

Amrop Leadership Series

Smart Factory, Smarter Leaders

Conversations
with the C-Suite

By
Claire JOUFFROY
Steffi GANDE



Leaders For What's Next

Smart Factory, Smarter Leaders

Conversations with the C-Suite



Executive Summary

What do C-suite practitioners really think about the Smart Factory? Is it a true paradigm shift? Or a case of the 'emperor's new clothes'? How high is the topic on the strategic agenda? What are the implications for human capital?

Finally, what could make for Smarter Leadership? To find out more, Amrop conducted confidential conversations with a select group of senior manufacturing executives from Europe and the US.

A Three Year Journey

In April 2011, summarizing the recommendations of the German Government's Industry 4.0 Taskforce at the Hannover Messe, three leaders from industry, politics and science announced a fourth industrial revolution. "In the next decade, a Cyber-Physical system will make new business models possible," read the statement by Kagermann, Lukas and Wahlster. "The Internet of Things will be complemented by the so-called Internet of Services, because Smart Products offer abilities in terms of intelligent services. Thanks to internet-enabled, machine-to-machine communication (M2M), this new generation of products can autonomously share information, act, and mutually drive each other."

In 2012, the Economist confirmed: "Factories are becoming vastly more efficient, thanks to automated milling machines that can swap their own tools, cut in multiple directions and "feel" if something is going wrong, together with robots equipped with vision and other sensing systems." Nissan's British factory was already amongst Europe's most productive, posting an 80% hike in capacity over 13 years with just under a 20% growth in workforce. "As the number of people directly employed in making things declines, the cost of labour as a proportion of the total cost of production will diminish too," the Economist predicted. "This will encourage makers to move some of the work back to rich countries."

Three years on, in 2014, the Financial Times reported that the workforce at the Siemens Amberg automation plant had remained stable for 20 years. Siegfried Russwurm, (Siemens industry division), explained that smart factories...aren't, very. Still, manual or simple administrative work would decline, he predicted, with a shift towards more complex design, configuration and management jobs. The possible "reshoring of manufacturing from low cost countries" due to consumer willingness to pay for customized products (via production automation and connectivity) was again evoked.

Shortly after, the Nikkei Asian Review opined that "at this time of radical change driven by advances in IT, the ability to create new value will be a *life or death issue* for Japanese manufacturers." Collaboration between manufacturers and governments would be vital. As Siemens and nine other German manufactures converged to co-create an AI production system, Chinese Premier Li Keqiang, meeting with German Chancellor Angela Merkel, pledged cooperation in technological exchanges and industry standardization. However Japan might face difficulties: "they tend to focus on in-house and in-group – rather than industrywide – networks, their presence in Industry 4.0 is minor."

Leaders are Initially Cynical

The C-suite executives interviewed by Amrop initially expressed mixed views about the Smart Factory. Some dismissed it as buzz or repackaging. Others considered their plant as 'already automated.' One doubted its benefit for mid-sized firms. Its applicability across all industries was also questioned. Some saw the Smart Factory as an operational or departmental, rather than top level strategic, concern. Only a handful took a visionary view.

But Strategic Relevance Quickly Emerges

Views evolved as we moved more deeply into the terrain. Yes, the Smart Factory offered distinct leverage value in one or more business areas. Yes, it was enabling innovation and customer-focus, backed by financial and production efficiencies. For one company, it had facilitated a new, market-leading business model.

Yet Smart Factory Has Limits

Blockages were raised less frequently than benefits, yet there were concerns. If some saw data collection as a clear benefit, others felt that only human intelligence could design fit-for-purpose systems and make sense of the resultant bits and bytes. Smart production was inherently complex, too, and would need incremental management or even a whole new revenue model. Furthermore, experimentation and errors risked endangering a prime opportunity - customer focus. The expense of installation risked undermining another one - cost benefit.

There is a Gap Between Automation and Interaction

Most participants saw the Smart Factory in terms of high plant *automation*, rather than inter-machine *communication*. Only two reflected its highest aspirations. For example, the Group Innovation VP of a Tier One automotive manufacturer predicted that, if every part of tomorrow's car would be connected and intelligent, so, too, would the plant that made it.

