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IMPROVING MANUFACTURING PERFORMANCE USING INDUSTRY 4.0


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ABOUT THE AUTHOR

John Broadbent has 45+ years' experience in manufacturing, starting his journey in Dec 1975 as a mechanical engineering cadet.

During the 1980s, he held various roles from project engineering, maintenance, to engineering management positions.

The advent of PLCs, HMIs, SCADA systems, DCS and MES caught John's attention, which led him into creating a world-class industrial automation business in 1995, with an enviable blue-chip client base.

During the 1990s he was also part of an Australian factory build team in SE Asia, working in Malaysia, China, and Thailand. It was in Thailand where he was given the opportunity to explore what has become known as 'smart factory' concepts, with outstanding results.

Then along came Industry 4.0 and smart factories became something of a buzz-phrase. John already had experience in this area and realised many businesses were struggling with the understanding of Industry 4.0, so he developed an engaging keynote to demystify the concept and make it accessible to SMEs.

He also developed an appetite for integrating ERP systems with factory systems, which led to subsequent relationships and experience with multiple ERPs for larger manufacturers.

The last 20 years of his career have been dedicated to helping manufacturers of all sizes utilise smart factory concepts, so he has seen first-hand the positive change these investments have made on profitability, longevity, sustainability and culture.

Unlike other proponents for Industry 4.0 or smart factories, John is acutely aware that systems are only one part of the solution, and that it is the alignment between people, processes and systems that's critical for project and business success.

His passion and experience are valued by both local and international organisations, and he is a sought-after keynote presenter to organisations, industry best-practice networks, as well as at manufacturing events. He also conducts readiness assessments for manufacturing organisations, to help them align their direction and effort, and where to invest.

He has also conducted workshops for universities as well as private companies on how to get the Industry 4.0 rubber to hit the road, which he now offers as both public and private workshops.

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01 INTRODUCTION

Improving manufacturing performance is key to ensuring all resources are being utilised in the most efficient and sustainable way. Fundamentally, ***it's about doing more with less***, whether it's utilities, raw materials or people.

> *Improving operational efficiency is a universal, perennial challenge across all manufacturing industries, including the food industry."*
>
> *– Lux Research*

Most manufacturing businesses are struggling with what's become known as 'digital transformation', a phrase that's been bandied about at conferences and in various media, from social to print. There's a lot of hype around too, confusing many manufacturers.

What we do know from research is that it's happening all over the manufacturing world and business leaders are aware they must do ***something***. But how to start? Who to trust? What projects to initiate?

This document lays the foundations for how you can determine the 'state-of-the-nation', as well as identifying your business's position in terms of Industry 4.0 readiness and maturity. It explains how you can explore the skills and appetite for embracing aspects of Industry 4.0, as well as identifying areas for investment, and associated strategic and competitive importance.

Those that have already embarked on this journey are reaping rewards and gaining competitive advantage, so there is enough evidence out there now to know that this approach, when well planned and executed, delivers in spades.

This document also outlines why some who have embarked on projects have failed, so you can avoid the pitfalls they have already experienced, and more importantly, learn from them.

There are various components to the digital transformation journey, however a major one is that information from the manufacturing environment becomes ***more real-time***. This means we know about issues sooner. However, to do this we have to accept that the large majority of our 'measures' are ***lag-based***, that is, known only via the rear-view mirror and well after the event.

Evidence shows that as a business moves more toward a ***lead-measure-driven*** culture, it becomes more agile and therefore more responsive to changing conditions, both within the four walls of its operation and along the external supply chain. It also improves customer-responsiveness, especially at the service level.

Finally, it is not all about the ***systems***. It is about a fine-tuned alignment between ***people, processes and systems***.

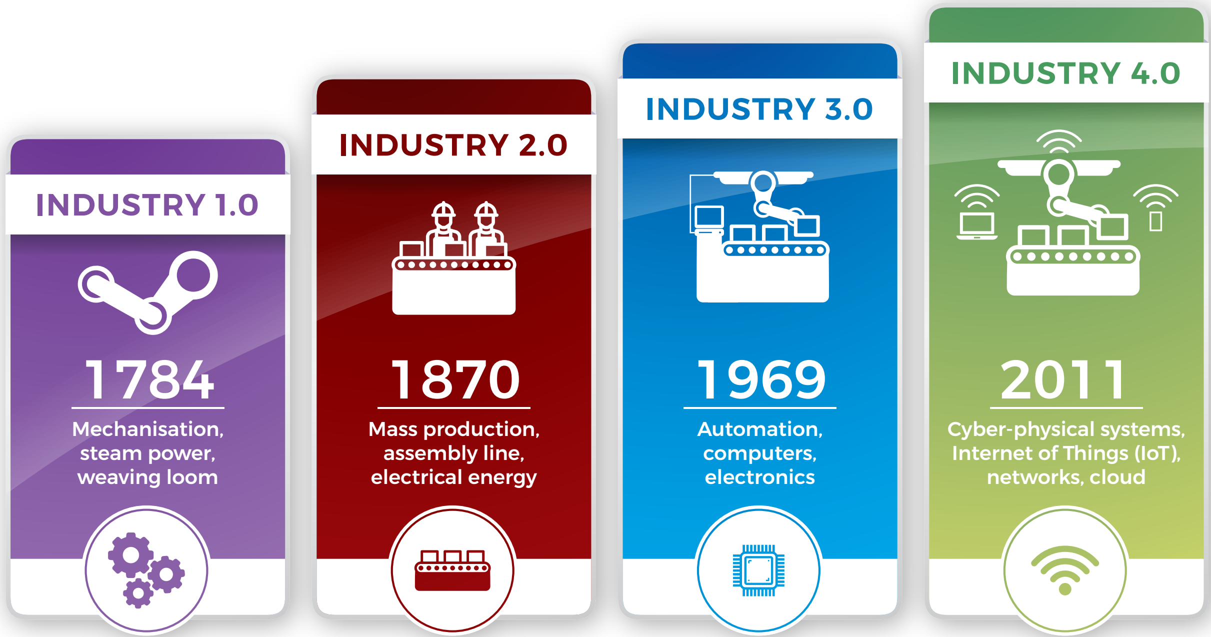
It also requires a committed leadership, otherwise expecting initiatives to spring from the factory floor, without support, guidance, commitment, budget, strategy, and resources, simply sets any project up for failure. The research and statistics show this too.

