Supply Chain flow

Growth means complexity

Company Growth

Raw Material → Supplier → Manufacturer → Distributor → Retailer → Customer

Source
Processes aimed at supplying the company with the goods and services necessary to meet the planned or actual demand

Make
Processes that govern the transformation of the product to the finished state to satisfy planned or actual demand

Deliver
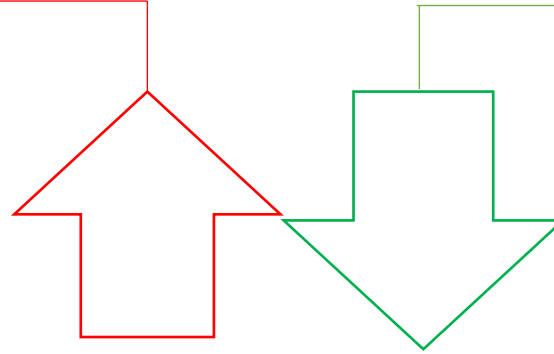Processes that deal with the allocation of finished products and services to meet planned or actual demand.

COMPLETE
END to END **SUPPLY CHAIN**

Supply Chain flow

Growth means complexity

MORE COMPLEXITY

MORE COMPETITIVENESS

More problems to solve

Operative tools increase

More obstacles to correct data exchange

Reduction Overall Leadtime

Less Supply Chain buffers

Decrease the «broken telephone» effect

Simulation

Multi-scenario / multi-rule simulations and "what if" analysis

Immediate evidence about perturbative actions from other users or processes

Multi user and multi function simulative and cooperative environment

Cooperation

Event & Workflow based cooperative system

Integrated inter-function information sharing environment
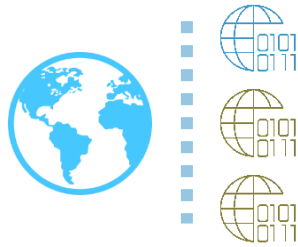
End To End Monitoring

Complete traceability across the entire Supply Chain

Monitoring of the actual performances and comparison with the historical data
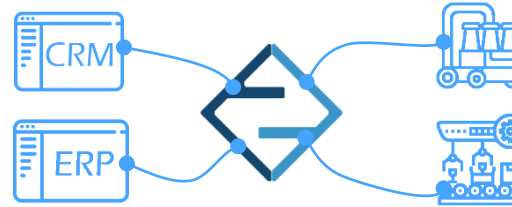
The ComplEtE «*DIGITAL TWIN*»

ComplEtE models the complexity of the entire Supply Chain into a virtual avatar (Digital Twin) capable to simulate every possible behaviour
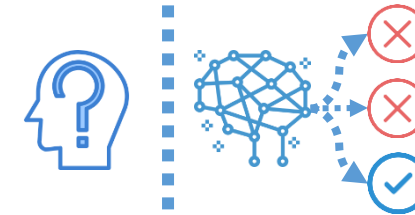
Enhanced Digital Twin

Create, modify, replicate a digital *avatar* of Products, Resources, Network & Company Rules
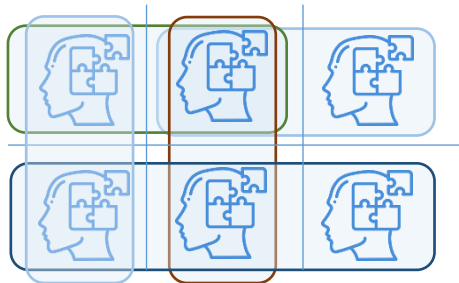
Physical & Virtual Standard Connectors

Standard Certified Connectors with PLM, CRM, ERP
IoT and Field Electronics certified connections

A.I. based Propositive Algorithms

Simulate different scenarios evaluate the results supported by Deep Learning algorithms

Virtual Groups for infos and users

Users are grouped by functions or targets and share the right information

Shared simulations to focus on same targets

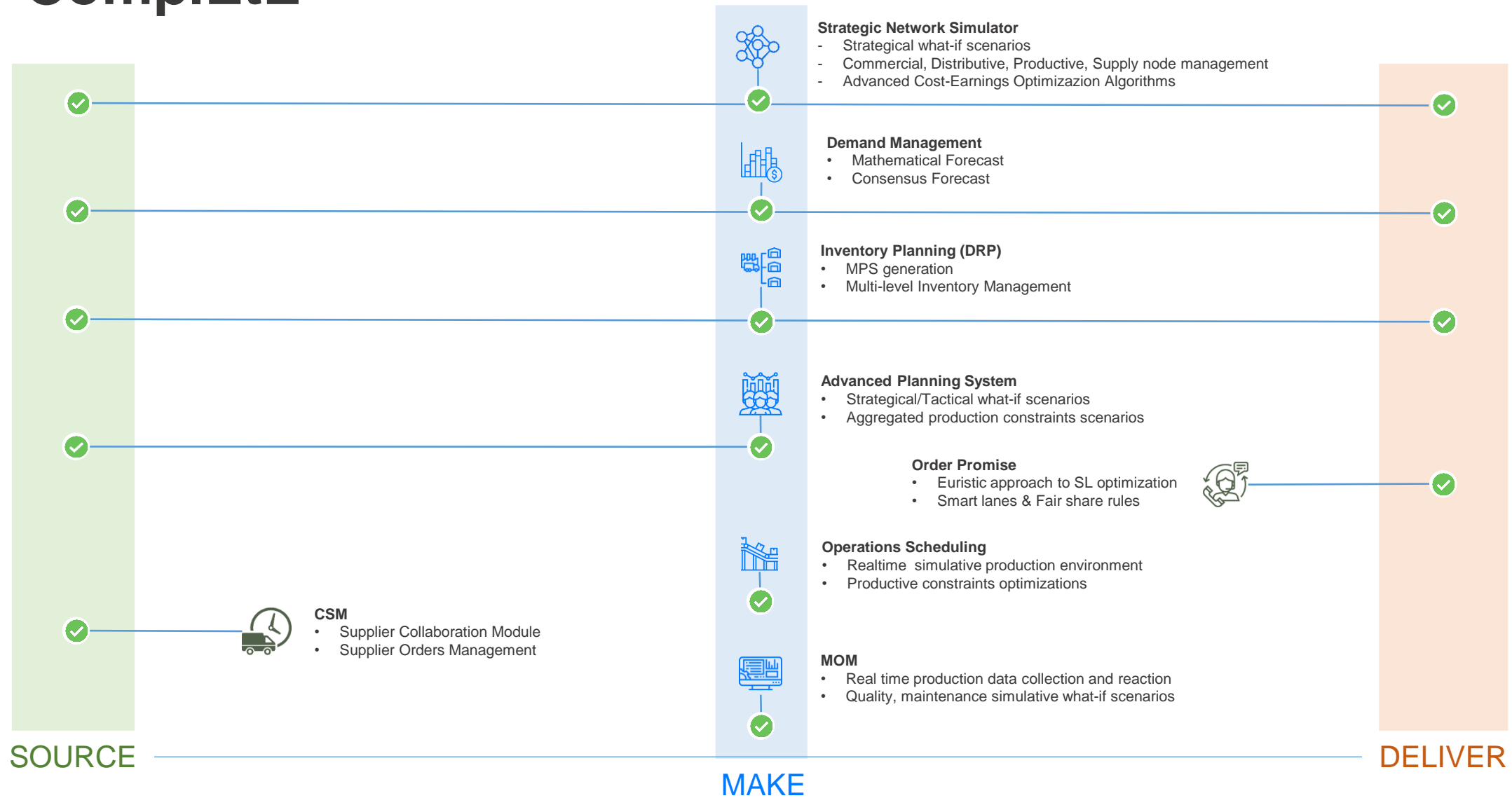Multiple users can share simulations, analisys and find out the best approach with the help pf the entire team
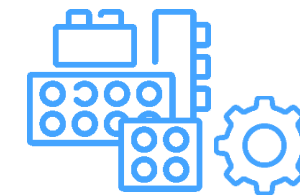
Modular Architecture «Smart Bricks»

Every digital process can combine algorithms, transformations and services to achieve the optimal solution.

COMPLETE
END to END **SUPPLY CHAIN**

La soluzione ComplEtE

Strategic Network Simulator
- Strategical what-if scenarios
- Commercial, Distributive, Productive, Supply node management
- Advanced Cost-Earnings Optimizazion Algorithms

Demand Management
- Mathematical Forecast
- Consensus Forecast

Inventory Planning (DRP)
- MPS generation
- Multi-level Inventory Management

Advanced Planning System
- Strategical/Tactical what-if scenarios
- Aggregated production constraints scenarios

Order Promise
- Euristic approach to SL optimization
- Smart lanes & Fair share rules

Operations Scheduling
- Realtime simulative production environment
- Productive constraints optimizations

CSM
- Supplier Collaboration Module
- Supplier Orders Management

MOM
- Real time production data collection and reaction
- Quality, maintenance simulative what-if scenarios