The Human Factor is Evolving Fast

A shift in workforce at lower organizational tiers, from manufacturing and administration, to analysis and management, is inevitable. But the human brain is not set to be switched off any time soon. To ensure the Smart Factory fulfils its game-changing potential, a full talent management circuit board must connect multiple layers, dimensions and disciplines.

Smart Factory, Smarter Leaders

Amrop proposes a profile for the Smart Factory Leader. This should complement leadership business and professional 'givens' (such as 'the ability to manage change' or 'build collaborative external networks'), and can lead to clear set of benefits at board level, we argue (see the full article for details).

- 1 Influence the construction of a high-performing, multi-disciplinary Board
- 2 Maintain a clear-eyed helicopter view in the face of unpredictability, tabling Smart Factory priorities and keeping heads above water
- 3 Anticipate market and technical developments, translating M2M communication possibilities into distinctive B2B or B2C innovations, portfolio extensions and new business models
- 4 Build a forward-looking and agile culture - integrating Smart Factory whilst preserving fundamental or founding values
- 5 Synthesize the paradox of *evolution* and *revolution* - incrementally engineering operating infrastructure whilst balancing financial risk, cost efficiencies, quality and safety
- 6 Have a strong personal interest or specialism in technology and related issues, and ability to interact constructively with technical or digital profiles
- 7 Nurture a passion for talent - be the steward of a living human capital circuit board connecting all corners of the organization.

Smart Factory, Smarter Leaders

Conversations with the C-Suite

The Smart Factory (or Industry 4.0) has now entered common parlance. Yet press attention has mainly focused on the strategies and activities of industrial giants: from Siemens and ABB to IBM. However, all kinds of organizations, from large- to small-cap, from first to second tier suppliers, have much to gain - potentially. What is the attitude of C-suite leaders to the topic?

Do they believe in the original vision of Smart Factory as a “Cyber-physical system making new business models possible?” Or is the Smart Factory rather a case of the ‘emperor’s new clothes’? How high is the topic positioned on their strategic agenda?

Given our interviewees’ definitions and understanding of Smart Factory, what are its implications for human capital? What leadership qualities are needed to shift the Smart Factory into a higher gear and drive their organizations into a new arena of possibilities?

To find out the reality behind the headlines, Amrop conducted conversations with 14 senior executives in a range of industrial sub-sectors in Northern Europe. From Germany, to Denmark, Finland, France, and the US. Almost all were either operations or supply chain leaders, or were responsible at corporate level for their company’s industrial, engineering or technology domains.

Their organizations were either end-stage, first or second tier manufacturers. In terms of their share structure, half were family-owned. The remainder were either listed, independent, or were private equity- or trust-held.

Contents

How did we Get Here?.....	5
Conversations with the C-suite.....	8
Some Cynicism at the Outset.....	8
The Strategic Relevance of the Smart Factory Quickly Comes into Focus.....	9
A Bouquet of Benefits.....	9
But Some Cracks in the Vase.....	10
The Gap Between Automation and Interaction.....	11
The Human Factor.....	12
Appendix, Further Reading, Authors.....	14
Acknowledgements.....	15

How Did We Get Here?

“Staking a claim as a production center - even in a high-earning region - will increasingly be the key question in the global race. Over the last ten years, contrary to other industrialized countries, Germany has kept its production workforce stable. Not least because of its mid-sized, but highly innovative industries, Germany has handled the economic effects of the financial crisis better than many others. The development and integration of new technologies and processes contributed considerably to this.”

Summarizing the recommendations of the German Government’s Industry 4.0 Taskforce at the 2011 Hannover Messe, this is how Kagermann, Lukas and Wahlster, three leading representatives from industry, politics and science, introduced what they believed would be an industrial paradigm shift. “In the next decade,” they announced, “a Cyber-Physical system will make new business models possible. Germany could play ‘first violin.’”

