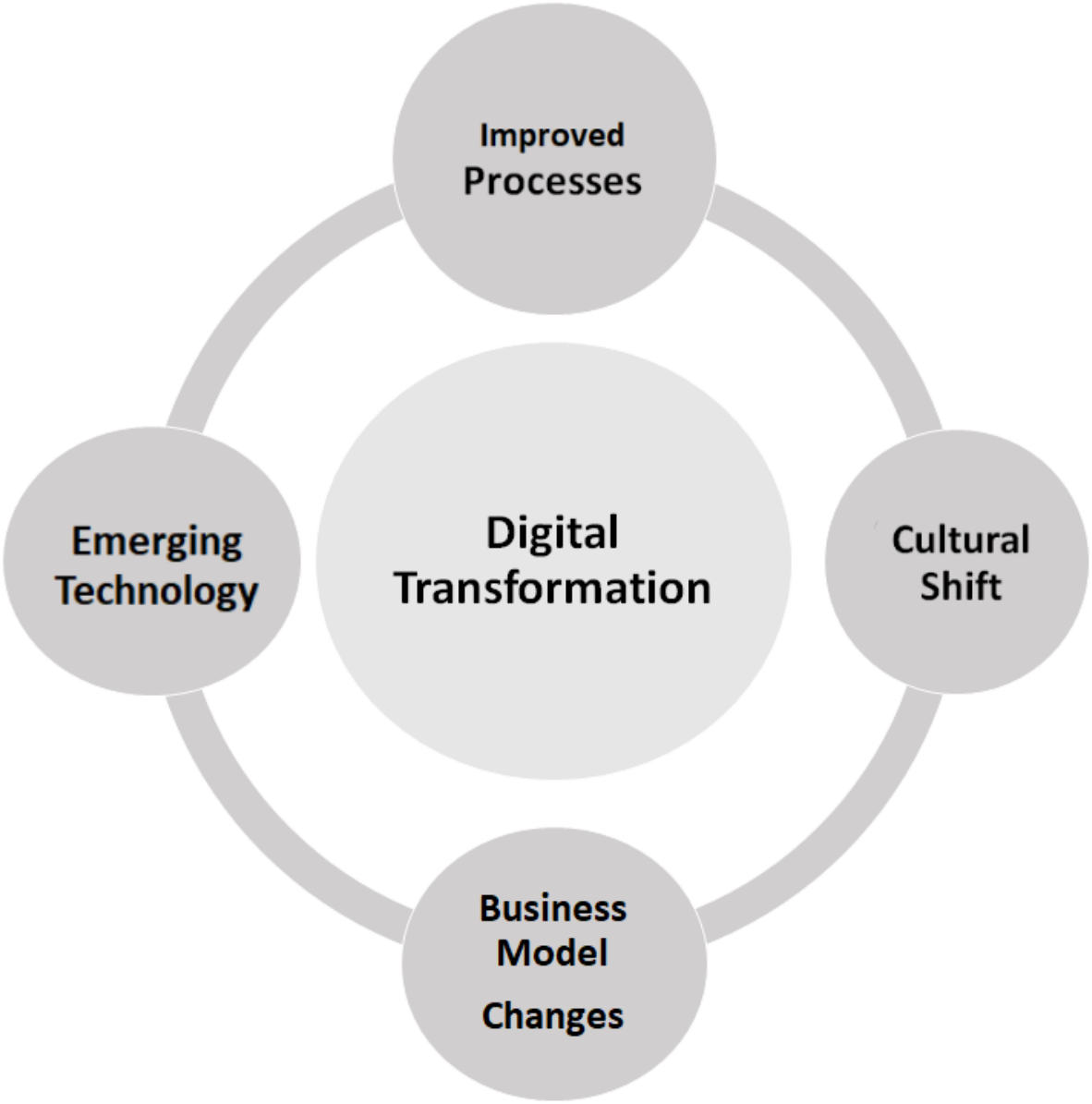
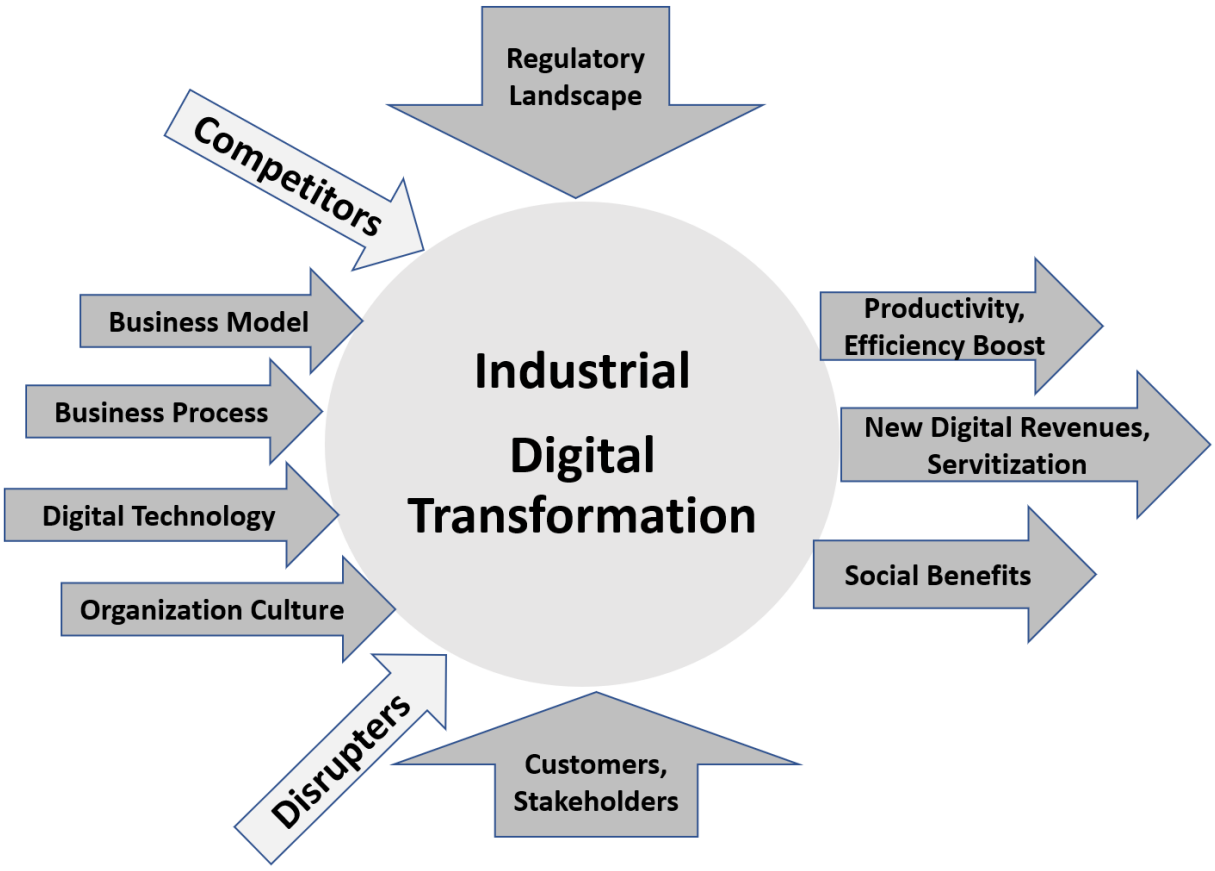
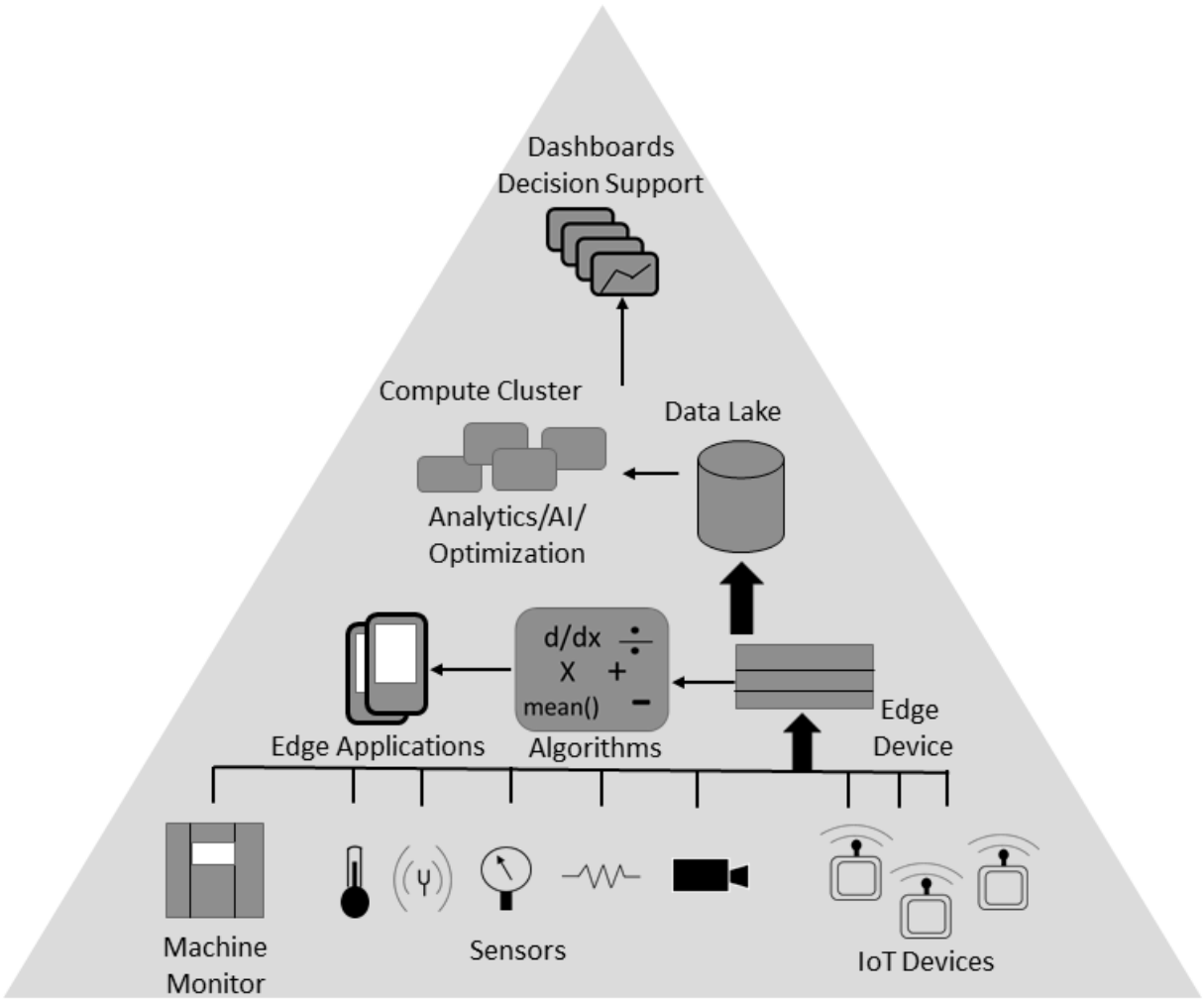
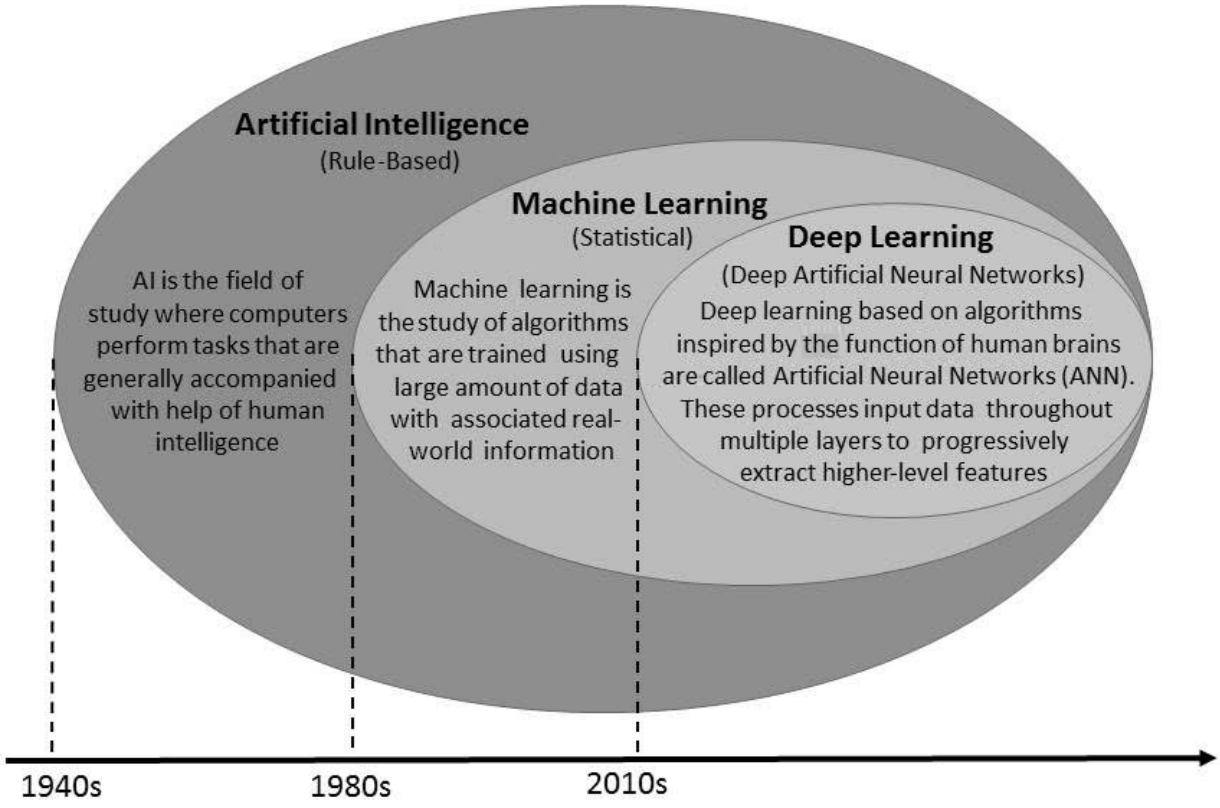
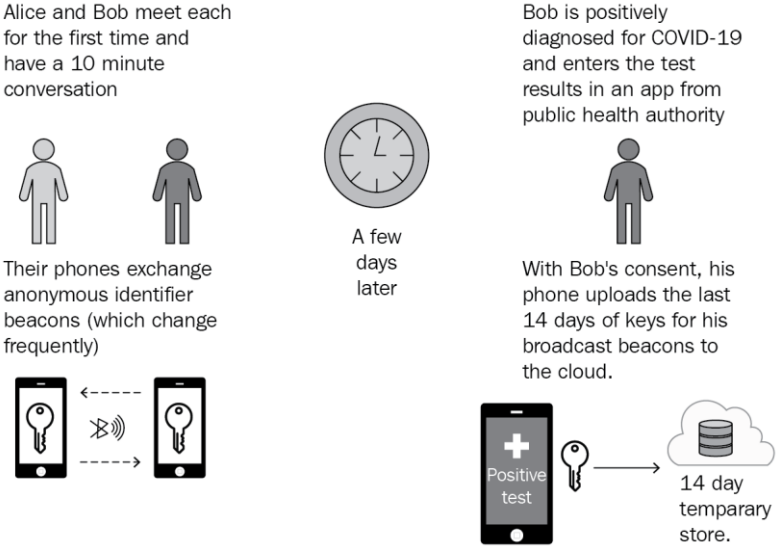
Chapter 1: Introducing Digital Transformation




Regulatory Landscape
Competitors
Business Model
Business Process
Digital Technology
Organization Culture
Industrial Digital Transformation
Productivity, Efficiency Boost
New Digital Revenues, Servitization
Social Benefits
Customers, Stakeholders
Disrupters


Dashboards
Decision Support
Compute Cluster
Data Lake
Analytics/AI/
Optimization
d/dx
X
mean()
Edge Applications
Algorithms
Edge
Device
Machine
Monitor
Sensors
IoT Devices


Artificial Intelligence
(Rule-Based)
AI is the field of study where computers perform tasks that are generally accompanied with help of human intelligence
Machine Learning
(Statistical)
Machine learning is the study of algorithms that are trained using large amount of data with associated real-world information
Deep Learning
(Deep Artificial Neural Networks)
Deep learning based on algorithms inspired by the function of human brains are called Artificial Neural Networks (ANN). These processes input data throughout multiple layers to progressively extract higher-level features
1940s
1980s
2010s

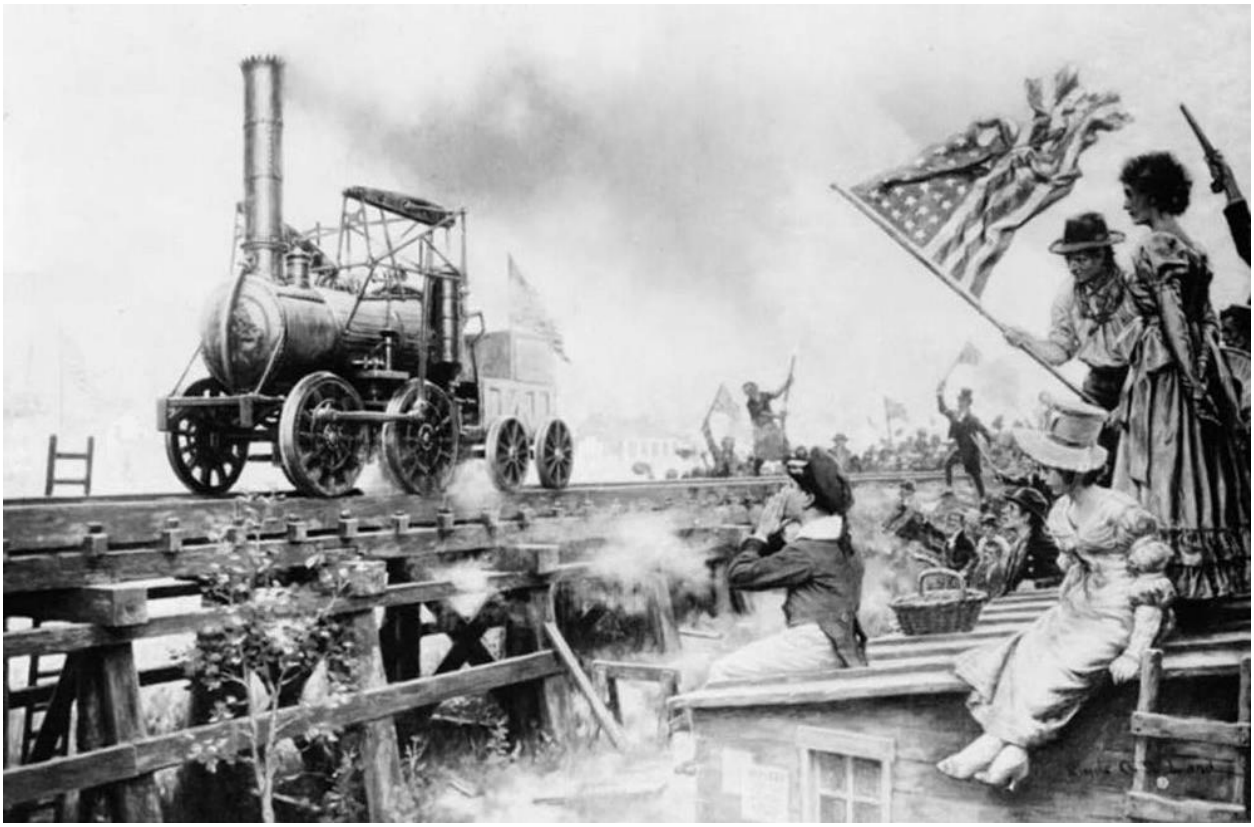

Alice and Bob meet each for the first time and have a 10 minute conversation
Their phones exchange anonymous identifier beacons (which change frequently)
A few days later
Bob is positively diagnosed for COVID-19 and enters the test results in an app from public health authority
With Bob's consent, his phone uploads the last 14 days of keys for his broadcast beacons to the cloud.
Positive test
14 day temparary store.

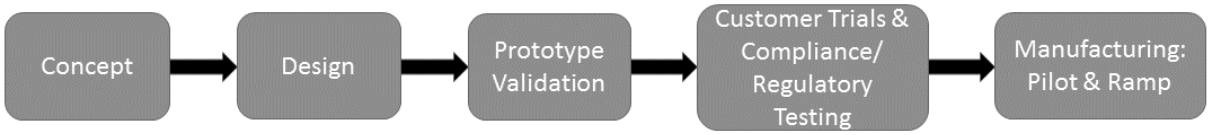
Fourth industrial revolution
Cyber physical systems

Third industrial revolution
Electronics and IT systems, automation

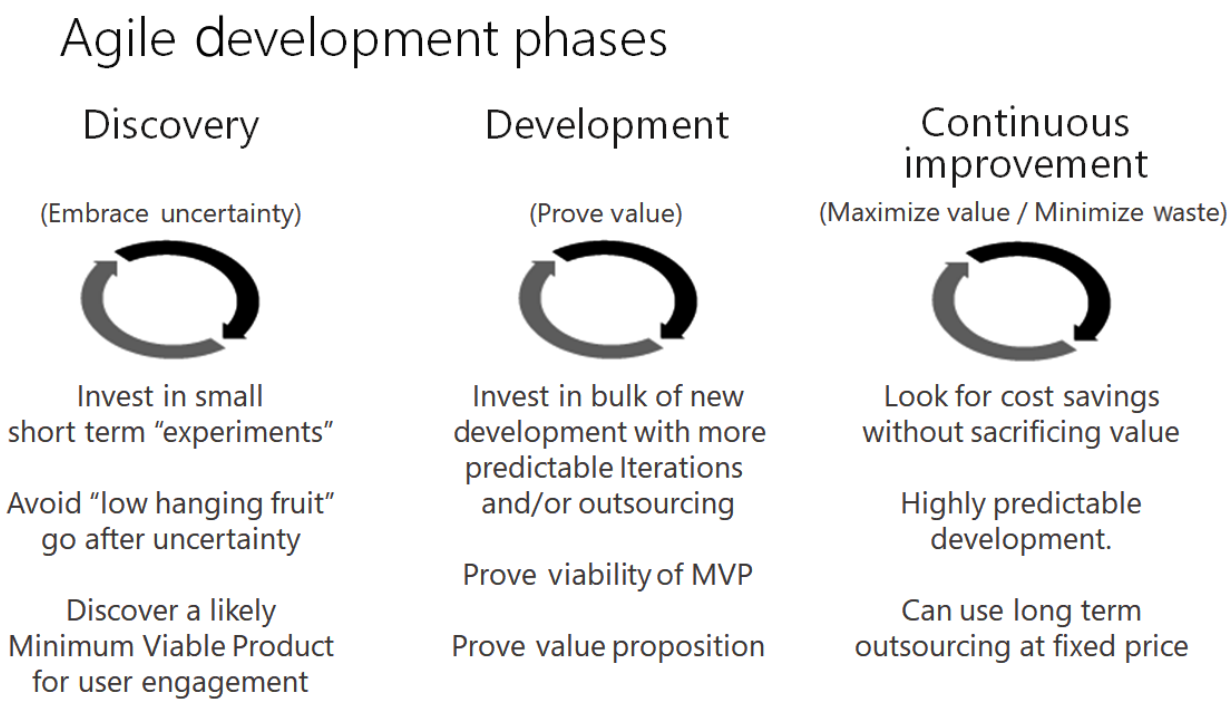
Second industrial revolution
Mass Production and Electricity

