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IoT

INTERNET OF THINGS

View from the top

The best way to get something done is to begin

Economy

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F.I.T.T. for investors

Winners and losers of the Industrial Internet

Deep dive into the Industrial Internet of Things (IIoT)

Today nearly all industrial customers explore the benefits from digital transformation of their businesses. Many suppliers try to capture share of the Industrial Internet (IIoT) opportunity, be it automation suppliers, generic cloud platform companies or analytic tool cos. We explore the key opportunities and risks associated to IIoT and review digital strategies of cos. under our coverage to establish tomorrow's winners and losers in an IIoT world. This could have significant impact on multiples, with Schneider and Siemens offering highest re-rating opportunity in our view.

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Winners and losers of the Industrial Internet

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Industrial end-markets are still at the beginning of their digitalization journey

The Industrial Internet is about optimizing entire manufacturing systems, including products, processes, supply chains and business models. We estimate digitized solutions could generate c.15% annual opex savings in industrial markets by making assets more efficient. This could reduce the addressable market size for traditional manufacturers of big iron machines. However, this should translate in a market opportunity of c.$200bn for IIoT suppliers in areas like predictive maintenance or operation optimization.

IIoT strategies are as much defensive as they are offensive

Industrial companies will have to be good at software to remain successful as an increasing share of the manufacturing value chain could shift to providers of sensors, data analytics and industrial cloud architectures. For example, a key risk for the manufacturers of large pieces of equipment requiring maintenance/retrofit is that software companies specializing in analytics or 3D printing might take a growing share of the lucrative service business pie.

3 building blocks for success: Siemens and Schneider well placed

We believe successful companies in an IIoT world will combine an integrated platform of digital solutions; deep domain know-how to give context to data analytics and automation/control activities to in real-time the insights from data analysis on manufacturing processes. Siemens stands out for its comprehensive portfolio of automation and software tools but, the group faces significant digital disruption risks on servicing of its installed base. We rank Schneider and ABB highly. Both have relatively similar IIoT competencies but in different end-markets. We also estimate Schneider is running 5 years ahead of ABB in implementation of its group-wide digital platform and strategy.

10% valuation multiple expansion opportunity for Schneider and Siemens

One interesting potential ripple effect of the digitalization process could be a re-rating of automation companies. Software cos. typically trade at a 40% premium to capital goods cos. Automation vendors claim around 40-60% of their revenue embeds some form of software and connectivity. Assuming investors re-value half of their IIoT-related revenue on software-like multiples, this would expand their valuation multiples by c.10%. We believe Schneider (Buy, TP €76) and Siemens (Hold, TP €126) offer highest re-rating opportunity.

Valuation and risks

EV/EBITA is our preferred multiple, for the implicit relationship between EV/EBITA multiples and companies' ROCE. Downside risks: general macro weakness and slower-than-expected cost-cutting progress. Upside risks: stronger-than-expected macro conditions and new restructuring programmes.

Key Changes

Company	Target Price	Rating
SIEGn.DE	122.00 to 126.00(EUR)	-
ABBN.S	22.00 to 23.00(CHF)	-
SCHN.PA	73.00 to 76.00(EUR)	-

Source: Deutsche Bank

Companies Featured

Siemens AG (SIEGn.DE),EUR127.60			Hold
	2016A	2017E	2018E
DB EPS (EUR)	6.80	7.92	8.66
P/E (x)	13.5	16.1	14.7
EV/EBITA (x)	9.7	11.5	10.7
ABB Ltd. (ABBN.S),CHF23.29			**Hold**
	2016A	2017E	2018E
DB EPS (USD)	1.11	1.19	1.38
P/E (x)	18.2	19.6	16.8
EV/EBITA (x)	14.3	13.6	11.8
Legrand (LEGD.PA),EUR56.48			**Buy**
	2016A	2017E	2018E
DB EPS (EUR)	2.23	2.55	2.77
P/E (x)	22.4	22.1	20.4
EV/EBITA (x)	14.7	14.7	13.4
Schneider Electric (SCHN.PA),EUR68.32			**Buy**
	2016A	2017E	2018E
DB EPS (EUR)	3.32	3.98	4.40
P/E (x)	17.3	17.2	15.5
EV/EBITA (x)	12.3	12.4	11.4

Source: Deutsche Bank

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Investment summary

Diving into the IIoT world

Some call it the Industrial Internet of Things (IIoT) while others call it Industry 4.0. We think they are all parts of the same story. The IIoT is a network of intelligent industrial devices and machines that connect people, machines and processes from the factory floor to the executive offices. This network can collect, share and analyze greater amounts of data and at far greater speed than before, helping to improve operational efficiency, safety and maintenance of industrial companies. Key technologies behind the IIoT are not new but they have improved in terms of cost and integration capabilities. Today's digitization of the manufacturing sector is driven by the declining costs of sensors, the advances in big data tools, the declining price of data processing and storage and the convergence between enterprise software and factory floor software.

Today, nearly all industrial customers are exploring how they could benefit from a digital transformation of their businesses. And many suppliers are trying to capture a share of the Industrial Internet of Things (IIoT) opportunity, be it automation suppliers, analytic tool companies or generic cloud platform providers. It is not easy to separate the wheat from the chaff. What is talk only and what actually brings value?

Key highlights of our report

We establish what it takes to be an industrial digital winner on page 14-17. We review the opportunities and threats associated to the industrial internet on page 18-34 and show who will be tomorrow's winners and losers in the IIoT world, including a detailed analysis of the digital strategies of companies under our global coverage on page 38-65. For those who are less familiar to the industrial software and automation jargon, we provide a 101 section on page 67-77, which delves into the HMI, MES, DCS, CAD/CAM and Cloud concepts. Our report also includes a comparison of GE and Siemens' cloud-based data analytics platforms Predix and MindSphere on page 35-37.

We also highlight that the IIoT could change investors' long-term perception on industrials stocks on page 10-13. On the one hand, traditional manufacturers facing digital disruption could experience a de-rating (e.g. Sandvik because of the advance of 3D printing). On the other hand, companies perceived to be successfully harnessing the industrial internet could see their valuation multiples expand and (partially) catch-up with those of software companies, which today trade at a 40% premium to capgoods names. Automation companies have the building blocks to succeed in an IIoT world. Siemens (Hold, TP €126, up from €122) and Schneider (BUY, TP €76, up from €73) could benefit the most, with an estimated 10% potential rerating.

The IIoT will make the industrial world 15% more efficient

The value creation from analyzing data from sensors in a factory could be far ranging, potentially higher than the value creation from analyzing information that people leave on the web. Industrial end-markets are still at the beginning of their digitalization journey. IDC predicts that data generated on connected devices will rise from 4ZB in 2013 to 44ZB by 2020 and 180ZB five years later. Connecting machines over the Internet opens up new opportunities to collect

and analyze various data from industrial facilities and fleets of machines in order to boost efficiency, reduce throughput times, trim energy costs and fine-tune maintenance. An example is the ability to gather and analyze all data on connected locomotives, in combination with external factors (weather, etc) in order to optimize costs, perform predictive maintenance as well as optimize entire fleets of trains with intelligent traffic management. Overall, we estimate that digitized products and solutions could sharply improve operation and asset efficiency and generate around 15% opex savings across the largest industrial end-markets, equivalent to more than $1trillion.

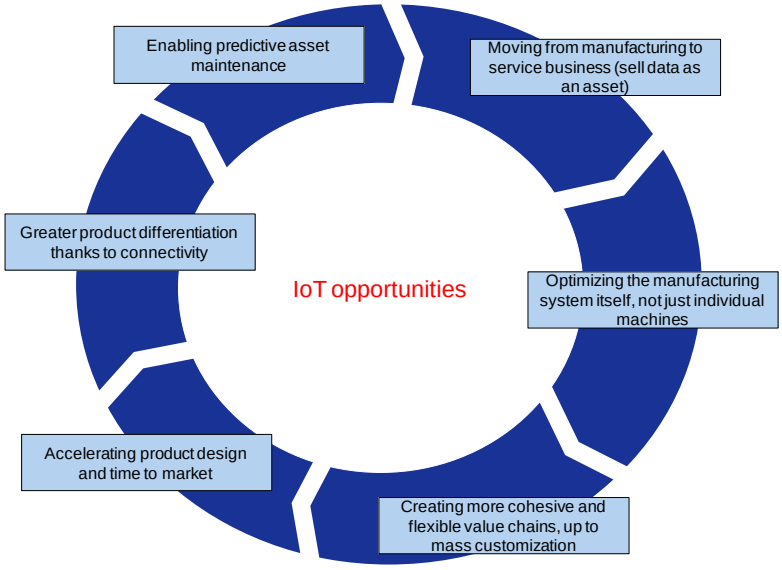
This could translate into a €200bn revenue opportunity for IIoT suppliers

We estimate that IIoT providers will capture their fair share of the savings generated for industrial customers. By 2025, the IIoT could generate a market opportunity of $200bn for providers of data collection and advisory services, remote and predictive maintenance, asset performance management, operation optimization software, smart building equipment, etc. Thanks to higher-value added software-based solutions, IIoT suppliers can better differentiate their value propositions, develop greater customer intimacy and stickiness and drive pull-through of their hardware offerings.

Industrial manufacturers' business models could also evolve from sellers of machines into service providers, reducing the sector cyclicality. For example, manufacturers could develop pay-by-use services, i.e., let customers pay products according to their usage rather than purchase them outright. IIoT platforms could also be used to develop Platform as a Service (PaaS) business models or host OEM-developed applications and take a share of the revenue generated.

In the chart below, we highlight some of the key IIoT opportunities for both industrial customers and their suppliers.

Figure 1: IIoT key opportunities



Source: Deutsche Bank

Who will be an IIoT winner?

We believe that domain know-how, automation expertise and a group-wide platform of agnostic software capabilities are the building blocks to be an industrial digital winner. On our analysis, Siemens (Hold) and Schneider (Buy) offer the best IIoT portfolios in our universe.

1/ Automation companies (Siemens, Rockwell, Schneider, ABB, etc) have what it takes to succeed and capture the largest share of the IIoT €200bn opportunity. They've had control systems, asset management and operation management suites for decades, trying to communicate with assets and predict outcomes. In practice, we see the industrial Internet essentially as a gradual extension of factory-level automation solutions to system-wide optimization solutions thanks to the Internet and the cloud.

2/ Strong data analytics expertise is key but a digital platform with open and agnostic software capabilities is equally important to make all digital technologies available for customers and across the organization. Most industrial companies have built platforms regrouping their digital technologies over the past few years but we estimate that GE, Siemens and Schneider offer the most advanced and integrated digital platforms. On the other hand, we believe it has taken ABB or Emerson much more time to articulate their respective digital strategy and that they will strive to catch up.

3/ Domain know-how is critical to give context to data analytics. GE and Siemens are the world's two largest industrial companies; they have the ability to take their domain knowledge at scale in a number of large infrastructure end-markets such as Utilities, Healthcare or Railways. ABB also stands out as holding the largest installed base in Power Grids and in Process Automation.

We show below a table recapitulating the key areas of digital expertise and strengths for select capital goods companies.

Figure 2: Ranking select industrial companies on their digital positioning/strategy

Company	Installed base	Automation expertise	Software platform	**Overall ranking**	Domain know-how	Key strength
Siemens (Hold)	+++	+++	+++	**+++**	Power, Rail, Healthcare, Buildings, Discrete/Process industries	Unique combination of leadership in automation and PLM/CAD/CAM
Schneider (Buy)	++	++	++	**++**	Buildings, Discrete industries, Data Centers	#1 in HMI/SCADA, Operation Management and DCIM
Rockwell (Buy)	+	+++	+	**++**	Discrete industries	Pure play in automation (70% of sales embed software) #2 in PLC; #4 in HMI
ABB (Hold)	+++	++	+	**++**	Power Grids, Robotics, Process industries	#1 position in process control / #1 in EAM and process MES
GE (Hold)	+++	=	++	**+**	Power, Healthcare, Aircraft, Oil & Gas	Installed base, cloud platform, 22,000 software engineers
Emerson (Hold)	+	++	+	**+**	Process industries	Strong position in DCS (#4), sensors and actuators
Legrand (Buy)	+	=	=	**=**	Buildings	Brand name, distribution network for connected products

Source: Deutsche Bank

Schneider (BUY, TP €76, up from €73)

Schneider offers a strong IoT portfolio in our view, including a comprehensive automation portfolio (encompassing discrete and process controls), an integrated platform, EcoStruXure, that they started building in 2009, as well as best in class software offerings for energy management and operational

management, including a #1 position in HMI/SCADA. We believe that Schneider is ideally positioned to capitalize on the rising convergence between automation and electrification, with software facilitating integration between the two fields. The group estimates that already 45% of sales are IoT-related, including 4% of vertical software, 16% of control systems and 25% of connected products.

The stock trades on 11.2x 2018e EV/EBITA, at a 10% discount to the sector average. We believe the market underestimates the IIoT potential for Schneider and that the stock is reap for an 11% re-rating assuming investors re-value half of the group's IIoT-related revenue on software-like multiples. For more details, please refer to our 'Valuation repercussions' section page 10-13. We also believe the stock could surprise on the upside in 2017, in terms of organic growth (60% short-cycle), margin improvement (cost cutting and positive mix effects) and capital allocation strategy (new share buyback following the DTN transaction).

Siemens (Hold, TP €126, up from €122)

We believe that Siemens stands out in terms of IIoT capabilities given its unique combination of a leading automation platform and strong software expertise. Siemens offers a unique set of CAD/CAM/PLM and operation optimization software tools, allowing the group to provide a complete digital representation of the physical industrial value chains. We expect Siemens to retain its #1 global position in automation and take a leadership role in the smart manufacturing space. Following the $4.5bn acquisition of Mentor Graphics (Electronic Design Simulation), vertical software will account for around €4.3bn of revenue, or 5% of group sales (source: Siemens press release, November 14, 2016). Digital services represent another €1bn of revenue and are growing fast. In 2016, Siemens also launched MindSphere, a cloud-based open operating system (competing with GE Predix) which includes connectivity capabilities (plug & play interface for Siemens and 3rd-party products), data analytics and applications for customers, as well as tools for developers. Adding connected devices and control systems, we estimate that IoT already accounts for around 40% of group sales.

However, like GE, Siemens also faces significant digital disruption risks in that they need to defend their huge installed base of hardware (and the associated lucrative service profit pool) against software companies specializing in data analytics. Overall, we estimate that the group's deep domain knowhow and long-standing expertise in both physics and software should enable the group to offset these risks.

The stock trades on 10.7x 2018e EV/EBITA, at a 14% discount to the capital goods sector average. There is scope for a 10% re-rating assuming investors re-value half of the group's IIoT-related revenue on software-like multiples.

ABB (Hold, TP SF23, up from SF22)

55% of ABB sales already embed some software or connectivity features. We estimate that ABB has a best in class IT/OT offering for grid operators. The group also holds a leading position in process automation (#1 in control systems, #1 in MES and top 3-5 player in measurement), which they can leverage for the IIoT. ABB and Schneider have relatively similar IIoT competencies, albeit in relatively different end-markets. We also believe ABB has been slower at combining its digital capabilities together and marketing them to customers. The group is probably lagging 5 years behind Schneider in

the implementation of a group-wide digital platform and strategy. Moreover, we expect a slower IIoT traction in Process industries, given these industries are typically risk-adverse and reluctant to changes, and still very much on a cost-cutting/capex reduction mode.

The stock trades on 11.8x 2018e EV/EBITA, at a 5% discount to the sector average. There is scope for an 11% re-rating assuming investors re-value half of the group's IIoT-related revenue on software-like multiples. In our view, this should however be offset by M&A risks and competitive risks in T&D.

We show below a list of the major automation and software providers to the manufacturing industry. More details can be found on the IIoT positioning and strategy of companies under our coverage on pages 38-66.

Figure 3: Positioning of major automation/software providers

	Process software	Process controls	Process hardware	Discrete software	Discrete controls	Discrete hardware
ABB	Strong	Strong	Medium	Weak	Weak	Strong
Schneider	Strong	Medium	Weak	Medium	Strong	Medium
Siemens	Medium	Strong	Medium	Strong	Strong	Strong
Emerson	Medium	Strong	Strong			Medium
Rockwell		Medium		Medium	Strong	Medium
Honeywell	Strong	Strong	Medium			
GE	Medium		Medium	Medium	Weak	
AspenTech	Strong					
Autodesk				Strong		
Aveva	Strong			Strong		
Dassault Syst.				Strong		
Hexagon	Strong					
SAP				Strong		
PTC				Strong		

Source: Deutsche Bank

The threat of digital disruption - who will be tomorrow's losers?

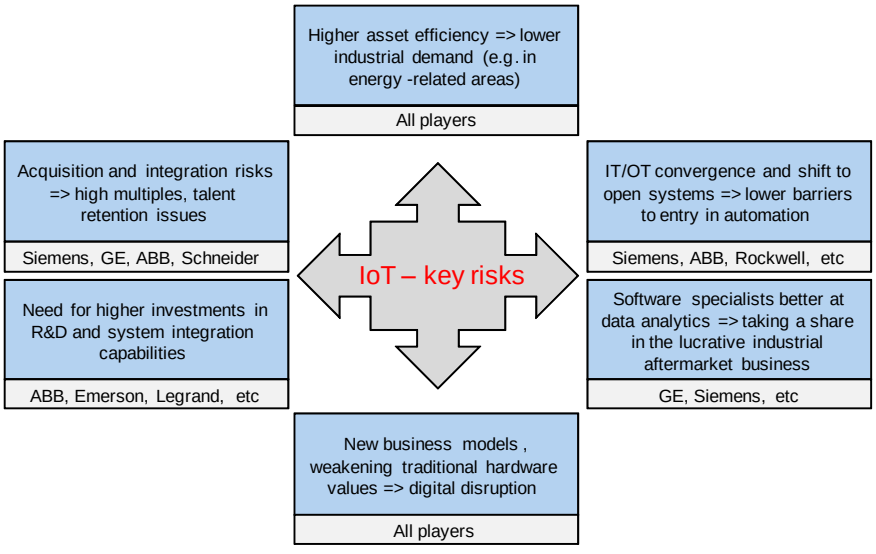
We believe that IIoT strategies are as much defensive as they are offensive.

With the IIoT, the world will be less about capex and more about operational and asset efficiency. As explained before, we estimate that digitized solutions could generate c.15% annual opex savings for industrial customers, equivalent to over $1trillion. While improving the industry overall productivity, this would also likely imply slower industrial demand growth for machines and spare parts. This would impact traditional manufacturers of big iron machines failing to expand in data-based services. Digitalization of a given end-market could also have ripple effects on other end-markets. For example, if buildings become more energy efficient, it will alter long-term demand for electricity, which would have negative consequences for steam and gas turbine manufacturers. Generally, the savings on energy and resource consumption generated through software and services should affect some important end-markets for the sector, like Power Generation, Oil & Gas or Metals & Mining.

Value should shift to players who make the best use of data. New competitors will likely emerge with new business models, which could weaken traditional hardware values. In the consumer world, Airbnb is a good example of rivals that can appear out of nowhere and that bring greater productivity but don't own the assets they sell. Eventually, value could shift from traditional manufacturers to producers of sensors and connected devices, 3D printing players, providers of industrial software solutions and industrial cloud architectures. We provide below a few examples.

- **Software companies specializing in analytics might take a growing share of the lucrative service business pie** for the providers of large pieces of equipment requiring maintenance/retrofit. GE and Siemens are the ultimate big asset companies, generating the bulk of their profits on services, which puts them at risk of digital disruption. This probably explains why both companies have been aggressively expanding in the digital space.
- **New low-cost providers (not necessarily in emerging markets) could emerge, thanks to a complete digitalization of their production and distribution processes.** They could be able to displace incumbent manufacturers, whose legacy production base would cost too much to modernize. For example, 3D printing could displace tooling companies like Sandvik or Kennametal. In the aftermarket domain, 3D printing could also offer local players the opportunity to deliver more rapidly spare parts that are cheaper to the aircraft industries or to utilities.
- **Even automation companies could be somewhat displaced if they are not good enough at software and analytics.** The advance of the industrial internet means automation providers will increasingly have to shift to open systems and some of their proprietary technologies and systems might become obsolete. The rising convergence between IT and OT technologies could result in higher competition from software players trying to make in-roads on the factory floor (e.g., Dassault Systemes or SAP extending their PLM or ERP offerings into MES and beyond).

Figure 4: Key risks associated to the IIoT



Source: Deutsche Bank

This report primarily deals with automation vendors, which we generally see as IIoT winners. In upcoming reports, we will analyze in more details who will be the main IIoT losers in the industrial space.

IIoT implications for valuation

Far-ranging consequences on industrials' valuation

One interesting potential ripple effect of the digitalization of the industry could be the impact on investors' long-term perception for stocks - either negatively or positively. This could have far-ranging consequences on industrials' valuation multiples.

Traditional companies failing to embrace the digital transformation could be penalized by structurally lower multiples, reflecting concerns of 1/ digital disruption (e.g., 3D printing threat for Sandvik Machining Solutions) or 2/ structurally slower demand growth, due to higher asset, resource and energy efficiency (e.g., steam and gas turbines for GE and Siemens, mining equipment for Sandvik and Atlas Copco, etc). Generally, we believe the capital goods sector could be a net loser given the risks of seeing its importance in the manufacturing value chain shifting to data analytics providers and to the cloud architectures that support them.

In contrast, companies perceived to be successfully harnessing the industrial internet could see their valuation multiples expand and (partially) catch-up with those of software companies, which today trade at a 40% premium to capgoods names on average.

Figure 5: Valuation table for select industrial and software companies

31 March 2017	Analyst	Rating	Currency	Target Price	Current Price	P/E (x)		EV/EBITA (x)		FCF Yield (%)		Dividend Yield (%)		EBITA margin (%)	
						2017e	2018e	2017e	2018e	2017e	2018e	2017e	2018e	2017e	2018e
Industrials						**18.9**	**16.9**	**13.6**	**12.2**	**5.2**	**5.7**	**2.6**	**2.9**	**14.2**	**14.8**
Siemens	Gael de-Bray, CFA	Hold	EUR	126	126	16.0	14.6	11.4	10.6	5.6	6.1	3.1	3.5	11.0	11.5
ABB	Gael de-Bray, CFA	Hold	CHF	23	23	19.4	16.6	13.5	11.7	5.3	5.9	3.3	3.6	11.5	12.6
Schneider	Gael de-Bray, CFA	Buy	EUR	76	68	17.0	15.4	12.3	11.2	5.9	6.1	3.3	3.6	13.5	14.1
Legrand	Gael de-Bray, CFA	Buy	EUR	60	55	21.6	19.9	14.3	13.1	4.4	5.0	2.4	2.6	20.1	20.8
Rockwell	John G. Inch	Buy	USD	173	154	24.5	21.5	16.8	14.3	4.5	4.8	2.0	2.2	18.9	19.9
GE	John G. Inch	Hold	USD	28	30	17.9	15.5	16.6	14.7	6.5	5.4	3.1	3.1	12.5	12.8
Emerson	John G. Inch	Hold	USD	59	60	23.3	21.3	16.0	14.5	5.0	5.5	3.2	3.2	17.6	18.0
Eaton	John G. Inch	Hold	USD	70	74	16.8	15.1	12.8	11.7	6.6	7.3	3.1	3.3	15.6	16.1
Honeywell	John G. Inch	Buy	USD	137	125	17.6	16.1	12.6	11.6	4.8	5.5	2.1	3.2	19.4	20.1
Yokogawa[12]	not covered	na	JPY	na	1,775	18.4	16.5	11.6	10.0	4.6	5.2	1.6	1.7	9.2	9.9
Mitsubishi Electric	Takeshi Kitaura	Buy	JPY	2,100	1,611	14.7	13.0	11.8	10.0	4.3	5.5	1.8	2.0	6.7	7.3
Software Companies						**28.1**	**24.8**	**18.4**	**16.3**	**3.4**	**4.0**	**1.7**	**1.9**	**28.6**	**29.4**
SAP	Alex Tout	Buy	EUR	90	91	21.2	19.0	15.2	13.4	3.8	4.5	1.7	1.9	29.7	30.4
PTC[1]	not covered	na	USD	na	53	41.7	32.9	23.6	22.3	1.9	2.8	na	na	23.4	23.0
Dassault Systemes	Alex Tout	Hold	EUR	65	80	29.9	27.7	17.7	15.9	3.3	3.6	na	na	31.6	32.2
Aspen Tech[12]	not covered	na	USD	na	59	29.0	28.0	19.7	17.7	4.1	na	na	na	44.2	44.8
Hexagon	Alex Tout	Buy	SEK	400	360	19.8	17.6	17.6	15.0	4.3	5.3	1.5	1.7	24.5	26.1
Synopsys[12]	not covered	na	USD	na	72	22.2	20.4	16.3	14.1	4.2	5.1	na	na	23.5	24.5
ESI Group[12]	not covered	na	EUR	na	50	26.9	22.4	17.7	14.6	1.5	2.1	na	na	11.9	13.0
Aveva[1]	not covered	na	GBP	na	20	26.8	25.2	18.7	17.4	3.4	3.7	2.2	2.3	26.1	26.6
Ansys[13]	not covered	na	USD	na	107	28.7	26.3	17.2	15.9	3.8	4.1	na	na	46.7	47.4
Nemetschek[1]	not covered	na	EUR	na	51	34.3	28.5	19.9	16.2	3.7	4.7	1.3	1.5	24.6	25.6

Source: Deutsche Bank, Factset, Bloomberg
[1] Based on FactSet consensus (not DBe)
[2] Uses EV/EBIT (instead of EV/EBITA) and EBIT margin (instead of EBITA margin) due to lack of data availability
[3] Based on FactSet consensus for EV/EBIT(instead of EV/EBITA) and EBIT margin (instead of EBITA margin), remaining data DBe

As shown in the table below, we calculate that, assuming the share of software-like revenue increases to 25%, this could raise capital goods companies' margins by over 300bp and multiples by around 10%. In practice, such increase in the share of software revenue would likely take a long time to materialize and require an active acquisition strategy. This then leads to some questions on the real Return on Investment generated on a software-led acquisition strategy. Industrial companies' M&A track record generally does not play in their favour.

