

AISS Technology Update

Introduction to Lean Six Sigma with KNIME

Alessandro Polidoro & Rosaria Silipo



May 5, 2025



Speakers



Alessandro Polidoro

Industrial engineer and manager
Master Black Belt in Lean Six
Sigma, KNIME expert, and AISS
Director.

Industrial engineer with a PhD in Physical Sciences and Industrial and Energy Innovation Engineering from the Guglielmo Marconi University. Certified Project Manager (ISIPM-AV, PRINCE2), Master Black Belt in Lean Six Sigma, and KNIME Certified Trainer. Director of the Italian Lean Six Sigma Academy (AISS) since 2023, lecturer for master's programs and courses on Industry 4.0 and Lean 4.0, consultant for industrial innovation and digital transformation. Has held managerial roles in multinational companies in the automotive and industrial sectors. Currently ICT Manufacturing Manager at Ariston Group.

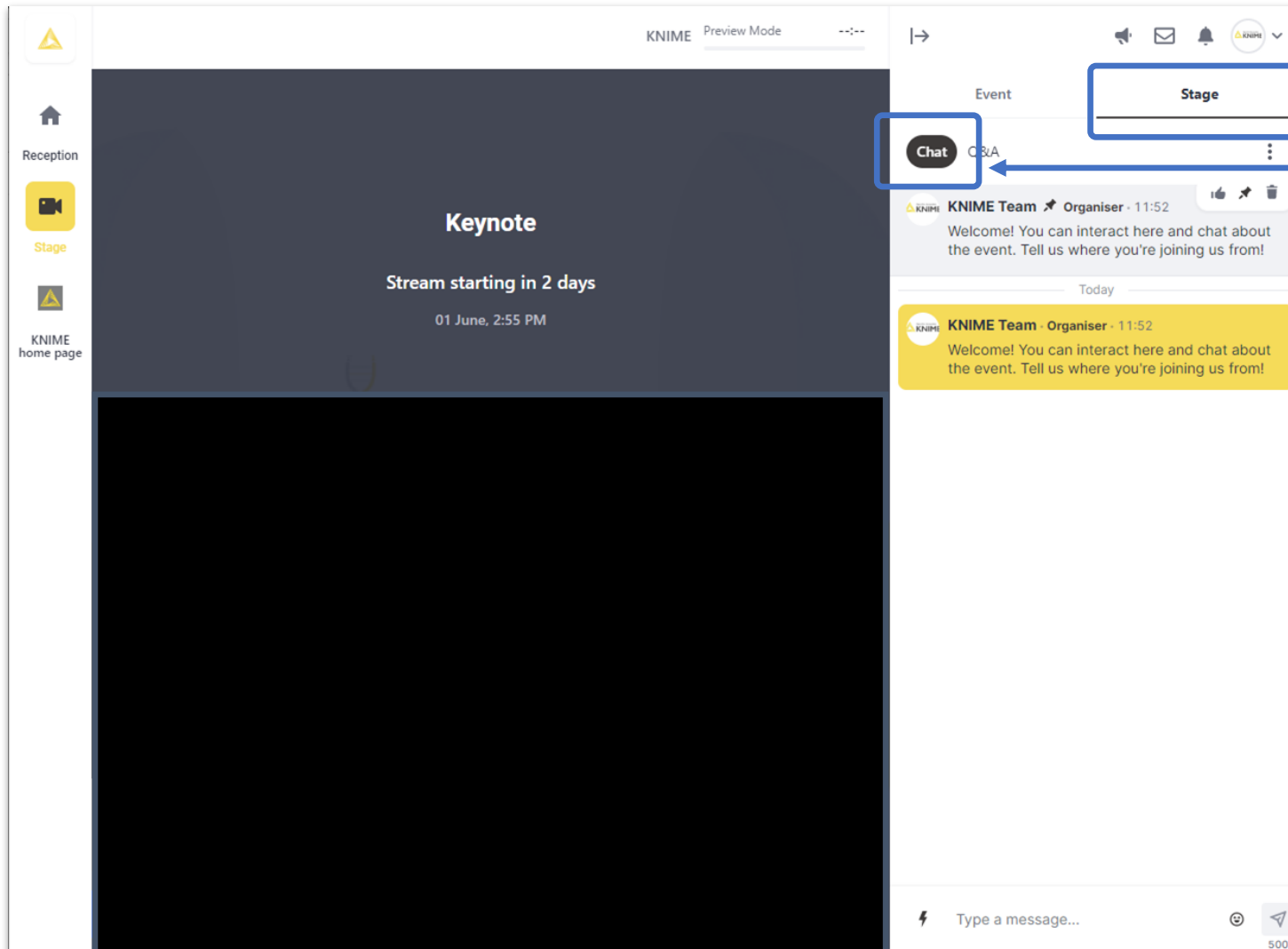


Rosaria Silipo

Principal Data Scientist
and KNIME expert.

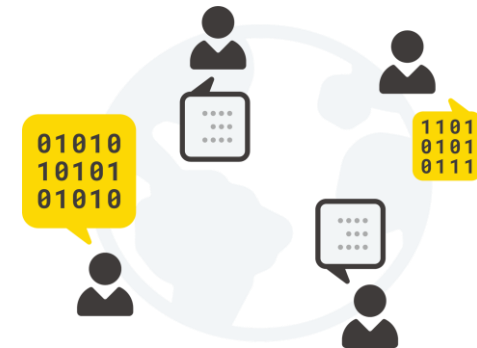
Graduated in Electrical Engineering from the University of Florence (Italy) in 1992 and earned a PhD in Bioengineering in 1996. Currently serves as VP of the Data Science Evangelism team at KNIME. She has over 25 years of experience in the field of Artificial Intelligence. Prior to joining KNIME, she worked at Viseca in Zurich, Siemens in Munich, and Nuance Communications in Menlo Park, California. Her expertise in AI spans applications in IoT, Customer Intelligence, Marketing Analytics, Financial Services, and Cybersecurity. She is the author of over 50 scientific publications and two books: "Guide to Intelligent Data Science" (Springer) and "Codeless Deep Learning with KNIME" (Packt), both published in 2020.