First industrial revolution
Mechanization, steam, and water power

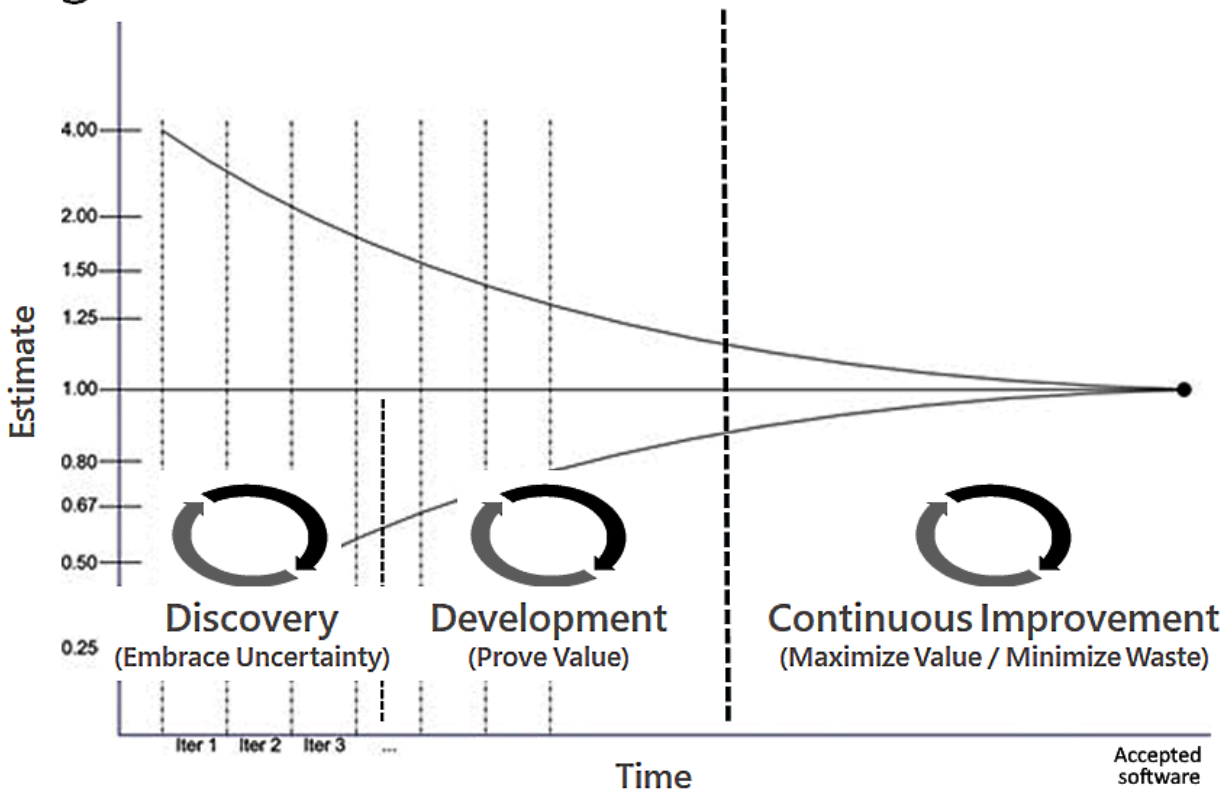


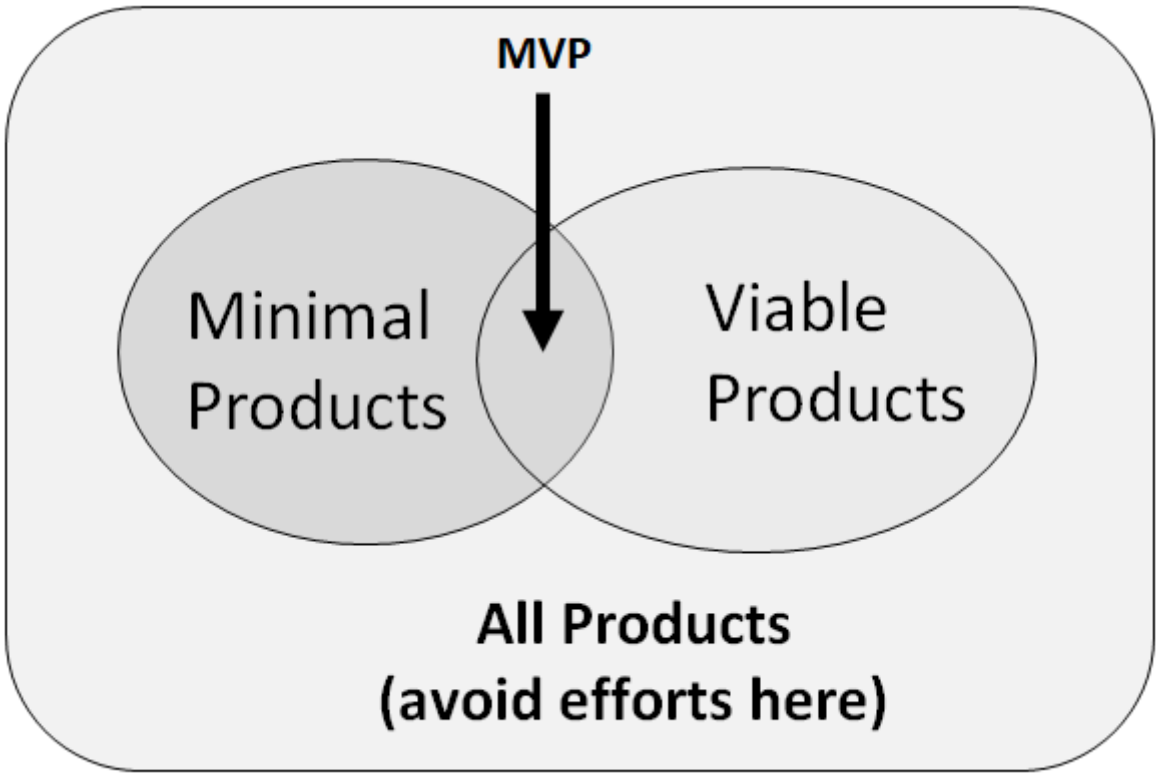

Concept
Design
Prototype Validation
Customer Trials & Compliance/ Regulatory Testing
Manufacturing: Pilot & Ramp

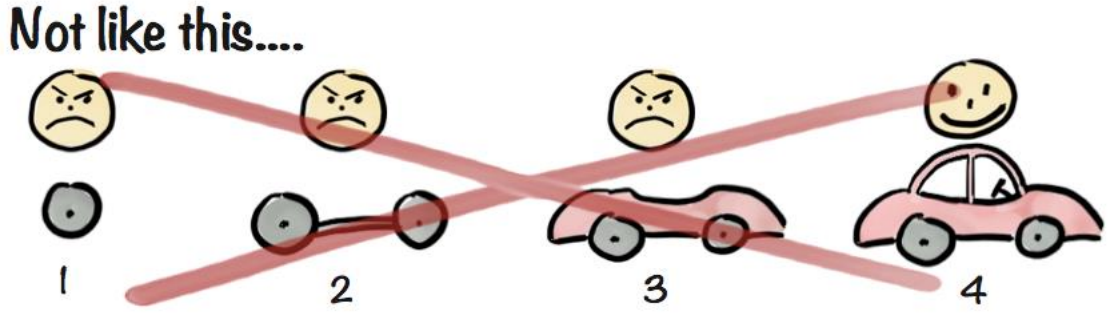
Chapter 2: Transforming the Culture in an Organization

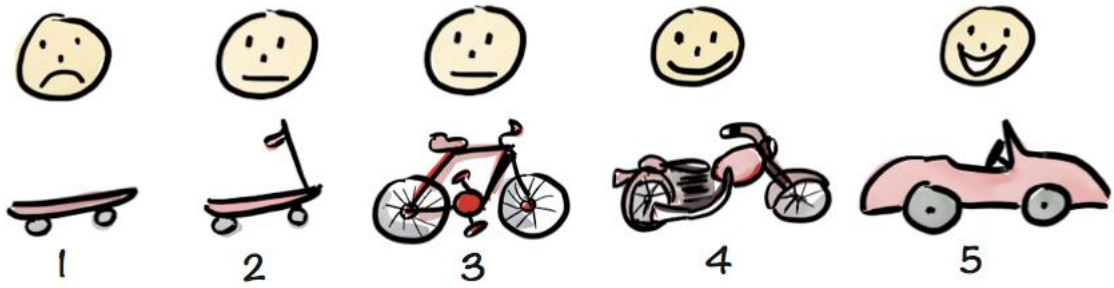


Agile/Lean Processes




MVP
Minimal Products
Viable Products
All Products
(avoid efforts here)

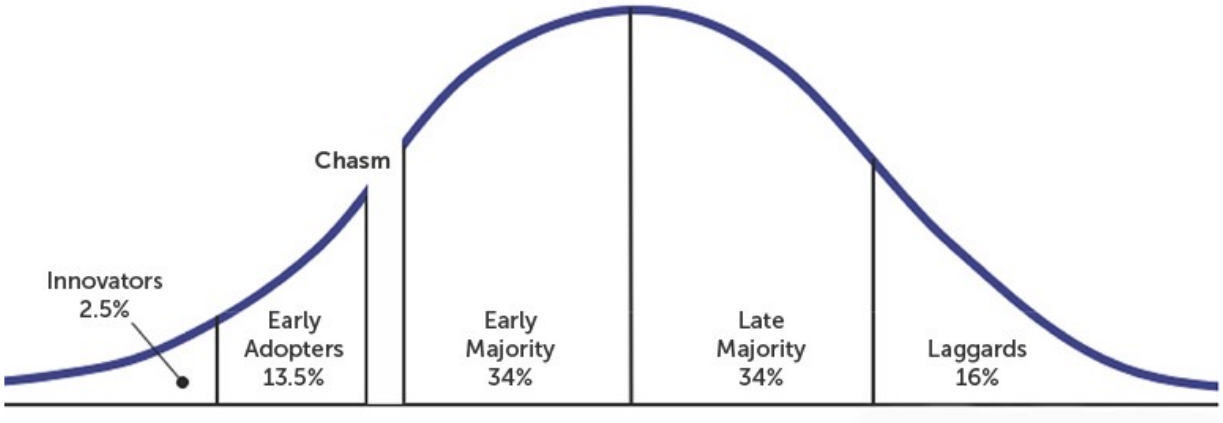

Not like this....
1
2
3
4

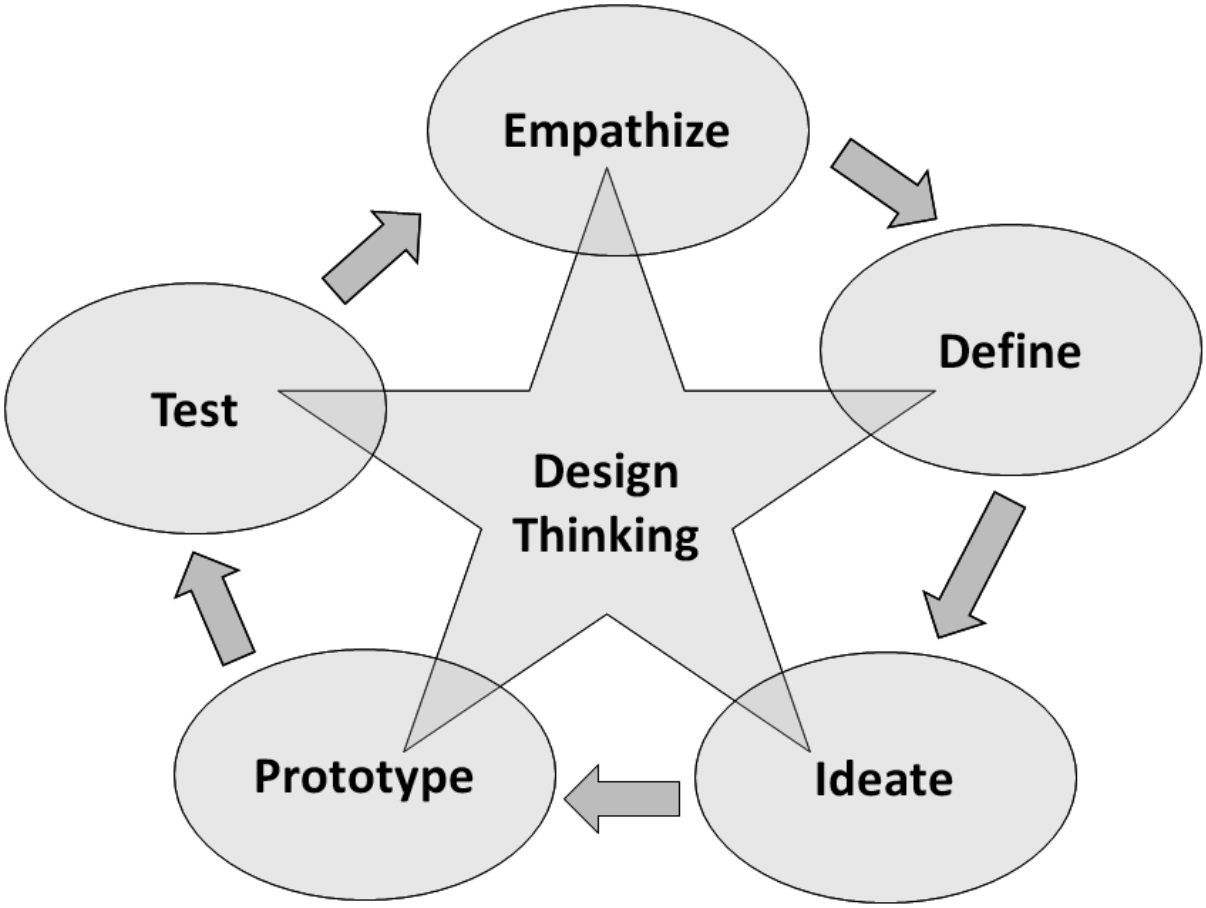

Like this!
1
2
3
4
5

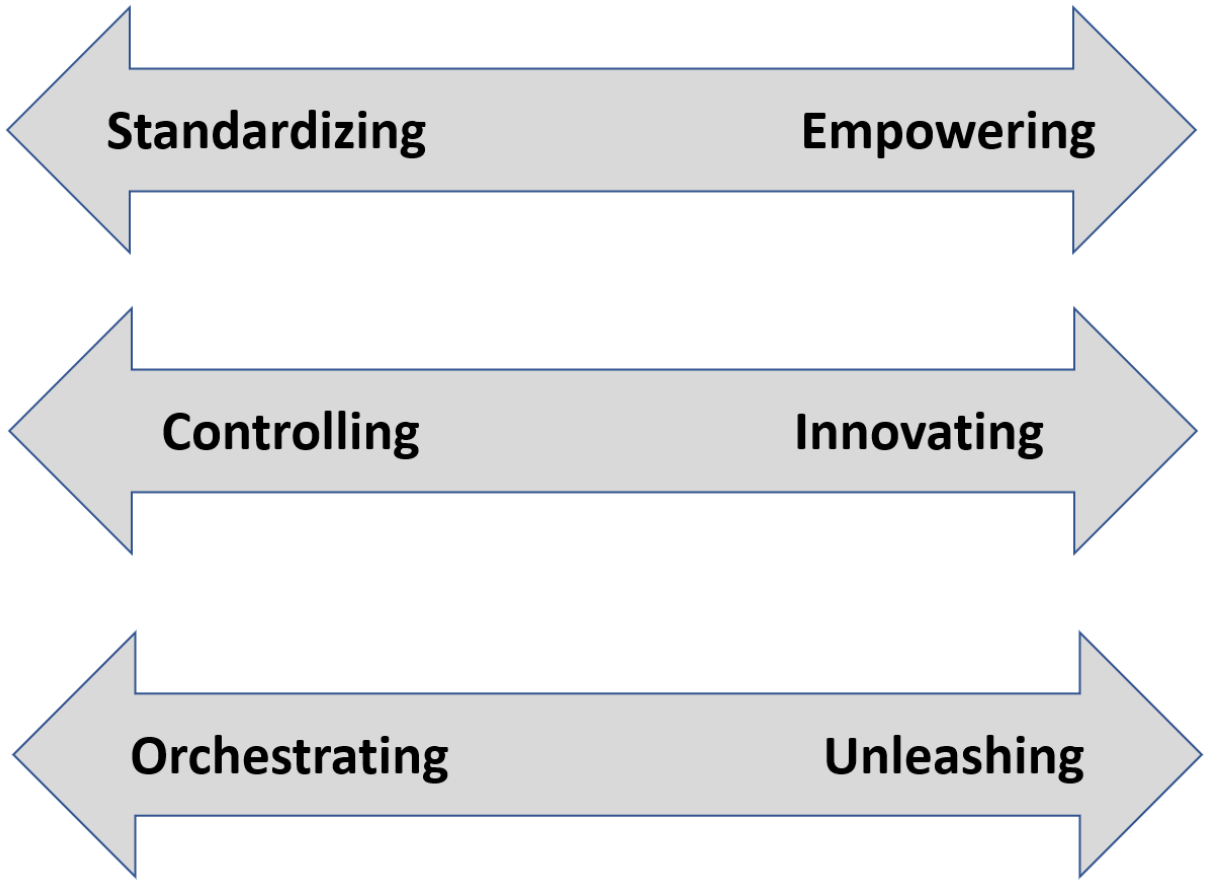
Innovation

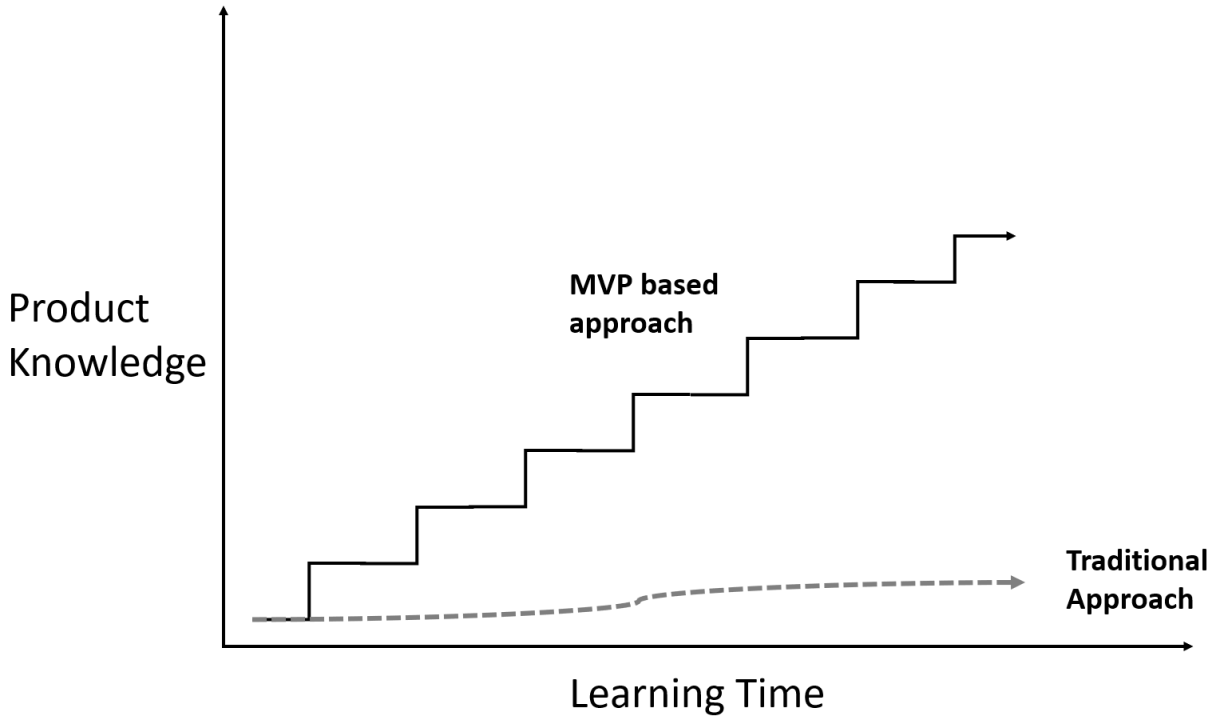
Sustaining Innovation	Disruptive Innovation
Existing Busines/Operating Model Existing Culture	New Business/Operating Model New Culture
Agile/Lean Modular Development Modular Contracting IaaS PaaS Virtualization Cost/Process Optimization	User - Centered Open Innovation DevOps Agile Security Elastic/Scalable Cloud SaaS Mission Enablement

Technology Adoption Life Cycle

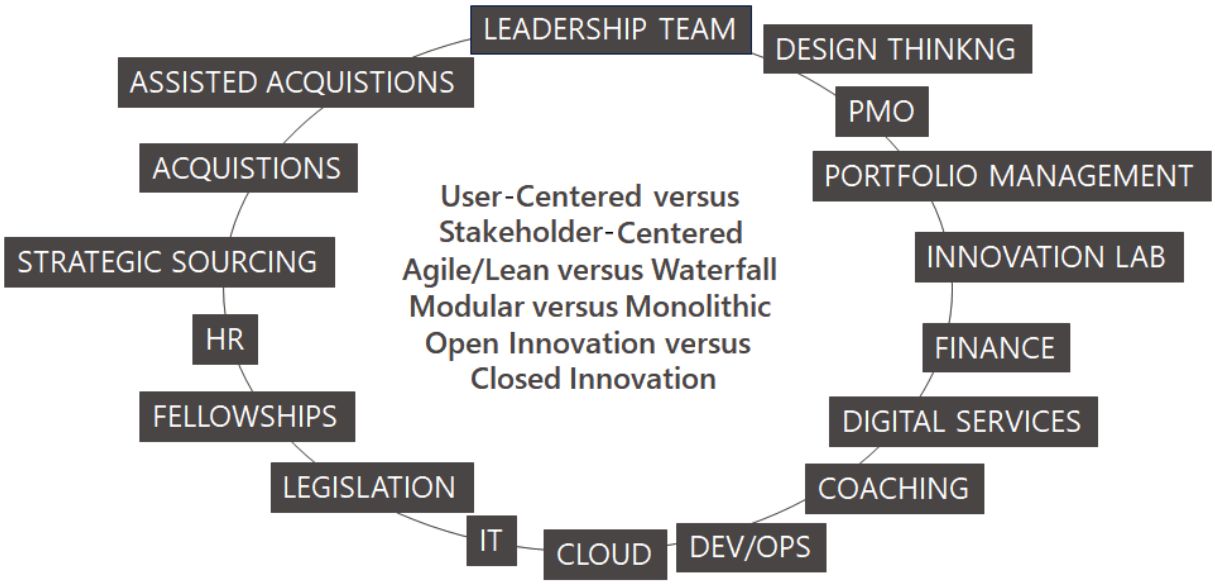


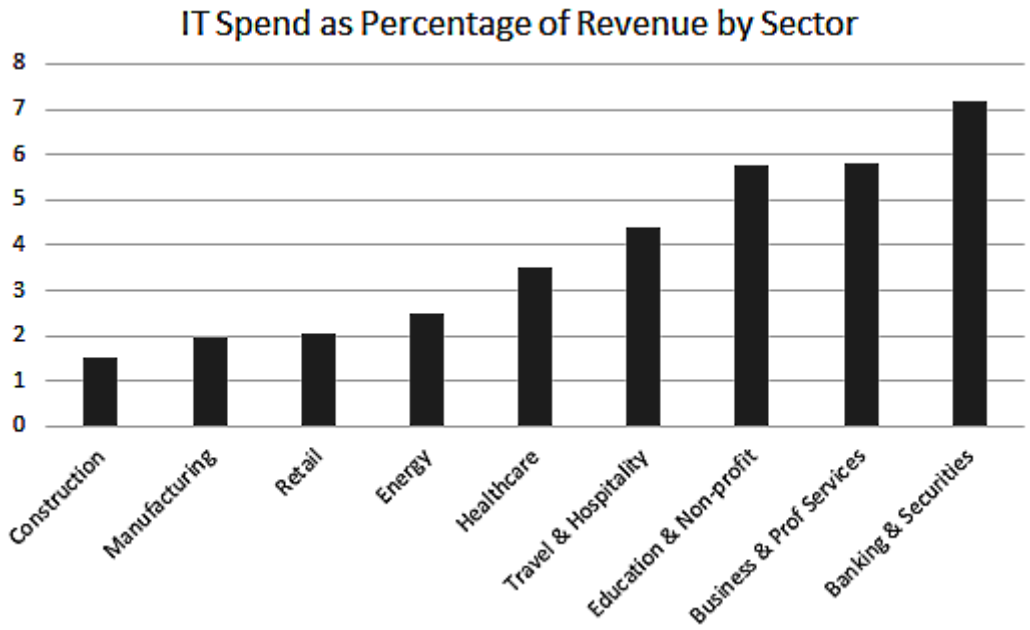

Empathize
Define
Ideate
Prototype
Test
Design
Thinking

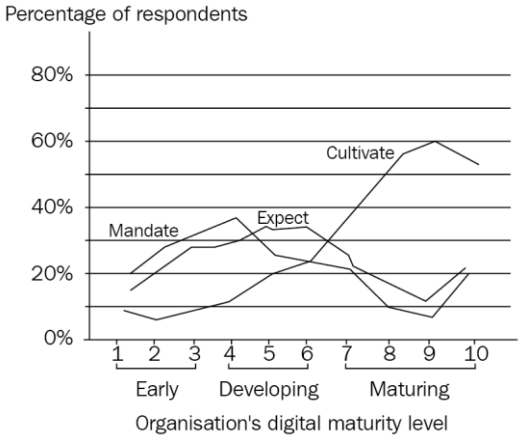

Standardizing
Empowering
Controlling
Innovating
Orchestrating
Unleashing


Product Knowledge
MVP based approach
Traditional Approach
Learning Time

Policy & Governance Echo-Chamber





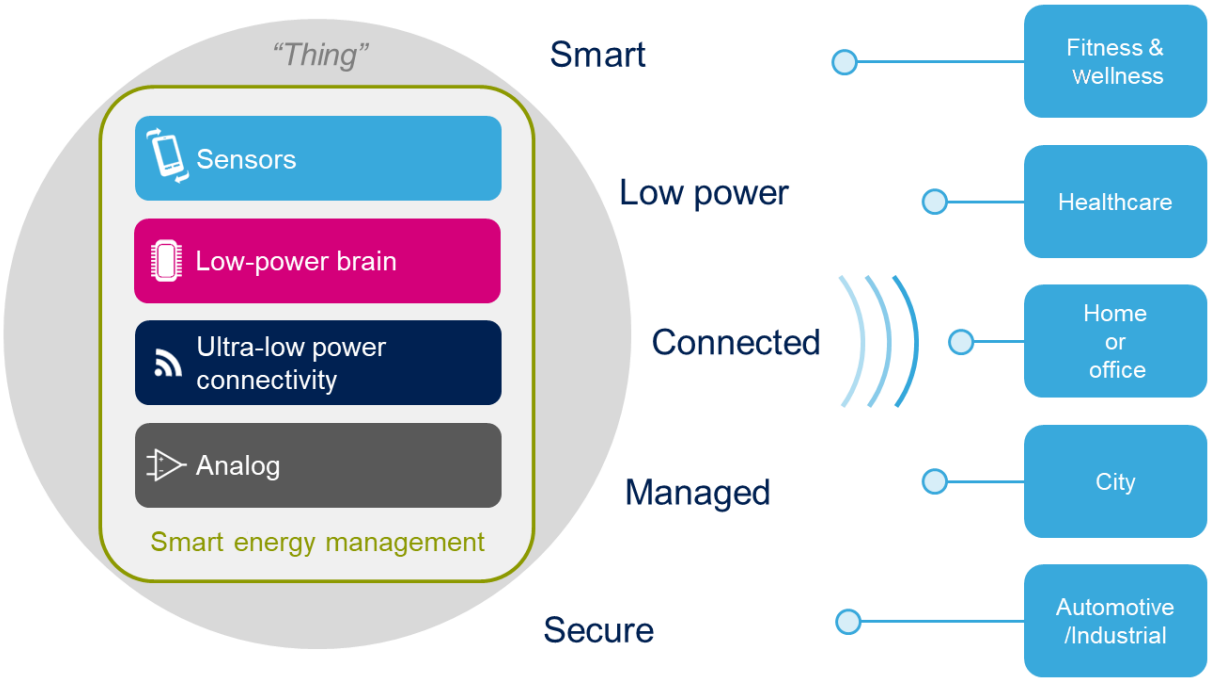


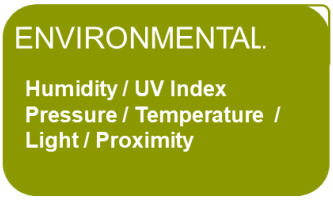
Mandate -
Mandating from management

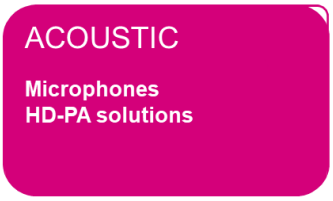
Expect -
Expecting employees to be motivated to embrace digital business opportunities

