

Evolution of Maintenance Processes in Industry 4.0

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References

Premier Reference Source

Applications and Challenges of Maintenance and Safety Engineering in Industry 4.0



Alberto Martinetti, Micaela DeMichela, and Sarbjeet Singh



BS EN 60300-3-14:2004



BSI Standards Publication

Dependability management Application guide



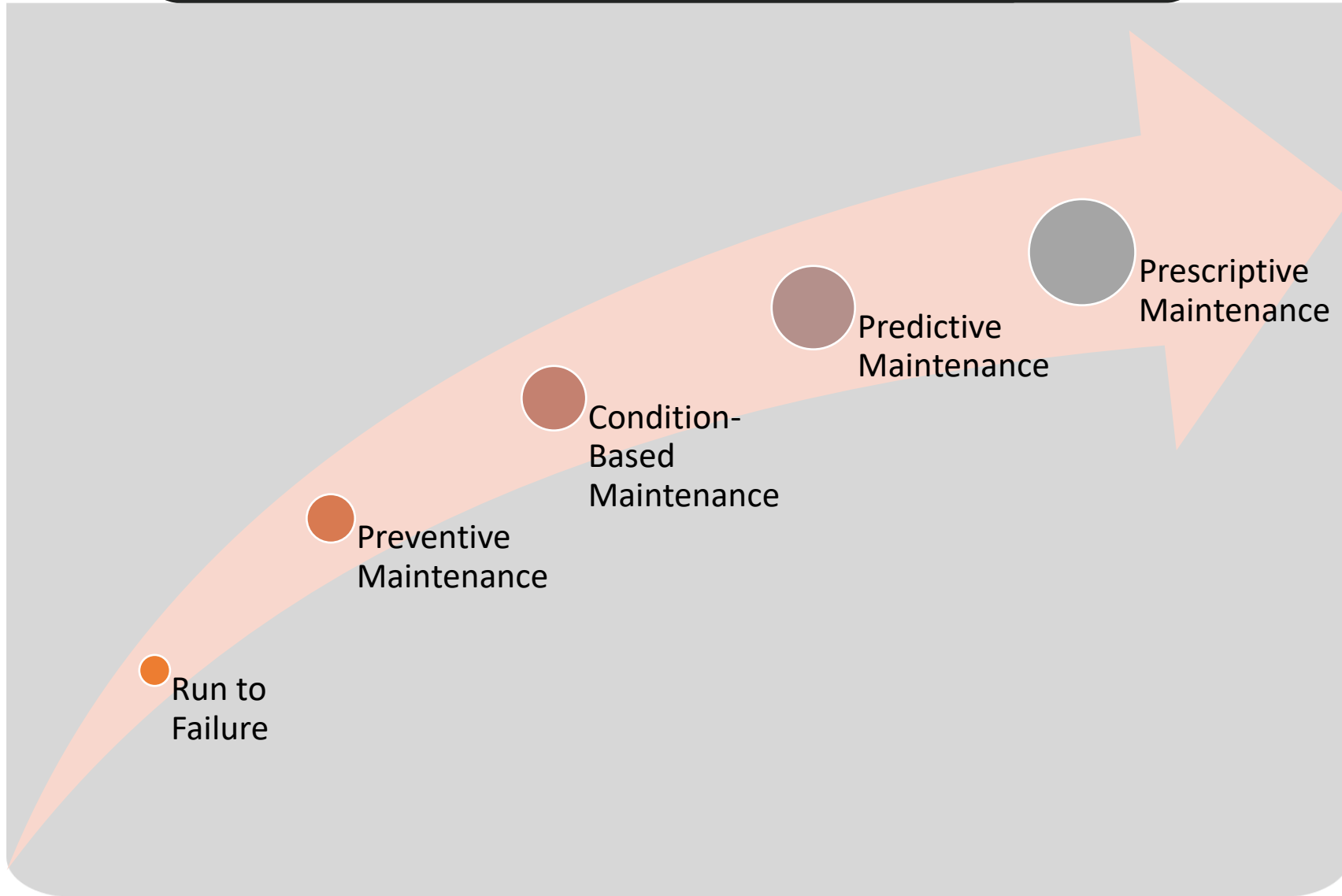
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Introduction

