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Enabling effective change.

INDUSTRY 4.0:

Business Value
Business Opportunities
Business Challenges

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Introduction

In this whitepaper, we aim to get behind the buzzwords and jargon and look at the business value, the business opportunities and the business challenges surrounding Industry 4.0.

We will take a business-led perspective, rather than a technology-led perspective. Technology is of course the enabler. But to a certain extent we will leave the technology to one side for now whilst we look at what it really means for your business.

There is a definite clamour around Industry 4.0 at the moment. Incidentally, the dictionary definition of clamour is ‘a loud and confused noise’…

From the businesses we speak to, there seems to be the overall feeling of ‘we know we should be doing something, but we’re not really sure what or how’. There is also strong messages getting played out to businesses that they better do something sooner rather than later or they risk getting left behind by their competitors, both locally and globally. Undoubtedly that could be the case for a lot of businesses. But there’s no point in having technology for technology’s sake. So what parts of Industry 4.0 are right for your business? It is key that the upfront work is done to really understand what is going to drive the highest value into the business, what problem is it solving, where is the biggest benefit.

As technological advances abound at pace for the industrial sector, there is huge business value at stake, massive opportunities to be seized, and of course, plentiful challenges to be overcome.

It is certainly exciting times in the manufacturing and supply chain world.

1: The What, How & Why of Industry 4.0

Let us start with just a quick look at the what, how and why of Industry 4.0 – to understand the context and backdrop. Warning – there is a little bit of jargon in this section, see the jargon buster at the end of the chapter.

The What

The term Industry 4.0, the fourth industrial revolution, has been coined to reflect the wholescale change taking hold of the industrial sector. Digital transformation meets manufacturing and supply chain. This move to digitisation involves 3 key parts. Firstly, the Internet of Things and cyber-physical systems such as sensors having the ability to collect data that can be used by manufacturers and producers. Secondly, the advancements in big data and powerful analytics means that systems can trawl through huge data sets and produce insights that can be acted upon quickly. Thirdly, the communications infrastructure backing this up is secure enough to be used by heavy industries.

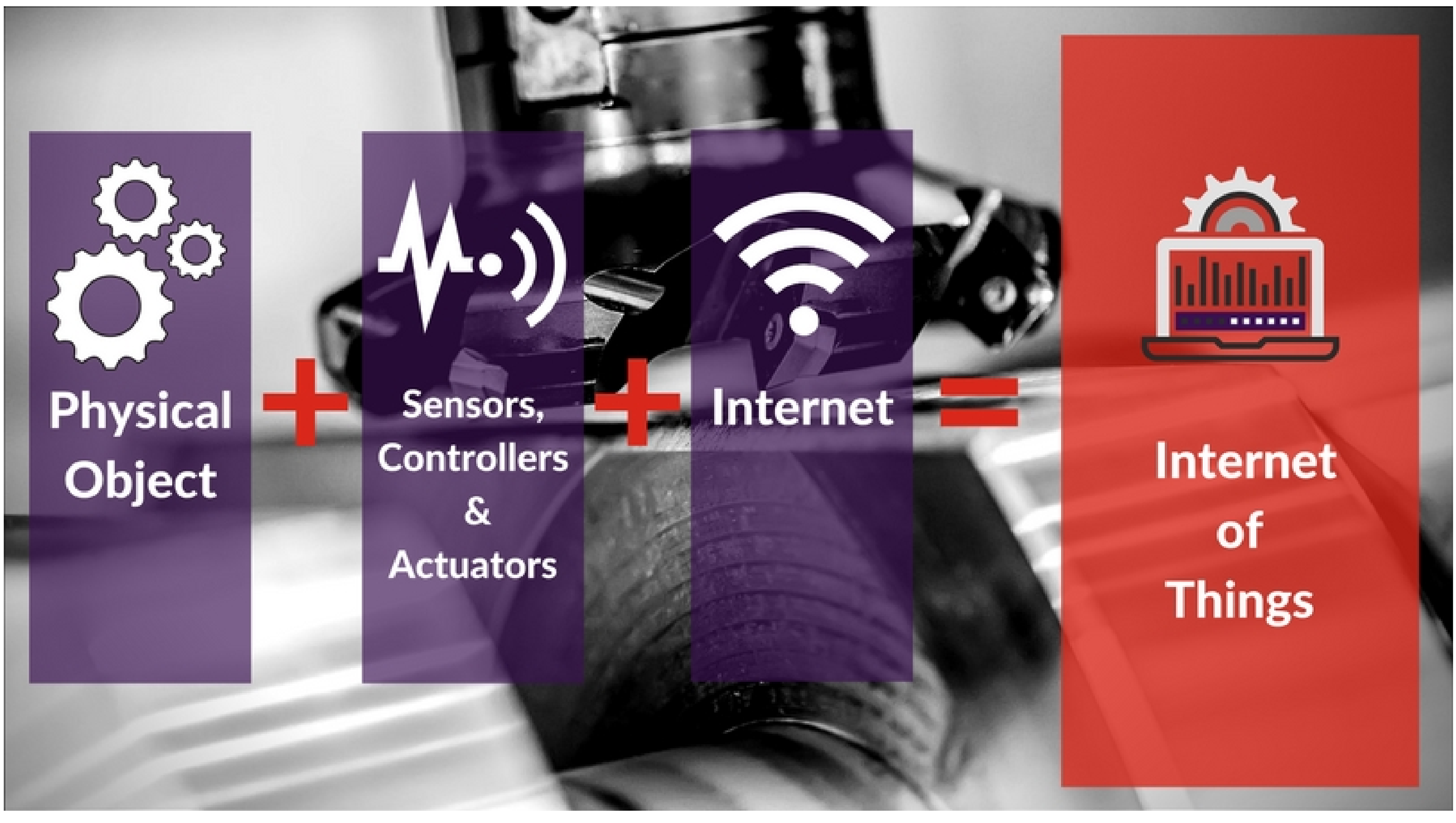
1: The What, How & Why of Industry 4.0

The vision is to create a Smart Factory. The target is to achieve a significant increase in efficiency and yield through the use of:

- **Self-Optimisation:** Systems and machines adapting and improving processes autonomously

- **Self-Configuration:** Systems and machinery altering setup to increase efficiency

- **Self-Diagnosis:** Systems and machinery locating and solving problems with out human interaction



It is about embracing advances in information and communication technology to drive a much higher level of automation and digitisation across the supply chain and the production line.