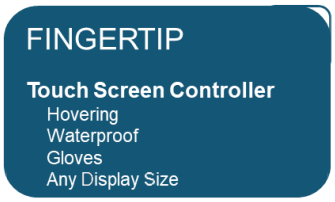
Cultivate -
Cultivating a strong digital business culture that strives for risk-taking, collaboration, agility, continuous learning

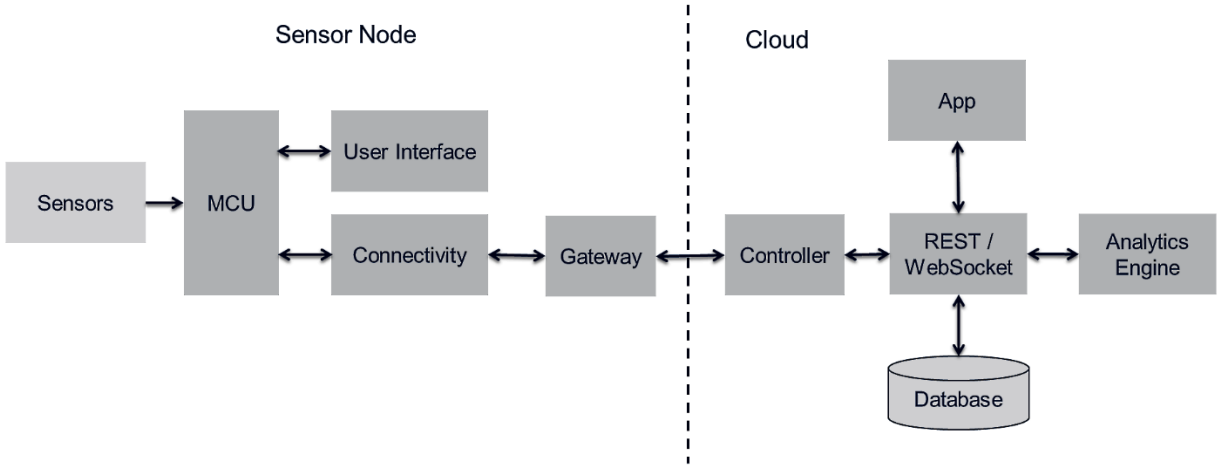
Chapter 3: Emerging Technologies to Accelerate Digital Transformation

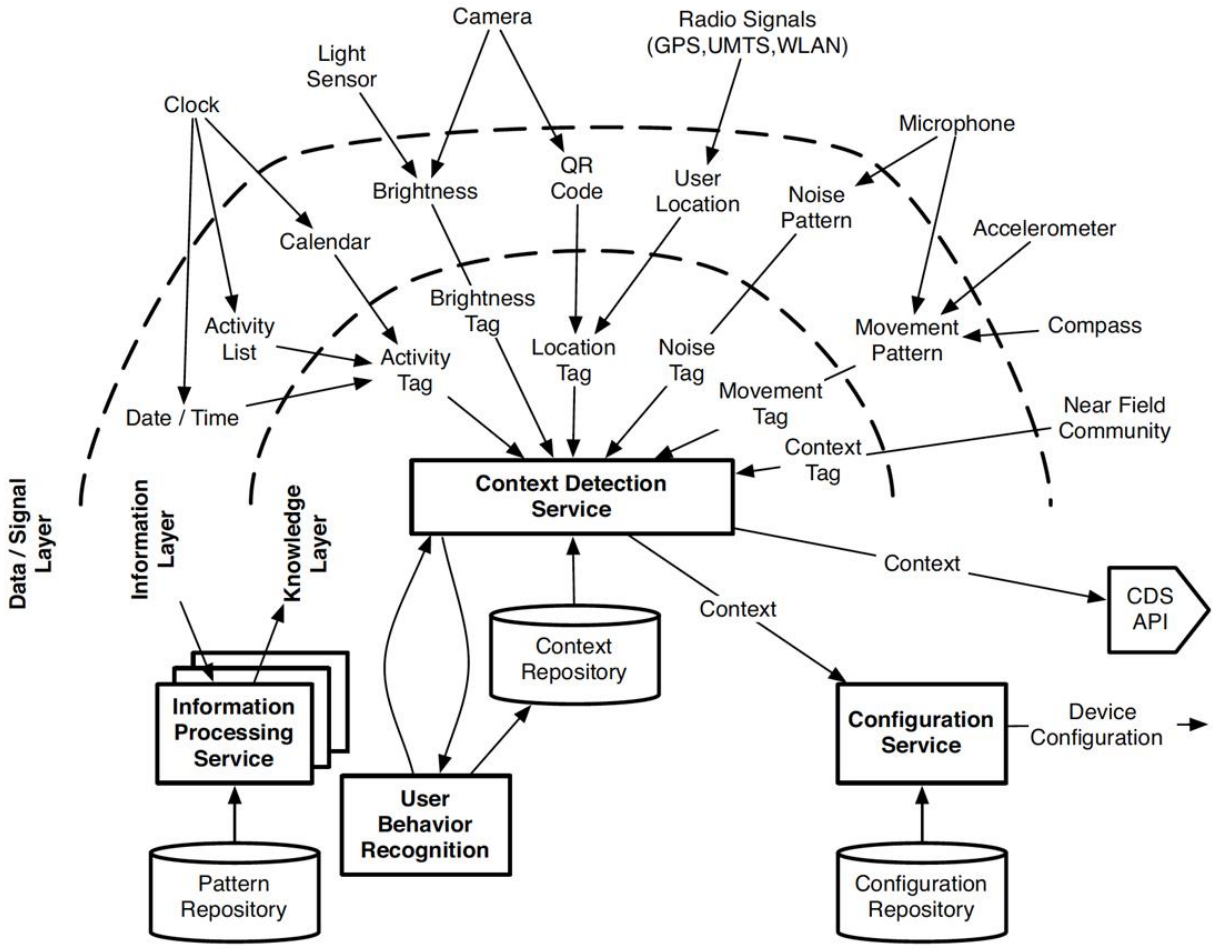









Sensor Node
Cloud
Sensors
MCU
User Interface
Connectivity
Gateway
Controller
App
REST / WebSocket
Analytics Engine
Database


Camera
Radio Signals (GPS,UMTS,WLAN)
Light Sensor
Clock
Microphone
Brightness
QR Code
User Location
Noise Pattern
Accelerometer
Calendar
Brightness Tag
Activity List
Activity Tag
Location Tag
Noise Tag
Movement Pattern
Compass
Date / Time
Movement Tag
Near Field Community
Context Tag
Context Detection Service
Data / Signal Layer
Information Layer
Knowledge Layer
Context
CDS API
Context
Context Repository
Information Processing Service
User Behavior Recognition
Configuration Service
Device Configuration
Pattern Repository
Configuration Repository

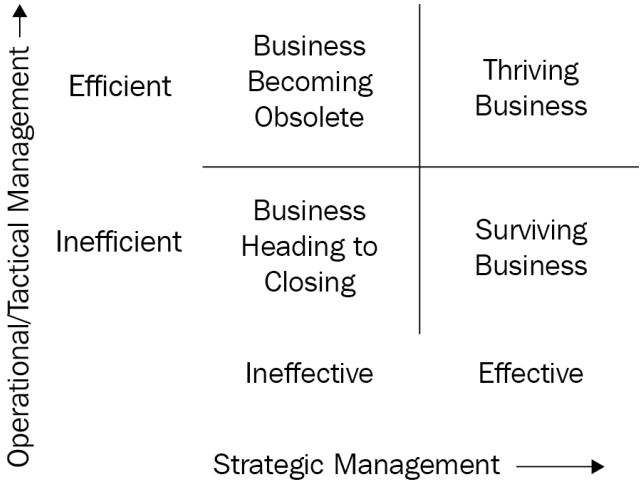
JamesProvost.com

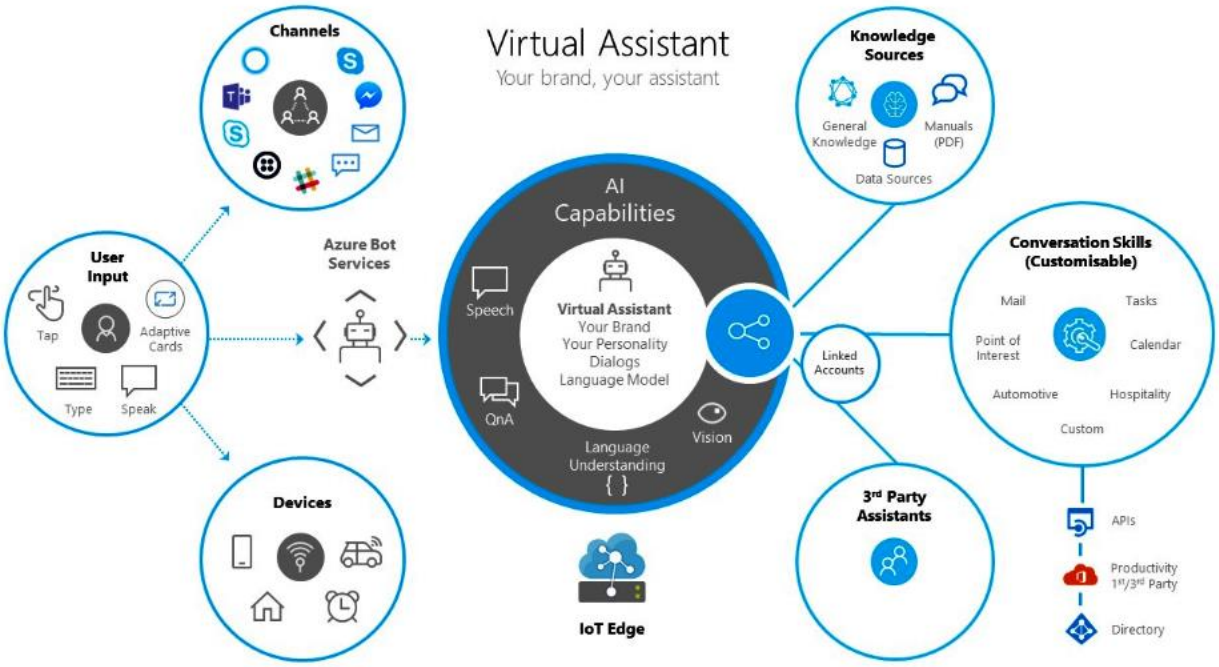
Nest Weave
(Application)

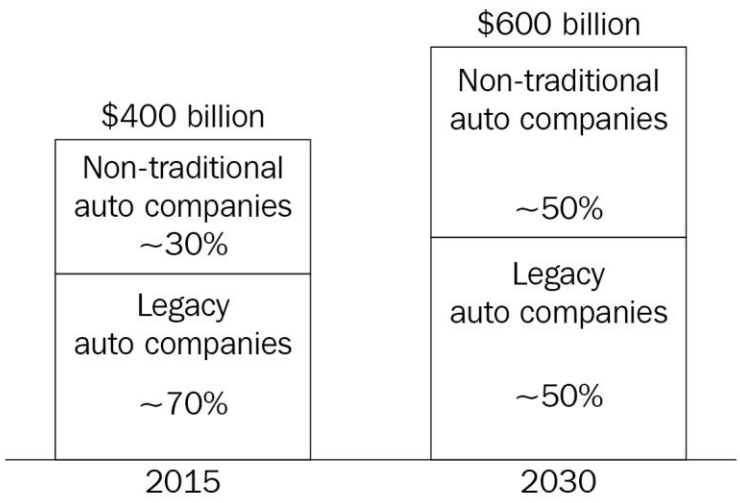
Thread Networking Protocol
(Transport Network)

IEEE 802.15.4 MAC/PHY
(Physical Layer)

Chapter 4: Business Drivers for Industrial Digital Transformation



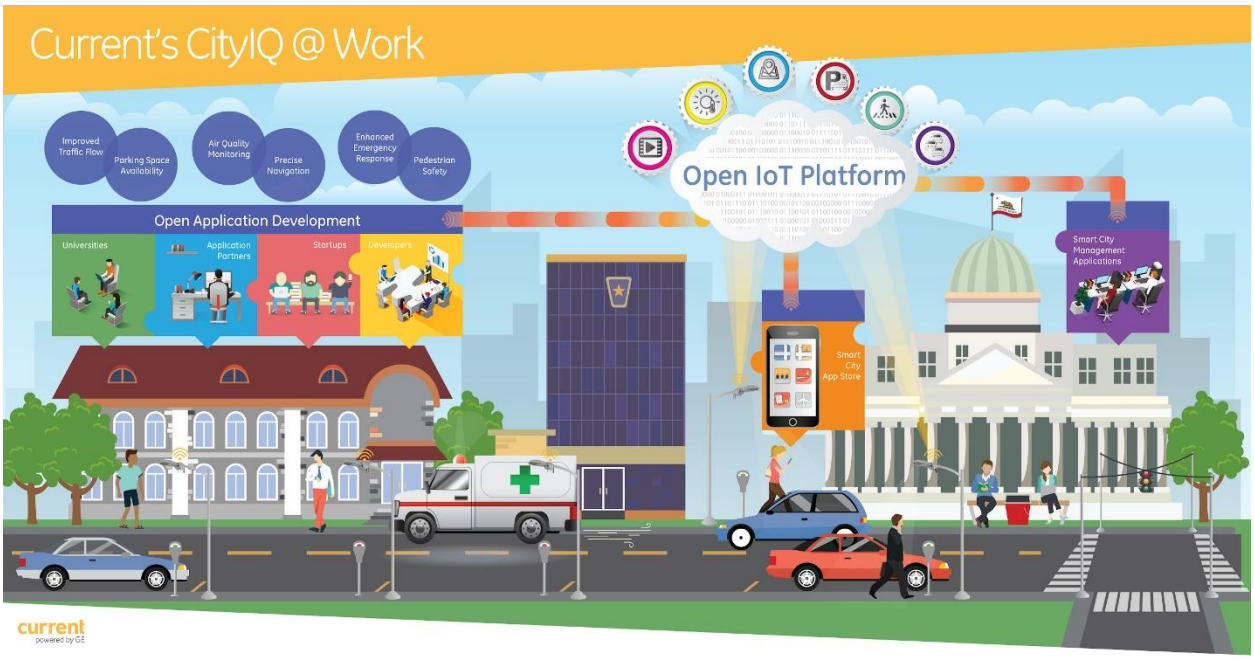


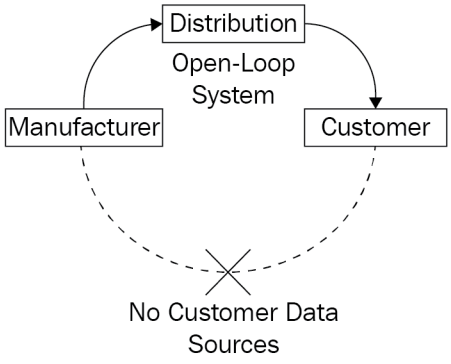


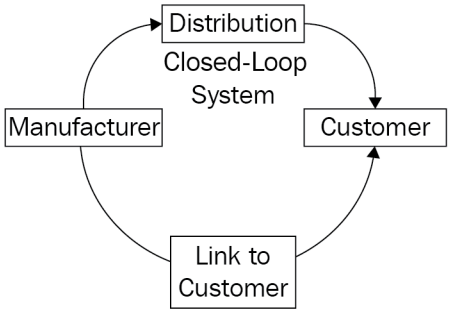
SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

Full Automation

0	1	2	3	4	5
No Automation	**Driver Assistance**	**Partial Automation**	**Conditional Automation**	**High Automation**	**Full Automation**
Zero autonomy; the driver performs all driving tasks.	Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.	Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.	Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.	The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.	The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.


Current's CityIQ @ Work
Improved Traffic Flow
Parking Space Availability
Air Quality Monitoring
Precise Navigation
Enhanced Emergency Response
Pedestrian Safety
Open IoT Platform
Open Application Development
Universities
Application Partners
Startups
Developers
Smart City Management Applications
Smart City App Store
current
powered by GE

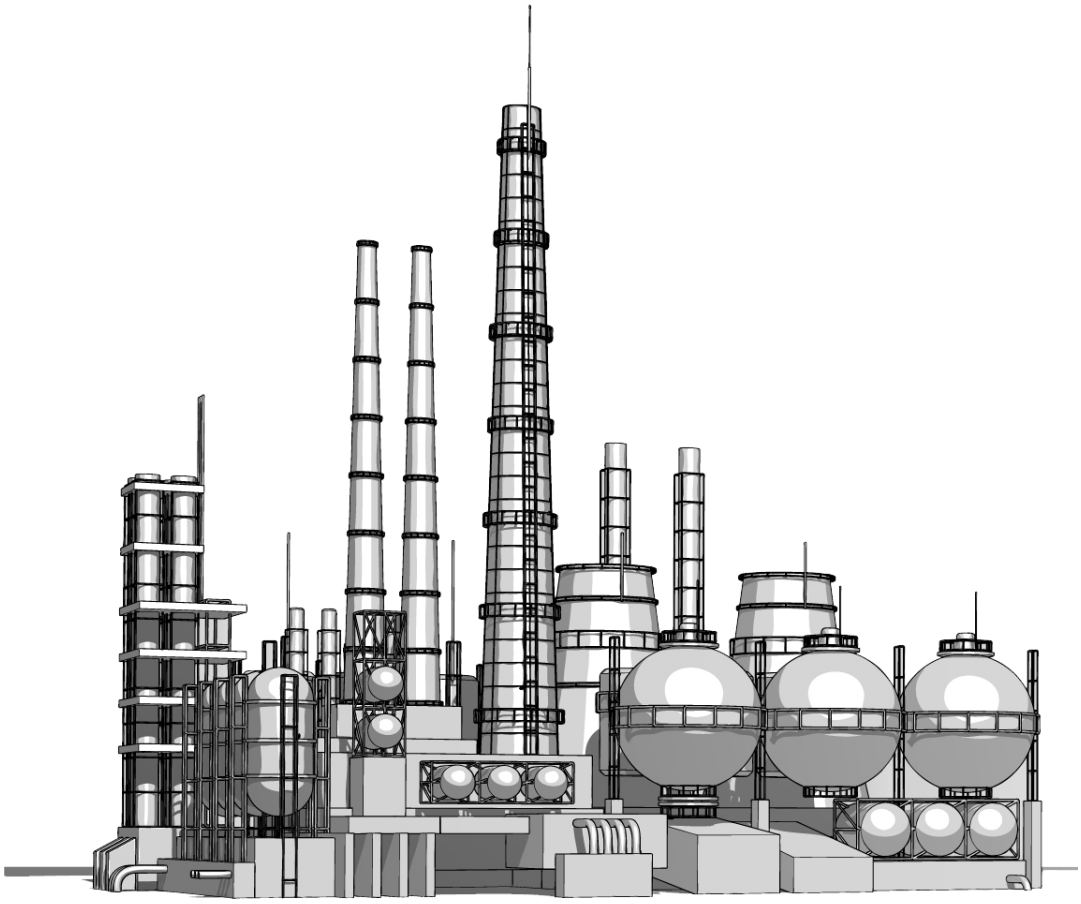

Distribution
Open-Loop System
Manufacturer
Customer
No Customer Data Sources


Distribution
Closed-Loop System
Manufacturer
Customer
Link to Customer

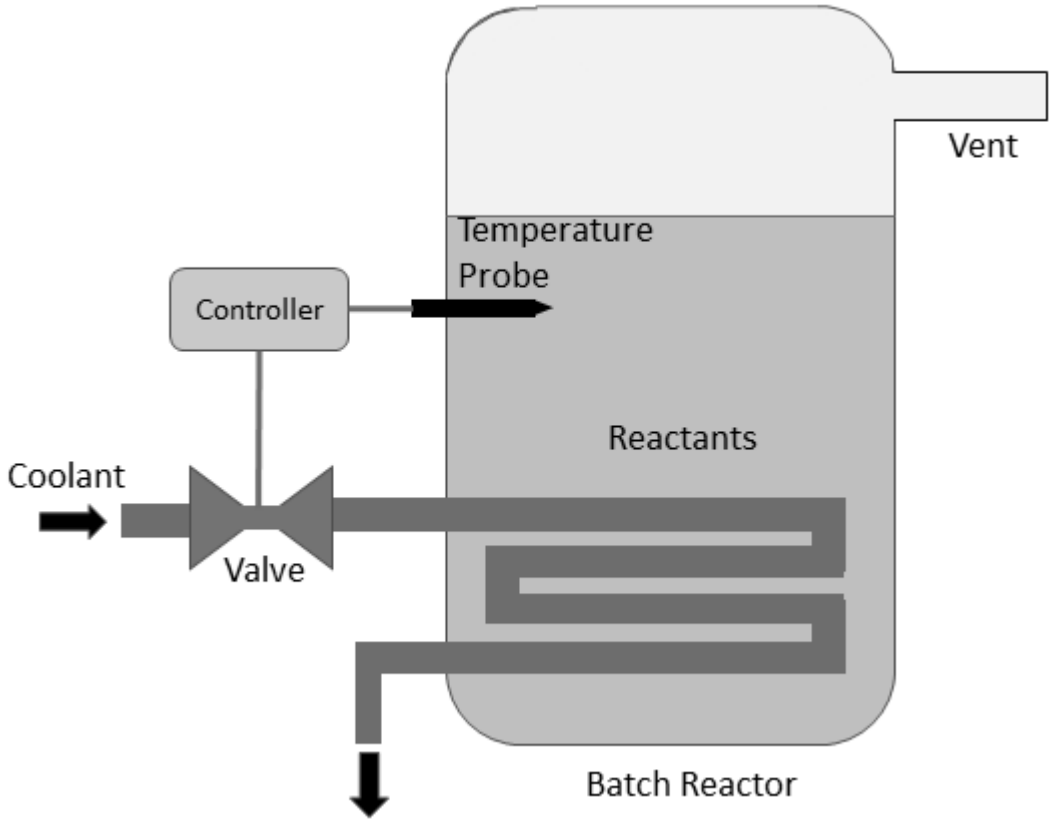

SIGNATURE
VISA
2013
AT&T
10:00 AM
Settings
Jackson Walker
Charge
$15.33
Enter an optional note
Clear
7
8
9
4
5
6
1
2
3
00
0

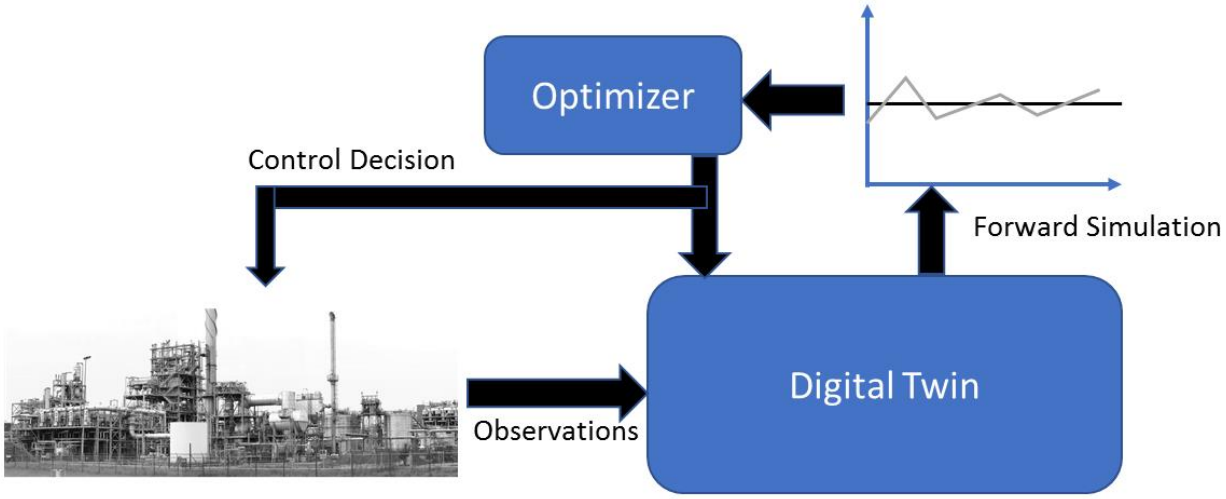
	Service Name
A	Air-as-a-Service (Kaeser Kompressoren)
B	Backend-as-a-Service (Mobile backend mBaaS)
C	Container-as-a-Service
D	Data-as-a-Service
E	Enterprise-as-a-Service
F	Function-as-a-Service / Furniture-as-a-Service
G	Games-as-a-Service
H	Hardware-as-a-Service
I	Infrastructure-as-a-Service
J	Juju-as-a-Service (Kubernetes service)
K	Kubernetes-as-a-Service (Rackspace)
L	Location-as-a-Service
M	Mobility-as-a-Service
N	Networking-as-a-Service
O	Operations-as-a-Service
P	Platform-as-a-Service
Q	Quality-as-a-Service
R	Recovery-as-a-Service
S	Software-as-a-Service
T	Tires-as-a-Service
U	Update-as-a-Service
V	Voice-as-a-Service
W	Workspace-as-a-service
X	Anything-as-a-Service (XaaS)
Y	Hybriss-as-a-Service (YaaS - SAP Hybris)
Z	Zenoss-as-a-Service

