6TH ANNUAL CONNECTEDPLANT CONFERENCE
Digitalization Dynamics Decoded

"We believe the future of manufacturing is 'neural"

Neural Manufacturing: Future of Smarter Factory

May 2022

Farid Bichareh
Connected Plants – Solution Director
IIC Smart Factory Chair

tcs Neural Manufacturing™

Building on belief

Smart Factory

Employ combinations of modern technologies to create a new digital forms of efficiency and flexibility by connecting different processes, information streams and stakeholders (frontline workers, planners, etc.) in a streamlined fashion. Might also be referred to as “digital factory” or “intelligent factory.”

Process/Machinery Automation

Connected Devices/Process- IIoT

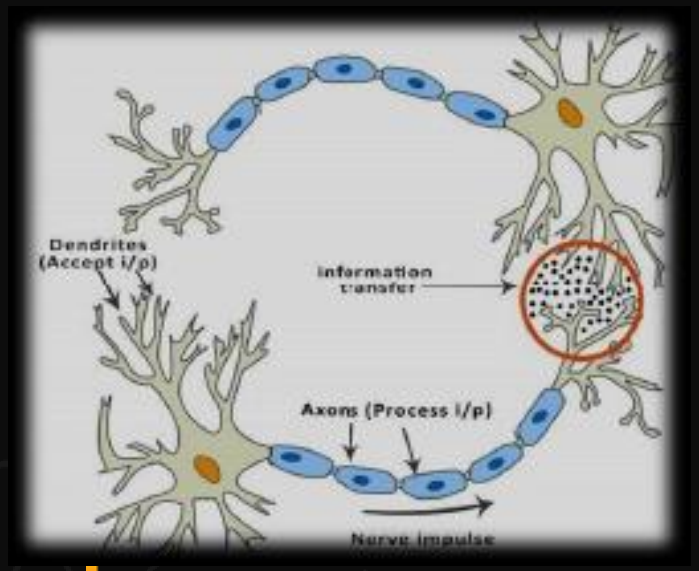
Data Collection/Analytics/AI

(AI) Neural Networking

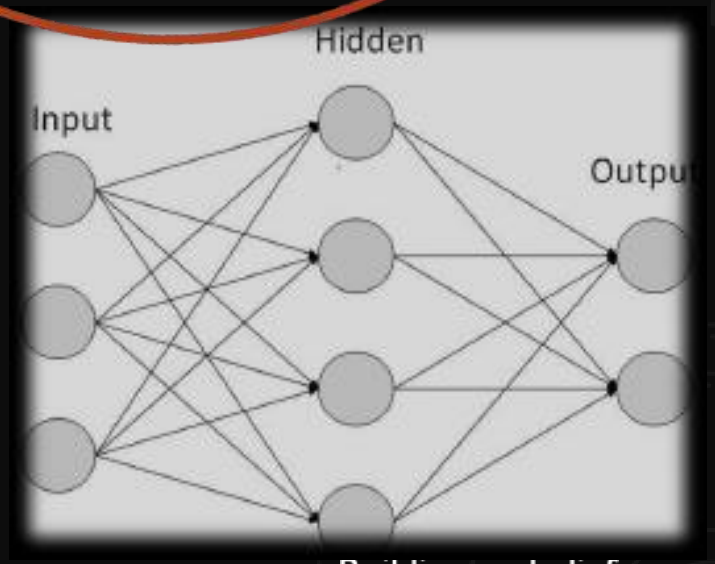
"A computing system made up of a number of simple, highly interconnected processing elements, which process information by their dynamic state response to external inputs"

Dr. Robert Hecht-Nielsen

The human brain is composed of 86 billion nerve cells called neurons



ANNs are composed of multiple nodes, which imitate biological neurons of human brain. The neurons are connected by links, and they interact with each other.