1: The What, How & Why of Industry 4.0

The How

To help understand how all of this has come about - consider the sheer scale of the Internet of Things in terms of the number of connected devices, as illustrated below:

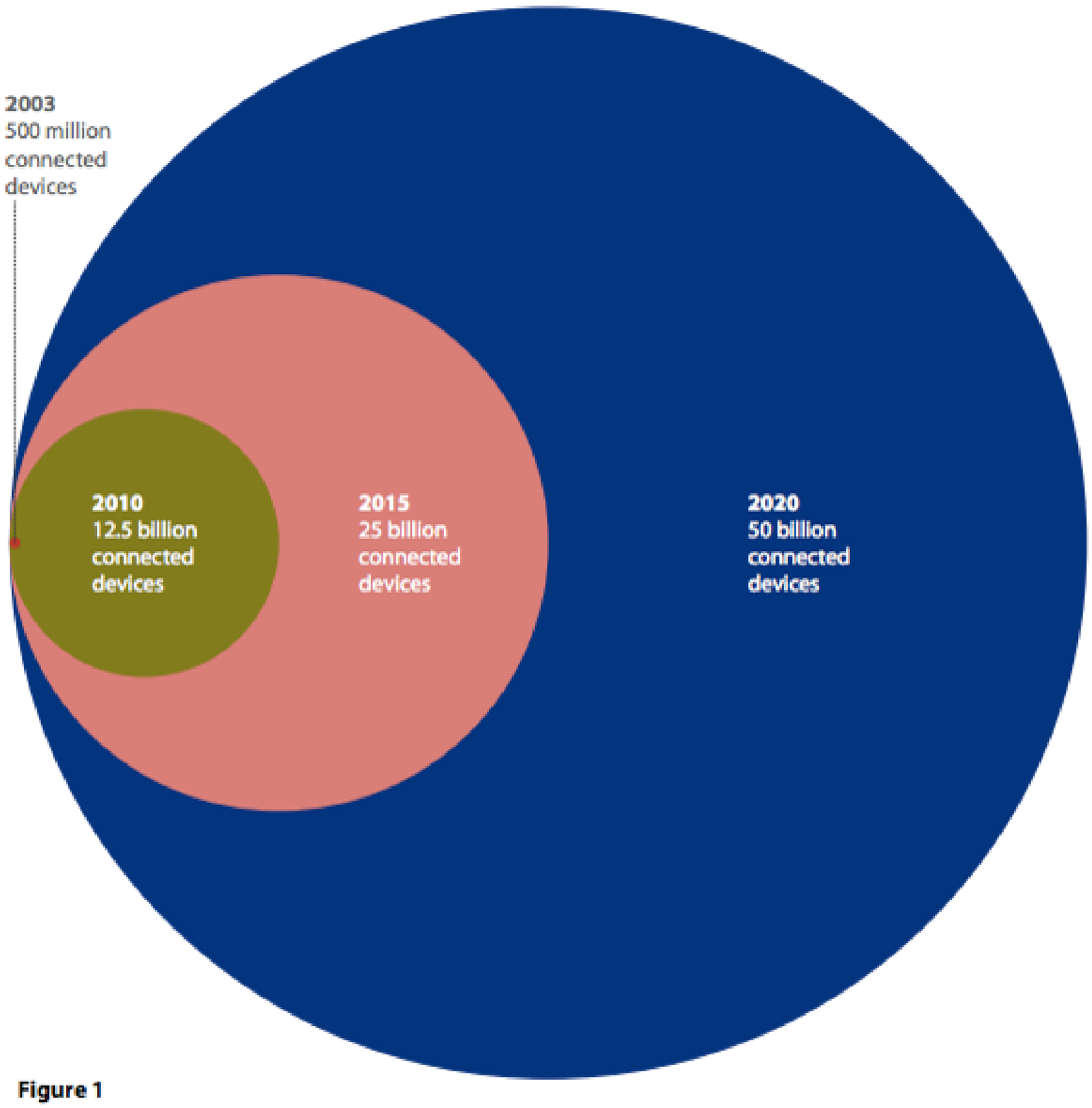


Figure 1
Scale of the IoT explosion
Source: Carré & Strauss visualization based on Cisco figures

There are three main factors that have been driving the meteoric rise of the Internet of Things:

1. Miniaturisation
- Devices have become smaller, more powerful and energy efficient

2. Affordability
- Costs have been consistently going down

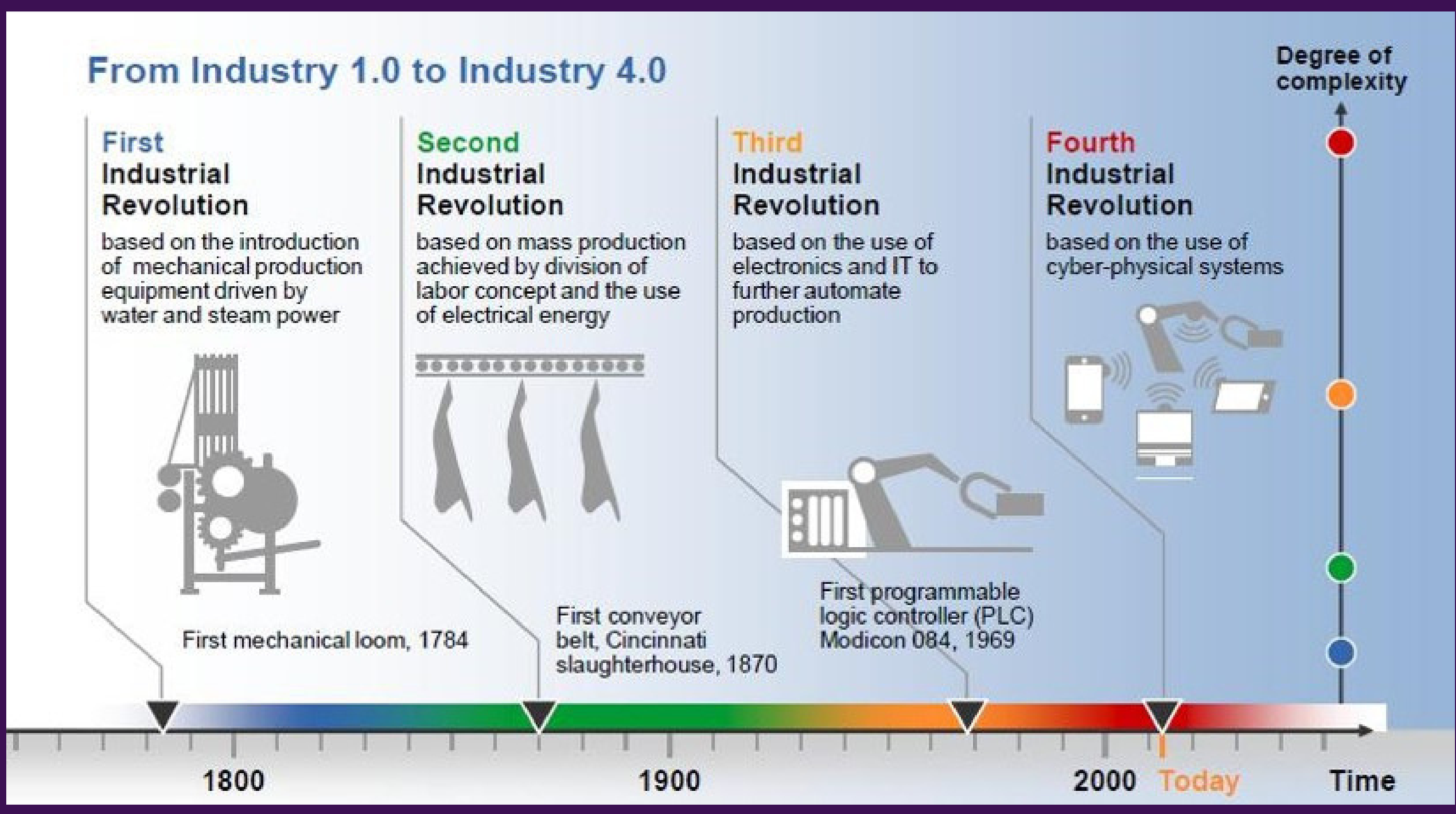
3. De-wireisation
- More and more things are becoming wireless

1: The What, How & Why of Industry 4.0

In some ways, it is the perfect storm in terms of the advancement and availability of various game-changing technologies all coming of age at once. Because some of the technologies have been around for a while in their own right – but it's the convergence of all of the technologies mentioned above that is driving the true revolutionary nature of the change for the sector.

The Why

As with previous industrial revolutions, the key aim is to streamline the manufacturing process further. And obviously the benefits that go hand in hand with streamlining boil down to improved efficiencies, customer satisfaction, quality, and margins.



*Source - DFKI German Research for AI 2011

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1: The What, How & Why of Industry 4.0

There have been various studies done to look at the economic impact of the Internet of Things. However you look at it, the numbers are pretty compelling:

McKinsey

> $2.7 trillion to $6.2 trillion

Potential economic impact of IoT annually by 2025

GE

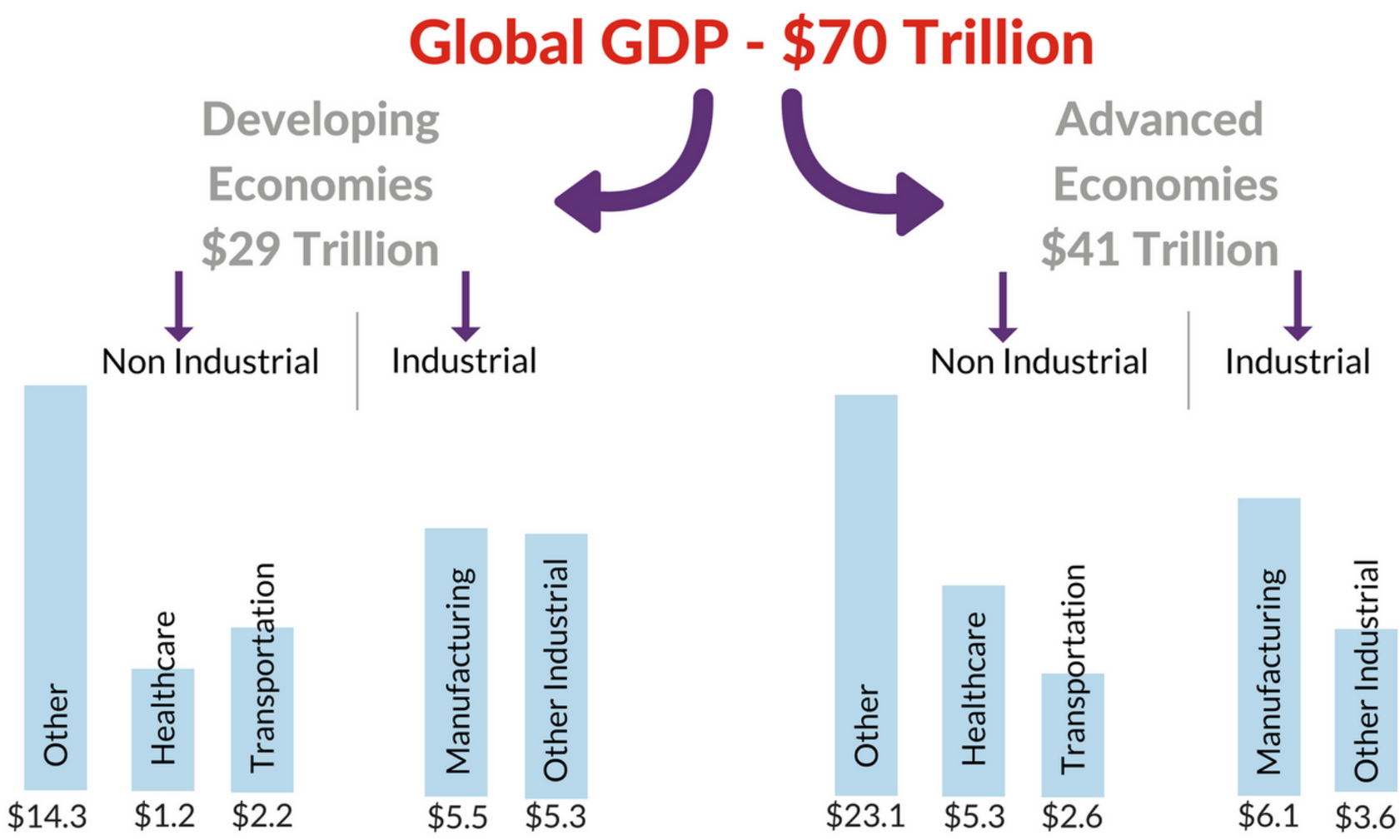
> $32.3 trillion

Industrial Internet opportunity = 46% GDP (see figure below)

Cisco

> $14.4 trillion

Value at stake (net profit) for the IoE economy over next decade



* Source: Industrial Internet: Pushing the Boundaries of Minds and Machines, citing World Bank & GE research

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Why Industry 4.0?