In the end, digital transformation is ***a whole-of-business affair***, best approached with the support of a committed leadership. It can be implemented in stages as long we understand what the stages are and in what order they must be done. Let's begin our exploration ...

02 UNDERSTANDING INDUSTRY 4.0

"Industrie 4.0" is known as the 4th Industrial Revolution, coined by Germany in 2011. You might also see it represented as ***4IR***.

If we look at the evolution of industry, the diagram below shows the inventions that emerged at the time, to create a major shift in how we made things:



We could also think of them this way:

1. Mechanisation
2. Electrification
3. Computerisation
4. Cyber-physical systems – supported by networks, cloud and 'Things', which describe systems where the cyber world (computers) interact with the physical world, and includes systems such as autonomous vehicles, automatic pilots, smart buildings, smart electrical grids and the typical human-machine-interfaces (HMIs) found in manufacturing plants

At the time of writing (2021), the Australian manufacturing environment is experiencing some businesses embarking on their Industry 4.0 journey, however the large majority have adopted either a 'wait-and-see', or in some cases, an unhelpful 'do nothing' approach!

The reasons for this are varied, however for most it comes down to:

- Lack of understanding – confused by all the hype, especially from vendors
- Lack of internal expertise – don't know that they don't know
- Lack of collaboration – siloed cultures that prevent effective internal cooperation (IT vs OT)
- Lack of strategy – no identified objective(s)
- Lack of leadership – owners or C-level are not committed to digital transformation

This table below from Lux Research shows there are six 'pillars', which digital transformation enables, and the ensuing value that emerges when they're in place. Each can be affected in part as the transformation progresses, so it's not an 'all-or-nothing' binary outcome:

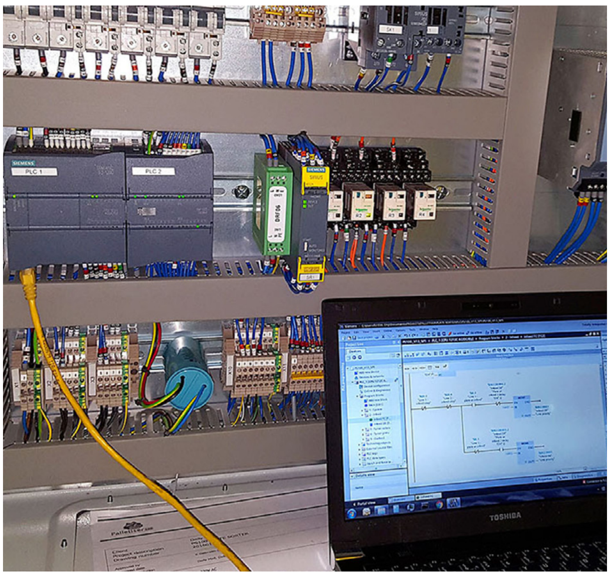
Uncover Invisible Insights	Find an insight by analyzing a signal or set of signals that humans can't easily interpret
Predict the Future	Determine the most likely outcome of a future situation - a practicular type of invisible insight
Optimize	Find optimal setpoints given a set of constraints - a practicular type of invisible insight
Upskill Humans	Grant humans a skill they didn't have before
Make Information Accessible	Make information visible and apparent
Automate	Eliminate or reduce human involvement in a process, task or decision

(Source: Lux Research)

Sometimes, digital transformation influences only one, however a mature transformation will impact all six, and to varying degrees. This often happens in parallel, depending on the business itself, so it's important to understand and be aware of the impact across each of these.

03 STARTING THE INDUSTRY 4.0 JOURNEY

Before we can commence our Industry 4.0 journey, research across a range of sectors has clearly shown there are a couple of precursor steps that must be in place. In other words, there are two mandatory prerequisites:

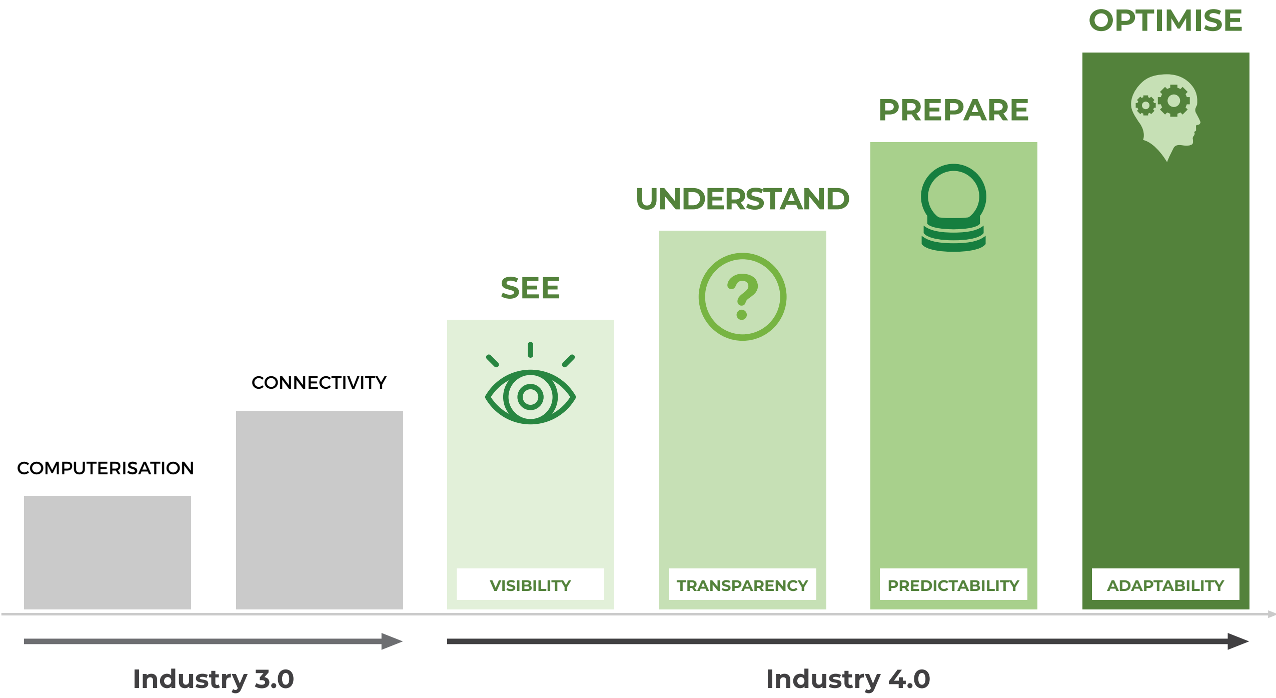


1. ***Computerisation*** – Data is made available from production processes and systems with minimal human involvement (not spreadsheets!), which means equipment purchases must include accessibility to information held in it

2. ***Connectivity*** – Appropriate IT infrastructure such as local area networks (LANs), Wi-Fi, switches, firewalls and cyber-security are in place to support the extraction

These prerequisites lay the foundations for digital transformation of manufacturing, which in itself is a complex journey and one that requires leadership, commitment, focus, investment, regular review, inquisitiveness, grit, and most of all, patience!

The diagram below shows this evolution with Industry 3.0 components in place, that then precede any foray into Industry 4.0. Again, most Australian manufacturers are stuck at Industry 3.0, with some aware that they even have old equipment still at Industry 2.0.



The two precursor steps mentioned above are shown in grey, so let's take a closer look at each of the remaining four:

3.1 STARTING THE INDUSTRY 4.0 JOURNEY

This step is about making data visible, utilising the foundation steps of computerisation and connectivity, to 'see' ***what*** is happening in various parts of the process. We can only improve what we measure, so this is the first and necessary step on the Industry 4.0 journey.

It is vitally important therefore that when purchasing manufacturing equipment and systems, we are cognisant of ensuring we can connect it to our network and ***mine*** information from it. Only then can we make it visible and useable.

(You can download a free copy of the Smart Factory Equipment Checklist here: https://realisepotential.com.au/smart-factory-equipment-checklist)

3.2 TRANSPARENCY

In this step, data is placed into context, for without it, it is meaningless with no frame of reference. This then gives meaning as to ***why*** we are seeing what we are seeing, therefore providing an understanding of the process conditions. It often means comparing current values with standards, although sometimes, 'standards' do not realistically reflect what is actually achievable and in some cases, are rarely reviewed through the lens of continuous improvement. It also aids problem-solving and root cause analysis (RCA).

3.3 PREDICTABILITY

At this level of maturity, confidence in the data is high and trusted to the degree that we can predict the most likely outcome. In other words, ***what*** will happen.

An example of this might be the capture of single pack weights that are being automatically tracked on a statistical chart (SPC), and when several sample values are ‘heading south’, algorithms can predict that ‘if nothing changes’, the product will be out of specification and faulty goods will be made. From this information, an operator alert can notify that a process adjustment needs to be made.

A place that has already established some maturity is with rotating machines, using vibration and temperature data for predictive maintenance. Some cloud-based monthly subscription-based systems are available to do this.

3.4 ADAPTABILITY

Finally, we mature to a level where we trust the data, analysis and algorithms enough that we implement systems to automatically make the changes.

At this level we ask ***how*** we can make a change to create a positive outcome.

In the example above in *3.3*, rather than an operator making a change, an automatic adjustment to (say) a filling process can be made, then monitored for effect. With concepts such as machine learning (ML), this then improves as more samples are gathered over time.

It’s important to note that as this progression matures, it naturally impacts the ‘six pillars’ previously shown on *page 5*, so we could think of those as being horizontal bands, super-imposed on each of the four vertical maturity pillars above. The mix and impact across each band will be different for each business, due to unique context, however it’s important to understand that the impacts will be there, nevertheless, and often with financial gains being discovered at each stage of maturity development. Often, explicit financial improvements will be there, with some being pleasantly surprised when implicit savings appear too!

04 LEAD MEASURES

Digital transformation is an enabler, which facilitates the availability of measures.

As mentioned in the Introduction, lead measures help a business determine an outcome (that is, forward-looking), rather than lag measures which are produced after the event (rear-view mirror looking).

Lead measures are also ‘input-based’ whereas lag measures can be considered as ‘output-based’. When chosen well, they can predict with a high degree of certainty, what a lag measure result will be.

This is invaluable for results such as P&L, variance, yield, quality, attainment, customer satisfaction, and the granddaddy of them all, EBITDA.

