

SAWAVE

web edition

14 aprile 2021

Industrial analytics e machine learning guidano la Digital Transformation: la visione di GE Digital per la fabbrica interconnessa

Mario Testino



Soluzioni per l'analisi avanzata di processo

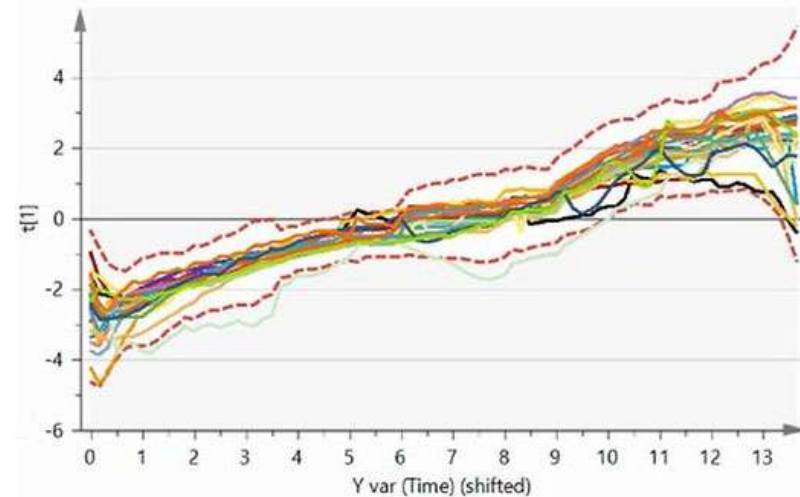


Mario Testino
COO di ServiTecno

La complessità dei processi produttivi

L'analisi dei dati del processo è molto molto complessa. Ci sono molti insiemi di dati, provenienti da diverse fonti e per trasformarli in informazioni significative è necessario un metodo per gestirli in modo che siano tutti nel posto giusto al momento giusto

- Identificare alla radice la causa dei problemi nelle lavorazioni
- Identificare il lotto migliore nel tentativo di replicarlo
- Ridurre i costi e gli sprechi
- Migliorare l'efficienza e la qualità

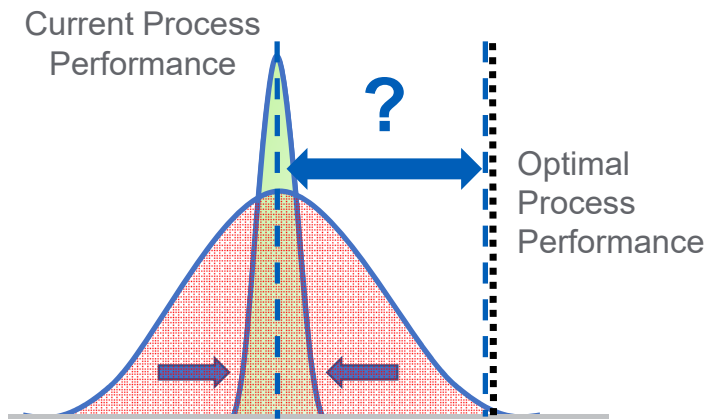


Comprendere il processo in profondità

1. CAPIRE le variazioni di processo

Analisi di processo

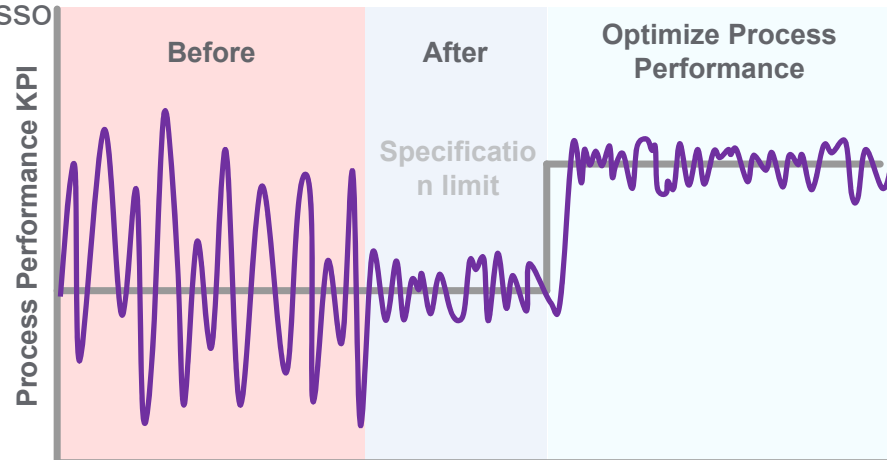
Ottieni nuove informazioni dai dati e scopri le cause profonde delle variazioni delle prestazioni di processo



