

Strategizing for Technology-Driven Disruptive Change



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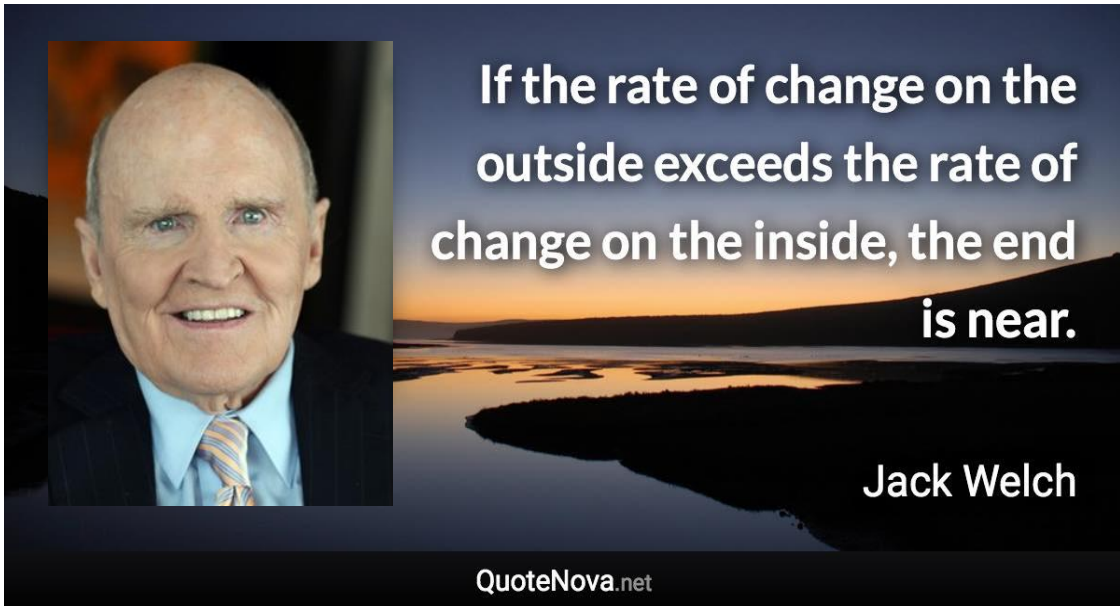
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A strategically-focused understanding of the technologies that are driving changes in our built environments.

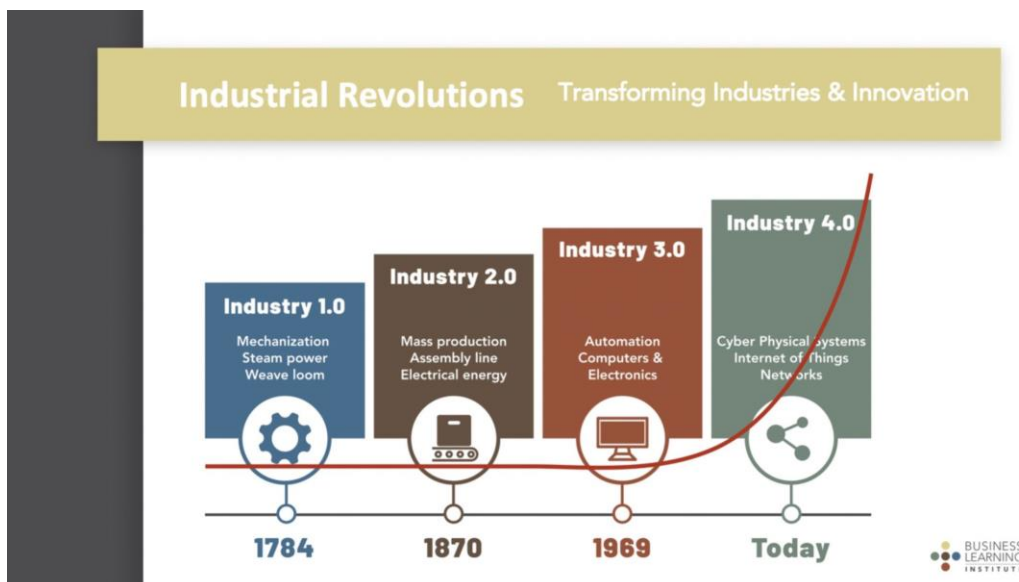
The megatrends that are reshaping our profession.