Figure 6: Digitalization process – impact on multiples and margins for industrial companies

Share of software as a % of sales	Impact on P/E	Impact on EV/EBITA	Impact on margin
5%	+2%	+2%	+70bp
15%	+7%	+5%	+220bp
25%	+12%	+9%	+360bp
35%	+17%	+12%	+500bp

Source: Deutsche Bank

Investors' perception could change more rapidly than the reality. Today, best-positioned industrial companies generate only 5-10% of sales from vertical software. However, most automation companies claim that a large share of their offerings already embed some form of software and connectivity such as control systems or connected devices. For example, Schneider states that IoT accounts for 45% of its revenue. Rockwell and ABB also mentioned that 70% and 55% of their revenue include digital technologies. If industrial growth accelerates in 2017-18 thanks to more favorable cyclical forces, investors could attribute some of this growth to the IIoT trend and start applying higher multiples to a larger share of IIoT-related revenue than just to the mere vertical software exposure. We've seen such re-ratings before. Back in 2000, during the tech bubble, Siemens traded on an EV/adj. EBITA of 25x, at a significant premium to the sector because of its telecom equipment exposure.

There are in fact some parallels between the tech bubble in the late 1990s and the current IIoT "hype". Virtually every CEO is talking about the IIoT trend. However, we would argue that whilst during the tech bubble the market got too excited too early, it could be now the right time to get excited. This is because IIoT and, in fact, IoT in general are in many ways the realization of what was being hyped in the late 1990s – the ubiquity of the internet. Whilst we are not implying that the Internet of Things, as it is currently taking shape, was anticipated in the tech bubble, the hype was undeniably based on the opportunities arising from the pervasiveness of the internet. It is exactly this pervasiveness of the internet which is now more tangibly being implemented in the manufacturing sector. Hence, we don't see the current IIoT "hype" (if it even deserves this term) as a recurrence of the tech bubble, but we see it as a continuation of the same theme for which now the right time has come.

In the table below, we show the potential upside to multiples for select automation providers, on the assumption that investors would revalue half of their IIoT-related revenue on software-like multiples (16x EV/EBITA).

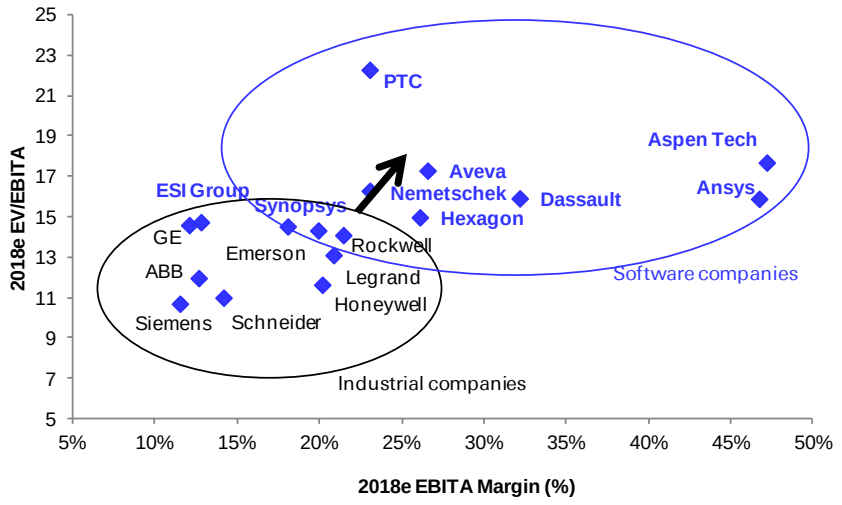
Figure 7: Upside to multiples assuming half of the IIoT-related revenue is valued on software-like multiples

Company	Software revenue	Total IIoT revenue (1)	2018e EV/EBITA	Potential 2018 EV/EBITA (2)	Upside to multiples (2)
Rockwell	8%	70%	14.2x	14.9x	+5%
ABB	5%	55%	11.8x	13.0x	+10%
Schneider	4%	45%	11.0x	12.2x	+11%
Siemens	5%	40%	10.7x	11.8x	+10%
Legrand	0%	9%	13.0x	13.2x	+1%

Source: Deutsche Bank
(1) including software, control systems and connected devices
(2) assuming half of the IIoT-related revenue is valued on software-like multiples

We estimate that Siemens (Hold) and Schneider (Buy) should be the two main candidates for a re-rating. Today they both trade at a 10%-ish discount to the sector average, reflecting: 1) a poor track record in terms of capital allocation and the perceived acquisition risks for Schneider, and 2) a conglomerate discount and a poor 10-year operational track record for Siemens. This perception could be about to change, providing Schneider pursues a more shareholder-friendly policy (as recently evidenced by a new €1bn share buyback program following the DTN transaction) and providing Siemens delivers consistent and clean results for a few more quarters. We continue to favour Schneider over Siemens due to its greater focus on automation/energy efficiency, higher scope for cost cutting and lower risk profile (limited project execution risks).

Figure 8: 2018 EV/EBITA and EBITA margins for select capital goods and software companies



Source: Deutsche Bank, Factset

Value destruction on software acquisitions?

We expect most industrial companies to follow an active M&A strategy in the software domain. We believe most companies will focus on bolt-on moves for specialized software companies with revenue of €10-100m, rather than embark on large deals. GE, Siemens, ABB and Schneider should be the most active in our view to extend their existing offerings to more verticals.

We could potentially see some mega-mergers between IT and OT companies to support the "shop-floor to top floor" vision of the real-time enterprise. Invensys, with the acquisition of enterprise software firm Baan in 2000, came too early and failed to realize this vision. But, as highlighted by the $4.5bn acquisition of Mentor Graphics by Siemens, now the time might be coming for this to become reality. Overall, over the past ten years, Siemens has already spent $10bn on software deals, including the purchases of UGS, LMS, CD Adapco and Mentor Graphics (for the last see Siemens press release November 14, 2016). So far, with the exception of Siemens, most automation vendors have made acquisitions essentially in areas like HMI/SCADA, MES and EAM. In the next few years, this could possibly extend to the CAD/CAM area if the established partnerships (e.g., GE with PTC) do not prove efficient enough.

Software deals don't come cheap with multiples typically over 5 turns above the capital goods sector's usual multiples. While software assets can be seen as strategic, it could prove difficult for industrial companies to generate value when paying multiples well above their own multiples. We show below a list of some the latest software acquisitions made by industrial companies. The median EV/EBIT multiple paid was 17x over 2007-16, well above the sector average multiple of 11x over the same period.

Figure 9: Software acquisitions in the industrial space

Target	Acquiror	Date	EV paid ($m)	Sales ($m)	EV/Sales	EV/EBITA	Comments
Siemens	Mentor Graphics	2016	4500	1200	3.8	n/a	Electronics design software
Hexagon	MSC Software	2016	834	230	3.6	14.5	CAE (simulation) software
GE	Bit Stew Syst.	2016	153				Real-time analytics
GE	ServiceMax	2016	916	60	15.3		Field service management (Saas)
GE	Meridium	2016	495				Asset Performance Management software
Siemens	CD Adapco	2015	970	200	4.9	n/a	Engineering simulation software
Siemens	LMS	2012	870	239	3.6	n/a	Test mechatronic simulation software
Siemens	Rugged.com	2012	350	94	3.7	33.8	Communication and networking solutions
Schneider	Telvent	2011	1906	990	1.9	14.8	Infrastructure management software
Schneider	Summit Energy	2011	268	65	4.1	20.6	Energy management / sustainability consulting
ABB	Mincon	2011	800	200	4.0	18.2	Mining EAM software
ABB	Ventyx	2010	1000	250	4.0	16.0	Utility EAM software
Honeywell	Metrologic	2008	720	246	2.9	18.3	Metrology and related software
Siemens	UGS	2007	3500	1240	2.8	14.9	PLM design software

Source: Deutsche Bank, Factset, company data

Associated risks include integration risks (due to the difference of culture between IT and OT employees) and talent retention risks. The skills set and mentality needed to build and grow a software business are different from those needed in the hardware space. Industrial companies need to build the right environment in terms of processes, skills, compensation system and culture. For example, the integration of Ventyx by ABB has not gone smoothly and it took them several years to build a unified IT/OT architecture for the grid. Similarly, Schneider management acknowledges that the Telvent acquisition was difficult to integrate and must still deliver value.

What does it take to be an industrial digital winner?

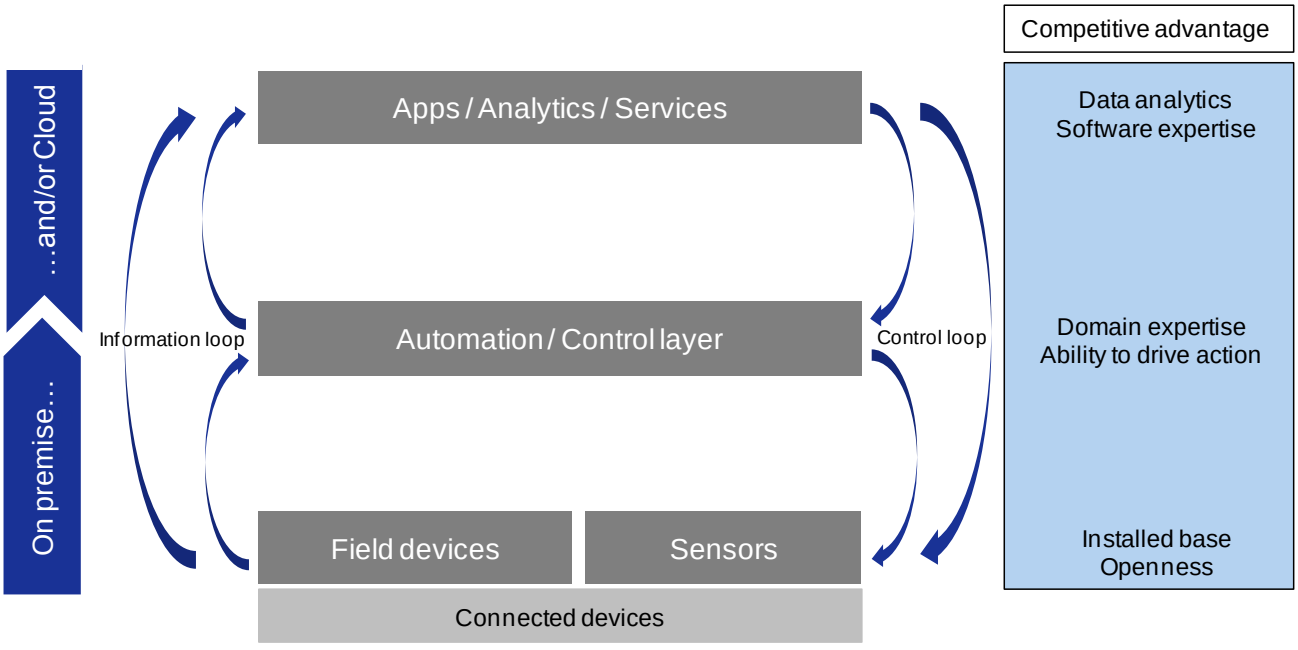
3 important layers to win in IIoT

The consumer world and the industrial word differ in that social-networking services are easy to scale but industrial companies have specific requirements that call for more customized approaches. In traditional IT markets, one firm has quickly come to dominate, for example Google in online search or Microsoft in computer operating system, but in the industrial world, we estimate that there will be several winners, each on specific verticals.

We believe that successful companies in an IIoT word will be those combining: 1/ a large installed base with customer access and deep domain know-how, 2/ strong data analytics capabilities and 3/ automation/control activities to implement in real-time on manufacturing process the insights coming from data analysis. Generally, we believe that industrial automation companies are well positioned since they have the ability to sense, analyze and act.

- **Sense** – capture data and connect machines from shop floor to top floor
- **Analyze** – convert data into meaningful analytics
- **Act –** drive action through real-time information and business logic

Figure 10: The building blocks to be an industrial digital winner



Source: Deutsche Bank

1/ A big installed base – hardware still matters

The IIoT starts with the addition of sensors and connectivity features to field devices, making the size of the installed base an important criteria. In theory, the larger the installed base, the larger the database and the more powerful analysis tools can be. This could result in an asymmetry of information between companies which benefit from a large installed base in a given industry and others which don't. The same imbalance occurred in the consumer world, benefiting players like Bookings or AirB&B at the expense of traditional lodging players.

Domain know-how is key to give context to data analytics. Thanks to decade-long experience and large installed bases, industrial companies have a solid domain expertise of the industry of their customers and deep knowledge about the physics and materials of the machines they sell. It is relatively easy to add sensors and capture data, but we think that only specific and targeted solutions built upon some specific industry knowledge can make the data truly actionable and provide value add. Analytics solutions that are too generic could miss the point. It is important to look at customers' challenges and opportunities from a process perspective, not just from a data perspective. Data analysis creates more value when it remains close to the core business. We also believe industrial companies have an advantage over pure play software firms in that they can apply the software offerings internally first, improve them from there and provide customers proven business cases based on their own experience.

Companies with the largest installed bases include: GE and Siemens in Infrastructure areas like Power Generation, Rail and Healthcare. GE is also strong in Aviation while Siemens is the undisputed #1 player in discrete automation (in the automotive segment in particular). ABB has the largest installed base in T&D equipment and in Process automation. Schneider is also well placed given its leadership in low voltage and medium voltage electrical equipment (with a particular strength in buildings) and its large installed base of discrete industrial control components (#2) and process (3rd largest installed base in DCS).

2/ Automation and control expertise

The automation and the control room can be seen as the Internet of Things gateway. Most automation companies highlight the importance of being in the control loop to be real partners of customers, work directly in their operations and be able to implement insights from data analytics in real-time. Unlike Siemens or Schneider, GE is hardly active in the control room, so it is more difficult for them to influence directly the operations, the uptime speed, or the product design of their customers.

Process expertise gives customer access and trust. In factory floors, robustness, reliability and security are the most important factors. It is generally very hard for competitors to break into the industrial automation sector because of the trust companies like Siemens, Rockwell or Schneider have built up over the decades. Given high switching costs and high barriers to entry, we believe that the automation/control layer will remain largely untouched. PLC and DCS have ensured safe control for years and we don't see real-time control and safety being centralized to the cloud and suffering from

the competition of IT players. Of course, in an IIoT world, proprietary communications that maintain the IT-OT divide will not stay, but we rather see automation companies benefiting from the convergence and moving up a layer into analytics/services, rather than IT companies moving down in automation and/or hardware manufacturing.

We estimate that Discrete automation should see the greatest IIoT-related growth opportunities as discrete industries generally show faster upgrade/replacement cycles and are less reluctant to changes than process industries. Moreover, with the exception of the automotive sector, discrete industries tend to have more scattered customer bases (e.g., the diversity of machine builders), with the penetration and sophistication of software generally lower.

Key automation players include: Siemens, Rockwell, Mitsubishi and Schneider in discrete industries and ABB, Siemens, Emerson, Honeywell, Yokogawa and Schneider in process industries. In Hybrid automation, we estimate that Siemens, Rockwell and Schneider are best placed.

Control systems are already quite smart and already embed a lot of software and algorithms. However they're also very focused and tend to lack a broader context. This is why the IIoT can raise companies' productivity to a higher level by looking at the bigger picture. Big data analytics can bring together data from enterprise and control systems as well as customer comments on social media or external information (such as weather forecasts) to deliver the full context in which customers operate.

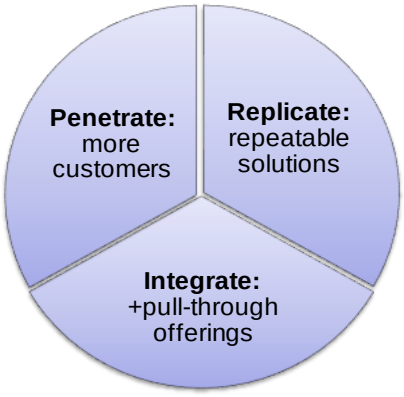
3/ A horizontal, re-usable platform of digital technologies

Hardware matters, but software is of course critical. Industrial companies could struggle because of a lack of good analytics tools and algorithms. We believe most industrial companies still need to improve their digital skills. In the past few years, we have generally seen a structural increase in R&D spending across the sector (half of which in software/electronics).

The combination of connectivity and analytics gives companies access to new capabilities like asset performance, management, simulation of processes, augmented reality solutions for operators, etc. IoT also offers companies the ability to understand in real time how each of their individual products is being used by customers, together with insights into the products' current status.

An integrated platform is important in order not to reinvent the wheel every time and make all digital assets and technologies available for customers and all businesses across the organization. We believe that Siemens and Schneider have been early developers of group-wide common architectures regrouping their various expertise and offerings along the energy management and automation value chains. In turn, companies such as ABB have fallen short in this respect and only now are they building up such a platform.

Figure 11: A common platform is key to leverage digital offerings across all market verticals



Source: Deutsche Bank, ABB

Industrial companies with best-in class software and data analytics include: GE, Siemens, Schneider and ABB. Siemens stands out with its unique combination of PLM software tools (#2) and strong presence in MES (#2) and HMI/SCADA (#2). GE is most well-known for its well-advertised cloud-based platform Predix and its Asset Performance Management (APM) solutions. Schneider is #1 in HMI/SCADA and also has a strong position in MES (#4 on our estimate). ABB is #1 in Process MES.

Industrial Internet – key opportunities

Industrial markets are at the beginning of their digitalization journey

The Industrial Internet has the potential to change industrial companies' business models, thanks to the continuous data flow that can be exchanged and analyzed and the resulting increased cooperation between the network of suppliers, the manufacturer and its consumers. Key technologies behind the IIoT are not new but they have improved in terms of cost and integration capabilities. For decades, manufacturers have fitted their factories and logistics centers with sensors. The only difference is that sensors and devices were rarely networked via the Internet Protocol and sensor data was not really monetized through big data analytics and optimization software applications.

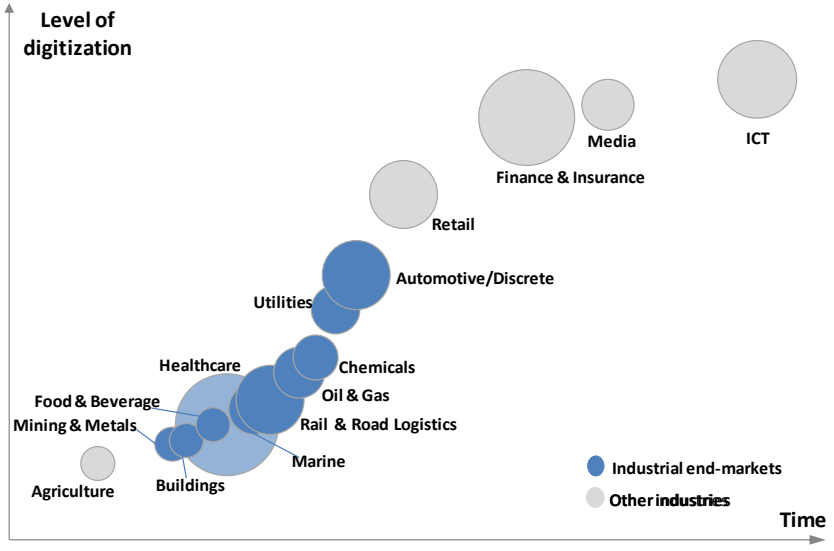
Figure 12: Technology tailwinds driving adoption of IIoT

Technologies	Consequences
Lower cost of sensors	More connectivity / more smart devices on the factory floor
IT-OT convergence	More secure connections between plants and enterprise
Higher computing power	Better business decisions thanks to the conversion of data into real information

Source: Deutsche Bank

Most industrial end-markets are still at the beginning of their digitalization journey, suggesting that the potential to generate value for customers through digital services is significant.

Figure 13: Most industrial end-markets are still at the beginning of their digitalization journey



Source: Deutsche Bank, ABB

There is a huge potential for machine generated data, with clear business opportunities enabled by IoT today, like increasing industrial performance, making factories more resource-efficient, accelerating time to market or enabling make-to-order and just in time deliveries. There is already substantial value coming from user generated data (targeted advertising, share economy, health analytics is coming, etc) and such value could similarly occur in the industrial world. Already today, the Industrial Internet appears to bring tangible applications and no longer sounds like a mere marketing ploy. Over time, the data fed by devices and machines should make up a greater proportion of the data circulating into the internet of "things" than the data input by humans. According to IDC, connected devices will increase from 11bn today to 30bn by 2020 and 80bn by 2025. IDC also predicts that generated data will rise from 4ZB in 2013 to 44ZB by 2020 and 180ZB five years later.

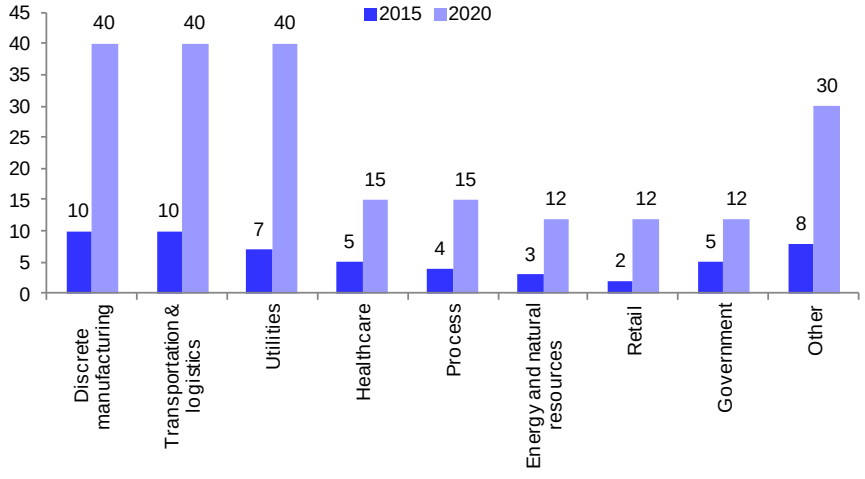
Figure 14: Siemens example - sensor and machine data / day

Gas turbine	25 GB
Smart Grid platform	30 GB
Computer tomography	60 GB
Traffic management system	6 TB

Source: Deutsche Bank, Siemens

We believe that the IIoT revenue opportunity could amount to around €200bn by 2025 for the more technology-centric companies in areas like remote monitoring, predictive maintenance, operation optimization, inventory management, demand response programs, etc. On the other hand, the higher asset efficiency and opex savings generated by digital solutions could result in a reduced addressable market size for more traditional manufacturers which fail to harness data. In the graph below, the BCG shows where the most value could be created from an end-market standpoint. We find it interesting that major industrial companies in our universe will be as much IoT customers (to improve their own productivity) as they will be IoT providers (of digital services like predictive maintenance).