- More competition and need for continuous improvement
- Higher demand for flexibility and agility
- Greater need for accelerated growth to face global competition
- The huge untapped potential in information

*Source - Lina Huertas,
Head of Technology Strategy for Digital Manufacturing, MTC

Jargon Buster

Advanced manufacturing — New industrial technologies that integrate software into the manufacturing process.

Artificial Intelligence (AI) — Also called machine intelligence. The capacity of a machine to perceive its environment and make rational decisions based upon its surroundings, displaying problem-solving capabilities similar to that of humans.

Big data — Used to describe the collection and storage of huge quantities of data, "big data" is generally characterized by a high quantity of the "3Vs:" volume, velocity, and variety.

Cloud computing — Using a network of remote servers to host your data on the internet rather than on your personal computer.

Cyber Physical Systems - A mechanism controlled or monitored by computer-based algorithms, tightly integrated with the internet and its users. In cyber-physical systems, physical and software components are deeply intertwined.

Human-Machine Interface (HMI) – A device or software that allows you to interact with a machine

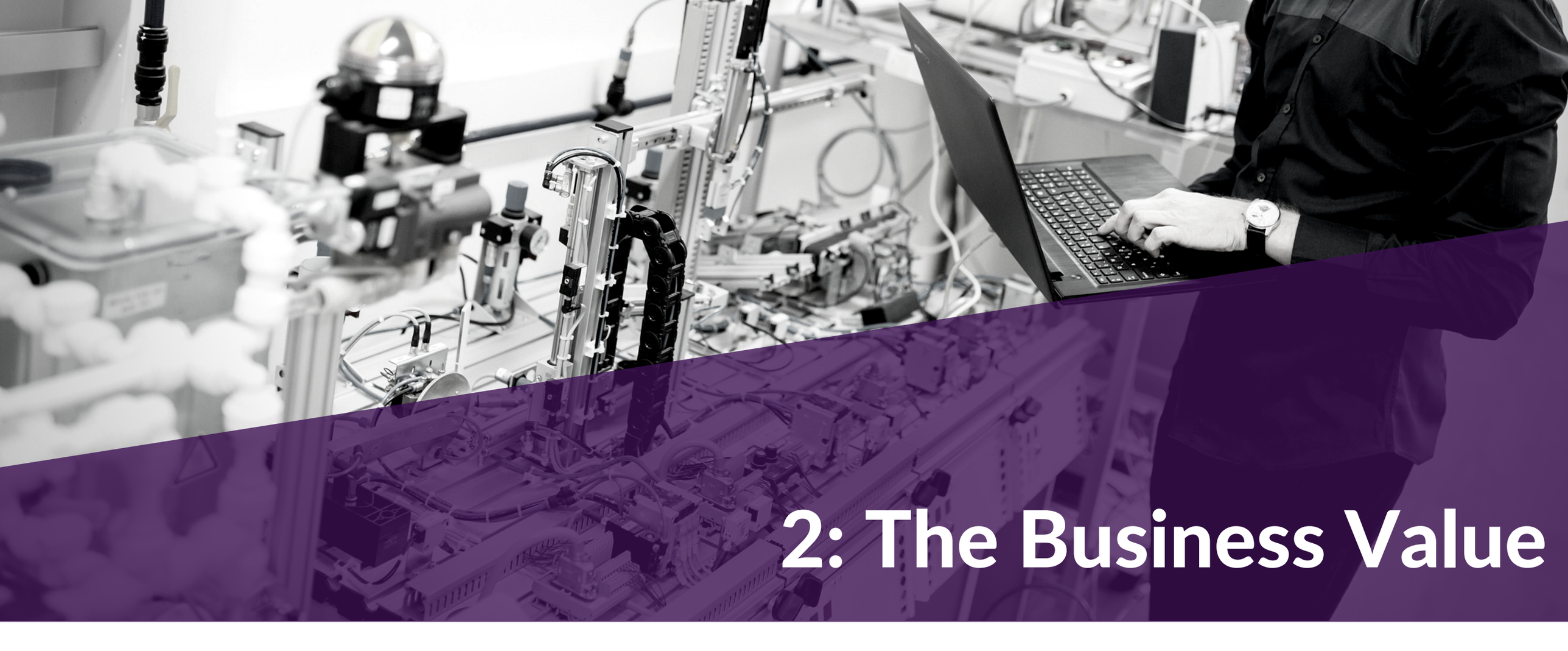
Internet of Things – The interconnection via the internet of devices, applications, buildings and products.

Interoperability — The capacity to communicate, adapt, and exchange data with other machines and software.

Machine to Machine (M2M) — A broad label that can be used to describe any technology that enables networked devices to exchange information and perform actions without the manual assistance of humans.

Platform — A piece of software or technology upon which smaller software applications can run. Your computer's operating system is a platform upon which all of its other functions work.

Smart Factory — Describes a factory environment where machinery and equipment are able to improve processes through automation and self-optimisation.