SOURCE

MAKE

DELIVER

COMPLETE
END to END SUPPLY CHAIN

Supply Chain solutions application

Time Horizon concept

Product Family

End product

Components

Operations

Freeze
Time Fence

Cumulative
Lead Time

Planning
Time fence

End of
Horizon

S&OP
ice

S&OP
slush

S&OP
water

MPS
ice

MPS
slush

MPS
water

MRP
slush

MRP
water

FFS

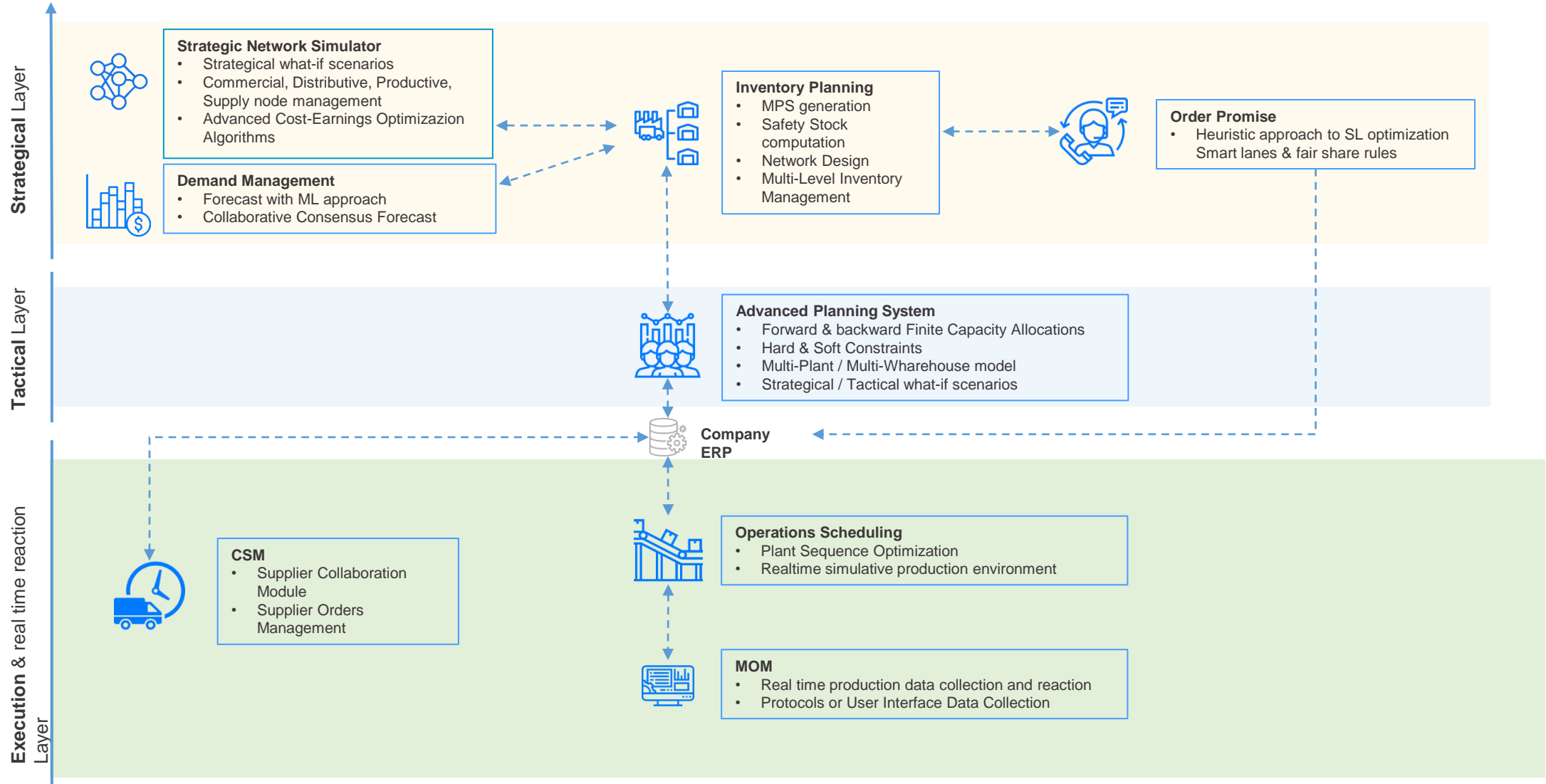Feedback

Constraints

Order Driven

Forecast Driven
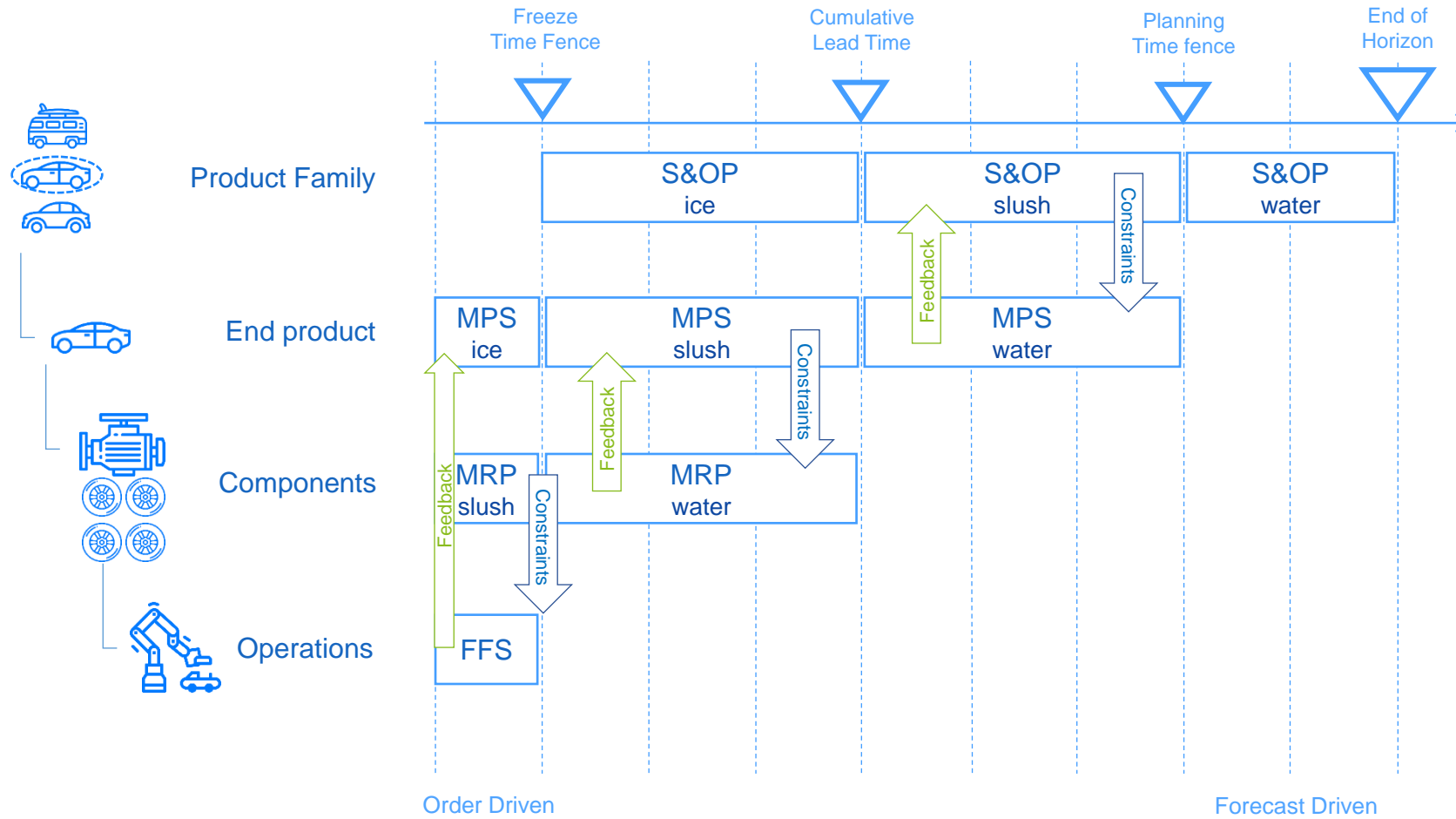
APICS

LEGEND

S&OP : Sales and Operation Planning
MPS: Master Production Scheduling
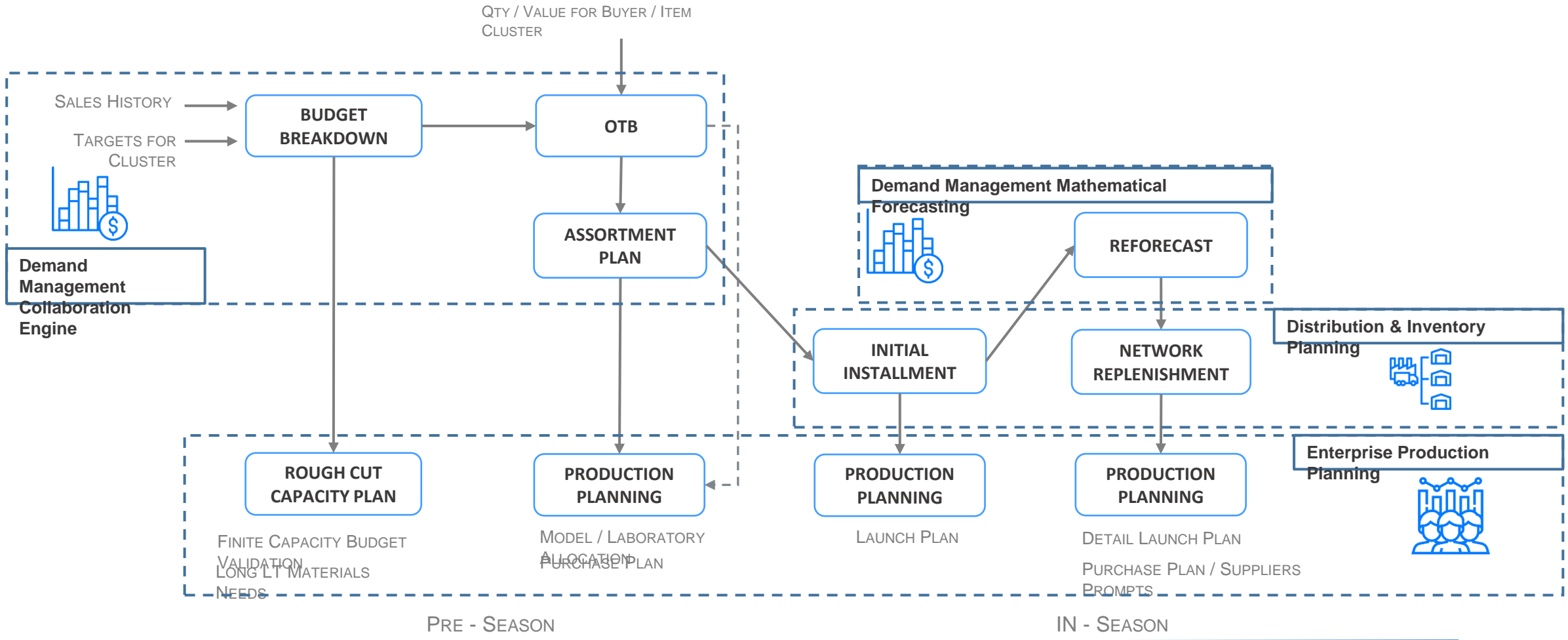**MRP**: Material Resource Planning
FFS: Finite Forward Scheduling

COMPLETE
END to END **SUPPLY CHAIN**

Supply Chain *Bricks*

From metal to screw : Typical Manufacturing Solutions Flow

Strategical Layer

Strategic Network Simulator
- Strategical what-if scenarios
- Commercial, Distributive, Productive, Supply node management
- Advanced Cost-Earnings Optimizazion Algorithms

