AI for ‘SMART’ness

a recommendation for IoT based Analytics

IOTSHOW.IN

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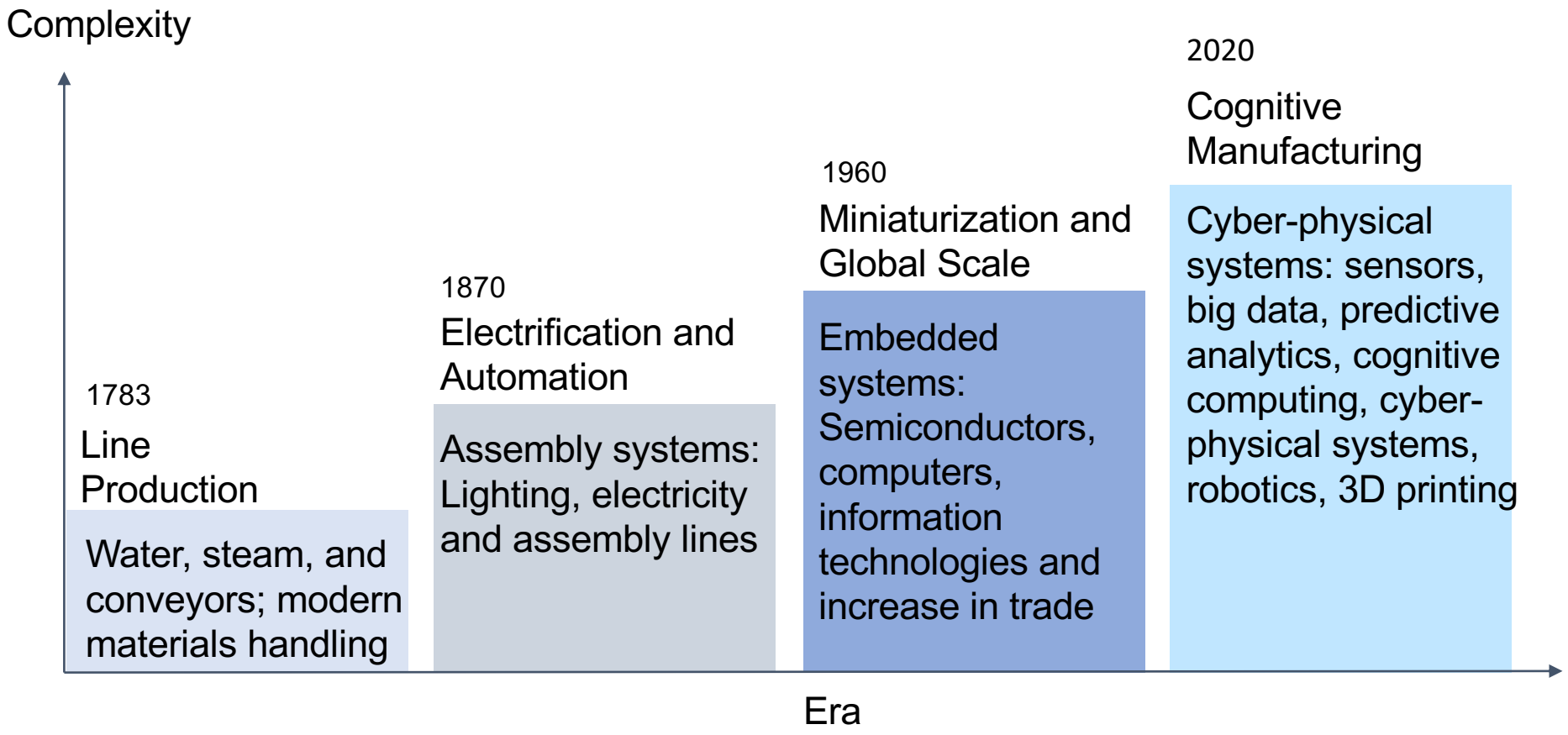
IBM Watson IoT™

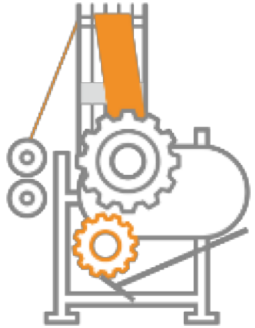
Alex J Joseph
Program Director, IoT
IBM **India Software Labs**

We have entered the fourth revolution of industry !