Neural Manufacturing™

Building on belief

Future of even “Smarter” Factory: Inspired by human system

Sense
Perceive
Act

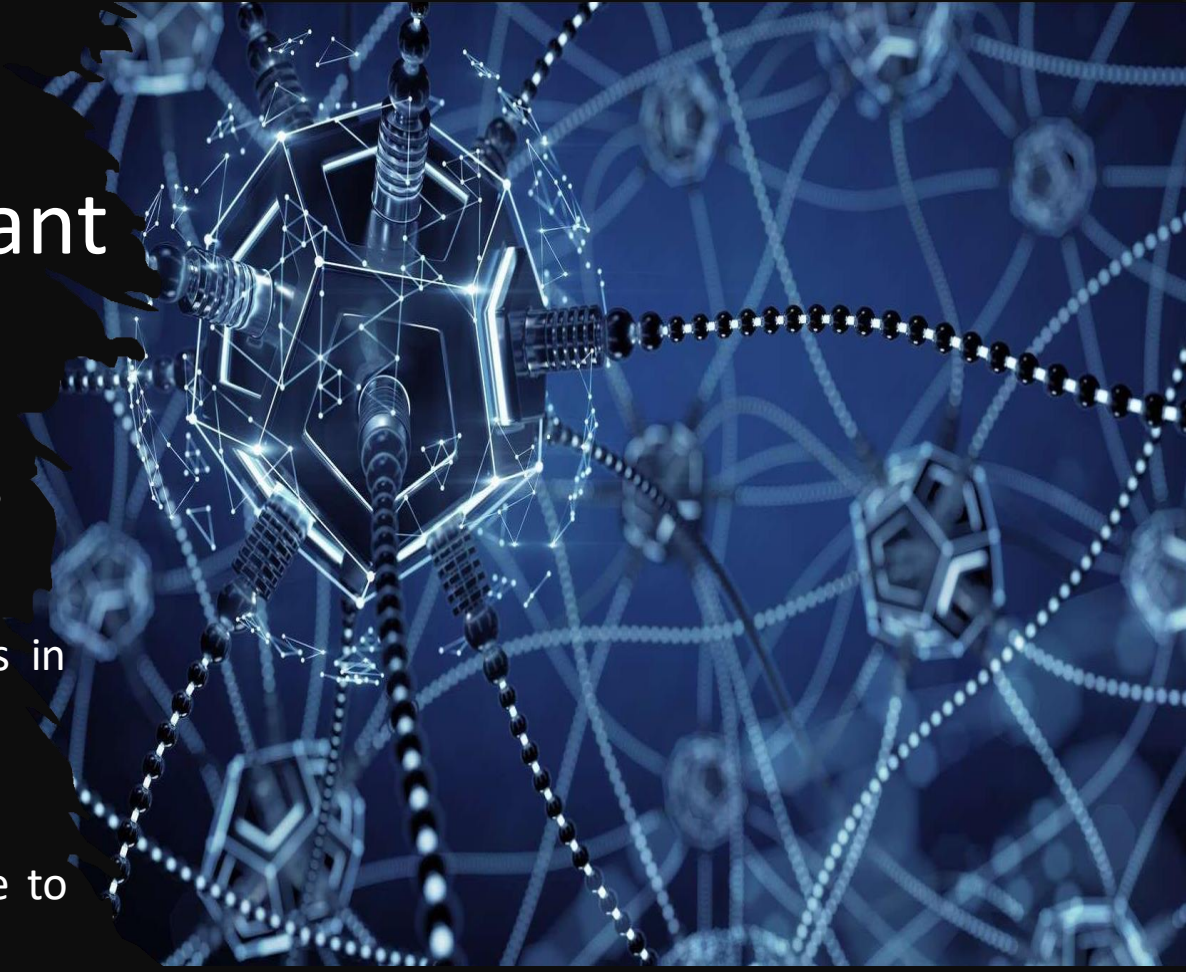
Adaptability, resilience & purpose driven are hallmarks of many species

Imagine if your factory can behave and act like a human system:

- Have memory & knowledge base and can learn
- Can contextualize, analyze, model and self-optimize/correct
- Be capable of synchronize and demonstrate autonomous actions and decision making

What if your plant operation becomes “Neural” ?

AI Neural Network throughout Manufacturing Value Chain and Plant



- Each node monitors a certain part of the value chain and plant
- Collecting all Data to teach itself the normal operation parameters
- Over time, each node analyzes, models and make decision
- Each node shares this data/analysis/decisions with other nodes in real time
- Each node can identify where and when, what action is required
- Other nodes or central node/brain can make decision on where to optimize and even accomplish this without human intervention.

This fast, reactive and adoptive process saves time and product loss, and quickly becomes proactive as each node learns patterns and identifies triggers in advance. It can model predictive response and best practices for future events and their effects.