Demand Management
- Forecast with ML approach
- Collaborative Consensus Forecast

Inventory Planning
- MPS generation
- Safety Stock computation
- Network Design
- Multi-Level Inventory Management

Order Promise
- Heuristic approach to SL optimization Smart lanes & fair share rules

Tactical Layer

Advanced Planning System
- Forward & backward Finite Capacity Allocations
- Hard & Soft Constraints
- Multi-Plant / Multi-Wharehouse model
- Strategical / Tactical what-if scenarios

Company ERP

Execution & real time reaction Layer

CSM
- Supplier Collaboration Module
- Supplier Orders Management

Operations Scheduling
- Plant Sequence Optimization
- Realtime simulative production environment

MOM
- Real time production data collection and reaction
- Protocols or User Interface Data Collection

COMPLETE
END to END **SUPPLY CHAIN**

The Overall Picture of the Fashion Processes

From sketch to tissue : Typical Fashion Solution Flow

QTY / VALUE FOR BUYER / ITEM CLUSTER

SALES HISTORY

TARGETS FOR CLUSTER

BUDGET BREAKDOWN

OTB

Demand Management Collaboration Engine

ASSORTMENT PLAN

Demand Management Mathematical Forecasting

REFORECAST

Distribution & Inventory Planning

INITIAL INSTALLMENT

NETWORK REPLENISHMENT

Enterprise Production Planning

ROUGH CUT CAPACITY PLAN

PRODUCTION PLANNING

PRODUCTION PLANNING

PRODUCTION PLANNING

FINITE CAPACITY BUDGET VALIDATION
LONG LT MATERIALS NEEDS

MODEL / LABORATORY ALLOCATION
PURCHASE PLAN

LAUNCH PLAN

DETAIL LAUNCH PLAN

PURCHASE PLAN / SUPPLIERS PROMPTS

PRE - SEASON

IN - SEASON

COMPLETE
END to END **SUPPLY CHAIN**

The ComplEtE Cooperative Supply Chain Framework

ComplEtE is able to manage the entire Supply Chain Network complexity thanks to a modular approach integrated by a common transparent cooperative platform.
It lets any process and any information to run smoothly and be shared automatically accross each persona and be available when it's really needed
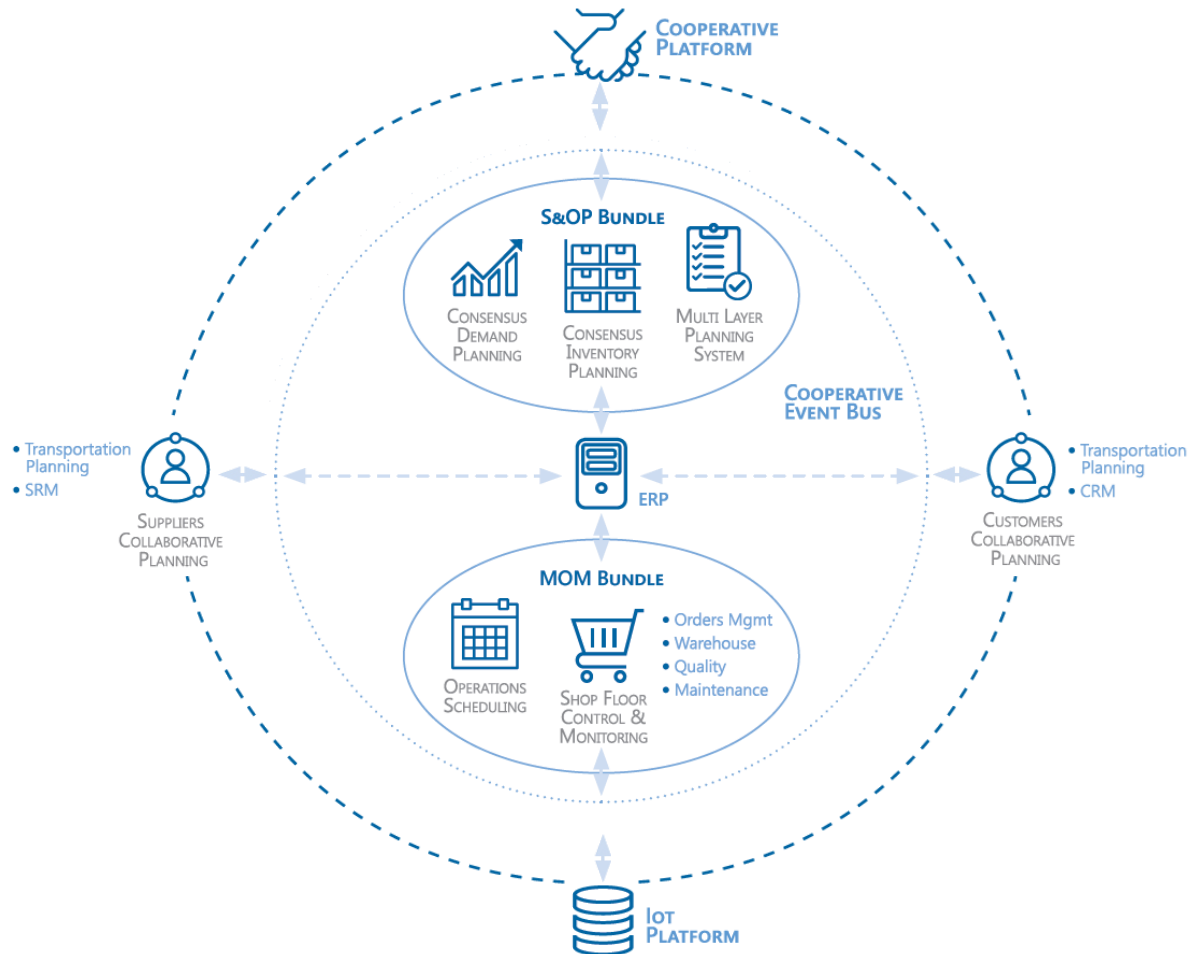
Standard Approach

One complete framework to support all the processes of the Supply Chain

- ○ S&OP bundle – From forecast to resources allocation
- ○ MOM Bundle – To optimize the production real time driven by the factory events

Extended Approach

Three new layer to manage transparently, coherently with a workflow based approach

- ○ Supplier network management
- ○ Customer network management
- ○ IoT devices network management

Cooperative Approach

Everything inside the Cloud based Cooperative Platform

- ○ To guarantee target sharing
- ○ To guarantee the needed information anywhere in any moment

COMPLETE
END to END SUPPLY CHAIN

COMPLETE — Supply Chain Framework

ERP & Local Data
- SAP
- ORACLE — JD EDWARDS
- STEALTH
- Microsoft Dynamics 365

IoT devices
Edge Computing interface

Smart Cooperative Data Management System

Cooperative Algorithms Network
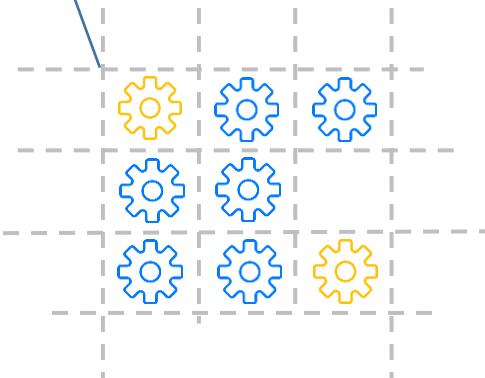
DGS Porini Smart Services & Third Parties Services

Artificial Intelligent Algorithms

Machine Learning Algorithms
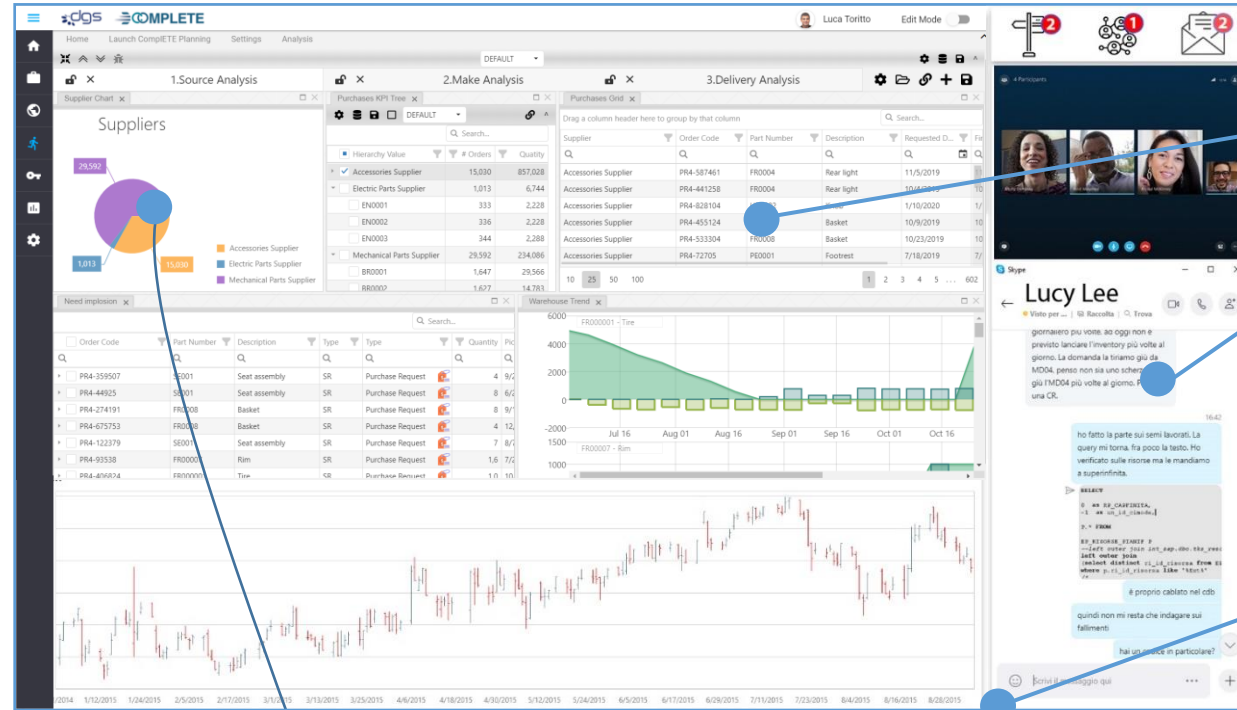
- Events Driven Workflow Notification Engine
- Multi Dimensional Customizable GUI
- Third Parties Widget & Modules integration
- Exogenous Series Management for AI algorithms
- Integrated Cooperative Platform
- Unique Microsoft Based Technology

