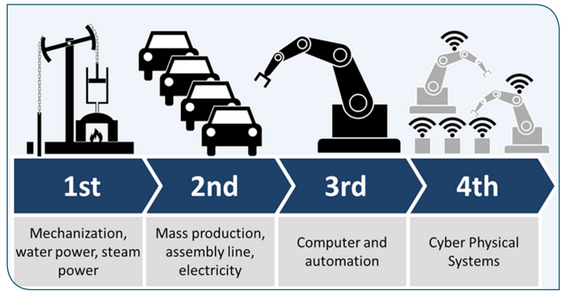
Getting the most out of Industry 4.0

Many manufacturers are still uncertain about how to implement Industry 4.0. This example looks at how software can contribute to advanced smart automation technology in a steel mill

What is Industry 4.0? Industry 4.0 represents a new industrial transition phase that could last for the next 20 years or so. It concerns the industrial adaptation of new technologies, based on Big Data and cyber physical systems that are just emerging. The image below shows the three earlier transition phases we have already passed through:

- The generation of power and mechanical automation
- Industrialisation
- Electronic automation.



In 2015 we entered the 4th industrial revolution, often referred to as 'smart automation'. Decisive enablers in this transition phase are cyber physical systems, which include integration of computation, networking and physical processes.

Today computational power is at such a high level, that it doesn't limit the data or software engineers. Networking speeds have also advanced so much, that Gigabyte speed is already standard and will soon be replaced by faster and therefore more powerful network infrastructure. Up to date physical systems such as sensors with advanced data collection and transmission capabilities, allow detailed information flow with almost no delay. This results in high data volume and accumulates over time into Big Data.

Big Data in industrial environments such as steel rolling mills, needs well structured, long term, plant-wide data storage and access to allow value generating applications across related data e.g. consecutive production lines. A product passing several production steps must be clearly identified and tracked over the whole chain.

US-based consulting company McKinsey, defines Industry 4.0 driven by four major disruptions:

- The astonishing rise in data volumes and storage capability
- The increase of computational power and connectivity (e.g. new low-power networks and low-power wide-area networks)
- New forms of human machine interaction, such as touch interfaces and augmented reality systems
- New methods in transferring digital instructions to the physical world, such as advanced robotics and 3D printing.

However, not all companies are aware of the emerging technologies. Only 30% of technology suppliers and 16% of manufacturers have an Industry 4.0 strategy in place and just 24% have assigned clear responsibilities to implement it.

Calculating the cost

What is the expected impact of Industry 4.0 compared to the major investment needs of the 1st, 2nd and 3rd industrial revolutions?

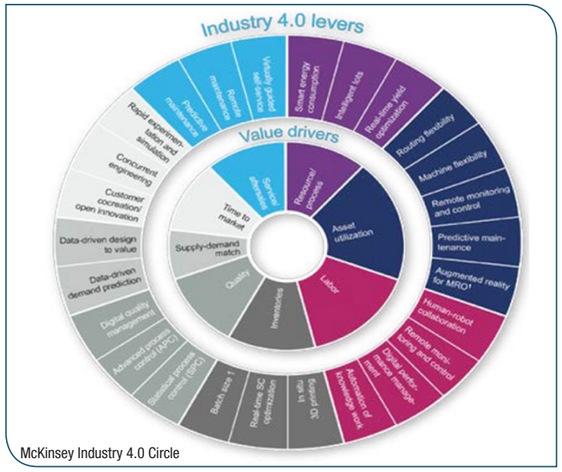
- Industry 1.0 to 3.0 (steam power, conveyor belts and the rise of automation & robotics) resulted in the replacement of 80 to 100% of industrial equipment
- McKinsey doesn't expect the same investment with Industry 4.0. Having said that the executives surveyed, estimate that approximately 40% of today's equipment will need upgrading or replacement
- Traditional companies may face major challenges in competition and marketing strategy from companies with an Industry 4.0 approach.

McKinsey recommends pragmatic steps should be taken towards Industry 4.0:

- Manufacturers should focus on a limited number of Industry 4.0 applications, rather than trying to cover all levers at once
- Companies should not be afraid to use technology work-arounds to begin implementing Industry 4.0 techniques
- Manufacturers should build a portfolio of third-party technology providers, as Industry 4.0 is causing a shift from the single-provider model to one that hinges on a set of integrated technology suppliers
- To capture value from Industry 4.0, companies need to establish a dedicated cross-functional team.

QuinLogic and Industry 4.0

McKinsey defined a circle of Industry 4.0 value drivers and levers which are involved in the 4th industrial revolution:



McKinsey Industry 4.0 Circle

QuinLogic's 'value driver' contribution is mainly in the area of quality, labour, asset utilisation, resources and processes. These value drivers are heavily influenced by QuinLogic software modules.

How to achieve quality standards in an Industry 4.0 environment

Production conditions will often change, simply to allow for the flexibility needs of the market. Not just grade-specific production but customised mass production is the rule of the game. Therefore:

- Individual quality has to be certified and made transparent for each single product, in all process steps, for all people involved
- Quality has to be certified and made transparent for each individual process, in every step of production, for all people involved.