“Neural Manufacturing”

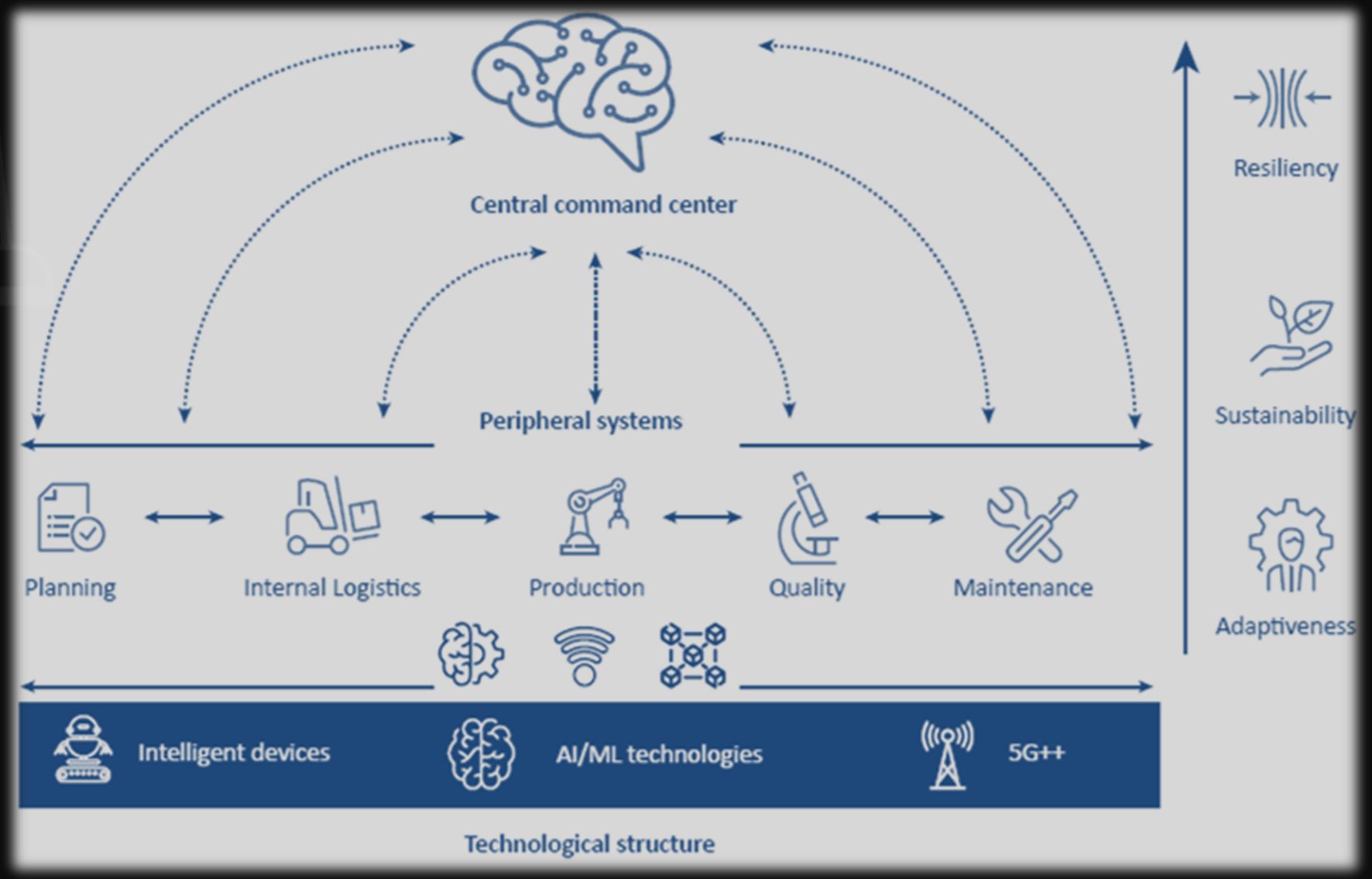
Fully Automation enabled with **cognitive intelligence**