COMPLETE
END to END SUPPLY CHAIN

CompIEtE Technology

Customer Devices

«Hummingbird» Presentation Layer — React — HTML5

SaaS Distribution Model
(Microservices Architecture) — Azure — SERVIZI APP

Social Layer {Web API} { REST }
YAMMER   TEAMS   SKYPE

DGS Web API Constellation { REST }
APP INSIGHTS

Sim1
Sim2
SimN

Simulative Environment

Cooperative Layer

Real Time Analysis & Forcing Engine

Workflow Event Engine
LOGIC APP   FLOW

Entreprise Service Bus

Big Data Services
HADOOP   DATA WHS   DATA LAKE

AI / ML Engine
COGNITIVE SERVICES   MACHINE LEARNING

DGS Smart Services

Third Parties Services

CompIEtE Tecnological DB — SQL — SQL AZURE

Data Sync

DATA FACTORY

Other Sources

IoT Hub & Edge Computing
IoT EDGE   SQL SERVER

Microsoft Dynamics 365   SAP ORACLE

Microsoft Dynamics CRM   TEAMCENTER

Local Client

- **Responsive Technology**
- **Multi Browser**
- **Single Page Application**

Cloud Server

- **Horizontal/Vertical Scalability**
- **Third Parties Algos Pluggable engine**
- **Deep Learning Approach**
- **Math-Euristic Algorithms**
- **Microservices Architecture**

Local Server

- **Distributed Local Intelligence**
- **Standard ERP Integration**

COMPLETE
END to END SUPPLY CHAIN

CompIEtE Technology

The information you need when you need where you need

CPPS & IoT in ComplEtE

Layer	Description	Technology
Collaboration & Process	Involving People & Business Process	ComplEtE Collaborative Microsoft Flow
Application	Reporting, Analytics, Control	ComplEtE Demand, ComplEtE Inventory, ComplEtE Planning, ComplEtE Scheduling, MS Power BI
Data Abstraction	Aggregation & Access	Azure Cosmos DB
Data Accumulation	Storage	Azure Data Lake Storage
Edge Computing	Data Element Analysis & Transformation	ComplEtE MOM
Connectivity	Communication & Processing Units	ComplEtE IoT Platform
Physical Devices & Controllers	All the «Things» in IoT	Machine Protocols, IoT devices & Platforms

"Building the Internet of Things / An IoT Reference Model", Jim Green, CTO Cisco Systems

COMPLETE
END to END **SUPPLY CHAIN**

COMPLETE Services

Consensus Demand Planning Smart Service

Extrapolative techniques of the historical series

- Computation of the best forecast curve by a parametric voting system (best-fit)
- Trend and seasonality computation with ad-hoc mathematical algorithms
- Automatic highlight of statistical anomalies (outliers)
- Capability of sporadic series study
- Forecast and projection of newness, substitutions and end-of-life products. Enhanced phase in and phase out management
- *Factors influencing demand*:
    - Detail level: SKU, product family, customer, region, …
    - Forecast horizon and bucket dimension (week, month, quarter, …)
    - Historical data:
        - Sell-in, sell-out, customer orders, …

Causal methods correlation based

- Multi-axis demand clustering
- Automatic correlation beetween orders / sales trends and exogenous variables
- Paramters, quantities and values forcings. What-if simulations.
- *Factors influencing demand*:
    - Company:
        - Sales data, Price, Promotion
        - Service Level
    - Marketplace:
        - Consumer perception
        - Demographics
        - Competition
        - Innovation
    - Regulation
        - Economics
        - Business Cycle
        - Weather conditions

Qualitative methods collaboration based

- Multi-axis top-down and bottom-up exploration of predictive and historical information
- Sharing and harmonization of data among different processes and users (sales, logistics, production)
- Forcings at every aggregation level
- Approving Workflow collaborative and easy to configure
- *Factors influencing demand*:
    - Customer initiatives
    - Events and promotions
    - Macroeconomic trend variations

COMPLETE
END to END SUPPLY CHAIN

Inventory Management Smart Service
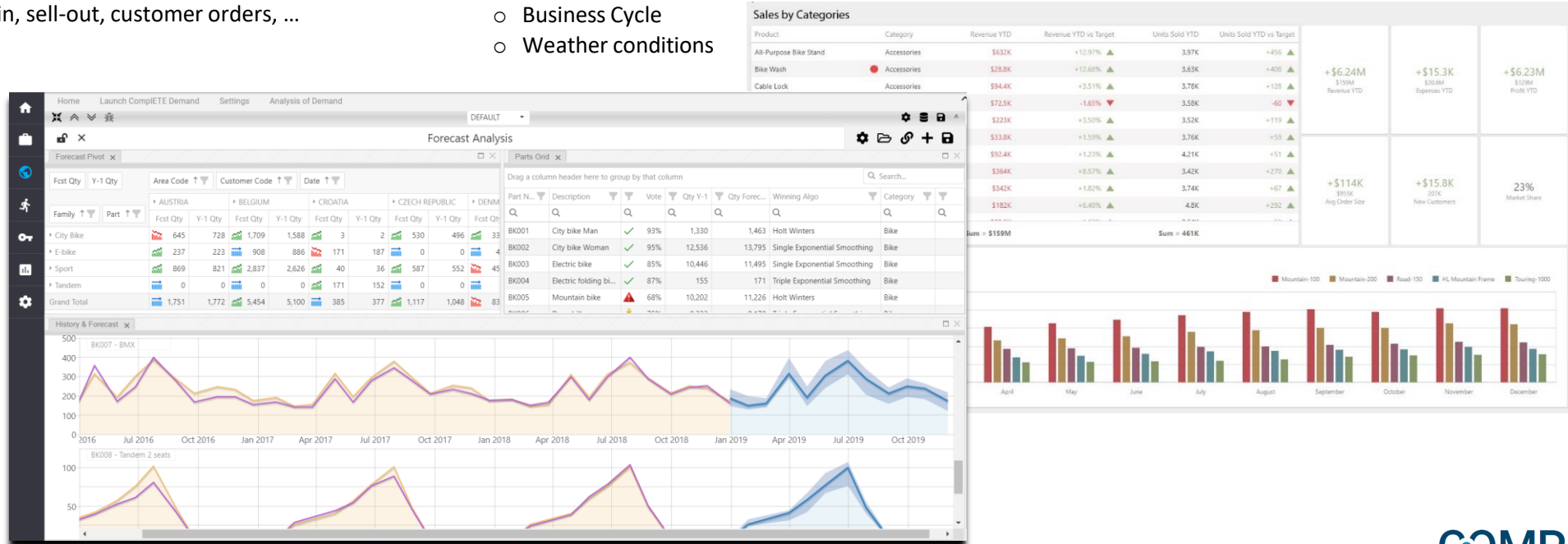
Stock Target Management

- Easy generation of the distribution network, the relationships beetween items and wharehouses, times and costs matrix.
- Safety stock computation, with heuristic or mathematic rules, for each item / logic node.
- Rolling real-time fine tuning of the safety stock proposals, as a function of a given safety stock level and the actual sales
- Sophisticated mathematical library (simplex method) for the optimization of the stock mix
- Customizable logics for demand slotting and for demand netting.
- Clustering and splitting paremerizable algorithms

Inventory Control

- Multi axis / wharehouse stock computation and monitoring.
- Real time computation of KPIs about costs, coverage time, stock rotation index, customer service, ...
- Generation of simulative scenarios, what-if evaluation of different policies about stock coverage, production, replenishment, ...
- Capability to force every element at every clustering level (multi-axis aggregation)
- Configurable and collaborative approval workflow
- Sharing, comparison and collaboration on different simulative scenarios, strategies, policies.

Master Plan Generation

- Replenishment plan computation, demand netting comparing independent demand (Customer Orders, Forecasts, Safety Stock needs) against the Deposit Plan (on-hand, productions, in-transit goods, planned work orders)
- Different math-heuristic algorithms for the Master Production Plan generation
- Shipping, suppliers and transportation calendars
- Multi-axis, multi-level and multi-hierarchy forcing at every aggregation level

Enterprise Production Planning Smart Service
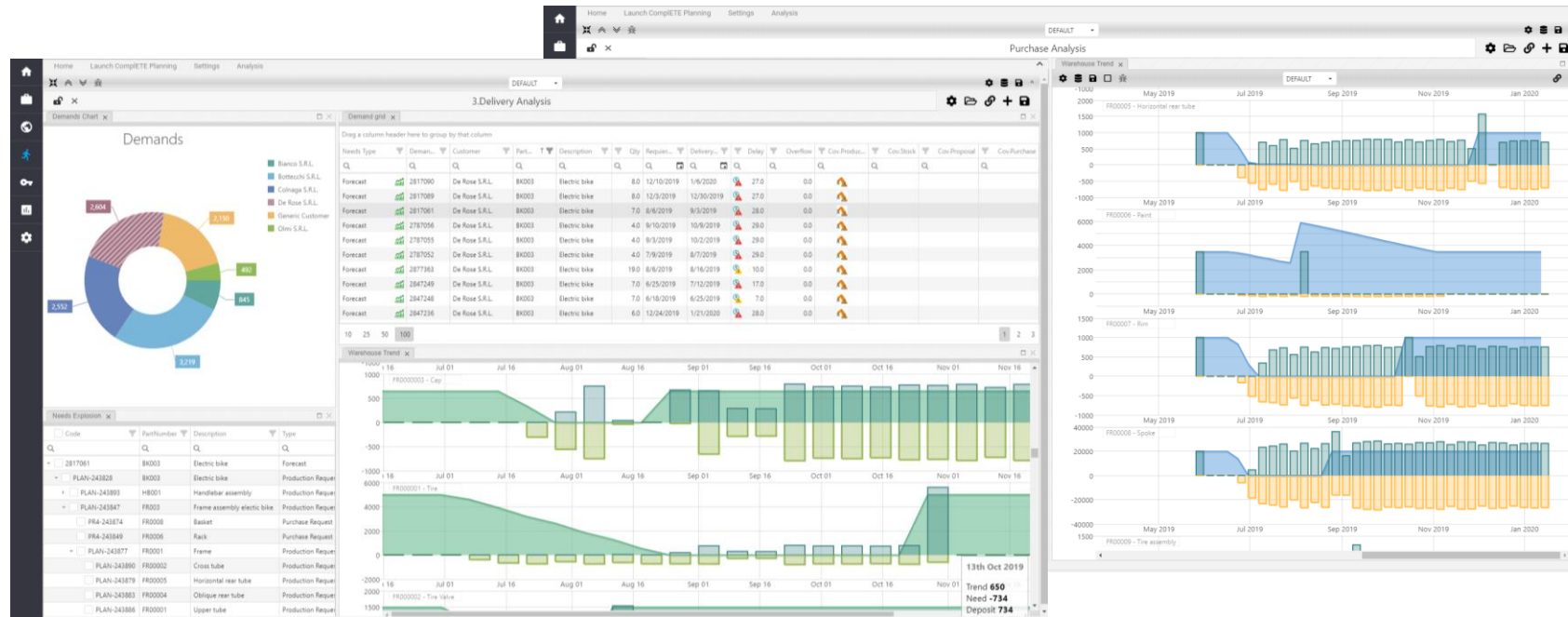
Resource Capacity Planning