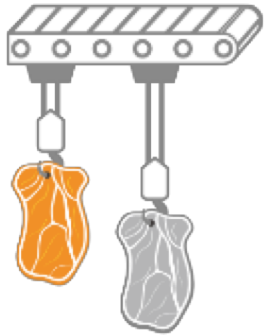
The 4th Industrial Revolution – cyber models to create digital factories

First
Industrial Revolution
based on the introduction of mechanical production equipment driven by water and steam power



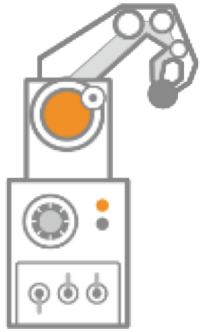
First mechanical loom,1784

Second
Industrial Revolution
based on mass production achieved by division of labor concept and the use of electrical energy



First conveyor belt, Cincinnati slaughterhouse, 1870

Third
Industrial Revolution
based on the use of electronics and IT to further automate production



First programmable logic controller (PLC) Modicon 084,1969

Fourth
Industrial Revolution
based on the use of cyber-physical systems

TODAY

Degree of complexity

Fourth

Third

Second

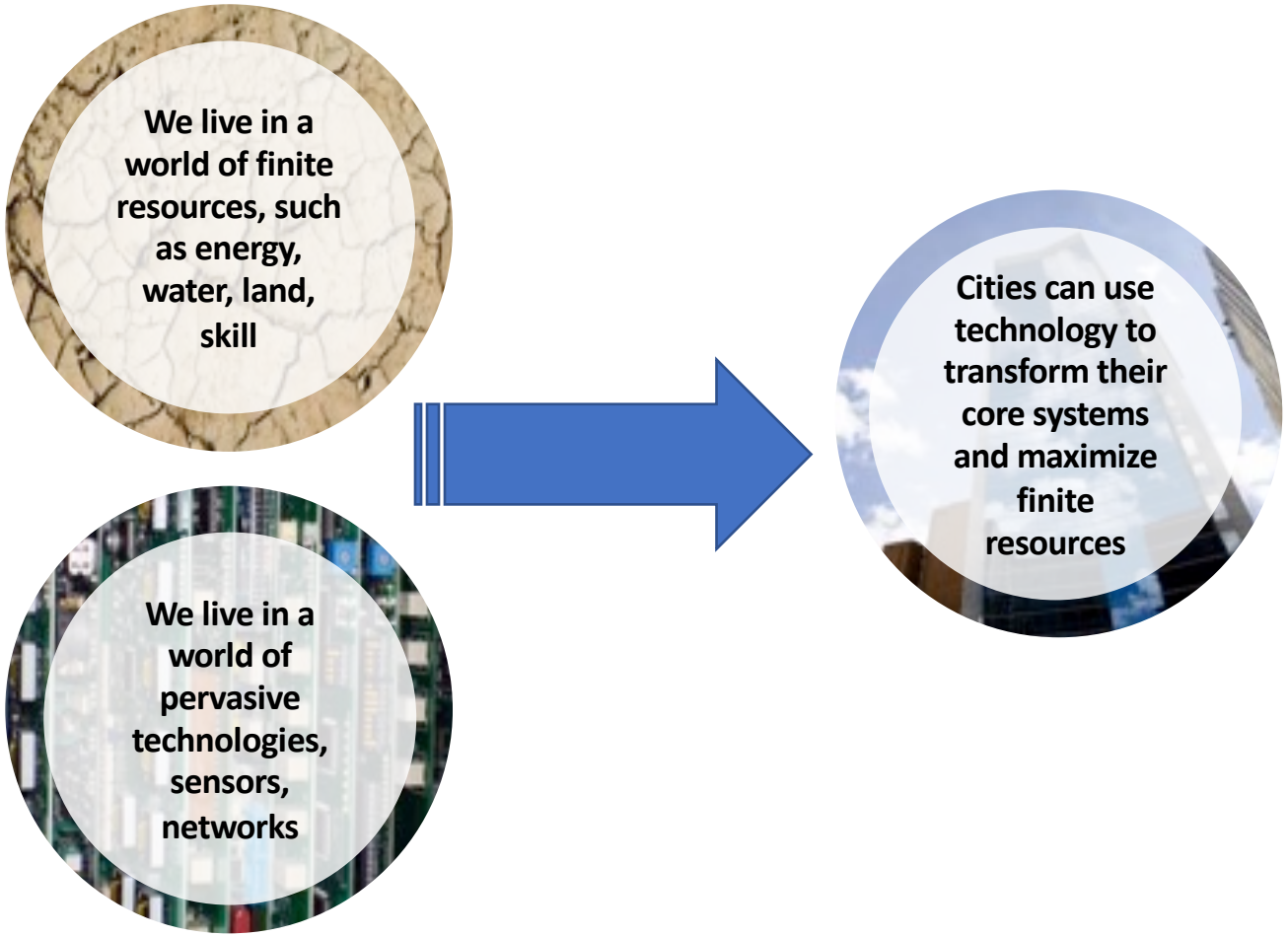
First

1800