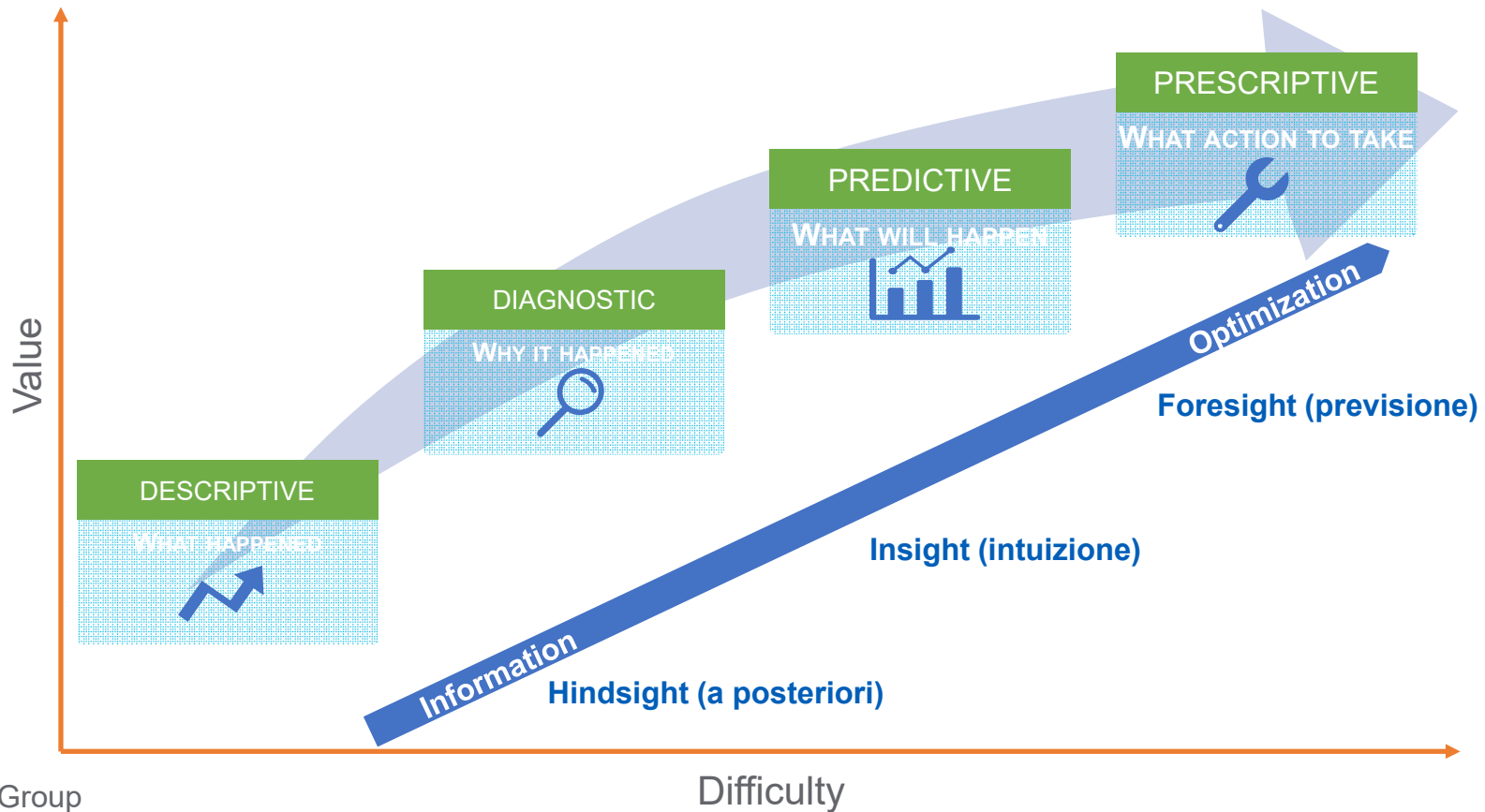
2. RIDURRE le variazioni di processo

Monitoraggio e Predizione del processo

Monitorare le prestazioni del processo per rilevare tempestivamente le deviazioni e prevedere guasti e KPI per ridurre la variazione delle prestazioni del processo