Real-time data capturing and analytics for **contextual intelligence**

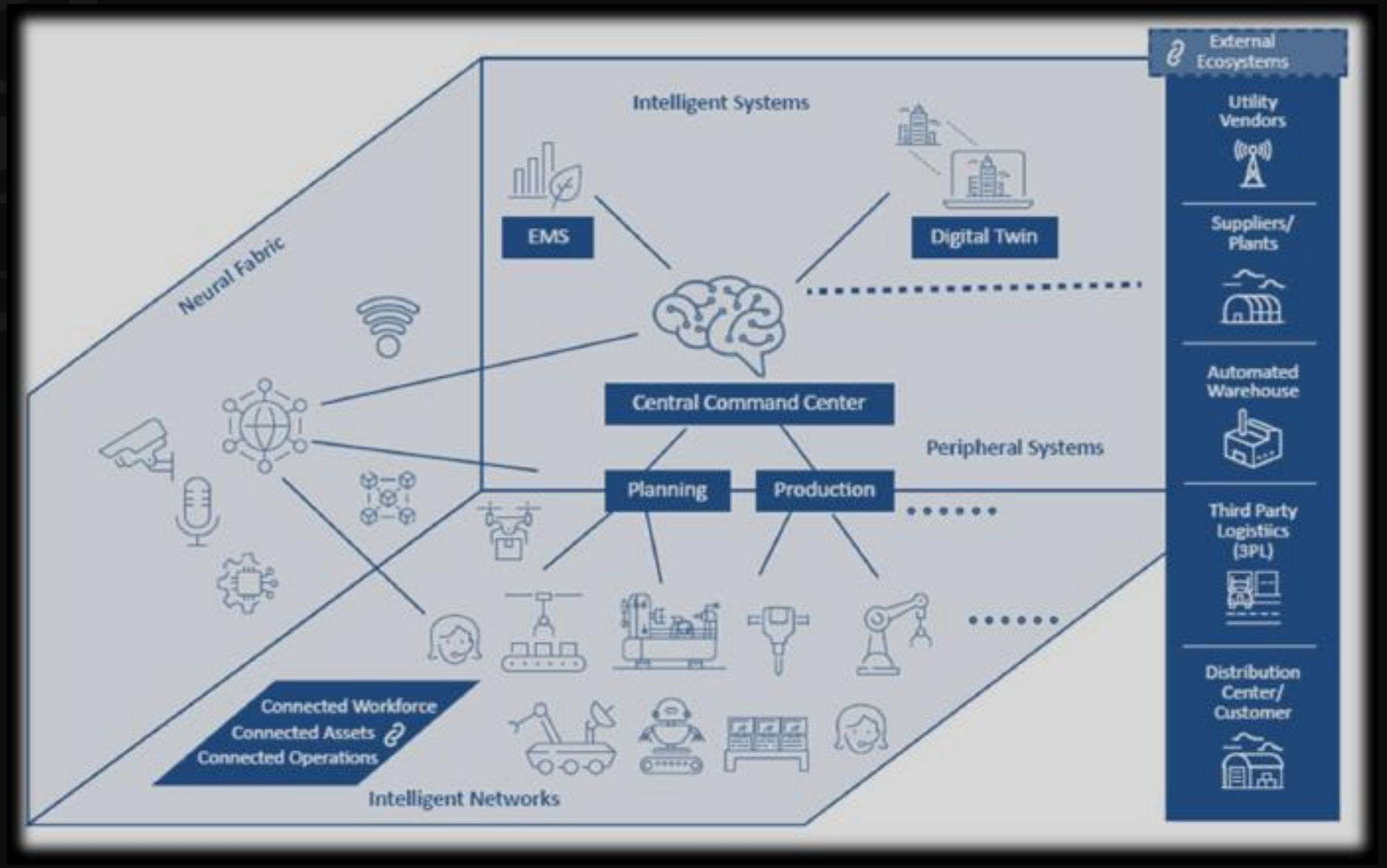