1900

2000

A smarter city is one that uses technology to transform its core systems and optimize finite resources



Smarter cities use the possibilities of new technologies - data collection and modeling, allowing analytics – to **create insights and inform decisions** and actions by city staff…

…tackling the challenge of finite resources

‘Smart’ requires that solutions be instrumented, interconnected and intelligent

The world is becoming more instrumented, interconnected and intelligent

Instrumented

Event capture and filtering for timely response

Systems that automatically adjust

+

Interconnected

Any to any linkage of people, process, and systems

Social media and the internet used to collaborate

+

Intelligent

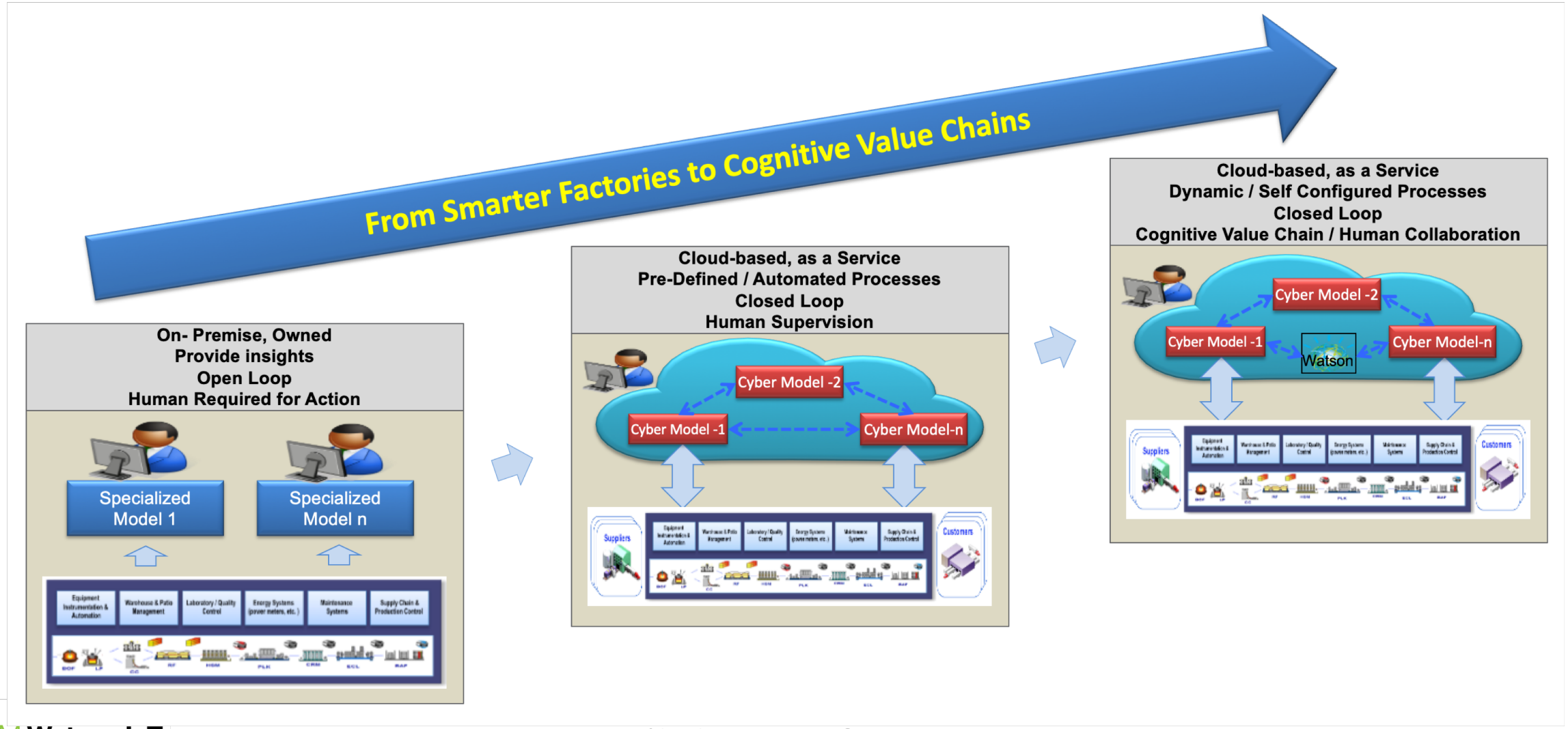
Deep discovery, search and collaboration across systems