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“The only smart strategy is to embrace and start leading the digital transformation of your company (organization).”



Andrew McAfee. MIT Research Scientist
Coauthor of “*The Second Machine Age*”

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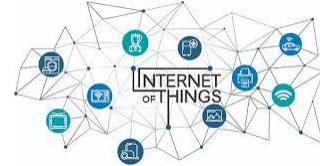
Second Half of the Chessboard



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The Fourth Industrial Revolution

Big Data Driven
 IoT Enabled
 OT Engineered
 AI Elevated
 5G Fueled
 Blockchain Secured



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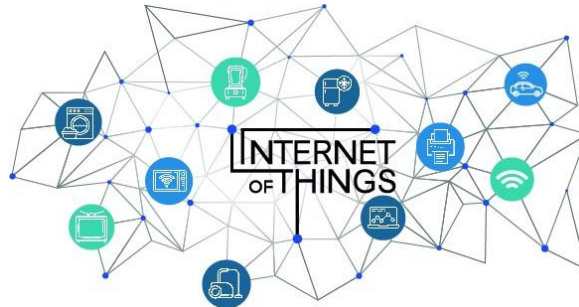
Big Data Driven



Capacity

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IoT Enabled



Sensors

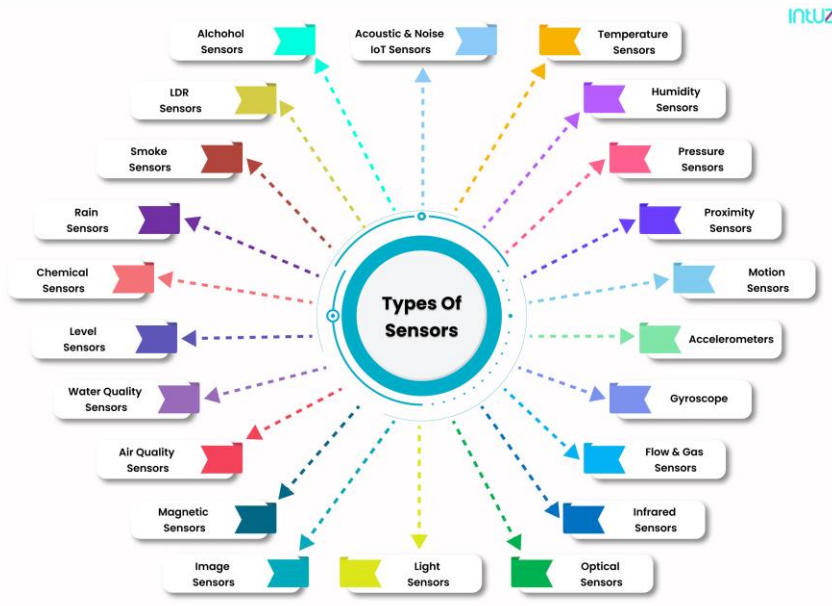
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Internet of Things



Smart building features. Source: [Senseware](#)

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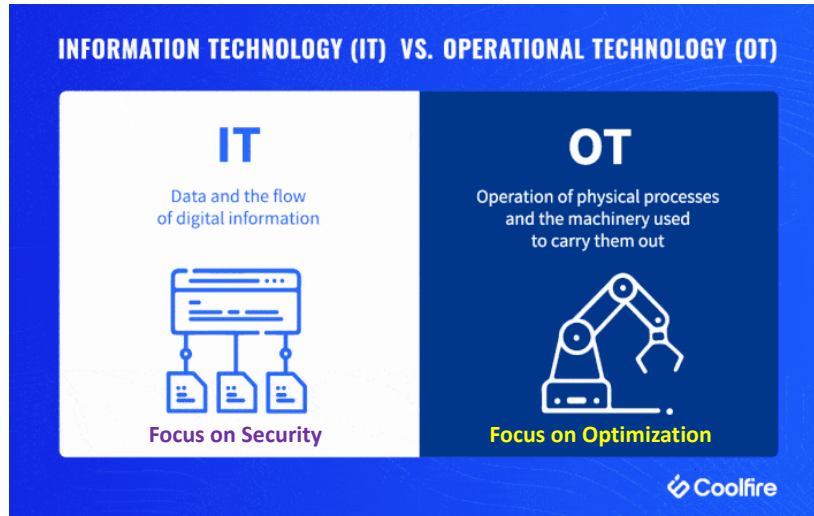
OT Engineered (Operations Technology)



