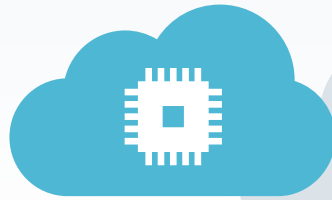


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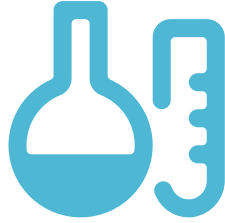


The Digitalisation Productivity Bonus in Pharmaceutical Manufacturing

What value does digitalisation offer the pharmaceutical industry?

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Management Summary

- Digital transformation – or Industry 4.0 - is a widely recognised imperative in manufacturing. Manufacturing CFOs, however, require measurable outcomes on which to base their investment in digital transformation
 - Research from Siemens Financial Services has shown that measurable improvements in manufacturing productivity are the most reliable starting point for the digital transformation business case
 - In this paper, productivity gains from digitalisation and automation – known as the Digitalisation Productivity Bonus – has been estimated for the Pharmaceutical industry in the UK
 - Creating an automated, digitised manufacturing environment requires major investment. Specialist financing tools – Finance 4.0 - are being developed by expert financiers to enable affordable and sustainable transition to the smart, digitalised factory
- Industry 4.0 Financing is now employing that new mind-set to offer techniques which range across:
 - Pay to access/use equipment and technology finance so that precious capital is not tied up in depreciating equipment
 - Technology upgrade and update to take advantage of the latest innovations
 - Software finance to embrace all aspects of an Industry 4.0 solution
 - Pay for outcomes to align rate of benefit with rate of payment
 - Transition finance to minimise disruption in the move to automation and digitalisation
 - Working capital solutions to manage cash-flow in a digital world





Automation and Digitalisation: The new imperative

There is no longer debate about whether the Fourth Industrial Revolution – Industry 4.0 – is under way; the conversation has moved on to address where, how much and how quickly it is being implemented. Digitalisation of the manufacturing environment and its processes forms the foundation of Industry 4.0, adoption of which varies from country to country and economy to economy. In some parts of the world and in certain industries, the emphasis is placed on automating previously manual processes. Automated systems are, by definition, programmed and controlled through digital systems; and where automation is already widespread, further digitalisation is taking the form of the Internet of Things (IoT). This development involves the widespread installation of sensors in the physical environment and the ability to rapidly enhance production economics through real-time performance data analysis. Some digitalisation pioneers are using digital controls and digital data analyses to improve a wide range of processes, including production capacity, job setup and turnaround, uptime maximisation, predictive maintenance, supply-chain logistics and just-in-time distribution. There are even instances of manufacturers – including those in the pharmaceutical sector - improving their competitive capabilities edge through mass customisation, a technique where tailored products are offered with much the same economies formerly associated with mass production.ⁱ

For manufacturers that want to remain competitive in increasingly aggressive markets, the move to increased automation and Industry 4.0 is not an option – it is a necessity. But seizing the competitive advantages of automation and digitalisation that lie at the heart of Industry 4.0 requires a substantial investment in new-generation automated and digital platforms. Responsible business leaders will therefore need a solid business case that justifies this kind of significant investment to stakeholders and shareholders, one that paints a credible picture of the revenue, margin and growth benefits an investment in automation and digitalisation technology will bring.

Early movers in the manufacturing community (see figure 1) are already enjoying many Industry 4.0 benefits, yet the precise commercial gain from each of these benefits can sometimes be challenging to calculate. To help establish a more precise starting point for manufacturers embarking on the automation and digitalisation journey, Siemens Financial Services commissioned research to understand which of these benefits could be most reliably estimated and used by most manufacturers to formulate a business case for investing in Industry 4.0 technology.

Figure 1



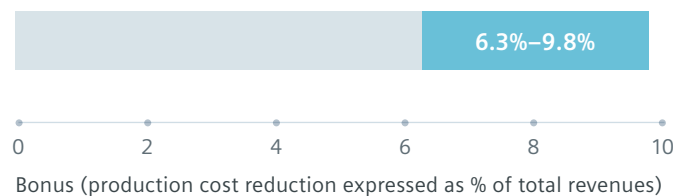
The starting point for a business case: The Digitalisation Productivity Bonus

The vast majority of manufacturers and expert consultants interviewed for the researchⁱⁱ confirmed that the ability to increase manufacturing productivity is a universal starting point for determining measurable value from digitalisation. The ability to manufacture the same product volume at less cost, or manufacture more products for little or no increase in costs, resonates with manufacturers considering digital technology investment as a competitive enabler. This was felt to be the case for both manufacturers taking their first steps into automation and those looking to install the latest sensor-based technology to fully digitalise their production environment.

The research revealed that by automating and digitalising their production systems, manufacturers were set to make production productivity gains equivalent to between 6.3% and 9.8% of their annual revenues.