Best practices for aligning smart technology to city, business and citizen needs

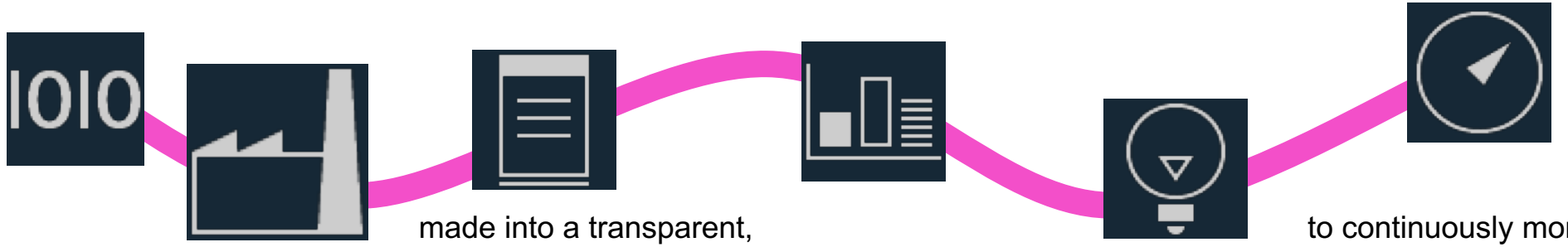
=

Smart

Our Vision : Realize full potential of IoT and Industry 4.0



Apply : Cognitive capabilities to digitize and optimize previously inaccessible areas of the processes



collected manufacturing and enterprise data

made into a transparent, comprehensive, interactive, minable corpus of information

that makes new patterns visible in the data

to continuously monitor, predict, respond and interact with humans and machines

To deliver

- Smarter Equipment Maintenance
- Smarter Asset Operations
- Smarter Product Design
- Smarter Quality
- Smarter Factory Operations
- Smarter Employee Safety
- Smarter Energy

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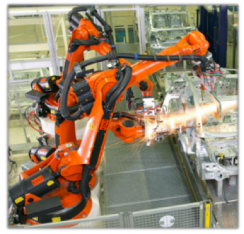
Embracing AI : through logical steps of value

Gather the data

- Instrument your equipment/assets to collect data
- Gather already existing data



Asset needs to be connected, outfitted with sensor or data gathered

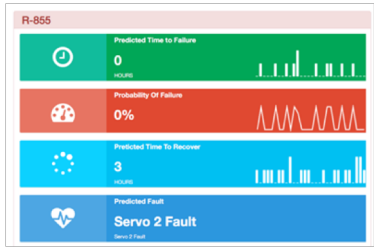
Visualize the patterns

- Visualize your data in meaningful dashboards
- Start to see patterns
- Build with Bluemix

Use the platform to quickly build dashboards for data visualization

Advance to Analytics

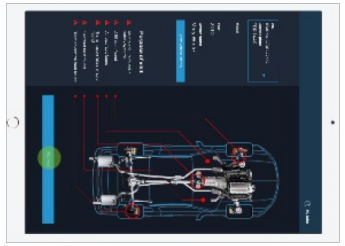
- Gain insights from the data
- Produce models, prediction recommendations



Use analytical models to predict equipment failures and provide recommendations

Infuse with AI

- Refine models with cognitive machine learning
- Utilize other AI models & functions to improve engagement



Use speech, video, image to diagnose complex problems

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How : Automated Analytics Process

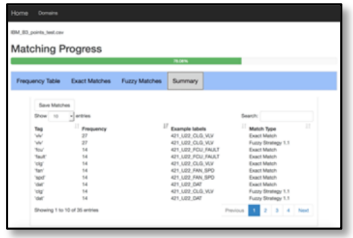
Identify the relevant domain concepts

build domain knowledge

Brick
(http://brickschema.org/)