Lead measures can often seem initially unrelated to lag measures. For example, preventive maintenance task completion rate percentage (PM%) might not seem at first glance to have an impact on (say) production attainment. However, on closer analysis it makes sense that if equipment is being maintained at a high level of PM% task completion, then breakdowns should be minimised, production rate should be near optimal and quality should be high. This has a direct impact on attainment and measures such as Overall Equipment Effectiveness (OEE).

As per our lead-measure criteria of being “predictive and influenceable”, PM% task completion rate can be influenced by adherence to PM schedules, and PM% is predictive because of the cause and effect relationship between equipment maintenance, line performance and quality.

Acquisition of lead measures can also be categorised into three ‘buckets’, where the options move from least to most cost of investment:

1. **Easy / Have** – Available in existing data repositories
2. **Can Get** – Available in existing equipment or sensors but not yet connected, collected, stored, or made visible
3. **Capex** – Can be made available with investment in new ‘edge’ sensors, computerisation, or connectivity components

4.1 EXISTING DATA REPOSITORIES

Data in this category includes information in systems such as:

- Enterprise Resource Planning (ERP) systems such as SAP, Oracle, MS Dynamics, JD Edwards, Pronto, Infor, NetSuite
- Factory databases such as MES, LIMS, QA systems and custom databases
- Process Historians where various analogue process values are captured and stored, such as energy, flow, temperature, pressure, recipe numbers, cycle times, etc
- SCADA and HMI systems
- Building Management Systems (BMS)

Factory information (not ERP-related) is extracted from multiple and disparate data sources throughout the plant, including production equipment, and is often available for viewing as lead measures, if only they were identified.

4.2 EXISTING EQUIPMENT

Data in this category will already be available from existing equipment and connected to the IT network, or available but not yet connected. Therefore, it is available to be extracted and stored in existing repositories, with minimal effort and cost.

4.3 NEW EQUIPMENT & SENSORS

Data in this category will have been identified as a lead measure, yet the ability to automatically collect and store in existing repositories is hampered by a lack of connectivity, or lack of edge devices from which the data would normally be collected.

Values in this category require investment in sensors and perhaps other devices, as well as cabling, from which the information can then be extracted.

Once measures are understood, defined, and assessed via the above three categories, a plan can be put in place to execute, as well as some understanding of where future capex investment might have the best return-on-investment (ROI).

05 INPUTS & OUTPUTS

In essence, each process within the four walls of a manufacturing facility can be simplified into the following process flow, where ‘inputs’ are lead measures and ‘outputs’ are lag measures. The ‘process’ itself is the conversion of inputs to outputs:

INPUTS (CONSUME) → **PROCESS (TRANSFORM)** → **OUTPUTS (PRODUCE)**

If we view this at a macro level, that is, across the entire plant, the following diagram applies:

POWER
WATER
GAS
LABOUR
RAW MATERIALS

→ **PROCESS(ES)** → **FINISHED GOODS**
WASTE

Even at an individual production order level, the same model applies, although the complexities of measuring and/or capturing inputs at this granular level may be more difficult at the start of the journey. This can be especially so for labour when resources are moved between production areas during a shift, for example.

5.1 MACRO INPUTS

It is possible to capture the inputs at a macro level and relate these to outputs over a given period. Capture of this type requires very little investment and in fact, most of it can be done manually, such as reading meters (power, water, gas) and recording in a spreadsheet (although not the preferred method) or database.

For example, total consumption of power over a set and given period, such as a week, can be captured from a manual or electronic meter reading. The number of kw.h consumed would be directly equated to the amount of output of finished goods produced (i.e. kg), thereby providing a kw.h/kg (input-over-output) relationship and one that can be recorded via a trend.

Coupled with the other macro inputs, these provide some rudimentary insights into cause-and-effect.

To really enhance the level of granularity, however, requires automatic capture and at a lower level than the example above from the main power meter. This is where sub-metering plays an important role.

5.2 SUB METERING

To gain deeper understanding of how and where inputs are consumed, especially those that are utilities-based (power, water, gas), it is necessary to implement sub-metering.

Sub-metering captures consumptions as the utility flows down the branches it can take. For example, the main incoming power meter gives total power consumption for the site, while sub-metering at a line-based switchboard would provide power usage for that area only.

Sub-metering might require capital expenditure for meters and installation, as well as connection to the site-wide network and collection into a suitable (existing) data repository.

