Benefits of Industry 4.0 / Smart Manufacturing
Totally Integrated Automation for Manufacturing
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New business models in the Internet age

From bookstore to e-book

From Yellow Pages to marketplace

From record store to streaming

From taxi to ride-sharing
Studies emphasize manufacturing transformation

» Trend to individualized mass production requires extended communication technologies along the value chain «

ARC Advisory Group

» The shift towards networked production is just beginning «

The Economist Intelligence Unit

» Digital manufacturing is expected to change the face of today’s industry structures and value chains «

McKinsey & Company
The Internet is revolutionizing the business world and creates major challenges for manufacturing companies.
Manufacturing is moving into the age of digitalization

The 1st Industrial Revolution:
- Water and steam

The 2nd Industrial Revolution:
- Electricity, mass production
- Automation

The 3rd Industrial Revolution:
- Digitalization

The 4th Industrial Revolution:
- Big Data and analytics
- Autonomous robots
- Augmented reality
- Additive manufacturing, e.g. 3D printing
- Cloud
- Horizontal/vertical software integration
- Industrial Internet (network of hardware-integrated sensors)
- Cyber security

Sources: BITKOM, BCG

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Digitalization addresses all aspects of the industrial value chain

Siemens Digital Enterprise portfolio addresses specific aspects of digitalization in industry
Smart Manufacturing and The Siemens “Digital Enterprise”

The idea for a modern **Smart Manufacturing** environment offers a comprehensive, seamless integrated merge of the Real and Virtual worlds and a Seamless flow of data from Field to Enterprise levels. This allows for a complete optimization of the entire product/project lifecycle which achieves lower costs, reduced time to market, and greater flexibility for adopters of this paradigm shift.

**Siemens** offers a complete portfolio of leading edge solutions and automation technologies within our **Digital Enterprise** to make this automation modernization possible.

The seamless integration from Design, Development, to Production.
Key areas expected where advanced automation provides significant advantages

Reducing the time to market
- Shorter innovation cycles
- More complex products
- Larger data volumes

Enhancing flexibility
- Individualized mass production
- Volatile markets
- High productivity

Increasing efficiency
- Energy and resource efficiency as key competitive factors
Only a holistic automation approach including the whole value add chain will yield sustainable competitiveness.
Siemens Digital Enterprise Holistic Approach to Smart Manufacturing
“Digital Enterprise” Software Suite – Answers for the future of manufacturing
Digital Enterprise Software Suite – PLM

Product Lifecycle Management Software

- Product Planning, Design, Test and Simulation
- Production Planning, Engineering and Simulation

PLM software and automation, products get to market up to 50% faster.

Top Down, Product Driven
Manufacturing Execution Software

- Planning & Scheduling
- Quality Management
- Manufacturing Execution
- Manufacturing Intelligence
- SCADA / HMI

MES/MOM is the real-time core element linking PLM to Automation.
Industrial Automation Software

- Integrated engineering and runtime for controllers, distributed I/O, HMI, drives, motion control and motors
- Industrial Safety and Security

Siemens TIA portal reduces engineering costs by up to 30%.
The meaning of Digitalization?
Requirements for machines resulting from market trends

Ability to meet customer demands...

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottles</td>
<td>...requires vertical integration to ERP and MES level of end-customer to the process</td>
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</table>

Reaction to changing market trends...

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
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<tbody>
<tr>
<td>Graph</td>
<td>...requires digitalization and simulation</td>
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High number of product variants...

<table>
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<tr>
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<th>Description</th>
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<tr>
<td>Machinery</td>
<td>...requires modularity of machines</td>
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Production improvements...

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<th>Description</th>
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<tr>
<td>Cloud</td>
<td>...require highly available machines</td>
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Plant Cloud Services
Customer statement

“To be able to react in shortest time on market trends, we need flexible and individualizing machines.”

“For us, simulation means an essential quality improvement.”

“Future concepts are based on software. With software the vision of self-learning machines will be achievable.”

Rainer Feuchter, CEO Optima Packaging Group
Horizontal integration in the value chain
The role of digitalization in engineering

- Complete process information to optimize machine performance
- Shorten start-up times with ability for complete process simulation in advance

Machine builder as supplier

Requirements of end-customer

- Define production KPIs (throughput, quality, etc.)
- Streamline the start-up
- Faster time to Market
- Continuous improvement of productivity, based on simulations

Engineering
- Mechanical
- Electrical
- Automation

Execution
- Simulation
- Commissioning

Teamcenter
Vertical integration in the value chain
The role of digitalization in production

**Engineering / System Integrator as supplier**
- Distribution of process data seamlessly available
- Implement line management systems
- Implement maintenance concepts of a smarter systems

**Requirements of end-customer**
- Define production KPIs (throughput, quality…)
- Streamline suppliers, orders, changes, etc.
- Define maintenance concepts both preventive and predictive
- Meet customer demands of quantity and quality
Digitalization in machine building
An example for seamless engineering along the entire value chain

From virtual to real

Individualization

Product / Production requirements

Cloud Services

Integration of production planning and production engineering

PLM
Simulation of entire production

MES
Data Transparency

Totally Integrated Automation
component interoperability

TIA Portal
Efficient Engineering
The meaning of digitalization for the entire production
The way to increase productivity – continuously optimize and extend the production

A consistent connection between IT level and machine level is the key to continuously increasing productivity.
Totally Integrated Automation – the basis for the industrial concepts of Smart Manufacturing
What is Totally Integrated Automation?

Interoperability of all Automation Components

The TIA open system architecture spans the entire production process and offers maximum interoperability across all automation components.

These shared characteristics minimize engineering time.