Figure 15: IoT spending ($bn) in select industries



Source: BCG Internet of Things buyer survey; IDC

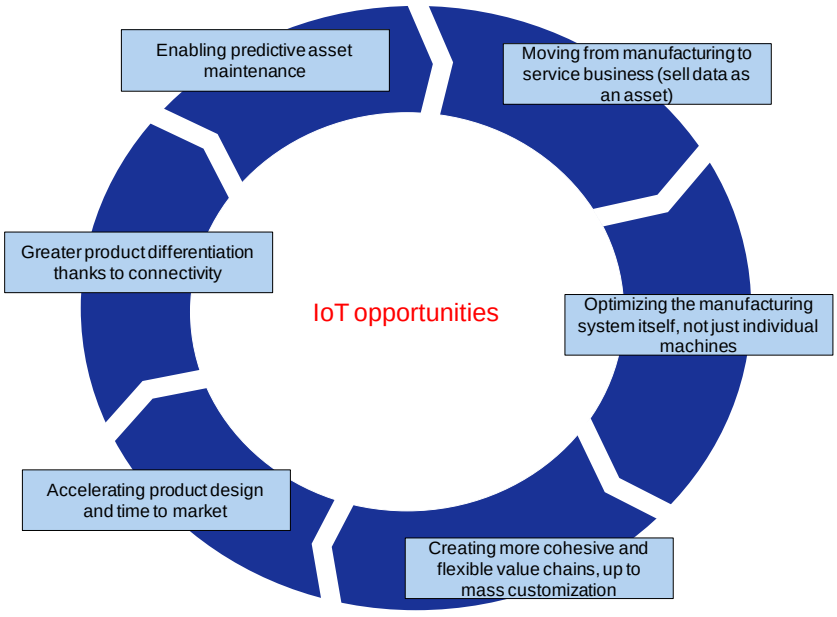
The value creation from analyzing data from sensors in a factory could be far ranging, potentially higher than the value creation from analyzing information that people leave on the web. The Industrial Internet is about optimizing the entire manufacturing system, including processes, supply chains, products and business models. Connecting machines and people over the Internet opens up new opportunities to collect and analyze various data from industrial facilities and fleets of machines in order to boost efficiency, reduce throughput times, trim energy costs and fine-tune maintenance. An example is the ability to gather and analyze all data on connected locomotives, in combination with external factors (weather, etc) in order to optimize costs, provide real-time diagnostics, perform predictive maintenance as well as optimize entire fleets of trains with intelligent traffic management.

- **Impact on manufacturing processes:** The Industrial Internet offers the potential to address two of the industrial environment's key challenges: 1/ shorten time to market (develop more complex products with shorter innovation cycles) thanks to simulation tools; 2/ optimize industrial processes (as well as individual assets) to reduce inefficiencies, increase production output and quality, workforce safety and reduce resource consumption.
- **Impact on supply chains:** Connectivity features can improve visibility and coordination in the supply chains, tracking inventory, boxes, containers or trucks and enabling greater interaction between manufacturers, suppliers and customers for more efficient, real-time business planning and execution. Long-term goal is mass-customization.
- **Impact on products and services:** Connectivity and data analytics enable to collect detailed information on products and provide customers remote diagnostics and maintenance, and even possibly remote operations, with product as a service as a new delivery model. The value proposition shifts from selling a piece of hardware to fulfilling specific functions (for example drilling for oil or maintaining the power supply in a city). For manufacturers, it also means an opportunity to differentiate their product offering, extract more value from their installed base, tap into new and more recurring revenue streams and build deeper and stickier customer relationships (at a higher hierarchical level).

We believe IIoT support 7 key patterns:

- 1/ Higher manufacturing efficiency
- 2/ More flexibility in the supply chain
- 3/ Accelerated product design and time to market
- 4/ Higher product differentiation through connectivity features
- 5/ Predictive maintenance
- 6/ A shift from product manufacturing to product-as-a-service
- 7/ An opportunity to reshuffle the cards globally

Figure 16: IoT key patterns



Source: Deutsche Bank

1/ Optimization of manufacturing processes

The industrial internet enables to optimize the manufacturing system itself, rather than just the individual machines/components. GE explains that the manufacturing inefficiencies that persist today are much greater at the system level, rather than at the individual physical machine level because complexity has outstripped the ability of human operators to identify and reduce these inefficiencies. With the Industrial Internet, companies can gather more information, helping to identify and reduce manufacturing efficiencies, and fully optimise industrial processes. As such, machine learning and advanced algorithms can make entire systems more efficient without human intervention. Connected wind turbines, for example, can increase electricity output by comparing operating data with weather data and making necessary adjustments.

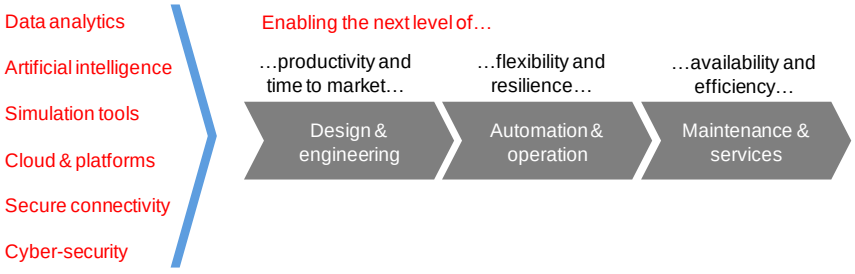
The industrial internet can make factories more resource and energy-efficient, thanks to the exchange of real-time information, enabling a better coordination of the resource needs and availabilities. One of the biggest potential benefits of the industrial internet is the breakdown of enterprise silos thanks to closer integration of production systems and ERP systems, Product Lifecycle Management (PLM) systems, Supply Chain Management (SCM) and Customer Relationship Management (CRM) systems. Today these systems are managed somewhat independently of each other. It is believed that a more holistic approach could facilitate enormous efficiency gains. Smart enterprise control does not mean replacing current automation systems with completely new systems. Instead, it implies the connection of current automation systems with enterprise, lifecycle and value chain systems. This optimizes the entire enterprise and enables a much greater degree of business control.

PWC sees an average efficiency increase of 3.3% p.a. due to the digitization and increased integration of value chains. According to a PWC survey in

Germany (235 German industrial companies), only 20% of the surveyed industrial companies have digitized their key processes and it is mostly individual units and isolated applications that have been automated and digitized thus far; in 5 years' time, 85% will have implemented Industry 4.0 solutions in important business divisions. According to the same PWC analysis, companies anticipate an average efficiency increase of 3.3% p.a. due to the digitization and increased integration of value chains. They also expect annual cost savings of 2.6%. Measured against the cost reductions typical for industrial companies of 3% to 5% p.a., the planned savings due to the Industrial Internet will make a strong contribution.

In the capital goods sector, company processes are an important differentiation factor in international competition. Contrary to products, processes can be kept confidential for longer because they do not appear in the market and are therefore more difficult to analyze and replicate.

Figure 17: Creating benefits along entire industrial customer value chains



Source: Deutsche Bank, Siemens

2/ Greater flexibility into the supply chain, ultimately allowing mass customization

As the world of production becomes more and more networked and production control more and more decentralized, the re-organization of logistics comes at the forefront.

The communicating capabilities brought by the industrial internet will create more cohesive and flexible value chains, by ensuring a better integration of the IT systems used in the various functions (from the enterprise to the shop floor level) and departments (from R&D, engineering, to production and after-sale service), and by enabling closer links between manufacturers, their suppliers and their customers.

More integrated value chains can result in reduced work-in progress inventory, make-to-order manufacturing capabilities, just in time deliveries, and the possibility to create individualized products tailored to one customer needs at relatively low marginal cost. As a global real-time communication platform, the Industrial internet can indeed sharply accelerate business processes by enabling companies to synchronize activities with their business partners and to ensure direct contact to the end customer. Make-to-order manufacturing and just-in-time delivery are already today becoming decisive competitive factors.

Mass customization is logistics' ultimate goal. Fully digitized value chains will ultimately include the ability to economically develop mass customization (individual products manufactured at mass-manufacturing costs and at speed). Due to its complexity, mass customization however probably remains a long-term play.

3/ Accelerated product design and time to market

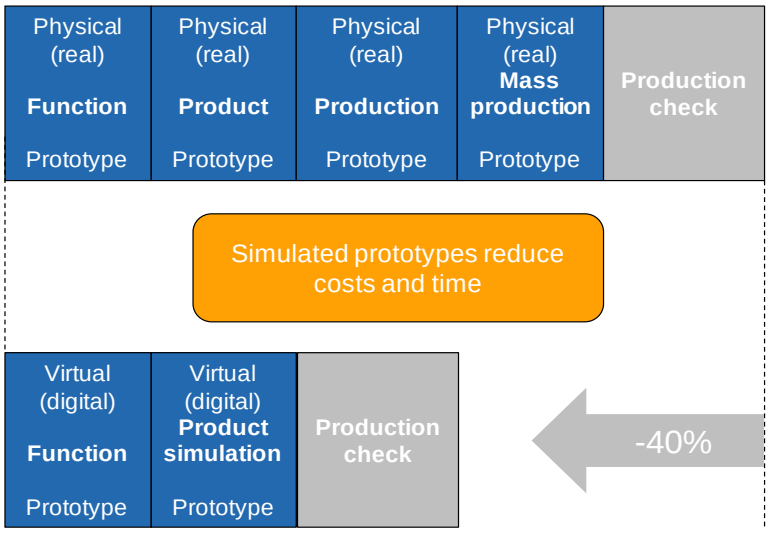
Simulations are a key enabler of the Digital Enterprise. Manufacturing systems become increasingly complex, reflecting the addition of more and more functionalities and the increased customization of products. As a result, in order to save cost and time, the simulation of products, materials, production processes but also plant operations will increasingly be used to replicate the physical world, based on virtual models.

3D simulations can allow operators to test and optimize the machine settings for the next product in line in the virtual world before the physical changeover, thereby driving down machine setup times and increasing quality. For example, Siemens and a German machine-tool vendor developed a virtual machine that can simulate the machining of parts using data from the physical machine. This lowers the setup time for the actual machining process by as much as 80%.

According to Siemens, the complete digital representation of the entire physical value chain is the ultimate goal. Industry 4.0 will use virtual plants and products to prepare the physical production. Every process will first be simulated and verified virtually, before it is uploaded into the physical machines controlling the production.

Another application is virtual training. Siemens has developed a virtual plant-operator training module for its Comos software that uses a realistic, 3D environment with augmented-reality glasses to train plant personnel to handle emergencies. In this virtual world, operators can learn to interact and get more familiar with machines thanks to a cyber-representation. They also can change parameters and retrieve maintenance instructions. Schneider has a relatively similar offering with SimSci.

Figure 18: Faster product development process with virtual prototyping



Source: Deutsche Bank, Siemens

4/ Greater product differentiation

Connected products help raise barriers to entry against low-cost providers and differentiate from traditional suppliers that have not made the digital shift. A mechanically perfect product is no longer seen as enough to withstand international competition, while demand for connected products and digitalized services is expected to grow above average. The differentiation of products is increasingly moving towards more software, superior sensor technology, connectivity and generation of data. This enables automation vendors to add more IP, which is easier to protect than hardware design.

Connected products can generate a better experience for customers. For example, in the consumer world, at Babolat, rackets equipped with sensors can analyze the player's game and improve their technique. In the industrial world, motors with sensors can be monitored continuously, which allows operators to prevent downtime and lost production, enable higher speed and better output, increase motor life and reduce energy consumption. In the home, Legrand is partnering with Netatmo for the new Celiane connected switches and power outlets in order to make electrical installation smarter, including for example a wireless master switch that can turn on and off all the lights and cameras, the ability to reposition wireless switches in a room and remotely control lights, shutters, etc via its Home Control app on a smartphone.

Products with connectivity features generally sell at a higher price, which provide manufacturers a better mix/higher revenue. For example, Legrand estimates that its connected products (9% of revenue in 2016) can fetch 10% to 30% higher prices and sometimes a multiplier effect (when customers switch from a traditional chime to an entry door system and to a digital entry phone.

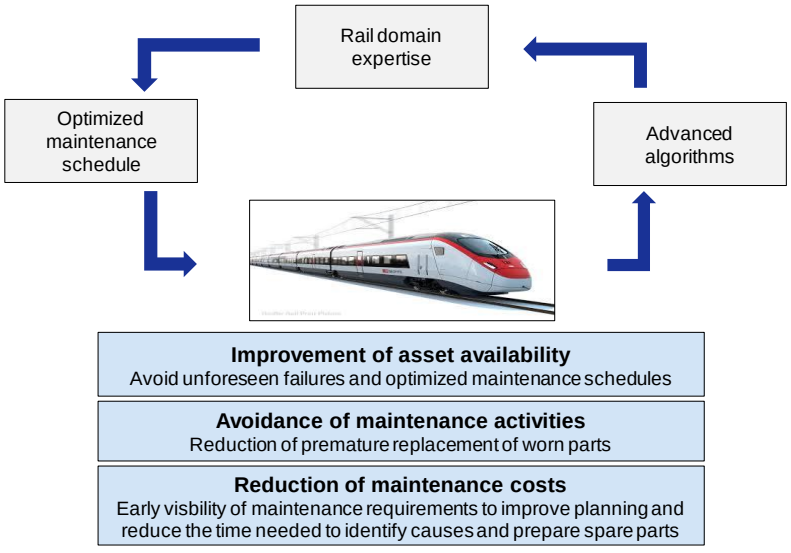
5/ Remote monitoring and predictive asset maintenance

Wireless connectivity, cloud architectures and low cost sensors will foster the use of smart assets for maintenance and emissions tracking. Applications such as predictive asset maintenance are not new to the industry, but have had limited uptake due to the prohibitive costs of physical connectivity (the cost of cabling to the sensors) and of connectivity (integration with existing systems). Wireless IP connectivity, cloud-based architectures and the development of a new generation of simple, small and low cost sensors now overcome these cost barriers.

The Industrial Internet helps optimize inspection, maintenance and repair processes. An aggregate view across machines and individual components enables the optimal number of parts to be delivered at the right time to the correct location. This minimizes parts inventory requirements and maintenance costs.

Machine reliability rates can be raised strongly thanks to predictive analytics to avoid unplanned outages. Data from connected machines can be used to properly maintain assets based on their current operating realities. In practice, operators can see how many hours a particular component has been operating and under what conditions, and thanks to analytic tools, can compare this information to the operating histories of similar components in other plants to assess the probability and timing of component failure. Reliability engineers can also mine this data to improve overall maintenance processes.

Figure 19: Predictive maintenance – Example: Rail transportation



Source: Deutsche Bank, Siemens,Stadler

6/ From product manufacturing to service businesses

Thanks to the use of data analytics, automation vendors can extract more recurring business from their (very often) sub-optimized installed bases. Traditional automation providers have huge installed bases of equipment (comprised of valves, motors, drives, PLC, DCS, HMI, etc). For example, ABB estimates the size of its installed base is around $300bn. In recent years, most

manufacturers like Schneider or ABB have emphasized service penetration as a key growth driver and, as a result, have strove to better identify their installed base by product and geography. The idea is to better leverage the presence in their customers' premises and the deep knowledge of their processes in order to generate recurring data-driven revenue from the automation installed base. Offerings include Asset Performance Management, guaranteed availability based on predictive maintenance or consulting services that monetize the value of manufacturing companies' expertise in their processes or products.

Software-based offerings enhance the relationships between automation vendors and their customers. Thanks to high-value added software applications, automation companies can get access to the C-level management layer, develop greater customer intimacy and stickiness and move away from what used to be mostly a simple product supplier-to-customer relationship. Generally software value propositions enhance mind-share and drives pull-through of hardware offerings. This helps counterbalance the continued price pressure resulting from the trend towards less proprietary and more open automation systems.

Industrial companies can evolve from sellers of physical assets in to service providers that focus on data as an asset. For example, the gathering of product usage data makes it possible to let customers pay products according to their usage, rather than purchasing them outright. For example, utilities could pay for their gas turbines by the load and hospitals could pay for their CT scanners according to the number of imaging procedures performed. The concept of product as a service (PAAS) or pay-by-use services is effectively turning industrial goods from capex to opex.

New generic services like platforms are also needed. Because of interoperability issues, demand for new objectless platforms is increasing, for example to make all connected products (movement detectors, alarms, entry door, lighting, etc) from different brands fully interactive in the home.

7/ An opportunity to reshuffle the cards globally

Hierarchies in the manufacturing value chain are likely to change. Companies which successfully use the internet to develop highly automated and increasingly service-oriented business models will become more competitive, and their customers will benefit from a broader supply of individualized products and services. Profit pools could shift from traditional equipment manufacturers to producers of connected machines and to the cloud-based infrastructure to support them.

The IoT could make companies' manufacturing presence in developed economies more justifiable. According to Roland Berger, emerging countries hold 40% of worldwide manufacturing. They have doubled their share in the last two decades. In the meantime, Western Europe has lost over 10% of manufacturing value added, from 36% to 25%. Since 1990, the number of manufacturing jobs in China and Brazil increased by 39% and 23% respectively, whereas in Germany this figure decreased by 8%, in France by 20% and in the UK by 29%. At a more micro level, we have also seen most European capital goods companies relocating jobs to low-income countries, which today represent 40-50% of their workforce, up from 15-20% fifteen years ago. Now with the Industrial internet, the cards might be reshuffled as it

will require an increase in well-trained employees with a foundation in mathematics, data science and IT, making companies' manufacturing presence in advanced economies more justifiable. Overall, Roland Berger estimates there is a chance that Europe will increase its industry share from 15% up to 20% of the region's value added.

The Industrial Internet is not just for companies in advanced economies trying to cope with ever-rising global competition. In China too, rising wages, limited energy resources and demand for higher production quality amplify the need for intelligent manufacturing. China is already the fastest-growing market for industrial robots worldwide. Many Chinese companies have made automation a top priority in order to face soaring competition. In the automotive, electronics and machinery industries in particular, there is enormous potential for companies to transform the old and labor intensive manufacturing models.

Industrial Internet – key risks

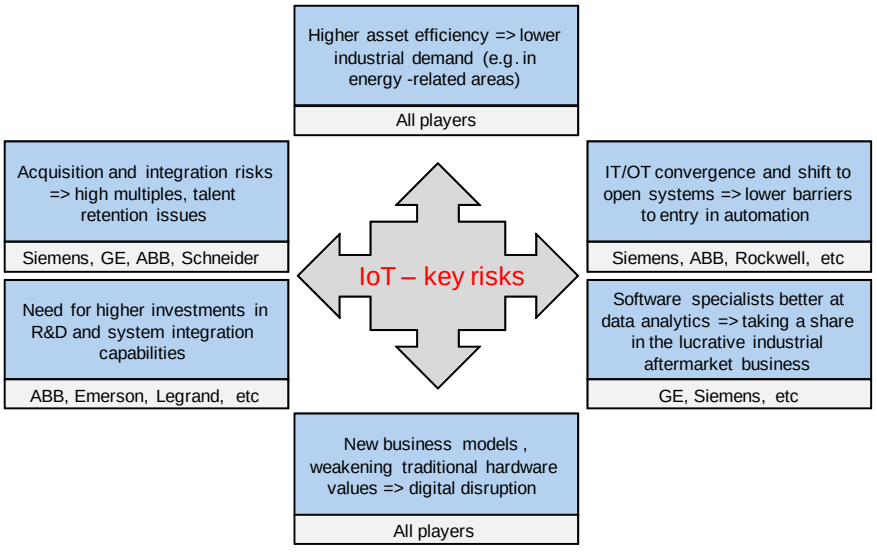
Industrial companies do not really have the choice but to embrace digital transformation

Industrial companies will have to be good at software and analytics to be successful in the future, as value will likely shift towards competitors who make the best use of data or towards suppliers of sensors, data analytics tools and cloud-based infrastructures. The online lodging Airbnb is a good example of rivals that can appear out of nowhere and that bring greater productivity but don't own the assets they sell.

We see 6 main risks for industrial companies, resulting from the development of the IIoT:

- 1/ New business models weakening traditional hardware values
- 2/ Rising competition in aftermarket/services
- 3/ Lower industrial demand due to higher asset efficiency
- 4/ Openness and lower barriers to entry in automation
- 5/ Higher investments in R&D and system integration capabilities
- 6/ Acquisition risks

Figure 20: IoT – key risks for industrial companies



Source: Deutsche Bank

1/ New business models weakening traditional hardware values

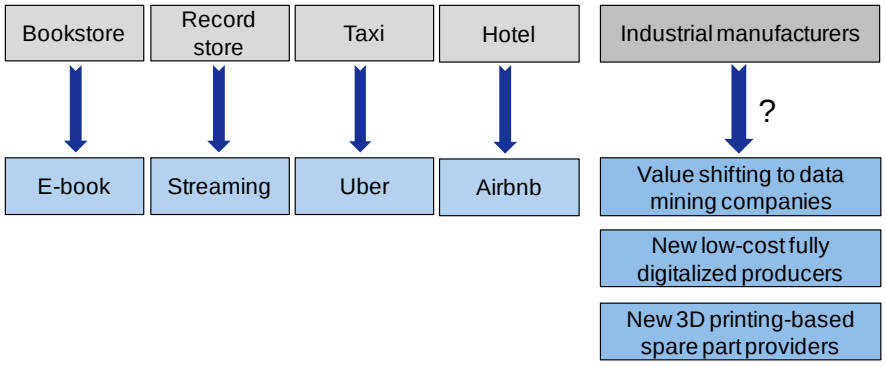
With the advance of IIoT, there will likely be new competitors with innovative industrial business models. The real danger is that the data and analysis become worth more than the installed equipment itself. This could echo what has already happened with internet in the consumer world, with for example, the transition from bookstore to e-book, from record store to streaming, from taxi to Uber, etc. GE and Siemens are the ultimate big asset companies and accordingly the most at risk of digital disruption from traditional and non-traditional competitors. This probably explains why both GE and Siemens have been pushing hard to move in the digital space.

New low-cost providers (not necessarily in emerging markets) could emerge, thanks to a complete digitalization of their production and distribution processes. They could be able to displace incumbent manufacturers, whose legacy production base would cost too much to modernize. Moreover, traditional product development process and innovation cycles are typically measured in years – with digital, companies must learn to design new services with innovation cycles measured in months or weeks.

In the aftermarket domain, 3D printing could offer local players the opportunity to deliver more rapidly spare parts that are cheaper to the aircraft industries or to utilities.

The roles of designers, product manufacturers, contractors and distributors and their hierarchies in the manufacturing value chain are likely to change. The key question is where the high margins will be in the future? In the design, in manufacturing processes or in customer data expertise? Suppliers of sensors, connected machines, optimization software and providers of the cloud-based infrastructure that support them might lead the suppliers' pack in the future while traditional machine and tooling companies could shift down to tier 2 suppliers.

Figure 21: Threat of digital disruption echoing what happened in the consumer world



Source: Deutsche Bank

A key difference with the consumer world is that the Industry is generally slow to adapt. This applies to both customers and suppliers. In theory, it should be relatively easy for manufacturers to gather data from their products, run

analytics and realize proofs of concepts. But the challenge is scaling these up and monetizing them. Industry is generally slow to adapt to new technologies because reliability generally matters more than innovation in factory floors and because it can take decades to replace existing assets with connected intelligent manufacturing systems. Moreover, customers usually do not want another big IT development; which would take years to deliver true ROI; they will likely start small and gradually scale up their IIoT initiatives.