Welcome! Use the live CHAT

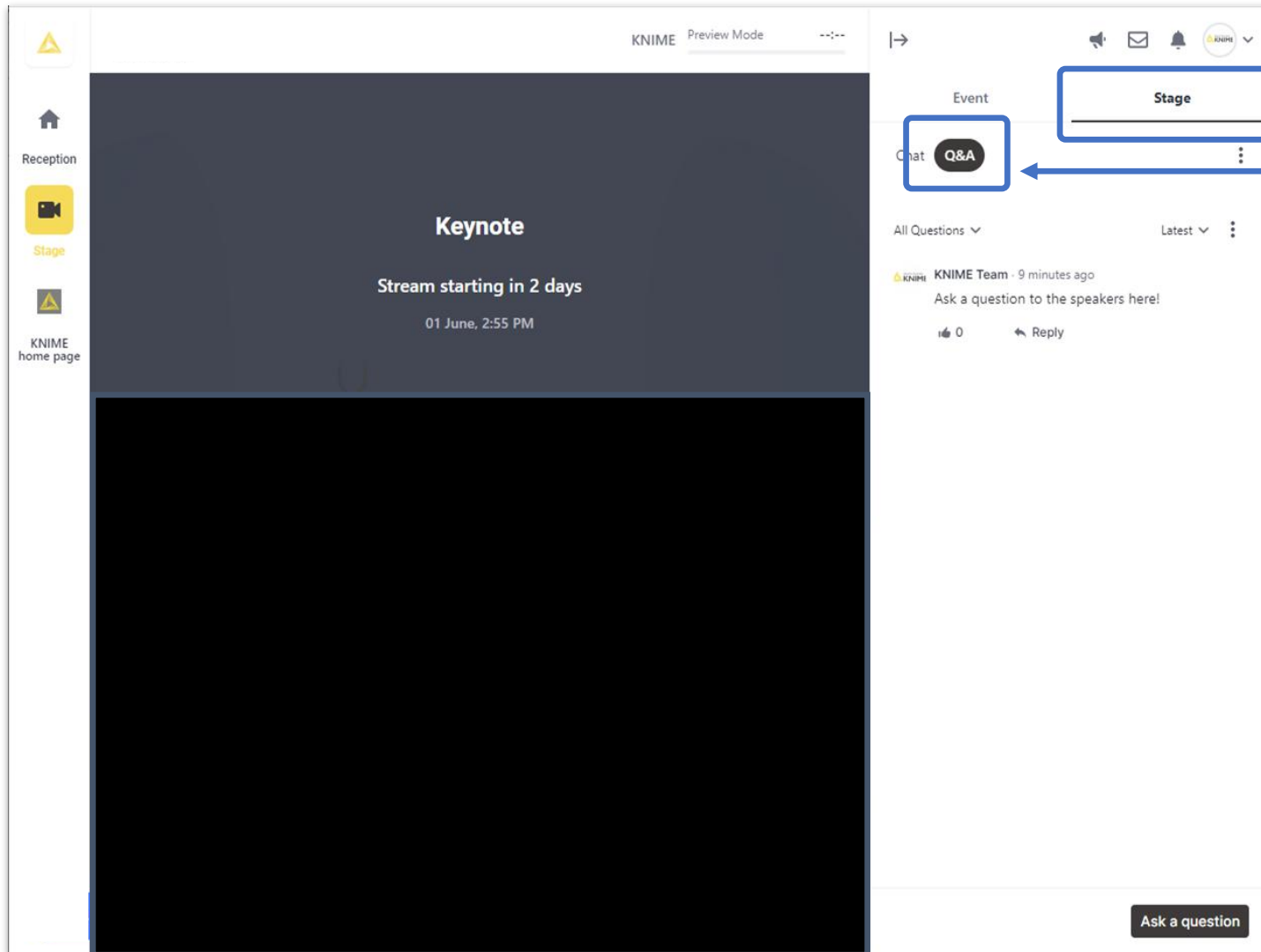


Here you can interact with others about the event!

Post where you are joining us from in the chat!



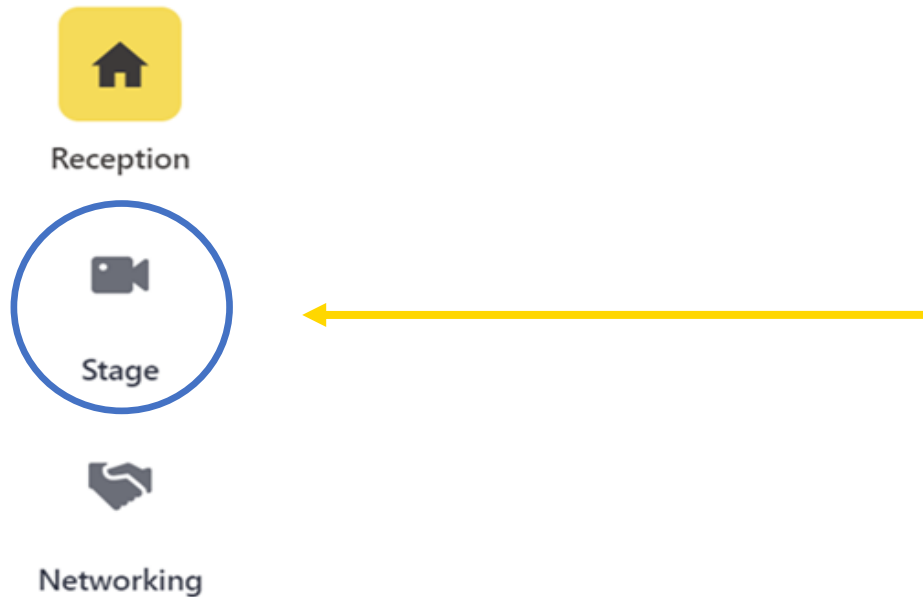
Questions? Use the Q&A Tab



Here you can ask questions to the KNIME team and speakers!

