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Enabling Digital Transformation of Industry With AI and Big Data

Thursday, 17 March 2022 | Technical Topic Webinar

Presented By

Dr. Imtiaz Madni | EIT Lecturer and Senior Electrical Engineer

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Agenda

1	Welcome and Introduction
2	What is Industrial AI?
3	Enterprise AI Applications
4	International standards in enabling smart manufacturing
5	SC 42 ecosystem approach
6	Conclusion and Q&A

Introduction - Presenter

Dr. Imtiaz Madni – EIT Lecturer and Senior Electrical Engineer

Dr. Imtiaz Madni comes from a solid technical background with a diverse working experience in the energy industry as an electrical system engineer and electrical project manager. He has a demonstrated history of working in the manufacturing, electrical systems, renewables, and higher education industries.

With a Ph.D. in Electrical and Electronics Engineering, Imtiaz has a background in generating innovative ideas and strategies to improve processes that provide a deeper understanding of multifaceted problems that companies encounter in their daily operations. Together with renowned scientists and high-end industry collaborators, Imtiaz is working on the energy transformation of Australia.

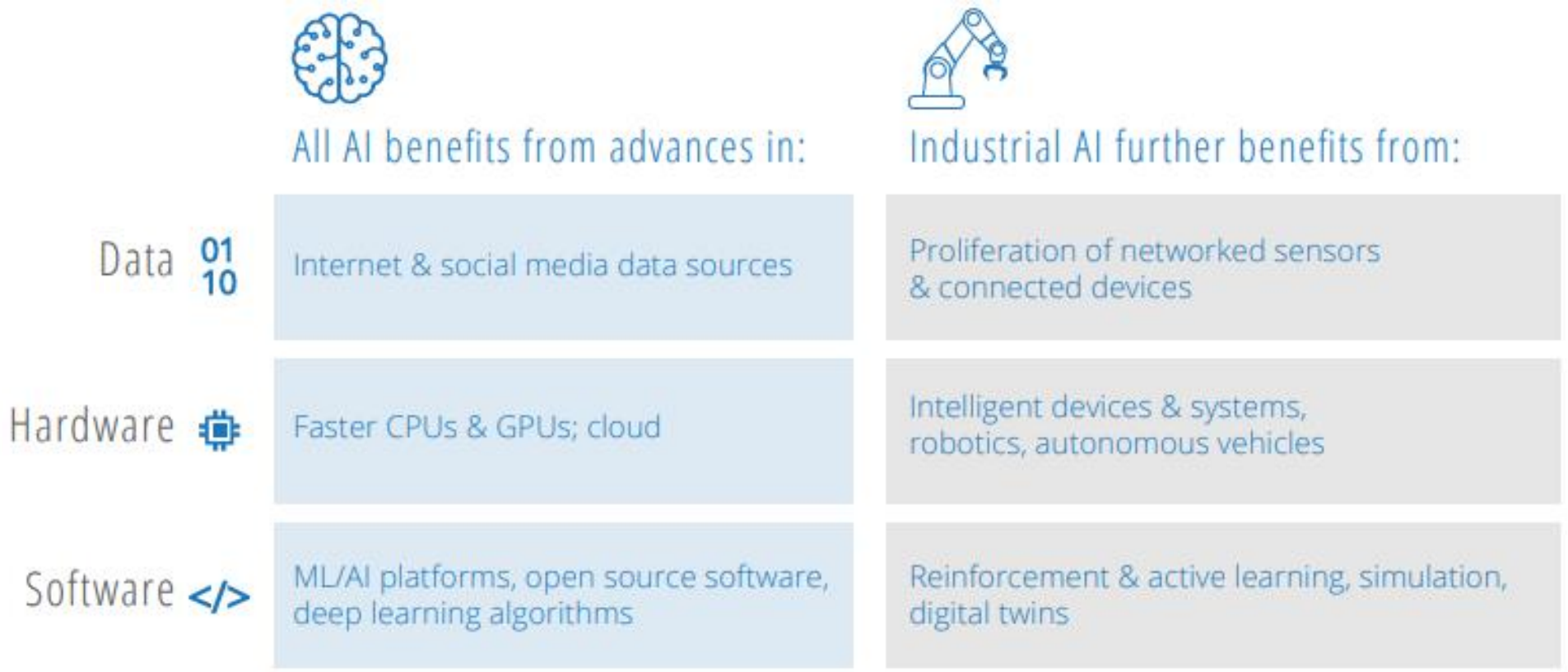
Before moving to Australia, he was working as a post-graduate researcher at the Chinese Academy of Sciences in China.

Find him at: https://www.linkedin.com/in/imtiaz-madni-a8aa652a

What is Industrial AI?

Artificial intelligence (AI) refers to those computer science techniques and technologies that allow software to exhibit 'smarts'—in other words, to do things that seem human-like.

This can include things like making decisions, recognizing objects, or understanding speech. It really is a very broad term.



How does AI Relate to ML and Big Data?

Strictly speaking, **machine learning (ML)** is a subset of AI.

ML refers to a set of techniques that allow us to create AI software by training that software with data) to display some desired intelligent behavior.

While machine learning is only one way to build an artificially intelligent system, for all practical purposes ML and AI are used interchangeably today.

All the interesting activity in AI is in machine learning.

How does this relate to **big data**? Well, data is used to train the machines, and the more you have of it the better.

And how about predictive analytics?

Well, machine learning can be a more powerful way to make predictions, and one that can learn from patterns in the data.

What is Industrial Internet of Things (IIoT)?

The **Internet of Things (IoT)** is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data.

For enterprises whose operations involve the physical world, the industrial internet of things (IoT/IIoT) is an increasingly important source of insight into the status, location and performance of enterprise assets.

Source: Medium.com

To what then does the term “industrial AI” refer?

Certainly the word industrial has certain immediate connotations, primarily of manufacturing and heavy industry.

But to limit our scope to just those industries would be to miss the less obvious connections between a broad set of related use cases, the environments they exist within, and the common challenges and requirements that they give rise to.

We define industrial AI as any application of AI relating to the physical operations or systems of an enterprise. Industrial AI is focused on helping an enterprise monitor, optimize or control the behavior of these operations and systems to improve their efficiency and performance.

Defining Industrial AI

Engineering Institute of Technology.

Industrial AI

Any AI relating to the physical operations and systems of an enterprise

Physical Operations

- Logistics
- Asset Management & Maintenance
- Production & Assembly
- Facilities and more...

Physical Systems

- Fleet
- Sensors & Devices
- Machine Tools
- Industrial Robots
- Production Line
- Developed Assets & Infrastructure
- HVAC and more...

Source: CloudPulse Strategies

How is Industrial AI Different?

The stakes are much higher!