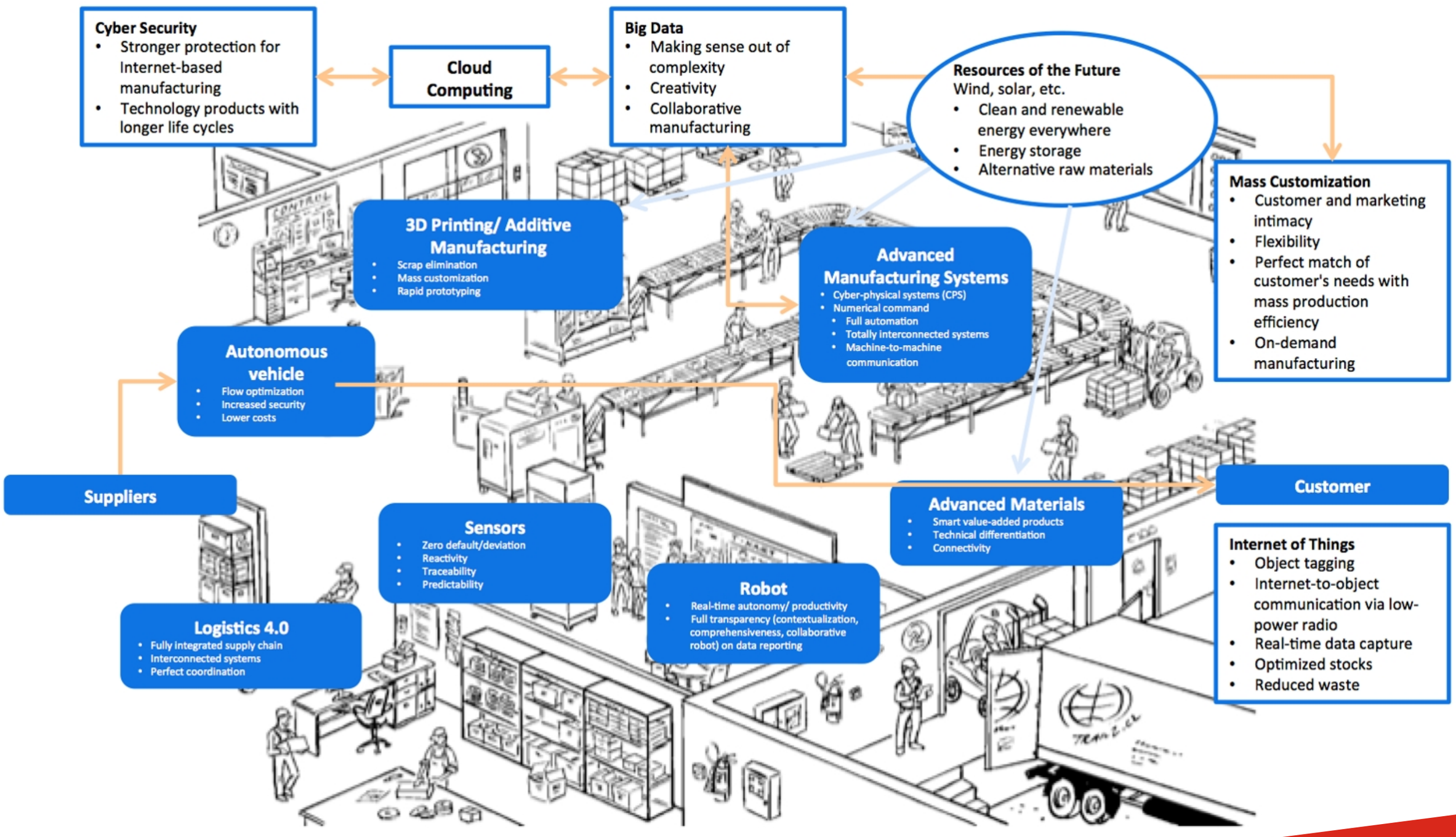


2: The Business Value

So let us take a look at the business value that Industry 4.0 offers up. Bear in mind too, that as well as the economic value, there is also the wider concept of value to consider including employee value, customer value and supplier value.

There is a myriad of value-add initiatives that can be undertaken to move towards a Smart Factory environment – some examples are illustrated in the diagram below. From the supplier to the customer, across the shop floor and the warehouse, and covering the full supply chain. These initiatives are aimed at driving out:

1. **Increased productivity**
2. **New added value**
3. **Improved customer experiences**



*Source - MongoDB & Bosch Software Innovations

2: The Business Value

Industry 4.0 is not just one technology, or one business discipline. It is not just one project and then you achieve Industry 4.0 certificate status. It is basically just part of the continuous improvement cycle – part of the ongoing investment in technology and process improvement to drive value into the business. It just so happens that right now there are a lot of new technologies converging at once giving a plethora of improvement opportunities.

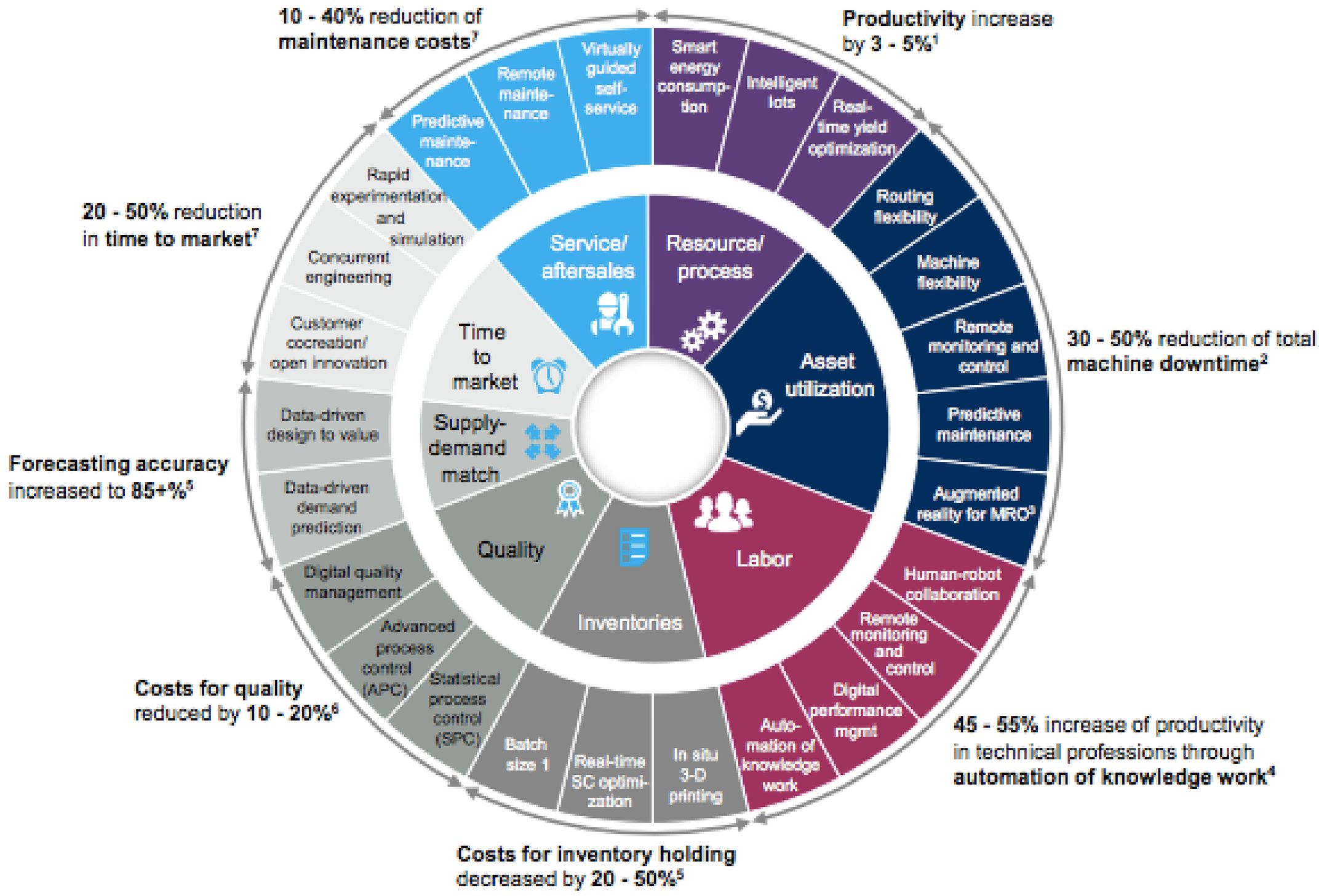
The trick is going to be in determining which of all the possible projects, improvements, and investments are right for your business.