Autonomous decision making

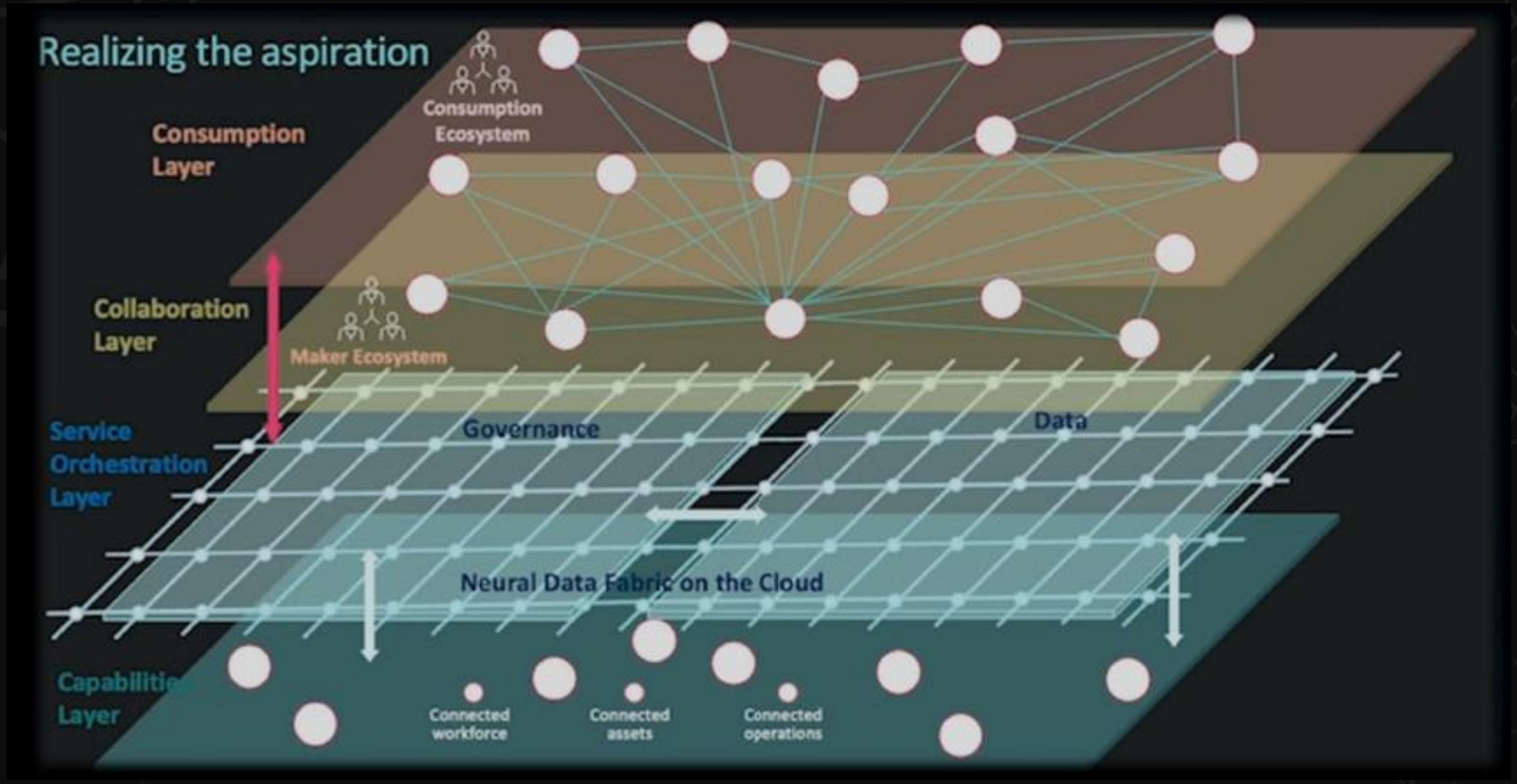
“Autonomous Manufacturing”