Global Digitalisation Productivity Bonus: reduced production costs resulting from conversion to digitalised technology

Figure 2



Termed the **Digitalisation Productivity Bonus**, this gain was identified by respondents as the most reliable starting point to make a business case for investing in Industry 4.0 technology upgrades.

Sector focus: Pharmaceuticals

Pharmaceutical plants typically experience high levels of downtime. According to one analyst, digitalisation and data analytics can reduce this downtime by 30-40%ⁱⁱⁱ, significantly improving overall equipment effectiveness (OEE). IoT communication between machines and machine-learning Artificial Intelligence (AI) delivers seamless processes, predictive maintenance and automatic corrective actions.

The pharmaceutical manufacturing environment is highly sensitive and tightly regulated. The smallest error can result in life-changing patient outcomes and disastrous commercial, legal and reputational impact for the manufacturer. As such, the advantages of 'Pharma 4.0' can often deliver amplified operational and competitive value.

A few years ago, a global pharmaceutical giant had to recall over a half a million tablets because of packaging and human monitoring error in the plant^{iv}. Digitalisation and automation have now ensured that the company will not suffer the financial and brand ramifications of a similar error in the future. By introducing digital sensors and robotics and investing in high-availability computing to guard against data transfer issues between units, the company has created a fully automated production line which has the by-product benefits of making it much easier to maintain cleanroom processes, capture and manage electronic batch records, and analyse process performance (through root cause analysis) to identify and implement improvements.

Further points of value for Pharma 4.0 are being gained in the field of regulatory compliance. One manufacturer has installed digital sensors for visual, environmental, temperature and chemical monitoring throughout its manufacturing process^v. This has now automated compliance reporting which previously involved expensive manual monitoring, although half-yearly manual tests are still made by an outside agency to audit and verify the automated reporting. Not only has this released precious funds for investment elsewhere in the business, it has also provided the means for alerts when any of these factors move outside of defined tolerances, triggering early intervention that minimises the cost of potential contamination, formulation errors and consequent process shutdown.

Mass customisation is also of importance to the pharmaceutical sector, given that individualised formulations are coming more into vogue. Although the topic of individualised medication manufacturing raises important issues of quality, batch stability, and risk management, there are some areas that may benefit from being able to manufacture short runs of customised therapies at the kind of price previously associated with mass production. One manufacturer is currently trialling such digitalised processes with analgesic combinations^{vi}.

Digital integration of the distribution chain (through distributors, then pharmacists and retailers, to the clinician and patient) offers pharmaceutical companies greater opportunities to combat fraud. One generics manufacturer^{vii} became aware of several counterfeit versions of its products in certain countries. The company introduced an encrypted digital signature onto its packaging which allowed genuine products to be tracked and traced down the distribution chain, with healthcare organisations able to verify the product through a secure portal in the cloud.

Sector focus: Pharmaceuticals (continued)

Finally, digital information integration up the supply chain and down the distribution chain is delivering greatly enhanced demand-supply management. One manufacturer that supplies a wide range of therapies has set up information links with all the hospitals within a single locality^{viii}. Links into these hospitals' clinical information systems gather aggregated anonymised patient data in a selection of specialities and use predictive analytics to better plan manufacturing production volumes. This pilot has already demonstrated high levels of accuracy and is planned for gradual roll-out across the country through the next few years.

All in all, with changing business models, new competitive challenges, developing consumer demands and proximity and innovative manufacturing possibilities enabled through digitalisation, further production efficiencies are an imperative for an industry undergoing such major disruption.

Even though the pharmaceutical industry is already a highly automated industry it is still looking to Industry 4.0 digitalisation to improve production efficiency further, as well as leveraging incremental competitive gains from digital connectivity between people, machines, systems and locations – within the factory, down the supply chain and connecting with distributors and customers. In order to give an idea of the fundamental financial benefit to be gained from Industry 4.0 in pharmaceutical manufacturing, this paper has applied its **Digitalisation Productivity Bonus** model to the sector in the UK. The average 'Bonus' percentage baseline was applied to the total annual revenue of the pharmaceutical manufacturers across the country (revenue data derived from official third party sources). The resulting financial sums in the table below estimate how much pharmaceutical manufacturers could gain from improvements in manufacturing productivity as a direct result of digital transformation. These efficiencies, although not estimated here, can also be realised throughout the supply chain.

Estimated **Digitalisation Productivity Bonus** – reduced production costs resulting from conversion to digitalised technology for pharmaceutical manufacturers



Baseline Bonus (production cost reduction)

£973.1m

The **Digitalisation Productivity Bonus** is only one aspect of value that digitalisation is delivering in the pharmaceutical industry. Nevertheless, it provides industry players with a reliable starting point from which to build a digital transformation business case. These gains from conversion to an Industry 4.0 environment might then be returned to shareholders, invested in R&D, or used to fund a sharper competitive position in a company's key marketplaces.