2/ New competition looming in aftermarket/services

Software companies specializing in analytics might take a growing share of the lucrative industrial service business pie in the future. Industrial companies like Siemens or GE know the materials and the physics of their gas turbines and medical scanners and have so far relied on this expertise to provide maintenance services to their customers. This is important, as, for industrial companies, the most lucrative business is generally not selling the machines, but servicing them. However, software companies that specialize in analytics, are increasingly looking to take a part of that pie, by studying vibration, noise, pressure, temperature and other data and figuring when machines might break and need maintenance. The risk is that, if the data gathered by industrial companies is used by IT, these IT vendors could understand the machines almost as well as manufacturers and get between them and one of their largest profit pools. Basically, if traditional industrial manufacturers do not satisfy customer's demands to replace machines less often and to spend less money on maintenance thanks to data analytics, others will.

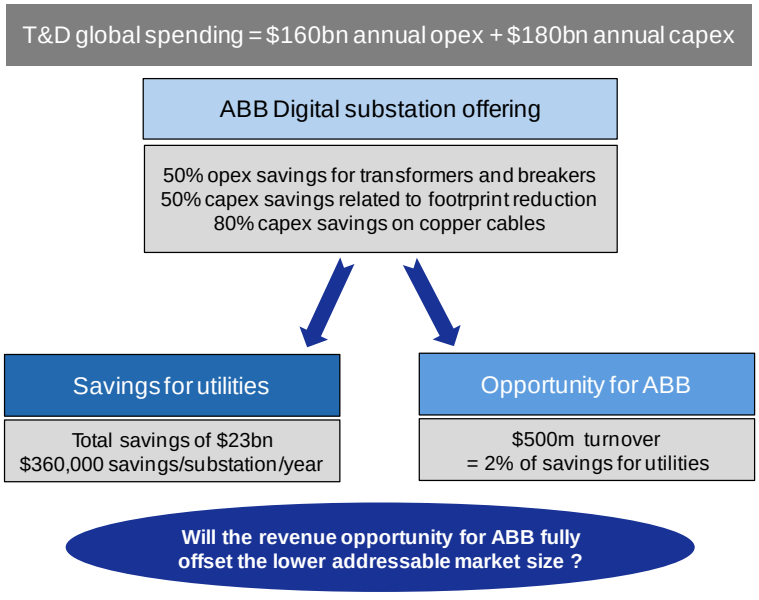
Software specialists can be better than industrial companies at data analytics. Historically, traditional industrial companies have not been so great at software. GE and Siemens solutions have always embedded software, for example to monitor gas turbines or medical scanners, but their software offerings have often been scattered and not always best in class. According to research by Forrester and Xively, 51% of companies are collecting data from connected products, but only 33% are leveraging the intelligence to create actionable insights. It is relatively easy to add sensors and capture data, but the key value added is to make that data truly actionable, and this is where some industrial companies could struggle because of their lack of digital background and lack of good analytics tools and algorithms.

- Generally, we believe that large industrial companies (Siemens, GE, etc) can use Big Data at scale (given their installed bases) but still lack best-in class or innovative data analytics capabilities. Analytics are arguably more difficult to implement in the industrial world than in the consumer world. A misfiring algorithm on the web that might lead a person to see an irrelevant online ad is not a costly mistake. But bad analytics in the industrial world might prompt the earlier replacement of turbine, which could have lasted many more years otherwise. This could cost a few millions of $.
- IT giants can be successful at providing horizontal platforms with generic analytics solutions, but this should mainly apply to general purpose reporting tools. For the more operational use cases, solutions need to be specific and targeted to see customer adoption. This is why many new software companies (including a flurry of start-ups) are now offering new analytics offerings for specific verticals like Utilities or Oil & Gas, or for specific manufacturing actions like wind turbine energy efficiency or valve maintenance optimization.

3/ Lower industrial demand due to higher asset efficiency?

ABB estimates that digitalization technologies could represent a $20bn revenue opportunity for them but also result in $1trillion of savings annually for their customers. We estimate this would be equivalent to a circa 15% reduction of the global opex across industrial markets (excluding healthcare). One key question is that, even if this is not a zero sum game, some of the savings generated by customers should negatively impact traditional suppliers by lowering the demand for equipment and spare parts, for which the lifetime would be increased. For example, $340bn every year are spent to maintain, build and operate substations and many T&D players are launching digital substations for more efficient transmission and distribution of electricity. In particular, ABB estimates that its new digital substation can offer 50% opex savings for transformers and breakers, 50% capex savings related to footprint reduction and 80% capex savings on copper cables. Total savings are estimated at $360,000/substation/year through services and software. Multiplied by 65,000 HV substations (air-insulated), this could result in $23bn yearly savings for grid operators. ABB itself would likely capture a share of these savings, estimated at c.2% or $500m. However, while software and services would bring incremental revenue, this might not be enough to offset the lost revenue on transformers, breakers and cables.

Figure 22: Higher asset efficiency resulting in significant savings for customers… at the expense of traditional manufacturers? Substation example



Source: Deutsche Bank, ABB, McKinsey

Digitalization of a given end-market can also have ripple effects on other end-markets. If buildings find a more efficient way to manage their functionalities and reduce energy consumption, it will alter long-term demand for electricity, which would have major consequences for gas turbine manufacturers. Generally speaking, across industries, the huge potential savings on resource and energy consumption generated through software and services should impact negatively some of the largest pockets of capex for the capital goods industry like power generation, T&D, Oil & Gas and Metals & Mining. The

world should be less and less about capex, and more and more about efficiency and productivity. Traditional manufacturers of big iron machines should be the most affected.

4/ Towards lower barriers to entry in automation?

The automation industry has historically shown high profitability reflecting high barriers to entry and the use of relatively closed, proprietary systems, which created some stickiness in the market.

With the advance of the industrial internet and the convergence between IT and OT, the risk is that automation companies have to shift to open systems and their proprietary technologies become obsolete. This would effectively lower barriers to entry for the legacy players failing to expand in upper-level software applications. The pace of innovation tends to be much quicker in the IT world than in the OT world: IT is more pervasive and standardized and tends to adapt far more quickly to technological trends; in contrast, some manufacturing operations are built to remain untouched for many years. In the OT world, reliability and security tends to be more important than innovation.

It may also happen that the controllers and I/O systems that talk to the sensors and actuators become less relevant going forward. Field devices (valves, actuators, drives, etc) that are the closest to the production assets could become smart enough to form the backbone of truly distributed control and become the differentiating hardware. Human Machine Interface (HMI) systems, that display information to people to monitor and manage the processes, could also further gain in importance. Overall, the sensors at the bottom and the User Interface Devices seen by the user at the top could displace somewhat the importance of PLCs in the value chain, making players such as Siemens or Rockwell less dominant on the factory floor.

With the IT/OT convergence, automation vendors have two options: 1/ leave the leader position to the IT vendors and lose importance in the value chain, or 2/ be an actor and harness the internet to develop automated, digitalized and service-oriented business models.

- The traditional IT mega-vendors (IBM, Infor, Microsoft, Oracle, SAP, NetSuite, etc) typically use ERP as their flagship offering and have expanded into supply chain activities including design, sourcing, manufacturing, logistics, sales & marketing, and service management.
- In contrast, the OT vendors (Siemens, Rockwell, Emerson, ABB, Schneider, Yokogawa, Honeywell, etc) have used DCS or PLC as the reference to strengthen their positioning in manufacturing operations.
- For many years, there has already been some competition between IT and OT vendors for the world in-between, namely for MES. We expect this trend to further accelerate and possibly extend to the CAD/CAM area. Overall, we believe industrial vendors are forced to look beyond their traditional OT capabilities given the changes to the competitive landscape that the Industrial Internet is about to bring.

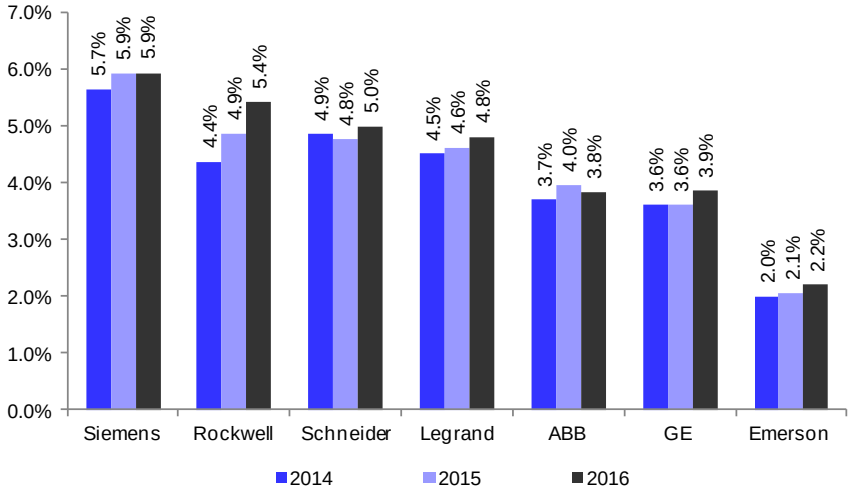
5/ Need for higher investments in R&D and system integration capabilities

The digital transformation is already resulting in higher spending on R&D at most companies. Industrial companies generally lack digital skills in areas like web design, online customer experience and mobile app development. They need to employ more data scientists and software engineers, rather than just mechanical or electrical engineers

They also need to skill-up their sales organizations as they move from product sales to solutions around software and analytics such as outcome-based offerings. Interestingly, many companies have recently created the role of chief Digital Officer to supervise their digitalization transformation, as evidenced for example by the recent appointment of Guido Jouret at ABB in 2016.

The chart below shows the rise in R&D spending at select capital goods companies over the past few years.

Figure 23: Towards higher R&D spending as a % of sales



Source: Deutsche Bank, company data

6/ Acquisition and integration risks

We expect most industrial companies to follow an active M&A strategy in the software domain. That said, we would expect primarily bolt-on moves for specialized software companies with revenue of €10-50m, rather than large deals.

We could potentially see some mega-mergers between IT and OT companies to support the "shop-floor to top floor" vision of the real-time enterprise. Invensys, with the acquisition of enterprise software firm Baan in 2000, came too early and failed to realize this vision. But, as highlighted by the $4.5bn acquisition of Mentor Graphics by Siemens, now the time might be coming for this to become reality. Overall, over the past ten years, Siemens has already spent €10bn on software deals, including the purchases of UGS, LMS, CD Adaco and Mentor (for Mentor, see the Siemens press release, November 14, 2016).

Software deals don't come cheap with multiples typically 5-10 turns above the capital goods sector's usual multiples. While software assets can be seen as strategic, it could prove difficult for industrial companies to generate value. Associated risks include integration risks (due to the difference of culture between IT and OT employees) and talent retention risks. The skills set and mentality needed to build and grow a software business are different from those needed in the hardware space. Industrial companies need to build the right environment in terms of processes, skills, compensation system and culture.

We show the major automation and industrial software suppliers in the table below.

Figure 24: Positioning of major automation/software providers

	Process software	Process controls	Process hardware	Discrete software	Discrete controls	Discrete hardware
ABB	Strong	Strong	Medium	Weak	Weak	Strong
Schneider	Strong	Medium	Weak	Medium	Strong	Medium
Siemens	Medium	Strong	Medium	Strong	Strong	Strong
Emerson	Medium	Strong	Strong			Medium
Rockwell		Medium		Medium	Strong	Medium
Honeywell	Strong	Strong	Medium			
GE	Medium		Medium	Medium	Weak	
AspenTech	Strong					
Autodesk				Strong		
Aveva	Strong			Strong		
Dassault Syst.				Strong		
Hexagon	Strong					
SAP				Strong		
PTC				Strong		

Source: Deutsche Bank

Cloud platforms - Mindsphere vs. Predix

What are Predix and MindSphere?

GE Predix and Siemens MindSphere are cloud-based data analytics platforms. These industrial clouds add a layer of intelligence and a large memory to factory floors, allowing customers and OEMs to perform data analytics at scale for operation optimization and asset performance management.

Many companies have been deploying industrial cloud platforms in the past few years. Some are specialist industrial cloud providers with hardware-plus-software solutions aimed specifically at industrial customers, others are all-purpose cloud services which have some components but not a ready-to-be-used package for industrial applications. Some of the key vendors are industrial companies like General Electric (Predix), Siemens (MindSphere), Schneider Electric (EcoStruxure/WonderWare), ABB (Ability), Honeywell (Connected Performance Services), Bosch (IoT Suite)… or IT companies like Microsoft (Azure), SAP (Hana), Cisco (IoT System), IBM (Bluemix), Amazon (AWS Cloud), Infor (CloudSuite), etc. Many partnerships/collaboration between IT and industrial companies have already been announced.

Given the breadth of their hardware offering and large installed base, we believe that GE and Siemens' platforms could attract more customers and developers than any other providers.

What makes industrial cloud platforms different from other cloud architectures?

Industrial companies can capitalize on their experience in manufacturing the machines that generate the data (turbines, locomotives, jet engines, CT scanners, etc). Data from sensors on machines may be polluted with external noise and the good data has to be sorted from the bad data. In theory, industrial manufacturers like GE and Siemens know better than anyone else what data is important for their own machines and where to look for anomalies.

Industrial clouds have to provide higher levels of security, reliability and performance than consumer or e-commerce clouds. There are major differences in terms of how industrial clouds will shape up versus consumer clouds.

- **1/ Reliability and real-time characteristics.** In the consumer world, the connected assets like fridges or watches are fairly superficial and do not require the same reliability and real-time profile as most industrial equipment.
- **2/ Security of data** matters more in the industrial world. In the consumer world, people have almost given up on how the data can be. In the industrial world, security of power plants or trains is paramount and need to be implemented at the system level. The starting point is that industrial companies own the data and they want to have full control over it. It means that security controls in industrial clouds need to allow companies

to encrypt the data so that only them can see it. In turn, if companies want to get fleet analytics, they can sign an agreement to share some of their data with GE or Siemens data allowing them to do comparisons and analytics.

- **3/ Cloud format and location.** In the consumer world, people give their information for free. Industrial companies will not want to turn the data over to someone else and will try to monetize the data in some way. Many customers will likely want to keep their critical data close to the machines, in the field, as they do not necessarily trust the cloud availability all the time, and not everywhere. Data sovereignty requirements also mean that countries are enacting more and more rules to prevent data on critical assets such as trains and turbines from leaving the country. Industrial companies will probably have to build smaller data centers inside neutral co-location facilities in each region, instead of a few hyperscale data centers located in the US. Overall, industrial companies need to be able to move the workload dynamically from one place to another, from the edge to the cloud. In the consumer world, you typically do not find several layers and networks are much simpler.

How industrial companies can monetize their platforms?

Both Predix and MindSphere have been launched recently and the real question is how these solutions can be scaled up and monetized. GE claims Predix could be $200m of revenues in 2017 and up to $4bn by 2020. In practice, for the time being, we believe that the main applications are the sale of digital services like Asset Performance Management (APM - including condition monitoring and predictive maintenance). APM are not new but the ability to create digital twins of physical assets and run simulations looking at forecasts on input costs and historical data on entire fleets further enhance the value of service agreements. Beyond predictive maintenance, there are various business models, including:

- hosting applications developed by a customer (jointly or not) on which GE would take a share of the revenue generated.
- licenses by selling traditional software on a subscription basis. They can also sell customers specific outcome, and based on their ability to deliver on the outcome, take a share of the value delivered.
- service fees in a Platform as a service (PaaS) business model
- enhancing mindshare and increasing the sale of hardware.

Siemens MindSphere - a more comprehensive offering than GE Predix

Unlike Siemens or Schneider, GE is hardly active in the control room

Siemens is the undisputed leader in the automation industry while GE only has a small presence in discrete controls. GE Predix is not building the automation/control systems but needs to communicate with these systems. In theory, GE is not fully equipped to act in real-time and influence directly the operations and the uptime speed of their customers. Some would even argue that, to some extent, they can only sell the insights on data more like a study made by a consultant.

There will still be a lot of intelligence and analytics taking place close to machines on the factory floor (at the 'edge'). The cloud is cheap but it generally offers low latency. Sending data to the cloud and bringing it back to the edge is inefficient for many applications requiring real-time decisions, so more analytics and intelligence need to happen at the edge, on sensors, devices, machines and controllers to fully optimize their assets and operations. This gives an edge to automation providers.

Siemens is the only one that offers a direct interface between operational product sensor data and the product design

Both GE and Siemens can use the data describing a turbine or a train to create a digital twin of that particular machine or equipment. This would allow engineer to test products and feed the virtual model with data from the real world to improve performance of the equipment. GE's design capabilities essentially come from a partnership with PTC. In contrast, Siemens has strong PLM capabilities in-house and can feed operational product sensor data back into design in a fully integrated way for continuous product design improvement. This effectively closes the life-cycle data-loop.

Siemens partnership with IBM Watson should attract more developers

In December 2016, Siemens announced a new partnership with IBM to include IBM's Watson, an artificial intelligence service, in the Mindsphere platform. We believe this is an interesting collaboration, which should attract more apps developers to the platform. The integration of IBM technologies will further ease the use of advanced analytics by providing visualization and dashboards for business customers and analytics tools via Application Programming Interface (APIs) for app-developers.

It seems to be relatively easier to get started with MindSphere

Siemens provides plug and play connectivity solutions (MindConnect Nano) for its products, as well as for those of 3rd party suppliers. Siemens connector box is a IPC-based gateway that makes it possible to quickly connect machines without coding, irrespective of the manufacturer. In the future, this function will be integrated into all communication-capable products in the Siemens portfolio (motors, drives, controls, etc).

Detailed company IIoT strategy analysis

Siemens – Leading the pack – page 39-43

Schneider – All key blocks in place – page 44-49

ABB – Leading in process and T&D – page 50-53

Legrand – Focused on connected products – page 54-56

GE – A cloud platform for infrastructure – page 57-58

Rockwell – Openness and scalability – page 59-60

Emerson – Integrated IIoT offer for process – page 61

Hexagon – Integrating sensors and software – page 62-63

Dassault Systemes – Leading PLM platform – page 64-65

SIEMENS – leading the pack

A long-standing digital strategy

We believe Siemens is well positioned to maintain a leadership role in the industrial software space. The group combines a long-standing expertise in hardware and physics (thanks to its broad basis in automation and electrification) and a strong IT expertise. Back in 1996, Siemens introduced the Totally Integrated Automation (TIA) portal (providing an integrated portfolio of hardware and software using, among other things, the programmable Simatic controllers) and is now targeting complete digital representation of the physical value chain thanks to its PLM offering. In 2016, Siemens generated €3.3bn of revenue from the sale of vertical software and €1bn in digital services, with an expected CAGR of 8% over 2017-2020.

Siemens, just like GE, is trying to transform from a manufacturer of machines into a digital company. Both companies are the world's 2 largest industrial conglomerates with annual revenues of around $100bn. But GE mostly sells big, stand-alone products (such as locomotives, gas turbines and jet engines) while Siemens has strong product design, factory automation and integration capabilities. Siemens already has a long-standing experience in CAD/CAM software and control systems, and in some aspect is therefore already more of an IT firm than GE today.

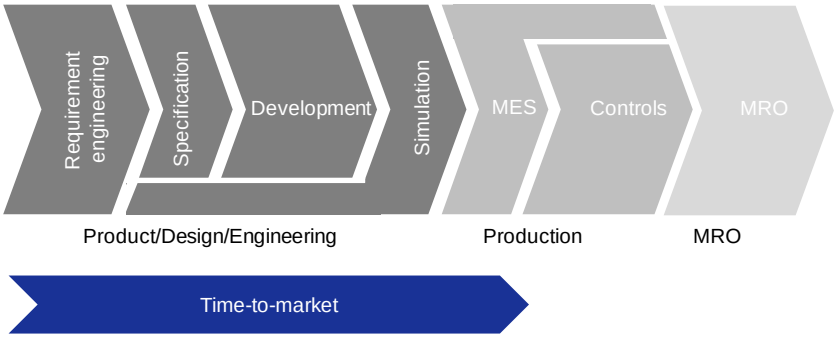
The group has best-in-class innovation capabilities, with 28,800 researchers and 17,500 software engineers. Siemens has invested massively in the last 15 years in building up its software portfolio to support the entire industrial value chain, from product definition through to after-sales services. The suite of software is called the "Digital Enterprise Software Suite". The backbone of the suite is called Teamcenter, a collaborative product data management platform. Siemens' digital offering has recently been complemented by the launch of MindSphere in 2016, an open cloud platform, designed as an operating system for the Internet of Things.

In today's hype for the Industrial Internet, Siemens is one of the few companies still executing a long-term strategy initiated nearly 10 years ago. Since the acquisition of UGS in 2007, Siemens industrial digitalization strategy has been based on the integration of a leading PLM offering with a leading automation platform. One could only argue that the implementation of this visionary strategy is taking time since Siemens has not yet truly benefiting from its lead and comprehensive offering. Excluding the strong growth seen in the pure PLM activities, Siemens' more traditional automation activities have not really outgrown the market.

The most comprehensive IIoT set-up

Siemens offers the world's most complete portfolio of software tools with strong positions in both the design/virtual production sphere and the real production sphere. According to Siemens, simulation of the product and the associated production processes will provide the greatest productivity gains in the future. One of the greatest challenges is to overcome the format discontinuities between the main areas of the technical value chain: between the engineering of products, the associated planning of production systems and processes and the production execution itself. As such, over the past ten years, Siemens has built up an integrated suite of software solutions spanning the entire value chain. Based on the Teamcenter collaboration platform, the plan is to provide seamless integration of PLM (Product Lifecycle Management), CAx (Computed Aided Design & Manufacturing), MES/MOM (Manufacturing Execution System/Manufacturing Operations Management) and TIA (Totally Integrated Automation). The Siemens Cloud platform, known as MindSphere and launched in April 2016, also provides a way for companies to implement its many software tools without having to erect a computer data center on site.

Figure 25: Software can support the whole design, make and maintenance processes



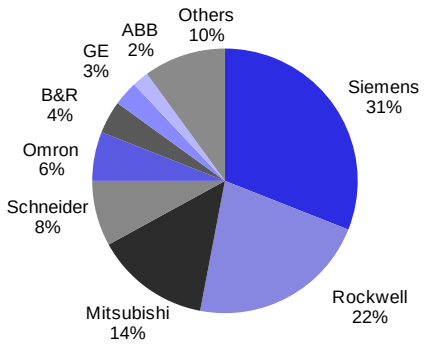
Source: Deutsche Bank, Siemens

An undisputed #1 position in automation…

In the real production sphere, Siemens is the undisputed leader in industrial automation with #1 or #2 positions in all categories (MES, PLC, CNC and DCS). Siemens stands out in terms of the size of its industrial base of factory and process hardware, with 30 million automation systems installed. This provides the group with deep domain know-how in a broad range of markets and industries and with a large fleet of connected devices.

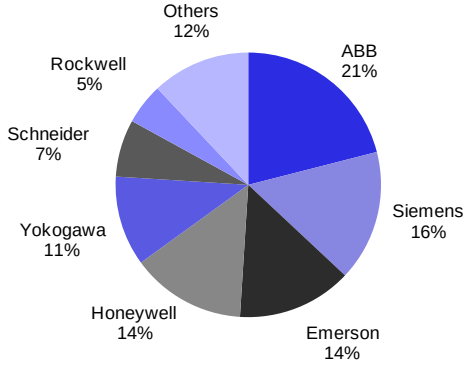
- **Manufacturing Execution Systems (MES)** offer a complete overview of the manufacturing process. With Simatic IT, Siemens estimates it ranks #2 globally in MES.
- **Command & Control systems (including DCS and PLC)** enable the control of individual manufacturing steps. With Simatic S7, Siemens ranks #1 in PLC (market share of >30%), #2 in DCS (market share of >15%, including power gen-related DCS). The group also ranks #1 in CNC controllers, on par with Fanuc per our estimates.