Pillars of Neural Plant Framework

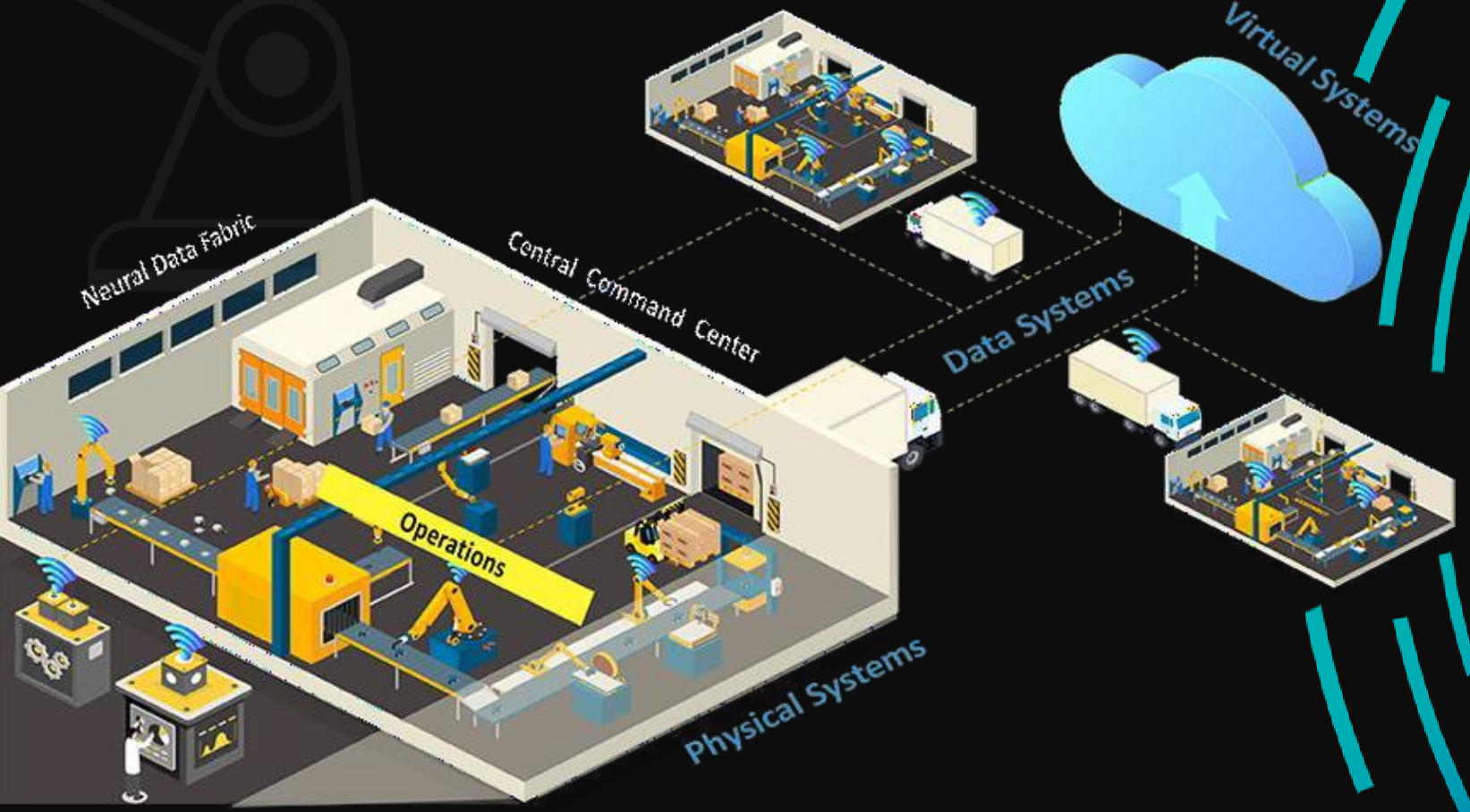


Functional Architecture of Neural Manufacturing




Realizing the aspiration
Consumption Ecosystem
Consumption Layer
Collaboration Layer
Maker Ecosystem
Service Orchestration Layer
Governance
Data
Neural Data Fabric on the Cloud
Capabilities Layer
Connected workforce
Connected assets
Connected operations

Neural Manufacturing System



Responsive Value Chain

Connected, Cognitive & Collaborative Planning

Automation

Autonomous actions decisions on the edge

Cognitive Operations

Data Driven Insights & Intelligent commands

Learning, Memory & Knowledge

Continuous learning enriching decisions

Cloud Virtualization

'Twins' for the Smart Plant and real time planning

Adaptive Production Processes

Segment of One Manufacturing

Plants that can Think, Feel and Act

We see the factory of the future as a confluence of Physical, Virtual, Data and Ecosystems

tcs Neural Manufacturing™

Building on belief

Sense-Perceive-Act
To Respond

Predict Saftey Hazards,
Energy Anomalies

Sustainable

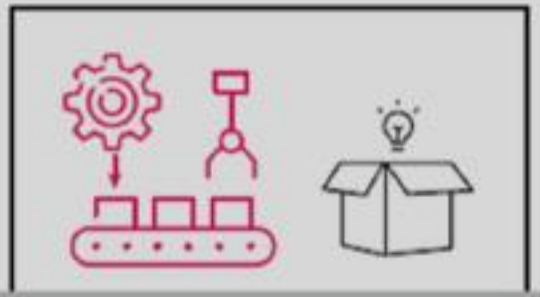
Self Heal

Neural Manufacturing – USE CASE : NPI

New product data is entered into the digital twin of the neural plant by engineers for manufacturing feasibility check. Data is fed into the digital twin for mass production after the changes in the infrastructure