Un maturity model per l'analisi dei "big data di impianto"



Source: Gartner Group

Difficulty

3 Temi che supportano lo sviluppo digitale

La manodopera digitale è l'elemento fondamentale della modernizzazione delle aziende industriali



GE Digital

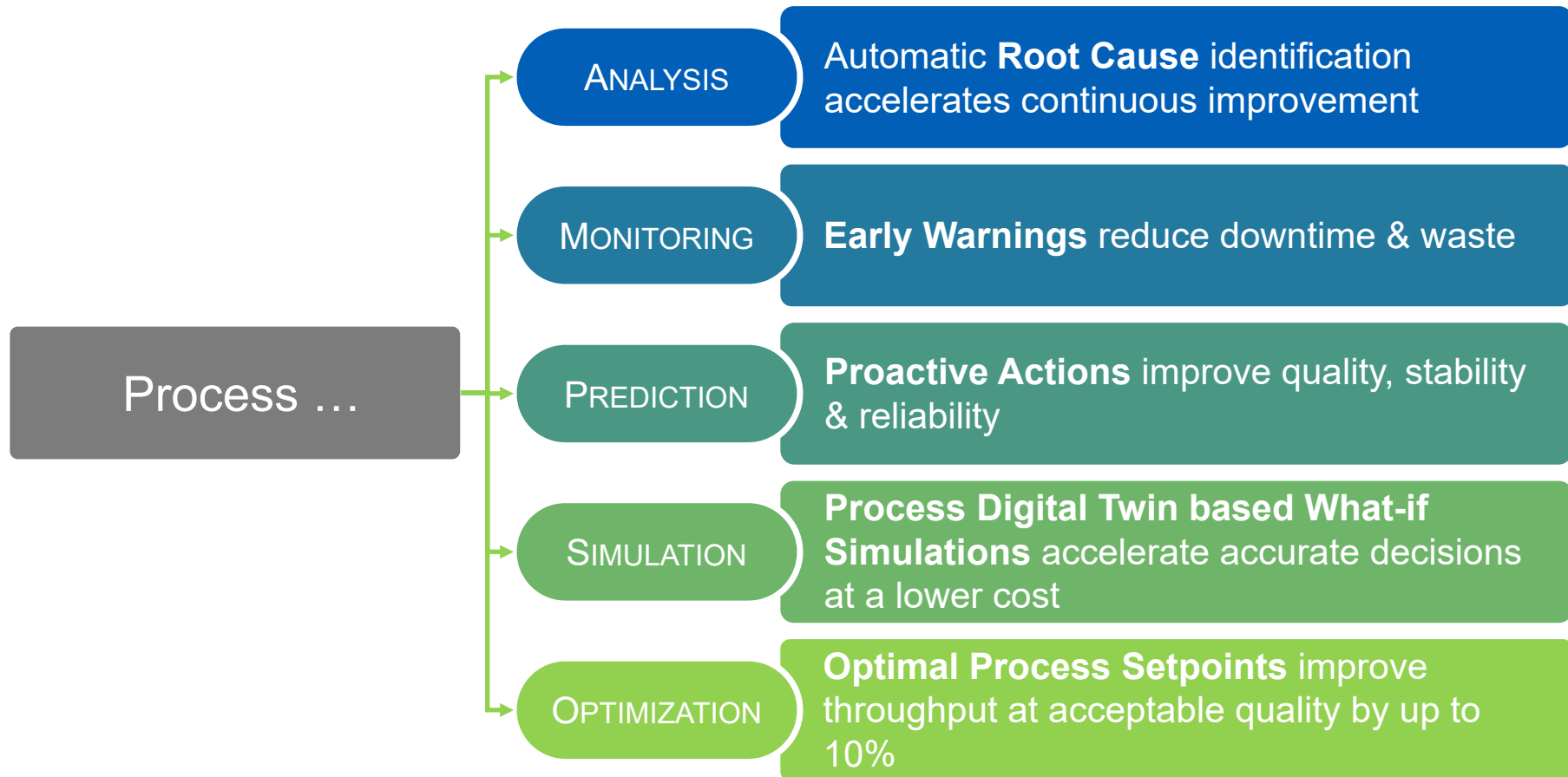
Visibilità e scalabilità aziendale / trasversale per massimizzare la flessibilità