Of course, by the time of this portentous statement, electronics and IT were already a familiar feature of the manufacturing landscape. The automation of production processes had brought about a third industrial revolution, one of “new materials, robots and central management systems.” Yet, what Kagermann, Lukas and Wahlster believed would distinguish the *fourth* revolution was rather more sophisticated than that. “The business potential of the 4th revolution doesn’t just lie in process optimization, but in serving a variety of domains. The Internet of Things will be complemented by the so-called Internet of Services, because Smart Products offer abilities in terms of intelligent services. Thanks to internet-enabled, machine-to-machine communication (M2M), this new generation of products can autonomously share information, act, and mutually drive each other.”

In a nutshell: “The third industrial revolution... will be replaced in the next decade by the Internet of Things on the basis of Cyber-Physical Systems.”

One Year On

A year after the Hannover Messe, it seemed as if the predictions were coming to pass. The Economist was upbeat: “Factories are becoming vastly more efficient, thanks to automated milling machines that can swap their own tools, cut in multiple directions and “feel” if something is going wrong, together with robots equipped with vision and other sensing systems.”

In April 2011, Kagermann, Lukas and Wahlster, three leading representatives from industry, politics and science, introduced to the German Hannover Fair their prediction of industrial paradigm shift. “In the next decade, a Cyber-Physical system will make new business models possible.



Another intention announced in Hannover - restoring high-earning economies to their former status as vigorous production centers was being fulfilled, or so it seemed

If Germany's three oracles had positioned the country as "first violin" in the cyber-orchestra, this was hardly a solo performance. Nissan's British factory in Sunderland was already one of the most productive in Europe, according to the Economist, having achieved close to an 80% hike in production capacity over the past 13 years with just under a 20% growth in workforce. Meanwhile Colin Smith, Director of Engineering and Technology for Rolls-Royce, considered manual tools incapable of producing "modern stuff." For Smith: "the days of huge factories full of lots of people are not there any more."

Furthermore, another prediction announced in Hannover - restoring high-earning economies to their former status as vigorous production centers was being fulfilled - or so it seemed. "As the number of people directly employed in making things declines, the cost of labour as a proportion of the total cost of production will diminish too," the Economist predicted. "This will encourage makers to move some of the work back to rich countries, not least because new manufacturing techniques make it cheaper and faster to respond to changing local tastes."

Kagermann, Lukas and Wahlster had considered the presence of medium sized, innovative businesses to be a crisis-resistor in post-2009 Germany, and the Economist saw their role strengthening further still, thanks to the evolution of the Smart Factory. "Much of what is coming will empower small and medium-sized firms and individual entrepreneurs. Launching novel products will become easier and cheaper."

Interestingly, the Economist saw digital manufacturing not as a fourth, but as a third industrial revolution. Is this question of evolution, then, rather than an entirely new industrial chapter? Later we will find out what our interviewees think of that.

Three Years On

In April 2014, the Financial Times reported that the Siemens workforce at its Amberg automation plant had remained stable for the past 20 years. Smart machines had not affected numbers. Why? Siegfried Russwurm, Board Member in charge of Siemens' industry division, had a clear explanation for this: smart factories...aren't, very.

“Programmable logic controllers...are not creative in the sense of thinking something new or coping with an unprecedented situation – that is the human privilege...” Russwurm pronounced. Manual work, or simple administrative employment, however, would inevitably decline, he predicted, with a shift towards more complex jobs, such as the design and configuration of industrial processes and plant management. “There will be jobs for real experts as long as they are prepared to embrace this world.”

The possible “reshoring of manufacturing from low cost countries” due to the willingness of consumers to pay for customized products was again raised - made possible by production automation and connectivity. However, the FT also warned about a ghost in the machine - the risk of cyber attacks. “US authorities are particularly concerned by the fact that industrial control systems are now directly accessible via the internet.”

And the Asian Response

“A revolution brewing with German ‘Smart Factory’ project” read the headline in Nikkei Asian Review in December 2014. Whilst Kagermann, Lukas and Wahlster had seen Industry 4.0 as the core of industrial advantage to come, the Nikkei Asian Review was more existential: “In this time of radical change driven by advances in information technology, the ability to create new value will be a *life or death issue* for Japanese manufacturers.”