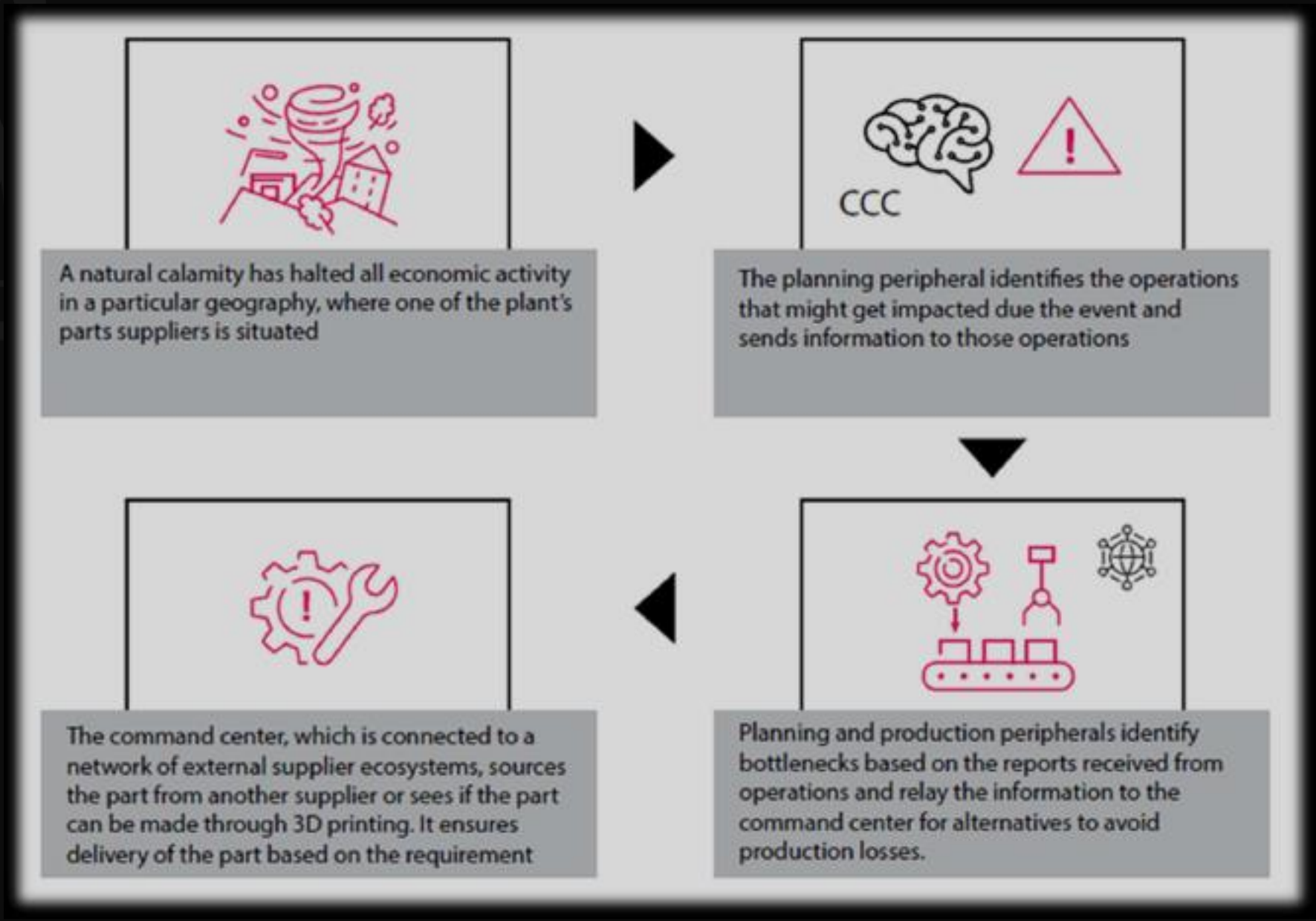
The command center of the neural plant extracts new product information from the digital twin and shares it with all the manufacturing systems inside the plant

The neural plant aligns itself autonomously to manufacture the new product and updates the same in the digital twin for further analysis