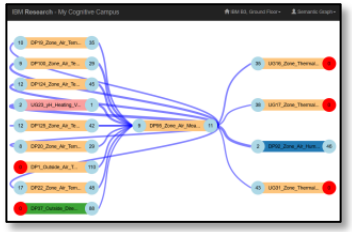
Create instances for one specific IoT system

semantic mapping meta-data



Create a knowledge graph by adding missing relationships

reason physics graph



Use the knowledge graph to deploy analytics

deploying analytics

Choose a priority usecase : Energy

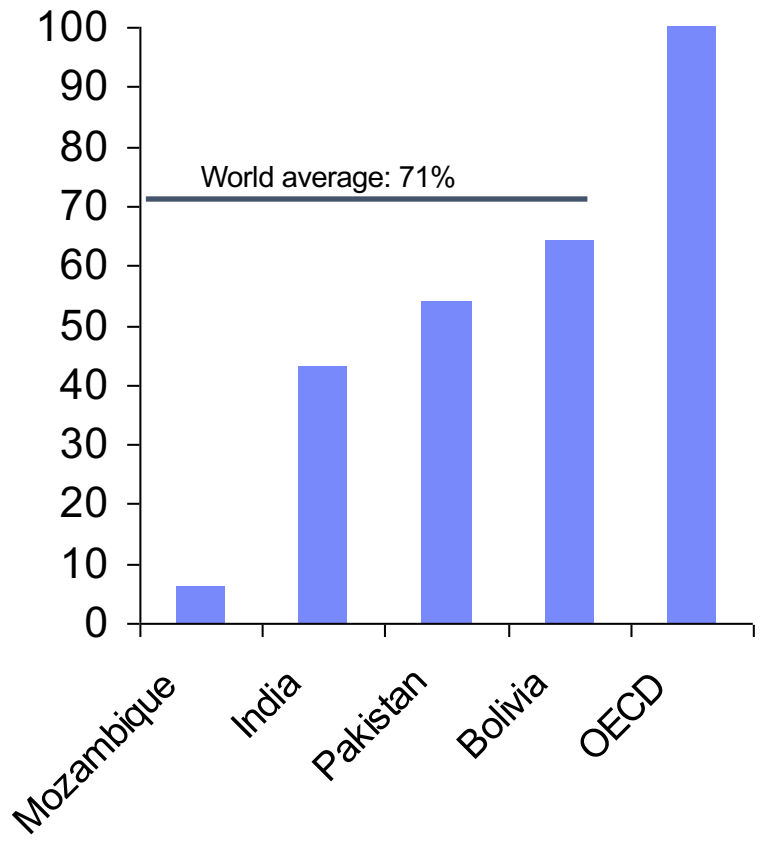
Cities are realizing that their current energy systems are insecure, inefficient and unsustainable

Source

UN Human Development Report; EIA Annual Outlook 2008; IBM Institute for Business Value estimates of urban/non-urban emissions

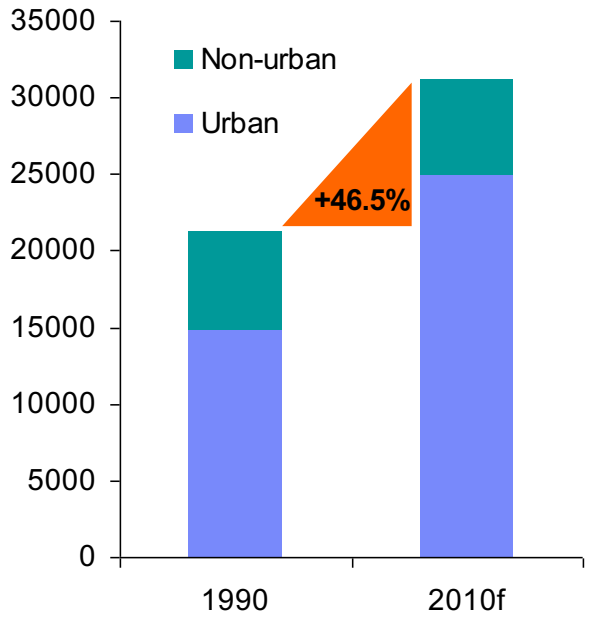
Access to electricity, 2006

% of total population



Global CO2 emissions, 1990-2010

Metric tons, urban/non-urban estimates



Why this usecase as sample ?