Applications

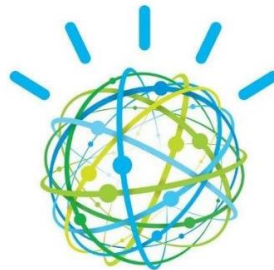
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OT Engineered



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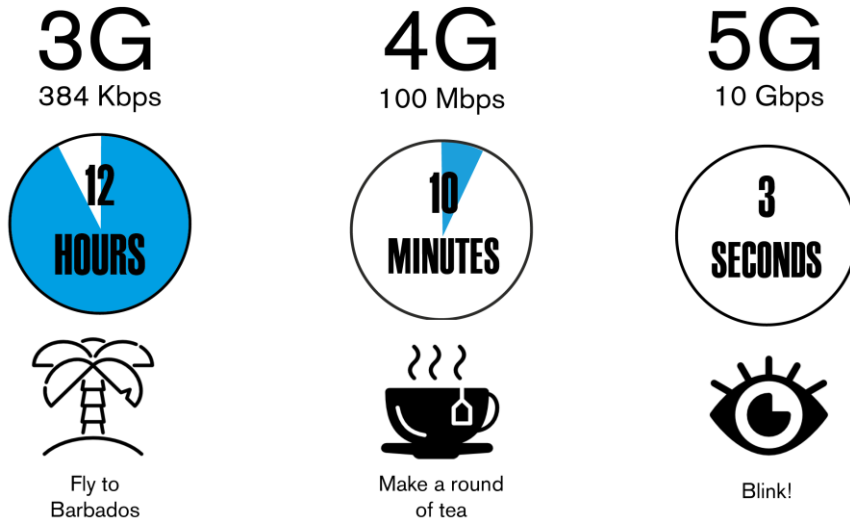
AI Elevated



Machine Learning

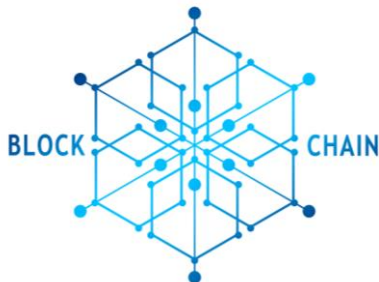
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HOW LONG WOULD IT TAKE TO DOWNLOAD "E.T." THE MOVIE?



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Blockchain Secured



Trust

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Blockchain Secured

“The Internet wasn’t designed for transactions. It was designed for email and communications.”

George Gilder, Author & Economist

“What the Internet did for communications, Blockchain will do for trusted transactions.”

Ginni Rometty, President & CEO of IBM

“Blockchain technology could change our world more than people imagine. Bitcoin, however, could be a bubble.”

Jack Ma, CEO and Founder of Alibaba

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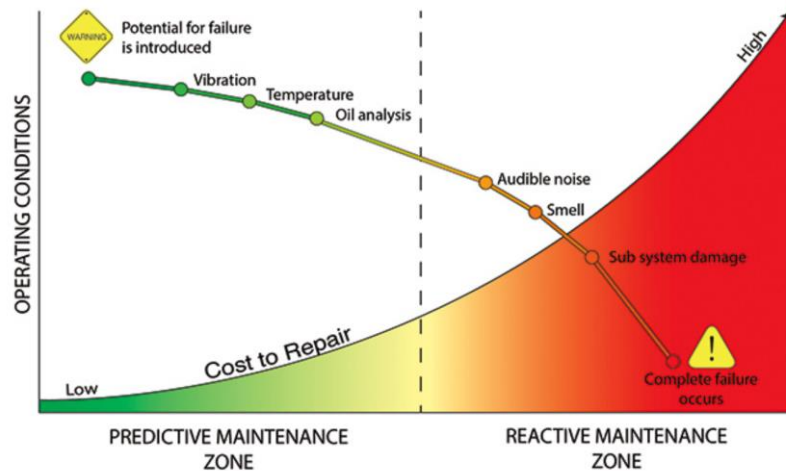
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Ten Megatrends Shaping Our Profession