Your question will be answered Live or during "Questions to the Speaker" session.

Streaming Problems? Got Lost?



- Use Chrome or Firefox web browser for the best experience
- Try refreshing your browser
- Use a cabled internet connection if you have poor WiFi
- Try private browser mode
- Click on '**Stage**' to go back to the stream

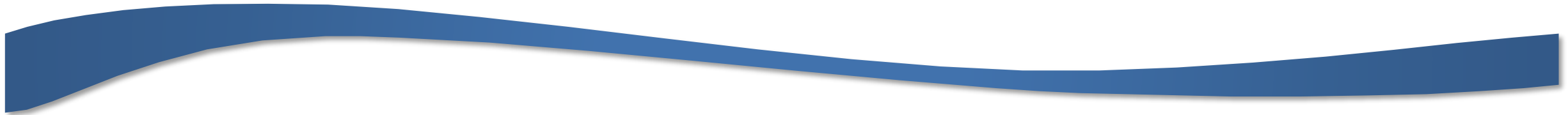


Agenda

- AISS – A. Polidoro
- Lean Six Sigma – A. Polidoro
- KNIME Analytics Platform – R. Silipo
- Lean Six Sigma with KNIME – A. Polidoro
- Q&A

AISS

(Accademia Italiana del Sei Sigma)





What is AISS (Accademia Italiana del Sei Sigma)

AISS is short for Accademia Italiana del Sei Sigma. AISS aims at:

- promoting the Lean Six Sigma approach within the Italian industry
- accelerating innovation and technology transfer processes.

Since its foundation in 2001, the Academy has become well known for its integration of academic research with practical expertise in the industrial and manufacturing sectors.



facebook



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Mobile: 3404267676





AISS Working Framework



AISS aims at spreading the Lean Six Sigma approach
in the Italian industry and at accelerating
innovation/technology transfer processes through:



Training

Research
iMetho

AISS

CI project
support

Q&E
magazi
ne

Courses
(LIVE/STREAMIN
G)

Workshops and
Seminars

Network

Classroom/st
andard

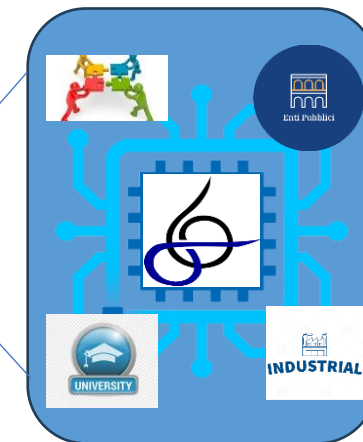
Corporate
courses
(targeted to
individual
client needs)

Round-table
discussions
on specific
topics with
national and
international
experts