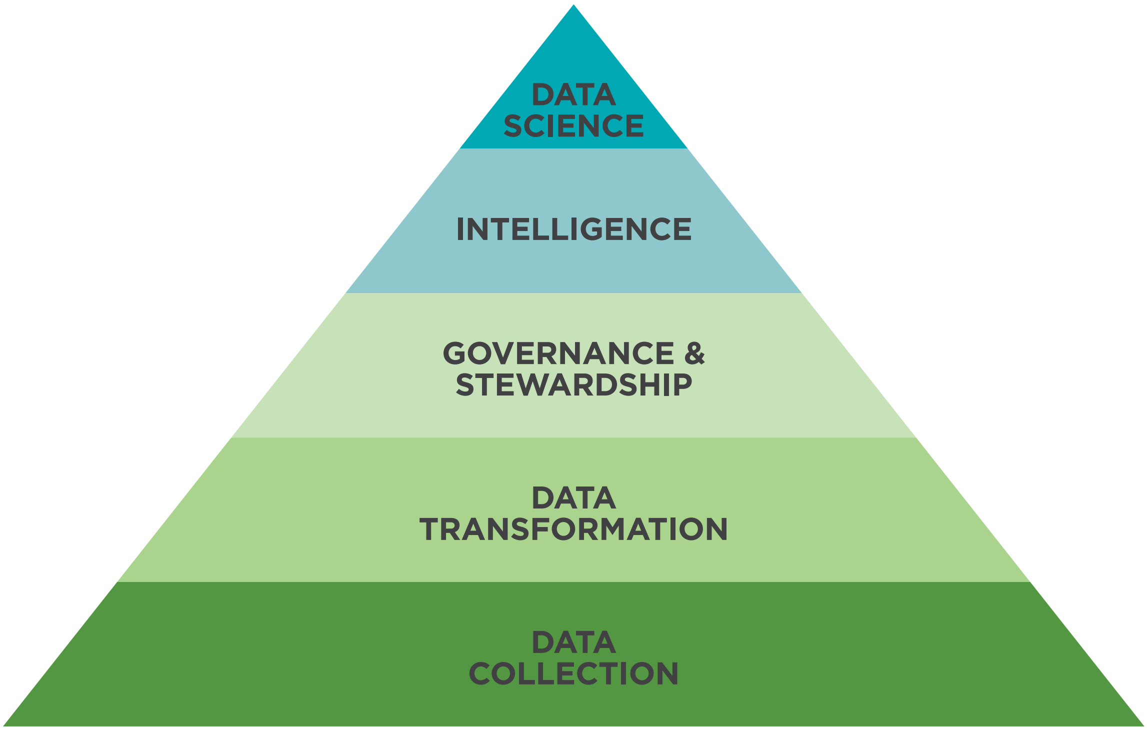
5.3 INPUT OUTPUT RELATIONSHIPS

Sometimes, relationships between inputs and outputs can appear to be or not to be meaningful. For example, the relationship between labour and finished goods kgs (hrs/kg) may or may not provide insight into production and labour efficiency. However, relationships such as this need to be explored, as sometimes, relationships can seem initially unrelated, yet able to be influenced through process or behavioural change.

This is an area that requires some experimentation and analysis if effective lead measures are to be captured and used to predict outcomes (outputs). A good book to read on this is The Four Disciplines of Execution, which is a Franklin-Covey production and an excellent audio book.

06 DATA PYRAMID

We can also view the collection of information as a ‘data pyramid’, that is, a hierarchical structure which shows the transition of data from its point of collection, to the heady heights of data science and machine learning, as per the graphic below:



The five levels can be summarised as:

6.1 DATA COLLECTION

From a manufacturing perspective this is data collected mainly from operational systems such as plant and equipment. In other words, the ‘raw’ data from the ‘edge’. To use a car example, this would be all the data collected by an engine management computer system, the large majority of which stays hidden to you the driver.

6.2 DATA TRANSFORMATION

This layer refers to the collection, extraction, and storage of information, including both the methods and processes that the data undergoes, to deliver it in context.

To continue with the car example, it would be that an electrical signal is read from an oxygen sensor in the exhaust stream, transformed into a value, compared to some setpoint to ensure normal operating range, and if so, ignored. Only when the value is outside normal limits would it be captured and stored, which might also trigger the engine management symbol to illuminate on the dashboard and inform the driver that a fault has occurred, or a service is required.

6.3 GOVERNANCE & STEWARDSHIP

While most larger organisations have a master data team who are responsible for ensuring the data in their ERP is up-to-date and accurate, most do not have anyone responsible for manufacturing data quality or stewardship. This is why some existing data collection systems go off-line and may not be noticed, sometimes for months.

However, once data is collected and used on a regular basis, particularly in live performance dashboards and trends, an outage of a lead-measurement point is noticed quickly so remedial action can be taken.

6.4 INTELLIGENCE

To follow on with the car example, this is the dashboard, which shows both lead and lag measures.

A lead measure would be the current speed, while a lag measure would be the number of kilometres displayed via the odometer. Fuel, water, and oil are inputs to the engine, while kms travelled is the result or output.

KPIs are another area where values from the various processes can be collected, calculated, and contextualised for the multiple tiers found within an organisation, often using business intelligence (BI) tools.

To take advantage of ***manufacturing intelligence***, however, which is the collection and display of real-time production information, there are several open-source and free options in the marketplace that will fulfil this requirement, so some research is required to ensure a wise choice is made, and with the support of your IT team.