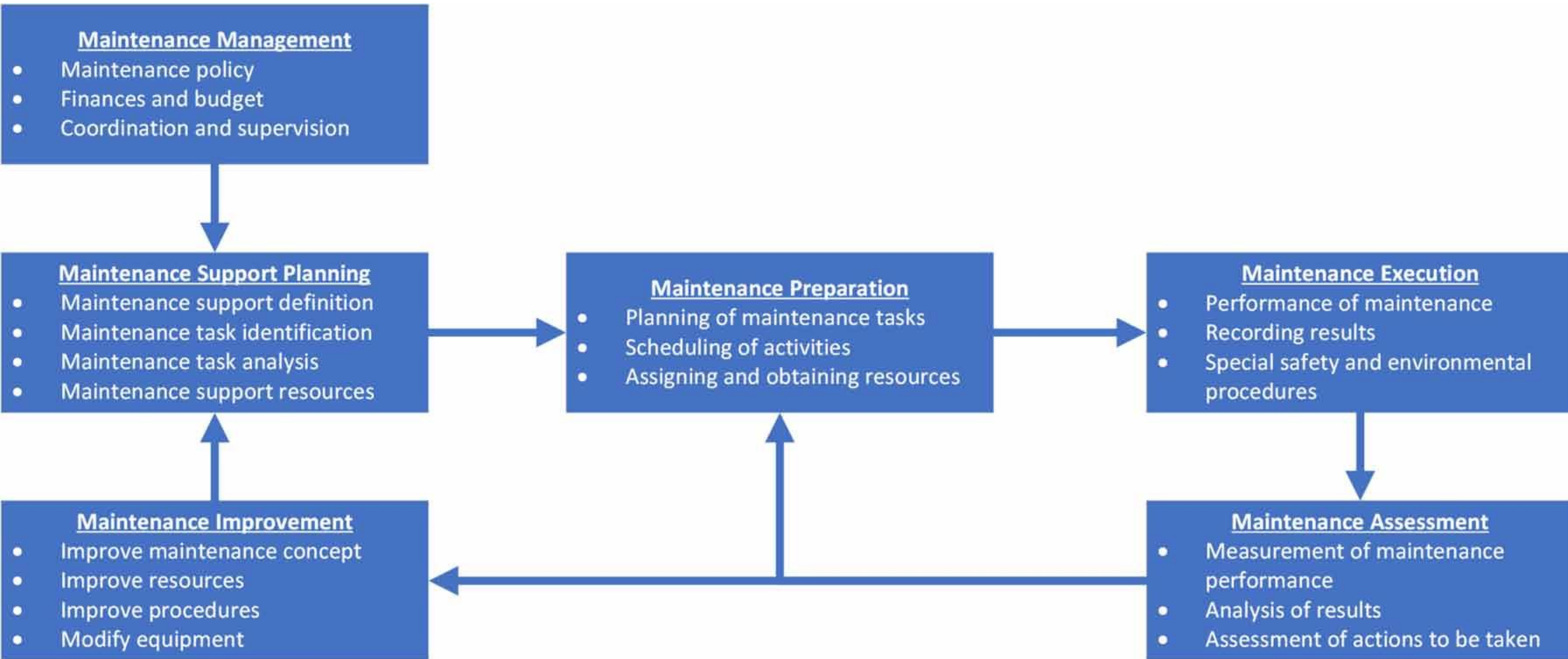
Several industries need the intelligent system to maximize their asset throughput at the lowest risk and cost.



Evolution of Maintenance



Maintenance Process



Enabling Technologies

Industry 4.0

Internet of Things (IoT)

IoT are used for data acquisition and connectivity



Artificial Intelligence (AI)

AI algorithms distinguish which specified limits of the parameter requests an immediate maintenance intervention.

Big Data (BD) and Data Mining (DM)

3Vs+2Vs
Volume, Velocity, Variety, Veracity, Value,



Cloud Computing (CC)

Deliver on-demand access to a shared pool of computing resources over the internet. IaaS/PaaS/SaaS



Service Oriented Architecture (SOA)

Due to dynamic nature of societal and market trends, industries require flexibility, interoperability, scalability, modularity.

Context Aware System (CAS)

CAS is a system that can automatically adapt its behavior based on the context in which it is being used.

Cyber Physical System (CPS)

CPS is a system that integrates the physical world with the digital world.



