



POLITECNICO
MILANO 1863

DIPARTIMENTO DI CHIMICA,
MATERIALI E INGEGNERIA CHIMICA
GIULIO NATTA

ENVISIONING THE FUTURE OF CHEMICAL PLANTS IN TRANSITION ERA

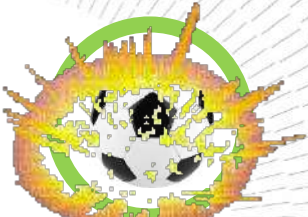
Decarbonization + digitalization to tackle grand challenges

Flavio Manenti

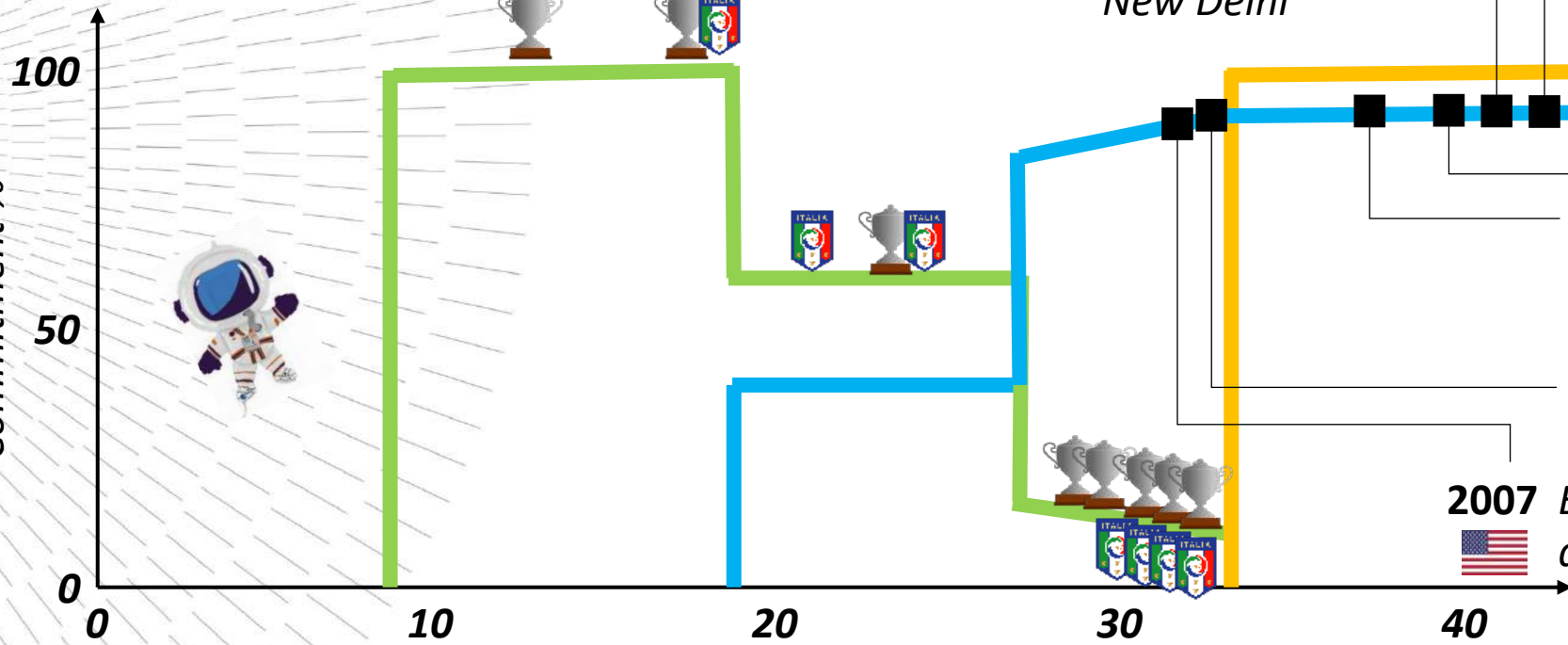
LIFE SUMMARY

MASS BALANCE ✓
 COMPONENT BALANCES ✓
 ENERGY BALANCE ✓
 MOMENTUM BALANCE ✓

✗ NOT VALIDATED
 THEORIES/AGENDA



Commitment %



Years

CHEMICAL PLANTS in TRANSITION ERA

DIGITALIZATION

Operations management



New process design

DECARBONIZATION

CHEMICAL PLANTS in TRANSITION ERA



New process design
DECARBONIZATION

DECARBONIZING CHEMICAL PLANTS

NATURAL GAS
OIL
COAL



MAX PROFIT
MAX PRODUCTION
GLOBALIZATION



FUELS
CHEMICALS
COMMODITIES

BIOMASSES
AGRI-FOOD RESIDS
(MICRO-)ALGAE
PLASTIC MIX
VULCAN'D RUBBERS
SLUDGES
CARBON DIOXIDE
OTHER EMISSIONS
WASTES
BY-PRODUCTS
WASTEWATERS