Financing Industry 4.0

Manufacturers around the world still face the challenge of having to make a major initial investment to acquire Industry 4.0 automation and/or digitalisation technology in the first place. To overcome this obstacle, specialist financiers have developed a set of financing tools called “Finance 4.0” These tools enable the transition to new-generation digital technology in a way that is affordable, sustainable and designed to alleviate the manufacturer’s cash-flow and working-capital pressures.

These specialist Finance 4.0 tools can be summarised as follows:

Pay to access/use equipment & technology finance

This enables the acquisition of a system or piece of equipment. Technology, service and maintenance are all included in a single agreement. Periods can be adjusted to match payments to the financial benefits gained. Master agreements can be established that help speed up future technology acquisitions.

Technology upgrade & update

Manufacturers want to access technology innovations as they appear (and digital innovation cycles are shortening^x). Finance can also offer options to upgrade during the financing period, whether to replace with a newer model or retrofit enhancements to the main technology platform.

Software finance

By definition, most Industry 4.0 technology solutions involve both hardware and software. Because specialist financiers understand how the software is implemented and likely benefits in practice, they can understand the associated risks and include the software as an element in the total financing package.

Pay for outcomes

These arrangements base payments on the expected business benefits, or “outcomes”, that automation or digitalisation technology makes possible.^x Actual financial savings, such as reduced electricity consumption, are used to subsidise or even totally fund monthly payments, making the technology cost neutral for the manufacturer.

Transition finance

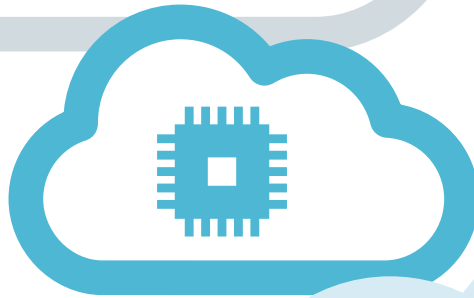
Manufacturers do not want to start paying for their Industry 4.0 technology platform until it is installed, tested and operational. Finance 4.0 recognises the challenges of transition and offers financing arrangements that defer payment – known as ‘extended payment terms’ - for a new system until it is reliably up and running, eliminating any period of cost duplication for the manufacturer.

Working capital solutions

Finance can be optimised in more areas than technology acquisition. Improved competitiveness can lead to sudden growth, which exerts pressures on supplies, inventory and overall cash flow. Financing services – usually based on some form of invoice finance – are available to help manage the broader financial challenges that success through digitalisation brings.

Key references

- ⁱ See, for instance: Deloitte Insights, Industry 4.0 Readiness Survey, Jan 2020; IBM, A framework for Industry 4.0, 10 Feb 2017; PwC, Industry 4.0 – Building the Digital Enterprise, 2016; McKinsey, Industry 4.0 (2015); Strategy&, Industry 4.0 (2014); McKinsey, “Manufacturing’s next act” (2015); Control Engineering Asia, “The dawn of the new industrial era with the Smart Factory” (January 2017); ABB, “The new age of industrial production” (2016); Assembly Magazine, Industry 4.0 (2016); Accenture, “The Growth Game-Changer: How the Industrial Internet of Things can drive progress and prosperity” (2015); Roland Berger, Industry 4.0 (2016); VDMA and McKinsey, “The future of German mechanical engineering” (2014); Oliver Wyman, “Digital Industry” (2015); Manufacturing Technology Center, Industry 4.0 (2016).
- ⁱⁱ Methodology: Over 60 international manufacturers, international management consultants and specialist academics were interviewed. Respondents gave their expert estimate of financial gain from increased manufacturing productivity resulting from implementation of the new generation of digitalise and/or automated manufacturing technology and equipment classified under the title of Industry 4.0 or The Fourth Industrial Revolution. Respondents expressed their estimates of this financial gain as a percentage of total revenues, using their knowledge of gains calculated as a proportion of total operating costs (total operating costs for manufacturing companies varies between 75% of revenues in Europe to 85%+ in China, according to official statistics). This model was then applied to total revenue data of the manufacturing sector in different countries and manufacturing subsegments around the world to estimate the financial gain from increased manufacturing productivity resulting from implementation of digitalisation and automation in each of these geographies and segments.
- ⁱⁱⁱ PM Group, Industry 4.0 Pharma Manufacturing, 13 Jan 2020; Strategy&, Digitization in Pharma, 19 Oct 2016
- ^{iv} Source: original research, USA
- ^v Source: original research, Germany. Also, for general points, see Manufacturing Chemist, IoT, Industry 4.0 and the pharmaceutical manufacturing sector, 8 Dec 2016
- ^{vi} Source: original research, UK
- ^{vii} Source: original research, India
- ^{viii} Source: original research, UK
- ^{ix} Research from Siemens Financial Services published in “Investing in Success” (2016) indicated that 67% of manufacturing respondents observed that technology replacement/upgrade cycles are shortening.
- ^x This whole subject is discussed in the Siemens Financial Services research paper “Opportunities and Outcomes” (February 2017).



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