If collaboration between *machines* is the name of the game and if industrial competitiveness in Asia, as the Nikkei Asian Review forecast, would be increased by Smart Factory networking, then collaboration between *manufacturers* and *governments* is equally important. As Siemens and nine other German manufactures converged in Kaiserslauten to co-create an AI production system, Chinese Premier Li Keqiang, meeting with German Chancellor Angela Merkel, pledged China’s cooperation in promoting technological exchanges and standardization for industry. Ties between the two countries should not be limited to buying and selling merchandise, he said. (The Chinese government seeks widespread use of AI by 2050). However, collaboration may not be a simple matter, at least for one Asian economy: “Japanese manufacturers are seen as having an edge over foreign rivals in automation,” said the Asian Review, “but because they tend to focus on in-house and in-group – rather than industrywide – networks, their presence in Industry 4.0 is minor.”

Whilst Kagermann, Lukas and Wahlster had seen Industry 4.0 as the core of industrial advantage to come, the Nikkei Asian Review was more existential: “In this time of radical change driven by advances in information technology, the ability to create new value will be a *life or death issue* for Japanese manufacturers.”

Some of our interviewees, irrespective of their company's size, or its position in the supply chain pecking order, initially dismissed the Smart Factory as a buzz word, a repackaging of issues that had been a subject of discussion for several years



Conversations with the C-suite

Some Cynicism at the Outset

In the opening stages of our discussions, the C-suite executives interviewed by Amrop expressed mixed views regarding the extent to which the Smart Factory really was the innovation it was cracked up to be. If this was tipped to be a 4th industrial revolution, it was turning out to be a rather quiet one.

This is because some of our interviewees, irrespective of their company's size, or its position in the supply chain pecking order, initially dismissed the Smart Factory as a buzz word, a repackaging of issues that had been a subject of discussion for several years

Others considered their plant to be already automated, meaning that the Smart Factory was hardly a pressing, or novel issue (we will see later whether 'automated' really equates to 'Smart Factory'). Contrary to the aspirations of our previously-cited commentators, the CEO of one power tool manufacturer questioned its real benefit for mid-sized firms. Its applicability across all industries was also called into question. Some thought that this was no strategic matter for the C-suite, but that it was – or should be – an operational or departmental concern.




At this stage in our conversations, only a minority of interviewees took a visionary view of the Smart Factory. For these leaders, it offered significant potential for new services and business generation, or was a strategic issue at group level, with implications for the whole supply chain organization.

For example, the Chief Digital Officer of a leading first tier multinational placed the Smart Factory number one on the strategic agenda, with the company extensively validating a decision making and implementation model with all stakeholders.

Meanwhile, the Group Innovation VP of a first tier automotive manufacturer predicted that, if every part of tomorrow's car would be connected and intelligent, so, too, would the plant that made it.

But the Strategic Relevance of the Smart Factory Quickly Comes into Focus

Interestingly, although views at the outset of our conversations were somewhat mixed, opinions evolved and crystallized as we moved more deeply into the terrain. In the table below, we summarize and categorize the statements (one per interviewee).

The Status of the Smart Factory in our Organization		
Operational Issue 	Under Investigation 	Strategic Imperative 
	Carefully studying feasibility with a group of other similar sized firms and the National Engineering Industry association	Integrated in strategic goals. Increasing demand for machine/parts that can be integrated into smart production systems
		A strategic issue at group level
		A strategic force and driver. Shareholder is committed, visionary, with a mid-term vision, strong beliefs
A goal rather than top priority, focus is on redefining the supply chain		A market opportunity driving product strategy (smart, low investment solution to manage complex mix of client/product/customization)
Focus is more on lean best practices		Part of a strategic vision, a change in the the manufacturing paradigm The (family) shareholder is forward-looking with an ability to prioritize investments
		Obviously a hot issue, as a leverage for innovative products
A topic in the manufacturing department, not (yet) at top management or strategic level (experimenting with the complexity of eliminating human interaction in most operations)		
Further concepts will be implemented, but not part of 2020 strategic agenda		
	Number 1 on the agenda. It will be approached step-by-step in a very structured manner. The decision and implementation model are the result of extensive validation with all stakeholders	

A Bouquet of Benefits

Originators and commentators have outlined the potential of the Smart Factory to re-establish high-earning markets as production centers. What did our participants see as its benefits?