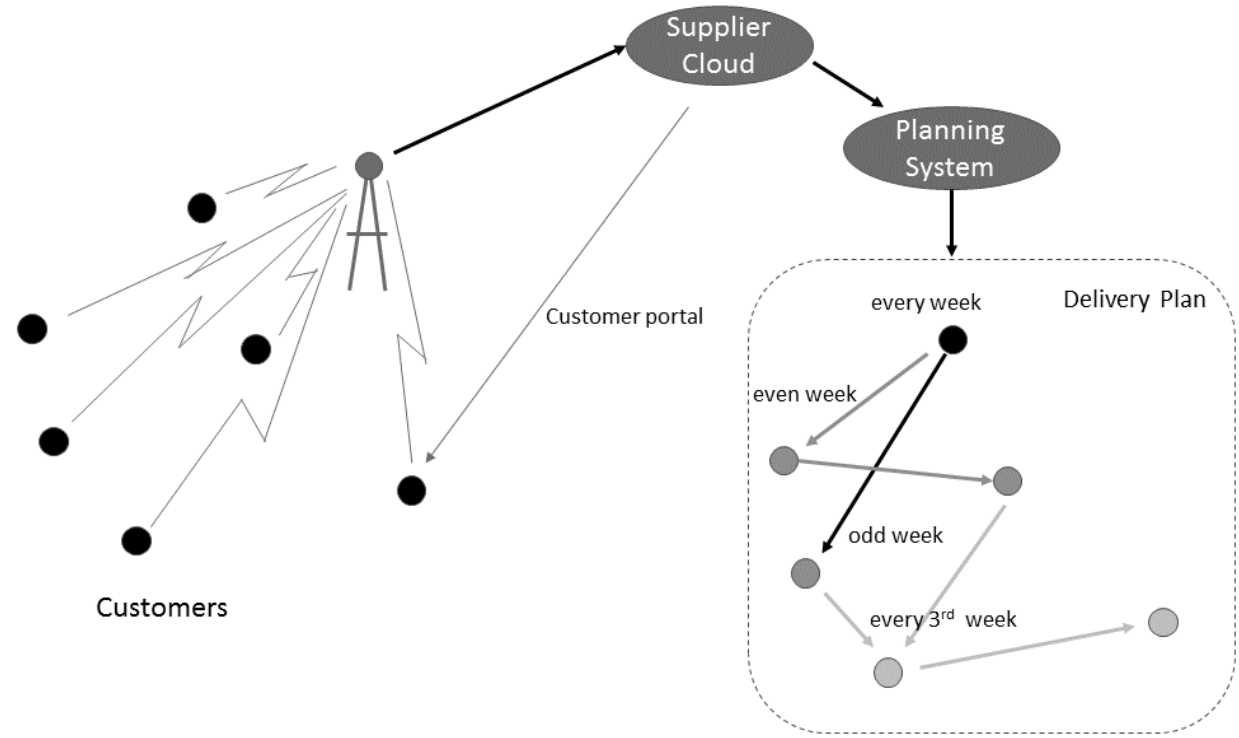
Top 5 Digital Transformation Challenges: Ordered by Company Size	
Less than 1,000 Employees	100 – 1,000 Employees
1. Lack of Expertise to Lead Digitization Initiatives 2. Employee Pushback 3. No Overarching Strategy for Digitization 4. Business Partners Unable to Support 5. Limited Budget	1. Employee Pushback 2. Organizational Structure Gets in the Way 3. No Overarching Strategy for Digitization 4. Limited Budget 5. Lack of Expertise to Lead Digitization Initiatives
1,000 – 5,000 Employees	More than 5,000 Employees
1. No Overarching Strategy for Digitization 2. Lack of Expertise to Lead Digitization Initiatives 3. Limited access to required Technical Expertise 4. Employee Pushback 5. Limited Budget	1. Lack of Expertise to Lead Digitization Initiatives 2. Organizational Structure Gets in the Way 3. No Overarching Strategy for Digitization 4. Limited access to required Technical Expertise 5. Employee Pushback

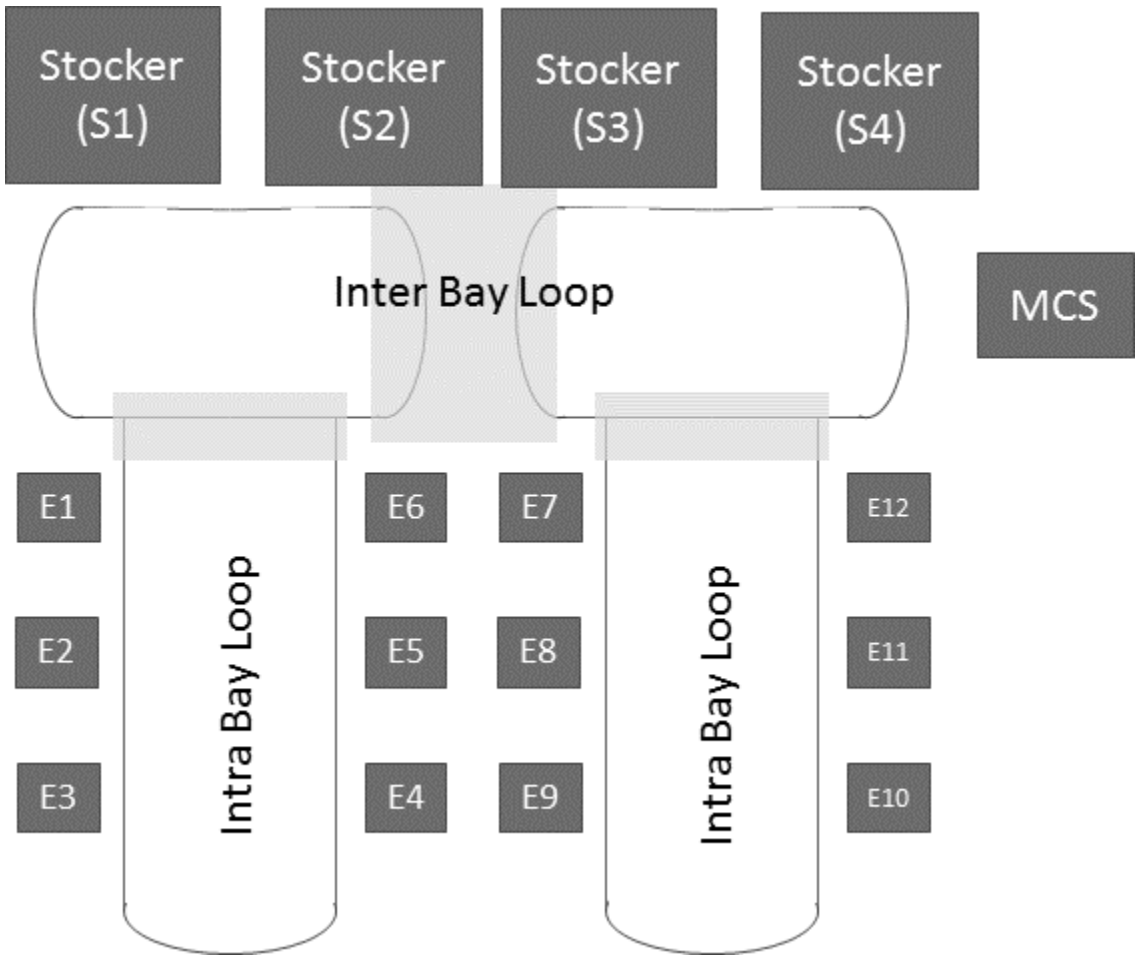


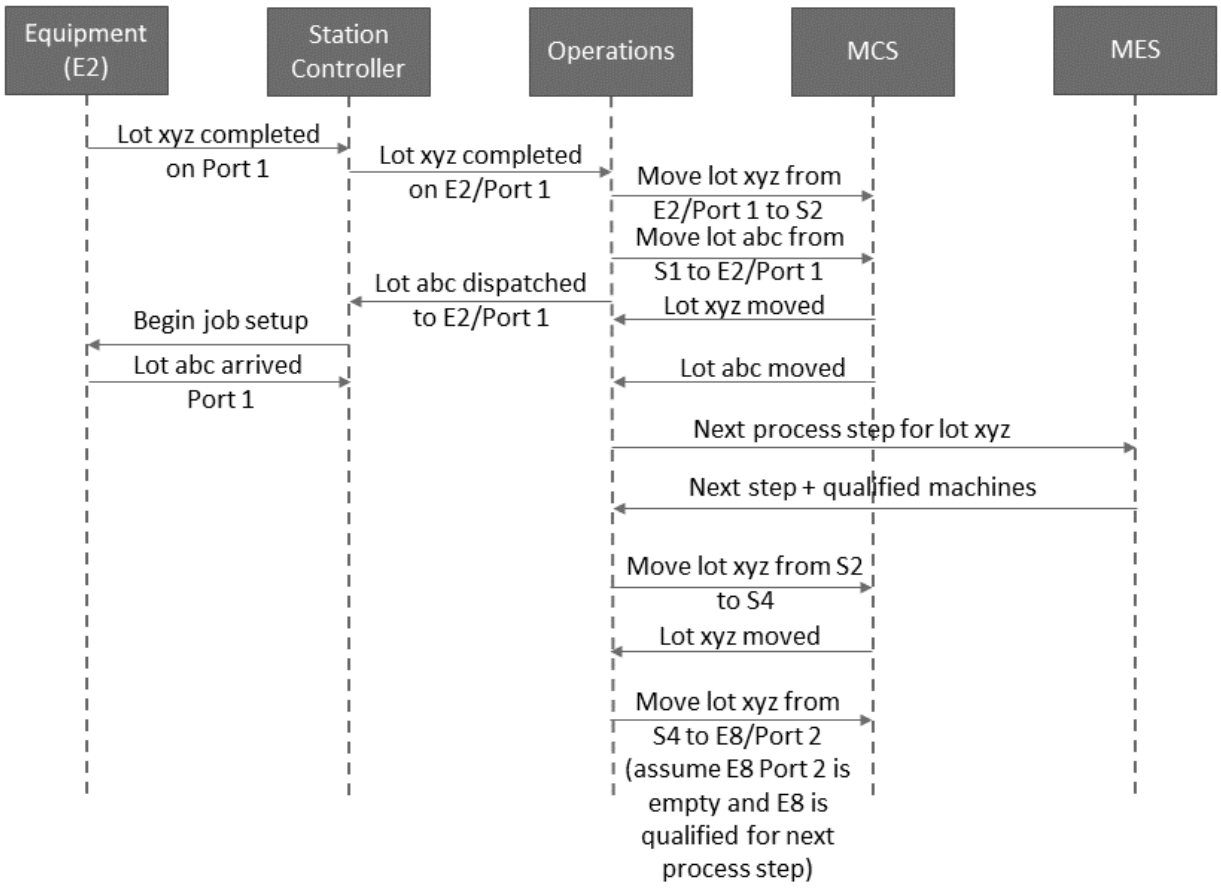
Chapter 5: Transforming One Industry at a Time

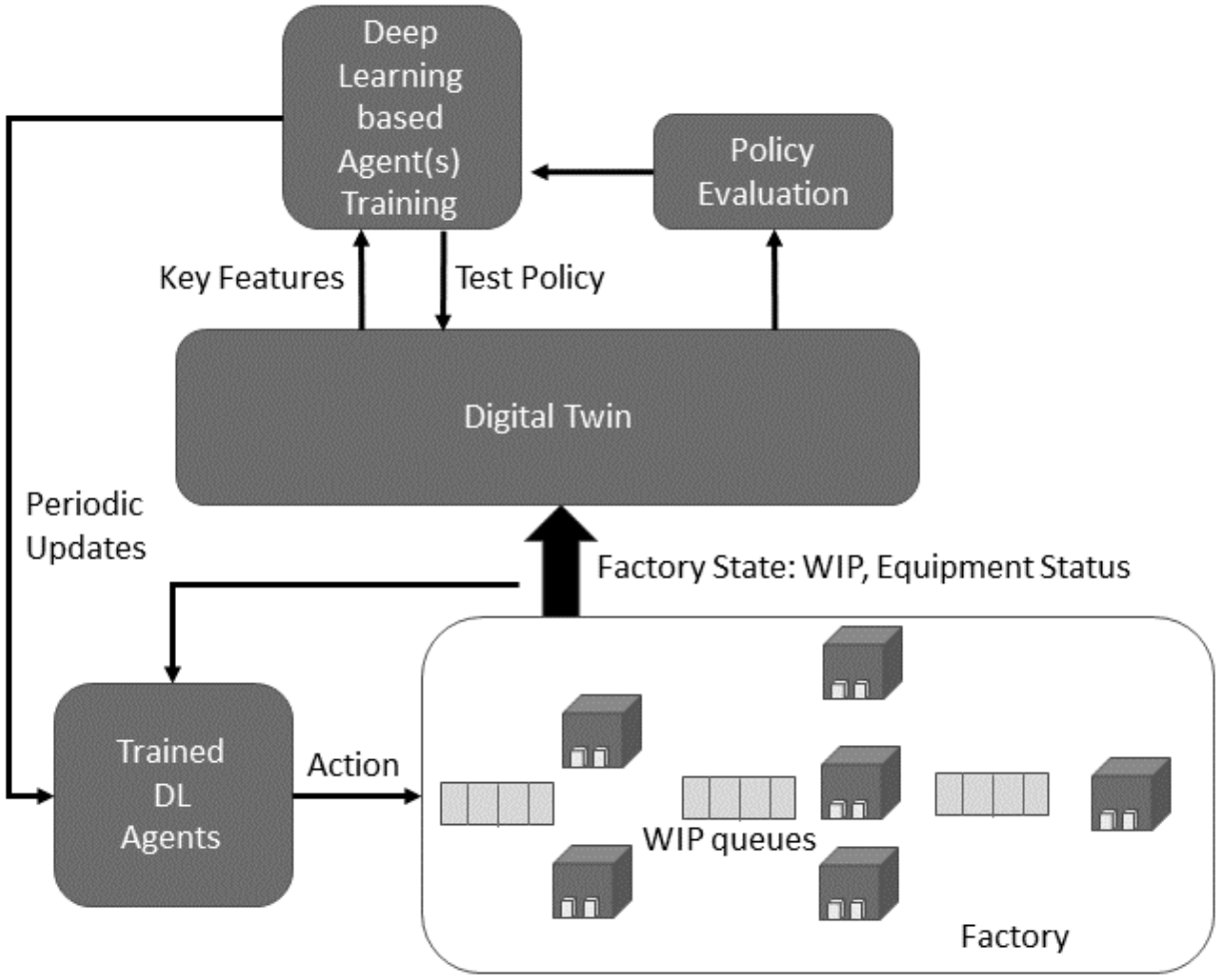


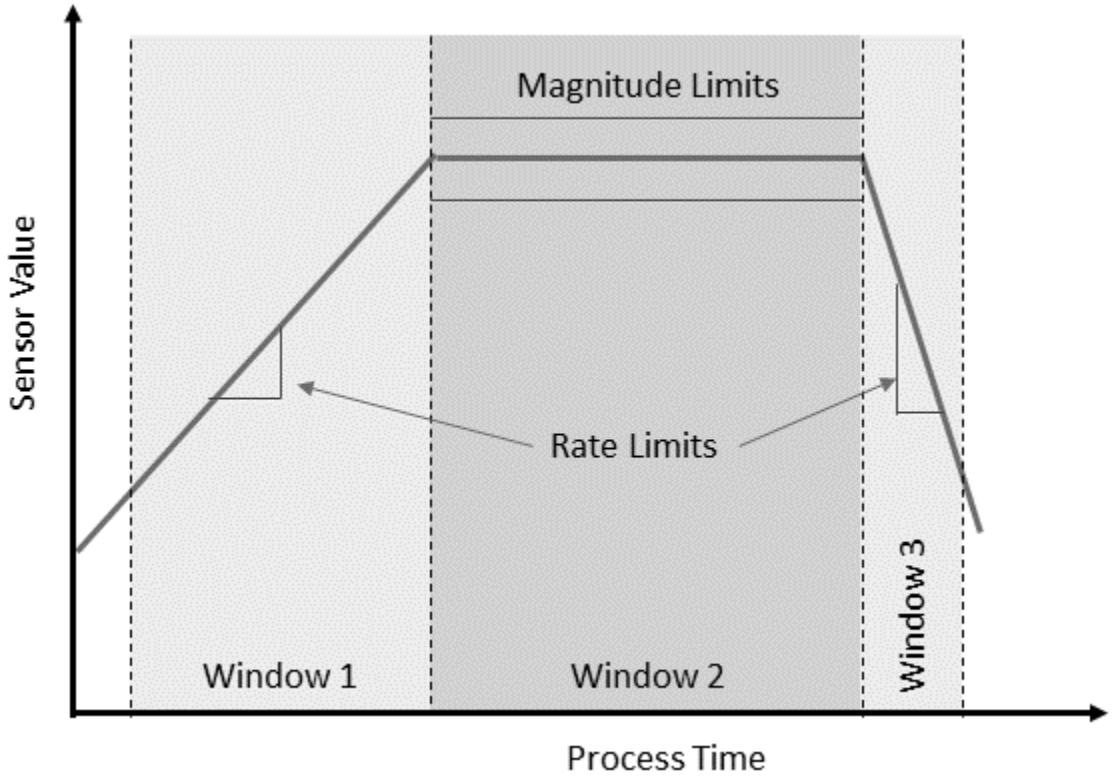


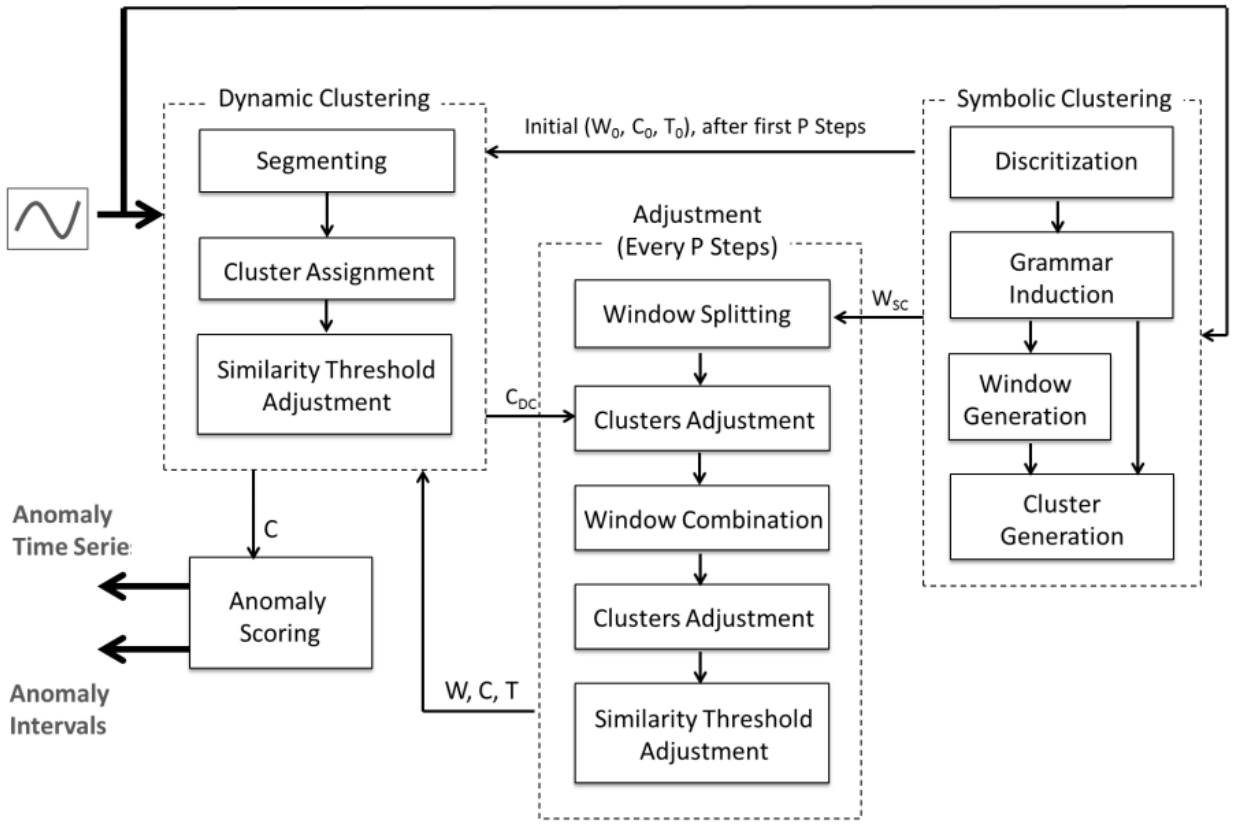

Supplier Cloud
Planning System
Customer portal
Customers
every week
Delivery Plan
even week
odd week
every 3rd week

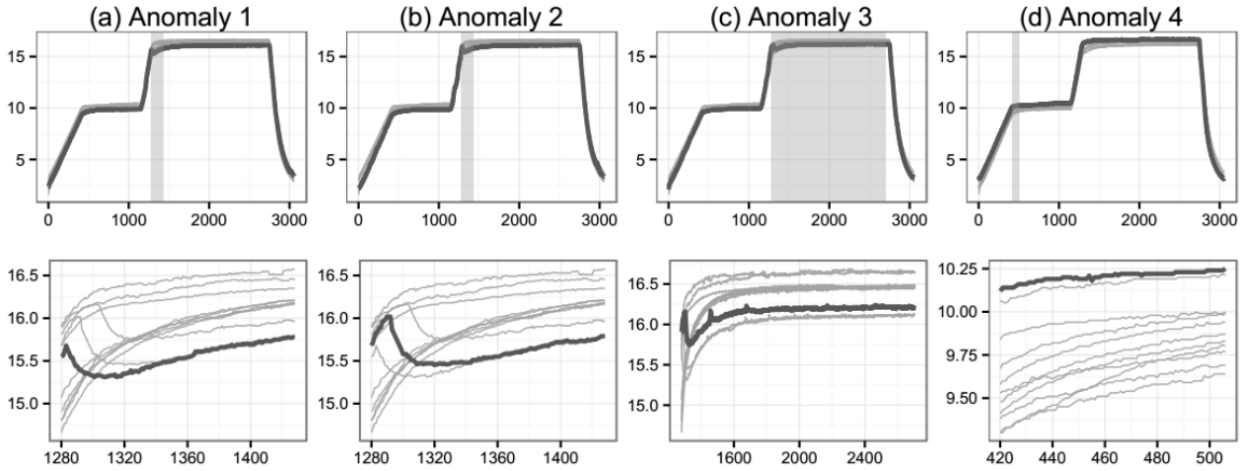

Stocker (S1)
Stocker (S2)
Stocker (S3)
Stocker (S4)
Inter Bay Loop
MCS
E1
E2
E3
Intra Bay Loop
E6
E5
E4
E7
E8
E9
Intra Bay Loop
E12
E11
E10

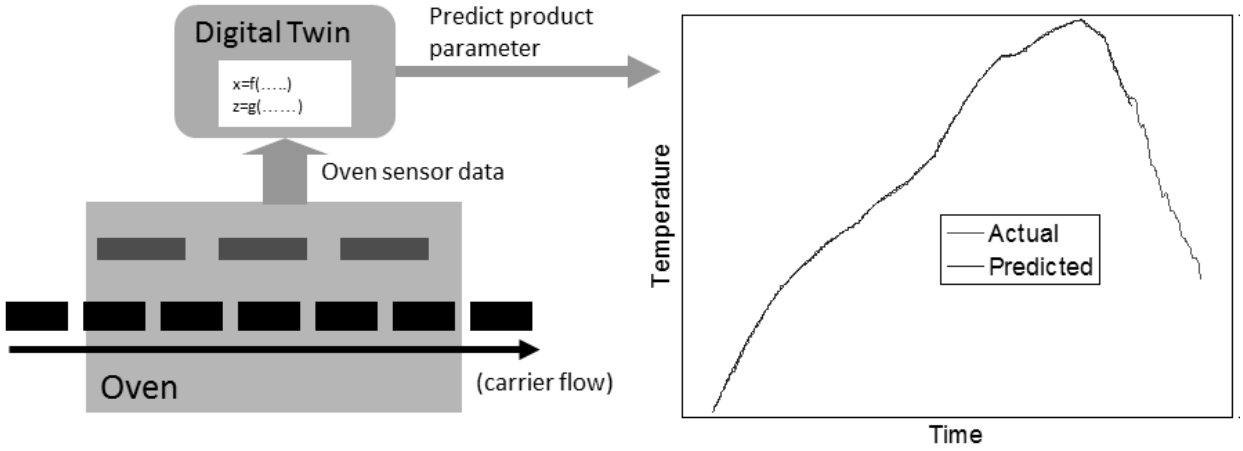

Equipment (E2)
Station Controller
Operations
MCS
MES
Lot xyz completed on Port 1
Lot xyz completed on E2/Port 1
Move lot xyz from E2/Port 1 to S2
Move lot abc from S1 to E2/Port 1
Lot abc dispatched to E2/Port 1
Lot xyz moved
Begin job setup
Lot abc arrived Port 1
Lot abc moved
Next process step for lot xyz
Next step + qualified machines
Move lot xyz from S2 to S4
Lot xyz moved
Move lot xyz from S4 to E8/Port 2 (assume E8 Port 2 is empty and E8 is qualified for next process step)