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Megatrend #1

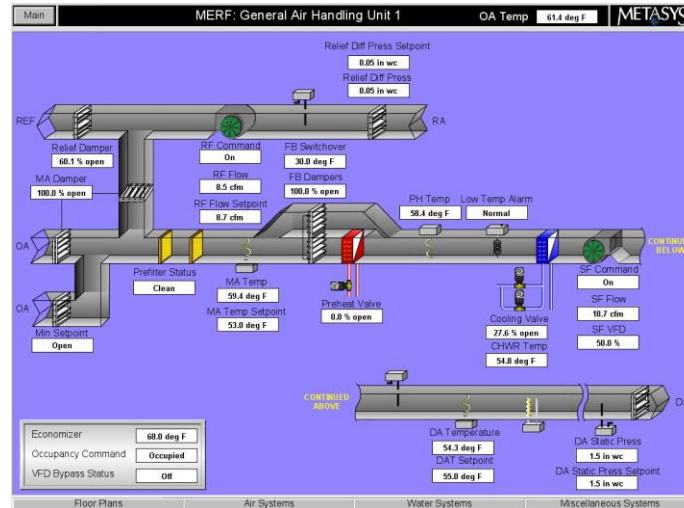
From reactive maintenance to predictive maintenance



5 Key Metrics that Affect Operational Efficiency. Image credit: CVP

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Internet of Things



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Internet of Things

Air Handler Performance

- Fan Runtime
- Fan Power
- VFD Control
- Static Pressure
- Heating Control
- Cooling Control
- Ventilation Air Control
- Economizer Control
- CO2 Control
- Outside Air Temperature
- Return Air Temperature
- Make-up Air Temperature
- Supply Air Temperatures
- Freeze Stat Alarms
- Smoke/Fire Alarm
- Pressure Drop Alarm

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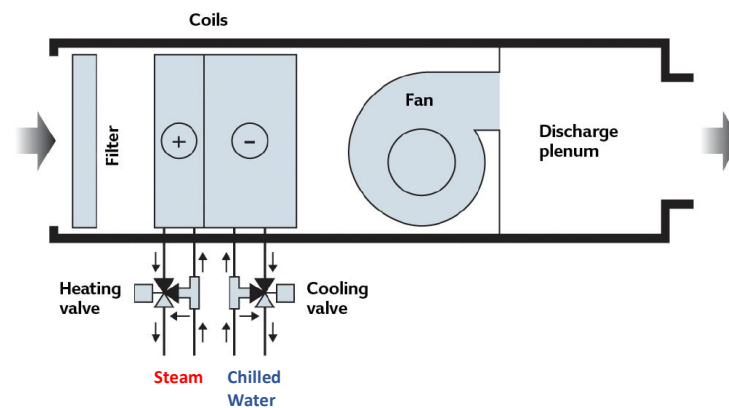
Fault Detection & Diagnostics

- Simultaneous heating and cooling
- CHW valve leaking by
- Steam valve leaking by
- Heat rec. running when it shouldn't
- Heat Recovery leaking by
- Dirty filters
- Not maintaining static
- CHWS temp too high
- DAT off set point
- Humidification when it shouldn't
- Not meeting humidity set point
- Humidity high limit
- CO2 sensor out of calibration
- Any current senses zero for a fan
- Multiple units running out of sync
- Air flow thru unit that is off
- Ave valve position versus OAT
- Economizer Optimization
- CW valve staging incorrectly
- Avg CHW delta T versus OAT

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Fault Detection & Diagnostics