Figure 26: Market shares in PLC



Source: Deutsche Bank, company data

Figure 27: Market shares in DCS



Source: Deutsche Bank, company data

…combined with a strong design/software offering

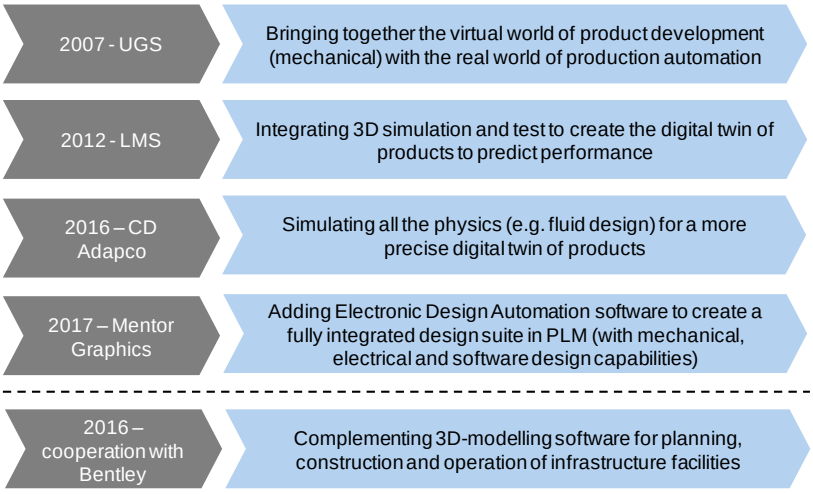
Within the design and virtual production sphere, Siemens is active through its PLM software business unit, part of the Digital Factory division. Siemens PLM employs 9,700 people and generates around €2.3bn of revenue per our estimates. Main solutions include CAx, DM and PDM.

- **Computer aided design / engineering / manufacturing (CAx)** solutions allow customers to design, simulate and manufacture products faster and more efficiently. With its NX solution, Siemens offers relatively unique multi-discipline simulation for structural, motion, thermal and flow applications. Siemens claims to be #2 in CAx. With NX, the data behind the product models lead to a parts list (called a bill of materials). Then, machines and plants are developed for the production with Digital Manufacturing solutions.
- **Digital manufacturing (DM)** enable customers to simulate and optimize entire production processes and material flows before production even begins. The result is a digital process description, called a bill of process. Siemens Tecnomatix solution ranks #1 globally.
- **Collaborative Product Data Management (cPDM)** enables global collaboration across the entire value chain. With PDM, the data generated in the bill of materials and bill of process (by CAx and DM) can be linked and the connections kept up to date. Siemens considers that the beginning and basis of a digital company is a joint data storage and data management system that permits hundreds of engineers to simultaneously work on a project and ensures the data is up to date and consistent at all times. Teamcenter is one of the leading software solutions for data management on the market. Siemens claims to be #2 in cPDM.

We believe Siemens has built up differentiating simulation capabilities. Following the recent acquisition of Mentor Graphics ($1.2bn of revenue), Siemens will become the sole industrial player to offer mechanical, thermal, electrical and electronic design capabilities on a single platform. Mentor Graphics is actually the latest addition to a series of acquisitions, including UGS (2007 – CAD software), LMS (2012 – mechanical simulation and testing) and CD-Adapco (2016 – simulation of fluid flow and heat transfer). The acquisition of Mentor will extend Siemens' digital portfolio with electronics IC and systems design and simulation. The combination will enable the group to enhance its product design capabilities to create a very precise digital twin of

any smart product and product line. According to Siemens, the electronics IC design capabilities are essential for smart connected products such as autonomous vehicles. We believe this should further consolidate Siemens as the leading automation supplier to the automotive industry source: Siemens press release, November 14, 2016).

Figure 28: The first provider of a fully integrated Digital Enterprise suite thanks to an active M&A strategy



Source: Deutsche Bank, Siemens

Sinalytics is the company-wide internal platform, which powers the group's digital services offering thanks to data analytics. Siemens is using the Synalytics platform to connect and monitor around 800,000 devices all over the world, such as gas turbines, wind turbines, buildings, trains and traffic control centers. Siemens links the data and expertise from all its various sectors so as to provide digital services such as preventing unplanned downtime of machines, increasing availability and reliability and improving customer ROI through flexible service, predictive maintenance, etc. Siemens already generated €1bn of revenue in digital services in 2016.

In 2016, Siemens launched MindSphere, a cloud-based data analytics platform which, unlike Sinalytics, is sold externally as an independent solution (like GE Predix). The platform includes connectivity capabilities, applications and services for customers and tools for developers. Several applications on the Siemens MindSphere platform are powered by Sinalytics (for example Energy Analytics). Designed as an open operating system for the Internet of Things, this platform makes it possible to improve the efficiency of plants by recording, storing and analyzing large volumes of production data. Eventually, it is supposed to become the basis of all applications and data-based services from Siemens and third-party providers, for example in the areas of predictive maintenance, energy data management and resource optimization. The architecture was initially based on SAP HANA but Siemens has been expanding the number of hosting partners to include Atos, Microsoft and Amazon. Siemens also plans to offer different cloud infrastructure formats, public, private or on-premise.

Key components of MindSphere are:

- open interfaces to connect industrial machines, plants or entire fleets, irrespective of the manufacturer
- products such as MindConnect Nano with which manufacturers can capture machine and plant data and transfer it securely to MindSphere
- data-based services from Siemens powered by Sinalytics (for exemple Energy Analytics)
- MindApps provided by Siemens (e.g., for predictive maintenance or energy data management services)
- a development platform on which individual applications can be easily created.

MindSphere is an open platform. With MindSphere, customers can select from an existing portfolio of applications and services from Siemens, or develop and market their own applications to suit their individual requirements. Siemens' goal is to support customers, machine builders, for example, when they add new applications and services to their machines. We believe it was very important for Siemens not to find themselves competing with machine builders and therefore displeasing an important group of customers that buy many components from Siemens. OEMs typically want to maintain direct relationships with their own industrial customers and would surely not like to have them interacting through a platform where the data would be controlled by someone else. Customers decide who should get access to the data. This enables manufacturers to use MindSphere to offer their own customers tailored, data-based services, using either existing MindApps (e.g., for predictive maintenance or energy management) or individually developed apps. They could eventually offer their customers new business models such as 'products as-a-service' rather than offering the products themselves (e.g., offering machine hours for sale).

SCHNEIDER – all key blocks in place

A clearly defined digital strategy

Schneider claims that the IoT already account for 45% of sales today. We estimate that Schneider has a strong position in all four building blocks of IIoT (Connect, Collect, Analyze, Act) and is well placed to be an IIoT winner by 2020. The group's offering includes nearly €1bn of sales in agnostic software (apps/analytics/services), €4bn in control systems, which typically embed a high share of software, and €6bn in connected products. Schneider IoT strategy can be summarized as follows:

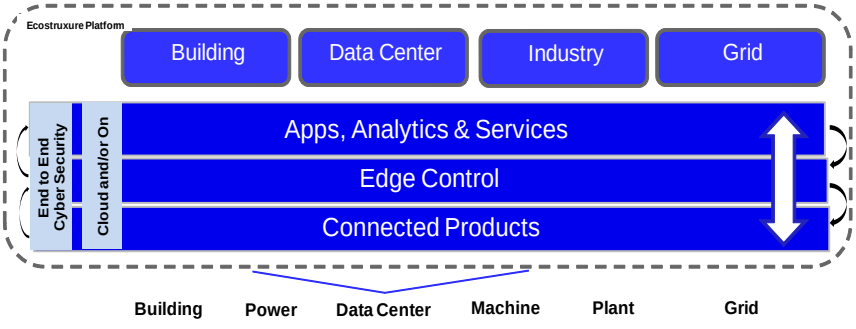
1/ enhance business with connectivity and analytics – in order to maintain and increase their competitive advantage by connecting all their assets

2/ build new offers and business models – in order to unlock trapped efficiency value with connected offers and subscription business models

3/ change customer engagement – by building lasting life-cycle relationships that allow them to offer value and experience, targeted at specific needs

We believe Schneider started its 'Industrial Internet of Things' journey as early as 1997 with the launch of the Transparent Factory concept in their industry automation division. Already at that time, the idea was to apply Ethernet and web technologies to the shop floor. The concept was then extended to other applications/end-markets in 2000 and renamed Transparent Ready. The following step was the launch of an internet-based on-premise control architecture platform in 2009, called EcoStruxure, integrating Schneider's various offerings in electrical distribution, critical power and cooling services, industrial control and building control systems. The latest version of EcoStruxure, taking the form of a true open IIoT architecture (with the ability to aggregate data and deliver digital services on the cloud) was released in April 2016.

Figure 29: EcoStruxure platform: 3 layers; 4 end-markets



Source: Deutsche Bank, company data

Schneider's EcoStruxure IIoT platform provides a portfolio of interoperable and cloud-connected and/or on-premise technologies. 450,000 EcoStruxure systems have already been deployed. The platform includes 6 specific architectures for buildings, power, data centers, machines, plants and grids. It is organized around three distinctive layers.

- **The first layer regroups Schneider's offerings in terms of connected products** with embedded intelligence, such as sensors, medium and low voltage breakers, drives, actuators, UPS and local HMIs. These products, wireless or wired, are directly connected to the Internet, making them smarter with sensing, real-time intelligence, and offering digital modularity capabilities (upgrade across lifecycle, activation of more advanced features). This also opens the door to digital twins. This connectivity ranges from the breaker to the boardroom. Schneider estimates that they already have more than 1bn connected devices to their Edge Control platforms. CEO JP Tricoire often takes the example of the buildings market, where an operator generally spends 50% of his time looking for a fault. If the equipment is connected, this 50% becomes 0%, so productivity gains can be as high as 50%. This first layer of connected products represents around €6bn of sales, or 25% of group sales. We estimate that nearly half of Schneider's product offering has connectivity features today. This compares to only 9% at Legrand for example.
- **The second layer is the Edge Control layer**. It can be seen as the digital backbone of Schneider systems. This layer includes connected control platforms with remote access and advanced automation capabilities. Control systems typically embed a large proportion of software. This layer represents around €4bn of sales for Schneider, or c.16% of sales (including PLC, PAC, DCS, HMI/SCADA). Importantly, Schneider's systems have all been developed on open standards, which is a guarantee for customers that they can be integrated with the rest of their installations. This has also enabled the deployment of an extensive Partner Ecosystem (integrators, developers). Key products/systems include for example the Modicon PLCs (for discrete processes), Foxboro DCS and Triconex safety systems (for continuous processes).
- **The third layer is Schneider's portfolio of apps, analytics and services.** It regroups vendor-agnostic software capabilities in asset performance management, sustainability, energy management optimization services, workplace efficiency, etc, with a total revenue pool of around €1bn (4% of sales). This layer has been a major focus of development at Schneider in the past 5 years, in terms of both R&D and acquisitions (including the integration of Invensys, Telvent and Summit Energy). Schneider's solutions are based on open IP protocols in order to work with multiple hardware, systems and controls. With this upper layer of intelligence, Schneider increasingly applies machine learning to transform data onto business insights and wants to create new differentiated user experiences and new business models (SaaS, Digital services).

- **Schneider offers customers the possibility to host their data on-premise** (for critical applications requiring real-time and high safety considerations - SCADA, HMI, Alarming, etc) **or on the cloud** (for applications that are not critical to the production process, but rather complementary – optimization, analysis, reporting, simulation, testing, etc).

Already a leading player in industrial software

Thanks to 10,000 developers delivered with 9,000 integrators, software plays a role for each of the 3 EcoStruxure layers described previously.

Schneider has been one the most aggressive in terms of software companies acquisitions in recent years including the acquisitions of Summit Energy in 2010, Telvent in 2011 and Invensys in 2014. Out of its 160,000 employees, Schneider has c. 10,000 application and software engineers. Software and data-based services have been a key axis of development at Schneider for several years. One of Schneider's key strategic intentions is to keep pushing the services that the group can offer through software. By connecting more and more customers to its control centers, Schneider can collect information, data and then offer analytics and new services, which enable its customers to benchmark and improve their processes (remote energy management, etc.).

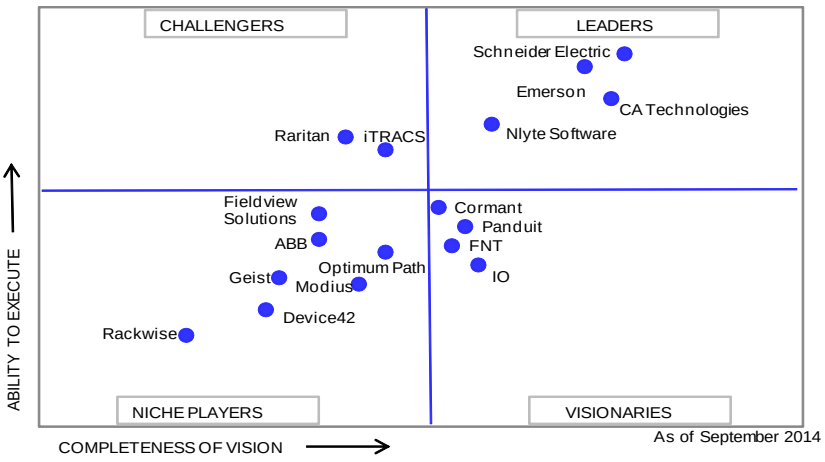
Schneider/Invensys has applied the power of the cloud for industrial automation for several years. As of 2012, Invensys and Microsoft joined forces to deliver cloud-based manufacturing solutions, including Wonderware Historian, Collaboration/ Business Process Management (BPM) workflow and SmartGlance, a visualization and reporting application for mobile devices

Schneider has well-known software franchises like Wonderware, Avantis, SimSci, Citec and Struxureware. According to ARC Advisory, Schneider holds the #1 market share position in Human Machine Interface (HMI) Software and Services and the #2 position in Simulation and Optimization Software and Services for Process Industries. It is also one of the leading vendors in the global MES market.

- **Wonderware is the global leader in HMI/ SCADA software with more than 1.6m licenses.** Wonderware InTouch has been the world's number one Human Machine Interface (HMI) for over 25 years. It is used in over one-third of the world's industrial facilities and offers the broadest partner ecosystem.

- **Schneider's energy management software is recognized as one of the most attractive solutions in the market** by major consultants such as Gartner, IDC etc. In 2015, a study from independent analyst firm Verdantix named Schneider a leader in the building energy management software market for the second year in a row. Other players include CA technologies, Carbon Systems, IBM or Verisae. Schneider's StruxureWare Resource Advisor is a cloud-based software-as-a-service platform which help customers to manage energy costs, mitigate security of supply risks and benefit from the potential of decentralised renewable power generation, with enterprise-wide energy data aggregation, reporting and analysis tools).
- **Schneider's software suite for data centers is perceived as state of the art** and is one of the most successful DCIM products in the market today. In 2015, the analyst firm IDC named Schneider as best positioned in the Data Center Infrastructure Management (DCIM) market for its comprehensive efficient solutions addressing concerns in the data center around space, power and cooling. Despite its smaller size, Schneider ranks ahead of Emerson in terms of capabilities and innovation strategy in this segment.

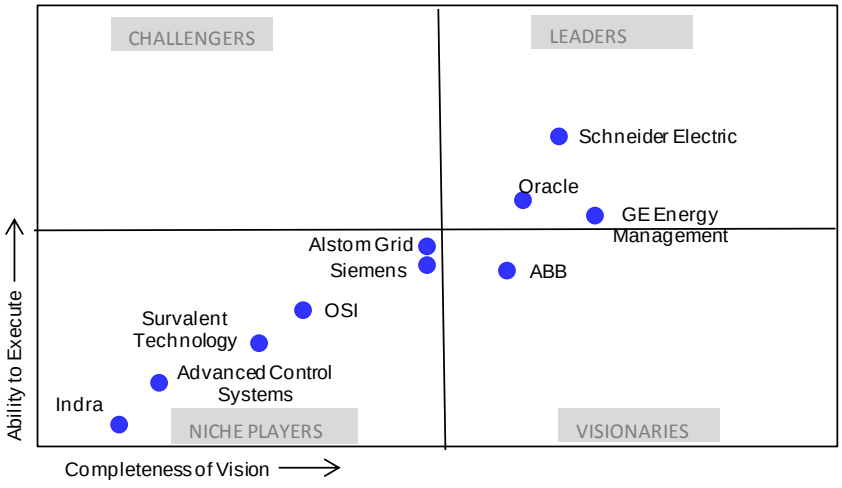
Figure 30: Worldwide Data Center Infrastructure Management vendor analysis



Source: Deutsche Bank, IDC

- **Despite holding a smaller installed base than ABB, Siemens or GE amongst utilities, Schneider has a good card to play in the decentralized energy software tools area.** While ABB has moved from the grid into building with the acquisition of Thomas & Betts, Schneider has come from the opposite direction. Already a top player in buildings, it bought the distribution grid assets of Areva in 2010 and Spanish grid network and software player Telvent in 2011. While Schneider's Infrastructure division has since underperformed its direct competitors on both growth and margins in recent years, we believe the group is back in the game. Given its strength in both buildings and grid automation, Schneider is well positioned to approach grid optimization ("smart grid" concept) from the customer side as well as the utility side. According to Gartner, Schneider today has the most advanced Distribution Management System (DMS) in the industry. Schneider's ADMS is used by >65 utility companies, serving over 60 million customers.

Figure 31: Advanced Distribution Management Systems – Magic Quadrant



Source: Deutsche Bank, Gartner (March 2015)

Does Schneider need to expand in Design?

Schneider is well positioned in controls, MES, visualization and simulation, but unlike Siemens, it is not active in Product Design. CAD/CAM (computer-aided design and manufacturing) refers to computer software that is used to both design a product and program manufacturing processes. CAM software uses the models and assemblies created on CAD software to drive the machines that turn the designs into physical parts. The main goal of CAD is to achieve faster product development and reduce time to market. The CAD market is already relatively consolidated with Dassault Systems, Siemens, PTC and Autodesk holding top positions.

The rationale behind the aborted Aveva deal was compelling in our view. Aveva would have provided the front-end engineering for plants that Schneider/Invensys software (via Foxboro, Triconix, Avantis) operate and maintain. Schneider would have therefore been able to provide an end-to-end solution for process industries (process simulation, 3D design, Asset Data Management, Operations Management), similar to what Siemens has done for discrete manufacturing. Moreover, the reverse integration process would have created the right environment for the software teams to develop aggressively their business. By keeping Aveva listed, it would have helped Schneider crystallize the value of its own software offerings (today buried into the group and implicitly valued at 11x EV/EBITA), facilitate talent retention and avoid integration issues. It would have also provided Schneider with a unique listed software platform that might have been used to further expand in software using typical software industry's multiples, rather than the lower capgoods multiples.

PLM-to-MES integration is a recent phenomenon as manufacturers look to accelerate product ramp-up times and establish a feedback loop between product design and production as part of ongoing quality efforts. In practice, small organizations are still reluctant to implement PLM software as they tend to require a great deal of resources to maintain and have high initial costs. Given Schneider's activities are generally skewed towards small and mid-sized customers (OEMs, etc), there is no sense of urgency to go after PLM in our view.

Aveva is a missed opportunity but Schneider does not necessarily need to expand in the Design space. Partnering with PLM companies is another option. For example, GE has partnered with PTC to integrate its Proficy Plant Applications and PTC Windchill MPMLink. Apart from Siemens, no other automation company is active in the PLM space.

A long history of innovation in open and Ethernet-based architectures

We believe Schneider was at the forefront of open automation. The group has a long history of innovation in open architectures, industry standardization and Ethernet-based technologies. In the 1990s, the group was implementing web servers in its programmable logic controllers with the Transparent Factory concept, while some of its competitors were still promoting proprietary protocols like Profibus (Siemens) and DeviceNet (Rockwell). Since then, most manufacturers have adopted a relatively similar, open and Ethernet-based strategy but we believe Schneider's customers still view the company's products as more open, transparent and easier-to-plug.

A strong domain knowledge

In the past 10 years, Schneider has built up strong systems capabilities. Schneider today has 20,000 solution engineers (with specific deep domain expertise) and 8,000 service engineers, extended by a network of 9,000 system integrators that the group leverages to bring its technologies to a larger scope of applications and geographies. We estimate that Schneider has particularly strong domain expertise and recognition in the buildings, water, petrochemical, data centers areas and with machine builders (packaging, HVAC, materials handling, etc).

Ability to combine plant controls and electrical controls

We believe that Schneider has one of the most extensive energy management platforms, with comprehensive products/systems driving both energy efficiency and operational efficiency for customers. Power technologies (low voltage, medium voltage, secure power) and Automation technologies (building automation, industrial automation and controls, distribution automation) account for 65% and 35% of sales respectively. In the past, control systems and power systems were treated separately. Now there is a trend to very integrated solutions between the two. In recent years, Schneider's portfolio has been built up around this convergence of power and automation, for the supply of energy efficiency and operational efficiency solutions. Along Siemens and ABB, we believe Schneider has a key competitive advantage vis-à-vis its US competitors (Rockwell, Emerson, Honeywell, etc) and Asian competitors (Fanuc, Yokogawa, Hollysys, etc), which are generally not active in electrical equipment.

A comprehensive product offering with the largest distribution network

An important aspect of Schneider's strategy is that it works around open systems and standards. The group has built a Software Partner Ecosystem of more than 4,000 partners, including Strategic Technology Alliances Partners such as Microsoft or Cisco.

Schneider has an unrivalled network of electrical wholesalers and IT resellers. Schneider sells 65% of sales through intermediaries like distributors, contractors and system integrators, who provide the group with the ability to reach large number of small and medium-sized customers. In Low Voltage, Schneider has an unmatched distribution network, being present in over 1 out of 2 points of sale in the world.

Schneider offers a very broad product offering in electrical equipment (circuit breakers, cable management, enclosures, panelboards, wiring devices, VDI equipment, meters, inverters, UPS, switchgears and transformers) and industrial control (PLC, DCS, HMI, contactors, motor starters, push buttons, drives, etc). Schneider benefits from scale effects, in particular in the low voltage market where it has an undisputed market leadership, being about 50% bigger than the second largest player globally (ABB). Scale and a comprehensive product range are key competitive advantages as electricians, panel builders and installers normally try to purchase all their products from a single supplier to benefit from price reductions, training services and the assurance that the products are technically compatible.

One area of relative weakness might be in process field devices. Schneider has a solid offering in terms of HMI/SCDA, process MES and DCS. But competitors such as ABB, Emerson and Siemens have also extensive field device product lines, and Rockwell Automation has a partnership with Endress+Hausser, the largest manufacturer of field devices in the world. We would look for Schneider to do some alliance or maybe even an acquisition in field devices (valves, actuators, etc).

ABB – leading in process and T&D

Late to define its digital strategy

We estimate that ABB has been investing less than its peers in software development. ABB employs close to 3,000 software engineers, compared to around 10,000 at Schneider, 17,500 at Siemens and 22,000 at GE. While these companies may be using slightly different definitions when they classify employees as "software engineers", we believe that the numbers do illustrate the fact that relative to its size, ABB has less active than its peers in software development.

ABB has good parts of the software business, but we estimate ABB has not done a very good job at articulating a proper group-wide digital strategy in the past. The group has been slower than the likes of Schneider and Siemens in pulling them all together in the industrial and building segments. Only very recently, ABB has developed a separate Enterprise Software group to bring its various software offerings under one house. One could argue that, since 2011, the group's main focus has been on expanding the breadth of its hardware offering (motors, low voltage products) and the capillarity of its distribution network (notably in the US) rather than reinforcing its expertise in the upper-level of the software applications.

This is however about to change. Last year, ABB appointed Guido Jouret (a pioneer in the Internet of Things while at Cisco) as Chief Digital Officer. In October 2016, the group also launched a centralized and dedicated digital organization and horizontal platform, called ABB Ability, regrouping all its digital technologies to share them across the entire group and make them available to all divisions and customers.

A significant presence in the process and utilities domain

ABB consider that already today 55% of what they sell has software or digital at its heart. This compares to Rockwell Automation on c.70% and Schneider on around 45%. Like other automation providers, the group has long been an expert in integrating digital components into its control systems. These include sensors, software, digital networks. ABB claims they have the world's largest installed base of connected industrial services, with 70,000 digital control systems and 6,000 enterprise-level software solutions.