Cyber Physical System Architecture of Industry 4.0

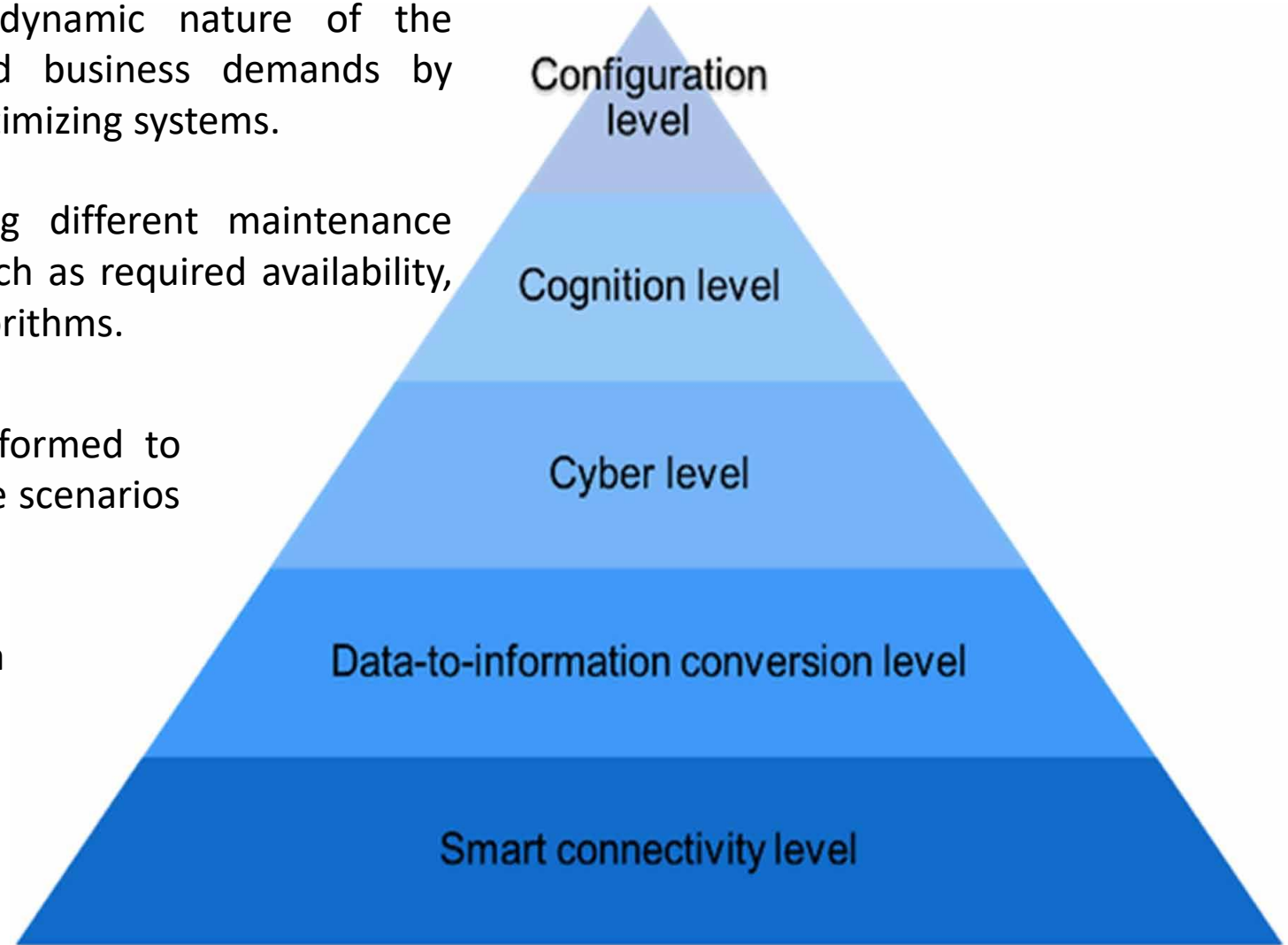
Adopt the strategies according to the dynamic nature of the environment, contextual requirements and business demands by implementing the self-configured and self-optimizing systems.

Decision-making is performed by analyzing different maintenance scenarios with optimizing the parameters such as required availability, total cost and total using efficient genetic algorithms.