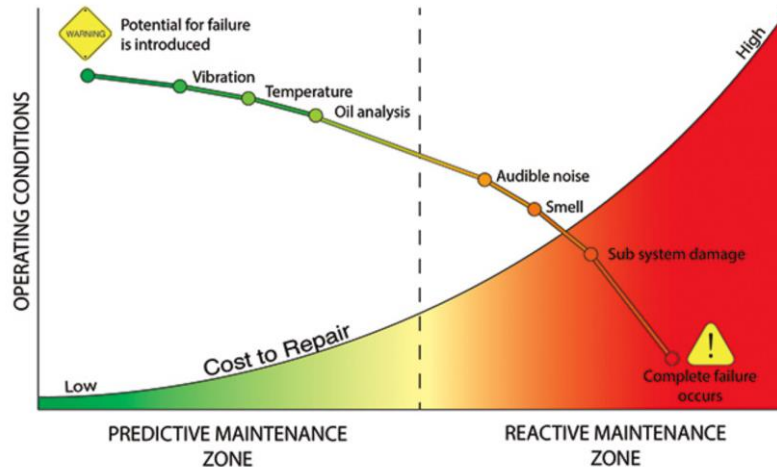
- Simultaneous heating and cooling



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Megatrend #2

From valuing institutional knowledge to valuing shared knowledge



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Megatrend #2

From valuing institutional knowledge to valuing shared knowledge

“The intuition about how a machine is operating on a factory floor used to come from working there thirty years and being able to detect a slightly different sound signature emanating from the machine, telling us something is not exactly right. That is a weak signal. Now with sensors, a new employee can detect a weak signal on the first day of work – without any intuition.”

Thank You for Being Late
An Optimist's Guide to Thriving in the Age of Accelerations
 Thomas L. Friedman

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Megatrend #2

From valuing institutional knowledge to valuing shared knowledge

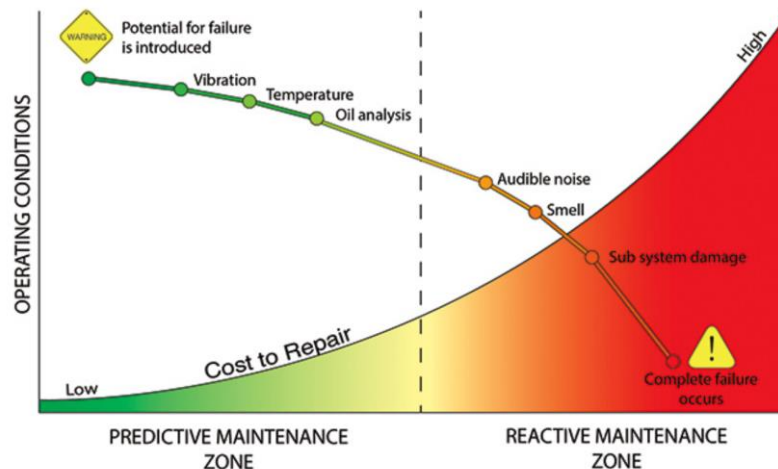
“Experienced workers knew how to process weak data. But now with Big Data, with a much finer grain of fidelity we can make finding a needle in the haystack the norm - not the exception. And we can augment the human worker with machines so they work as colleagues and enable them to process weak signals together and overnight become like a thirty year veteran.”

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 Thomas L. Friedman

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Megatrend #3

From funding repairs to funding detection and analytic systems



5 Key Metrics that Affect Operational Efficiency. Image credit: CVP

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Megatrend #3

From funding repairs to funding detection and analytic systems



- Better occupant experience
- Healthier building environments
- Reduced risk of business disruptions
- Increased productivity & wrench time
- Decreased cost of repairs
- Reduced scheduled PM activities
- Lower energy costs
- Retained energy conservation savings
- Improved turnover of new construction

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Megatrend #4

From preventative maintenance to condition-based maintenance



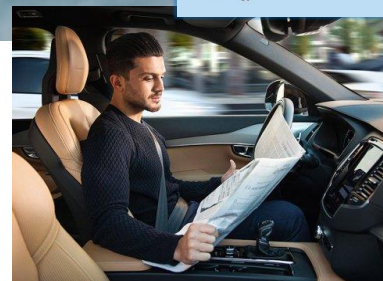
Industry 2.0
Mass production assembly lines using electrical power



Industry 4.0
The 'Smart Factory'. Autonomous decision making of cyber physical systems using machine learning and Big Data analysis. Interoperability through IoT and cloud technology.