	AI-Enabled Business Applications	Industrial AI
Primary domain:	Digital	Physical
Use cases:	• Marketing & sales • Customer service • HR • Productivity & collaboration • Analytics	• Predictive maintenance • Factory & warehouse automation • Supply chain management • Fleet logistics & routing • Quality control • Fault detection & isolation • HVAC automation
Data sources:	• Enterprise transactions • Business metrics • User interactions	• Enterprise data sources • SCADA systems • Industrial robots • IoT sensors
Delivery model:	Web, mobile, desktop	• Web, mobile, desktop • Industrial robots • Intelligent systems • Connected devices

Consider one example:

The case of a predictive maintenance system monitoring performance of an aircraft engine.

If an analytical system on a plane determines an engine is faulty, specialist technicians and engineers must be dispatched to remove and repair the faulty part.

Simultaneously, a loaner engine must be provided so the airline can keep up flight operations.

The entire deal can easily surpass $200,000.

How is Industrial AI Different?

Industrial AI thus presents several challenges that differentiate it from consumer and business applications of AI, including:

- Data acquisition and storage
- Training challenges
- Testing costs and complexity
- High regulatory requirements
- High cost of failure & change
- Large state spaces
- Cost of talent

Enterprise AI Applications Landscape

	AI-Enabled Business Applications	Industrial AI
Monitoring	• Business incident response • Brand sentiment monitoring • Fraud detection	• Quality control • Productive maintenance • Supply chain risk management
Optimization	•Campaign planning • Personalization & recommendations • Demand forecasting & planning	• Process planning • Job shop scheduling • Fleet management
Control	• Process automation • Camaign automation • Automated trading	• Factory automation • Autonomous vehicles • Smart grids

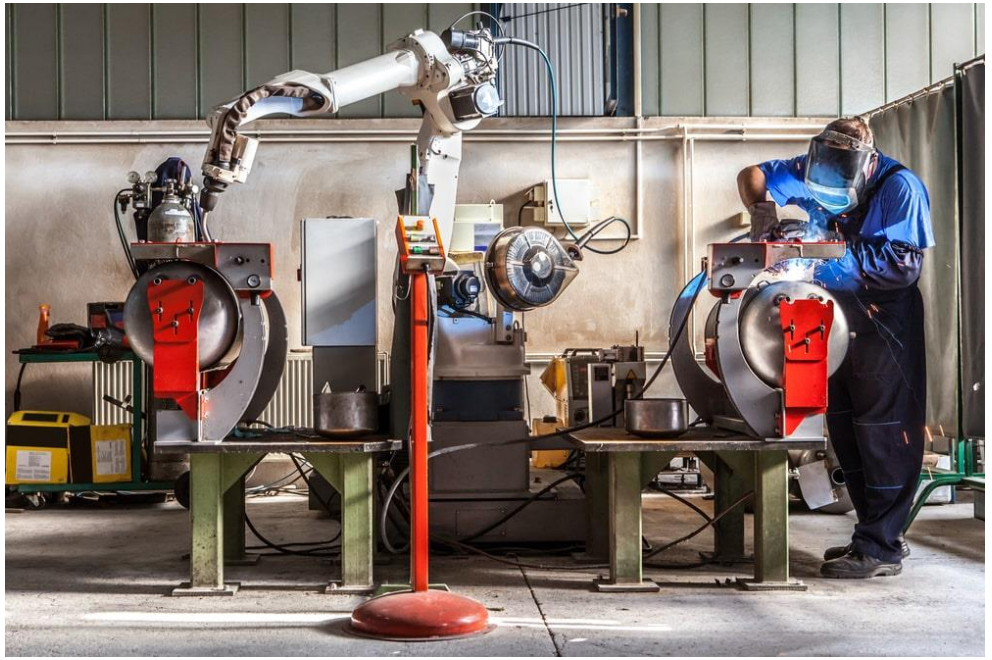
Industrial AI Applications

Cobots work with humans

Collaborative robots -- also called cobots -- frequently work alongside human workers, functioning as an extra set of hands.

While autonomous robots are programmed to repeatedly perform one specific task, cobots are capable of learning various tasks.

They also can detect and avoid obstacles, and this agility and spatial awareness allows them to work alongside -- and with -- human workers.



Industrial AI Applications

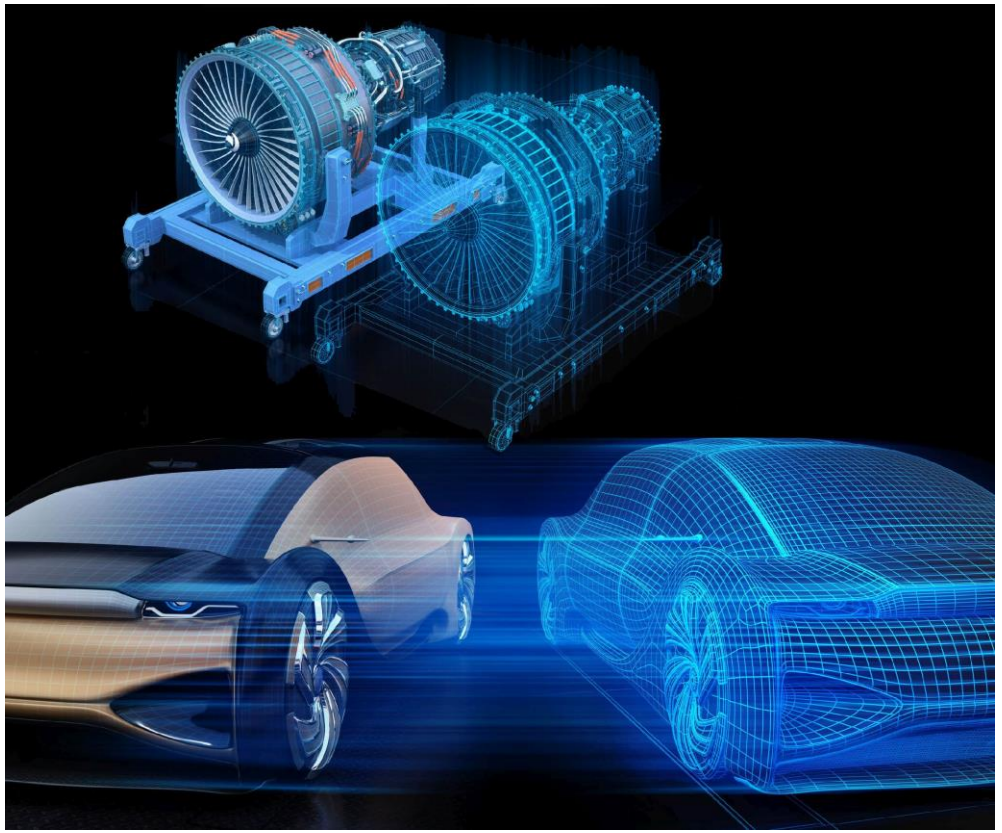
Digital twins help boost performance

Companies can use digital twins to better understand the inner workings of complicated machinery.

A digital twin is a virtual model of a physical object that receives information about its physical counterpart through the latter's smart sensors.

Using AI and other technologies, the digital twin helps deliver insight about the object.

Companies can monitor an object throughout its lifecycle, and get critical alerts, such as a need for inspection and maintenance.