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Consistent Data Management

Global Standards

Uniform Interfaces

— results in —

Saves Time

Reduces Costs

Boosts Flexibility
**Totally Integrated Automation** – Common Characteristics

**Industrial Data Management**

The highest possible decision-making confidence maximizes economical plant operations – through real-time access to all important data collected during production.

**Industrial Communication**

Unlimited, consistent communication maximizes transparency across all levels – by using international cross-vendor standards.

**Industrial Security**

Systematic minimization of the danger of an internal or external attack on plants and networks.

**Safety Integrated**

Reliable protection of people, machinery, and the environment – through the seamless integration of safety into standard automation technology.

**Integrated Engineering**

Less time, money, and effort – due to consistent, comprehensive engineering in all phases of the production process.
Industrial Data Management
Extract new value from your existing data – Siemens Plant Data Services

From Data...

Data analytics and simulation
Data collection
Cloud-based analytics ecosystem
Secure storage and data transfer

...to Value

Optimize energy performance
Enhance Industrial Security
Maximize Process Efficiency
Master asset uptime
Visualization & recommendations
Industrial Data Management
Always up to date with Totally Integrated Automation

Apps for...
- access to production data
- alerts for maintenance
- remote operation
- direct device diagnostics
Industrial Data Management
Energy Management – from data acquisition to energy management

Measuring
Metering - collect your Energy data
Machine/Field Level
ET200-Energy meter, SIRIUS SIMOCODE, SENTRON PAC, … Energy Box

Monitoring
Transparency - display and examine your Energy
Machine/Field Level
S7-1200, S7-1500, Basic Panels, Comfort Panel, … TIA Portal

Supervising and Controlling
Analyze and control your Energy
Control/System Level
SIMATIC WinCC V7, PCS7, SIMATIC powerrate PROFlenergy

Managing
Manage corporate Energy consumption
Management Level
SIMATIC IT Energy Analytics (as a managed service)
Industrial Communication
Real-time performance and open Ethernet communication in one system

PROFINET – communication from field to management level

IT level
- Quality Data
- Energy Data
- Diagnostic Data

Horizontal integration on machine level
- Full TCP/IP in parallel to real-time
- Industrial Standards e.g. OPC, Safety, Energy Management
- Maintenance and service

M2M
- Motion
- Orders
- Remote Service

TIA
- Machine level

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Global standards
Offering a maximum of interoperability

Management Level
- ERP
- MES

Operator Level
- SCADA

Control Level
- PLC
- HMI

Field Level
- Sensors
- Actors

Standards

Third-party equipment

Openness

Perfect interoperability across all automation levels through openness and standards
Industrial Communication
Industrial wireless LAN for mobile applications and operation

Mobile machine parts
- IWLAN avoids the usage of cables on moving machine parts and thus reduces maintenance costs

Mobile operation
- Mobile operation of machine via mobile panels
- Usage of Smart Devices with apps or for webserver access

Safety
- Safety applications (PROFIsafe) can be implemented with IWLAN without additional hardware

IWLAN combines the comfort of wireless communication with industrial reliability
The Siemens security concept – “Defense in Depth”

Siemens products and systems offer integrated security
- Know how and copy protection
- Authentication and user management
- Firewall and VPN (Virtual Private Network)
- System “hardening”

Siemens Plant Security Services
- Assets
- Implement
- Manage
Safety Integrated
The highest possible integration of Safety in automation

Seamless integration of Safety in HW & SW

Standard and fail-safe automation with…
- …one engineering
- …one controller
- …one network

No additional HW & SW is required

Safety Integrated in TIA Portal
- Controller S7-1200/1500
- Remote I/O ET 200
- Operation and monitoring SIMATIC HMI
- Drives SINAMICS
Integrated Engineering with TIA Portal saves significantly engineering time

- One common framework
- Unique and consistent user interface concept
- Common and centralized services

Totally Integrated Automation Portal

Common Data Management

- WinCC
- Step7
- Scout
- Startdrive

WinCC
Controller
Distributed I/O
Motion Control
Drives

Security Integrated

Safety Integrated

Diagnostics
Totally Integrated Automation Portal

What is TIA Portal?

Allows you to increase your Engineering Efficiency – up to 30% across the design, commissioning and maintenance phases as determined by users.
The portfolio of the components of Totally Integrated Automation as a subset of the complete Digital Enterprise solution

Product Lifecycle Management and Enterprise Resource Planning

- Product design
- Product data management
- Production planning
- ERP

Manufacturing Execution System

Operations

- SCADA System
- Totally Integrated Automation Portal
- Energy Management

Control

- Controller
- HMI
- IPC
- Communication
- Motion Control
- CNC

Field

- Power Supply
- Industrial Identification
- Distributed I/O
- Drive Systems
- Industrial Controls

Added value in all automation tasks

- Integrated Engineering
- Industrial Data Management
- Industrial Communication
- Industrial Security
- Safety Integrated
Horizontal and vertical integration in the value chain

From machine design to digital enterprise operation

- **Engineering**
  - Mechanical
  - Electrical
  - Automation

- **Simulation**

- **Commissioning**

- **Execution**
  - MES
  - SCADA
  - Energy Management

- **Maintenance**
  - Data Driven Services

- **Teamcenter**
Horizontal and vertical integration in the value chain

From machine design to digital enterprise operation

Engineering
- Mechanical: NX
- Electrical: EPLAN
- Automation: TIA Portal

Simulation
- NX

Commissioning
- NX & PLCSIM advanced
- TIA Portal

Execution
- SIMATIC IT
- SIMATIC WinCC
- SCADA
- Energy Management
- MES

Maintenance
- Data Driven Services

Cloud
- Mindsphere

Teamcenter
Realize innovation in the digital factory with Siemens

Digital Enterprise Software Suite

Transforming Machines into...

Totally Integrated Automation portfolio

Smart Manufacturing processes