Improving the reliability and efficiency of energy supply supports human capital in generating economic activity and growth

Source

WKCI, FBI and IBV calculations

Smarter Energy and Utilities

What it means	How it supports talent and innovation
▪ Fit sensors to gather data on usage across the energy system ▪ Interconnect appliances & devices between energy consumers and providers ▪ Optimise the use of the system and balance use across time	▪ More efficient, less polluting energy systems improve quality of life ▪ Increased certainty of supply to support human capital in generating economic activity and growth ▪ Secure and reliable energy provision for generating economic activity

Optimizing core systems for an innovation-enabling environment

Narrowing Down : India Context

India now finds itself halfway along the transition towards an open and well-performing energy sector

Energy Efficiency has emerged as one of the key policy priorities in India's energy sector since the enactment of Energy Conservation Act 2001. Subsequently, the Bureau of Energy Efficiency (BEE) was established in 2002

In the long term,

India's total electricity consumption would reach 3,264 TWh in 2035 (The WEO NPS)

India's own projection (The IEP 2008) , suggests an even higher consumption increase, reaching 3,880 TWh and 4 806 TWh in FY 2031/32.

* *implies that India's electricity consumption in FY 2031/32 would reach a level close to the 2009 electricity consumption of China (3 735 TWh) and the United States (4 165 TWh)*

-> One concept introduced in India is a "negawatt," referring to a negative Megawatt as a result of reducing energy needs.

- > All these points to our need of 'Investing in Energy Management & Optimization' - & **AI is the Key for this 'Smart'ness**

Setting the Context : Why Buildings ? *(factories, workspaces, retail stores …)*

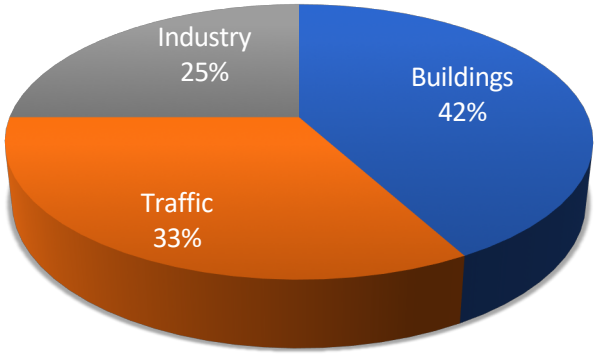
Source

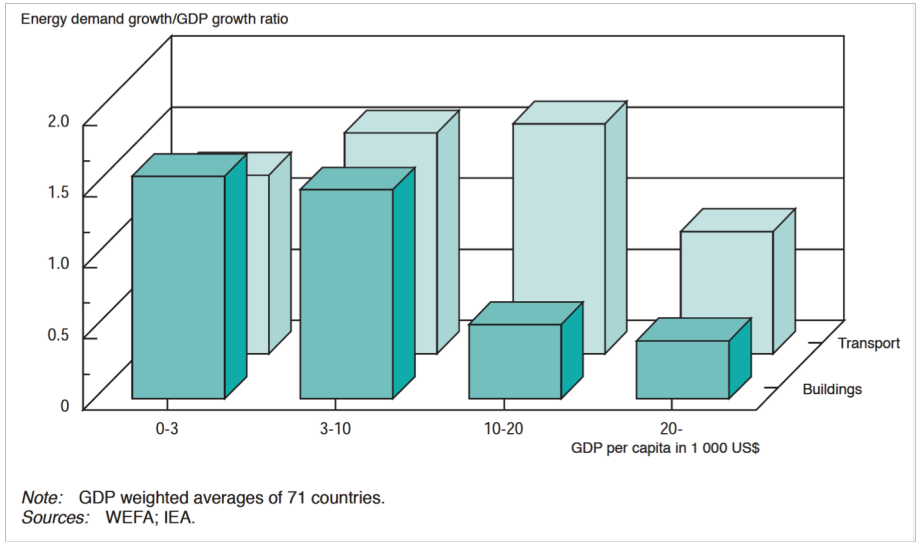
International Energy Agency: World energy outlook
&
Energy Study, from Wharton Econometric Forecasting Associates

- Buildings use 42% of the energy in western countries
- Buildings have the largest untapped energy saving potential
- For multinationals, 'Building Energy Management' happens on global scale
- One building can easily provide several thousands of data-points
- Huge amounts of data that needs to be integrated
- Demand for energy grows faster than economic growth, across segments

"We shape our buildings; thereafter they shape us"

- Winston Churchill





Note: GDP weighted averages of 71 countries.
Sources: WEFA; IEA.