Industrial AI Applications

Predictive maintenance improves safety, lowers costs

Manufacturing plants, railroads and other heavy equipment users are increasingly turning to AI-based predictive maintenance (PdM) to anticipate servicing needs.

If equipment isn't maintained in a timely manner, companies risk losing valuable time and money.

On the one hand, they waste money and resources if they perform machine maintenance too early.

On the other, waiting too long can cause the machine extensive wear and tear. The latter can also expose workers to safety hazards.

PdM systems can also help companies predict what replacement parts will be needed and when.

Industrial AI Applications

Machine learning algorithms predict demand

AI systems that use machine learning algorithms can detect buying patterns in human behavior and give insight to manufacturers.

For example, certain machine learning algorithms detect buying patterns that trigger manufacturers to ramp up production on a given item.

This ability to predict buying behavior helps ensure that manufacturers are producing high-demand inventory before the stores need it.

Industrial AI Applications

Several other applications including:

Lights-out factories to save money

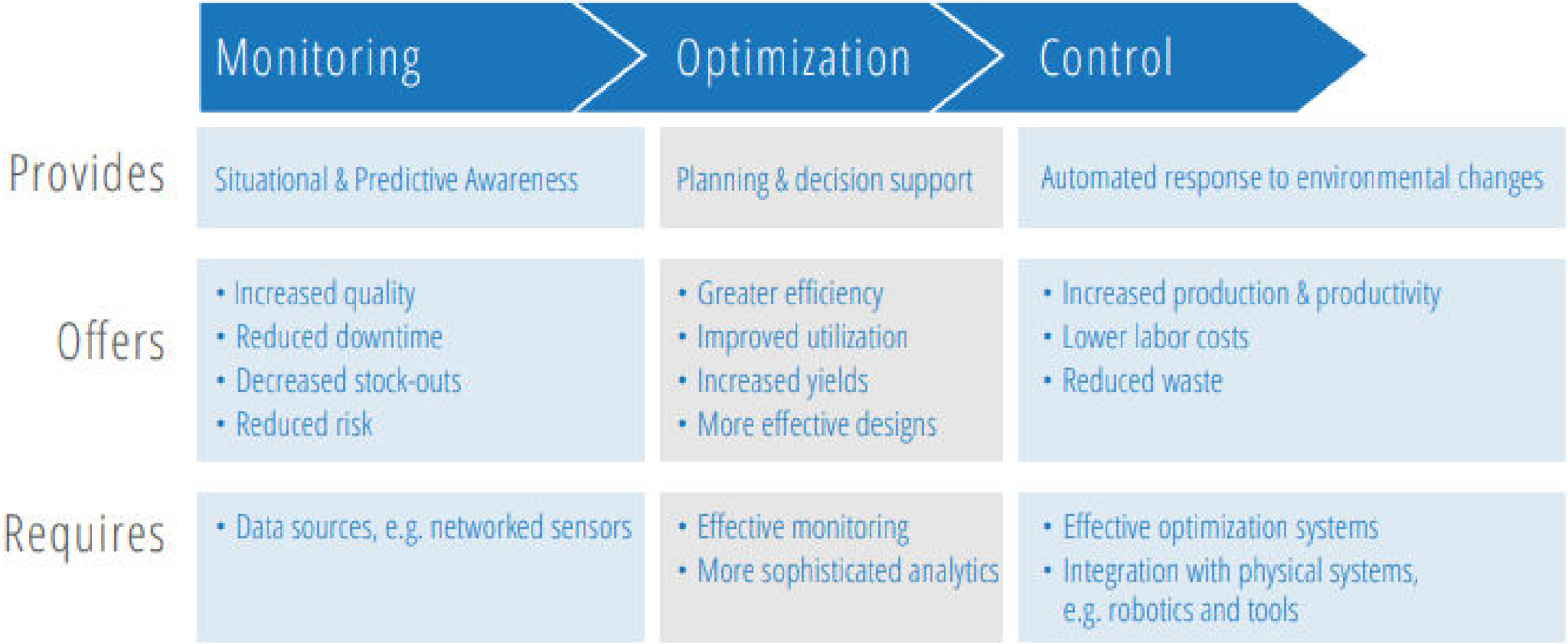
Inventory management to prevent bottlenecks

AI to boost supply chain management

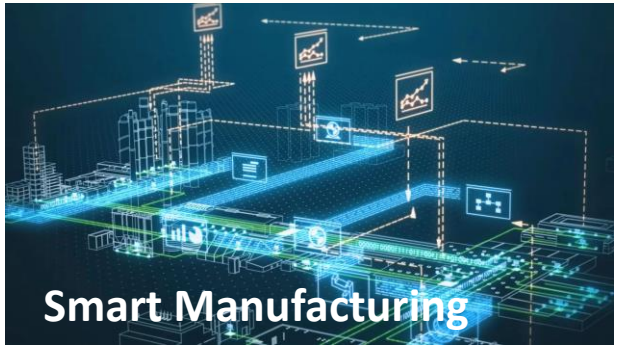
AI systems to detect errors

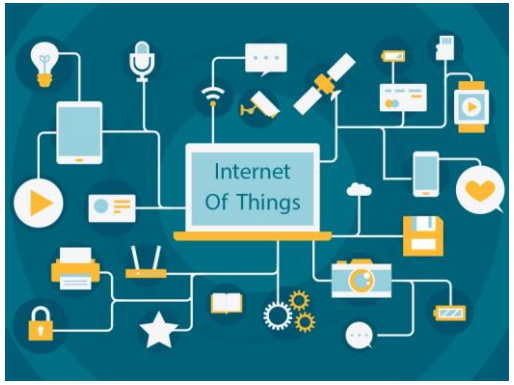
AI systems to help speed product development