Industry
testimonials
and success
stories in the
application of
Lean Six
Sigma

Experts

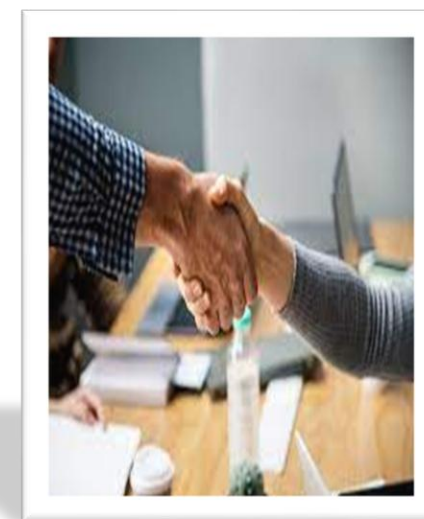
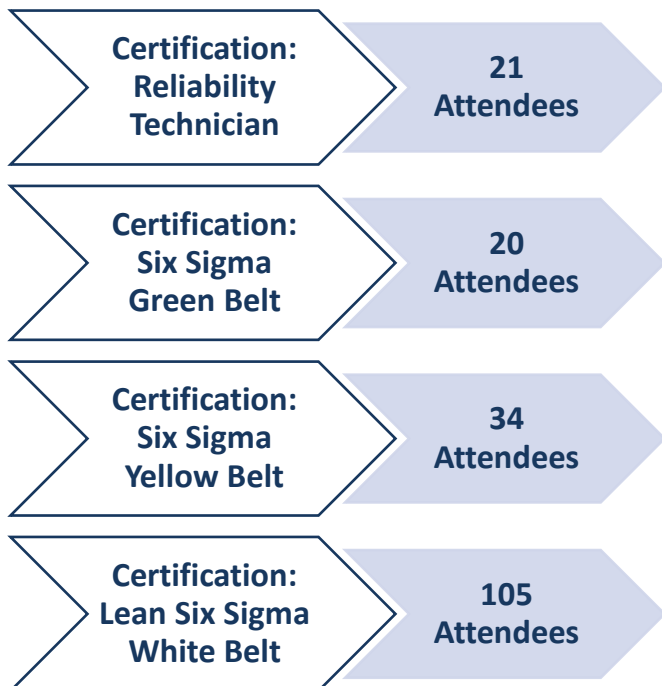
Experiences





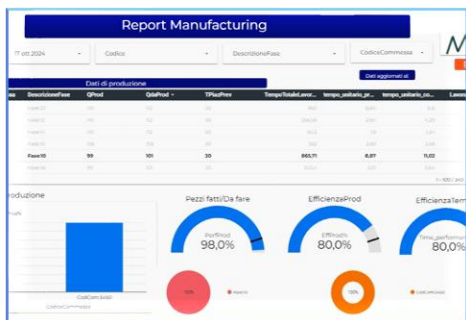
Training activities 2024/2025

Books





AISS & iMetho & KNIME



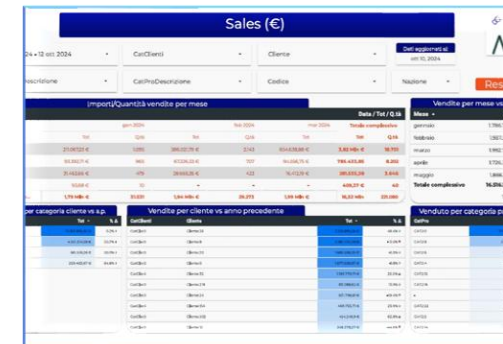
Dynamic Reports and Interactive Dashboards:

business performance displayed in a simple and intuitive way, with tools that convert data into valuable information.

Research and Development on models trained on their own data, both in the cloud and offline.



Enhanced Analysis for Strategic Decisions:
advanced analytics technologies and predictive models to make timely data-driven decisions.



Agile and Impactful Collaboration:

real-time sharing of reports from any device to improve collaboration and efficiency. Consulting on low-code/no-code applications.

Optimized production and maintenance plans thanks to historical series, manuals, and know-how integrated into the model, both global and local (in the case of sensitive and protected data).



- **January 2024**, planning to modernize the Lean Six Sigma courses at AISS
- **May 2024**, introduction a new course with KNIME within the Lean Six Sigma Courses at AISS Academy dedicated to Yellow Belt
- **July 2024**, two KNIME certified trainers
- **February 2025**, new AISS courses to KNIME dedicated to Green Belt
- **June 2025**, we run the first set of LSS courses completely based on KNIME for the analytics part for the Green Belt and starting Course for Black Belt and first course of Knime Basic.
- **End of year 2025**, AISS to become official training partner of KNIME



AISS & KNIME: The Team



ALESSANDRO POLIDORO

Industrial engineer with a PhD in Physical Sciences and Industrial and Energy Innovation Engineering obtained at the University of Guglielmo Marconi. Certified as a Project Manager (ISIPM-AV, PRINCE2), Black Belt Lean Six Sigma, and KNIME Certified Trainer. Director of the Italian Six Sigma Academy (AISS) since 2023, lecturer for master's programs and courses on Industry 4.0 and Lean 4.0 topics, and consultant for industrial innovation and digital transformation. He has held managerial roles in multinational companies in the automotive and industrial sectors. Currently, ICT Manager Manufacturing at Ariston Group.