- Indipendent demand aggregate planning, with finite / infinite capacity check of resources, assets, teams & constraints capacities.
- Tactical and operative planning on physical (machines, teams, assets) and logical (families, campaigns, …) resources and items
- Production proposal generation, finite capacity validated by considering complex BoM explosion, raw material needs, minimum lots, optimum mix logics.
- Cooperative and simulative environment with the purpose of sharing scenarios, what-if analysis and forcings in order to obtain a consensus MPS

Provisioning Planning

- Aggregate purchase plan on a medium term horizon
- Operative purchase plan (Master Purchase Plan) with purchase proposals computation according to the finite capacity check of all BoM levels constraints
- Capacity models (weekly / monthly rate, maximum supply capacity, …) for suppliers and contractors
- Critical materials and supppliers highlighting

Capable to Promise

- Real time evaluation of customer orders / demands fulfillment in term of lateness, financial and manufacturing impact
- Priority and ranking rules for orders fulfillment computation
- Multiplant, multiwharehouse and multilane logics.
- Order confirmation and «chain freeze» capability

Network Strategic Simulator Smart Service
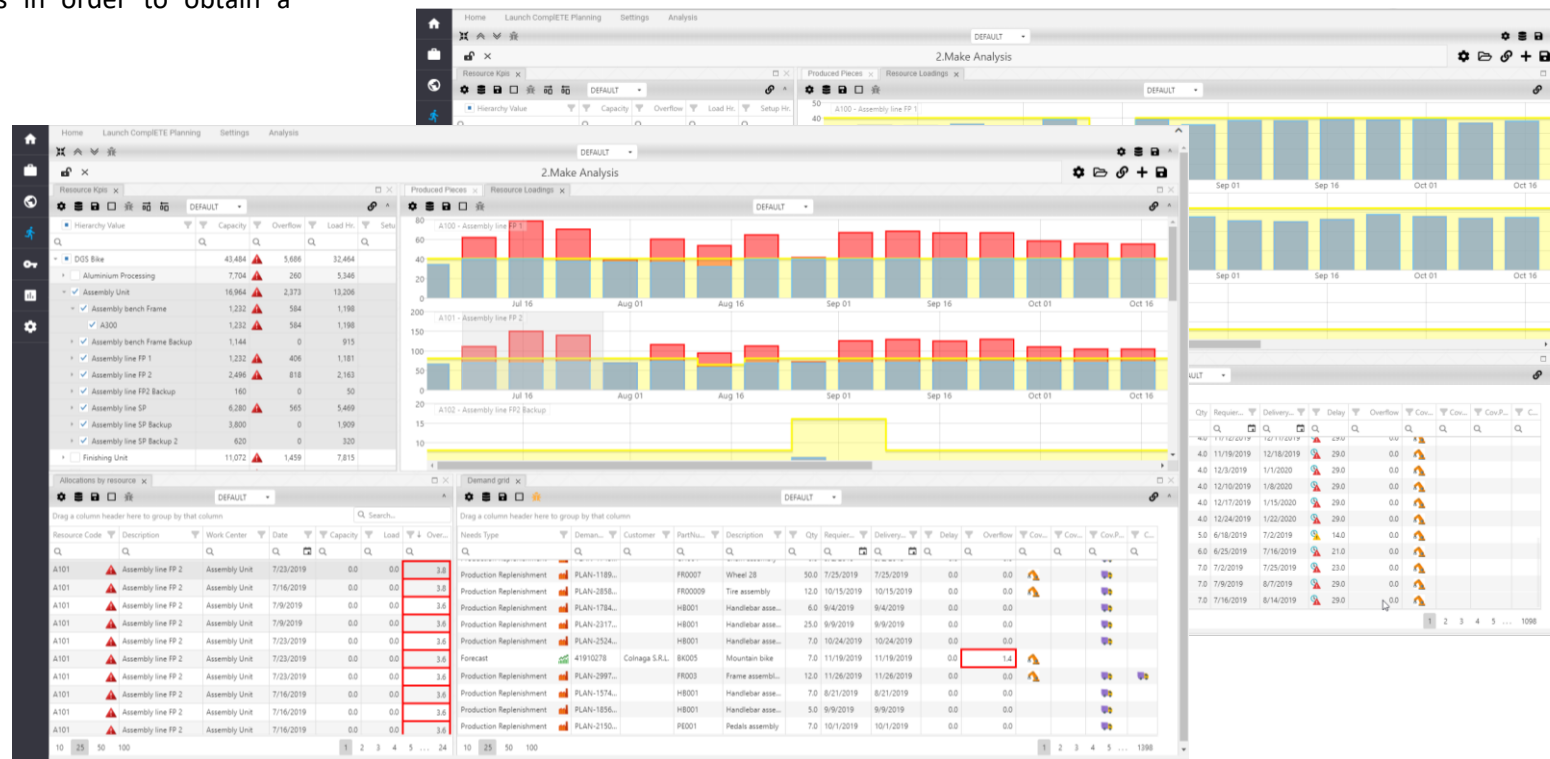
Main purpose:

Minimize the global balance (costs - revenues) in the entire planning horizon and in the entire logistic perimeter.

- Revenues as the sum of the gross incomes from all the satisfied customers' demands .
- Costs as the sum of the following components:
  - Material travel costs within the network (for each transport type: plane, truck, train…)
  - Purchases of raw materials from suppliers
  - Variable cost related to production and management of material
  - Fixed cost for the usage of productive or distributive resources
  - Costs of activation or deactivation of any productive, distributive network node
  - Penalty due to not-satisfied demands

Main characteristics:

- Productive and distributive network design considering node transitions cost and time
- Mathematical algorithms to compute the optimal demand, production, distribution allocation, through production and distributions nodes
- Multi-level complexity model to aggregate or disaggregate productive and distributive resources, adapting them to the desired level of complexity
- Multi-simulation and multi-scenario system to evaluate distributive and productive network performance
- Automatic alerting system for the productive and distributive bottle necks.
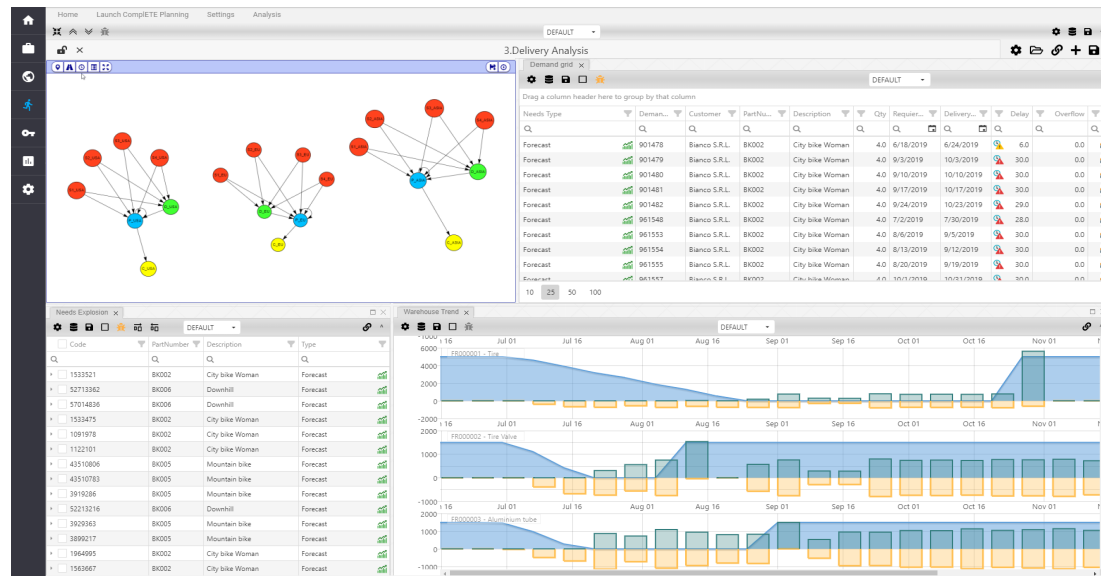
- Demand profile iterative calculation on all the levels of the distribution network (multi-level reforecast)
- Target stock and Replenishment need calculation on all the levels of the distribution network
- Material need propagation through the logistic network and critical missing real-time evidence alerting system
- Automatic distribution plan definition accross all the network nodes
- Integrated cooperative system to evaluate and synergize several distribution plans
- Approvative and cooperative configurable workflow

Suppliers Collaborative Planning Smart Service

Work Plan Collaboration

- Fully or partially integrated with the company supplier portal
- Create, validate e publish short or middle-term plans to suppliers and constractors
- Share documentation as sketches, technical schemas, control and preparation plans
- Select the best supplier through auctions or calls for tender
- Workflow based debate on shipment dates, plans, costs and quality
- Order confirmation events alerts or automatize ERP system order confirmation procedures

Work Plan Execution

- Incoming materials management reports
- Control and Share plan progress with all actors involved
- Real time monitoring of stock level for any owned internal and external warehouse
- Quality control plans execution
- Control the preparation and the execution of delivery plans