Trends Driving AI Advancement

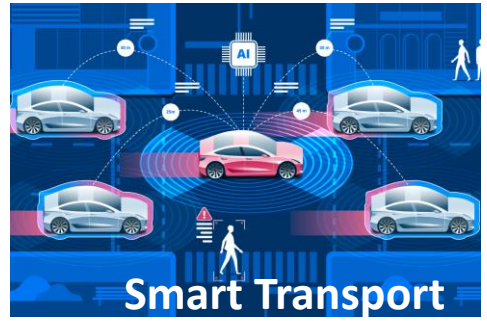


Trends Driving AI Advancement





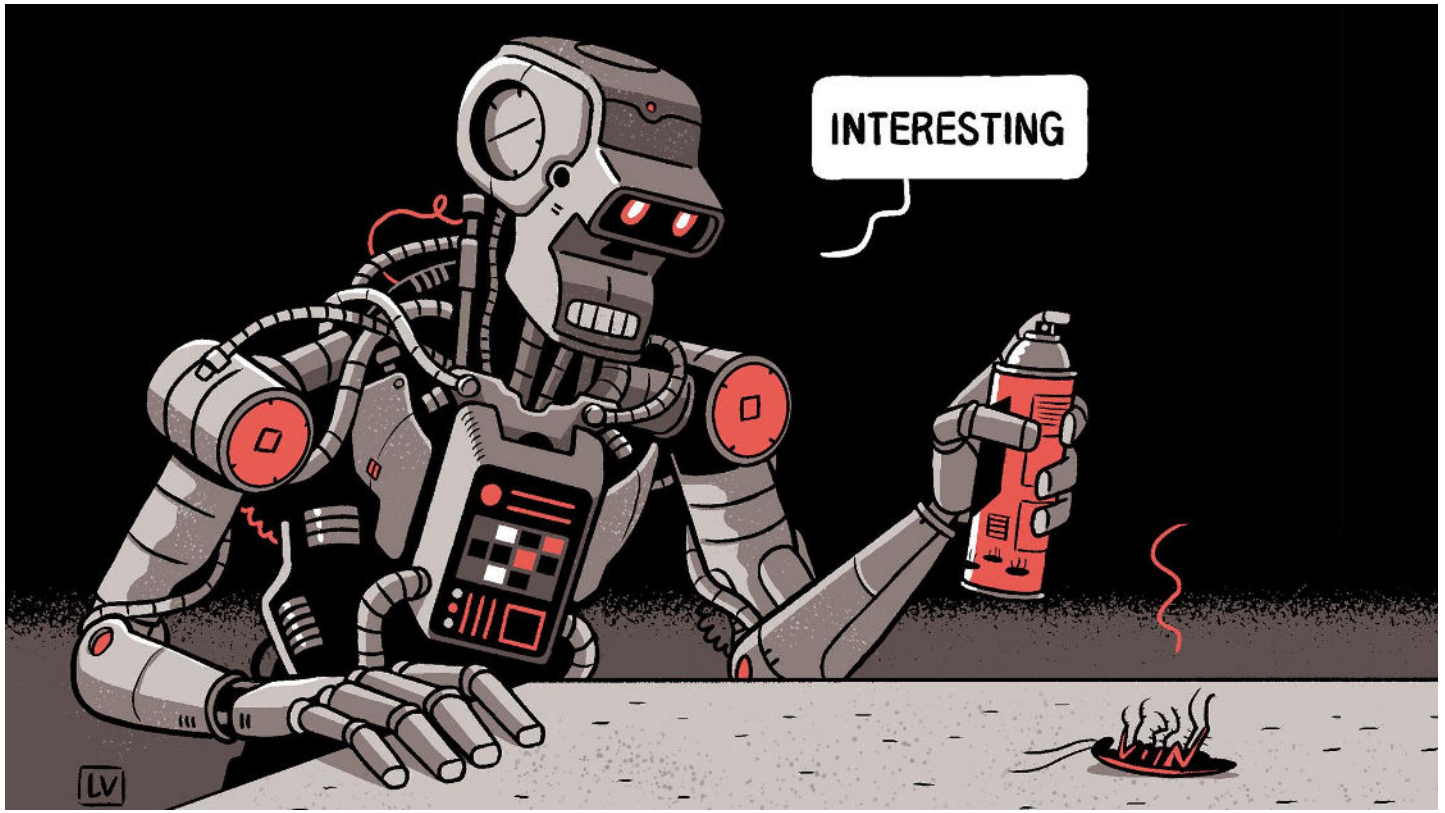
What AI can do for you?



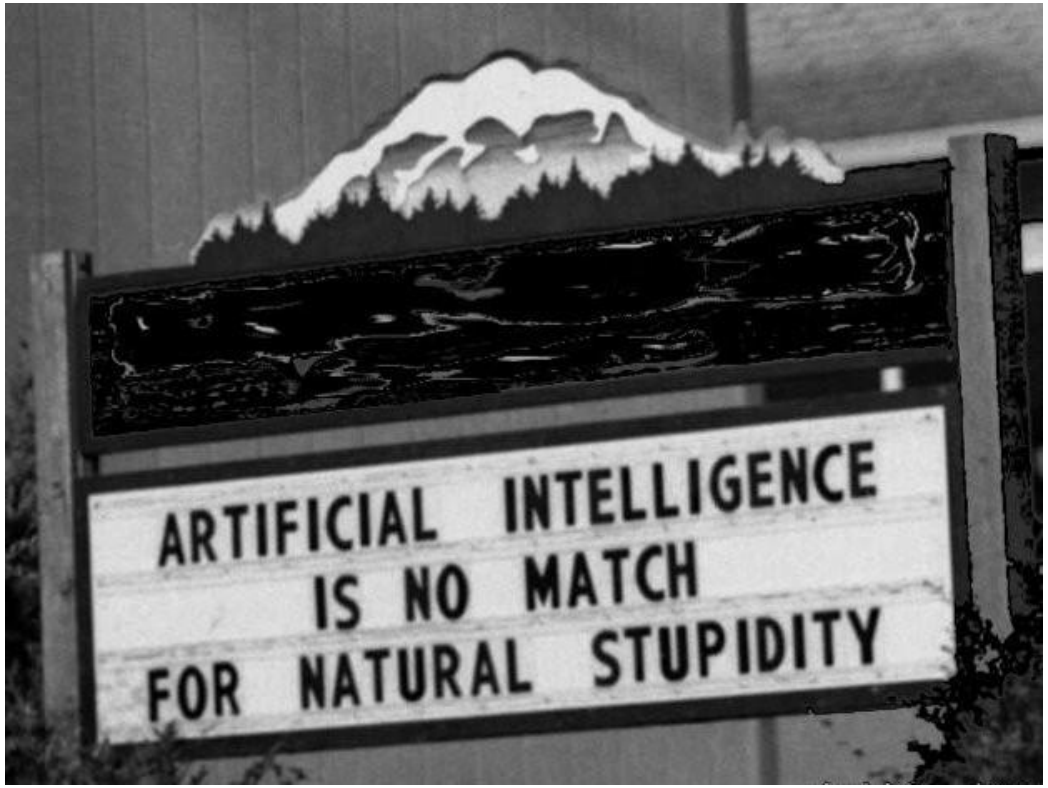
Important Questions Around AI

Engineering Institute of Technology.

Just how worried should we be about killer robots?



Important Questions Around AI



AI is a new and fast-changing field, full of innovators and disruptors.

There are however a number of points which must be dealt with:

- ethical and societal concerns such as the safety of machines working side by side with people in manufacturing plants, and
- the overall safety of AI enabled systems from a data perspective.

Other important questions have also been raised, such as:

Who is responsible for making decisions and managing how such systems are deployed?

Do managers have enough of an understanding of the wider implications?

How to Unlock the AI Promise?

Given that AI data is at the intersection

of many different fields, it is hugely important that

a common framework is developed.

How to Unlock the AI Promise?

AI technologies and their applications continue to grow and evolve.

AI technologies are now being deployed across almost every industry and sector, including transportation, healthcare, defense, finance and manufacturing.

But what exactly are these technologies?

How prevalent are they?

And with AI developing so rapidly,

How will International Standards respond to these challenges?