Industry 3.0
Automated production using electronics, programmable logic controllers (PLC), IT systems and robotics



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Megatrend #4

From preventative maintenance to condition-based maintenance

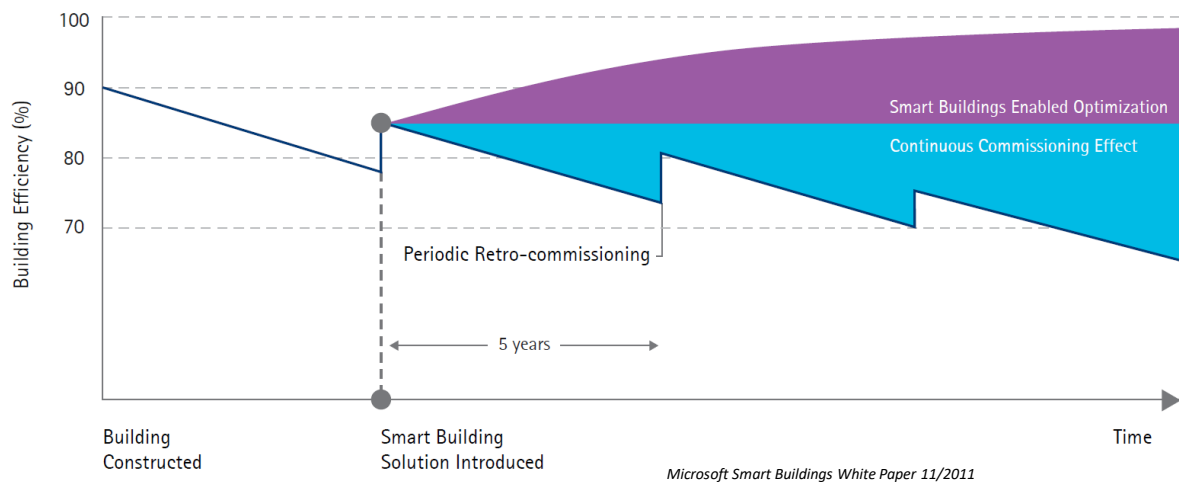
“Preventative maintenance was: change the oil every six thousand miles, whether you drive it hard or not. The new approach is “predictive maintenance” and “prescriptive maintenance” We can now predict nearly the exact moment when a tire, engine, car or truck battery, turbine fan or widget needs to be changed.”

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Megatrend #5

From recommissioning to continuous commissioning



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Megatrend #6
From competing with the Machine to complementing it



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Megatrend #6
From competing with the Machine to complementing it



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Megatrend #6

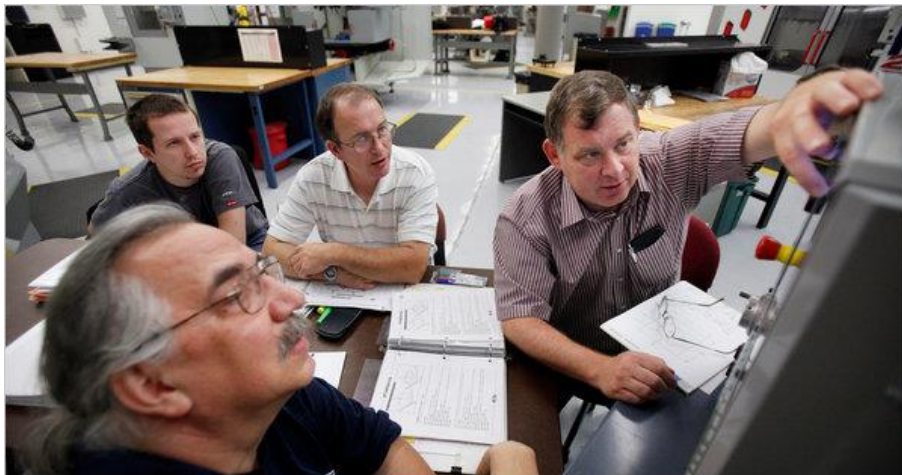
From competing with the Machine to complementing it