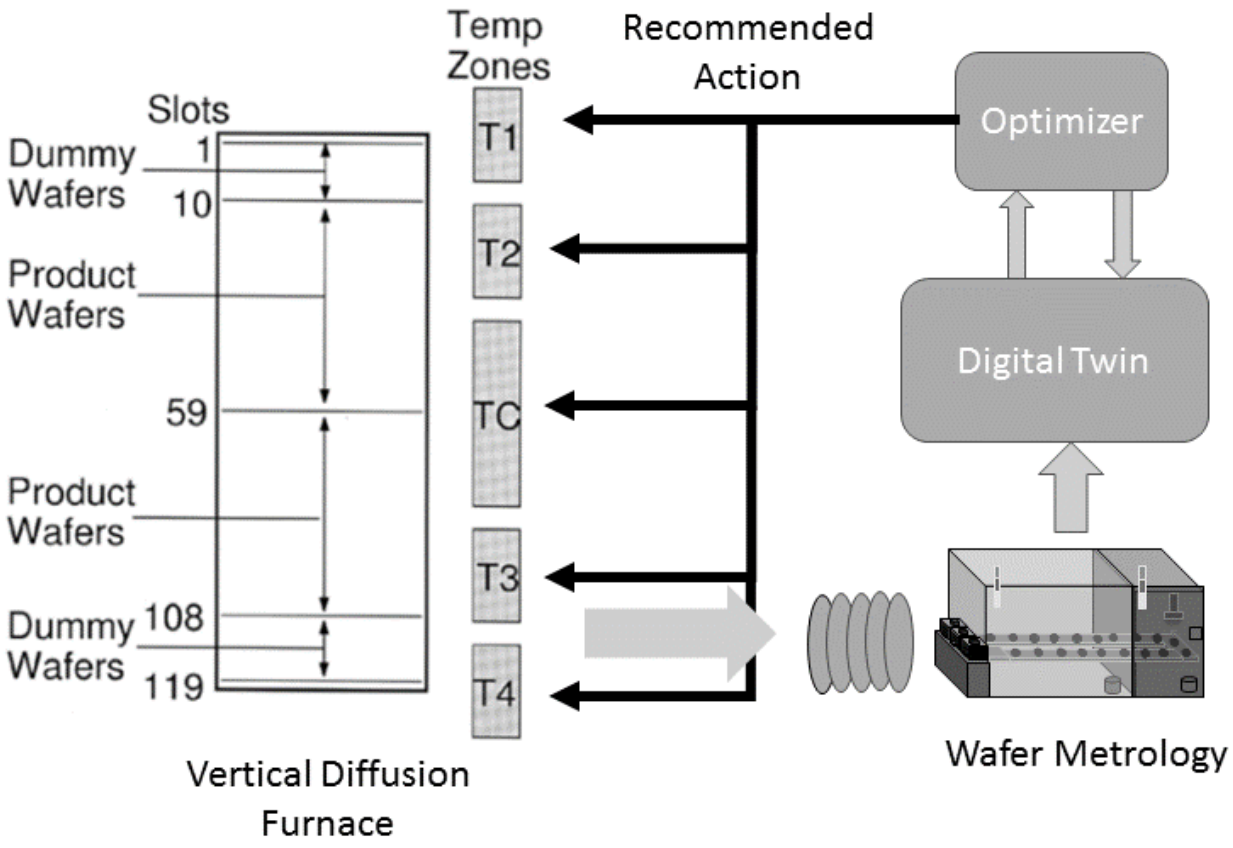

Deep Learning based Agent(s) Training
Policy Evaluation
Key Features
Test Policy
Digital Twin
Periodic Updates
Factory State: WIP, Equipment Status
Trained DL Agents
Action
WIP queues
Factory

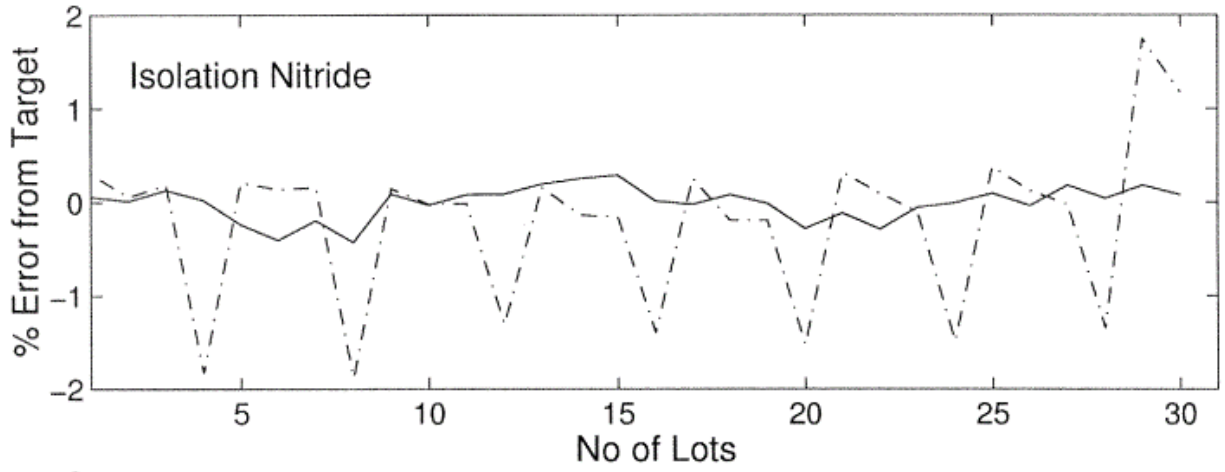

Magnitude Limits
Sensor Value
Rate Limits
Window 1
Window 2
Window 3
Process Time

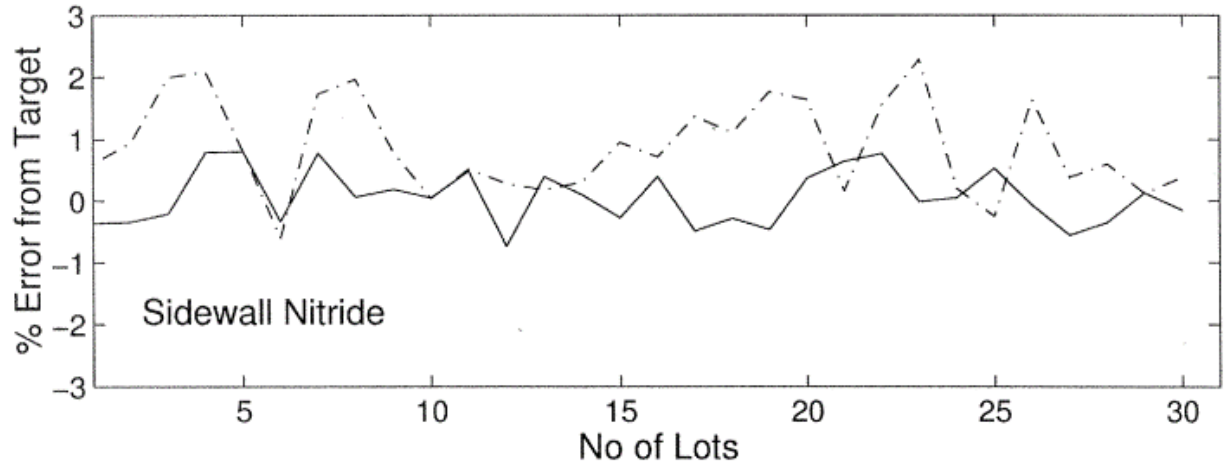

Dynamic Clustering
Segmenting
Cluster Assignment
Similarity Threshold Adjustment
Initial (W_0, C_0, T_0), after first P Steps
Symbolic Clustering
Discritization
Grammar Induction
Window Generation
Cluster Generation
Adjustment (Every P Steps)
Window Splitting
Clusters Adjustment
Window Combination
Clusters Adjustment
Similarity Threshold Adjustment
W_{SC}
C_{DC}
C
Anomaly Scoring
Anomaly Time Series
Anomaly Intervals
W, C, T

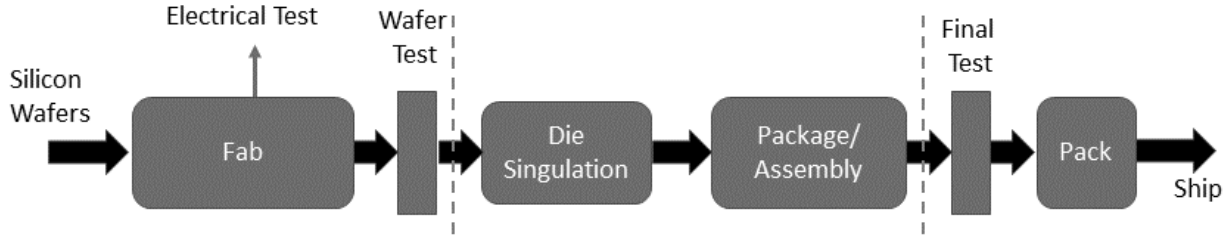

(a) Anomaly 1
(b) Anomaly 2
(c) Anomaly 3
(d) Anomaly 4

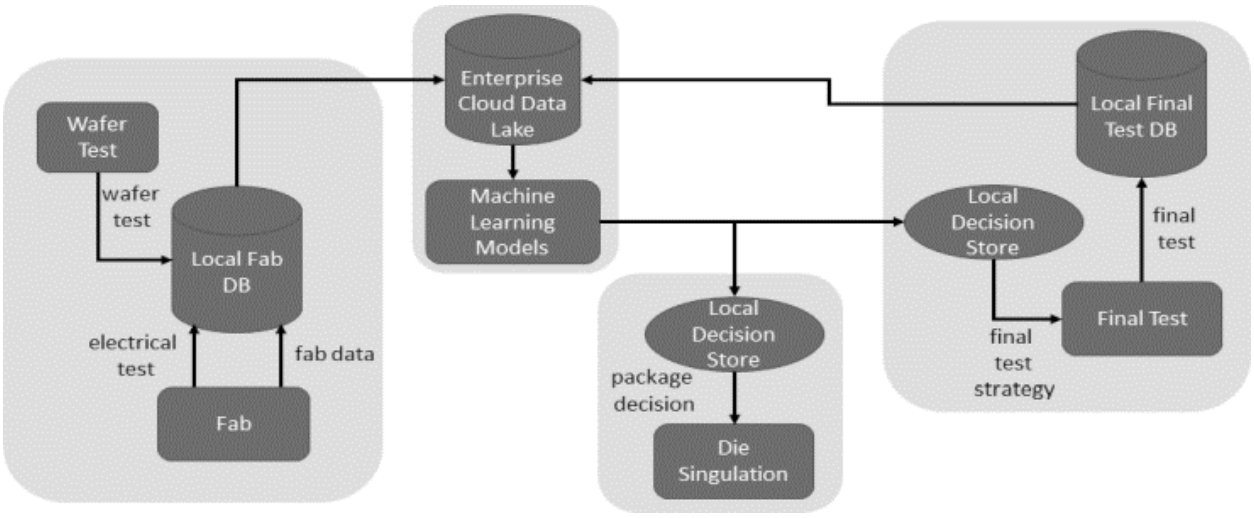

Digital Twin
x=f(…..)
z=g(……)
Predict product parameter
Oven sensor data
Oven
(carrier flow)
Temperature
Time
Actual
Predicted

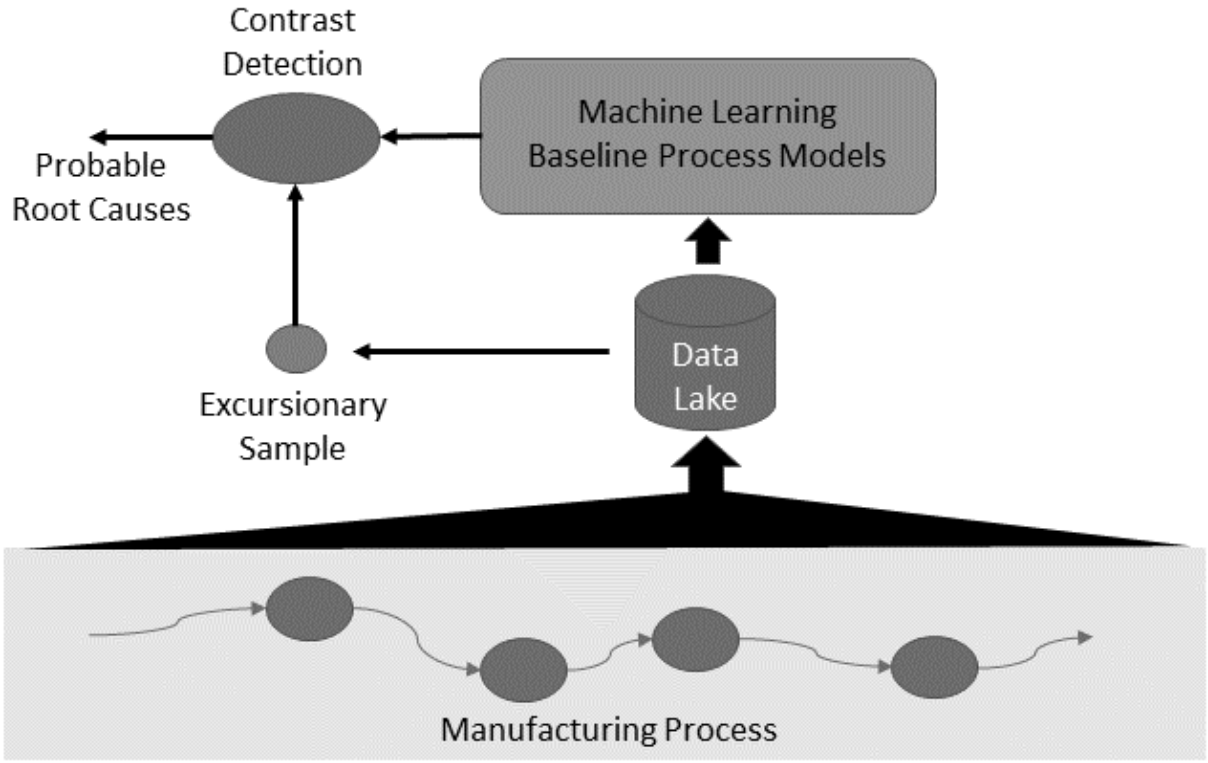

Temp Zones
Recommended Action
Slots
Dummy Wafers
1
10
Product Wafers
59
Product Wafers
Dummy Wafers
108
119
T1
T2
TC
T3
T4
Optimizer
Digital Twin
Vertical Diffusion Furnace
Wafer Metrology

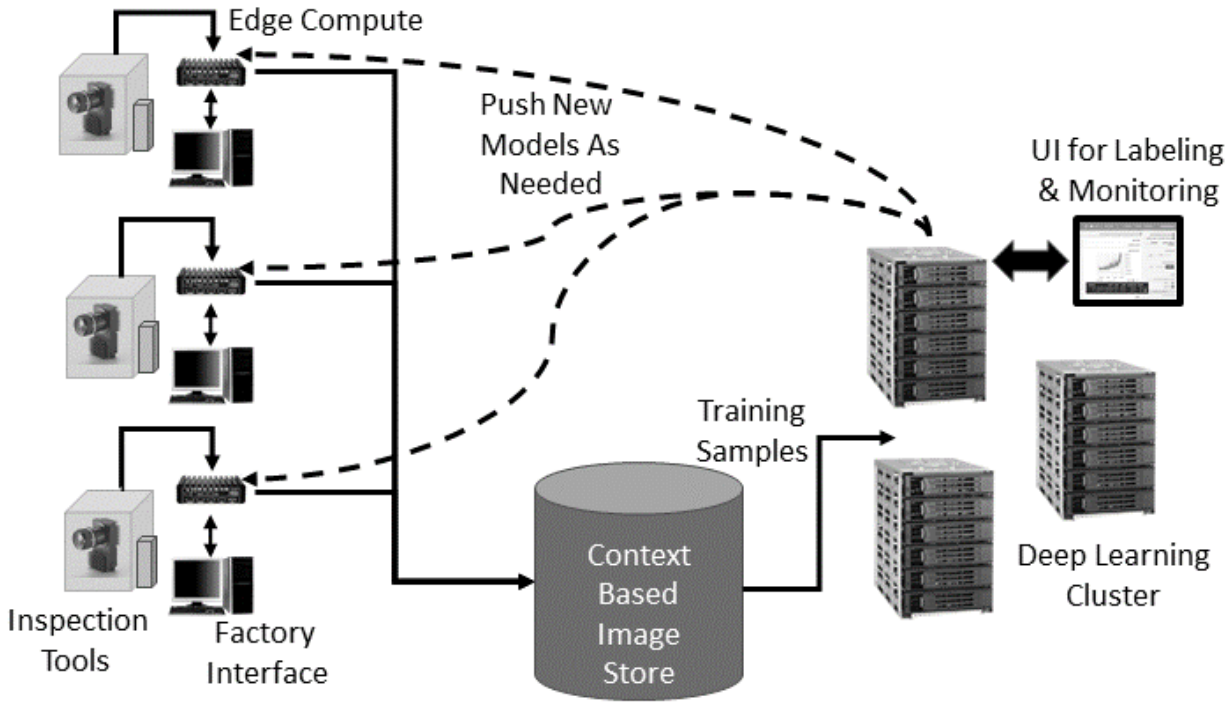

Isolation Nitride
% Error from Target
No of Lots
2
1
0
−1
−2
5
10
15
20
25
30

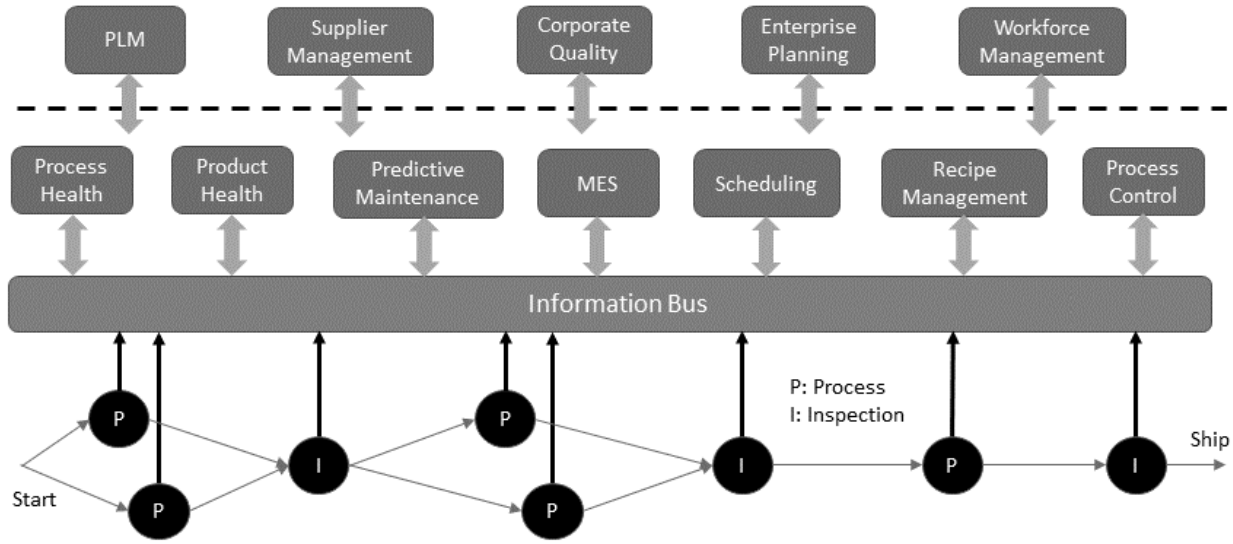

Sidewall Nitride
% Error from Target
No of Lots
3
2
1
0
−1
−2
−3
5
10
15
20
25
30

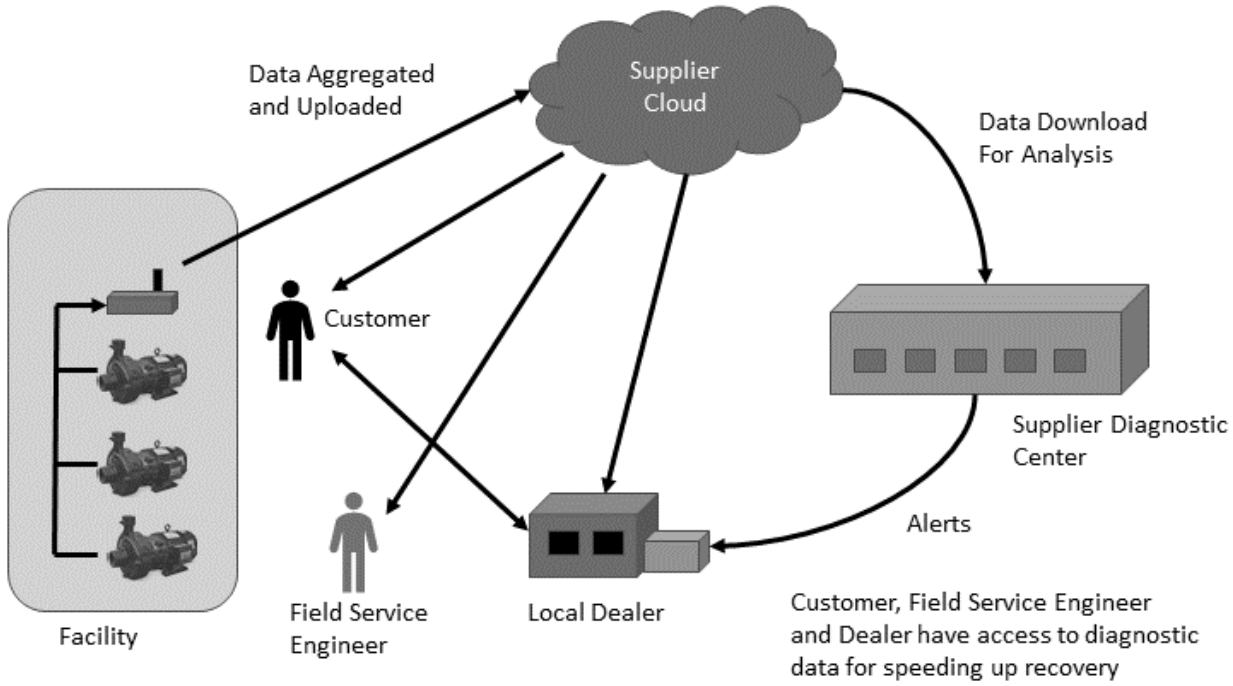

Electrical Test
Wafer Test
Final Test
Silicon Wafers
Fab
Die Singulation
Package/ Assembly
Pack
Ship

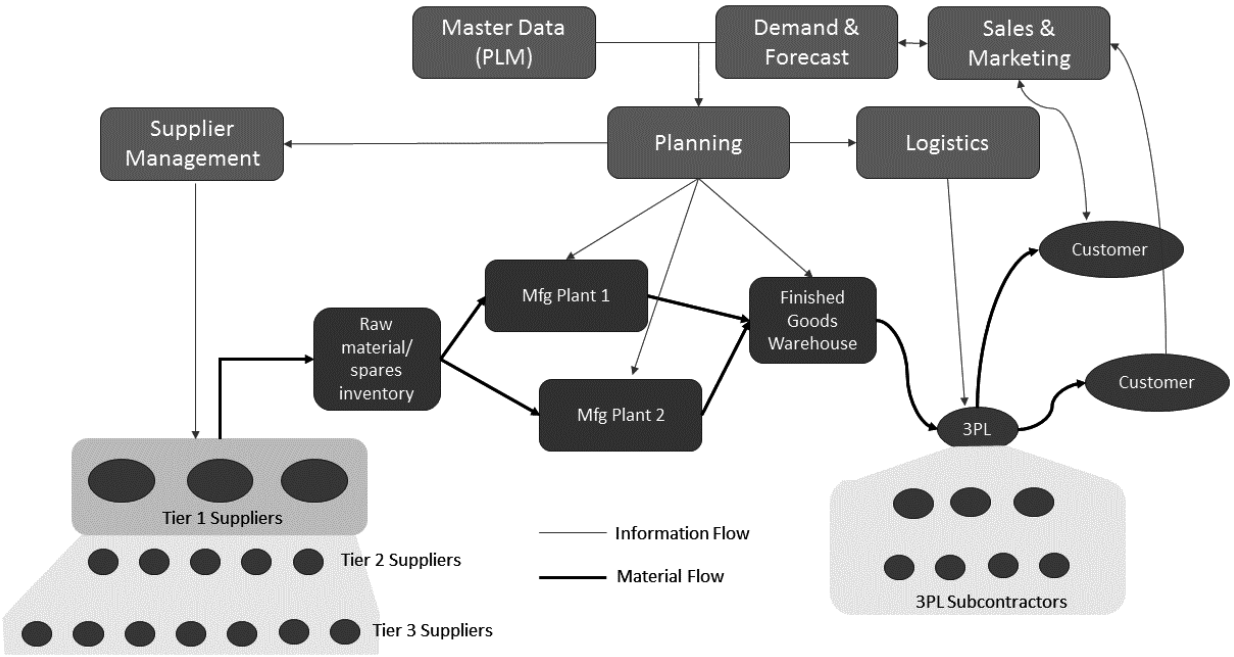

Wafer Test
wafer test
Local Fab DB
electrical test
fab data
Fab
Enterprise Cloud Data Lake
Machine Learning Models
Local Decision Store
package decision
Die Singulation
Local Final Test DB
Local Decision Store
final test
Final Test
final test strategy