How to Unlock the AI Promise?

It’s all about

trust

Artificial intelligence (AI) has the potential to aid progress in everything from the medical sphere to saving our planet, yet as the technology becomes ever more complex, questions of trust arise.

Increased regulation has helped to rebuild this trust, but grey areas remain.

How can we ensure AI is trustworthy without impeding its progress?

The US consumer regulator slammed Facebook with a **USD 5 billion** fine.

Threats to AI Trustworthiness

Key threats to AI trustworthiness are:

- Malicious use
- Personal data leaks
- Cybersecurity

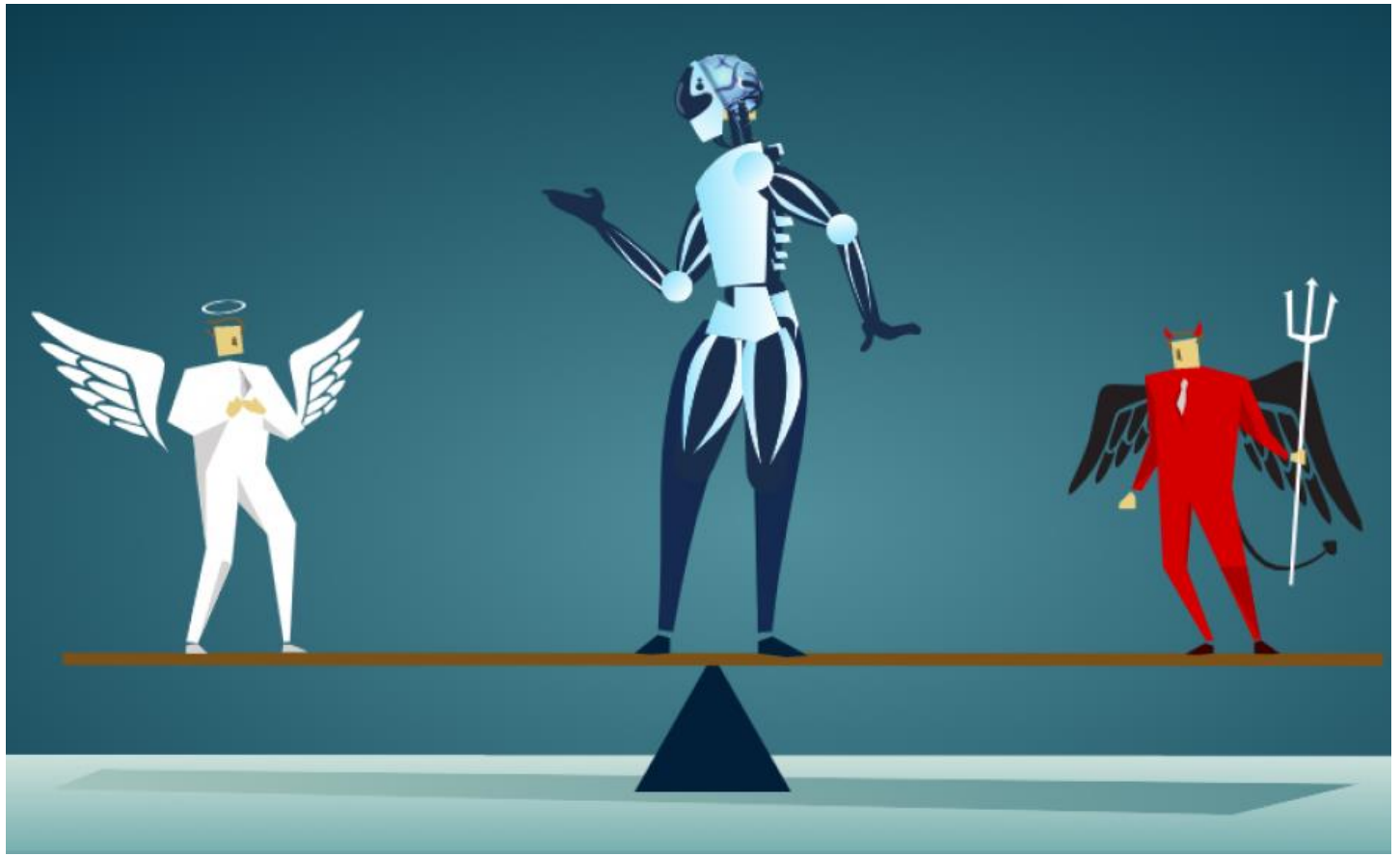
A self-driving car, for example, that is involved in an accident could be hacked and information related to liability meddled with.

A system that aggregates patient data and uses it to recommend treatments or make diagnoses could suffer errors or bugs that result in disastrous outcomes.

Standards for AI should provide tools for transparency and a common language.

The Time is Now!

To ethicize or not to ethicize…



Mitigating Ethical Challenges

Ethical decision making isn’t just another form of problem solving.

AI presents new and unique challenges to ethics.

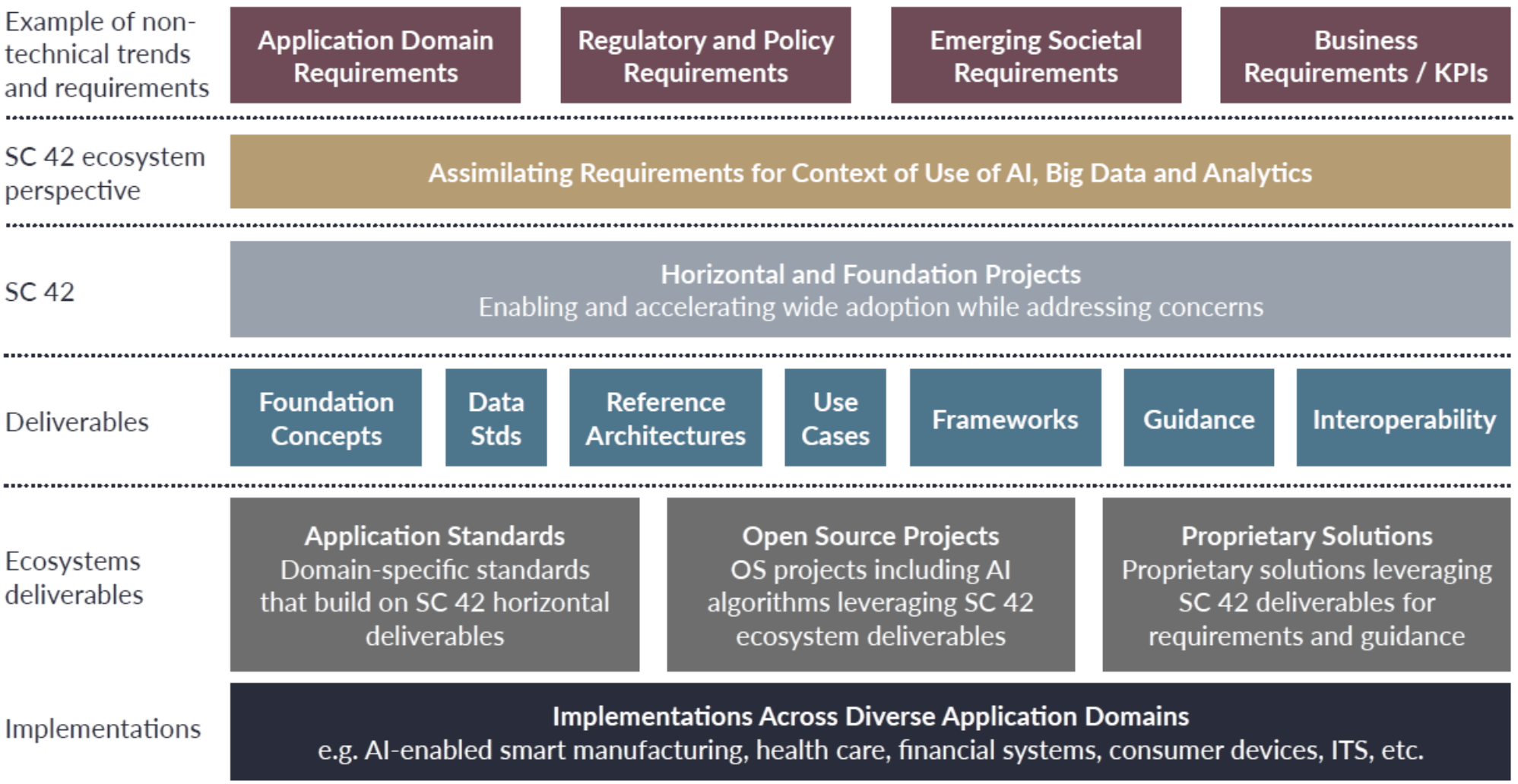
As artificial intelligence (AI) grows in capability and influence, experts are treading uncharted territory to develop the International Standards for ethical AI, addressing its challenges from the onset.