Why Optimize Buildings with AI ?

Source

https://www.iea.org/buildings

https://uk.practicallaw.thomsonreuters.com

36%	of global energy consumption is from the building sector
40%	of total direct and indirect CO_2 emissions
2.5%	per year increase global use of electricity in buildings
1%	CO_2 emissions continue to rise by nearly per year
30%	Dubai Integrated Energy Strategy for 2030: reduce energy demand and diversify energy sources

Building semantic model and knowledge graph	Integration with The Weather Company	AI models predictive analytics	Common platform for sensors and legacy hardware	Domain expertise in building management

20% reduction in refrigeration costs

16GWh reduction in energy use

Putting ‘AI’ into work : Insights from a Building

Business Value

Recommended approach is to capture and collect data from sensors and devices, and from your building control systems and energy meters; helps consolidate the information on a single IoT/ cloud platform to enable analytics against the same, leading to identify potential energy and operational savings. The solution is conceived to be cloud-based, mobile enabled, weather aware and to operate near real time, providing insights which could be further translated to recommendations that can be operationalized by your facilities management solution.

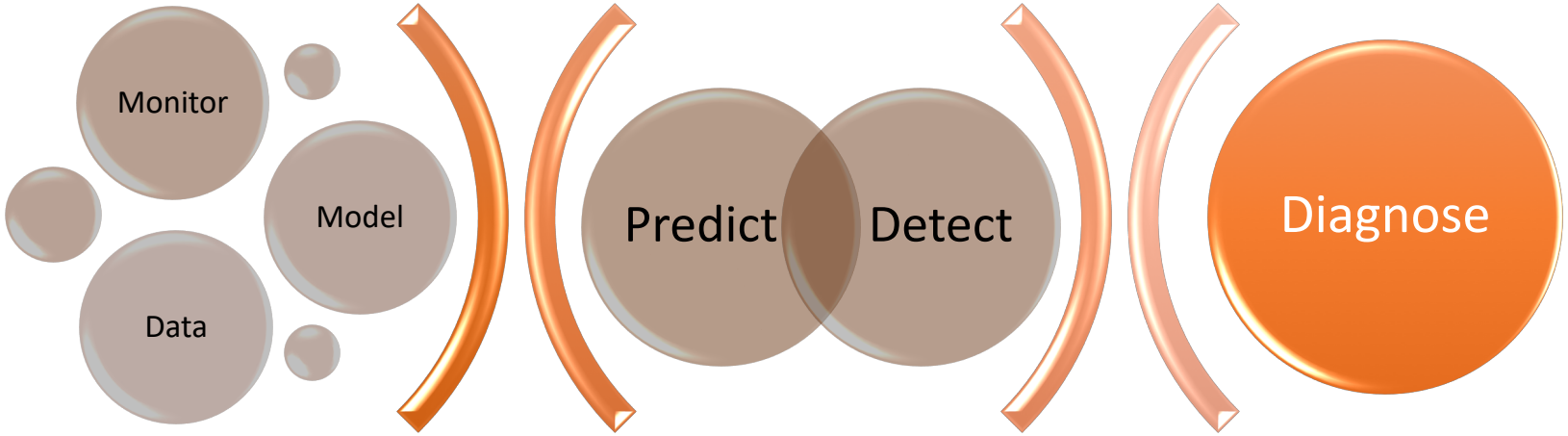
Differentiated Approach

- **IoT Enabled Data Collection**: Building data collected and persisted in one common platform, for all use cases
- **Advanced Analytics Engine**: AI models for predictions on Energy Usage/ Wastage, substantiated by a long history of IBM Research
- **Standardization & Semantic Modelling**: Building metadata schema standardized (BRICK) and semantic modelling styles adopted
- **Better Informed Energy Decisions**: Leverage the Weather Channel’s 140,000+ IoT-powered weather sensors.
- **Insights to Action:** Solution Insights can be translated to recommend, prioritize, monetize and assign actions to close issues

End User Benefits

- Lower Energy costs
- Lower Operational and Maintenance Costs
- Increased Productivity

Putting ‘AI’ into work : Modelling Approach



Data

1. Timeseries energy consumption from hierarchy of meters at hourly granularity
2. Weather ->
   - Temperature
   - Dew point
   - Humidity
   - Sun radiation