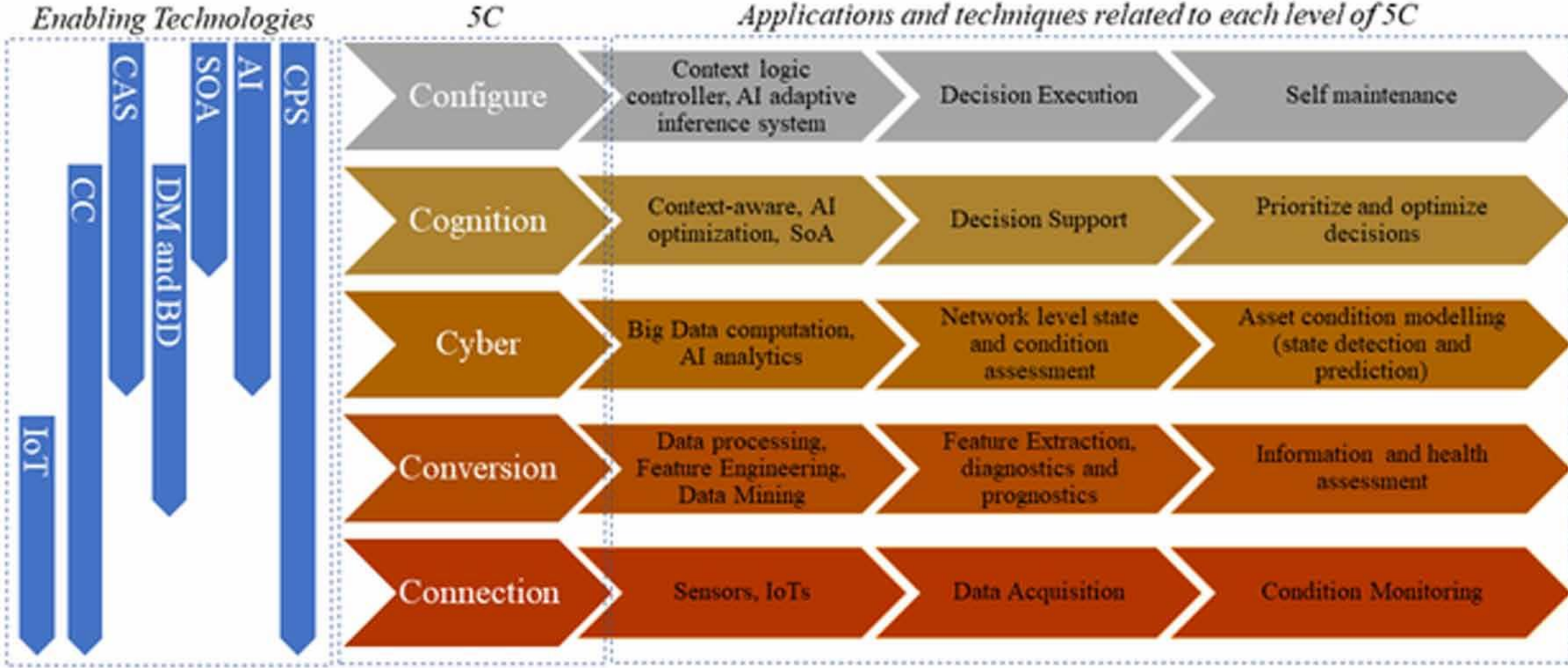
Modelling and simulation methods are performed to evaluate different operation and maintenance scenarios

Extract the required information from the data

Data acquisition using condition monitoring by existing sensors or Internet of Things (IoTs) thereafter storing the data.



Integration of the technologies of I4.0 in a CPS-based Framework



Challenges in Maintenance Process Within Industry 4.0 Context

Lack of Knowledge of Maintenance Role

Organizational Constraints

Self-Configurable

Data Management

Standardization of Framework and Solutions

Static Maintenance Process Information

Operation Based Framework

Integration of the Maintenance Processes into I4.0

Process / Level	Connection	Conversion	Cyber	Cognition	Configure
Maintenance management	<p>Acquisition of information regarding</p> <ul style="list-style-type: none"> • Maintenance policy • Organization structure • Financing and Budgeting • Insourcing/outsourcing 	<p>Extraction of</p> <ul style="list-style-type: none"> • Maintenance performance index • CAPEX/OPEX • Human performance index 	<ul style="list-style-type: none"> • Assessment of maintenance goal • Business and finance analytics for assessment of budget effectiveness • Business risk analysis 	<ul style="list-style-type: none"> • Scenario generation, simulation, optimization, analysis and assessment • Visualization to all stakeholders • Cost-benefit analysis • Multi-objective optimization • Collaborative decision modelling 	<ul style="list-style-type: none"> • Self-optimization for disturbances within organizational limitations • Self-adjustment of configuration with specific budget

Integration of the Maintenance Processes into I4.0

Process / Level	Connection	Conversion	Cyber	Cognition	Configure
Maintenance Support Planning	<ul style="list-style-type: none"> Collection of information about Maintenance resource and equipment capacity, reliability and availability Relevant maintenance tasks Task and component costs Operational profile Environmental conditions Documentation (standards, manuals, thresholds, etc.) Inventory 	<ul style="list-style-type: none"> Estimation of Item criticality System risk levels Remaining useful life (RUL) Maintenance task/support requirements Inventory levels 	<ul style="list-style-type: none"> Assessment of Plant or network criticality Risk comparison at network level Remaining useful life at network level Maintenance task/support requirements at network level Inventory levels at network 	<ul style="list-style-type: none"> Scenario generation, simulation, optimization, analysis and assessment Visualization to all stakeholders Cost-benefit analysis Multi-objective optimization Collaborative decision modelling 	<ul style="list-style-type: none"> Self-awareness of possible consequences of different scenarios Self-adjustment of loading and operating conditions Self-operational and functional tradeoffs to meet support planning limitations
	<ul style="list-style-type: none"> Acquisition of Inventory data Availability of the asset (maintenance 			<ul style="list-style-type: none"> Self-preparation for resource 	

با تشکر از توجه شما