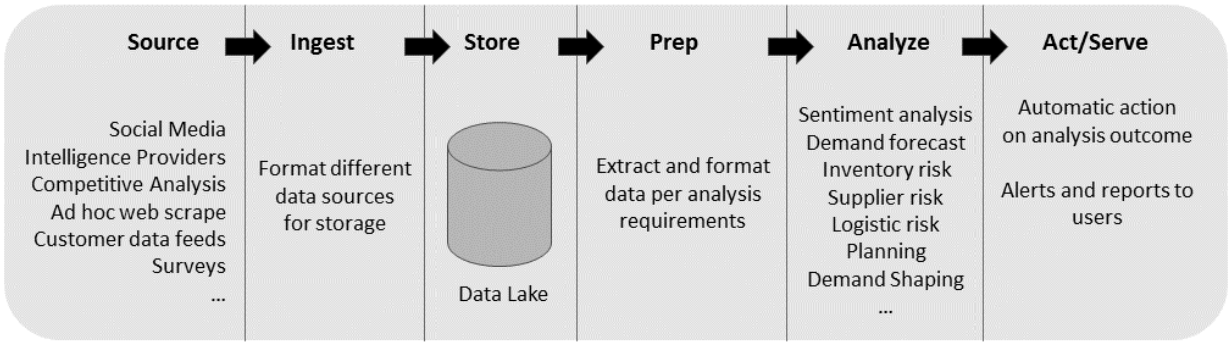

Contrast Detection
Probable Root Causes
Machine Learning Baseline Process Models
Excursionary Sample
Data Lake
Manufacturing Process

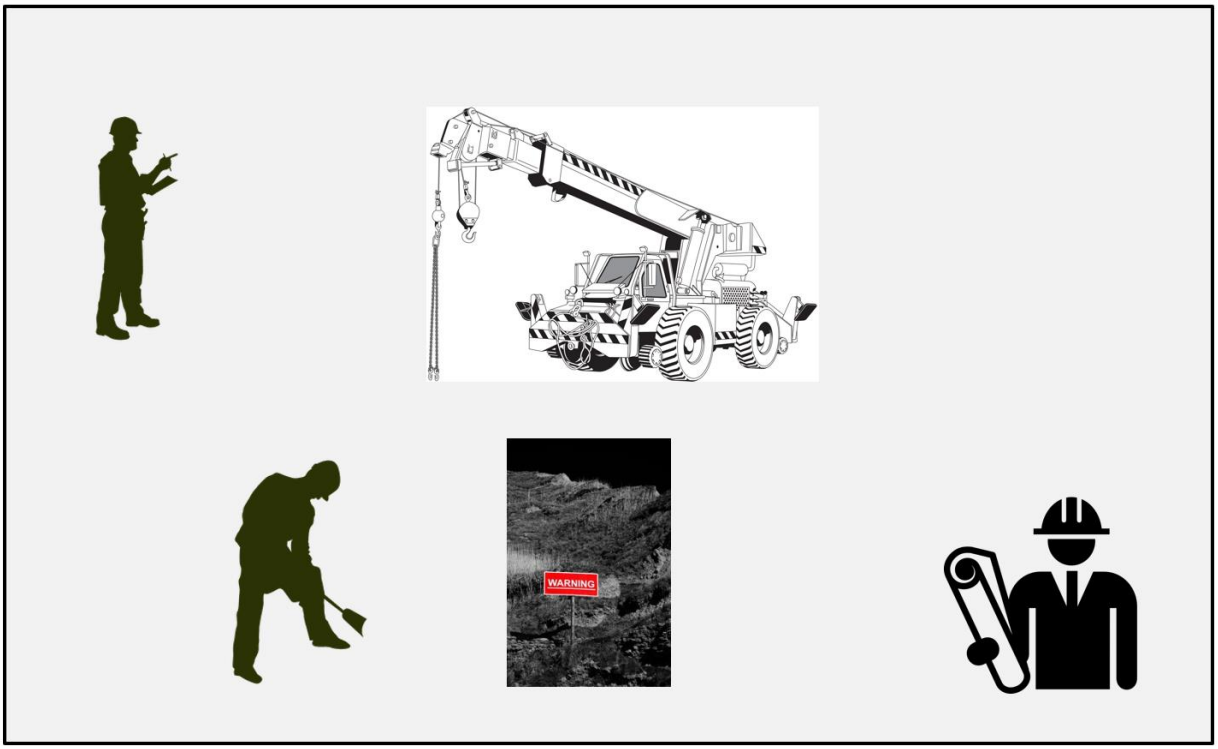

Edge Compute
Push New Models As Needed
UI for Labeling & Monitoring
Training Samples
Context Based Image Store
Deep Learning Cluster
Inspection Tools
Factory Interface

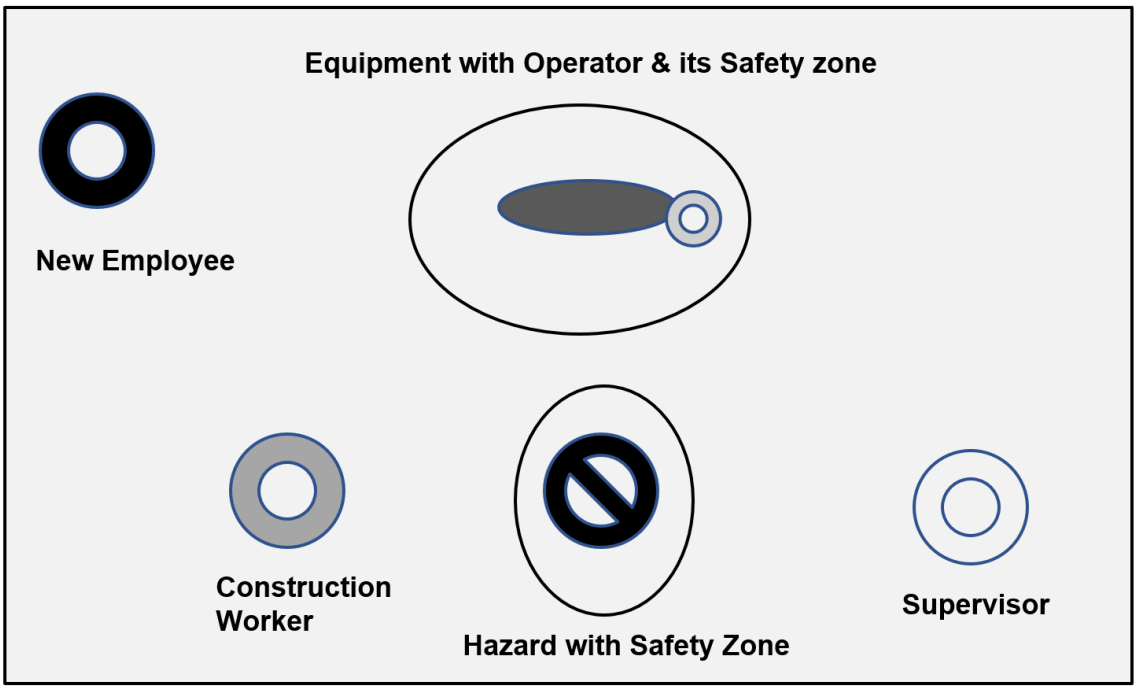

PLM
Supplier Management
Corporate Quality
Enterprise Planning
Workforce Management
Process Health
Product Health
Predictive Maintenance
MES
Scheduling
Recipe Management
Process Control
Information Bus
P: Process
I: Inspection
Start
Ship


Data Aggregated
and Uploaded
Supplier
Cloud
Data Download
For Analysis
Customer
Supplier Diagnostic
Center
Alerts
Facility
Field Service
Engineer
Local Dealer
Customer, Field Service Engineer
and Dealer have access to diagnostic
data for speeding up recovery

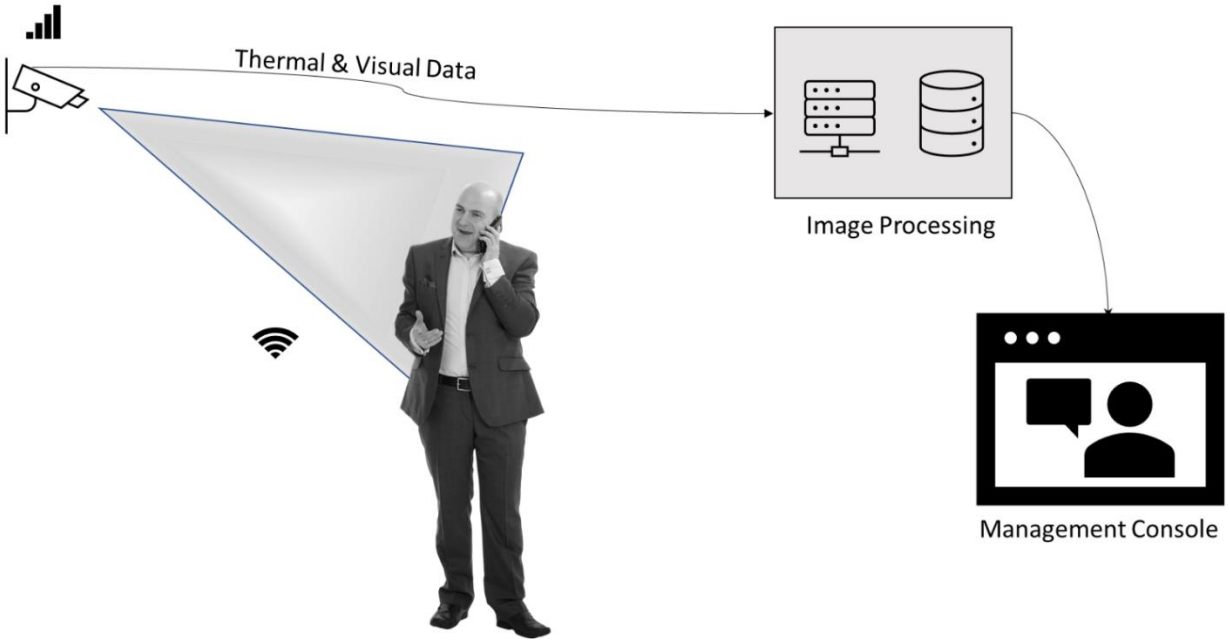

Master Data
(PLM)
Demand &
Forecast
Sales &
Marketing
Supplier
Management
Planning
Logistics
Customer
Mfg Plant 1
Raw
material/
spares
inventory
Finished
Goods
Warehouse
Customer
Mfg Plant 2
3PL
Tier 1 Suppliers
Information Flow
Material Flow
Tier 2 Suppliers
3PL Subcontractors
Tier 3 Suppliers

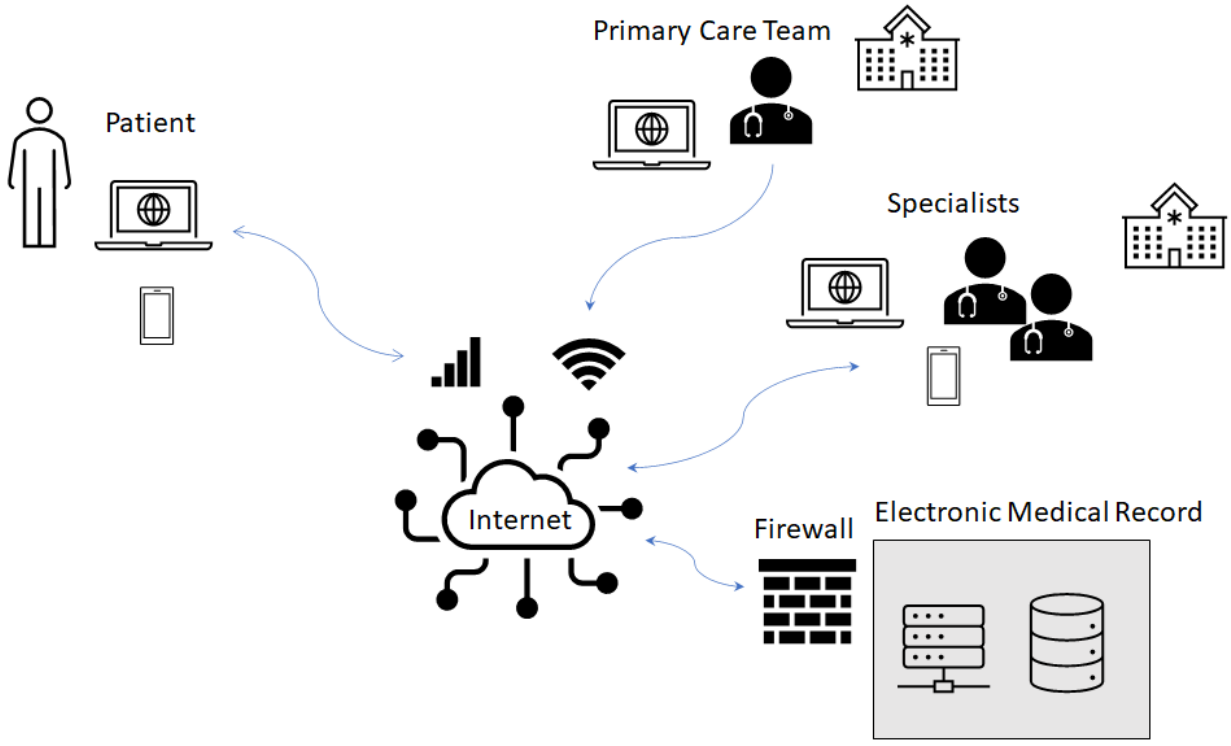

Source
Ingest
Store
Prep
Analyze
Act/Serve
Social Media
Intelligence Providers
Competitive Analysis
Ad hoc web scrape
Customer data feeds
Surveys
...
Format different data sources for storage
Data Lake
Extract and format data per analysis requirements
Sentiment analysis
Demand forecast
Inventory risk
Supplier risk
Logistic risk
Planning
Demand Shaping
...
Automatic action on analysis outcome
Alerts and reports to users

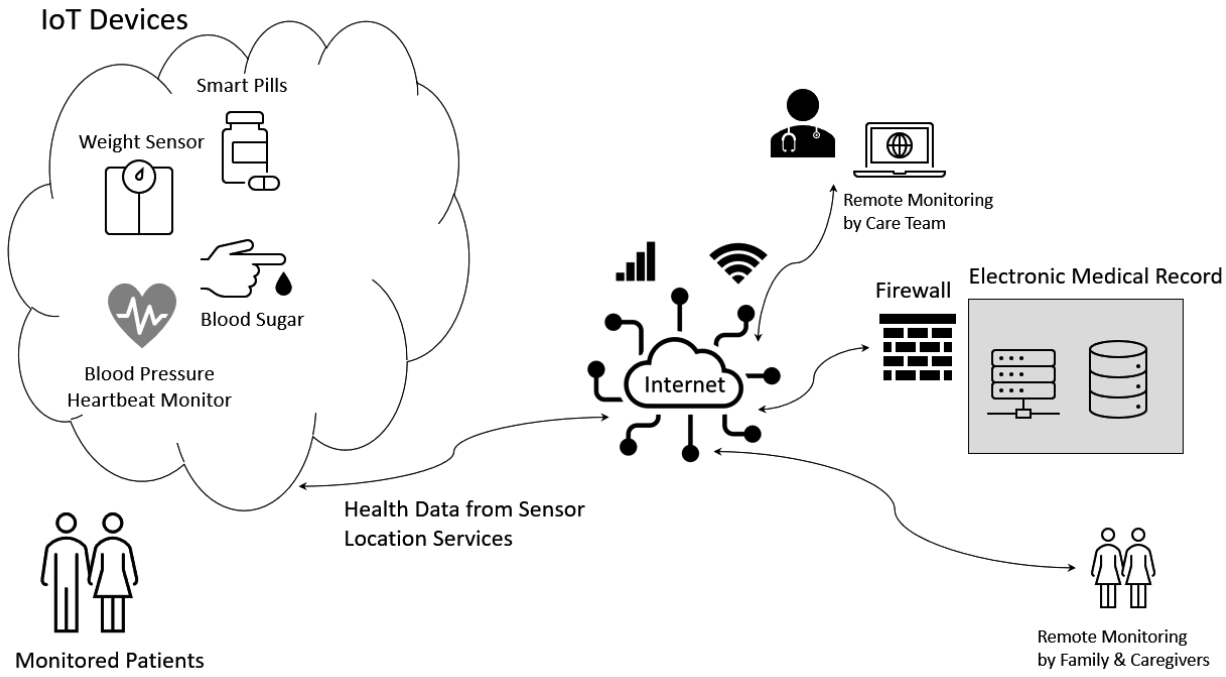

WARNING

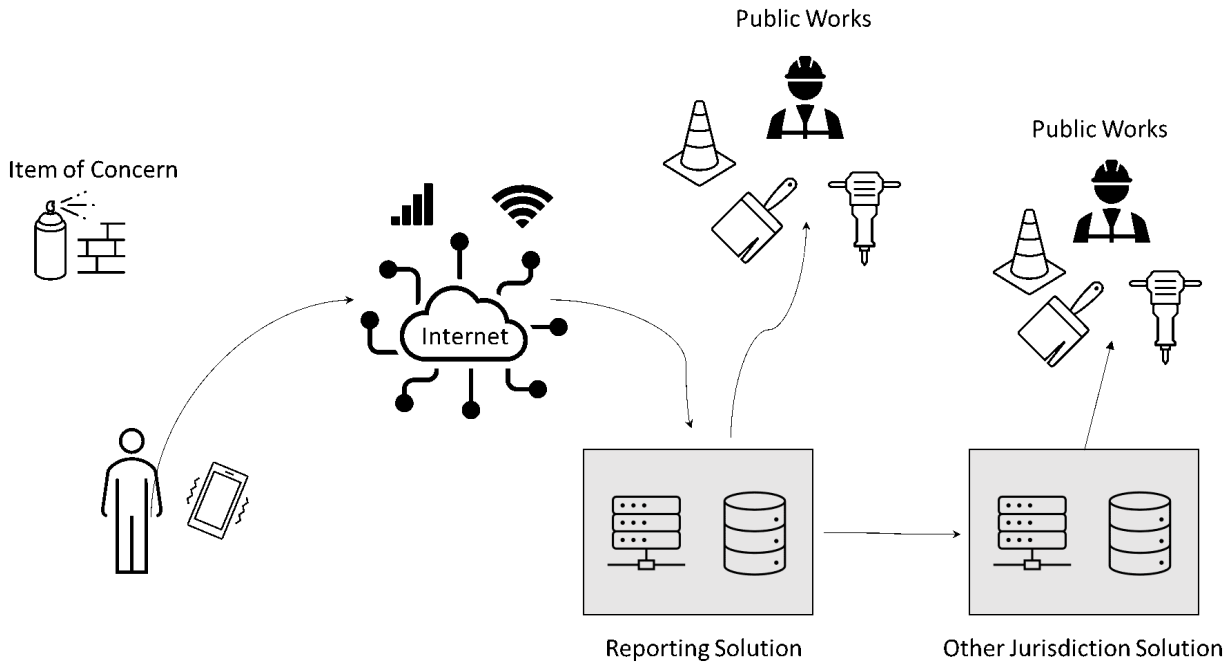

Equipment with Operator & its Safety zone
New Employee
Construction Worker
Hazard with Safety Zone
Supervisor

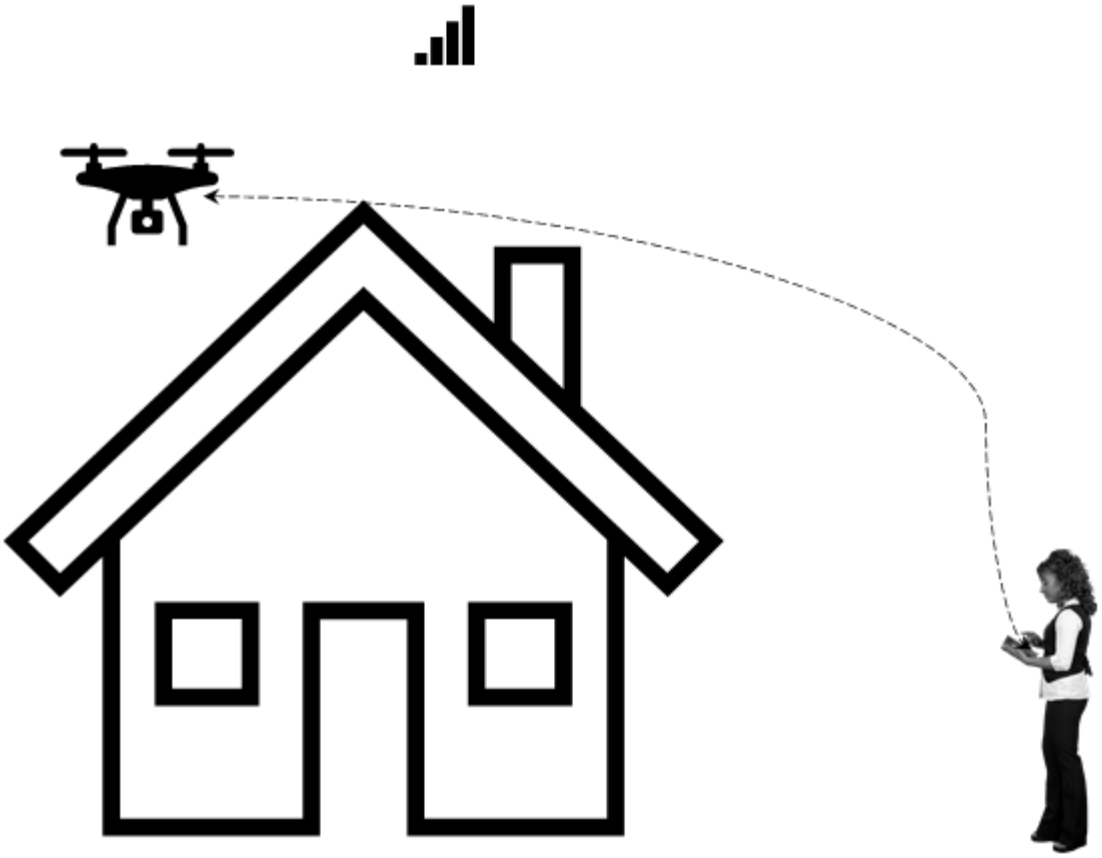
Chapter 6: Transforming the Public Sector



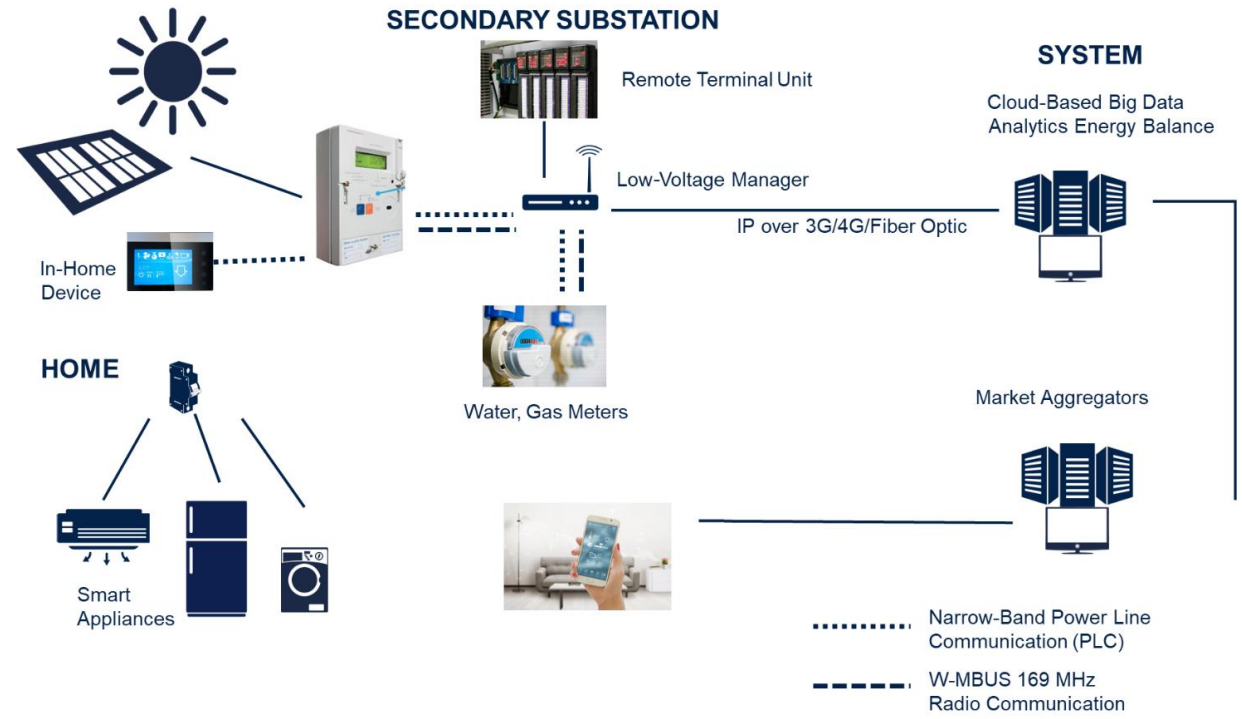


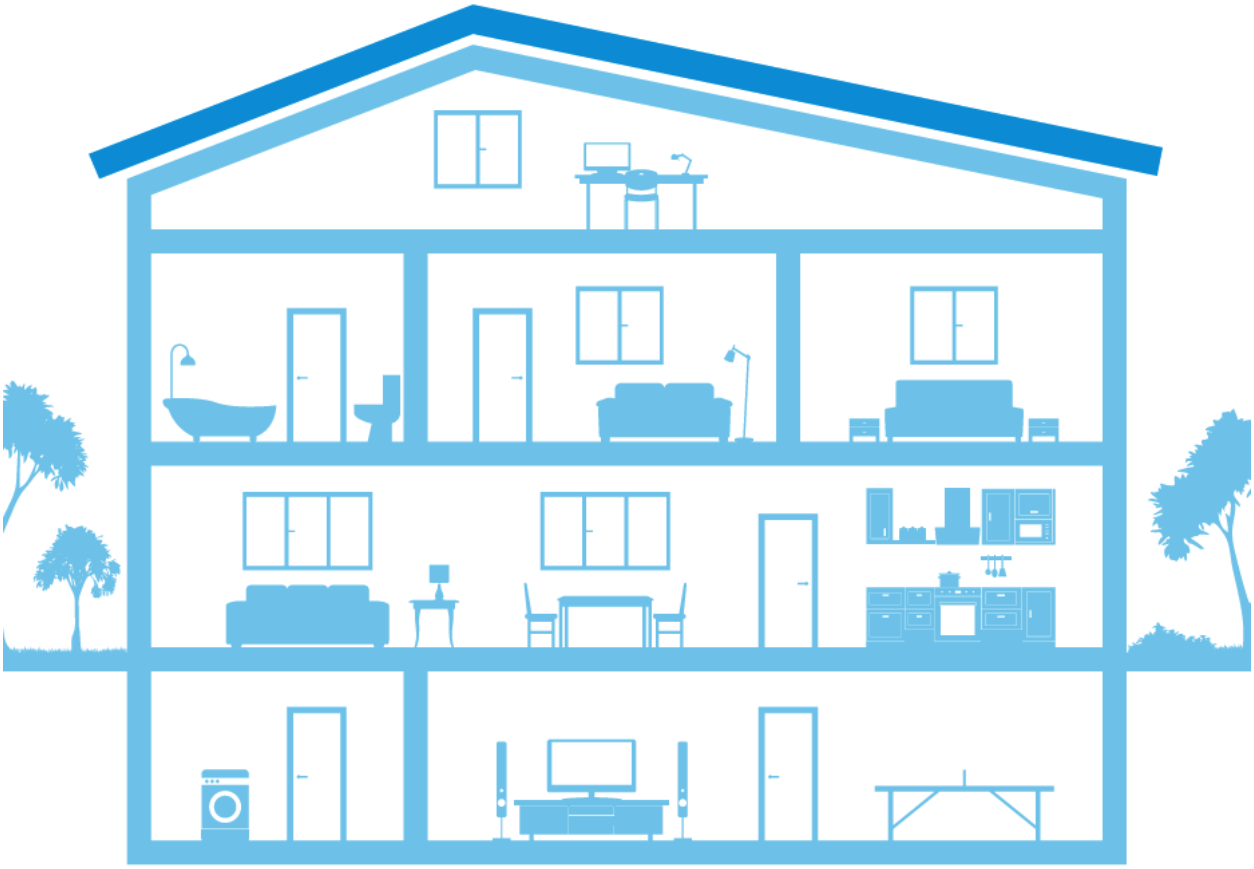

IoT Devices
Smart Pills
Weight Sensor
Blood Sugar
Blood Pressure
Heartbeat Monitor
Monitored Patients
Internet
Remote Monitoring
by Care Team
Firewall
Electronic Medical Record
Health Data from Sensor
Location Services
Remote Monitoring
by Family & Caregivers