BIO-FUELS
BIO-METHANOL
BIO-ETHANOL
BIO-DME
BIO-METHANE
GREEN HYDROGEN
BLUE HYDROGEN
LUBE BASES
OLEFINS
BIO-POLYMERS
FERTILIZERS

DECARBONIZING CHEMICAL PLANTS

NATURAL GAS
OIL
COAL



BIOMASSES
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OTHER EMISSIONS
WASTES
BY-PRODUCTS
WASTEWATERS



MAX PROFIT
MAX PRODUCTION
GLOBALIZATION

LOCAL MARKETS
ZERO EMISSIONS
ZERO RESIDUES
CIRCULARITY
SYMBIOSIS
NEXUS
SELF-SUSTAINABILITY

FLEXIBILITY
OPERABILITY
CONTROLLABILITY



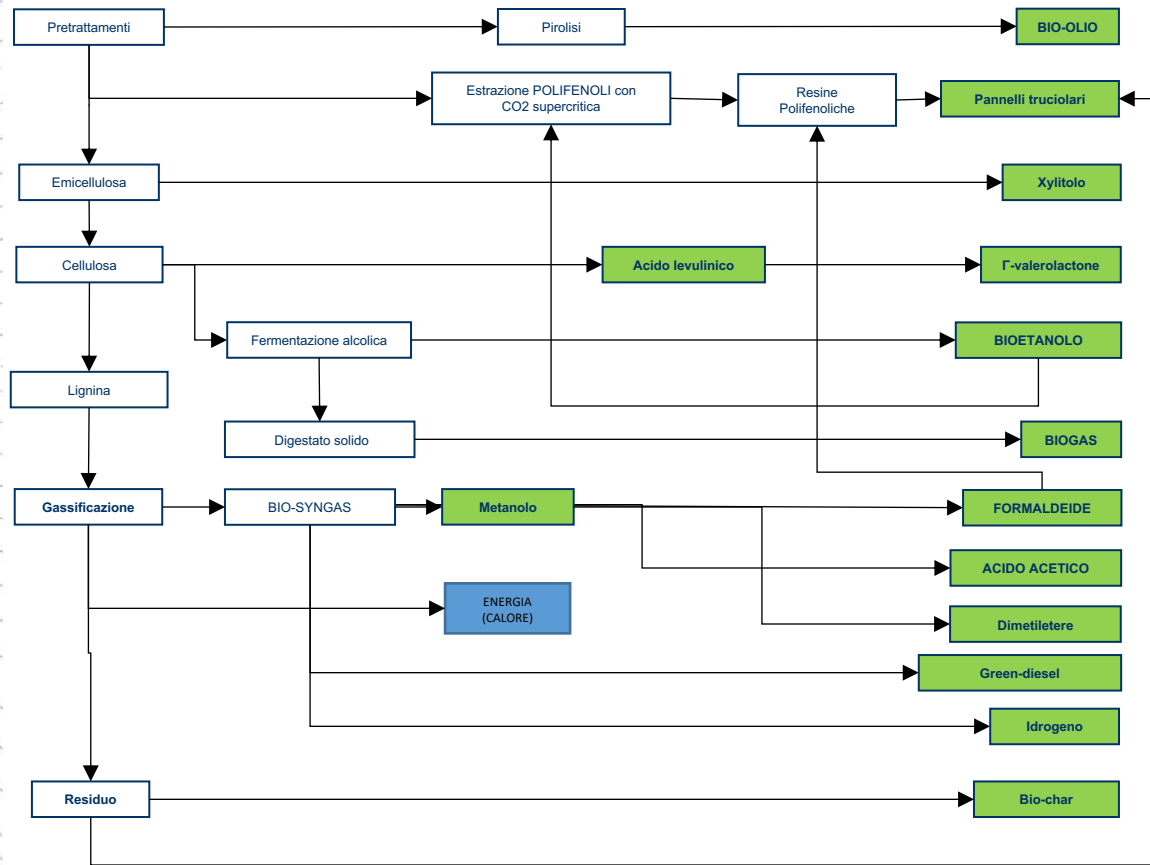
FUELS
CHEMICALS
COMMODITIES



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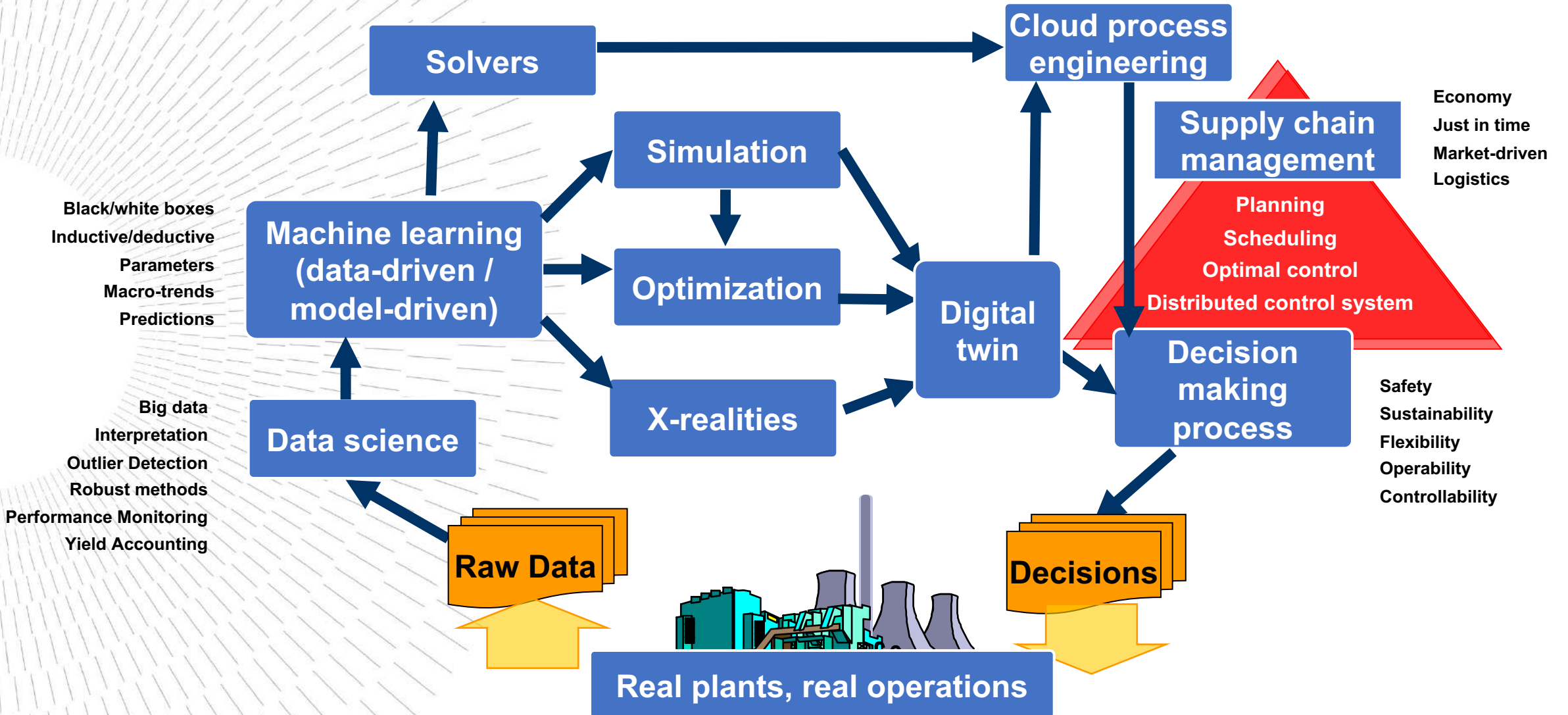
CHEMICAL PLANTS in TRANSITION ERA

DIGITALIZATION

Operations management



DIGITALIZING CHEMICAL PLANTS





DATA



24 MLN €

Last 5y, investments on reserach and process industrialization

484

Indexed published papers, proceedings and books

21

Filed patents on CO2 utilization and green/blue hydrogen synthesis

EXPORTING the VISION to EUROPE



CAPE-WP /
EFCE
President-elect,
London UK, 2018-
2024



... and **WORLDWIDE**

Process Systems Engineering World
President-elect in Kyoto JP, 2022-2024





THANK YOU

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