The views of the believers (the majority of those interviewed) broadly reflected those of the commentators. Yes, the Smart Factory offered distinct leverage value in one or more business areas. Yes, it was enabling a virtuous balance between innovation and customer-focus on one hand, backed by financial and production efficiencies on the other. As the COO of a lighting devices and Smart Factory solutions provider summed up, the Smart Factory was a smart, low-investment answer to management complexity – a blend of client, product, and customization.

The Industrial Director of a branded kitchen manufacturer went further. The Smart Factory had had a transformative effect at the highest level, he reported, elevating the status of his company from non-player to Number one and propelling the business from a low added-value- into a high-tech player, one step ahead of the competition. As such, the model could be leveraged into a new business segment. In summary:

- **Innovation and customer-focus:** ultimately, the Smart Factory facilitates cutting-edge product or service developments – even new business models. It allows the all-important customization (supported by close proximity to customers and their data), a reduction of delivery lead times to the end user, and if teething problems are fixed, exceptional quality.
- **Financial and production efficiencies:** streamlining is a clear benefit, helpful too is the possibility of harvesting financial data direct from the supply chain, flexing production to fluctuating demand, and supporting competitive pricing. Safety and preventive maintenance is less of a priority.

Some Cracks in the Vase

Blockages were raised less frequently than benefits, yet some interviewees did have nagging concerns. If one saw the Smart Factory as a solution to management complexity, others were experiencing the opposite – Smart Factory was creating, or demanding, complexity. A whole new revenue model would be needed, one leader believed, designed in an incremental and interdisciplinary way – something it was not possible to figure out in advance. A Director for Industrial Engineering, whilst seeing huge potential for new services, also saw smart production as being inherently complex, again, requiring development through different stages. This interviewee was also meeting resistance on the factory floor.

Whilst several interviewees saw data collection as a plus, others, like Siemens Board Member Siegfried Russwurm, saw limits in bits and bytes. For the Managing Director of a company providing engineering solutions for the world's largest industrial groups, data was the real issue. Only human intelligence was able to select the smart and relevant information, he reflected. He was not alone.

Clearly, the gap between data and insights is still to be bridged, and an incremental approach to capacity building will be called for. If data is to speak, it needs grammar.

For the Industrial Director of a branded kitchen manufacturer, the Smart Factory had elevated the status of his company from non-player to Number one, transforming the business from a low added-value- into a high-tech player, one step ahead of the competition.



Exciting though these possibilities may seem, and even if Smart Factory delivers clear benefits for several practitioners, does their understanding and experience occupy such lofty heights? Well, the reality is more prosaic. Most of our participants spontaneously expressed Smart Factory in terms of heavy or high level plant *automation*, rather than inter-machine *communication*.

Further clouding the landscape, the still-experimental phase (and perhaps the sheer complexity) of Smart Factory risked endangering one of its prime opportunities - customer focus. One Technical Director cited high volumes of customer product complaints. And getting production right risked undermining the very cost benefits of the Smart Factory – it would be very expensive to introduce the concept to the production process, according to this realist.

The Gap Between Automation and Interaction

Let's pause for a moment. What does Smart Factory actually mean? Let's briefly recall the original vision of the industry 4.0 triumvirate: "The Internet of Things will be complemented by the so-called Internet of Services, because Smart Products offer abilities in terms of intelligent services. Thanks to internet-enabled, machine-to-machine communication (M2M), this new generation of products can autonomously share information, act, and mutually drive each other."

Exciting though these possibilities may seem, and even if Smart Factory delivers clear benefits for several practitioners, does their understanding and experience of the concept occupy these heights? Do they truly foresee the potential for turnaround in their business model, upstream and downstream collaboration? The reality is more modest. Most of our participants spontaneously expressed Smart Factory in terms of heavy or high level plant *automation*, rather than inter-machine *communication*. The statement of one senior executive summed up the equation: a high level of *automation* was already in place in most countries, he reported, and the *Smart Factory Model* was set for worldwide roll-out. For another, the story already seemed to be over at the end of its first chapter. The machine tools manufactured by his company were already Smart Factory compatible, and his clients had yet to ask for related data, he reported. Enough said.