Notification Management

- Integrated event logging system and workflow engine to generate and dispatch alerts when needed where needed
- Different calendars for internal production and any supplier
- Company mailing system integration
- Notifing engine to alert on inspection plan and quality control activities
- Real-time monitoring system on costs, delays, quality and bottle neck of any managed process

COMPLETE
END to END SUPPLY CHAIN
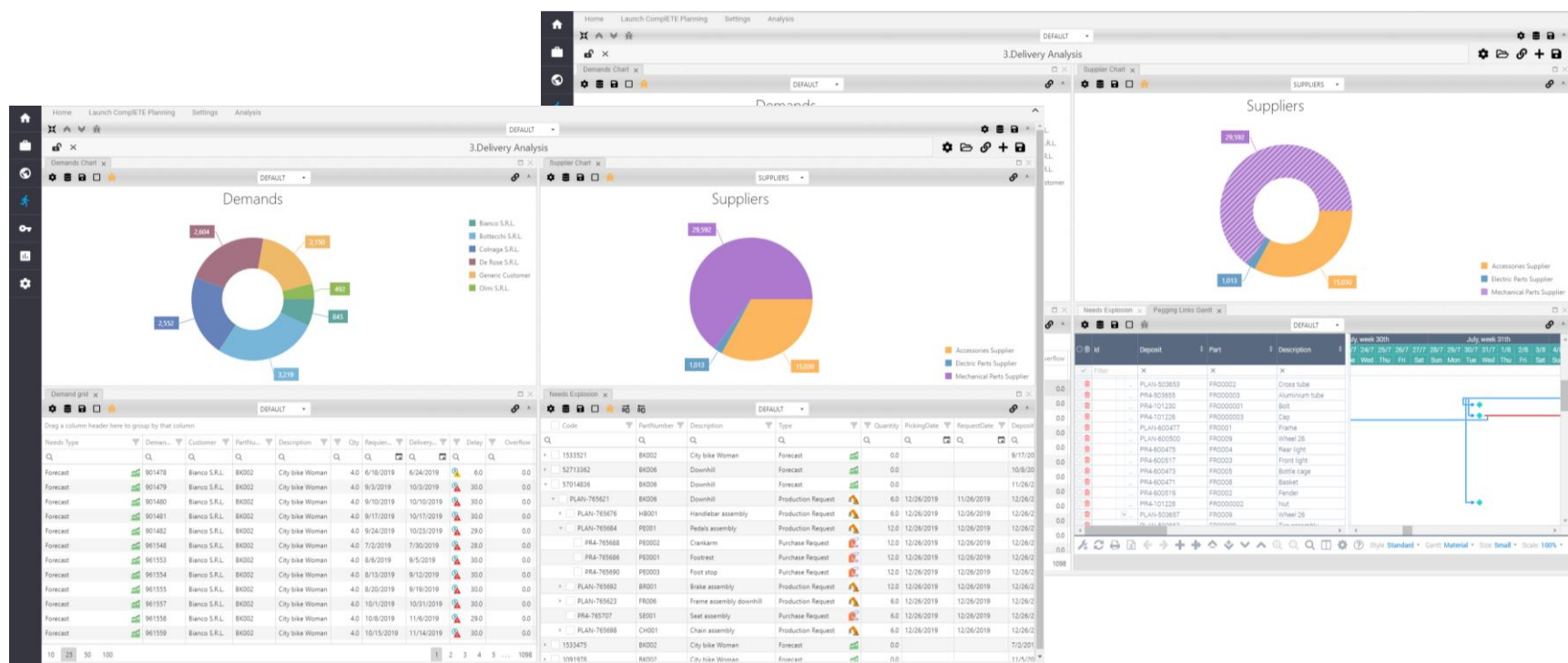
Plant Operations Scheduler

- Operations Scheduling and Syncronization
- Constrained activity allocation on plants, working centers, machines, work teams, tools, materials and generic assets
- Complete integration with the planning system to inherit strategical/tactical level defined production/commercial constraints.
- Multi step Push-Pull activities scheduling
- Impact analisys of high priority demands on the actual scheduled production plan
- Multi-simulative and multi-scenario forcing environment, to rapidly change the production plan and support decisions
- Real-time reaction of graphical objects during forcing, to understand immediately violated constraints and possible solutions
- Short-term purchase plan proposal and sollicit report to identify the most critical purchases still not delivered
- Critical materials report to identify the impact of shortage and evaluate possible alternatives (make or buy / alternative resources)

Local Optimizer

- Sequence optimization by working center, machine, local machine groups
- Local rescheduling optimization, considering planning inherit constraints and shop floor feedback
- Production constraints (resources, materials, work teams, tools) and logical constraints (sequence, parallelization, pert relations, partial deposits, production compatibility) management
- Production plan generation and deploy to operators and production lines through notifications on smart accessories (if supported) and by e-mail
- Requirements plan deploy to warehouse, quality and maintenance offices
- Cooperative advanced system to manage the cohexsistence of multiple planners and possible inconsistencies
- Monitoring and real-time reactions to shop floor events with automatic or semi-automatic rescheduling procedure with automatic publishing of impact reports

COMPLETE
END to END SUPPLY CHAIN
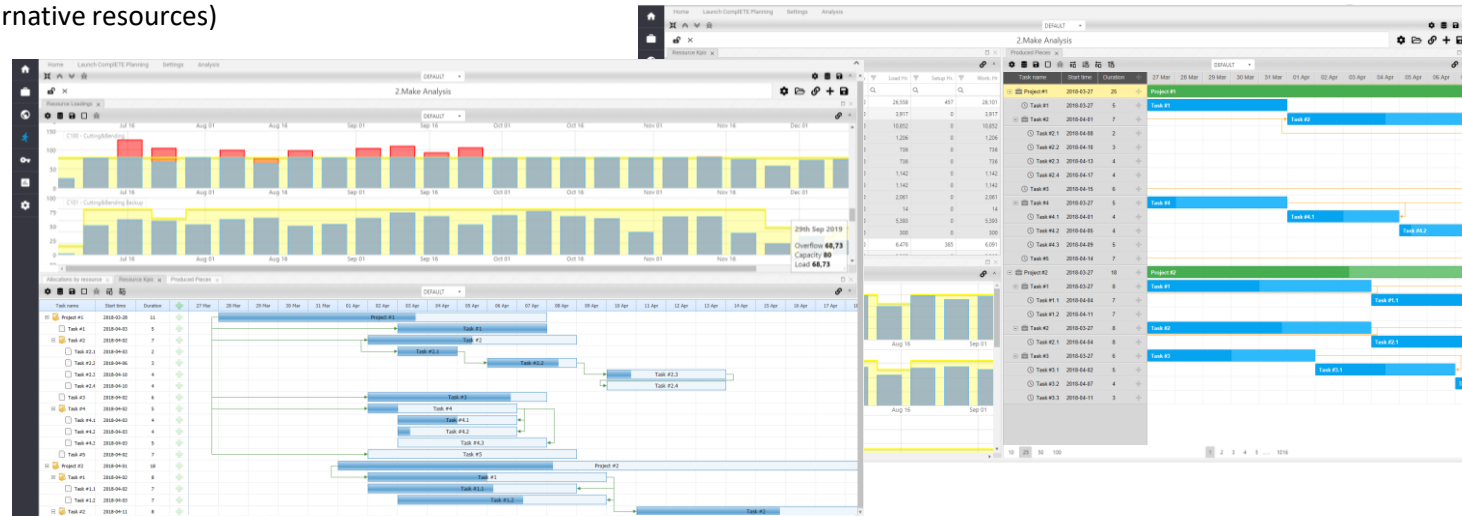
Orders Management

- Recording of start and suspension events, restart and end of each activity (setup, startup, working, reworking, maintenance) linked to order/operation to calculate, automatically, machine and personell time.
- Recording of the the progression of produced, scrapped and «wait for approval» quantities.
- Recording of downtime events linked to order/operation.
- Association between operators, machines, tools by order/operation.
- Recording of usage of materials lots by order/operation.
- Lots tracking and tracing , orders genealogy.
- Online documentation access (drawing, products card, pictures, clips)
- Production documentation generation (work order, sheet, labels, picking list)
- Constraints and progress rules configurability.
- Graphic User Interface composable and responsive on every device (pc, tablet e smartphone)
- Native integration with *IOT Platform*
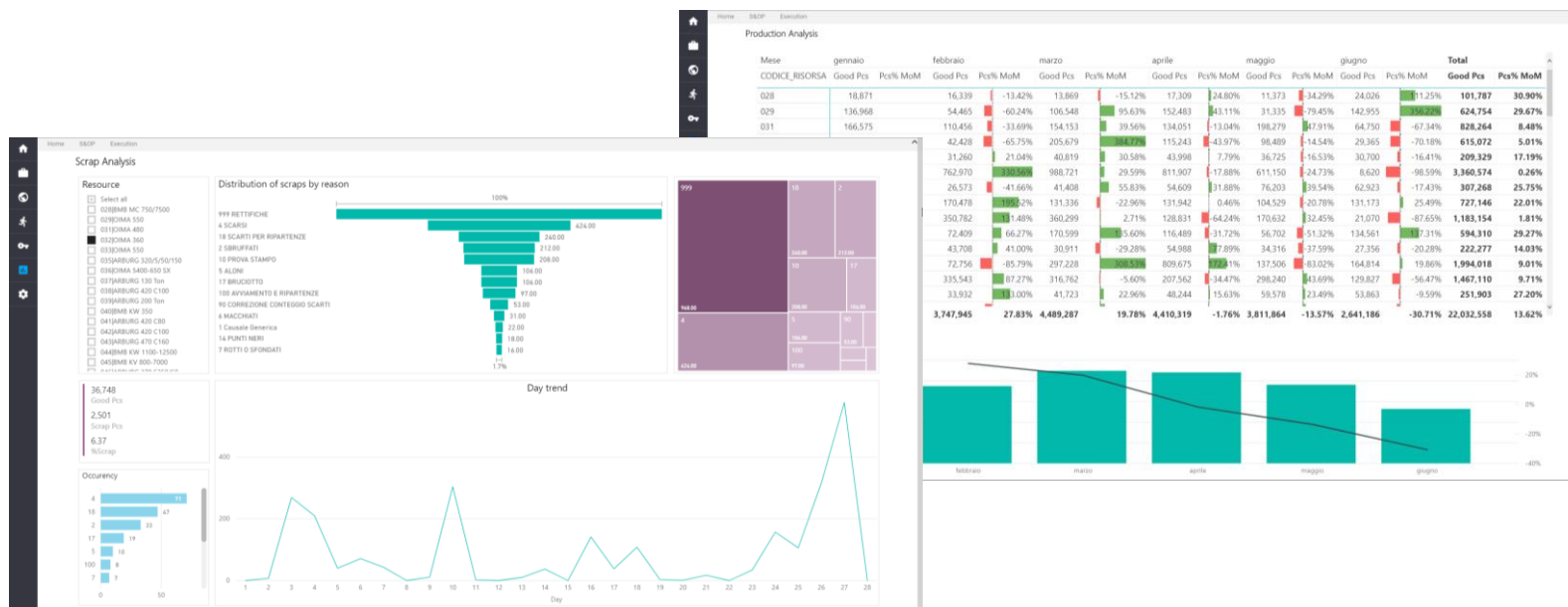
Warehouse