For example, to produce a piece of metal for a car involves a long multiple-step production chain. To produce a specific piece with exactly the right properties and in the right quality, is a highly complex task.

How to achieve improved quality standards in an Industry 4.0 environment

The example of steel parts for the automotive industry, illustrates the solution for seamless quality assurance as a model using all technology drivers of Industry 4.0. It requires a completely new approach to the integration of production data, and transparency in all steps of the production chain that a product travels through. The key is to:

- Establish full coverage from the very beginning, through to delivery to the customer
- Assure product quality in each production step
- Assure process quality to avoid deviations in products.

What are the immediate advantages of a multi-stage transparent quality assurance solution?

- Transparency of product and process quality throughout production
- Fast customer specific, cost-efficient and reliable production
- Savings from early sorting before moving on to value-adding steps
- Savings resulting from the immediate reaction to deviations
- Learning and know-how accumulation by understanding the impact of consecutive operations
- Fast root cause analyses based on qualified, validated and related historical data.

Why knowing your relatives is key

Understanding relations or the genealogy of products allows the opportunity to immediately access all necessary data e.g. for a specific production step or a final product. To know what chemistry, what coiling temperature or what surface quality was involved in the various steps in the process route, is key to a comprehensive understanding of process performance, quality issues and final efficiency. (See Coil Genealogy image below).

QuinLogic's recently developed Quality Execution System Production Data Warehouse claims to provide all features necessary for full data transparency in a rolling mill:

- Genealogy of embedded product flow reduces the Big Data complexity
- Fast access to relevant relational product information
- Flexible reporting on mill-wide data is no longer a challenge
- Easy to understand correlations and dependencies.

Expectations and possible achievements

Industry 4.0 has created uncertainties and irritations, but the expected efficiency improvements should create a high return for the investment involved.

The good news is that the return on investment is quicker than expected, however this is not the only benefit. Those companies not adopting Industry 4.0 with its increased capability, lower production costs and superior quality, may find themselves out of business in a similar way to steam engines following the first industrial revolution.

The key achievements of Industry 4.0 include:

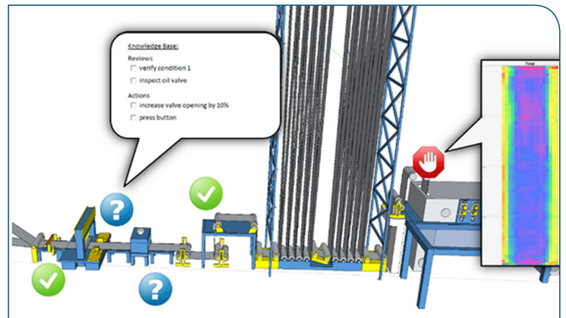
- Improved production management
- Efficient and flexible production
- Better understanding of correlations and dependencies
- Continuous improvement to strengthen market position
- Preservation of expertise and know-how within the company.

One example of Industry 4.0 within QuinLogic's software is the innovative use of company know-how. It has always been a huge challenge to make best use of the know-how available within a company. Brilliant solutions and sophisticated documents are distributed across a company, but part of it exists only in human brains.

QuinLogic developed a solution far beyond existing expert systems, to accumulate and provide know-how at the exact point it is needed, such as solving a process problem.

The QES Expert solution enables advice to be added to the software in an easy drag and drop method. With this in mind, the system grants the following benefits:

- Rules can trigger corrective actions which are shown directly at the point of interest
- Data and advice are immediately displayed
- Process managers can attribute their rules with advice, positions, approvals and workflow
- Collegues gain expertise and preserve expert know-how
- Semi-automatic support of continuous improvement



Industry 4.0 know-how accumulation in a steel mill environment

Summary

In summary the key targets of Industry 4.0 can be seen to be:
- Customer-specific manufacturing in industrial scale mass production
- Producing tailored products efficiently and at the lowest cost
- Delivering high quality with a short time to market
- Traceability to minimise risk.

Industry 4.0 key ingredients and features include:
- Smart factory as a result of increased IT power
- Machine to machine communications, also known as the Internet of Things
- Data-driven fact-based quality tracking and assurance
- Ready-to-use Industry 4.0 QES products 'out of the box'.

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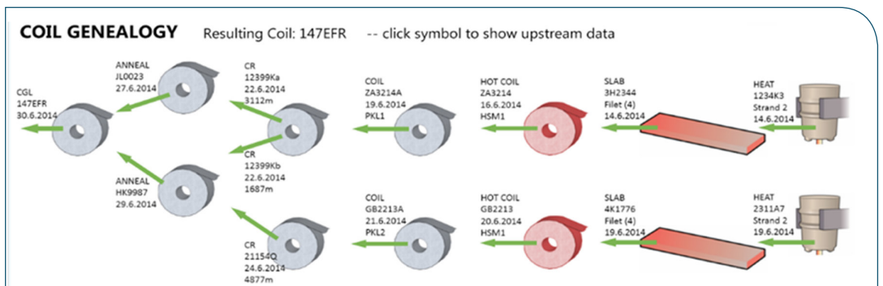

The genealogy module offers understanding of heat, slab, coil and sheet relations

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