The ISO/IEC JTC 1/SC 42 work program outlines several topics for AI, many of which are currently under development in its working group WG 3, Trustworthiness.

International Standards could play a role in identifying these ethical issues and provide the necessary framework to address them.

ISO will have to adapt and innovate to meet future challenges.

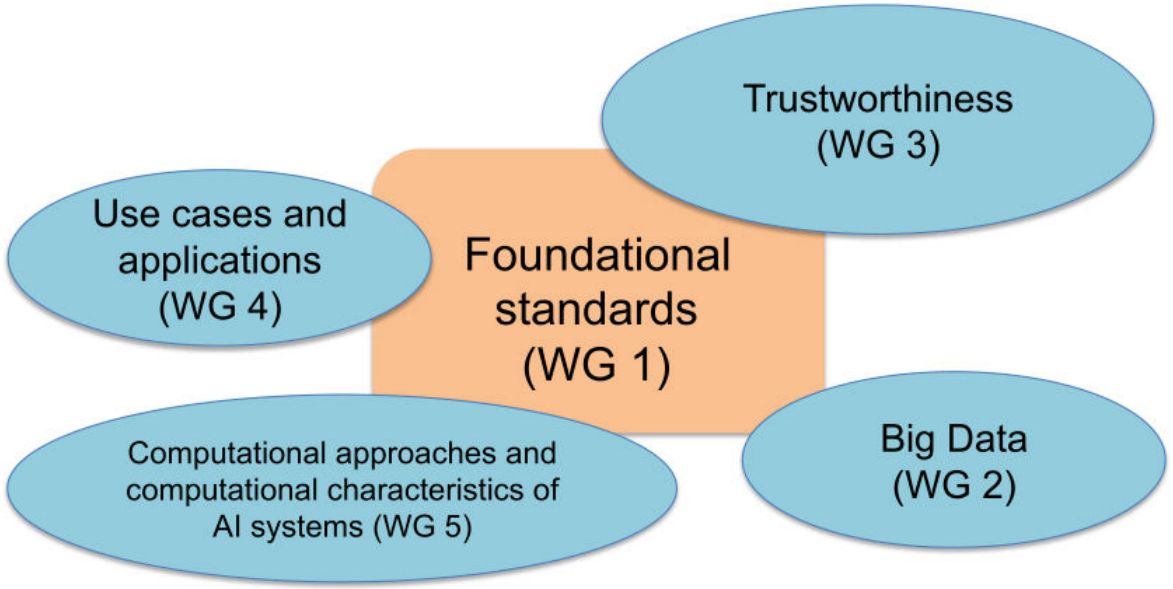
SC 42 Ecosystem Approach



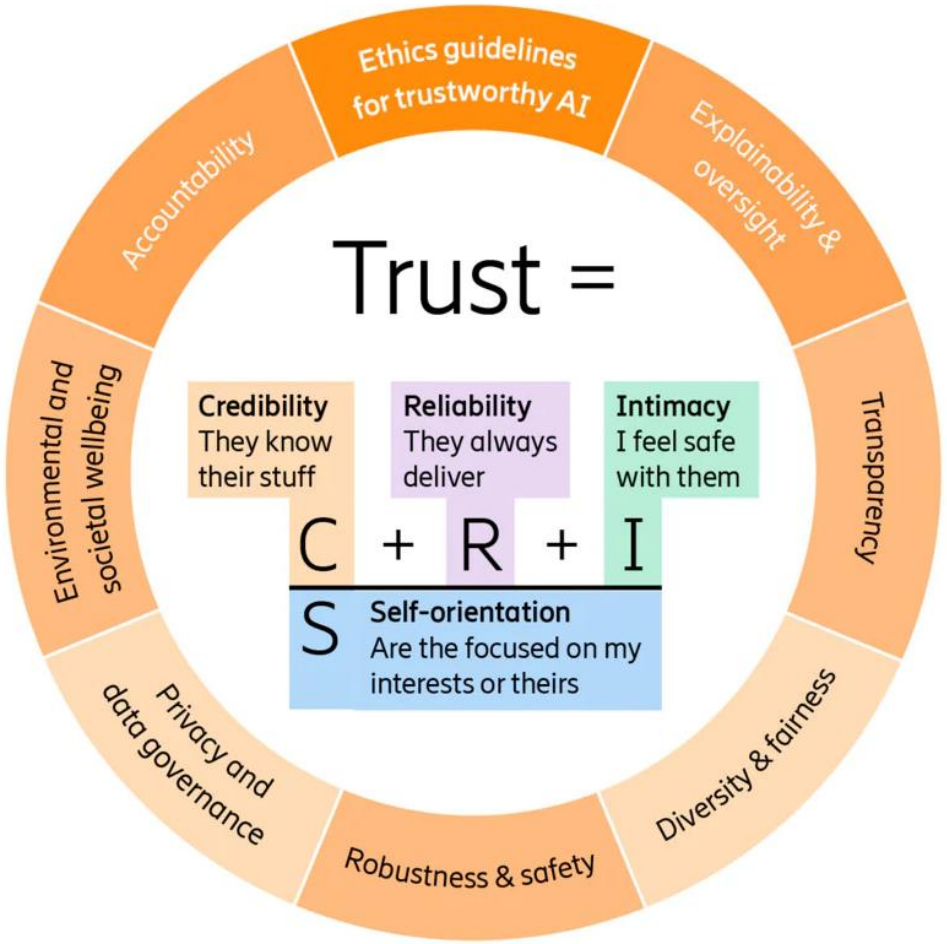
AI Foundational Standards

Foundational standards provide for a common language and frameworks that can be used by this increasingly diverse set of stakeholders.