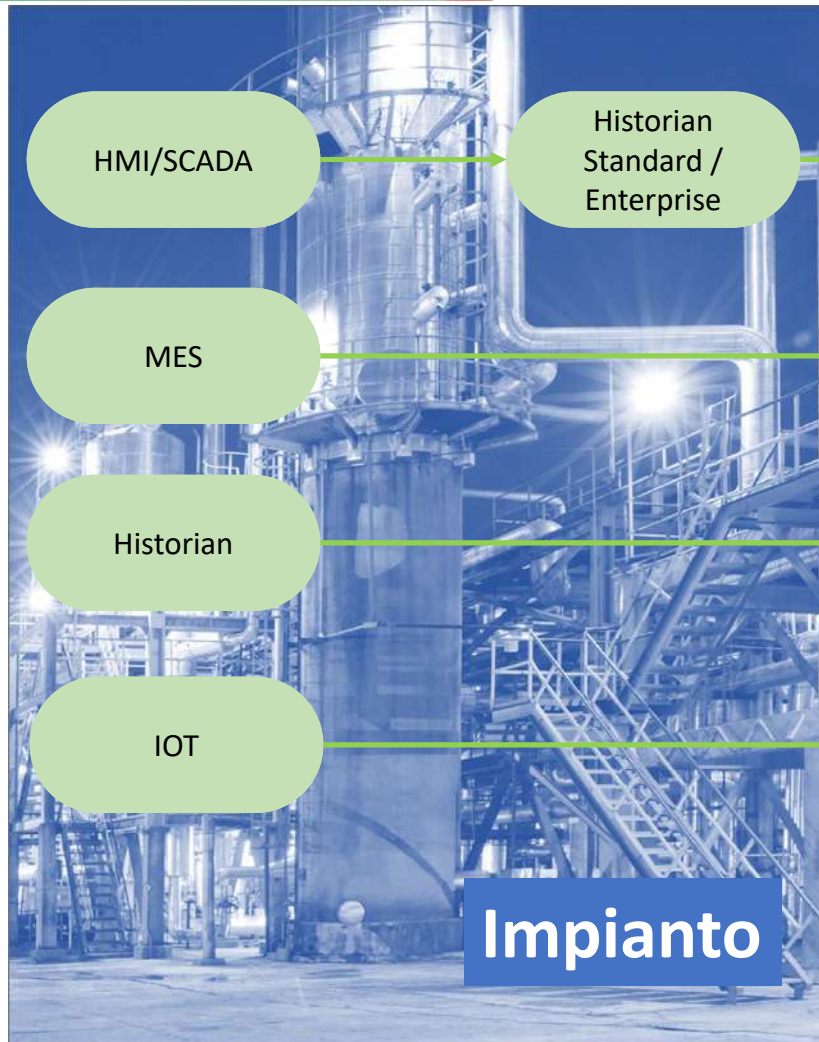
Miglioramento continuo delle operazioni attraverso il monitoraggio e il miglioramento delle prestazioni degli asset