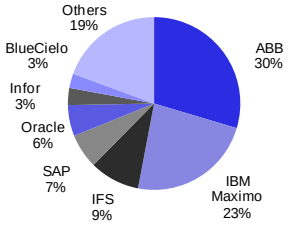
ABB holds a leading position in process Operational Technology (OT) with a large installed base. According to ARC Advisory Group, for more than ten years, ABB's distributed control solutions (DCS) including its system 800xA have held the #1 global market position, with a market share in excess of 20% in process industries. ABB itself considers that its DCS system 800xA offers the shortest and most secure path to the realization of the benefits of Internet of Things within process automation. ABB also claims to be #1 in MES for Process industries (following the Ventyx and Mincom acquisitions in 2010 and 2011 respectively) and a top 3-5 player in measurement and analytics

(pressure, temperature, flow level, etc) including a leadership position in force measurement. In the discrete world, ABB is lagging peers such as Siemens, Rockwell or Schneider: it centrally monitors thousands of industrial robots but lacks a meaningful presence in discrete control systems (#8 in PLC with a 2% global market share, primarily centered around O&G, Mining and Pulp & Paper).

ABB has some of the largest installed bases in power grids, robotics and control systems. Plenty of companies can actually attach a sensor to a machine and transmit the data to the cloud. The real value is what you do with the data and how you turn the data into actionable information for customers. A large installed base is therefore essential to build domain expertise to understand how the data can best be used and analyzed.

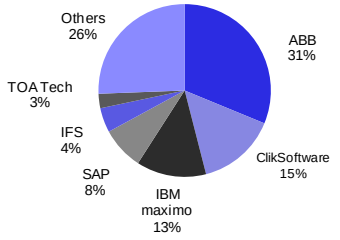
ABB had made select acquisitions over the last 5-7 years to build its software offering for the energy and mining sectors. The largest acquisition was that of Ventyx for $1bn in 2010, a software company specialized in grid load forecasting, network optimization and business analytics for utilities and grid operators. The integration of Ventyx has not gone smoothly with a massive reorganization and the shedding of many product families, which seem to have initially concerned many customers. However, we believe this has eventually been a big step toward the combination of IT and grid-side operations technology (OT) into a unified architecture for the smart grid. Of note, GTM Research's transformer monitoring report gave the ABB/Ventyx solution high marks against competitors, noting the breadth of the Ventyx IT portfolio and focus on providing a complete solution. Ventyx Asset Suite is however also often seen as one of the highest-cost EAM solutions to deploy and maintain and has still very limited presence outside of power generation and T&D.

Figure 32: Market share in EAM and workforce solutions in Power



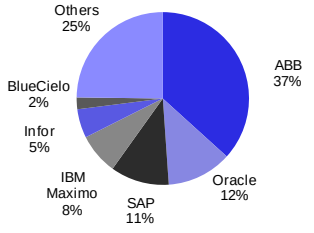
Source: Deutsche Bank, ARC Advisory Group, Global market Research, ABB

Figure 33: Market share in EAM and workforce solutions in T&D



Source: Deutsche Bank, ARC Advisory Group, Global market Research, ABB

Figure 34: Market share in EAM and workforce solutions in Mining



Source: Deutsche Bank, ARC Advisory Group, Global market Research, ABB

In theory, as the grid automation world leader, ABB should be well placed for a connected world. For decades ABB has helped utilities collect data for a deeper understanding of how to make their electricity grids safer and more reliable. We estimate that the group has today a best-in class IT/OT offering covering utilities. Most of what the Internet of Things proposes (connected devices responding to each other and to environmental changes) looks like very much modern grid automation systems. Indeed, many substation engineers are already used to collect and analyze information about the electrical network from Intelligent Electronic Devices (IEDs), Remote Terminal Units (RTUs) and Relays (which are all connected things). Using sensors, automation, 2-way communication systems, the smart grid enables a complete integration of all elements of the electricity system, from production to consumption, for the benefit of consumers, electricity producers and the

environment. It allows consumers to better control their electricity use and accommodates distributed energy resources and electric vehicle charging. We believe automation companies which have already been familiar to the grid automation world for many years (such as ABB, but also Siemens and Schneider) can use some of the lessons the grid taught them and will be better placed to navigate in the Industrial Internet world than Emerson, Rockwell or Yokogawa for example.

Launch of ABB Ability platform in October 2016

CEO estimates that ABB is a truly hidden digital champion, with 70 million connected devices through their control systems (including third-party devices). ABB's digital and software technologies has however been historically scattered across the organization.

Management therefore decided to launch a group-wide common platform, ABB AbilityTM, which will bring for the first time all the group's digital products and services under one roof (connected devices, control systems and cloud-based platform). In parallel, ABB also intends to bring all corporate brands under a single master ABB brand. Management estimate that it will increase customer loyalty and allow the group to better present its digital strategy. We note this move comes over 5 years later than at Schneider.

ABB intends to drive the Ability platform in a partnership approach, including a key partnership with Microsoft. Microsoft will bring intelligent cloud and B2B specific engineering teams that will work with ABB teams on vertical specific solutions. ABB brings domain and control room expertise. ABB and Microsoft have a long history of collaboration, and have delivered end-to-end solutions across several industries including Robotics, Smart Grids, Marine and Ports, and Electric Vehicle Charging Infrastructure. The two partners now want to take the partnership to a more comprehensive level. We however do not see this as a key differentiating factor since most automation vendors already have partnerships with Microsoft Azure (Rockwell, Schneider, etc).

Digital offerings provided by ABB Ability include: performance management solutions for asset-intensive industries; control systems for process industries; remote monitoring services for robots, motors and machinery; and control solutions for buildings, electric-vehicle charging networks and offshore platforms. Some of the more specialized offerings address energy management for data centers and navigation optimization for maritime shipping fleets, among many others. In March 2017, at its Customer World Forum in Houston, ABB showcased the following innovations:

- **ABB Ability System 800xA** – Select I/O, a new addition to System 800xA, is a redundant, Ethernet-based, single-channel I/O system. With Select I/O, customers can undertake major projects on a faster schedule with fewer cost overruns. It uses standardized cabinets that allow installers to digitally marshal signals instead of using labor-intensive marshalling panels. Loop checks can be done before the rest of the system is delivered, minimizing the impact of late changes and allowing for project tasks to be executed in parallel.
- **ABB Ability Asset Health Center** – Among the first ABB Ability solutions to be launched on Azure is ABB's next-generation asset performance management solution, Asset Health Center 3.0. uses predictive and prescriptive analytics and customized models to identify and prioritize

emerging maintenance needs based on probability of failure and asset criticality. This solution was launched on Azure in Jan. 2017.

- **ABB Ability Digital Substation** –This substation incorporates fiber optic current sensors and disconnecting circuit breakers to reduce maintenance requirements and the need for miles of conventional cabling. Thanks to digital sensors and cloud computing, grid operators can make decisions based on comprehensive, up-to-date information, while predictive algorithms can improve maintenance practices and asset management.
- **ABB Ability Smart Sensor** – This smart sensor solution was released in 2016. It connects low-voltage electric motors to the Industrial Internet, allowing them to be monitored continuously, transmitting data on vibration, temperature, loads and power consumption to the cloud. Alerts are generated as soon as any of the parameters deviates from the norm. This allows operators to prevent downtime and lost production, enable higher speed and better output, increase motor life by 40% and reduce energy consumption by 10%. ABB argues that applying such sensors across 300 million motors would generate energy savings equivalent to the output of 100 of the world's largest power plants.

Towards a more software-centric M&A approach?

ABB is likely to accelerate its M&A strategy and software could be part of it. ABB has already made a number of small purchases to shore up its presence in the smart grid area, including Insert Key Solutions (power plant control software), Epyon (EV charging start-up) and Powercorp (Australian distributed renewable integration). ABB has also invested in car charger company ECOtality, smart meter networking specialist Trilliant or cyber security provider Industrial Defender. In 2015, ABB has signed a MoU with Werum, the world's leading supplier of MES and manufacturing IT solutions for the global pharma and biotech industries (PAS-X software product is used in around 800 pharma and biotech installations worldwide).

We believe a larger move in software would be the next logical move. We believe ABB's discipline and strict financial acquisition criteria (Return >WACC by end of year 3) have probably refrained the group from embarking on more deals in recent years. That said, the recent appointment of a CDO and of a new CFO (coming from Nokia) could possibly change the M&A approach and speed of action. ABB could be eager to complement its strong process controls business with more capabilities in application software (design/planning/engineering and analytics/operation optimization).

Alternatively, ABB could show interest in GE Industrial Solutions ($3bn of sales in LV UPS and industrial control components). This is not a software asset but management wants to add early cycle activities to its portfolio and has already expressed interest in further building up its low voltage presence. ABB has only a small presence in UPS and discrete industrial control components (contactors, push buttons, relays, etc), so the acquisition would complement ABB's areas of strengths in discrete automation (robotics, motors & drives). Such a deal would add 9% of sales, 4% to EPS (+7% post synergies) and make the group more relevant in the low voltage and discrete automation markets while reducing its relative exposure to utilities and process industries. For more details, please refer to our note: 'GE Industrial Solutions for sale' (03/03/17).

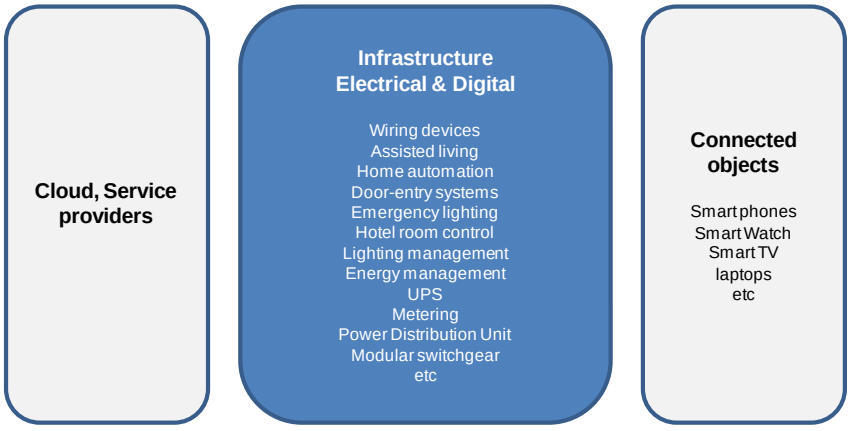
LEGRAND – focused on connected products

IIoT strategy centered around the Eliot program

Legrand has limited automation/software capabilities; nevertheless it should still benefit from the IIOT development. Legrand has over 2,000 people in R&D worldwide, including 750 in research on digital issues (electronics and software) to address energy efficiency, comfort, assisted living or security matters in buildings. Software costs represent half of total R&D costs.

Legrand estimates the Internet of Things market in the building sector will grow by more than 20% p.a. by 2020, as smart phone penetration, lower cost of sensors and almost ubiquitous free connectivity drive demand for connected and remotely controllable building-related products. Management estimates that the group can take a very active part in this transformation thanks to their unique position, between the cloud service providers and the proliferation of connected objects / user interfaces.

Figure 35: Electrical and digital infrastructure at the heart of IoT in buildings



Source: Deutsche Bank, Legrand

We believe that Legrand's digital transformation started in 1998 when the group took the decision to enter the digital infrastructure market with the acquisition of Ortronics. This has been followed more recently by the acquisitions of Raritan and Aegide.

In July 2015, Legrand decided to accelerate the roll-out of connected devices with the launch of a new program called Eliot. Eliot is an amalgamation of Electricity and IoT (Internet of Things). The aim of the program is to revitalise Legrand's offer and raise the number of the group's connectable product families to 40 by 2020 (out of its existing 83 families). Priorities are products that need maintenance, supervision or remote control and could therefore immediately benefit from being connected. In 2014, Legrand made sales of €200m with connectable devices. They already reached €400m in 2016 (9% of group sales) and management expect them to continue growing at a double digit rate by 2020.

Legrand has a key role to play

Legrand's legitimacy comes from the group's long-standing experience in buildings and extended distribution networks. Legrand has a strong brand image and electricians tend to be very reluctant to changes when it comes to their suppliers. Importantly, Legrand does not intend to enter the consumer electronics market and to sell massively through DIY or consumer electronics stores. As such, will not have to fight against consumer electronics giants. The group will continue to rely on its existing distribution networks, largely professional (distributors, electrical contractors, system integrators, specifiers), and only for certain ranges, will sell directly to end-users.

Legrand products have historically been characterized by their simplicity and their ease of use. These values are part of the group's DNA and are one of the many reasons behind the group's commercial success. Similarly, we would expect Legrand connected devices to remain very intuitive. Legrand expects connectivity to make its offering even more attractive for both end-users and installers: connected products help electricians reduce installation time; facility managers can control installation remotely and reduce maintenance costs; end-users can achieve energy savings, etc. CEO Gilles Schnepp recently highlighted that, when they are launching a new product, the adoption of connected products seems to grow faster than with traditional products.

Legrand is already a leading player in buildings' digital infrastructures. These digital infrastructures (based on VDI – voice data image - equipment) will need to be further developed to accommodate the growing number of connected devices and the increasing complexity of flow data going into buildings. Legrand already derives around 16% of sales from VDI equipment.

The sale of connected products creates a better mix and participates in the trading up of Legrand's products. Connected or digital products typically sell at a higher price than non-connected or analog solutions. The difference can be up to 30% or more, for example in the case of an IP access control system versus a traditional door entry system. For a power breaker, the pricing difference should however be marginal (a few %) because the breaker itself is the main function of the product. Overall, profitability remains a function of market share and is not related to whether products are connected or not connected.

The new features and different application uses of connected products tend to generate positive traction on overall demand. A customer would not necessarily switch from a black and white audio entry phone to a color entry phone but could be potentially tempted to buy a connected entry door solution. For the time being, pricing does not seem to be an issue: the basic functionalities of products remain the same, and the new costs of adding connectivity features are passed on to the market relatively easily: it is only a small part of the products and is generally more than offset by the higher value add.

Interoperability and openness are key success factors. Legrand's home automation solutions (My Home) used to communicate with a proprietary protocol and have failed to really get traction in the past. Legrand has shifted gears and now promotes "open languages" (like Zigbee), capable of integrating and communicating with as many third-party systems as possible,

in order to accelerate innovation and the deployment of the Internet of Things in buildings. For example, in October 2015, Legrand announced that it will develop connected products for the home that use The Nest Weave Communication Protocol. Legrand estimates that there will not be one dominant protocol or ecosystem in buildings and that the key success factor is the ability to work with various technologies, protocols and to work the interoperability at all levels.

IIoT transition is not without risk – execution is key

There are many new players entering the connected things market. Companies like Legrand or Schneider have commercialized home automation solutions for years but have had limited uptake from customers in the prior decade. With the arrival of IT giants like Google and Apple, home automation offerings are likely to become more democratized. Interest in such offerings was clearly revived following the acquisition of smart thermostat and smoke alarms manufacturer Nest by Google in February 2014 for $3.2bn. Apple has launched the HomeKit offering. There are also plenty of start-ups offering connected home products such as cameras, smoke alarms, security sirens, etc which can be sold directly to consumers. For more ambitious products which are sold to professionals, Legrand's distribution network remains a key competitive advantage.

Many companies are building hubs to centralize the various functionalities of all connected objects in a building. Such hubs have to be simple, more or less open and overcome current silos so that everything can be managed from a single central cockpit. There is already plentiful of various offerings, ranging from Legrand's My Home and the facility management systems of Schneider and ABB to Samsung's SmartThings, Apple's HomeKit and Google Nest network. Many construction and real estate companies (e.g., Bouygues Construction Energy Pass) and telecom companies (e.g., SFR's Home and Orange's Smart Home in France) are also entering the scene as they intend to capture a higher share of the value in buildings.

A key risk is that decision-making software will gradually replace the equipment at the heart of the system. In the future, home system providers could provide the equipment for nearly free, making the bulk of their value add and profit pool from service. We believe this could lead to some form of commoditization of the equipment.

GE: a cloud platform for infrastructure markets

Aiming to become a top10 software company

In recent years, GE has been very vocal about the digital opportunity for manufacturing companies. GE's digital project started in 2011, with the thinking that the industrial world and the digital world were increasingly colliding, and since then GE has heavily invested in its digital platform.

GE is developing an ecosystem around its Predix platform: the group claims to have around 22,000 developers building on Predix (expected to rise to 35,000+ in 2017) and 400 partners signed up for the platform in 2016. The aim is to extend their capabilities geographically and into new verticals in order to provide thousands of applications generating value for customers.

In 2016, GE derived $5bn of orders from its portfolio of digital service and software solutions, including $400m of Predix-powered orders. We however estimate that much of the $5bn is non-software per se but primarily relates to APM.

Building the #1 industrial operating system and cloud platform

GE wants to become the #1 industrial cloud platform. The aim is to repeat the success of Facebook, Google, IBM or Amazon in consumer and enterprise clouds to the industrial area. GE primarily targets the infrastructure sector (where it holds a large installed base) and intends to become the world's largest cloud solution designed specifically for industrial data analytics. GE forecast that more than 50 billion machines will be connected to the internet and that the equipment it installed will produce one billion gigabytes of data every day by 2020.

According to a survey conducted by the Internet of Things Institute, GE ranks #9 among the top 20 most important and influential companies in the IoT industry, behind IT companies such as Google, Cisco or Amazon or other industrial companies such as Siemens (#7). Other industrial companies mentioned are Honeywell (#11), Rockwell Automation (#13) and Schneider (#14).

Just like what Apple's IoS did for cell phones, GE wants to make Predix the operating system for the industrial internet. In the consumer domain, the success of the Apple iPhone has been accompanied by the development of the App Store offering millions of apps for nearly every function possible. GE's vision is that Predix operating system could lead to a similar App Store in the industrial sector. This is still early days and we believe that GE has had to do much of the developing for the time being. Predix generated around $50m of revenue in 2016 but GE expects to grow this number to $4bn by 2020.

Aiming to provide a virtual twin of every physical asset to improve Asset Performance Management capabilities

All data describing a turbine or a train can be sent to a Predix application that creates a digital twin of that particular machine or equipment. This would allow engineer to test products before they are built and feed the virtual model with data from the real world to improve performance of the equipment. Unlike Siemens, which has strong PLM capabilities in-house, GE's design capabilities essentially come from a partnership with PTC.

We believe GE aims to make Predix the platform that would digitally map the industrial asset network, including the entire landscape of wind farms or electrical grids for example, replicating what Facebook did for social networks or Linkedin for professional network.

Asset Performance Management (APM) is GE's main application. GE sees the digital industrial twin as the next evolution in the enhancement of their services franchise. Digital twins can be used to predict failures and optimize performance since they can be analyzed in the cloud, based on the system-wide view that Predix enables, including data collected from all other assets and with advanced analytics that are not possible to run at the factory level.

As of today, GE Digital Services are primarily comprised of upgrade contracts such as AGP (Advanced Gas Path) with utilities to enhance the value of customized service agreements. In addition to upgrade service agreements, GE is hoping to develop other business models, including:

- hosting applications developed by a customer (jointly or not) on which GE would take a share of the revenue generated.
- licenses: GE can sell traditional software on a subscription basis. They can also sell customers specific outcome, and based on their ability to deliver on the outcome, take a share of the value delivered.
- Platform as a service (PaaS), based on the Predix operating system.

Main weakness: lack of control/automation expertise

Unlike other automation players mentioned in this report, GE is hardly active in the control room, with only a small presence in discrete controls (PLCs). Predix is not building the automation/control systems but needs to communicate with these systems, for which security, reliability, robustness and latency are very important. In theory, GE is not fully equipped to act in real-time and influence directly the operations and the uptime speed of their customers. Some would even argue that, to some extent, they can only sell the insights on data more like a study made by a consultant.

ROCKWELL: openness and scalability

The Connected Enterprise defines Rockwell's IIoT strategy

Rockwell automation is a $5.9bn sales company with 22,000 employees. As such, the group is much smaller than the other industrial companies we mentioned in this report. In turn, it is the only one that focuses on automation and controls. Rockwell's strategy relies upon the Connected Enterprise concept, essentially the ability to provide customers greater productivity from integrated control and information by leveraging technologies such as mobility, data analytics and cloud computing.

69% of Rockwell revenue comes from products but the group estimates that all their value add today is in software or firmware. Hardware is still important, but software is where the most important changes are happening. Rockwell claims that data is a natural by-product of plant floor control processes and that 70% of sales include software or digital technologies. Pure vertical software revenue however probably accounts for around 8% of group sales.

To Rockwell's credit, the company has invested heavily over the years in network security product offerings and educational resources (the company has added a team of network and security consultants over the past 5 years) to enhance customers' comfort toward Connected Enterprise investments (connectivity, Cloud, data analytics, etc.) Rockwell expects to achieve double-digit growth in Information Solutions and Connected Services.

Implementing a more intelligent OT/IT network

Rockwell Automation believes that the IIoT is essentially about harnessing data and domain knowledge of operational processes and technology.

A common control platform for various applications

Rockwell is a strong #2 player in discrete control systems (PLC) behind Siemens, with a market share of over 20%. The group has also developed a multidiscipline approach, enabling the group to have a share of the DCS market (c.4%). Rockwell also claims to have a leading market position in safety automation and the fastest-growing pharma MES solution.

Rockwell estimates that they offer some natural simplification in that they have a common control platform for a variety of applications, ranging from blending (continuous) to packaging (discrete). Rockwell claims to have the only scalable and multidiscipline control platform with Logix (including a modern DCS). For example, this enables to have the same maintenance workers working on both the discrete and continuous sections of the automation system.

Rockwell believes that, in order to drive real-time actions, a lot of data analytics have to be implemented within the controller or in a server within the factory floor environment, giving a natural edge to automation providers. We agree with this view. Rockwell is open to working with cloud partners, including Predix, if some specific applications require cloud-based analytics. In this respect, Predix is more into the infrastructure world (aircrafts, gas turbines, etc) and generally not in direct competition with Rockwell.

Strong domain expertise

The automation industry is not a plug-and-play world. Domain know-how is therefore essential to identify sources of productivity and implement fully effective solutions. We believe Rockwell's vast installed base on the plant floor and domain expertise in discrete industries should allow the company to capture at least its fair share in the growing IoT market over time, at least in the US, where it holds an undisputed leadership in control systems.

Using an open and scalable approach, with a partnership strategy

Like Schneider, Rockwell is well positioned due to its unmodified Ethernet IP infrastructure, which allows manufacturing data to be readily transmitted from controller to the cloud, without requiring all sorts of gateways to go from one proprietary network to another. The use of one open standard like the Ethernet also allows Rockwell's customers to use a large number of third-party tools for applications such as PLM, CAD or supply chain optimization.

Rockwell's operations tend to be very focused on its key areas of expertise. The group sells 70% of its revenue through distributors. It also uses a number of key strategic partners, such as Cisco, Microsoft and Panduit, to leverage their expertise to the IT side of the equation and establish an efficient OT/IT bridge for their customers. Rockwell is not trying to do it all; the group would be fine to only provide the products and the controllers enabling the data flow but they also think that more and more clients will look to them to take a leadership role at a higher level value, due to their domain expertise in some specific verticals.

FactoryTalk portfolio of software

Like all automation providers, Rockwell has been delivering factory floor software for 30 years and is already recognized as a leading industrial software player in the US. Over the last 8 years, Rockwell's investments in R&D has grown at a CAGR of >6%, primarily in software-related disciplines. 60% of the group's development engineers are software engineers.

Beyond the well-known Allen-Bradley PLC range and ICS Triplex offering, Rockwell sells its software offerings (HMI, MES, Historian, etc) primarily under the FactoryTalk brand name. One of the latest additions to the FactoryTalk portfolio was FactoryTalk TeamONE, a collaborative mobile app, developed in collaboration with Microsoft to improve team productivity by offering near-time incident and device data and enabling users from the plant floor, engineering and IT departments to collaborate and share knowledge to quickly solve problems.