Which technologies will deliver the biggest return on investment, given your unique circumstances?

At Optimum PPS, we use our Value Discovery methodology to drive out improvement opportunities, identify the value drivers, and apply the priority matrix ruleset. This has proven to be a robust and objective process to compare and contrast business improvement opportunities with clear prioritisation established: all based on business value drivers.

2: The Business Value

McKinsey's 'digital compass' is a good illustration of various value drivers and the associated Industry 4.0 levers. We have found this a useful tool for starting discussions and explorations of key improvement opportunities.



1 Client experience
2 McKinsey analysis
3 Maintenance, repair, and operations
4 Cf. McKinsey Global Institute: Disruptive technologies
5 McKinsey analysis
6 Cf. T. Bauernhansl, M. ten Hompel, B. Vogel-Heuser (Ed.): Industrie 4.0 in Produktion, Automatisierung und Logistik (2014)
7 Cf. McKinsey Global Institute: Big data: The next frontier for innovation, competition, and productivity

SOURCE: McKinsey

Admittedly some of these initiatives are way off in the future for many firms, if at all. But the fact is, for many it is happening now. It would seem though that the majority of these shining light examples are happening outside of the UK. So perhaps it is no wonder that across the manufacturing sector in the UK, the alarm bells are ringing and businesses are being urged to no longer think of Industry 4.0 as a future aspiration, but to embrace it now before they are left behind. The warning signs were there for many other industries that have been turned on their heads with the arrival of the internet and digitisation – and in a relatively short timeframe it has proven that those that were slow to embrace the changes have suffered the consequences.

2: The Business Value

There are many examples now of live industrial applications with commercial benefits being realised:

Big Data

An African gold mine found ways to capture more data from sensors. New data showed unexpected fluctuations in oxygen levels during leaching, a key process

Results
Fixing this
Increased yield by 3.7% ($20million p/a)

Advanced Analytics

Car maker combined data from online configurator with purchasing data to identify options that customers are willing to pay a premium for. Reduced the options on one model to just 13,000 - three orders of magnitude fewer that its competitor, which offered 27,000,000

Results
Development time & production costs fell dramatically

Human-Machine Interfaces

Knapp AG developed picking technology using augmented reality headsets. This helps them locate items more quickly and precisely, hands free means they can build better pallets, integrated camera captures serial and lot ID numbers for real-time stock tracking.

Results
Error rates fell 40%

Digital to Physical Transfer

Local Motors almost exclusively builds cars using 3D Printing after crowd funding programme.

Results
Can build a new model in 1 year (industry avg 6 years)

Real Time Yield Optimisation

ABB use computer based system to mimic ideal user to manage kiln feed, fuel flow and fan-damper posistion