Le fasi possibili per la creazione di valore



Possibili scenari architetturali



Historian
Standard /
Enterprise

HMI/SCADA

MES

Historian

IOT

Impianto

Proficy CSense

Operations Hub

Proficy CSense

Operations Hub

Proficy CSense

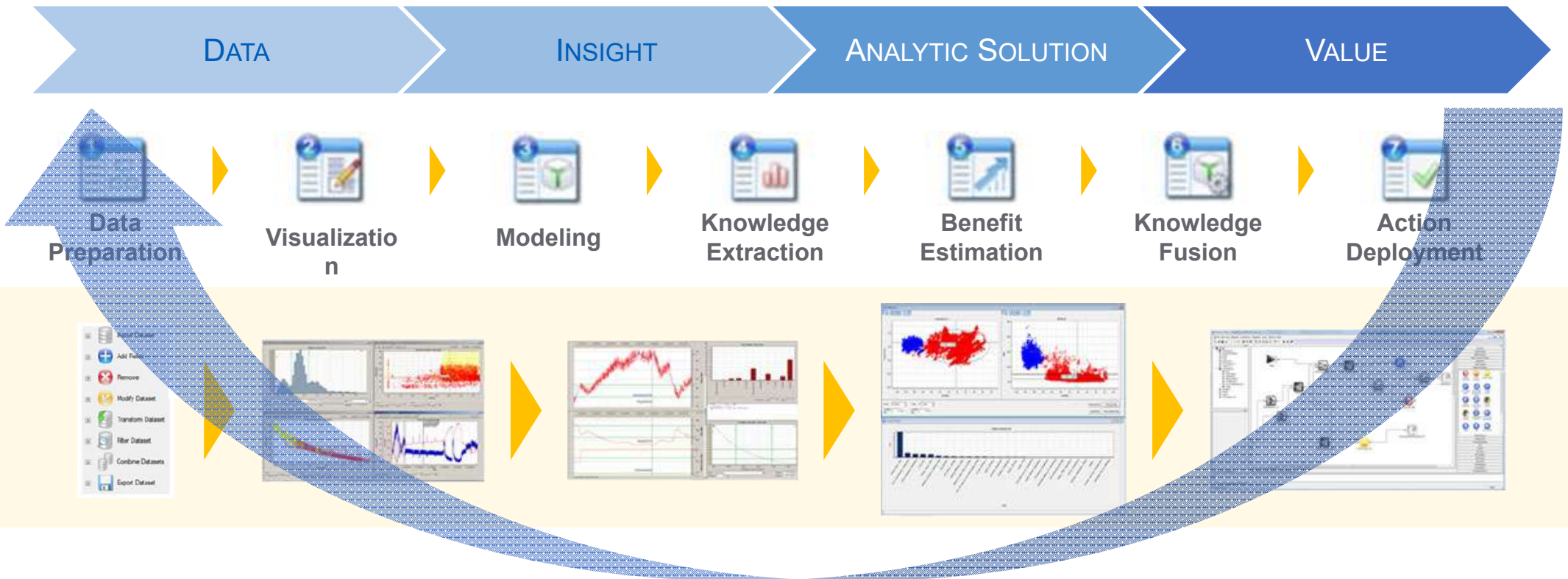
Operations Hub

Proficy CSense

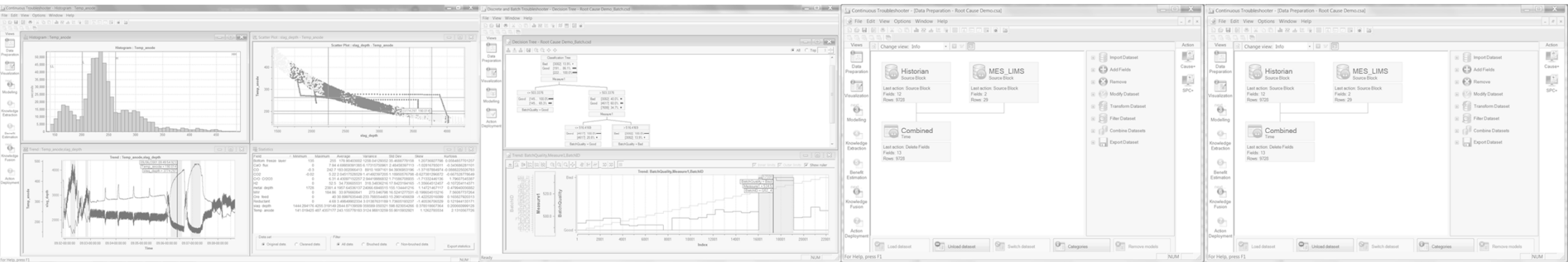
Operations Hub

Proficy CSense 8.0 from GE Digital

Miglioramento Continuo



Proficy Csense 8.0 from GE Digital



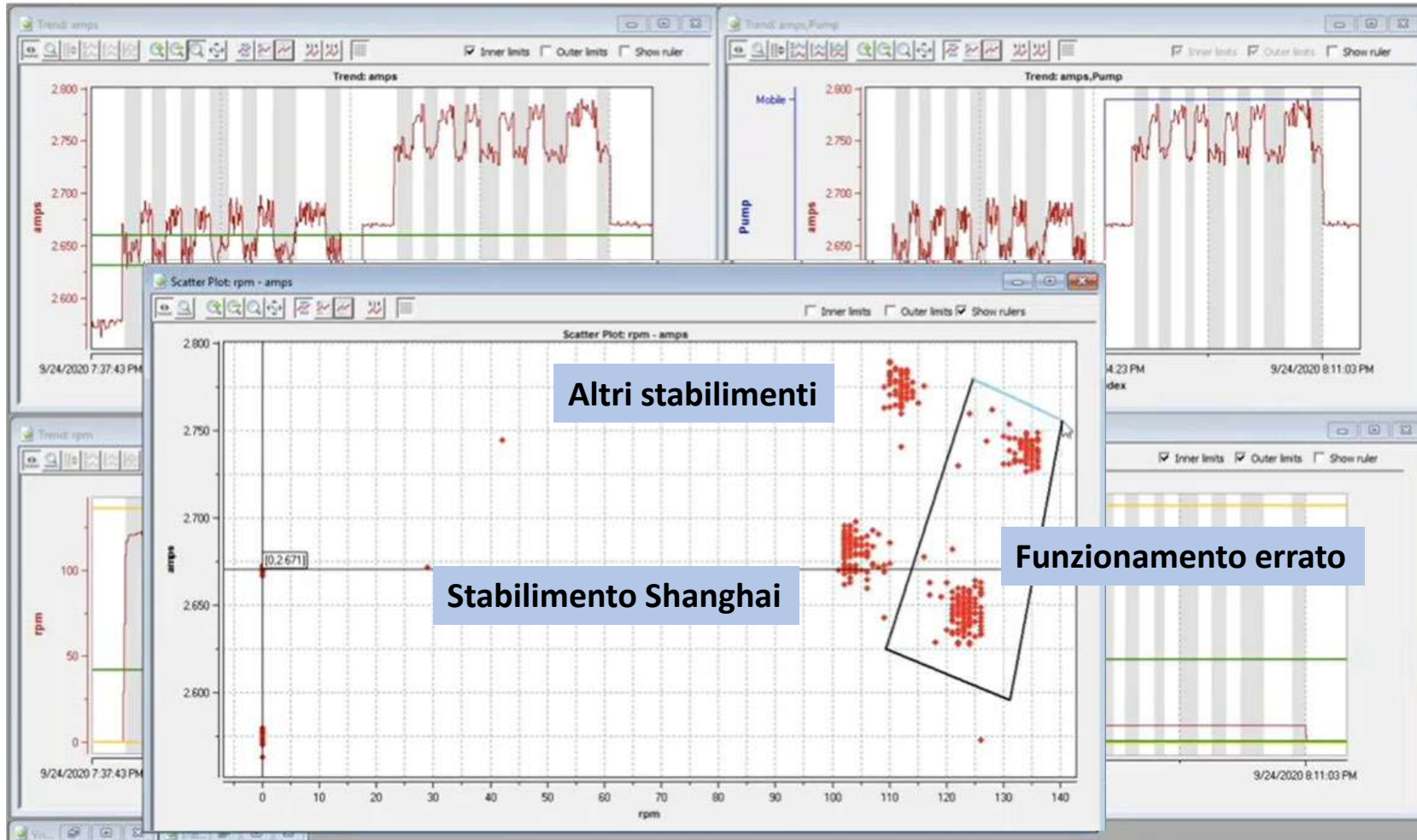
Configurazione delle basi di dati

The screenshot displays the 'Continuous Troubleshooter' application window, titled '[Data Preparation - Root Cause Demo.csa]'. The interface includes a menu bar (File, Edit, View, Options, Window, Help) and a toolbar with various icons. A 'Views' sidebar on the left lists stages: Data Preparation, Visualization, Modelling, Knowledge Extraction, Benefit Estimation, Knowledge Fusion, and