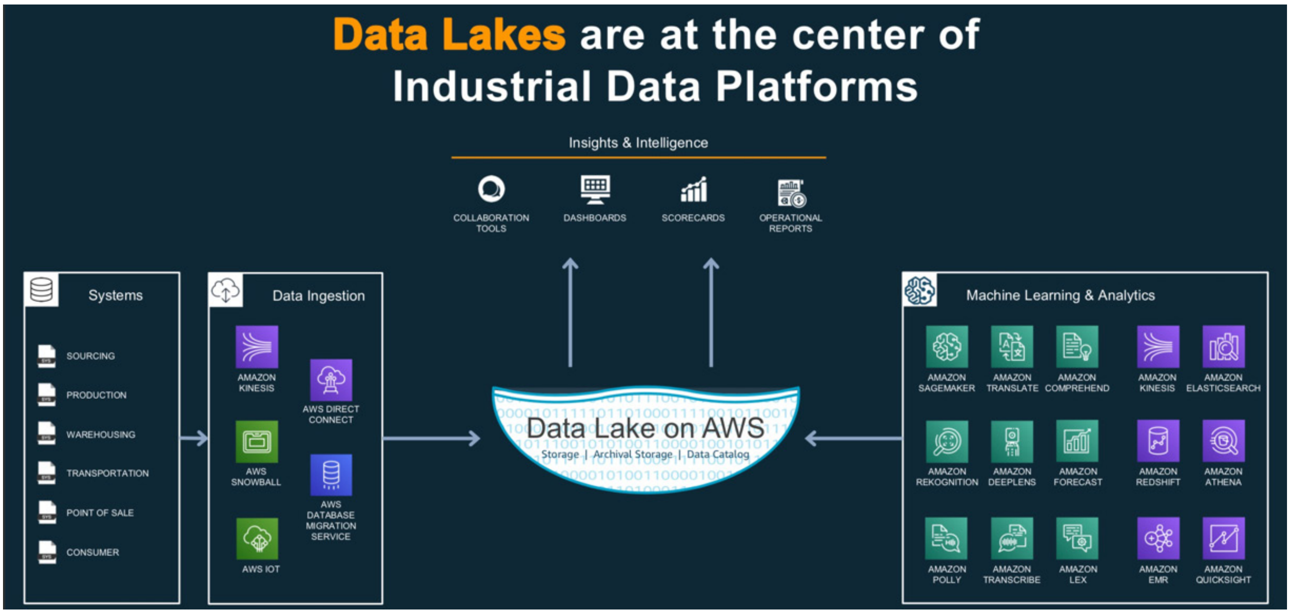
6.5 DATA SCIENCE

This is where predictive analytics and adaptability deliver the promise of Industry 4.0, using modalities such as artificial intelligence (AI) and machine learning (ML).

Referring to our car example, this is an autonomous vehicle, with lane sensing, anti-collision features, and self-navigation, which is a culmination of a whole host of data analysis, automatic decision-making and predictive modelling.

As an example, Amazon Web Services, also known as AWS, is one provider of data capture (ingestion), storage and analysis services as part of their data platforms, specifically geared toward manufacturing.

The diagram below shows some examples of its landscape and architecture, currently available to AWS customers. I use this as an example of how IoT-enabling businesses are offering ready-made tools to assist manufacturers in embracing machine learning (ML):



While many manufacturers are some way from capitalising on this final stage of development and maturity, in the words of Dr. Stephen Covey and Habit 2 from *'7 Habits of Highly Effective People'*, "Begin with the end in mind!"

Being aware of this end goal ensures that decisions made now, are made with awareness that sometime in the future, AI and ML will play a part.

07 WHAT OTHERS HAVE LEARNED

With Industry 4.0 now over a decade old, there's enough evidence from those who are the innovators and early-adopters, to show what happens when manufacturers embrace digital transformation.

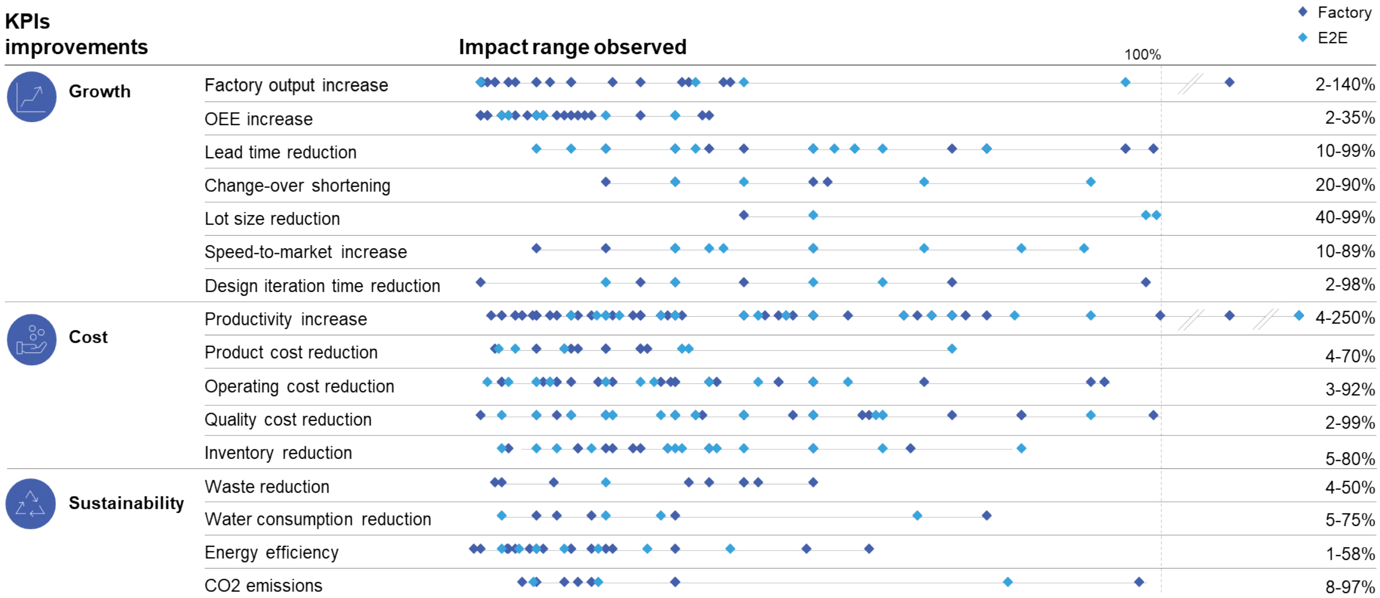
Whether we read reports from large consulting firms or generally search for information on manufacturing metric improvements, or read positioning statements from governments, we know what to expect.

In 2018, the World Economic Forum (WEF) created the Global Lighthouse Network (GLN) to gather global businesses who had adopted digital transformation and Industry 4.0. McKinsey and Co supported the assessments and audit of results.

By the end of 2021, there were 90 manufacturing businesses in the GLN, across a range of sectors: discrete, pharma, F&B, automotive, petrochemical, industrial components … who offered insight into their journey and improvements.

This table from the 2021 WEF GLN report shows the improvement in 16 key manufacturing performance metrics that most manufacturers will recognise:

> *"Digital factory investments have led to an average increase of 10 per cent in production output, 11 per cent in factory capacity utilization, and 12 per cent in labor productivity."*
>
> *- Deloitte*



The dark blue diamonds represent those businesses that have implemented Industry 4.0 within the four walls of their manufacturing facilities, while the lighter blue diamonds represent those that have applied these principles along their supply chain (end-to-end or E2E).

