time-to-market
- Innovative & competitive advantage
- Long-term competitive sustainability

Stakeholder & ecosystem
- Sustainability & environmental impact
- Enhanced collaboration & ecosystem integration
- Talent development & employee empowerment

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