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Megatrend #7

From rewarding expertise to rewarding collaboration



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Megatrend #8

From managing facilities to managing occupant experiences

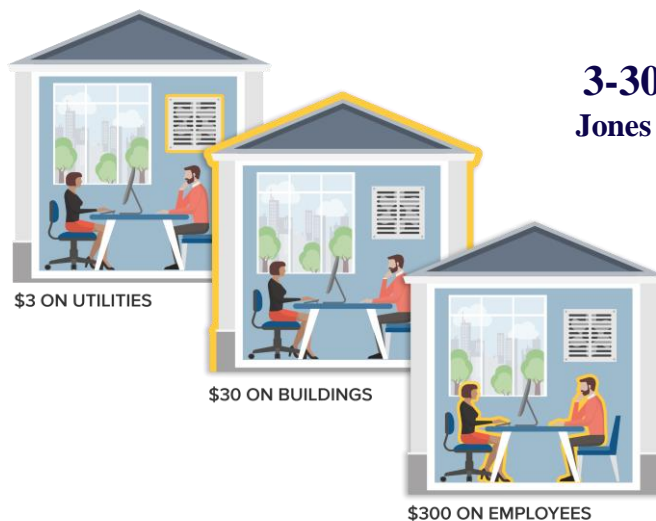


“...spend less time and resources on running buildings and more time on what is important – the occupant.”

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Megatrend #8

From managing facilities to managing occupant experiences



3-30-300 Rule
Jones Lang LaSalle

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Megatrend #8

From managing facilities to managing occupant experiences

- Create environments for enhancing the student experience
- Provide places to work that attract smart, sustainability-minded employees
- Ensure comfort with temperature, humidity and lighting tailored to occupant preferences
- Raise productivity, health and wellness through indoor air quality
- Empower individuals with control of occupant personal workspace
- Accommodate schedules and workflows of business operations
- Manage the indoor environment to pre-empt issues before they surface

Source: 75F

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Megatrend #9

From owning physical assets to ensuring systems performance



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Megatrend #10

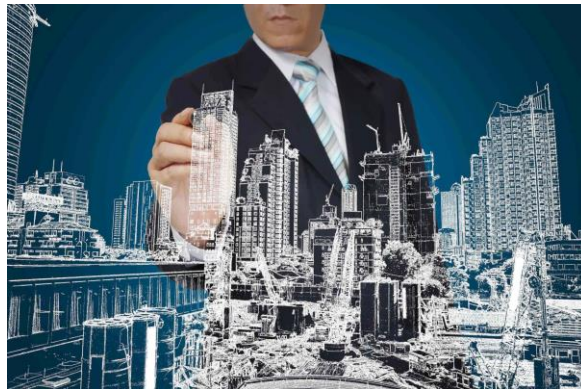
From leading top-down to leading bottom-up and outside-in



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Megatrend #10

From leading top-down to leading bottom-up and outside-in



Chief Operations Technology Officer

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Preparing for Disruptive Change

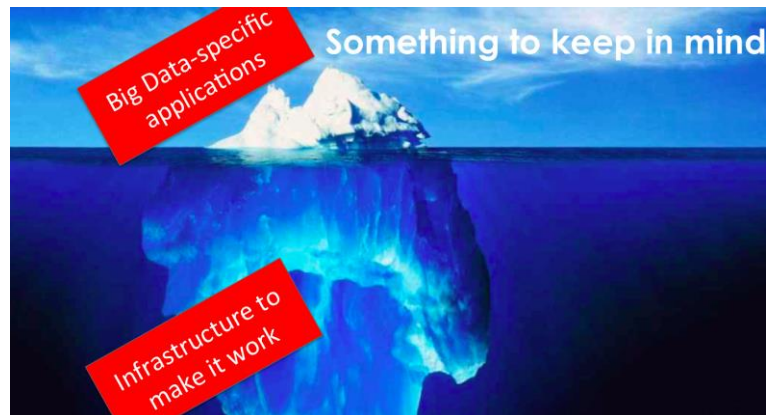
Maintain at least a basic understanding of the disruptive technological forces and embrace the Operations Technology role of your organization.