EMERSON: integrated IIoT portfolio for process industries

Emerson has a very different customer profile from Rockwell, almost the opposite, having strength in Oil & Gas and Process Industries. Emerson is a leading process automation player, with strong positions in DCS (#4-5 globally) and valves/actuators.

Pervasive sensing approach

We believe that one of Emerson's differentiating factors versus automation peers is its sizeable sensor/actuator offering. Thanks to the lower costs of computing and wireless technologies, sensors are no longer expensive to buy, install and maintain. Emerson estimates over the next 10 years, the pervasive sensing market will more than double the existing $16bn traditional measurement market, as it extends to a number of industries and areas where installing additional sensors has traditionally been physically difficult, expensive or technically challenging (oil and gas, refining, chemical, power, mining, etc). Pervasive sensing can provide improvements in process and worker safety, regulatory compliance, equipment reliability and energy efficiency. Emerson supplies sensors to monitor temperature, pressure, valve position, corrosion, erosion. In particular, wireless sensors are used in gas leak detection and for flame and smoke detection.

Merging Process Management and Industrial Automation

Emerson cooperates with Microsoft to send plant data from its control systems (DeltaV and Ovation) to the Azure IoT suite. Emerson then provides the data analysis to improve plant performance and maintenance. We believe that one of the (many) reasons behind the merger of Emerson's former Process Management and Industrial Automation divisions was to extend the group's IIOT services and potential to more areas such as power supplies and discrete manufacturing.

The Plantweb digital ecosystem

In October 2016, Emerson launched its Plantweb digital ecosystem, a portfolio of standards-based hardware, software and services for implementing the IIoT. In essence, Emerson tries to capitalize on the success of its advanced process control and safety architecture, Plantweb (launched in 1997) to move its offering to an upper level The new ecosystem ranges from process control, safety and asset management solutions to new offerings such as agnostic software applications for monitoring asset health (irrespective of the legacy DCS), performance modeling and facility-wide energy optimization. Like many other automation providers (Rockwell, ABB, Schneider, etc), Emerson chose Microsoft Azure IoT suite to expand Plantweb digital ecosystem to the cloud environment.

HEXAGON: integrating sensors and software

Hexagon's overall strategy centers on the feedback loop between sensor-based/optical inspection and measurement of physical products/objects and their virtual/software counterparts (see Figure 36). In practice, this manifests itself in two largely distinct business units- Geospatial Enterprise Solutions (GES) and Industrial Enterprise Solutions (IES), each approximately 50% of company revenues. GES is overwhelmingly focused on the Construction market, and is the less IT-intensive part of Hexagon's business, so in practice it is the company's IES unit that is most relevant from an IIoT perspective.

Figure 36: Heaxgon's positioning

Source: Hexagon

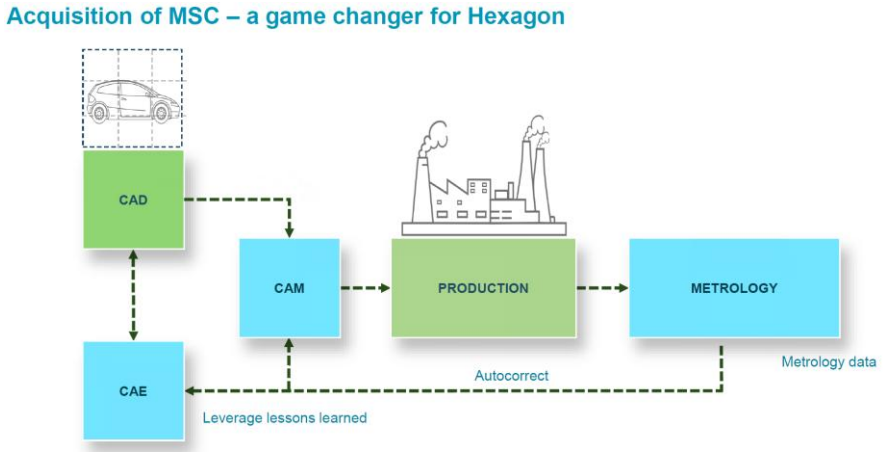
We believe that in its IES business unit, Hexagon fulfills many of the criteria we have identified as key indicators of success in IIoT i.e.

- Large installed base: the company's Metrology solutions are used in the production of 90% of commercial aircraft, 85% of smartphones and ~75% of cars produced annually.
- Automation & Control expertise: the company stresses that most of the value of its products are in the embedded/system software elements, for example its Metrology Management Solution (MMS) and 360 SIMS Automotive sector solution.
- Digital platform: Hexagon acquired the market leading plant design and operation software vendor Intergraph in 2010, and its flagship

SmartPlant product forms the basis of Hexagon's IIoT software platform (and is a ca. €1bn pure software business). This has been followed by further acquisitions such as Vero (CAD-CAM), Ecosys (project lifecycle mgmt) and MSC Software (Simulation).

That said, we do not claim that Hexagon is the "finished article" in IIoT-SmartPlant at present is largely a domain-specific Oil&Gas/process industry product, rather than a general IIoT platform. The company's assets within Metrology, Simulation and CAD-CAM have the potential to form the basis of a factory-floor IIoT platform in discrete manufacturing industries (the company has spoken of a "Smart Factory ambition), but at present are largely standalone solutions (see Figure 37). The company has a play on connected products (notably autonomous vehicles) via its GES sensor/optical portfolio, but has essentially no exposure to supply chain optimization.

Figure 37: Hexagon "Smart Factory" assets



Source: Hexagon

Like many of the companies discussed in this report, Hexagon's challenge over the coming years will be to evolve its offerings from domain-specific point solutions to a more comprehensive platform (we foresee 3 separate platforms in process manufacturing, discrete manufacturing & construction), while determining where to develop differentiating IP, and where to partner and drive interoperability.

DASSAULT SYSTEMES: leading PLM platform

Dassault Systemes (DSY) is the largest CAD/ PLM pure play (software) vendor, with its ENOVIA PLM solution (11% FY16 revenues) competing directly with Siemens' TeamCenter, as well as products from software peers like PTC, ORCL and SAP.

Through its PLM platform (i.e., CAD, PLM and Simulation software), DSY is levered to the themes of faster innovation/shorter time to market and longer term, the Digital Twin concept. Industry experts and Chief Information Officers (CIOs) we speak to in major Engineering firms consistently describe DSY's PLM platform as market-leading.

Figure 38: DSY's ENOVIA PLM Solution

Source: Dassault Systemes

DSY has made a number of targeted acquisitions in the MES/supply chain space in recent years, namely Quintiq (SCM & operations management), Apriso (manufacturing operations management) and most recently Ortems (production planning and scheduling) and continues to look for strategic opportunities to deploy its balance sheet (EUR 1.5bn net cash FY16).

That said, we believe DSY has relatively modest exposure to the near-term focus areas of IIoT:

- Factory floor/MES/supply chain are critical elements of IIoT, but are only addressed by a small minority of DSY's product set: we estimate Delmia (manufacturing operations/MES) only represents ~10% of group revenues.
- DSY lacks an IoT/data management platform comparable to GE's Predix, PTC Thingworx or Siemens Mindsphere.

We are also concerned that changing R&D priorities in DSY's major Automotive & Aerospace verticals (~50% of total revenue) are resulting in a relative deprioritization of traditional CAD/PLM, in favour of e.g., connected vehicles in Auto's, which focuses on sensors and in-vehicle software, rather

than chassis and engine design. Even Electric Vehicles, another key innovation area, can largely be designed using existing CAD/PLM tools, per our checks.

We believe DSY is yet to articulate a compelling end-to-end vision around IIoT, and instead appear more focused on expanding into adjacent industries such as CPG and Energy with their existing product set. Installed base customers have flagged that the latest version of DSY's PLM platform- V6- is difficult to integrate even with third party design & simulation tools, let alone IIoT systems originating more in the shop floor/supply chain.

Main technological pillars of the Industrial Internet

Many of the technologies that form the foundation for the Industrial Internet are already used in manufacturing. However, they are generally used in isolation and not widespread across the entire production process. The benefits of the Internet of Things are not really dependent on some future technology development; it is more a matter of smartly applying the technologies available today such as sensors, controllers, cloud storage, data analytics and industrial software tools. Only standards need to be worked on.

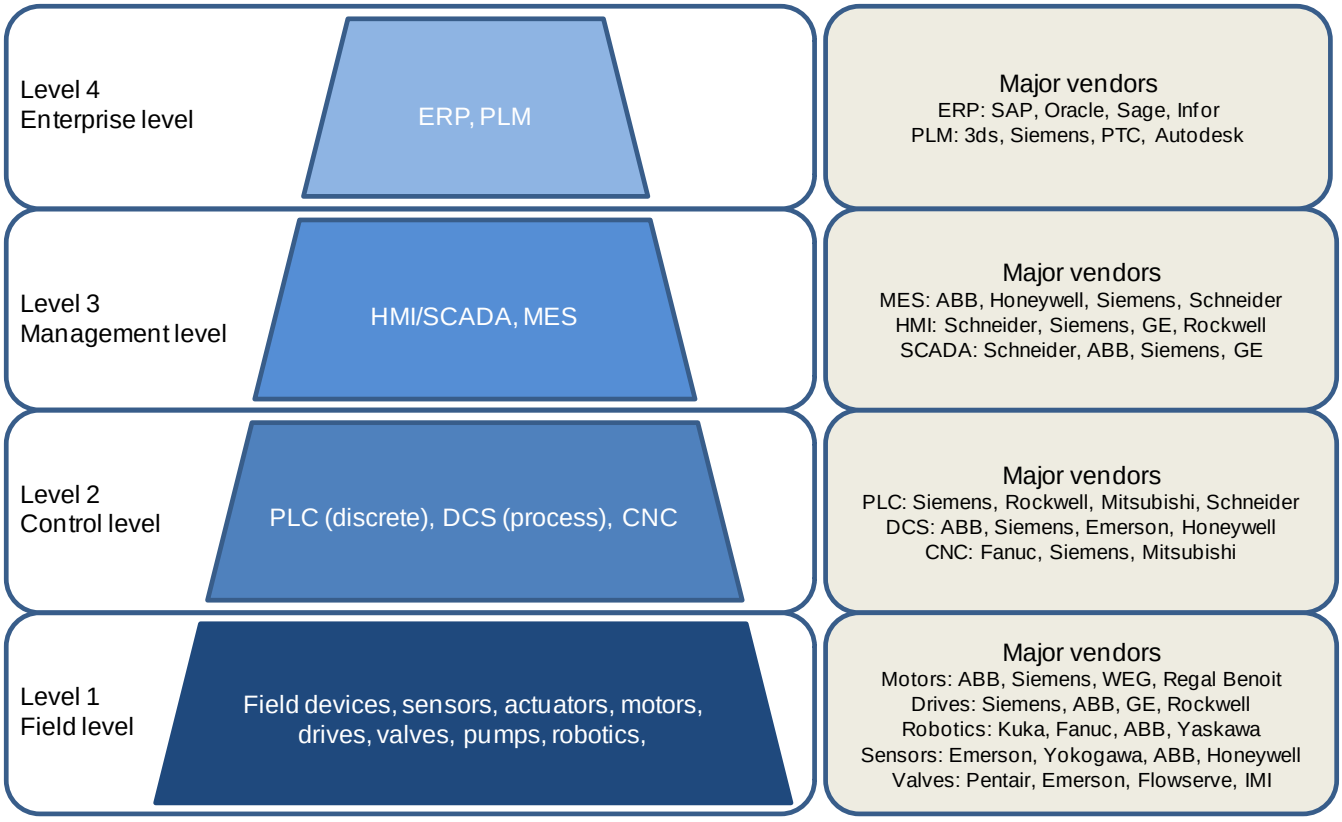
It will not be a technical revolution but most experts think it will be an organizational revolution: the availability of all information coming from all parts of the value chain in real time will lead to a new level of control over the entire life cycle of products, and it will allow increasingly individualized customer requirements.

Automation basics

The different instances in Automation are generally shown in a pyramid describing the different levels in a factory, where each level controls the level beneath and reports data to the level above.

- **Level 1.** The sensors and actuators are located at the bottom level. This level is called field level and is controlled by Programmable Logic Controllers (PLC) or Distributed Control Systems (DCS) in the control level.
- **Level 2.** In the control level, PLC and/or DCS run programs that control the sensors and actuators. Fieldbuses typically connect devices in this level but Industrial Ethernet now tries to replace fieldbuses. The data collected is then transferred to the management level.
- **Level 3.** In the management level, Manufacturing execution systems (MES) and supervisory control and data acquisition (SCADA) systems collect information about the production and allow the generation of schedules derived from the enterprise level.
- **Level 4.** The enterprise level includes enterprise resource planning (ERP) systems that focus on the company and the resources of it. Level 4 systems also include Product Lifecycle Management (PLM) and Customer Relationship Management (CRM) systems.

Figure 39: The automation layers



Source: Deutsche Bank

Sensors/actuators

Sensors are critical to the Internet of Things as they provide the data that algorithms will analyze. Sensors are generally used to monitor pressure, temperature, density, humidity, flow rate and motion. They are typically associated with process industries but discrete sensors can also be used to monitor position and proximity for example. The instrumentation market is fragmented globally. Honeywell, Emerson, Yokogawa, ABB are the largest global players. Endress+Hauser and Krohne are also strong niche players in sensors. Unlike Rockwell which partners with Endress+Hauser, Siemens and Schneider/Invensys have also developed their own ranges of transmitters and positioners.

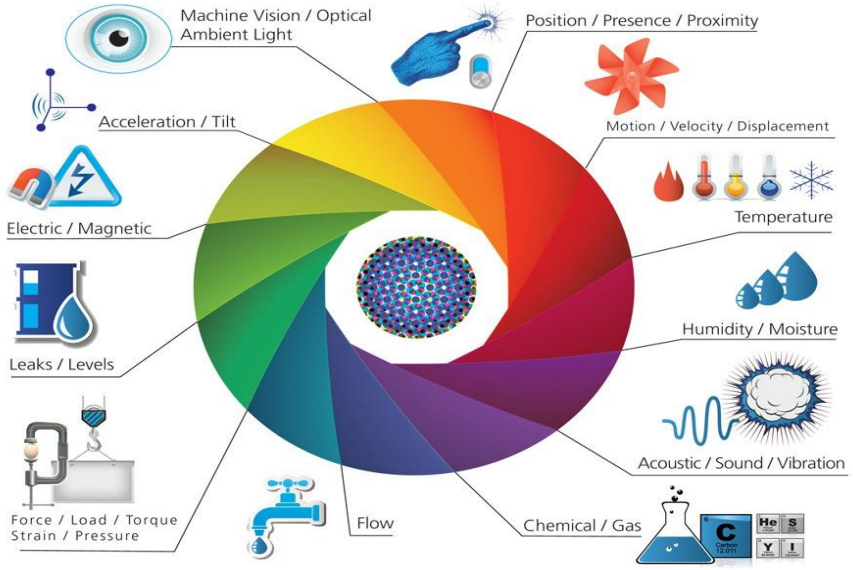
Today, only some of a manufacturer's sensors and machines are networked and make use of embedded computing. As seen previously, they are typically organized in a vertical automation pyramid in which they feed into an overarching process control system. A lot of data coming from sensors and actuators is not used today since not needed for control.

But thanks to the development of wireless technologies and advanced computing, the cost of equipping and monitoring machines with sensors has sharply declined. In some cases sensor costs have declined by as much as 100X over the past decade. Sensors that can work 10 years while transmitting data over wireless networks are reaching industrialization. Their lifetime cost is up to 10 times lower than classical wired sensors. Sensors are also becoming

more and more intelligent, more relevant, more precise and are gaining in autonomy. More sensors but also more devices, including even unfinished products, will be enriched with embedded computing and connected using standard technologies to process data in real time.

Sensors and actuators are key enablers of the Industrial Internet. With embedded computing, field devices gain in autonomy and can communicate and interact both with one another and with controllers, as necessary. It decentralizes analytics and decision making, enabling real-time responses. Sensors also help operators switch from preventive maintenance to predictive maintenance. The former's logic is calendar, irrespective of the real usage of the machine. For example, every 6 months, a checking process is performed. In contrast, predictive maintenance is based on the actual conditions of use. This requires instrumentation and a higher number of sensors.

Figure 40: Sensors can measure everything from temperature to pressure changes



Source: Postscape, Harbor Researchs

Emerson explains that pervasive sensing is the use of sensors to capture data on anything in a plant that could affect its operations. Emerson estimates over the next 10 years, the pervasive sensing market will more than double the existing $16bn traditional measurement market, as it extends automation companies' focus beyond traditional process control and safety systems to address applications such as site safety, security, reliability, and energy efficiency in a number of industries where installing additional sensors has traditionally been physically difficult, expensive or technically challenging (oil and gas, refining, chemical, power, mining, etc). In a press release, Emerson took the example of an Eastern European oil processing plant which decided to deploy a full wireless infrastructure to allow the addition of 12,000 sensing instruments in order to better detect energy losses, equipment corrosion and safety releases. It is 60% beyond the base of traditional process measurements.

Controllers

Above the instrumentation level sits the controllers level. For discrete automation, control systems tend to be based on Programmable Logic Controllers (PLC) while for process automation, they tend to use a Distributed Control Systems (DCS). DCS and PLCs are seen as the "brains" locally controlling the manufacturing process (via the control of millions of I/Os) and capable of communicating with operators (via HMI devices). A key aspect of the controller is the IDE (Integrated Development Environment) which provides access to vast libraries of reusable software code. Over time, programmers get familiar programming in a particular IDE and tend to be reluctant to switch suppliers for this reason. All leading PLC manufacturers supply PLC programming software.

We believe that controllers are key enablers of Industry 4.0. Thanks to their embedded computing, controllers are gaining in decision-making autonomy. They are continuously evolving with greater programming flexibility, more memory, smaller sizes, very high speed Ethernet and wireless capabilities. Sensors of smart factories will report both to the cloud and to the PLC simultaneously. This will enable to maintain high reliability and robustness on the factory floor, while enabling data to be analyzed for preventive maintenance and optimal performance within the scope of the entire manufacturing process.

PLCs are small industrial computer used to automate electronic and mechanical processes in discrete industries. PLCs have been around for 50 years. They can typically be used in hostile environments, with humidity, dust, varying temperatures, vibration and electromagnetic interferences. A PLC receives information through sensors and switches, evaluate the data via algorithms and sends outputs to control machines and industrial robots on the plant floor. Siemens is the largest player with a global market share in excess of 30%, followed by Rockwell (the undisputed leader in the US), Mitsubishi (leader in Japan) and Schneider. Other players include Omron (6%), B&R (4%) and GE (3%). ABB only has a small presence in the field (#8 player with an estimated 2% global share). In general, Siemens has always been the technology leader doing the most complex applications and consistently developing new and innovative PLC products. Rockwell Allen Bradley has always been viewed in the US as the benchmark for easy to use software, probably reflecting its strong market share and brand recognition. We believe Schneider Modicon is also perceived as a plug and play easy-to-install solution in Europe.

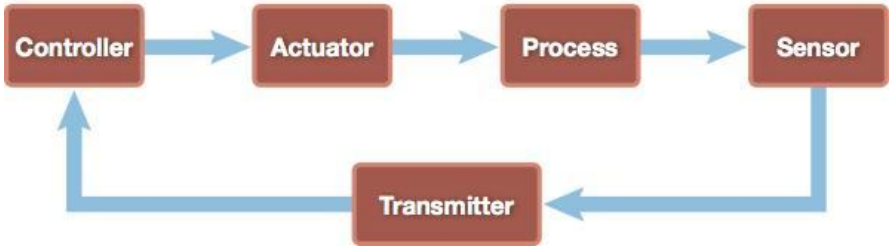
DCS are the control systems used to control the production process in continuous process industries by receiving inputs from sensors spread throughout the plant, executing algorithms, sending outputs to actuators and valves to control the flow of material throughout the process. ABB is the largest player with a global market share of 21%, followed by Siemens, Honeywell and Emerson. Rockwell and Schneider have also recently joined the field, organically for the former and through the acquisition of Invensys for the latter. Compared to PLCs, DCSs tend to be more sophisticated systems that control and coordinate the entire operations of a plant, rather than one specific application that a PLC may address. A typical client might purchase one or two DCS over the course of the year and spend about $200-300,000 in doing so, while a typical PLC customer would buy on average 50 units and spend

$40,000 in doing so. Of note, PLCs are becoming more sophisticated and are now efficiently competing with DCS in numerous hybrid industries and certain process industries; in this respect, Rockwell's Logix system has achieved notable success in recent years.

In the Industrial Internet world, controllers will likely continue to be major block of the system, even if more sensors and machines (and even sometimes products equipped with RFID tags) will be able to interact together. The deployment of controllers is modular and scalable and they continue to gain in intelligence and communication capabilities. Moreover, the use of PLCs is generally much more cost effective than if one had to equip each product with intelligent sensors.

On the factory floor, the most known tool of the control engineering profession is the feedback loop, as shown in the graphic below.

Figure 41: Feedback loop control



Source: Deutsche Bank

A feedback loop consists of 4 key elements:

- A sensor that measures the condition of the process
- a transmitter that converts the measurement into an electronic signal
- a controller that reads the transmitter's signal and takes decision upon the current state of the process
- an actuator that applies a corrective effort to the process based on the controller's instructions.

Convergence between IT and OT

Today, HR, accounting and sales processes are generally managed by IT systems. Many industrial processes (production planning, production, commissioning, etc) are also already supported by software. However, these systems have until now been mostly developed in a stand-alone environment and a large part of the data generated is unfiltered and comes with no meaning or is only used by a limited part of the company: the user of the data is mostly the department that generated it.

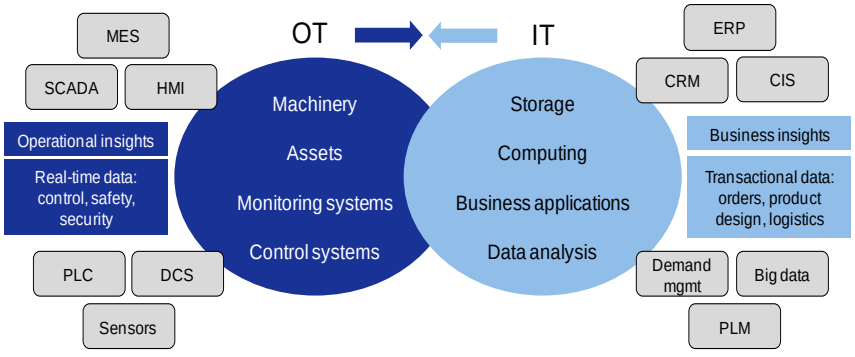
There are many industrial software acronyms (PLM, MES, SCM, EAM, APC, SCADA, etc) each one representing a sub-process. This list does not even take into account the other sub-systems (field trials, fault testing, simulation and

analysis used for specific purposes during the product creation or production operations). The interfaces between the different software tools are generally difficult to maintain and update, and can be subject to errors.

Only the seamless integration of data across the entire value chain could ensure industrial companies' efficiency and productivity. This is a major subject of Industry 4.0: the data will only be utilized to its full extent when the entire company and to some extent its customers can access it. The use and analysis of production data, customer data, energy prices, installed base information, logistics costs, weather information in a fully integrated and coordinated manner can help optimize plant productivity, plant availability, environmental impact, resource and energy efficiency.

There is an increasing convergence between Information Technology (IT) and Operational Technology (OT). In recent years, many industrial companies have been surfing on the IT/OT convergence, which has led to a number of software acquisitions. Industrial companies are now increasingly looking beyond OT (operational management, control & protection) into IT (business optimization & planning) to assessing the financial contribution of assets. The end-game is to provide complete control and enterprise IT solutions from one single provider.

Figure 42: OT and IT worlds now colliding



Source: Deutsche Bank

IT and OT had historically evolved differently, with different departments within companies. The barriers between the different software are now blurring as the rise of communication technologies such as Ethernet is leading to a common language between the IT and OT worlds. Over time, the various software bricks will likely converge to form a unique suite.