Public Works
Item of Concern
Internet
Public Works
Reporting Solution
Other Jurisdiction Solution



Stage	Description	Examples
Substitution	Replaces activities performed by hand with activities performed using a device. The method of teaching is not functionally changed.	Using word processors to type assignments or writing on an overhead projector slide instead of a blackboard.
Augmentation	The addition of technology enhances the learning experience.	Using advanced features of a word processor, such as cut and paste, spell check, or graphics, or enhancing presentations with graphics and other advanced features.
Modification	Teaching tasks are partially or entirely redesigned.	Flipped classrooms where students watch recorded lectures at home and work on assignments in the classroom.
Redefinition	Technology creates brand new methods of instruction that were not possible without technology.	Classrooms connected via video conference to other classrooms around the world to complete lessons that require engagement or collaboration between classrooms.


SECONDARY SUBSTATION
Remote Terminal Unit
SYSTEM
Cloud-Based Big Data
Analytics Energy Balance
Low-Voltage Manager
IP over 3G/4G/Fiber Optic
In-Home
Device
HOME
Water, Gas Meters
Market Aggregators
Smart
Appliances
Narrow-Band Power Line
Communication (PLC)
W-MBUS 169 MHz
Radio Communication



How to choose the channel

Red Channel

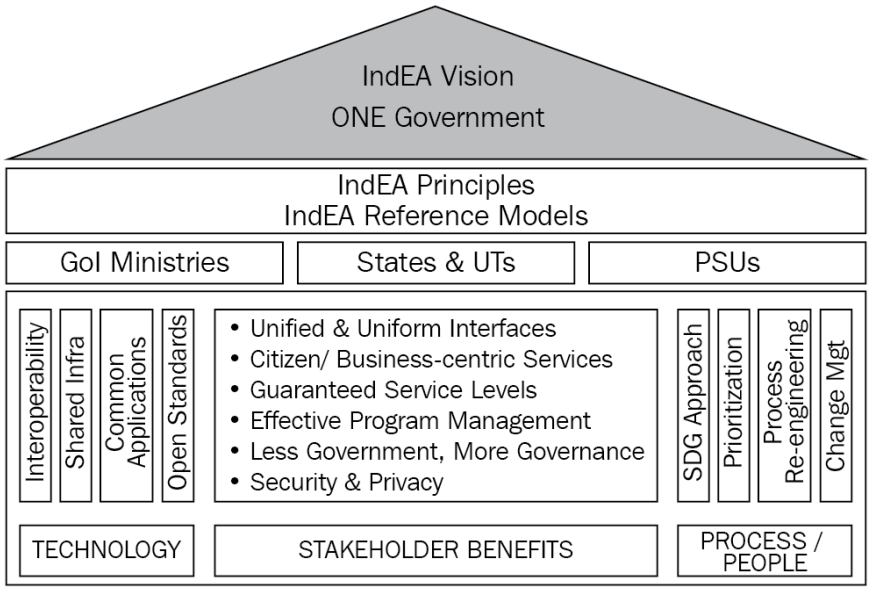
Good to declare

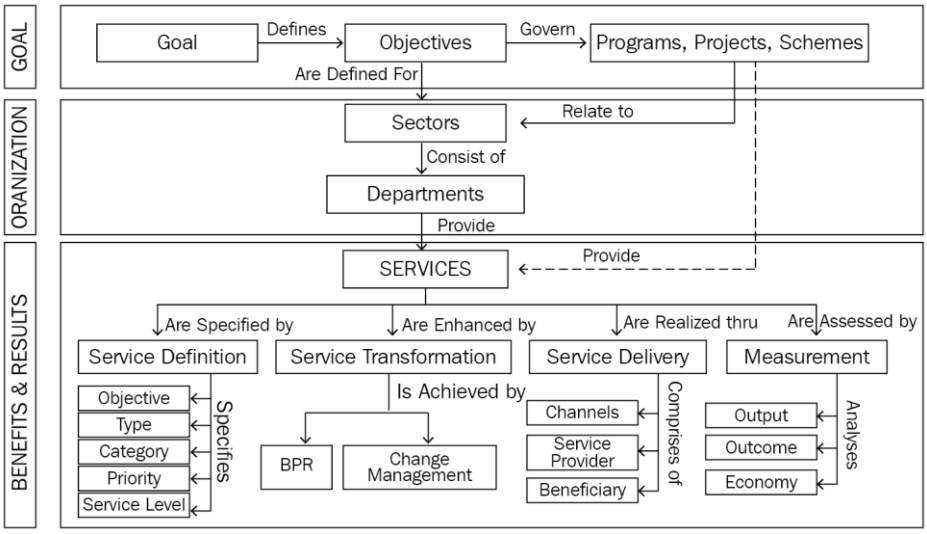
- Lost goods
- Cash and traveller's cheques when totalling more than BRL 10.000 or the equivalent in another foreign currency
- Items under control of the Sanitary, Agricultural and Army or subject to restrictions and provibitions of other agency
- Taxable goods that exceed the exemption limit

Green Channel

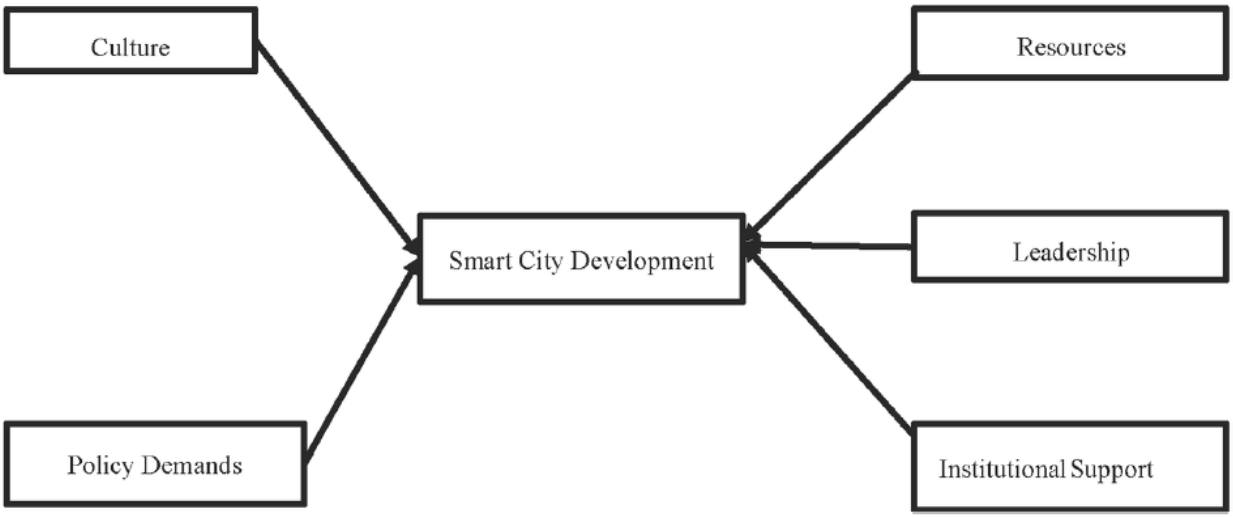
Nothing to declare

- Exemption goods
- Cash and traveller's cheques, up to BRL 10.000 or equivalent in another foreign currency
- Good of personal use or consumption
- Other goods up to the limit of exemption quota

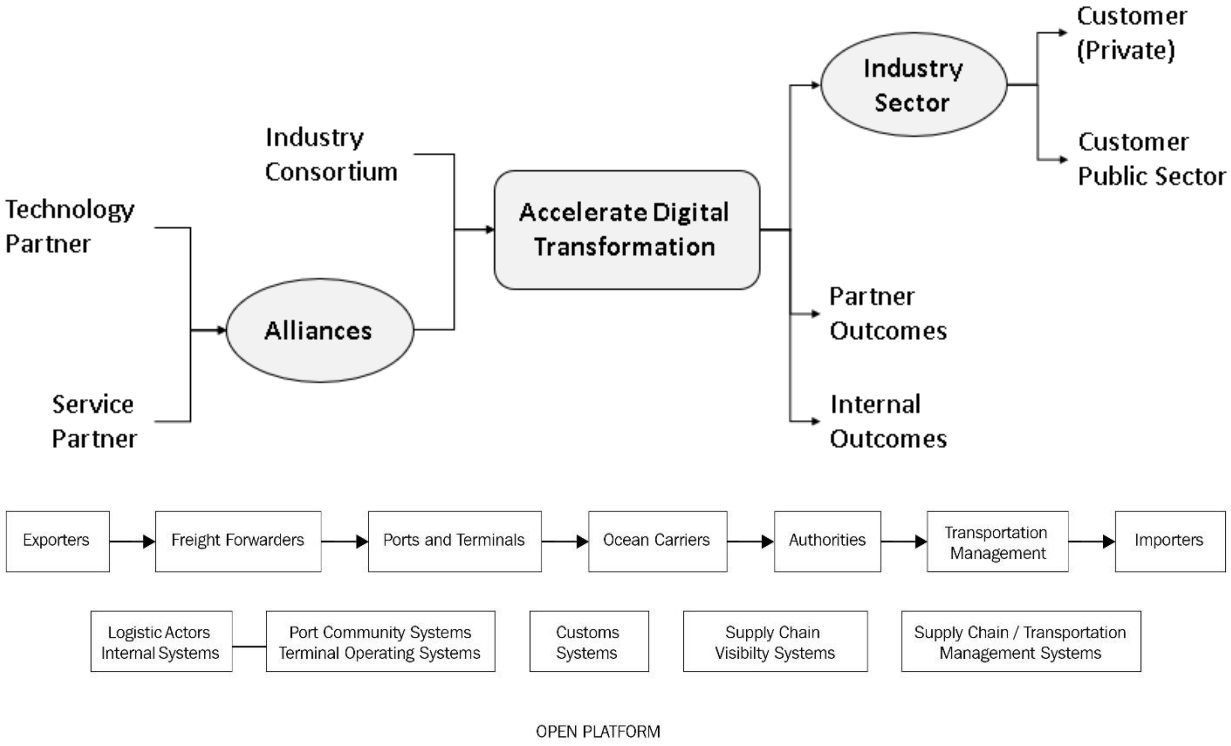




	Definition	Role	Use Case
IoT	Communication network between devices	Collecting data	Monitoring (surveillance) and control
Cloud Computing	Expandable/shrinkable “lake” to provide unified computing resources	Processing data, providing application services	Data centers, software and information service platforms
Mobile Internet	Wireless communication network	Transporting data, providing mobile application services	Mobile applications (mobile office work, mobile law enforcement)
Big Data	Ultra-large amounts of data with different structures, able to be used to illuminate data with valuable information	Data mining, data visualization	Industry and government intelligentization

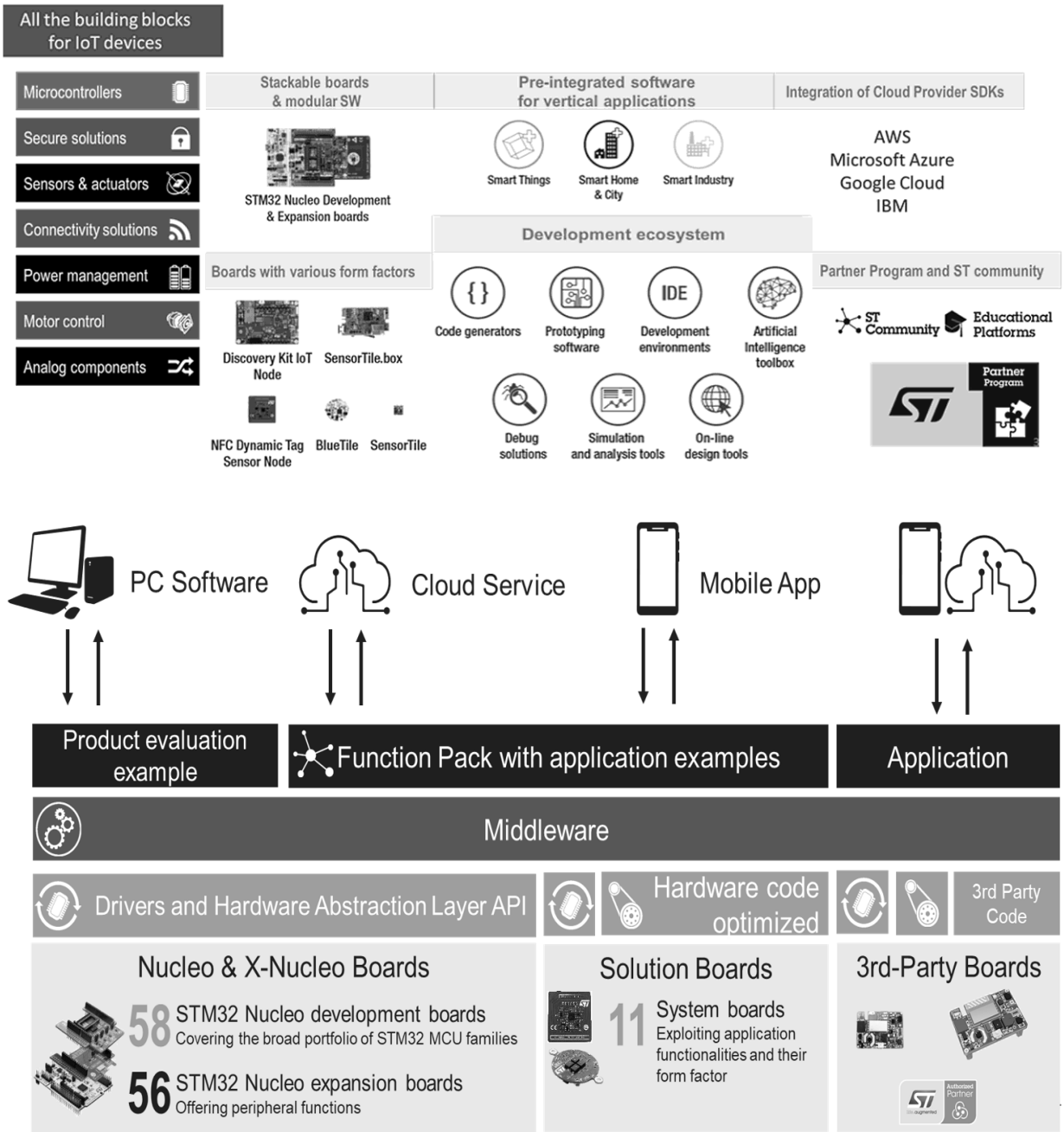

Culture
Policy Demands
Smart City Development
Resources
Leadership
Institutional Support

Chapter 7: The Transformation Ecosystem

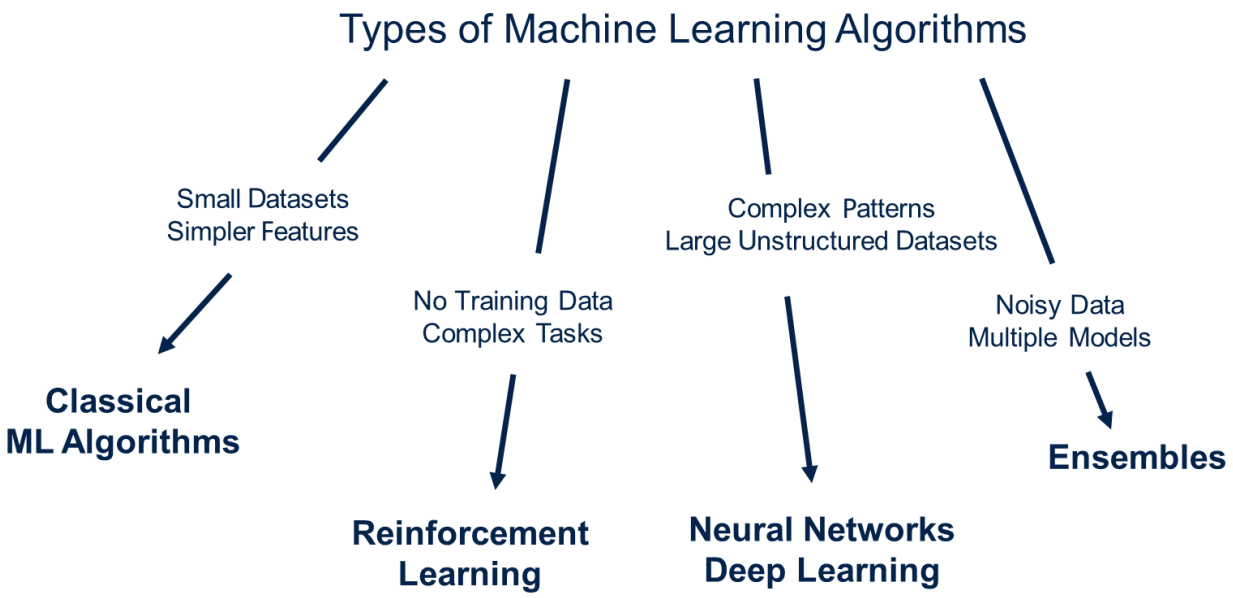


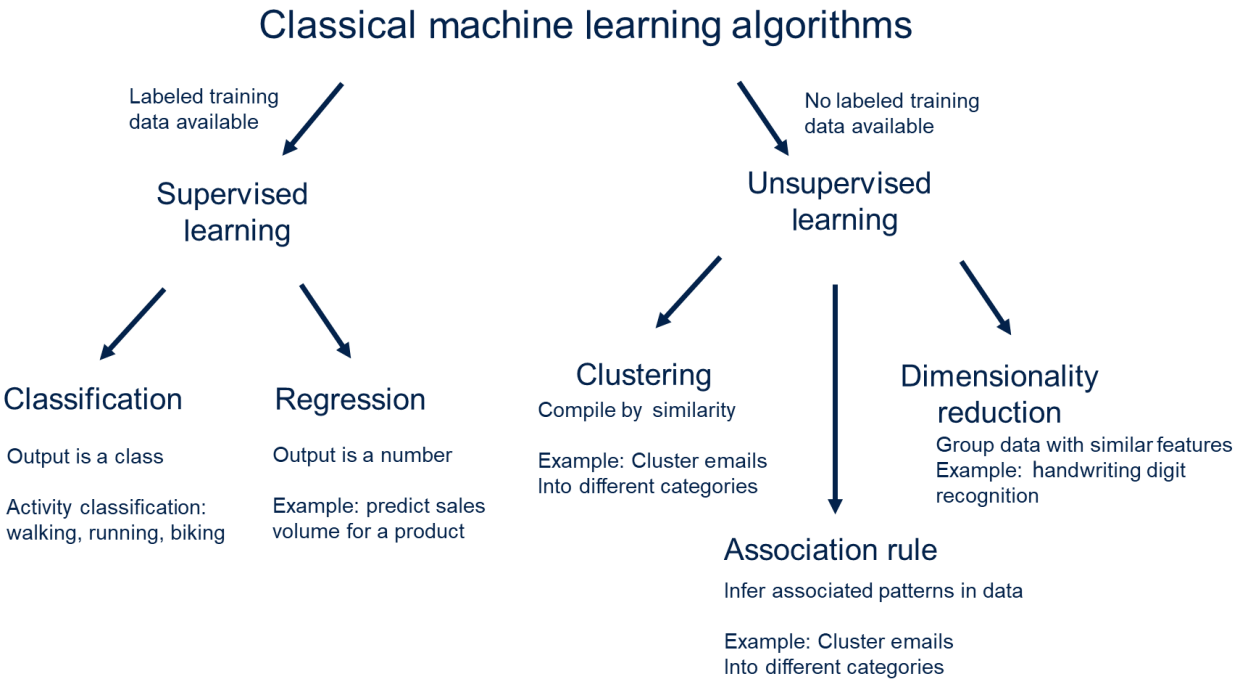
Outbreaks in 2018

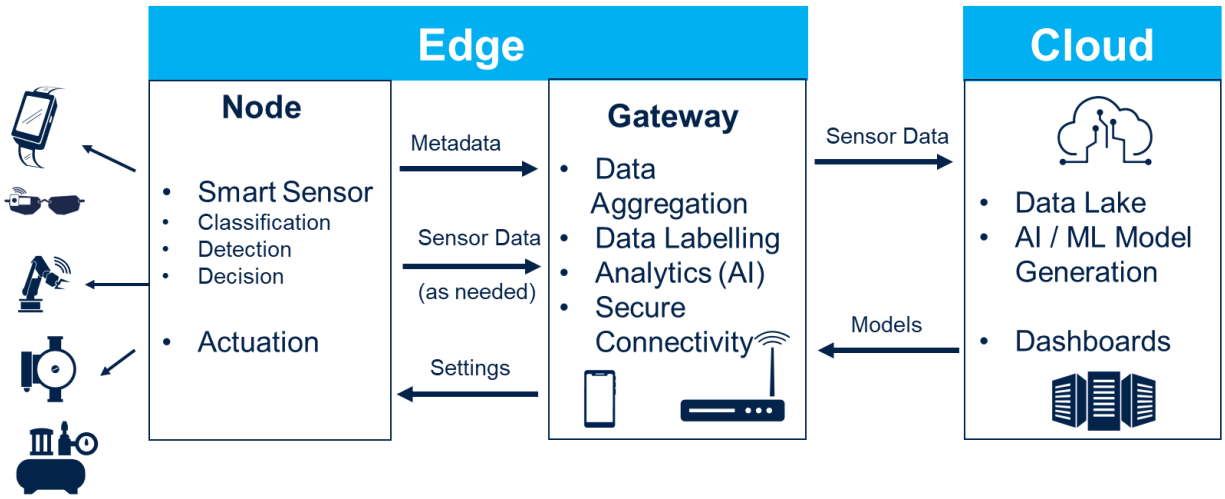
E. coli	Salmonella
210 people in 36 states infected from romaine lettuce.	• Breakfast cereal recall • Multiple crackers voluntarily recalled • Egg recalls in Eastern U.S. • Pre-cut melons recalled in 20+ states • Infections linked to raw turkey products in 26 states


All the building blocks for IoT devices
Microcontrollers
Secure solutions
Sensors & actuators
Connectivity solutions
Power management
Motor control
Analog components
Stackable boards & modular SW
STM32 Nucleo Development & Expansion boards
Boards with various form factors
Discovery Kit IoT Node
SensorTile.box
NFC Dynamic Tag Sensor Node
BlueTile
SensorTile
Pre-integrated software for vertical applications
Smart Things
Smart Home & City
Smart Industry
Development ecosystem
Code generators
Prototyping software
IDE
Development environments
Artificial Intelligence toolbox
Debug solutions
Simulation and analysis tools
On-line design tools
Integration of Cloud Provider SDKs
AWS
Microsoft Azure
Google Cloud
IBM
Partner Program and ST community
ST Community
Educational Platforms
Partner Program
PC Software
Cloud Service
Mobile App
Product evaluation example
Function Pack with application examples
Application
Middleware
Drivers and Hardware Abstraction Layer API
Hardware code optimized
3rd Party Code
Nucleo & X-Nucleo Boards
58 STM32 Nucleo development boards
Covering the broad portfolio of STM32 MCU families
56 STM32 Nucleo expansion boards
Offering peripheral functions
Solution Boards
11 System boards
Exploiting application functionalities and their form factor
3rd-Party Boards