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Preparing for Disruptive Change

Be positioned and prepared for the megatrends reshaping the profession.



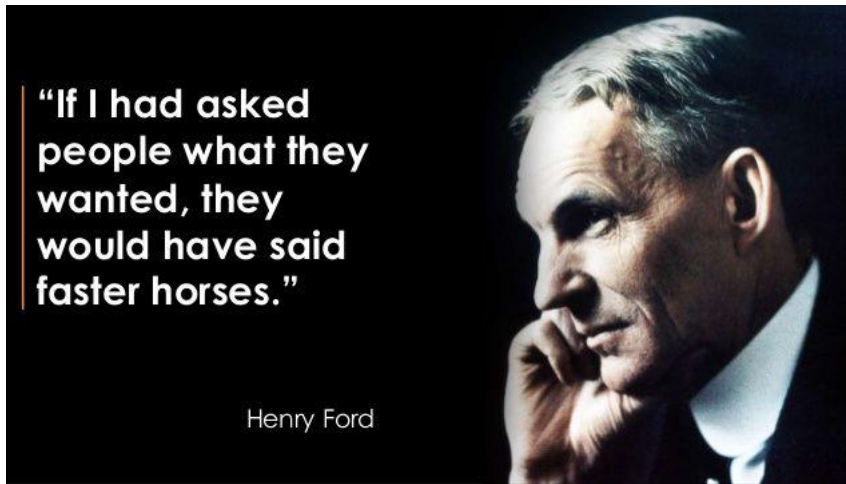
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Reviewing the Ten Megatrends

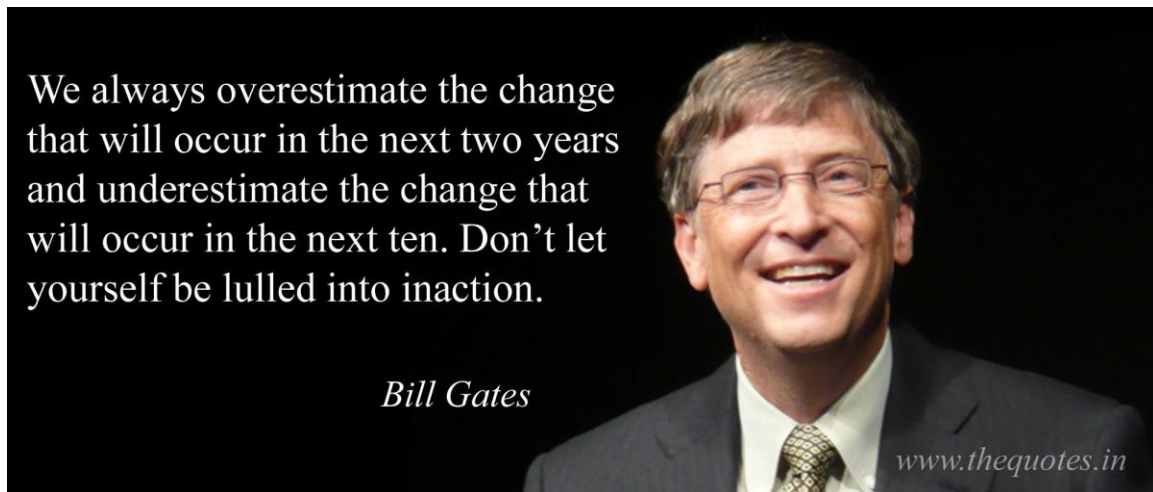
Source: Facilities Innovations LLC

From reactive maintenance to predictive maintenance
 From valuing institutional knowledge to valuing shared knowledge
 From funding repairs to funding detection and analytic systems
 From preventative maintenance to condition-based maintenance
 From recommissioning to continuous commissioning
 From competing with the Machine to complementing it
 From rewarding expertise to rewarding collaboration
 From managing facilities to managing occupant experiences
 From owning physical assets to ensuring systems performance
 From leading top-down to leading bottom-up and outside-in

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