But is it enough? In only a minority of cases was there any clear echo of the highest aspirations of the Smart Factory. One Technical Director, whilst admitting he was struggling with *automation* at this stage in the game, reported that his company was experimenting with eliminating human *interaction* in most operations. The Group Innovation VP of a Tier One automotive manufacturer predicted that, if every part of tomorrow's car would be connected and intelligent, so, too, would the plant that made it.

The Human Factor

Much has been written, (and imagined), about the effect of Smart Factory on human capital. As forecasters Stratfor recently put it, “even in places where the benefits will be the strongest, there will be significant disruption. Jobs will be created and destroyed.”

Building the Talent Circuit Board

The need to balance humanity with efficiency and safety emerged clearly from our conversations. Yet the picture is bigger still. If Smart Factory is to fulfil its game-changing vision, it must translate into an agile and forward-looking talent management strategy. One that connects all levels and dimensions of the evolving organization. The most competitive players will leave no corner untouched. When it comes to building the new talent circuit board, the human brain is not set to be switched off any time in the near future. And organizational brains need to be better connected than the highest-performing machine networks. “Getting smart means utilizing top talent,” as the Analytics Center put it, “building out new industrial infrastructure to handle more connected devices and sensors across an entire production line...” and beyond, to the creation of entirely new business models.

On the factory floor, the shift away from machine operation and simple administration is inevitable. But even here, the human factor cannot – and should not – be eliminated. As Risk Management reported in 2015, “smarter machines can alert operators well in advance of necessary repairs. Using the same sensors, data analytics and instrumentation, operators can learn about problems...before the entire machine breaks down and the manufacturing process comes to a halt.” Nonetheless: “While computerized equipment may reduce the possibility of human error, when a problem requiring human intervention occurs, there is the risk of having no one around with the skills to address the situation. Rather than one part of the assembly process breaking, the entire interconnected line could conceivably fail.” As such, the human factor remains indispensable.

At the technical level, grey matter is all the more relevant when we consider the need to gather the data that counts, and translate it into information. For this, the Smart Factory – and our interviewees, are seeking systems engineers who are not mere data collectors, but who can design architecture and algorithms that enable strategically relevant data to be harnessed, processed, interpreted and translated into meaning, in a constant internal and external feedback loop.

For sales and marketing to be an effective interface with customers in the Smart Factory world, practitioners must deploy data as a currency enabling them to discern and answer market needs in a way that is more predictive – and responsive – than ever before. This talent must be capable of spanning the operational and business development domains, plugging into and nourishing innovative networks. Such talent comes at a premium.

The finance function is affected, too. Cost benefits associated with linking machines to orders in real time, integrating the numbers into responsive supply chain systems, can have significant benefits for working capital. Accounting – even at the most administrative level, must increasingly become financial management.

Smart factory will be a multi-disciplinary, multi-dimensional business, then, and is already raising serious questions for those entrusted with human capital strategy. Identifying the internal talent best equipped to flourish and grow within this new system, determining where the knowledge gaps lie and how to bridge these, whether by designing compelling attraction strategies and personal development plans, installing wide-ranging formal learning and sponsoring informal learning, will demand courage, humanity and rigor.

Smarter Leaders

What does all this imply for top managers? Given the opportunities and risks of the Smart Factory, as well as the human and strategic complexity it raises, what qualities do Leaders need to equip a manufacturing organization for What's Next? Based on Amrop's experience and the statements of the leaders interviewed, we propose the following profile. This should complement, not replace, leadership business and professional 'givens' (such as 'the ability to manage change' or 'build collaborative external networks').

Smart Factory, Smarter Leaders...