The start of the improvement scale ***starts at '0'***, meaning NONE of the businesses went negative in their improvements! As you can see there are some spectacular results in there too, albeit they're outliers.

We now know that improvements, even at the lower end of the scale, can contribute substantially to the profitability of a manufacturing business.

08 WHY PROJECTS FAIL

There are many research reports you can find on the Internet about why IoT projects fail. One I found particularly compelling and insightful was from Cisco, with the sensational headline declaring, "Cisco Survey Reveals Close to Three-Fourths of IoT Projects are Failing" *(https://newsroom.cisco.com/press-release-content?articleId=1847422).*

On reading it there are four key findings that can really be applied to any project. At first glance they might appear to be common sense, however these are often overlooked, especially the ones that are people-centric:

8.1 THE HUMAN FACTOR MATTERS

Culture, organisation, and leadership were cited as important considerations, not just the 'tech' as I have previously noted. Also, collaboration between IT and the business was an essential ingredient for those projects that did succeed.

Accessing appropriate expertise in the technology set, whether internally or externally, was also an important consideration.

8.2 DON'T GO IT ALONE

The top-five challenges across all stages of implementation were:

1. Time to completion – often underestimated
2. Limited internal expertise – not enough internal knowledge or experience
3. Quality of data – what was collected was not of sufficient quality, with sometimes 'dirty data'
4. Integration across teams – needed more collaboration and interdepartmental communication and cooperation
5. Budget overruns – no surprises here when points 1 to 4 are taken into account

8.3 REAP THE BENEFITS

When critical success factors come together, organisations reaped a windfall in smart-data insights, with:

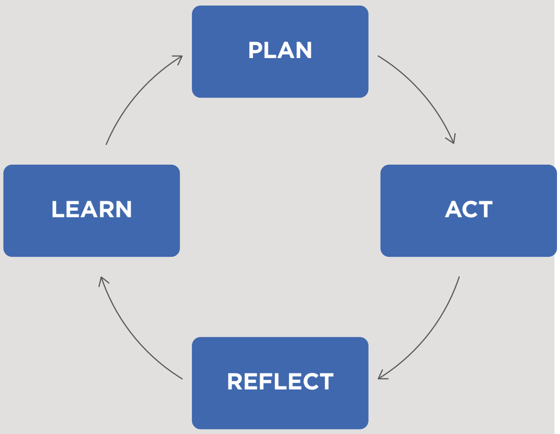
1. 73% of research participants using data from IoT completed projects to improve their business
2. Globally the top 3 benefits included improved:
   • Customer satisfaction (70% agreed)
   • Operational efficiencies (67% agreed)
   • Product / service quality (66% agreed)
3. Improved profitability was the top unexpected benefit (39% agreed)

8.4 LEARNING FROM EXPERIENCE

I found this to be the most surprising as "64 per cent agreed that learnings from stalled or failed IoT initiatives have helped accelerate their organisation's investment", meaning that failure ***propelled*** them into further investment.

If your organisation is risk-averse, there needs to be a cultural shift to accept that failure will be part of the learning cycle: *plan act reflect learn plan ...*

It is vitally important that a structure is put in place as to assess failure, formally debrief the result and to determine how the learnings can be inculcated into future iterations.



09 AVOIDING PILOT PURGATORY

Now that we can see what benefit we can obtain and are aware of why projects might fail, we should be in a better place to apply for funding to implement a pilot project.

The term, 'pilot purgatory' has become commonplace in Industry 4.0 related projects, in fact the WEF GLN itself has many projects still in pilot phase at the end of 2021, within the 90 members.

There are many opportunities to invest in projects and one way this is often done is under the title of 'proof of concept' or PoC.

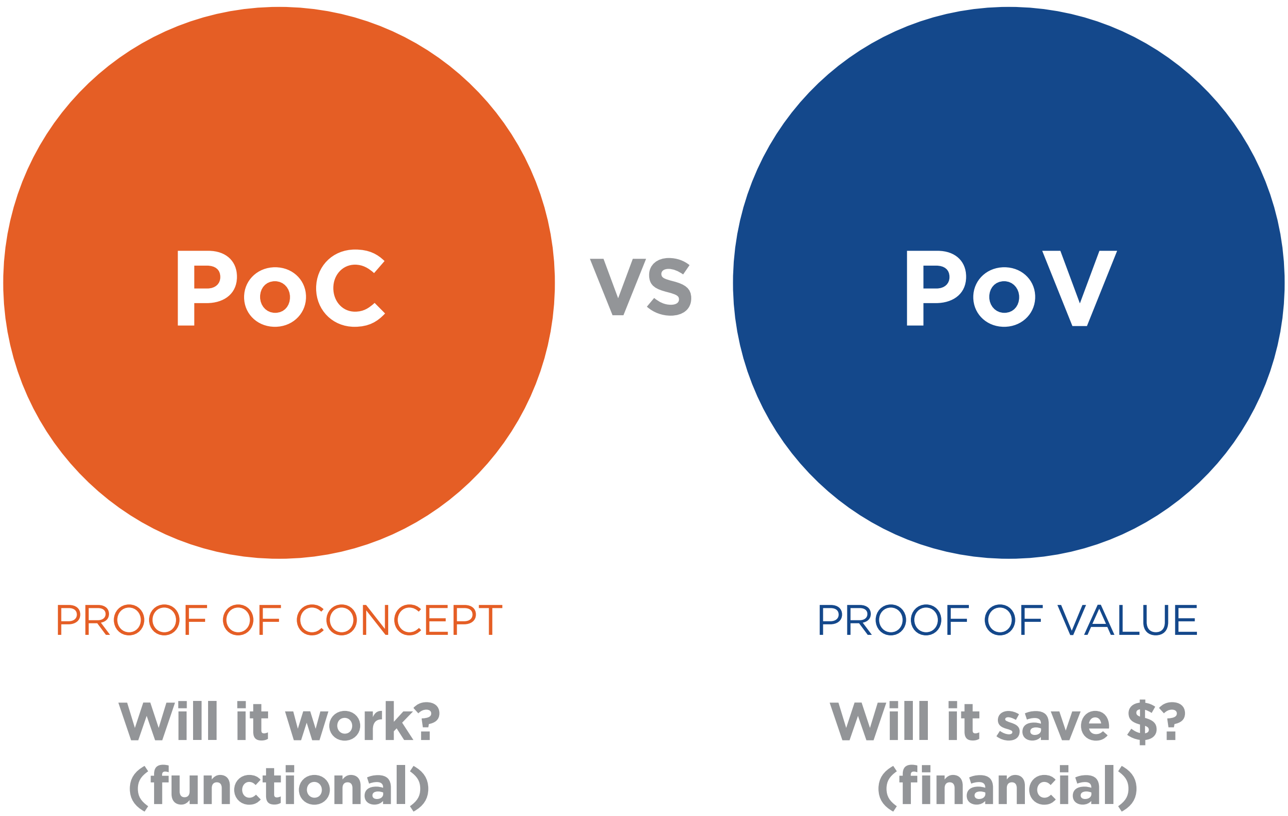
PoCs are employed to determine whether the concept itself is sound, that is, what might be the ***technical*** challenges along the way. This is suitable for new concepts, where perhaps the application of science and engineering might be novel.