- Products and material warehouses mapping
- Inter-operational warehouses mapping (wip)
- Picking missions generation for feeding production and shipment
- Deposit missions generation for storing on warehouse or feeding production
- Handling units cycle of life management
- Movimentation missions execution
- Missing and give back materials management
- Scraps,reworking,repair management
- Product re-configuration (remove and put)
- Material acceptation management
- Shipment management
- Warehouses level real time monitoring

Quality

- Document management
- Input material sequence of controls linked to vendor rating
- Subcontractor's material controls
- Suppliers vendor rating calculation
- Control plans management and association to productive processes
- Management of no-compliance, claims, corrective and preventive actions
- Inspections and audit management
- Measuring equipments management
- Finished product quality management
- Automatic production controls, driven by collecting data from *IOT Platform*
- Check-list, (Kpi) and dashboard
- Human resource management

Maintenance

- Predictive maintenance
  - Alert generation through the usage of predictive models based on machine learning methods, fed by IOT Platform real time data
  - Remote interaction with machines, sensors, in order to activate and edit measuring parameters (frequency, thresholds, ..)
- Preventive maintenance
  - Maintenance plans generation, depending on expiration policies
  - Interventions plan assigned to the maintener men
- Extraordinary maintenance
  - Call management on downtime or other events
  - Alert generation and forwarding to maintenace responsible or operator (Pc/tablet/smartphone)
- Spare parts and components warehouse management
- Maintenance activities execution, recording time spent and spare parts used
- Main maintenance KPIs (ISO 22400) monitoring:
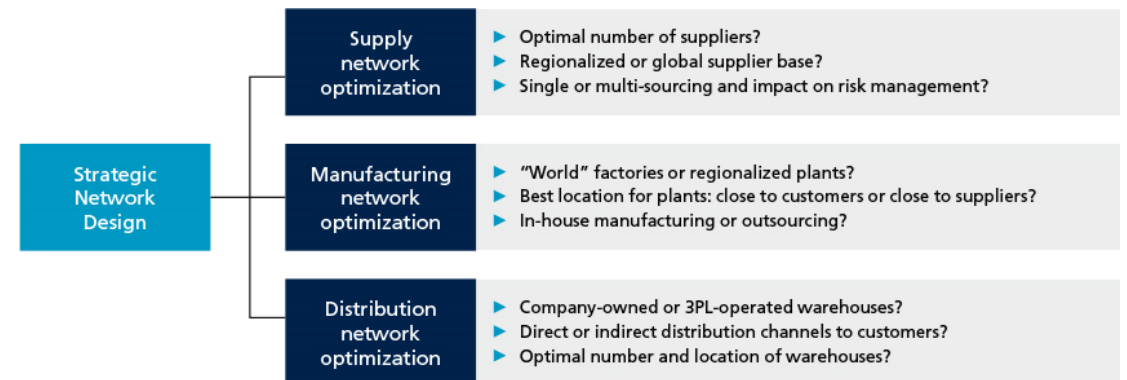 MTBF (Mean Time Before Failure), MTTF (Mean Time To Failure), MTTR (Mean Time To Repair)

COMPLETE
END to END SUPPLY CHAIN
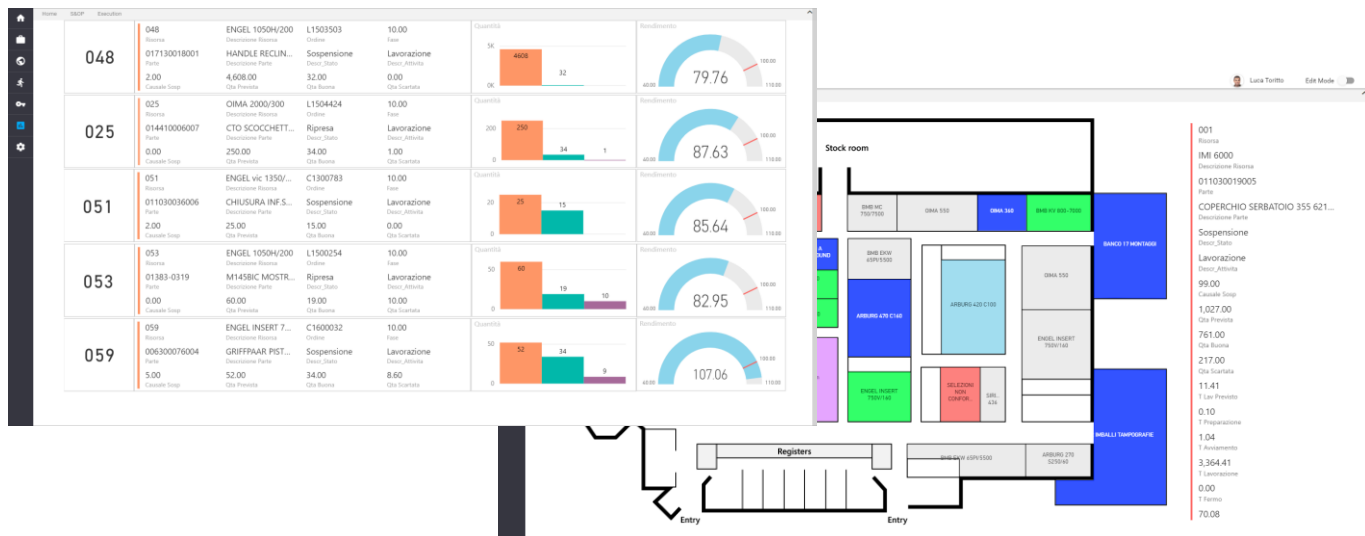
Deep Dive into the Strategic Network Simulator Solution

COMPLETE Strategic Network Modelling

Demand Management
- Forecast with ML approach
- Collaborative Consensus Forecast

Network Inventory Management
- MPS generation
- Safety Stock computation
- Network Design
- Multi-Level Inventory Management

Order Promise
- Heuristic approach to SL optimization
- Smart lanes & fair share rules

Enterprise Production Planning
- Forward & backward Finite Capacity Allocations
- Hard & Soft Constraints
- Multi-Plant / Multi-Wharehouse model
- Strategical / Tactical what-if scenarios

Supplier Collaboration
- Supplier Collaboration Module
- Supplier Orders Management

Company ERP

Production Scheduling
- Plant Sequence Optimization
- Realtime simulative production environment

Shop Floor Management
- Real time production data collection and reaction
- Protocols or User Interface Data Collection

The Network Design & Modelling is a part of the Network Inventory Management module in the ComplEtE suite. It allows to design and simulate strategic scnarios, providing optimal solutions regarding supplier base, manufacturing footprint and distribution systems, helping the user to take proper network design decisions

Strategic Network Design

Supply network optimization
- Optimal number of suppliers?
- Regionalized or global supplier base?
- Single or multi-sourcing and impact on risk management?

Manufacturing network optimization
- "World" factories or regionalized plants?
- Best location for plants: close to customers or close to suppliers?
- In-house manufacturing or outsourcing?

Distribution network optimization
- Company-owned or 3PL-operated warehouses?
- Direct or indirect distribution channels to customers?
- Optimal number and location of warehouses?

The strategic value of network design: Maximize profitability

The design of robustly operating and highly efficient networks for global operations is widely perceived as one of the key challenges in supply chain management.

Network design plays a crucial role for companies in all industries striving to deliver outstanding supply chain performance.

Network design ensures the efficiency of global and often complex operations.

Network design ensures that the supply chain is ready to support the strategy of the business and sustain the competitive advantages of the company in the long term.
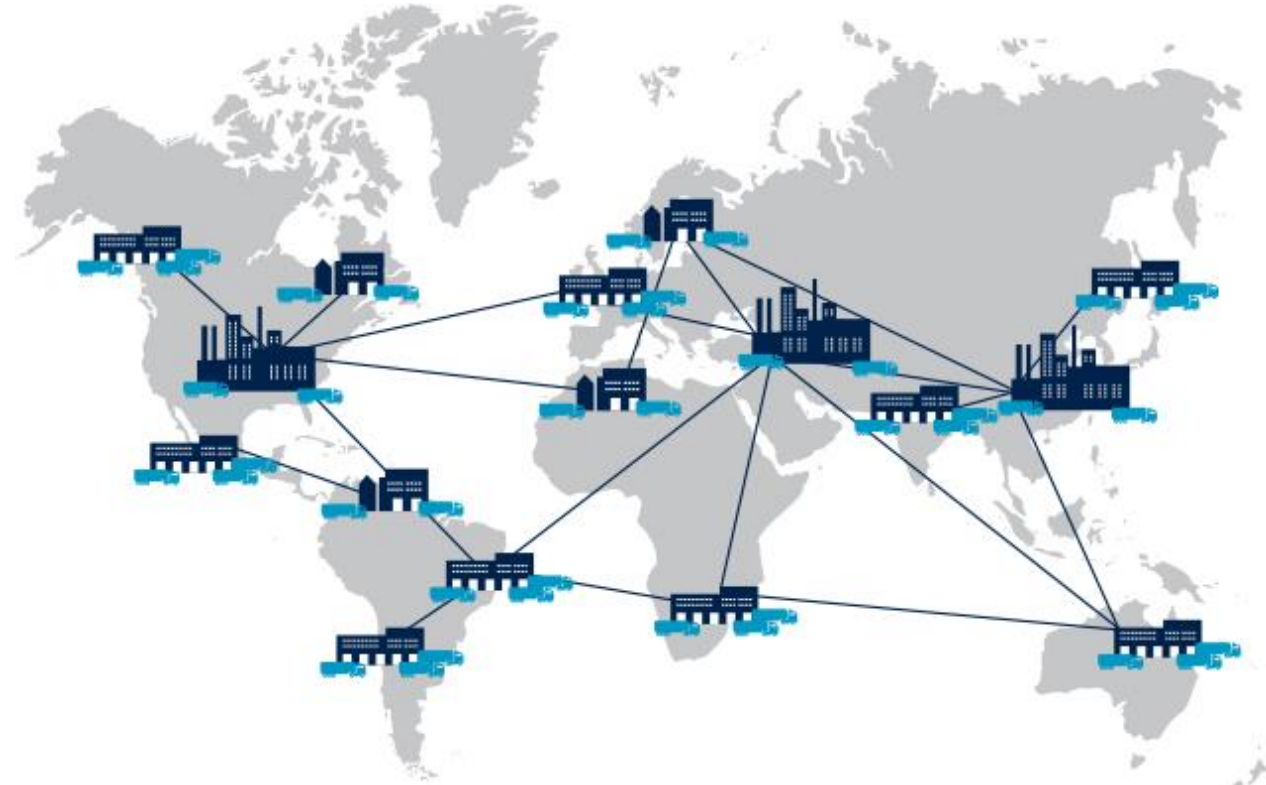
Source: Camelot – Strategic Network Design