IoT success is dependent on IT and OT finding a way to work together, and on all the proprietary protocols that exist in the OT world to be converted to IP. The process has already started in select verticals such as rail transportation, oil & gas and utilities. So far, most industrial companies have struggled with the integration of some of their recent software company acquisitions (e.g., Schneider with Telvent, or ABB with Ventyx). Combining IT and OT capabilities and cultures is a difficult task to handle. There is generally a lack of understanding from IT of the specific controls needs in the factory floor and from operations of the needs to regularly upgrade the systems and collect data out of them. IT people are generally young and they are not fully aware of the legacy issues: it might be for example difficult to change a computer because

some Siemens or Schneider older software would not run on the new platform. IT people are all about upgrading and finding way to communicate with equipment. OT people tend focus on reliability and to use the same technologies as far as they work.

Operation Technologies (OT)

Operation Technologies are software applications that deal with the physical transformation of products. They view the world with a bottom up perspective. They are task-specific systems, generally customized for industries and considered mission-critical. They are often based on vendor-specific, proprietary technologies and operate in a near real-time environment. Operational Technology applications can include, among others, MES, SCADA and HMI solutions.

SCADA (Supervisory Control and Data Acquisition)

SCADA systems are computer-based systems that monitor and control industrial processes in (near)-real time. SCADA distinguish themselves from other control systems such as DCSs by being primarily large-scale systems that include several manufacturing sites, potentially spread out over large areas. That said, differences between DCS and SCADA are blurring. A SCADA generally consists of RTUs (Remote Terminal units) or PLCs (more sophisticated embedded control capabilities than RTUs) that convert sensor signals to digital data. Data is then compiled and formatted so that a control room operator can make supervisory decisions (using the graphics of an HMI panel) to adjust PLC controls (for example change the set points for the motor speed that the PLC is supposed to control). We estimate the SCADA software market is worth around €2bn. Key end-markets include the Oil & Gas, Energy and Water & Wastewater segments. Major players are Siemens, ABB, Schneider, Rockwell, Emerson, GE, Honeywell, Iconics, etc.

HMI (Human Machine Interface)

HMIs are display units on the factory floor that enable operators to visualize a manufacturing process, providing diagnostic or logistics information graphically. We estimate the HMI hardware/software solutions market to be around €2bn. HMI vendors include Schneider, Siemens, GE, Rockwell, Interlink Electronics, Panasonic, B-Scada, Elektrobit, Advantech, etc.

HMI SCADA software is another key layer of the industrial internet of things. Yet, many of the traditional companies are not pursuing it as actively as in the past as they spend more time on somewhat "higher end" software—business intelligence and analytics.

MES (Manufacturing Execution System)

MES helps manage and enhance the performance of manufacturing processes on a production floor. The MES was actually created to do the interface between the automation control systems (SCADA, PLC or DCS) and the planning systems (ERP), and, as a result, was a way of doing IoT ahead of its time. Although DCS and ERP systems help manage manufacturing performance, neither of these systems can optimize what is produced, how it is produced or where it is produced:

- ERP systems can only record what is produced in operations.

- DCS are only able to control and monitor processes based on fixed sets of parameters and cannot dynamically react to changes in the manufacturing process unless instructed by end users.

- MES and other process optimization software therefore address the gap between DCS and ERP systems. They focus on the design and optimization of the manufacturing process; how the process is run and the economics of the process. Basically, the MES send to PLCs and DCS the commands to execute

production orders coming from the production planning software (ERP). It also tracks record of raw materials, production, maintenance, quality, and labor operations on a near-real time basis. The data from the production level (PLC and DCS) is then communicated to ERPs to further improve business processes.

We believe the MES market is worth around €5bn and should continue to grow at a faster pace than other automation-related segments. The automotive sector has historically accounted for a large share of the MES market but the development of cloud-based MES is now supporting its adoption in more and more industries. Manufacturing sites are unique and differ from each other even those producing similar products, which probably explains why there is no clear leader in the MES market. The market is extremely fragmented, as each MES solution has to be customized for any manufacturer. Major players include ABB, Honeywell, Schneider, Siemens, Rockwell, Dassault Systemes (Apriso), GE, Emerson, SAP, AspenTech, Andea Solutions and Werum IT Solutions.

A MES for automotive manufacturing must execute very complex processes in terms of automation and product variance, and do so at high speed. Siemens has extensive experience in MES for power train manufacturing. Aerospace and heavy equipment manufacturing have also much in common with automotive. However, since product does not typically move through the factory, a different type of MES is required.

There are many other specific Operations Management software tools for real-time optimization of manufacturing processes. For example, in electrical grids, Energy Management Systems (EMS) are used to manage and control transmission systems while Distribution Management Systems (DMS) are used to manage and control distribution networks (Fault Location, Isolation and Restoration, Vol/Var Optimization, etc).

Information technologies (IT)

Information Technologies (IT) are mostly software applications for commercial decision making, planning and resource allocation. They view the world with a top down approach, focusing on the business, operations and enterprise information systems required to operate and support a given business. They cover corporate functions like Finance, HR, Supply Chain, Order Management, Sales, etc. These functions and their processes tend to have commonality across industries. They generally use well established IT standards and are used in a time frame of hours to months. Information Technology applications can include, among others, ERP, EAM, CRM, PLM, etc.

Enterprise Resource Planning - ERP

ERP are used for managing financial and human resources, materials and assets. The ERP market is highly consolidated, controlled by a handful of players. Industrial companies generally do not participate in this field.

Enterprise Asset Management - EAM

EAM solutions include software such as SCM tools (Supply Chain Management), Warehouse Management (WMS) and Mobile Workforce Management (MWFM, for managing mobile field crews, mapping, work scheduling and optimization). EAM tools have historically been offered by IT specialists such as IBM Maximo, SAP, Oracle or Infor but we have seen some automation companies being increasingly active in this pace. Of note, ABB acquired Ventyx in 2010 in the energy segment and Mincon in 2011 in the mining segment.

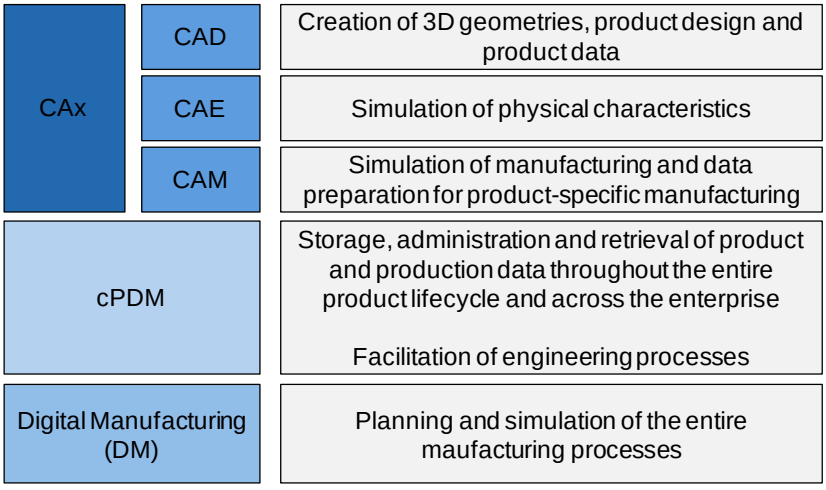
Product Lifecycle Management - PLM

PLM are used to create, manage and optimise the development of products all along their life on a virtual basis. PLM can be used to create virtual prototypes

of simple products and complete production lines, as well as simulate their behavior based on various assumptions. In fine, PLM shorten the time to market, reduce the cost of prototypes and improve products quality.

Essentially, PLM is collaboration software, but specifically designed for engineering and manufacturing companies. The benefits of PLM seem obvious now, but such solutions were previously only accessible to large companies who could afford to pay the high fees required to build such systems. Even now, off-the-shelf PLM software tends to require a high level of customization for each customer. Nonetheless, PLM software is becoming more widely used in the industrial sector.

Figure 43: PLM software applications



Source: Siemens

The PLM market size is around $40bn is forecast to grow at an 8% CAGR. The aerospace and automotive sectors have been the first to use PLM and today they can be used almost everywhere. PLM solutions generally regroup various business functions:

- **Product data Management (PDM)** - PDM is the use of software to track, manage and archive all changes to data related to a particular product (including engineering data such as CDA models, part number, suppliers, cost/price, etc). PDM serve as a central repository for product history and enable data exchange among all users interacting with the product (engineers, sales, buyers, etc).
- **Computer Aided Design / Manufacturing (CAD/CAM)** – CAD is the use of software to aid in the creation and optimization of a product design and create a database for manufacturing. CAD regroups information such as materials, dimensions, etc (bill of materials). Computer Aided Manufacturing (CAM) - CAD is the use of software to assist in the manufacturing operations of the product model generated in CAD.

Big Data and Analytics

The industrial system comprises huge numbers of machines ranging from electric motors to pumps, generators or turbines. All of these pieces of equipment are associated with information such as temperature, pressure, vibration, etc and are valuable to understanding performance of the unit itself and in relation to other machines and systems.

Analytics based on large data sets has emerged recently in the manufacturing world, thanks to the advances in big data software tools and the declining price of data processing. The gathering and analysis of data from many different sources such as production equipment, as well as enterprise-, supplier- and customer-management systems, will allow managers to support real-time decision making, optimize production processes and improve equipment quality and service. This will likely provide important competitive advantages for those companies that efficiently use the Big Data.

Siegfried Russwurm, CTO and Member of the Managing Board of Siemens, compares Industry 4.0 to a computer that plays chess and keeps on analyzing the different options so as to find the right strategy. Industry 4.0 enables industrial companies to compare different scenarii from virtual models and choose the best, cheapest and most efficient solutions.

The Cloud

Thanks to connectivity and Big Data, huge amounts of data can be continually produced by machines and systems. In the past, the collection and analysis of the data was carried out by means of hosted solutions, but in the future most automation vendors will offer a cloud-based solution to facilitate companies' IT management. Cloud computing means that the actual software resides on a server (or multiple servers) that can be accessed via internet by clients from various different locations. There are many benefits for end-users including:

- **Lowering costs**: the same solution is spread over a higher number of users and as such, the function costs are proportionately lower than for an individual solution in a company. The need for IT support of installed software and server administration overhead is also reduced because it is all handled on one server.
- **Leveraging multiple disciplines at the same time in the same simulation model**. For example, SimCentral from SimSci by Schneider Electric has collaboration capabilities built in. Multiple users in the same office or across the world can work on the same shared simulation simultaneously..
- **Providing scalability and reactivity**. Manufacturers can get started quickly and scale easily as the environment changes. Using a cloud-based hosted solution can also help foster faster adoption of new products and technologies, even if customers lack the appropriate infrastructure.

Many companies have been deploying industrial clouds in the past few years. Some are specialist industrial cloud providers with hardware-plus-software solutions aimed specifically at industrial companies, others are all-purpose cloud services which have some components but not in a ready-made package for industrial applications. Some of the key vendors are industrial companies like General Electric (Predix), Siemens (MindSphere), Schneider Electric (EcoStruxure/WonderWare), ABB (Ability), Honeywell (Connected Performance Services), Bosch (IoT Suite)… or IT companies like SAP (Hana), Cisco (IoT System), IBM (Bluemix), Amazon (AWS Cloud), Infor (CloudSuite), Microsoft (Azure), Google (GCP), etc. Many partnerships/collaboration between IT and industrial companies have already been announced.

More and more data analytics and functionalities will likely be deployed to the cloud as the performance and reaction times of cloud technologies continues to improve. Vendors of manufacturing-execution systems (MES) are among the companies that have started to offer cloud-based solutions. As a general rule, anything that is directly related to the physical output of the production process should stay on-premises. Activities that are not critical to the process, with little or no impact on safety, legal or financial risks but rather are complementary or

are supporting components of the process can be considered to be hosted on the cloud. This includes, for example, long-term process historians, dashboards, KPI monitoring, process analytics, MES reports, alerts and notifications, simulation and training environments, etc. Even systems that monitor and control processes may become cloud based. However, this will likely take a long time given many customers' concerns about latency and security data will likely hold them from moving to a full cloud-based environment.

Cybersecurity and data privacy protection will increasingly be critical problems to solve as companies embrace connectivity, big data and the cloud. Stuxnet, a computer worm that was designed to attack industrial programmable logic controllers (PLCs) in Iran in 2010 is a good example. Over the past couple of years, several industrial companies have acquired or made partnerships with cybersecurity companies (cf. Siemens' acquisition of Rugged.com).

- Companies have historically relied on production systems that used closed systems or were unconnected, but with the advance of the Internet of Things, the need to protect propriety data and critical industrial systems from cybersecurity threats becomes acute.
- Contrary to the world of consumer goods, the data generated by machines represents a real value for the company which owns the machines and is not made freely available to third-parties.
- Moreover, the issue of real-time capability is defined completely differently in the industrial context as opposed to personal use of the Internet. In the control of a production facility, network interruptions lasting only a millisecond can result in damage worth millions. In using a browser, they do not really matter.

Connectivity

Fieldbuses have historically been used to connect devices and controllers on the factory floor. A fieldbus is like a USB (Universal Serial Bus), but it connects industrial devices one to another, and not multimedia devices. Many different network protocols specifically designed for the industrial environment have been created. Most of them are today managed as open protocols, such as Modbus, Profibus, Foundation fieldbus, DeviceNet and ControlNet (the Common Industrial Protocols).

The first industrial data network was the Modbus protocol created in 1979 by Modicon (which was acquired by Schneider). Modbus was originally designed as a way to link devices with PLCs using a simple master/slave concept. Modbus is a half-duplex protocol (i.e., data can be transmitted in both directions on a signal carrier, but not at the same time) and is therefore highly deterministic (i.e., the time span in which a response is expected is predictable). But, being serial, it is quite slow, with data transmission rates as rates as low as 300 baud (and typically 2.4Kbaud). Today, Modbus is seen as a very simple, easy to implement and easy to use open protocol. The specification document is around 50 pages in length, which is a good indication of the protocol's low level of complexity. In comparison, Profibus' specification document is thousands of pages long.

Profibus is a very robust protocol that was designed to automate entire plants. It was originally created by Siemens but is now managed as open standard by the PI association. When connecting a controller to one smart device in a point-to-point configuration, or if there is only one remote site,

Modbus is an easy solution. For situations where there are more points, where different vendors are involved, or where there is a hazardous environment, Profibus is generally seen as a better solution.

Today new protocols tend to use Ethernet as the base. With Ethernet, all applications can be connected, from the instrumentation level all the way up to the end customer's IT infrastructure. This offers the best pathway to a single network architecture. With Ethernet, the speed of communication is also much faster, but the time span (the determinism) in which a response is expected is unpredictable. This is because Ethernet is a broadcast network, in which data can take variable paths and therefore variable times to travel from the sending node to the receiving node. If this is an email, nobody cares. If this is a control variable for a high-speed CNC mill, packet loss and speed loss can be a serious problem. The industrial environment requires "real-time" information transfer but it is difficult to guarantee real-time control functions over Ethernet. (Managed switches help by directing the data packet to only the designated receiving node or nodes, but they cannot eliminate collisions)

Many players are adapting Ethernet technology to better serve the plant floor. Ethernet-based protocols include for example, PROFINET (which is the successor of PROFIBUS protocol, generally supported by Siemens), Modbus over TCP/IP (which is an extension of the Modbus protocol to replace the serial connection with TCP/IP, generally supported by Schneider), or EtherNet/IP (supported by Rockwell). The first protocol that can produce robust, fast and deterministic control will win in theory. But, in practice, today end users, OEMs and integrators tend to choose protocols based on the strength of their relationship with the automation vendor. The size of the installed base remains a key barrier to entry.

- EtherNet/IP is an industrial protocol that operates over Ethernet, using the Common Industrial Protocols (ControlNet, DeviceNet). It is built on standard TCP/IP, making it easy to connect factory floor data from controllers to enterprise servers running Ethernet TCP/IP. EtherNet/IP (where the "IP" stands for "industrial protocol") should not be confused with Ethernet and IP (where "IP stands for "Internet Protocol"). EtherNet/IP is designed for the control applications that can accommodate a measure of non-deterministic data transfer, but it is significantly more robust and deterministic than standard Ethernet and TCP/IP are. EtherNet/IP was first developed by Rockwell Automation for its Allen-Bradley controllers, but it is now an open standard, managed by the ODVA association, which supports network technologies build on the Common Industrial Protocol (CIP), mainly DeviceNet, ControlNet and EtherNet/IP.
- Modbus over TPC/IP was created in 1999, when the Modbus protocol was adapted to use a TCP connection for the transport of the data. The main disadvantage of Modbus over TCP/IP is that with standard Ethernet it is only suitable for the low-speed class of communication (unlike Profinet whose different versions can be used on all speed classes). Modbus is still going strong because of its simplicity to adapt to Ethernet without significant change. It is now one of the major Ethernet protocols used in automation.
- Profinet is another industrial protocol, defined by Siemens, running on Ethernet, similar to EtherNet/IP. Profibus and Profinet are designed to work together. Profinet therefore merges the industrial experience of PROFIBUS (high-speed IO communications + safety + diagnostics capabilities) with the openness and flexible options of Ethernet. According to PI, Profinet is an open Ethernet standard designed to be "real-time Ethernet." Siemens is one of the leading proponents of Profinet, which thus benefits from the group's huge installed base of PLCs using Profibus.

Appendix

Valuation & risks

For current share prices, see Figure 5.

Siemens (SIEGn. DE, Hold) We derive our TP of €126 based on the average of three approaches: 1) a peer multiple comparison, 2) a 5-year DCF using our theoretical EV/EBITA method for the terminal value and 3) a SOP valuation. We adjust net debt for the debt borne by the financing division SFS and all debt-like liabilities such as pensions and environmental provisions. Key downside risks include: 1) execution issues on projects in Mobility, Power or Energy Management, 2) M&A risks, 3) higher price pressure in Power & Gas, Drives and Healthcare, 4) failure to accelerate restructuring efforts. Key upside risks include: 1) a divestment of Rolling Stock, 2) a new round of cost-cutting initiatives.

ABB (ABBN.S, Hold) We derive our SF23 target price from the mid-point of two approaches: 1) a 2018e peer multiple comparison, and 2) a 5-year DCF using our theoretical EV/EBITA multiple for the terminal value. Key upside risks include cost saves surprising, a rebound in oil prices, the industrial recovery being stronger than expected or the divestment of the Power Grids division under good terms. Key downside risks include accelerated Chinese competition in T&D in overseas markets and prolonged macro weakness.

Legrand (LEGD.PA, Buy) We derive our TP of €60 based on the mid-point of two approaches: 1) a 2018e peer multiple comparison (with a 20% premium to reflect the group's superior FCF generation profile), 2) a 5-year DCF using our theoretical EV/EBITA for the terminal value. Key downside risks include: 1) rising competition in home automation coming from the likes of Apple or Google, 2) lower operating leverage than expected reflecting the need to invest in electronics/software. Key upside risks include: 1) a quicker-than-expected rebound in European construction markets, 2) accelerated acquisition strategy or return to shareholders.

Schneider (SCHN. PA, Buy) We derive our TP of €76 based on the mid-point of two approaches: 1) a peer multiple comparison. 2) a 5-year DCF using our theoretical EV/EBITA method for the terminal value. Key downside risks would come from a more prolonged than expected downturn in China, further weakness in emerging markets-based currencies and expensive M&A.

General Electric (GE.N, Hold) We derive our $28 price target by applying 17x P/E to our 2018 GE Industrial EPS forecast and 9x P/E multiple to our 2018 GE Capital EPS forecast, which equates to a price per share of ~$31, or $28 discounted back at an assumed rate of 10%. Our blended valuation targets would represent an S&P market multiple for Industrial - consistent with the long run GE average - and a modest Capital discount to peers, driven by potential future tax headwinds and business runway uncertainties. Downside risks include weaker-than-expected earnings accretion from the Alstom acquisition. Upside risks include (gross) margin expansion ahead of expectations - driven by ongoing corporate simplification initiatives.

Rockwell Automation (ROK.N, Buy) We derive our price target of $173 by applying 19x forward P/E to our recovery scenario EPS of $10 in FY19, discounted back one year at an assumed 10% cost of equity capital. We believe our target could prove conservative as it assumes that ROK's valuation deflates to a high-teens (i.e., more normalized) level during a period of assumed ~30% EPS growth. Moreover, our assumption of a 10% discount rate could also be conservative given still low interest rates and associated equity cost of capital. Downside risks to our price target include aggressive border adjusted tax implementation that squeezes Rockwell short term coupled with potential international trade retaliation that causes our growth scenario to falter.

Emerson (EMR.N, Hold) We derive our price target of $59 by applying a 22x forward P/E to our FY18 EPS forecast. Considering FY18 could mark the first year of expansion after the past few years of energy downturn, coupled with Emerson's generally robust earnings quality, we believe a forward target multiple in the low 20s appears reasonable. We also note that Year 2 EPS accretion from the Pentair V&C transaction could potentially add to our EPS forecast, although the Oil & Gas/Process recovery could prove to be more uneven than what we are assuming at this point. Our price target would imply a 25x multiple on trough FY17 earnings, which also screens reasonable, particularly given the ongoing market environment of excess liquidity. Upside risks to our target include unforeseen future increases in oil prices and future business sale proceeds that exceed our expectations. Downside risks include distraction costs associated with the spin of Network Power and further Industrial Automation downsizing.

Dassault Systemes (DAST.PA, Hold) We derive our TP of €65 based on a simple average of the following inputs: - 23x our FY17E EPS of €2.73, yielding €63 - 13x our FY17E EBITDA of €1,055m, yielding €65 - 10yr DCF (WACC 8.3%, LT growth 2%, 89% equity financing), yielding €67. Upside risks: 1) Accretive M&A that is well received by investors 2) Macro improvement in industrial economy could boost sentiment 3) Opportunities in new growth markets e.g., EM, IoT could boost growth more than we expect. Downside risks: 1) global capex & R&D in important end markets may be weaker than we expect 2) aggressive competitors could gain share 3)DSY may be forced to transition its offerings to Cloud faster than we expect, which would be a headwind to revenues and margins.

Hexagon (HEXAb.ST, Buy) We value Hexagon based on a simple average of the following: 1) P/E- a 20x multiple of our FY18E EPS, yielding a target price of SEK 400 based on current EUR:SEK spot of 9.5. We feel this multiple is justified given Hexagon's improved end market outlook, although we discount by 10% vs the company's peak fwd PE multiple of 22x given the ongoing CEO investigation. 2) A 10yr DCF (89% equity financing, 8.3% WACC, 2% terminal growth rate) yielding the target price. Key downside risks include: The revival in the manufacturing & oil & gas outlook may prove less durable than we expect; Hexagon may experience more pricing and margin pressure on its hardware-centric products than we expect; Hexagon may see less margin benefit from the introduction of new products than we expect, resulting in weaker earnings.

Appendix 1

Important Disclosures

*Other information available upon request

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Equity rating key

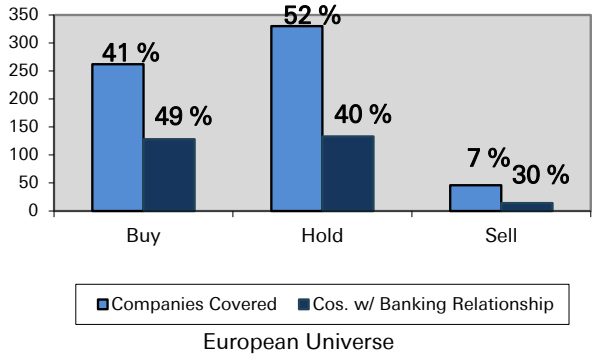
Buy: Based on a current 12- month view of total share-holder return (TSR = percentage change in share price from current price to projected target price plus pro-jected dividend yield) , we recommend that investors buy the stock.

Sell: Based on a current 12-month view of total share-holder return, we recommend that investors sell the stock

Hold: We take a neutral view on the stock 12-months out and, based on this time horizon, do not recommend either a Buy or Sell.

Newly issued research recommendations and target prices supersede previously published research.

Equity rating dispersion and banking relationships



European Universe

Additional Information

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