Typically, a hypothesis is created, physics and other laws of science are applied, a pilot project is created to test whether the science and engineering actually represent the real-world system, and so the ***concept*** is tested or proven.

When it comes to manufacturing, the IIoT and the realm of data collection though, transformation and delivery of data (which is the mainstay of Industry 4.0 projects), has been a known process for more than three decades, so why do we need to prove anything, conceptually or technically?

In order to obtain funding for such projects, CFOs and other financial leaders in manufacturing businesses are not interested in whether data can be collected, stored, transformed and delivered. They've been doing this themselves with business intelligence (BI) reports for P&L, variance, yield and EBITDA (just to name a few).

The real opportunity is translating what collection and delivery of timely information can contribute to the business's bottom line, or triple bottom line if you wish to assess social and environmental impacts, not only financial.



This then presents an opportunity to see Industry 4.0 projects as ***Proof of Value*** or PoV, which is a question not of technical capability, but of financial contribution. For example, in the Deloitte quote earlier in this document and the across-the-board assessment that digital manufacturing investment have made in terms of output (10%), capacity (11%) and labour productivity (12%), this is not chump change!

Those of us knowing that investment in projects such as this will improve the overall manufacturing outlook of improved efficiencies and a lower cost base, MUST present this in a new way that entices those holding the purse strings to see the financial impact this will have.

A pilot may be the best way, however the terms of reference (what it will cost and what it will return) are paramount to ensuring such projects get approved.

Sometimes, an initial foundation step of investment in (for example) IT infrastructure, will have no immediate return on investment, however just like constructing a multistorey building, we cannot do so until we lay down solid foundations.

It's up those responsible for these projects at a senior level, to 'sell' the vision, often 3-5 years, with the initial year's investment having low ROI and rising as improvement projects themselves come online.

The high cost of doing nothing also needs to be considered, as the manufacturing world is littered with the gravestones of those businesses who knew what they had to do, yet failed to act and innovate. Rest assured, a competitor, somewhere, is about to do just that.

10 ADVISORY BOARDS HAVE THEIR PLACE

Based on the Cisco research and many others, it is apparent that the large majority of manufacturers that start the Industry 4.0 journey, do not have the required expertise within their organisation.

The clever ones recognise this and convene an ***advisory board***, comprised of cross-departmental representatives that have some mandate, plus ***external expertise*** to guide and mentor the team to success.

Some factors that ensure an advisory board has the appropriate charter and will create value, can be things such as:

1. Utilising outside expertise – bring in specialist knowledge
2. Know what works – capitalise on others' experience
3. Cost-effective – can be much less than an FTE with high ROI
4. Ensure strategy is followed – ensure no 'shiny objectitus'
5. Hold accountability – keep everyone accountable for their commitments
6. Don't exercise control – simply keep the advisory group to its mandate

In other words, don't be afraid to seek outside and well-referenced help.

11 CONCLUSION

So, to conclude, if you are considering using Industry 4.0 as an underpinning platform for improving your manufacturing performance, and part of your digital transformation journey, remember:

1. Don’t buy the hype
2. Have a roadmap and stick to it
3. Ensure talent with support from external expertise
4. Collaborate between departments, especially IT-OT
5. Learn from others
6. Commit to the plan
7. Debrief!
8. Celebrate and learn from failure

There is a mountain of information available in reports, research papers, best-practice guides, technical papers and of course the platforms, tech and software systems themselves.

While it is possible to get overwhelmed by all that’s available, best to start by firstly assessing where your manufacturing business is on the Industry 3.0 / 4.0 maturity path, create an end goal, then ‘begin with the end in mind’.

I do hope you have found this document informative and that it has helped you understand where opportunity might be in your business, to improve manufacturing performance using Industry 4.0.

If you’re looking for someone to help you convene an Advisory Board, understand how to start, or simply looking to evaluate your Industry 4.0 readiness, you can contact me via:

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