COMPLETE
END to END SUPPLY CHAIN

The Objectives

The objective of strategic planning projects in supply chain is to design optimal networks in terms of **overall margin.**

In this respect ComplEtE Strategic Network Modelling objective is to minimize a function that takes into account:

- *Revenues* of final products purchased by customers;

- *Costs* due to:

  1. Production variable costs;
  2. Production fixed costs;
  3. Replenishment from suppliers for row materials;
  4. Transportation costs of parts within the network;
  5. Activation of new nodes;
  6. Deactivation of obsolete nodes;
  7. Demands not satisfied;

Features

The solution of the problem implements the following features:

- Maximum global capacity on nodes;
- Maximum capacity on nodes for a single produced part;
- A node can be activated only one time;
- A node can be deactivated only one time;
- An activated node can't be deactivated and vice versa;
- Customers can require final product with a maximum make span;
- Each node and arc can carry its lead time to the production/transport;

$$min \sum_{0 \leq t \leq T} C^t - R^t$$

where:

$$C^t = \sum_{i,j,p} x_{ijpkt} \left(cv_{ipt}^n + cv_{ijpk}^a \right) + \sum_{i,p} y_{ipt}^1 \cdot cf_{ipt} + \sum_i y_{it}^2 \cdot cf_{it} + \sum_i z_{it}^1 \cdot ca_{it} + \sum_i z_{it}^2 \cdot cd_{it} + \sum_{i,p} dns_{ipt} \cdot cv_{ipt}^n$$

$$R^t = \sum_{i,j,p} x_{ijpkt} \cdot rv_{jpt}$$

Tool Usage

- The Tool works inside the ComplEtE framework; it relies on the complete technological DataBase and use all the smart components the framework offers (simulation engine, what-if analysis, forcings, events, …)
- Each data can be imported via an ETL process (if present) or can be edited and maintained directly on the Tool.
- Every Analysis can be performed via the Data Analysis tools in the ComplEtE framework

COMPLETE
END to END **SUPPLY CHAIN**

Time Horizon

If the new number is greater than the current one, the parameters of the first period will be replicated in the new ones

If the new number is lower than the current one, data from the excess periods will be deleted

Number of periods: 8

Horizon start (year): 2020

Period length (month): 3 ▾

Confirm   Cancel

Node 3 (Producer) ✏ 🗑

Description...

Enable: ☑   Activated: ☑

| 1 Q '20 | 2 Q '20 | 3 Q '20 | 4 Q '20 | 1 Q '21 | 2 Q '21 |
| 3 Q '21 | 4 Q '21 |

Total Capacity: 30000 →

Fixed Cost: 1000 →

Deactivation Cost: 1000 →

- Number: how many periods there are;
- Length: the duration of a single period, chosen among monthly, two-month, three month, a quarter, half year and a year;
- Start: the year of the first period.

N.B. According to the input values, periods' label on nodes change.

COMPLETE
END to END SUPPLY CHAIN

Create New Node

Node Type

Node Name:

Description...

Enable: ☑ Activated: ☑

(Information enter below will be replicated for all periods. They can be modified later.)

Total Capacity: 999999

Fixed Cost: 0

Deactivation Cost: 0

Insert   Cancel

- Node Type: chosen between Customer, Producer, Distribution and Supplier;
- Node Name: unique Id of the node;
- Enabled: checked if the node has to be considered or ignored in future simulation;
- Activated: checked if the node, at the first period, is already present or not;
- Total Capacity: global production capacity (with no particular unit of measure);
- Fixed Cost: cost to pay at each period in which the is active;
- Deactivation / Activation Cost: cost to pay to deactivate or to activate the node.

N.B. The mask (and so the input required) changes according to the Type and Activated value. Moreover, once a node is added, its aspect (color and border style) also changes according these parameters.

Node 1 — Supplier

Node 2 — Producer

Node 3 — Distribution

Node 4 — Customer

Node — Enabled & Activated

Node — Not Activated

Node — Not Enabled

COMPLETE
END to END SUPPLY CHAIN

- To add a link, simply drag&drop from the source to the destination;
- A link can't be added twice between the two same nodes;
- If the source and the destination are the same node, a self-link will be added.

- A list represents the parts;
- Nested Lists represent components with quantity;
- To add a new part, just the name is required;
- To add a component, the sub-part and the quantity are required.

- Part: part to add;
- Capacity: the actual capacity for this part;
- Cap. Conversion: conversion coefficient to relate the production with the global node's capacity;
- Variable Cost: unitary cost;
- Fixed Cost: cost to pay if the part is effectively produced;
- Lead Time: time necessary for the production;
- Is Inventory: checked if this node has an inventory for this part, so that the cumulated lead time before this node becomes 0;

N.B. Also here, according to the node type, mask can change, and data get different meaning. For example, for customer's node, lead time means the maximum time for the demand's satisfaction, and capacity becomes demand.
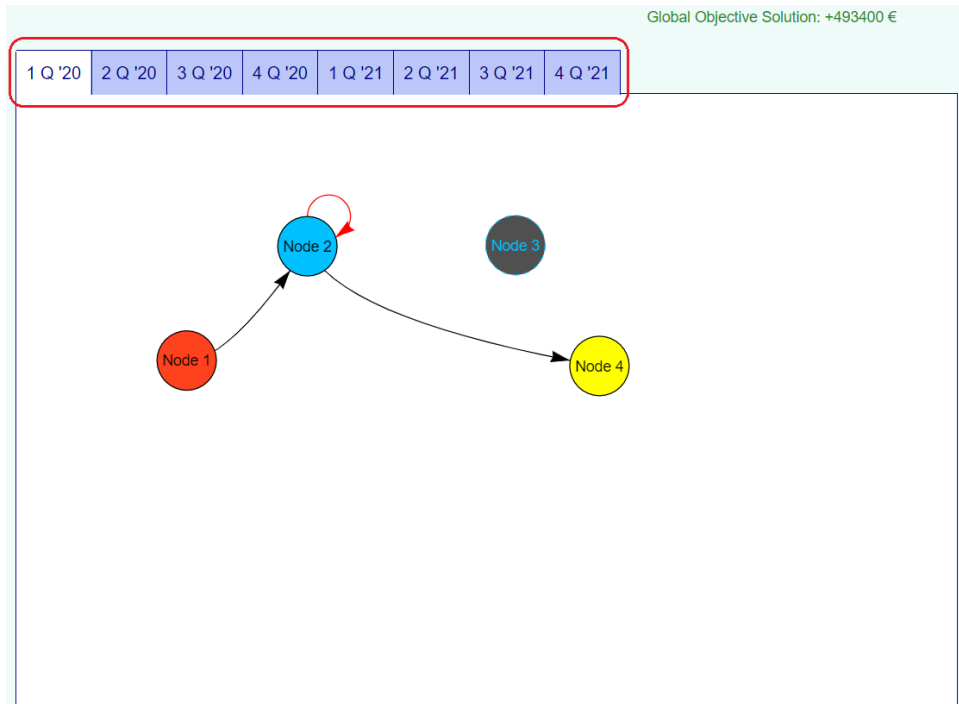
- Part: part to add;
- Transport type: the transportation mode, chosen among road, rail and by sea;
- Capacity: maximum capacity through this arc with this transportation mode for this part;
- Variable Cost: unitary cost of transport;
- Lead Time: transportation time.

Global Objective Solution: +493400 €

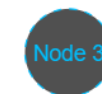| 1 Q '20 | 2 Q '20 | 3 Q '20 | 4 Q '20 | 1 Q '21 | 2 Q '21 | 3 Q '21 | 4 Q '21 |

- Global objective solution is shown;
- Toolbar allows to navigate the solution through periods;
- Nodes are represented according to their status in the solution;
- Clicking on node and on arc it is possible performs a cost analysis.

Node 2	Node 2	Node 3	Node 3
Normal	Activated	Deactivated	Not-Used

COMPLETE
END to END **SUPPLY CHAIN**

1 Q '20

Demands completely satisfied

Cost: 39200€   Revenue: 100000€

Activated Nodes: Deactivated Nodes:
- Node 2   - Node 3

- The satisfaction or less of the demand is provided;
- Total costs for this period;
- Total revenues for this period;
- List of activated nodes;
- List of deactivated nodes.

COMPLETE
END to END **SUPPLY CHAIN**

Cost Analysis:

- Activation Cost = 0€
- Fixed Cost for Part 2 = 100€
- 2000 Part 2 = 10000€ (6 d)
- Fixed Cost for Part 3 = 100€
- 1000 Part 3 = 5000€ (7 d)

Cost Analysis:

- 1000 Part 3 on road = 1000€

Each of these costs and quantities is indicated only if it is present.

- Cost of activation/deactivation;
- General fixed cost;
- Quantity and variable cost for each produced part;
- Cumulated lead time of a part;
- Fixed cost related to part;

- Quantity, transportation mode and variable cost of a transported part.

COMPLETE
END to END SUPPLY CHAIN