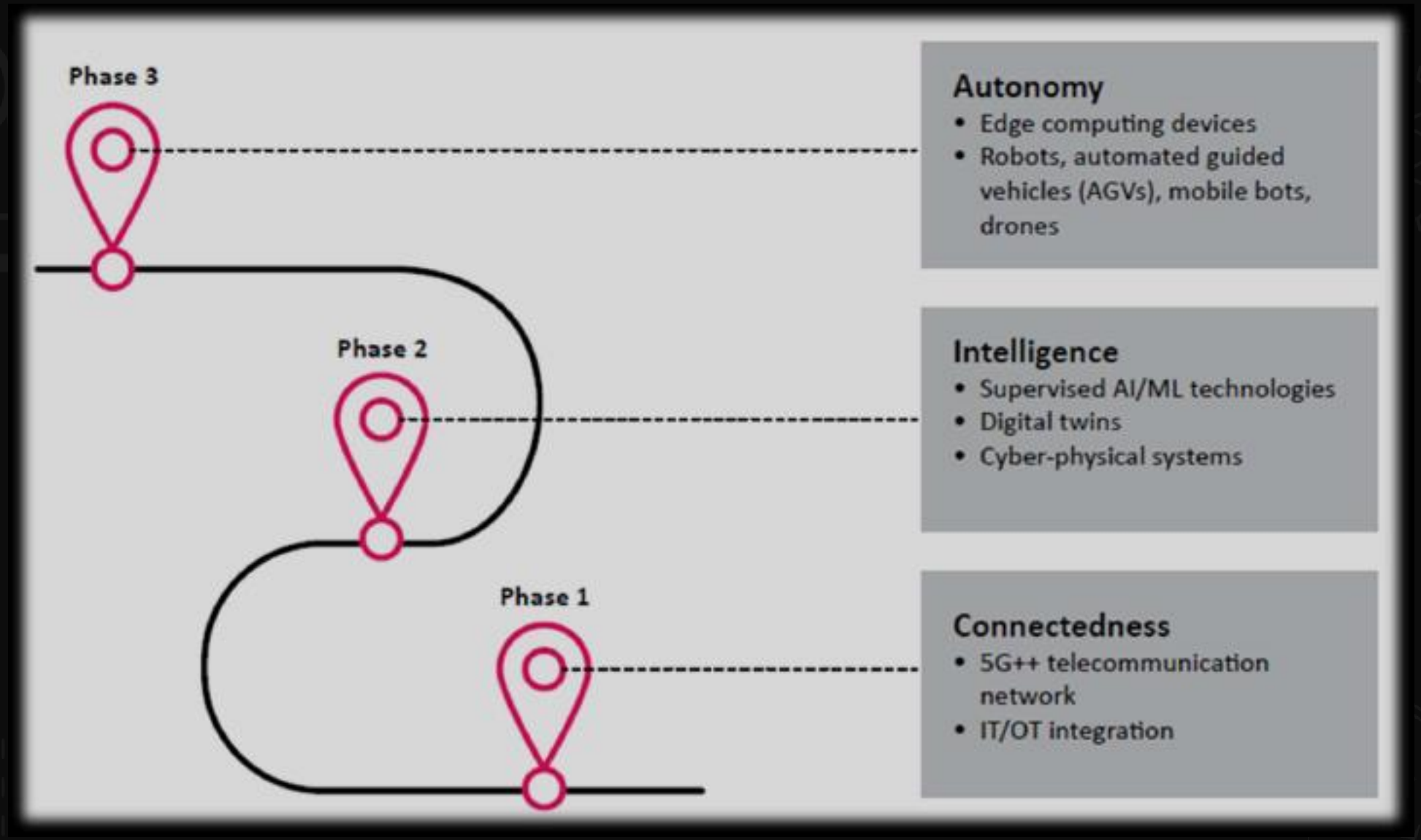


The new product is mass produced without the prototype phase

Neural Manufacturing – USE CASE : Self Healing



Steps toward Neural Plant Manufacturing

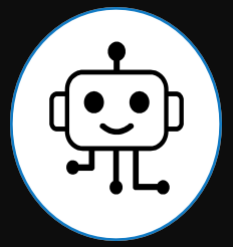


End to End Neural & Autonomous Manufacturing

Responsive Value Chain

Connected, Cognitive & Collaborative Planning

Automation



Autonomous actions decisions on the edge

Cognitive Operations

Data Driven Insights & Intelligent commands

Learning, Memory & Knowledge

Continuous learning enriching decisions

Cloud Virtualization

'Twins' for the Smart Plant and real time planning

Adaptive Production Processes

Segment of One Manufacturing

- **Creates a thought leadership Concept**
- **Provide a platform toward even smarter factory of future**

Bringing Life to Things

‘Neural Manufacturing’ journey

Leverage a design led strategic engagement

Factory of the Future

Self aware prescriptive & cognitive capabilities

3

Digital Transformation

Re-imagine the value proposition, enabling new business models through ecosystem-level restructuring.

Advanced Manufacturing & Automation
(Cognitive Automation, Additive Manufacturing, Robotics, AGVs)

Cyber-Physical Systems
(Data Models, Simulations, Digital Thread, Digital Twin)

2

Digitalization

Derive actionable insights, standardize business processes for cost efficiencies and operational excellence

Predictive simulation driven insights

Industrial Analytics
(Big Data, RPA, AI/ML)

1

Connect in context data visualization and workflows

Digitization

Transition from analog to digital Smart Products & Process, Sensorization

Smart Devices
(Sensors, Mobility, Wearables, Mixed Reality)

Platform(s)
(Cloud, IoT, Collaboration, Blockchain)

Cyber Security
(Network, Edge, Gateway, Integration, Applications)

tcs Neural Manufacturing™

Building on belief

TATA CONSULTANCY SERVICES

Thank You

Farid Bichareh

Connected Plants – Solution Director

IIC Smart Factory Chair

6TH ANNUAL CONNECTEDPLANT CONFERENCE

Digitalization Dynamics Decoded