SC 42 has taken on this important task for AI and also recently completed the foundational standards for big data.



AI Trustworthiness



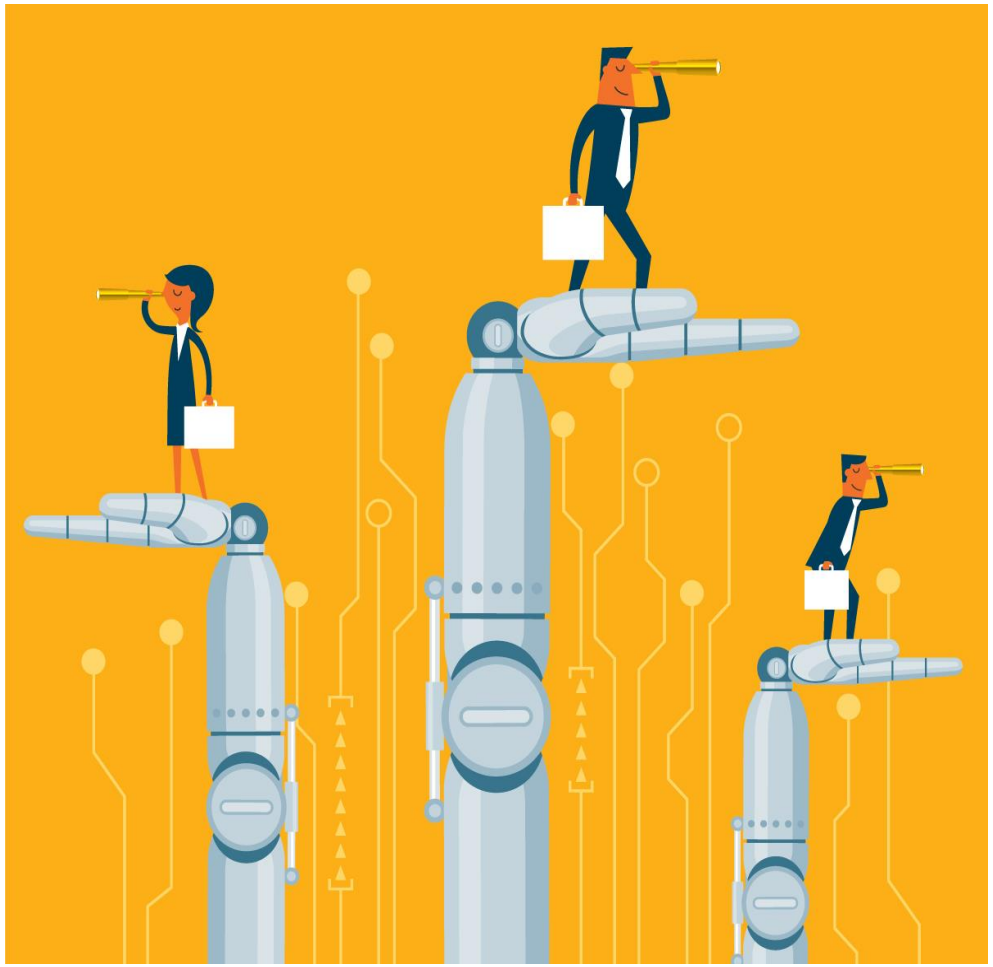
Aspects such as the trustworthiness of the technology are critical because the technologies are widely applicable.

SC 42 is developing a suite of standards that provides an overview of emerging issues such as:

- trustworthiness,
- robustness, and
- bias in AI,

along with technical standards to address them, for instance, the application of the ISO generic 31000 risk management framework to AI.