Model

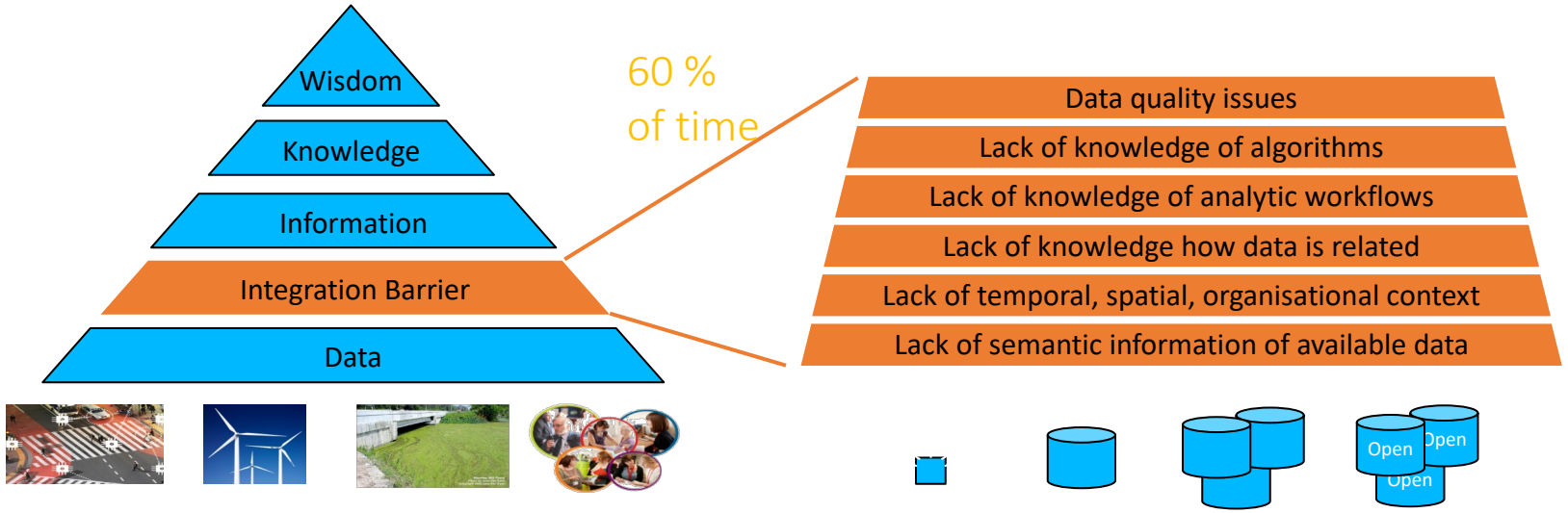
- Generalized Additive Model by a series of smooth functions of predictor variables
- Detect abnormal energy usage as deviation from predicted usage

Outputs

- Predicted Energy Usage for next 48 hours (from the last data available)
- Wastage of energy
- Which submeters and/or devices contribute how much to the wastage

Putting ‘AI’ into work : The Integration Barrier of Analytics

Data integration and analysis are core for the success of IoT and require novel, flexible, automatic solutions that go beyond traditional static, human-configured ELT processes to scale with the number and diversity of devices



Proposal : *AI FOR "SMART"NESS*

Track : Artificial Intelligence, Machine Learning & Deep Learning

Abstract : Industry 4.0 drives collaboration and networking across the factory value chain for the increased ability to connect and manage devices; and for reason of near real-time data collection which leads to a whole lot of insights of what is happening. While this entire concept will enable the Enterprises to become better connected it will mean the traditional architecture to converge and flatten as solution providers port or re-write existing applications to run on top of IoT platforms. IoT enabled MES, sensors, instrumentation, controls, assets, and materials will be the new norm. In this context, new business models for Smarter Factories will be around descriptive, predictive and prescriptive analytics – which will be the difference maker. Smart Factories need to be designed with much resilience in planning, to ensure zero tolerance to disruption. IBM's research driven IoT Solutions offer a wide range of AI models to drive cost savings and operational efficiency across the factory and its buildings value chain. For eg. Energy, being limited, and at the same time for being one of the major expense in any Industry, will need to be treasured for optimal (or sustainable) usage. This is another significant perspective of a Smarter Factory, which is driven from the context of Energy Optimization – again driven by the right use of AI models. The session is intended to discuss the strides which could be made, by using AI and IoT, in a factory space which is on the path to 'smartness' for the process and for the building.