Action Deployment. The main workspace shows a flow diagram with three blocks: 'Historian' (Source Block, 12 fields, 9728 rows), 'MES_LIMS' (Source Block, 2 fields, 29 rows), and 'Combined' (Time, 13 fields, 9728 rows). A right-hand 'Action' panel lists operations like 'Import Dataset', 'Add Fields', 'Remove', 'Modify Dataset', 'Transform Dataset', 'Filter Dataset', 'Combine Datasets', and 'Export Dataset'. At the bottom, there are buttons for 'Load dataset', 'Unload dataset', 'Switch dataset', 'Categories', and 'Remove models', along with a 'NUM' field.

Analisi dei dati e identificazione problema



Machine learning guidato



The screenshot displays a software interface for model construction and analysis. The main window shows the following components:

- Views:** A sidebar on the left with icons for Data Preparation, Visualization, Modeling, Knowledge Extraction, Benefit Estimation, Knowledge Fusion, and Action Deployment.
- Model target:** Temp_anode
- Model inputs:** Bottom_freeze_layer, CoO_flux, CO2, CrO_G-203, H2, metal_depth, MW, Ore_feed, Reduciant, slag_depth
- Model statistics:**

Statistic	Value
Number of construction cases	6810
Number of validation cases	2918
Number of patterns not used for training	0
Model fit on construction cases	94%
Model fit on validation cases	93%
- Model Construction Dialog:** A central dialog box titled "Model Construction" showing the following rules:


```

17. IF MW <= 40.68 AND
    =slag_depth > 3991.75
    THEN Temp_anode is Low (100%; 898 cases)

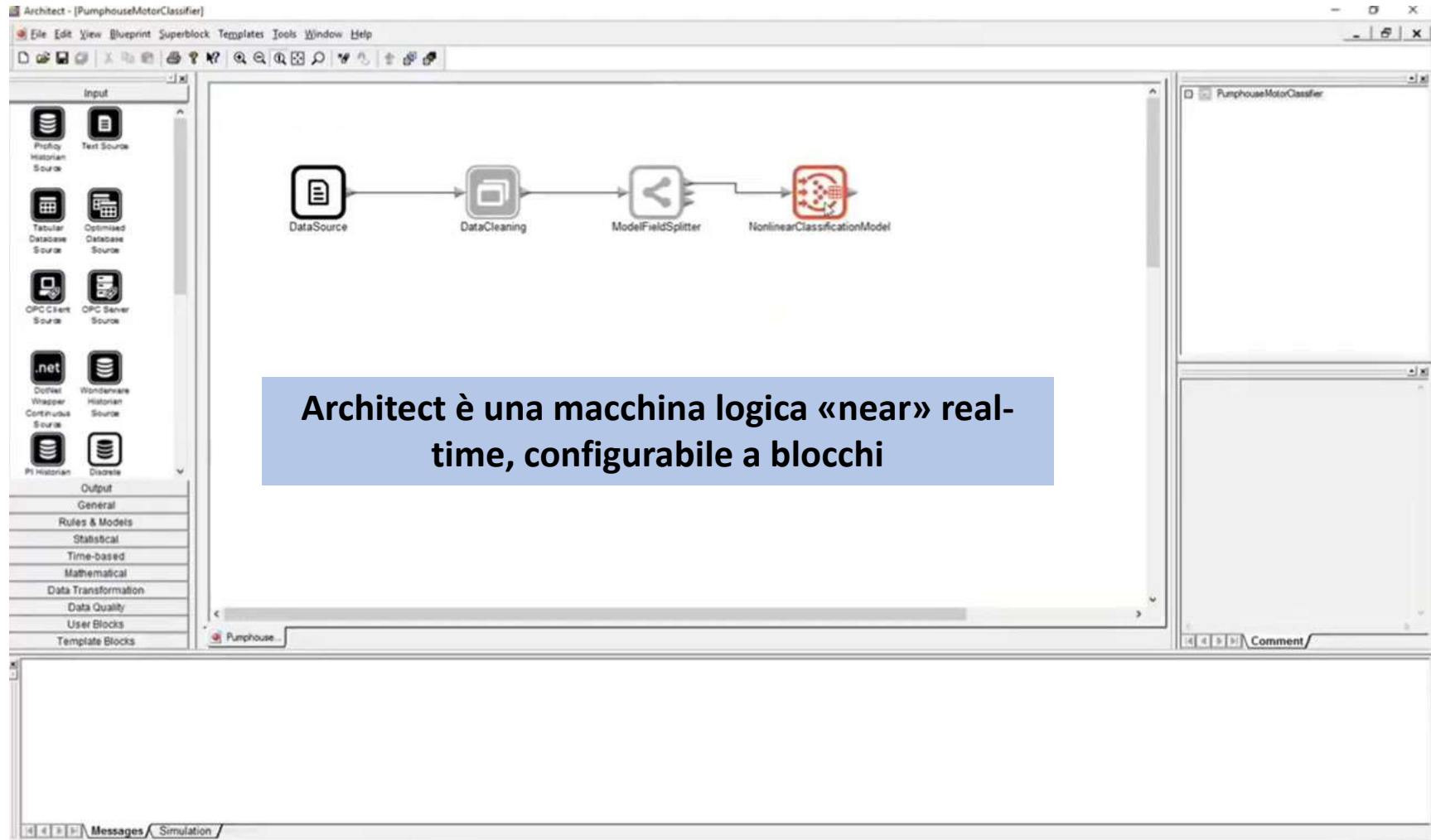
14. IF MW <= 20.1 AND
    =slag_depth <= 3991.75 AND
    =slag_depth > 3778.66
    THEN Temp_anode is Low (90%; 440 cases)

12. IF MW <= 39.75 AND
    =slag_depth <= 3778.66 AND
    =slag_depth > 3670.29
    THEN Temp_anode is Low (77%; 205 cases)

16. IF CoO_flux > 4.05 AND
    MW <= 40.68 AND
    MW > 20.1 AND