- 1 Influence the construction of a high-performing, multi-disciplinary Board. One which integrates Smart Factory into the strategic agenda and is hotwired into technical, industrial and human capital expertise
- 2 Maintain a clear-eyed helicopter view in the face of unpredictability and ambiguity, tabling Smart Factory priorities and keeping heads above water
- 3 Anticipate market and technical developments, translating M2M communication possibilities into distinctive B2B or B2C innovations, portfolio extensions and new business models. This demands the analytical bandwidth to garner insights from high volumes of data
- 4 Build a forward-looking and agile culture - integrating Smart Factory whilst preserving fundamental or founding values. Encourage multiple disciplines to connect across divisions and geographies, nourishing a climate of learning and building zones of failure-tolerant experimentation
- 5 Synthesize the paradox of *evolution* and *revolution* - incrementally engineering operating infrastructure to meet the new strategies, whilst balancing financial risk, cost efficiencies, quality and safety
- 6 Have a strong personal interest or specialism in technology and related issues, interacting with technical or digital profiles (also knowing one's own limits)
- 7 Nurture a passion for talent and be the steward of a living human capital circuit board. Possess the humility and wisdom to distinguish between the merits (and limits) of artificial and human intelligence. In experimental phases, engage in compassionate and constructive communication, blending digital and live media to resonate across the demographic spectrum. Exercising particular vigilance with:
 - Workforce/unions (replacement of people with technology)
 - Customers (product or service teething problems)

Conclusion

Could the very phenomenon that human intelligence is busy building have the potential to eliminate its originators? Will the Smart Factory turn out to be nothing more than a modest step towards more and better automation? Or does it have true potential to realize its original vision - equipping industrialized markets to regain a sustainable leadership position via agile and responsive digital/human interaction? For the latter scenario, smart leaders, even more than smart machines, will be the key.



Appendix

Amrop interviewed 14 senior executives in a range of industrial sub-sectors in Northern Europe. From Germany, to Denmark, Finland, France, and the US. Almost all were either operations or supply chain leaders, or were responsible at corporate level for their company's industrial, engineering or technology domains.

Their organizations spanned the supply chain – being either end-stage, first or second tier manufacturers. In terms of their share structure, half were family-owned. The remainder were either listed, independent, or were private equity- or trust-held.



Further Reading, sources

Industrie 4.0: Mit dem Internet der Dinge auf dem Weg zur 4. Industriellen Revolution, Kagermann, Lukas & Wahlster, April 2011

A third industrial revolution, The Economist, April, 2012

A revolution brewing with German 'Smart Factory' project, Nikkei Asian Review, December 2014

Germany Bets on 'Smart Factories' to Keep Its Manufacturing Edge, The Wall Street Journal, October, 2014

Europe's manufacturers experiment with the 'Smart Factory,' The Financial Times, April, 2014

Premiers pas dans l'usine connectée, Usine Nouvelle, September 2013

Smart Factories Bring Growth, Value to Industries, Analytics Center, April 2015

Industrial Intelligence: The Risks and Opportunities of Smart Manufacturing, Risk Management, March 2015

Smart Factories, The Next Industrial Revolution, Stratfor, May, 2015

Acknowledgements

Amrop sincerely thanks all the executives who shared their time, experiences, and insights with us. All names of participants and organizations have been withheld for confidentiality purposes. Furthermore, the male gender has been used throughout, reflecting the majority of the participants.

About the Authors

The interviews were conducted by Amrop Partners on behalf of the Amrop Global Automotive and Industrial Practice Group.

The project was led by Claire Jouffroy, Partner, Amrop Seeliger y Conde, France . Content analysis and report writing was performed by Claire Jouffroy and Steffi Gande, Global Content and Communications Manager, Amrop.

About the Amrop Global Automotive and Industrial Practice

Based on over 30 years' experience, Amrop's Automotive and Industrial Practice offers dedicated expertise in executive search, leadership assessment and board consulting to secure Leaders For What's Next – the professionals who will enable ambitious players to plan, initiate and execute with agility, efficiency and sustainability. We combine industrial insight with local know-how, connecting local or regional variances to a global framework. With 83 offices in 56 countries, Amrop is the largest partnership of its kind.