AI Ethical Aspects and Societal Considerations

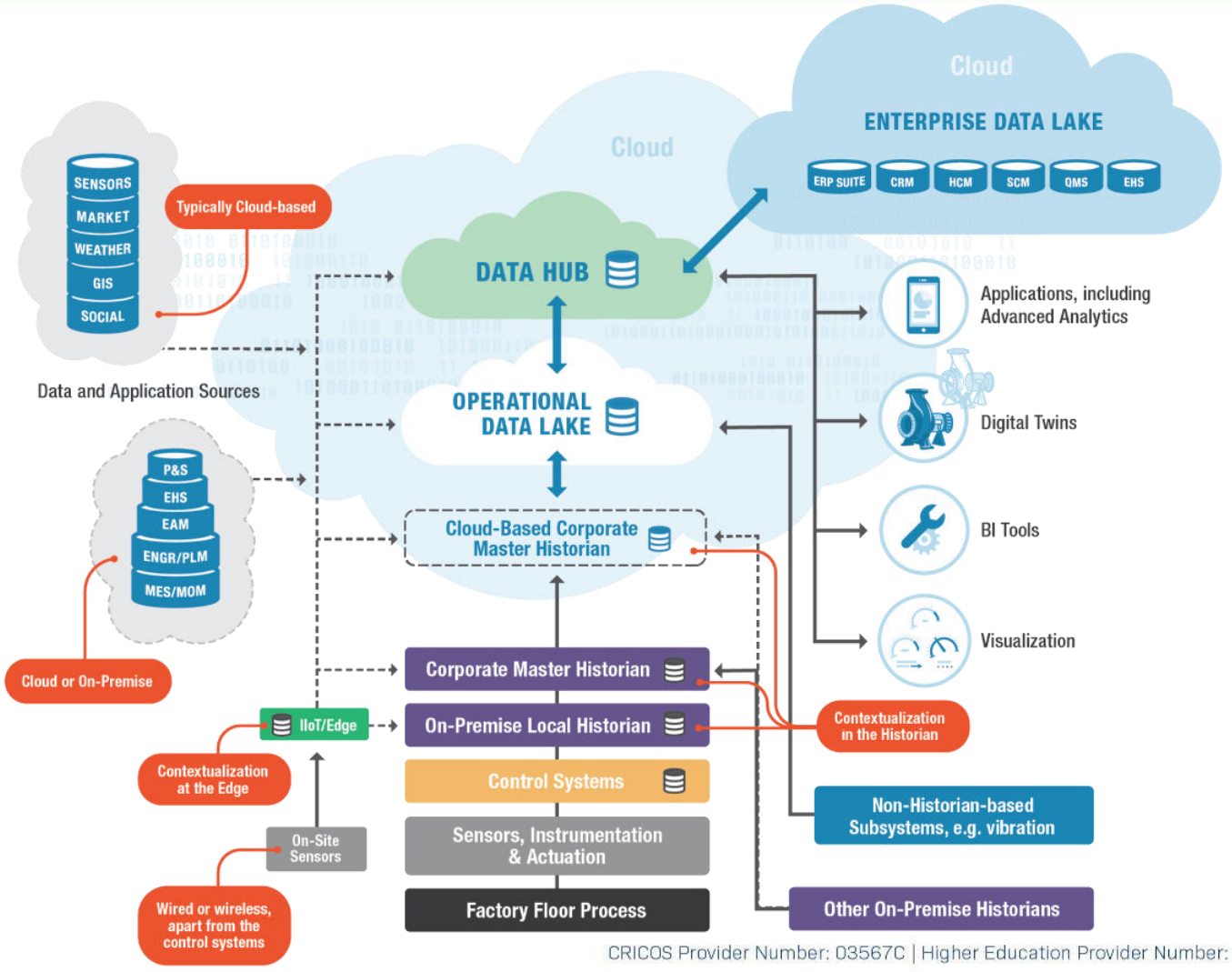


New requirements around ethics and societal concerns have emerged with recent information technologies, and AI is no exception.

SC 42 is addressing these concerns across the board in its deliverables – for example,

ethical and societal concerns around use cases – as well as specifically, by having deliverables that tie these requirements to the technical standards being developed.

Data Ecosystem for AI



Data is the Backbone of Industrial Automation & AI

Within its areas of focus, SC 42 is looking at the data ecosystem and has launched a four-part series on data quality for machine learning and analytics.

This complements the work in progress on big data analytics, as well as the published work on big data.

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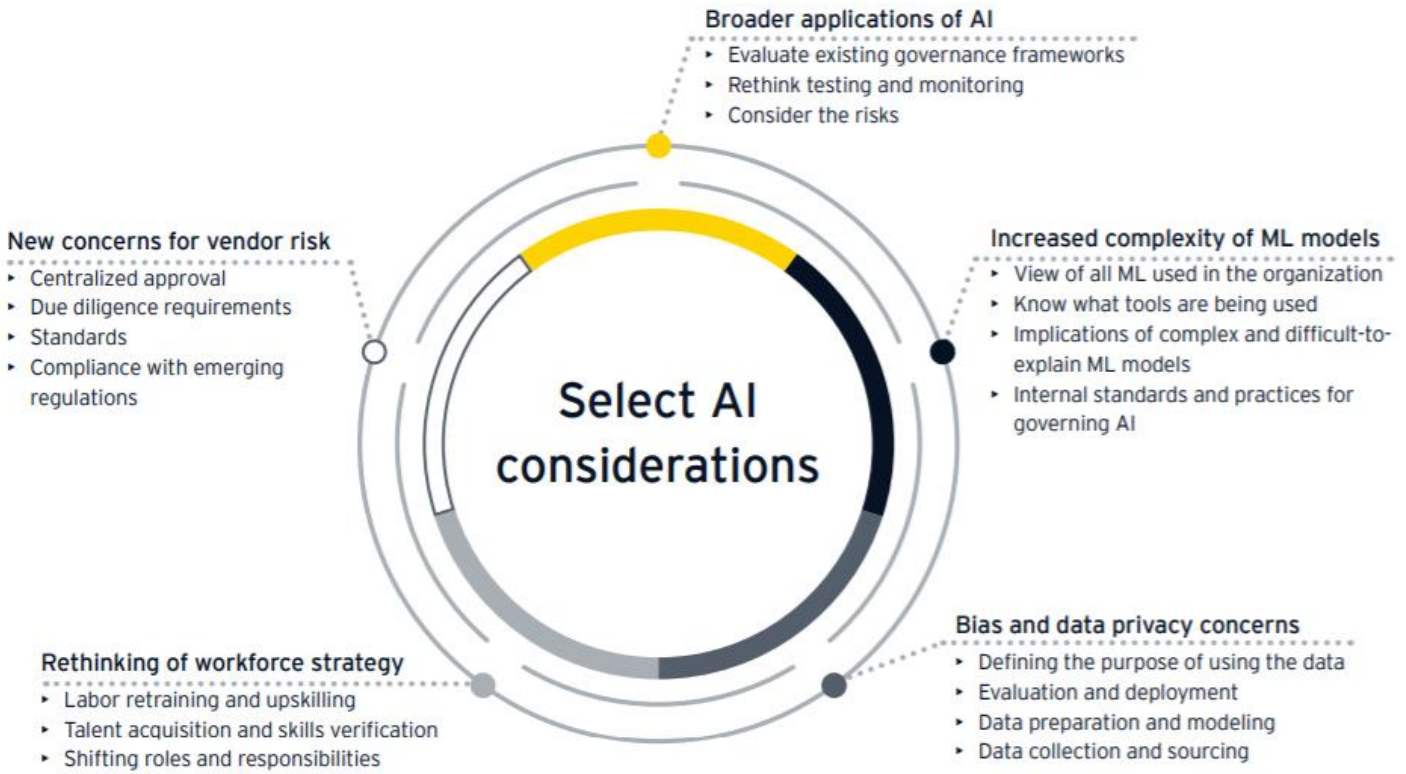
AI Governance Implications

SC 42 is collaborating with its sister subcommittee, SC 40, which covers IT service management and governance, to develop a standard targeted at governance implications that can arise.

The standard is aimed at executives or boards looking to deploy the technology and it addresses the issues with that perspecti



Computational Aspects for AI

SC 42 is also examining the computational aspects associated with knowledge management, which is focused on the front end of the process, through to the existing computational techniques used in an AI system and emerging computational needs.

Moreover, the committee has a project that looks at the assessment of classification performance for machine learning models.

This type of work will ensure that AI systems will factor in the practical needs of application domains, such as smart manufacturing.

AI Management Systems Standard

The unique aspect of AI technology has created the need for a methodology that covers process developers and deployers of AI systems use and increases user confidence by providing a platform that can be used for third-party certification.

SC 42 is leveraging the management systems standard (MMS) approach and has started work on ISO/IEC 42001 for an AI management system.

MSSs have been successful in other areas, such as ISO 9001, which specifies requirements for a quality management system, and the idea is to apply a similar approach for AI.

Concluding Remarks

The ability to provide insights is at the core of the digital transformation and the emerging applications and services powering it.

IT systems and technologies, such as AI and big data, are key enablers.

The international standards that SC 42 is developing in this area are crucial to removing barriers to adoption while addressing concerns.

Nonetheless, these standards and technologies will have to be used in concert with operational technology standards, such as those being developed by ISO.

SC 42's approach to consider the entire ecosystem and develop horizontal standards allows for a platform that makes such collaboration easier.

Upcoming Technical Webinars

Voltage, Stability and Islanding Control in Microgrids
Date and time: Thursday, 31 March 2022, 3:00pm - 4:00pm AWST
An Introduction to Calibration – Temperature Sensors
Date and time: Wednesday, 6 April 2022, 3:00pm - 4:00pm AWST

Upcoming webinars: https://www.eit.edu.au/news-events/events/

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Q&A

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