```
- Background Windows:**
 - A window titled "Correct" showing a time-series plot with a red line and a green shaded area.
 - A window titled "Input Distribution" showing a bar chart of input field values.
 - A window titled "3D Analysis" showing a 3D plot.

Uso del modello non-lineare all'interno di una «macchina» logica



Monitoraggio multi-variato del processo

The screenshot displays the 'Architect - Probes' software interface. On the left, there is a 'Input' panel with various data source icons (e.g., Prof by Historian Source, Text Source, Tabular Database Source, OPC Client Source, etc.) and an 'Output' panel with options like General, Rules & Models, Statistical, etc. The main area features a 'Probes' window with a time-series plot showing 'Temp_anode' (red line) and 'DZMOD' (green line) over time. A data table is visible: [Time] 4/1/20 19:41:07, Temp_anode: 220.7, DZMOD: 792, Alert_ACTIVE: 0.000. Below the plot are 'Scale Options' (Off, Auto, Ereset, Identical, Reset) and a 'Move only - no scaling' checkbox. To the right, a 'Monitoring_Fingerprint.mgd' window shows a process flow diagram: DataSource → DataCleaning → FieldSelector → MultiVariate_UnsupervisedLearning_PCA_Process_Fingerprint → MovingAlarm_01. A status bar at the bottom indicates 'Messages / Simulation / NUM'. A blue text box is overlaid on the bottom right of the interface.

Implementa il modello digitale del processo per il monitoraggio «multi-variato» dello stato di processo / macchina per fornire avvisi precoci di anomalie o deviazioni

The screenshot displays the ServiTecno software interface. On the left is a 'Rules & Models' palette with various icons for data processing and machine learning tasks. The main workspace shows a workflow diagram for 'predict_model.mgd' with the following steps: DataSource -> DataCleaning -> ModelFieldSelection -> OnlineTrainer -> Predictive_1Click_NonLinear_Neural_Network_Model -> Python_Extensibility_Deploy_Python_Machine_Learning_Models. Below the workflow is a 'Probes' window showing a time-series plot of 'Product quantity' from 9/1/01 to 9/2/01. The plot includes a red line for actual data and a green line for the model's prediction. A 'ModelOutput' box shows a value of 245.2. At the bottom, a console window shows execution logs for 'Data Source' and 'Server execution'.

Implementa modelli di Machine Learning con o senza riaddestramento

Possibilità di inserire modelli di ML in Python