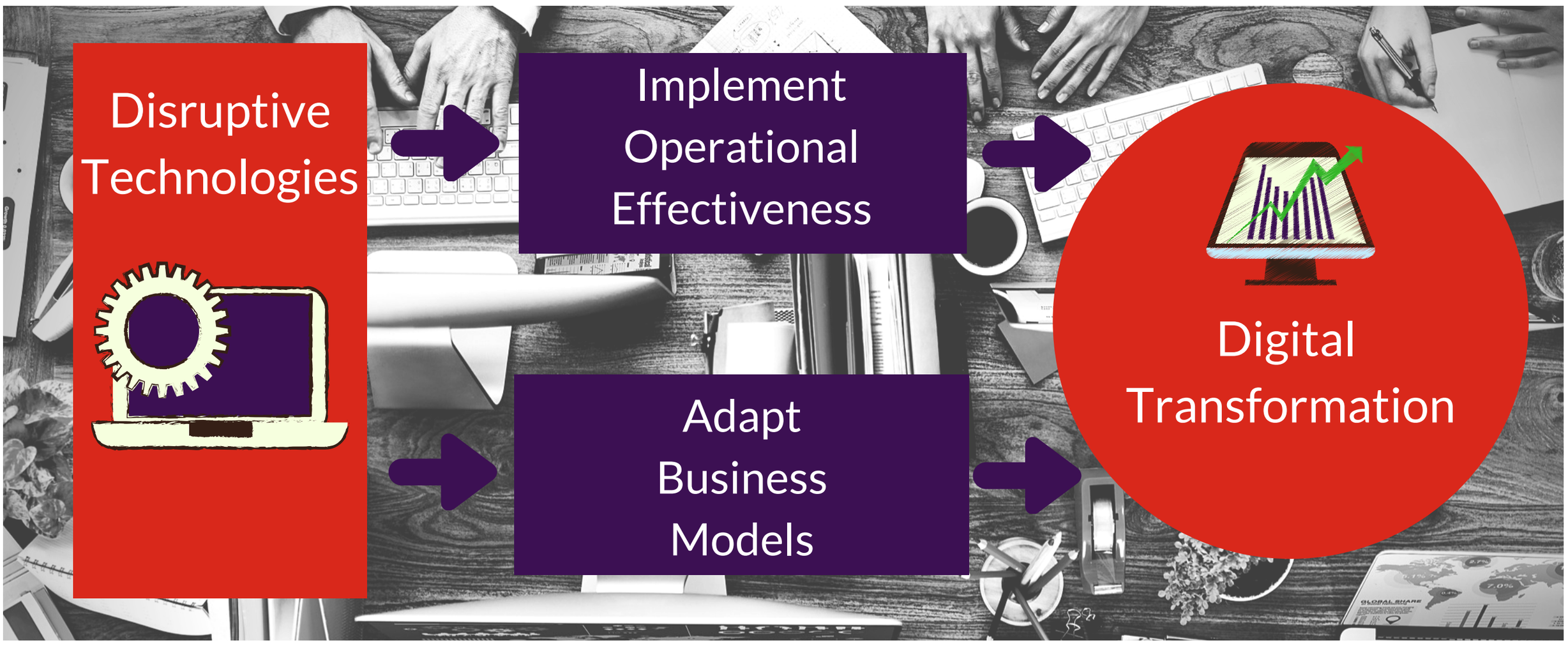
Results
New tools boosted throughput by 5%

3: The Business Opportunity

The traditional manufacturing business model is changing, and new models are emerging.

Change & Disruption = New Business Opportunities

Whilst the previous chapter focused mainly on leveraging the value from emerging technologies to increase operational efficiencies, this chapter looks at adapting business models. It is likely that overall digital transformation will be achieved when these 2 approaches are combined.



3: The Business Opportunity

Digital technologies are disrupting the manufacturing value chain. It requires companies to rethink their way of doing business. It requires a real mind shift to see and grasp the opportunities. We highlight a few examples below:

Platforms:

Products, services and information can be exchanged via predefined streams. Think open-source software applied to the manufacturing context.

> For example - a company might provide technology to connect multiple parties and coordinate their interactions.

SLM Solutions and Atos are currently running a pilot project to develop such a marketplace. Customers can submit their orders to a virtual broker platform run by Atos. Orders are then allocated to SLM's decentralised network of production sites. Then produced and shipped to the customer.

Licensed IP:

Today, many manufacturing companies have a deep expertise in their products and processes, but lack the expertise to generate value from their data.

> For example - manufacturers might offer consulting services or other businesses that monetise the value of their expertise.

Qualcomm makes more than half of its profits from intellectual-property royalties

Pay-By-Use and Subscription Based Services:

> For example - turning machinery from capex to opex for manufacturers.

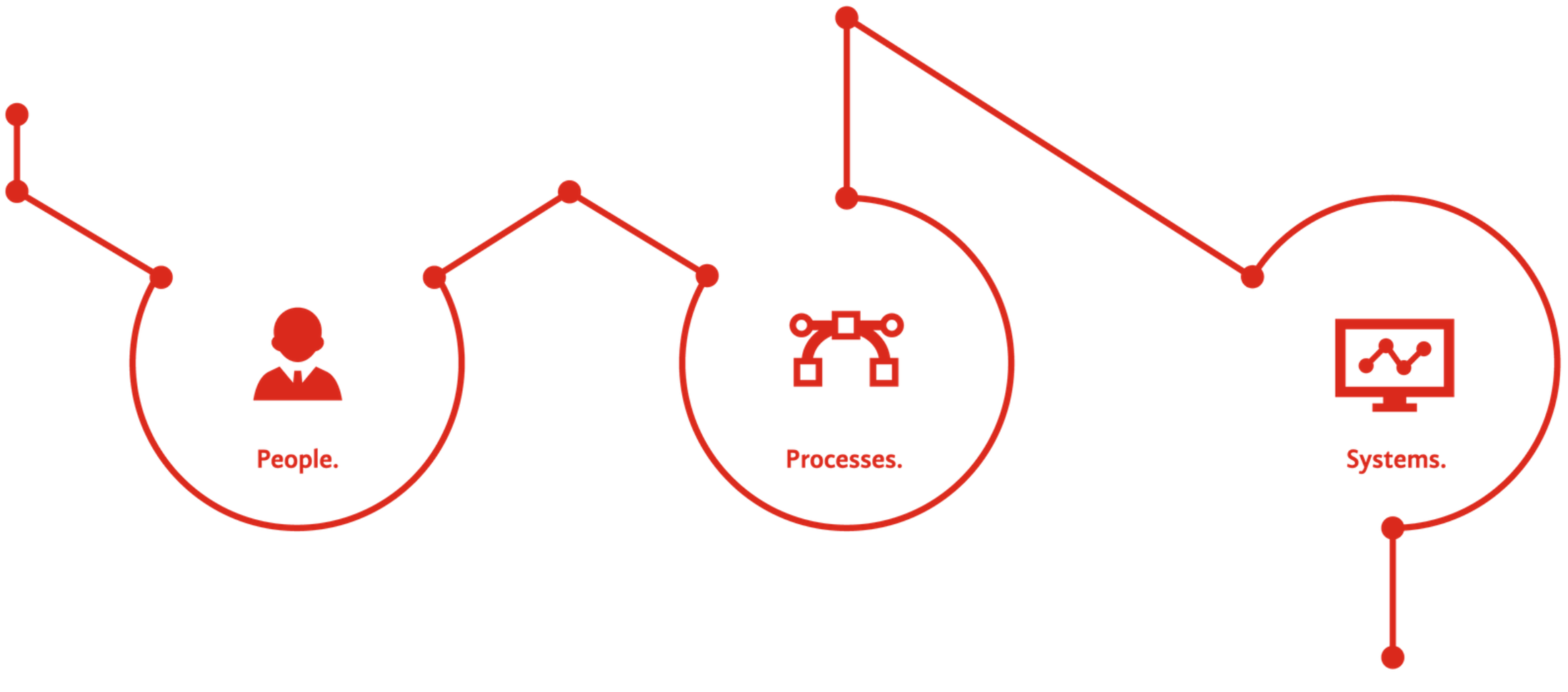
Rolls-Royce pioneered this approach in it's jet engine business.