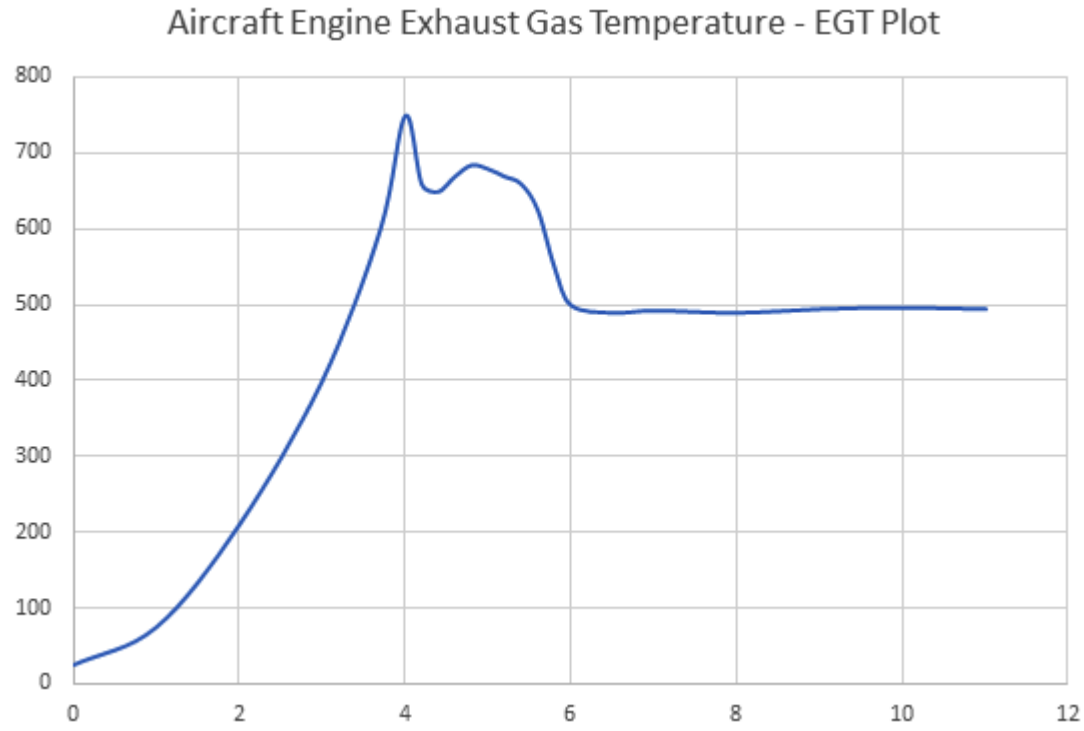
Chapter 8: Artificial Intelligence in Digital Transformation



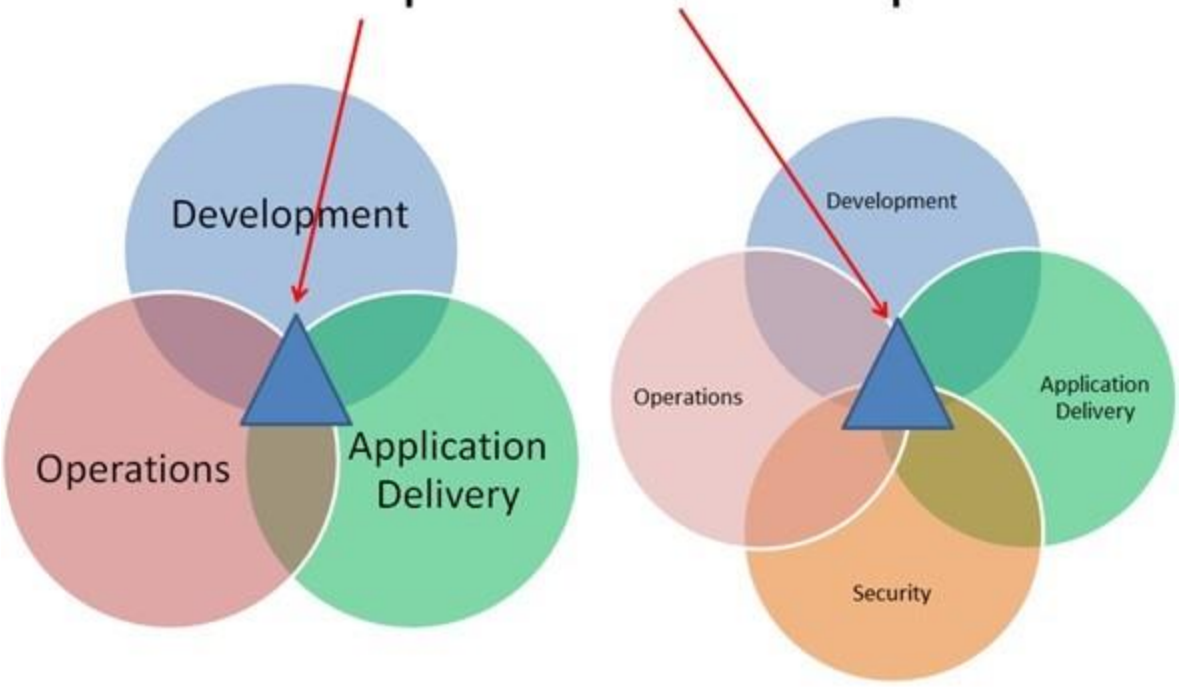




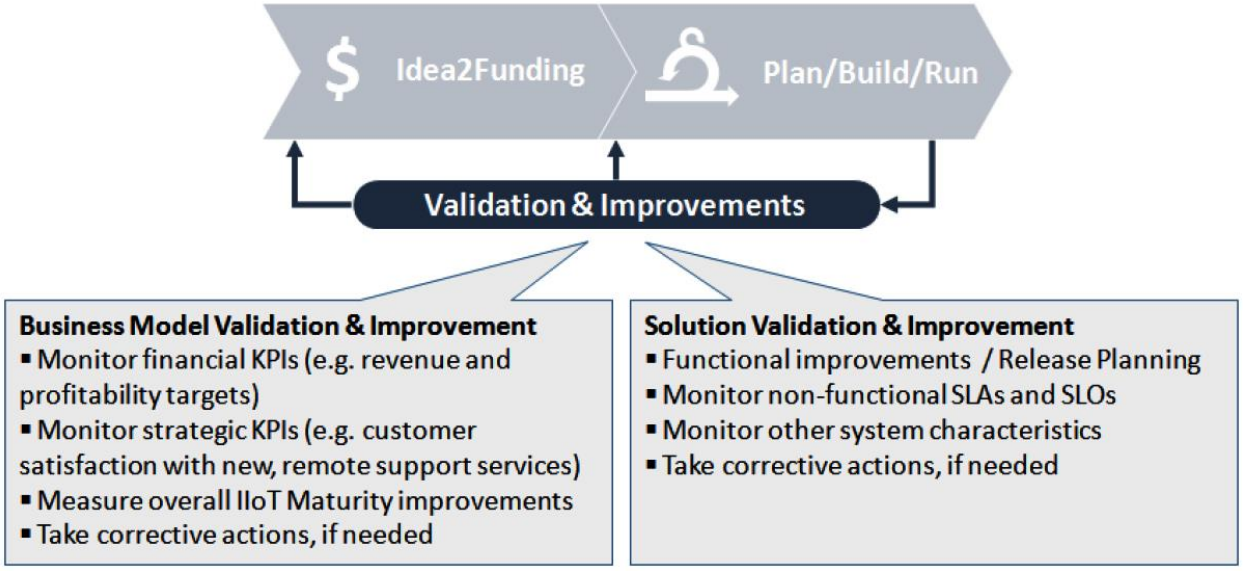
SELF - SERVICE CHECK - IN → SELF - SERVICE BAG DROP → SECURITY SCREENING → BORDER CONTROL → SELF - SERVICE BOARDING → ASSISTED BOARDING



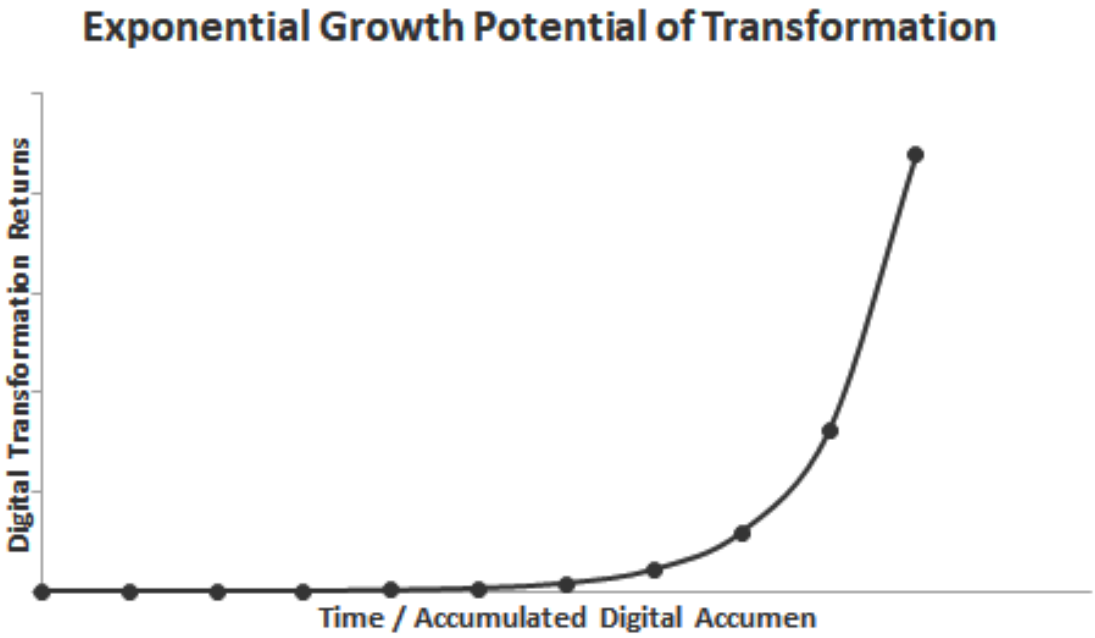
DevOps vs. DevSecOps



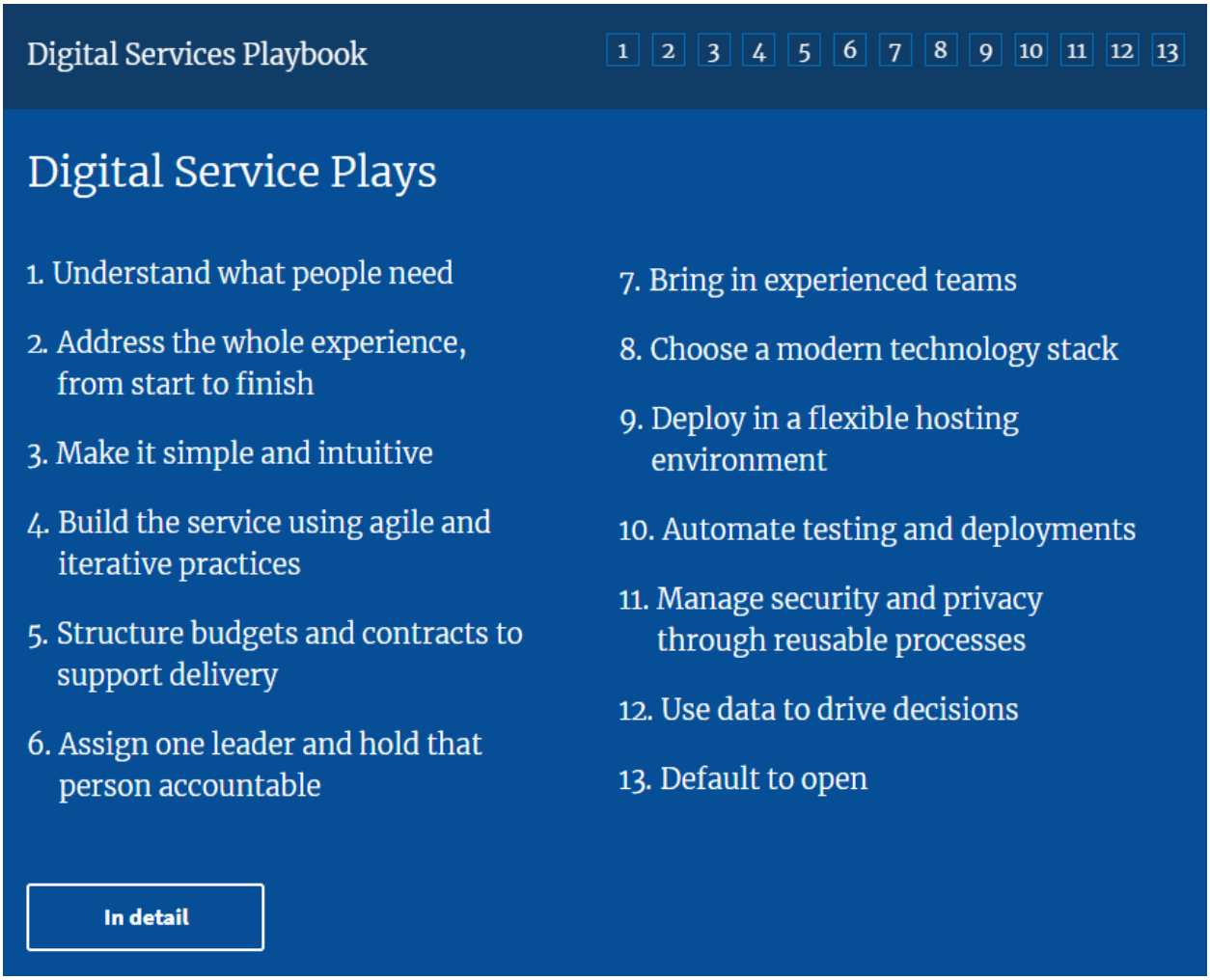
Chapter 9: Pitfalls to Avoid in the Digital Transformation Journey

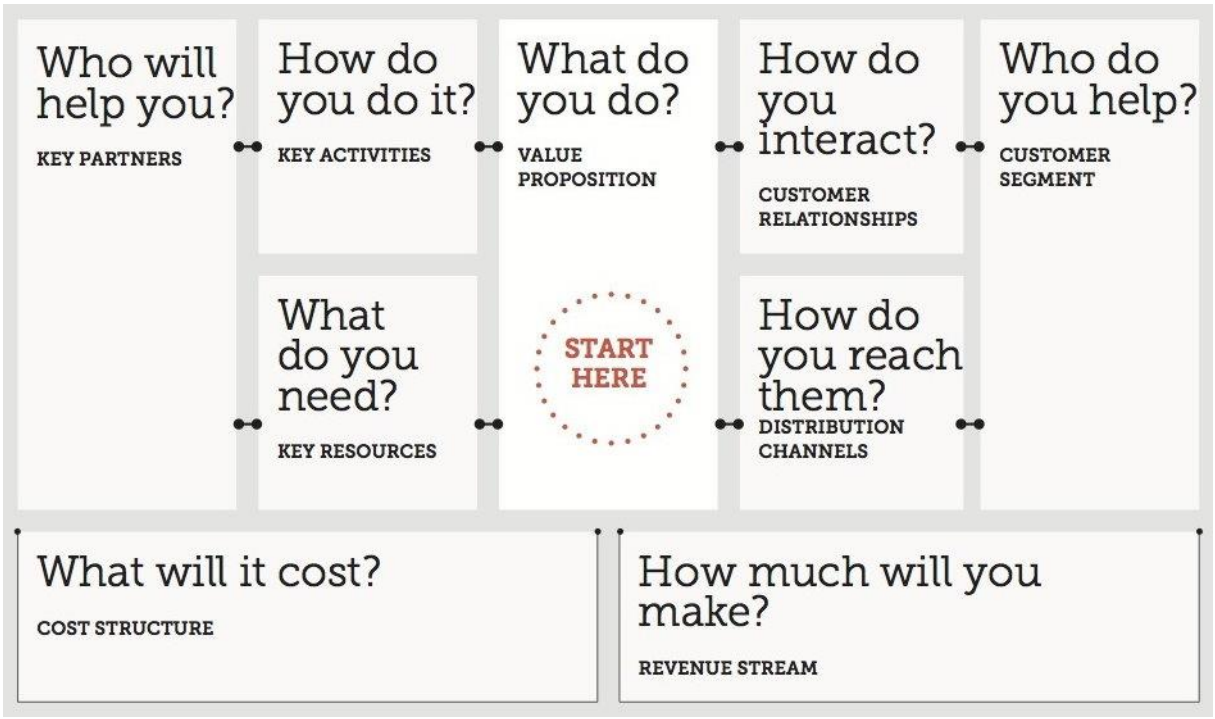


Chapter 10: Measuring the Value of Transformation



Chapter 11: The Blueprint for Success





1) Business Driven Product / Service Description

Pro-Health app is a mobile app + devices to provide:

- Life Policy quotations for desired life/health products
- A benchmark of how much can be saved if some health related metrics improve
- Set up a suggested plan to improve health supported by devices connected to the app
- Motivate and close the purchase once prospect customers have achieved target milestones

3) **Key Stakeholders**

- Chief Actuarial
- Chief Operations Officer
- Marketing Director
- Operations Manager
- Compliance Officer
- CIO / IT Delivery Head

7) Partnerships

- Devices for bio-metrics: IoT for health connectivity
- Health coaches
- App Usability.

4) Data Objects in Scope

Prospect Customer Personal Data: age, date of birth, etc.

Prospect customer biometrics: weight, blood pressure and sugar

Products suit for prospect customer

Health Measurements and milestones

5) Data Objects Current Available format

- Health measurements (Biometrics) Data: Not available
- Policy and quotation forms: paper-based

6) Machine Readable DO transformation technologies

- Devices connected to provide health measurements (IoT)
- Digital forms and electronic signature

8) Business Value Drivers

Increase Revenue

9) Implementation Model

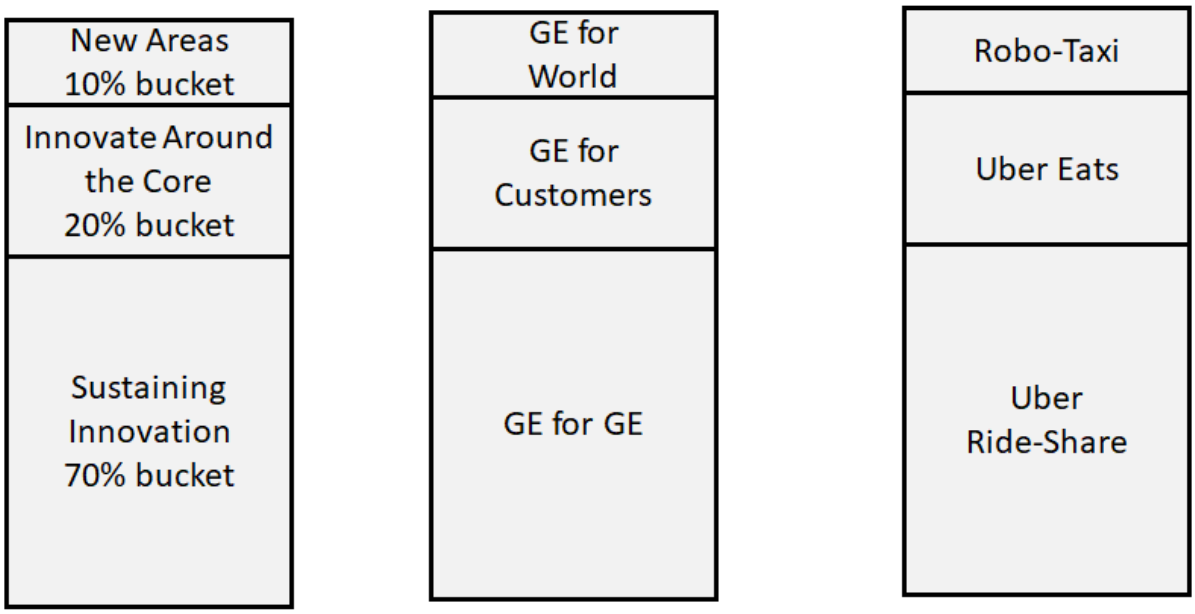
- Mobile Application with connected devices (body measure, IoT bracelet

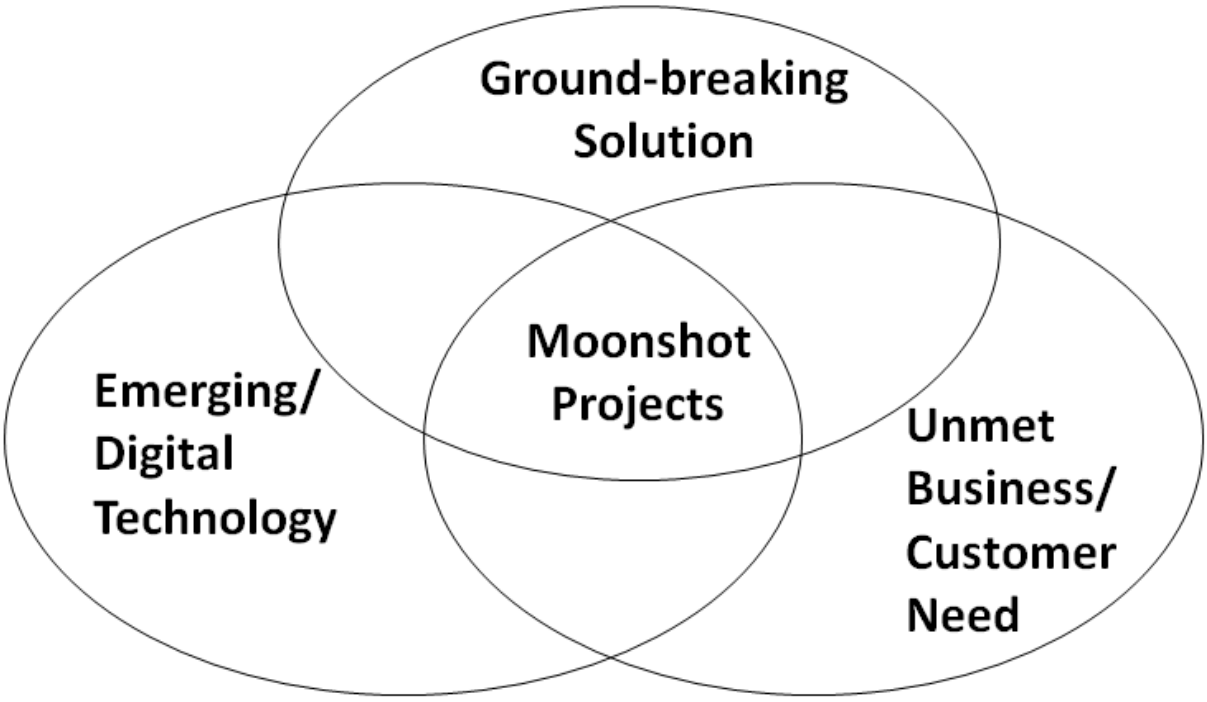
2) Business Value Proposition

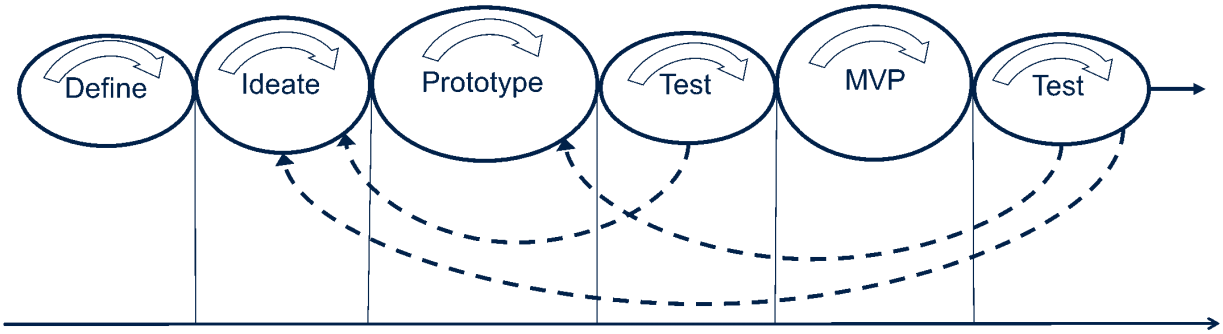
Our **Pro-Health app** help prospect customers **who want** to get more affordable life and health insurance **by** improving their overall health status through an easy to use app and devices to set up a tailored program targeted to accomplish key health metrics goals, **unlike** traditional approaches who focus only on prospect customer risks.

10) KPI's

- 10% in increased premium
- 4% persistency
- 5% improvement in opportunity to closed ratio.


New Areas
10% bucket
Innovate Around
the Core
20% bucket
Sustaining
Innovation
70% bucket
GE for
World
GE for
Customers
GE for GE
Robo-Taxi
Uber Eats
Uber
Ride-Share


Ground-breaking
Solution
Emerging/
Digital
Technology
Moonshot
Projects
Unmet
Business/
Customer
Need


Define
Ideate
Prototype
Test
MVP
Test


9:41 AM
42%
My Keys
Home Garage Door
Entry Door
Home Entry Gate
Work Garage