This will be at odds for many of the more traditional manufacturing companies so it will be interesting to see how this develops and who emerges as the true innovators in this area. The likelihood is that there will be many more initiatives and uptake in the operational effectiveness activities – it is less of a paradigm shift and therefore easier to grasp and apply. But if the majority focus on that, no doubt there will be big wins for the few that dare to be bold on the business model front.

4: The Business Challenges

Increasing product and process complexity combined with rapidly changing markets and dynamic competition are daily challenges faced by companies. Product, market and technology cycles also keep getting shorter. In order to remain competitive, companies must be able to develop products and services quickly and manage logistics and production systems efficiently. This is what Industry 4.0 is all about.

It means the digitalization and networking of products, machines, processes and people with business systems along the entire value chain.



This is just another form of change. The challenge lies in implementing the change effectively with a holistic approach across people, processes and systems.

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4: The Business Challenges

In terms of transitioning to Industry 4.0, we see 3 main challenges:

1. Data Management

With the increase in data points across an organisation the sheer volume of data is going to grow exponentially. Making sure that the data is captured, stored, accessible and analysable will become a major challenge. In order to leverage the full potential of the new technologies, data management will be an essential element to a successful Industry 4.0 adoption project.

2. Security / Reliability

With the increase in machines, devices and systems all connected to the internet comes an eased security threat and a reliability risk. System drop outs and security breaches could both lead to a serious detrimental impact on operations and productivity.

3. Change Management

The fact that Industry 4.0 is being talking about having a 'revolutionary' impact implies that the level of changes across an organisation will be enormous. And so the people and change management aspect will be absolutely critical to a successful transition to the new environments and ways of working.

5: The Implications

We are all about People, Processes and Systems and so here is our view on the implications of Industry 4.0 across each of these:

People Implications

Technology / Science / Engineering

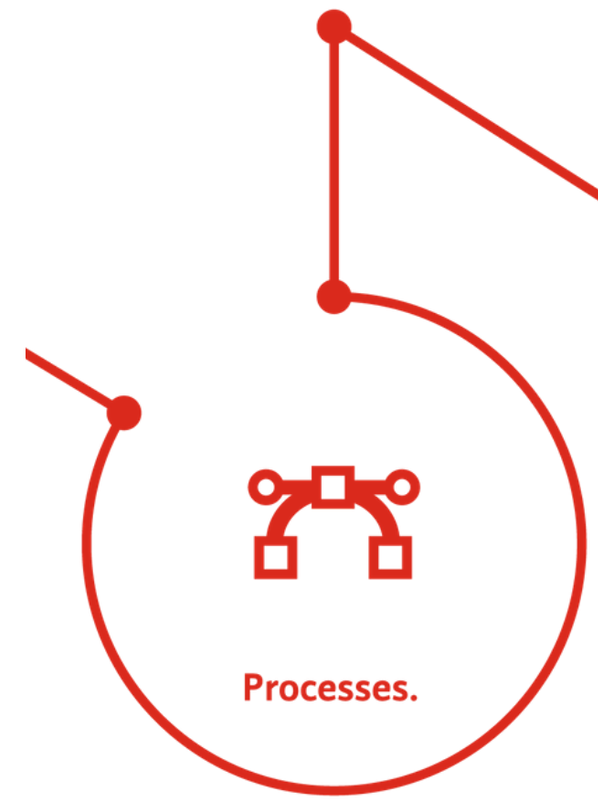
-> New opportunities, new skillsets required, new mindsets

Factory

-> Less people

-> Will need to understand full systems to implement true process change

-> Will need multiple skills to take on complex manufacturing roles to include implementation, support, and training of these highly advanced, cyber-physical systems



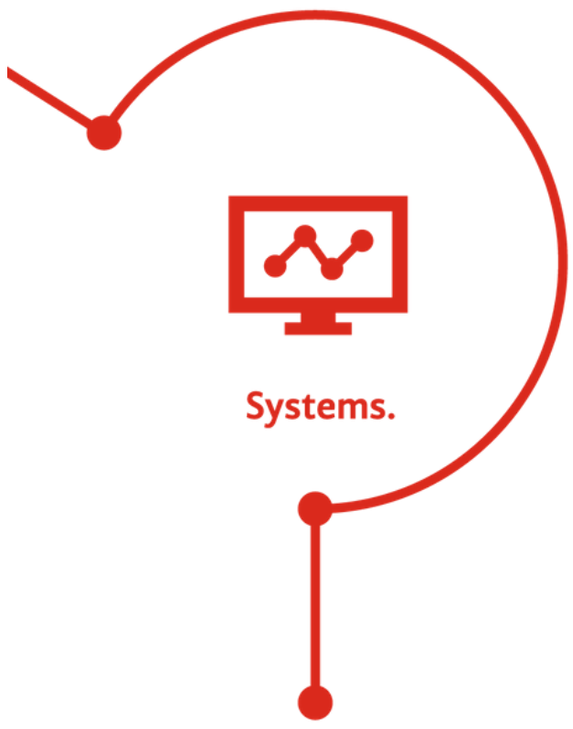
Process Implications

Lean will not disappear in Industry 4.0 - it should enable the true lean enterprise

-> Quicker flow of customised product

-> Radically reduce inventories throughout the supply chain

-> Significantly less waste



System Implications

Shop floors embedded with business systems and global networks of supply and demand through the cloud

-> Future potential: Self-diagnosing, self-optimising, self-configuring

-> Autonomously and automatically respond to changes in demand

"These Internet of Things products become platforms for new business services. With these additional services you can generate new revenue streams.

Either you do this yourself, or someone else will do it"

Stephen Ferber

Director of Communities & Partner Networks for IoT and Services

Bosch Software Innovations

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Enabling effective change.

Optimum PPS are business systems and digital transformation specialists.

All of our consultancy services are focused on driving business growth, business vaue and profitability for our customers.

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Change Management

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