Industrial expert in both Aeronautical Construction and Electronics, he works as a Quality System Manager at a multinational leader in its sector. Vice President and lecturer for AICQ Centronord, Board Member, lecturer, and Quality Manager at the Italian Six Sigma Academy, and Director of the journal Quality & Engineering. Additionally, he is Vice President of the Applied Statistics Association and President of the AICQ Statistical Methods Committee. On behalf of AICQ, he also works in the ISO Technical Committees: CT 016/GL 69 - Applications of Statistical Methods and CT 042/GL 01 - Statistics.



ALESSANDRO CELEGATO



RICCARDO BARBIERI

Graduated in Management Engineering from the University of Florence. In 2013, he began a post-doctoral collaboration with the University of Florence on topics related to sustainable mobility, including vehicle design and feasibility studies for the introduction of technologies in the urban context. In addition, he specializes in optimizing business production flows as an expert in the Six Sigma method for quality management, with over 5 years of field training and consulting experience. He has been a research fellow in the Moving group since 2016. Area of activity: sustainable mobility.

Graduated in Computer Engineering and KNIME Certified Trainer, he works at a leading telecommunications company. He has delivered several presentations on KNIME, AI, and machine learning at Uninettuno, UniPA, secondary education institutes, and various Linux Day events. He has published two courses on Udemy on KNIME Analytics Platform, where he teaches how to analyze data and apply machine learning algorithms using a low-code approach.



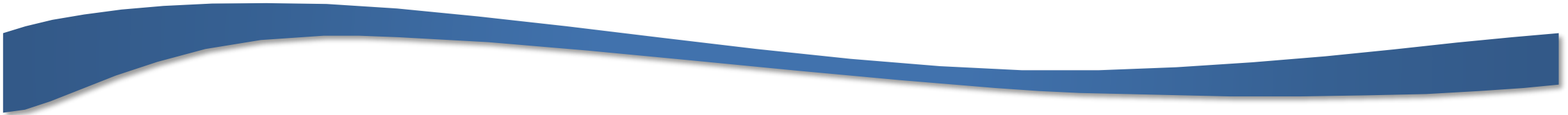
FRANCESCO ALAIMO



GIOVANNI VISCIO

ERP/MES Consultant. Staff training. Optimization of production processes. Project Manager and functional analyst for the management of management system implementation projects..

Lean Six Sigma



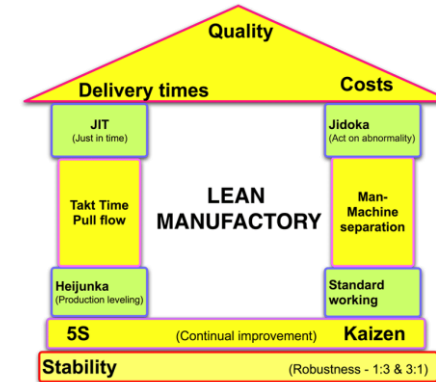


The term "**Lean Six Sigma**" comes from the combination of two concepts:

Lean: A term originating from the Toyota Production System. Since the 1950s, it has spread worldwide as a method for process improvement through the identification and elimination of waste in both production and services.

It's a philosophy and a set of tools and techniques that aim to streamline processes, reduce costs, and increase quality

Six Sigma: Today it represents the standard methodology for identifying and eliminating the root causes of defects **by reducing variability** in business processes and production.



Six Sigma DMAIC



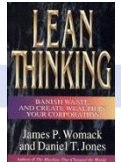
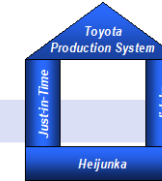
From TPS to Lean

1902

Toyoda invented a loom that stopped automatically in case of defects: the Jidoka principle was born.

1943

Ohno developed the Toyota Production System, an industrial model still used today.



1937

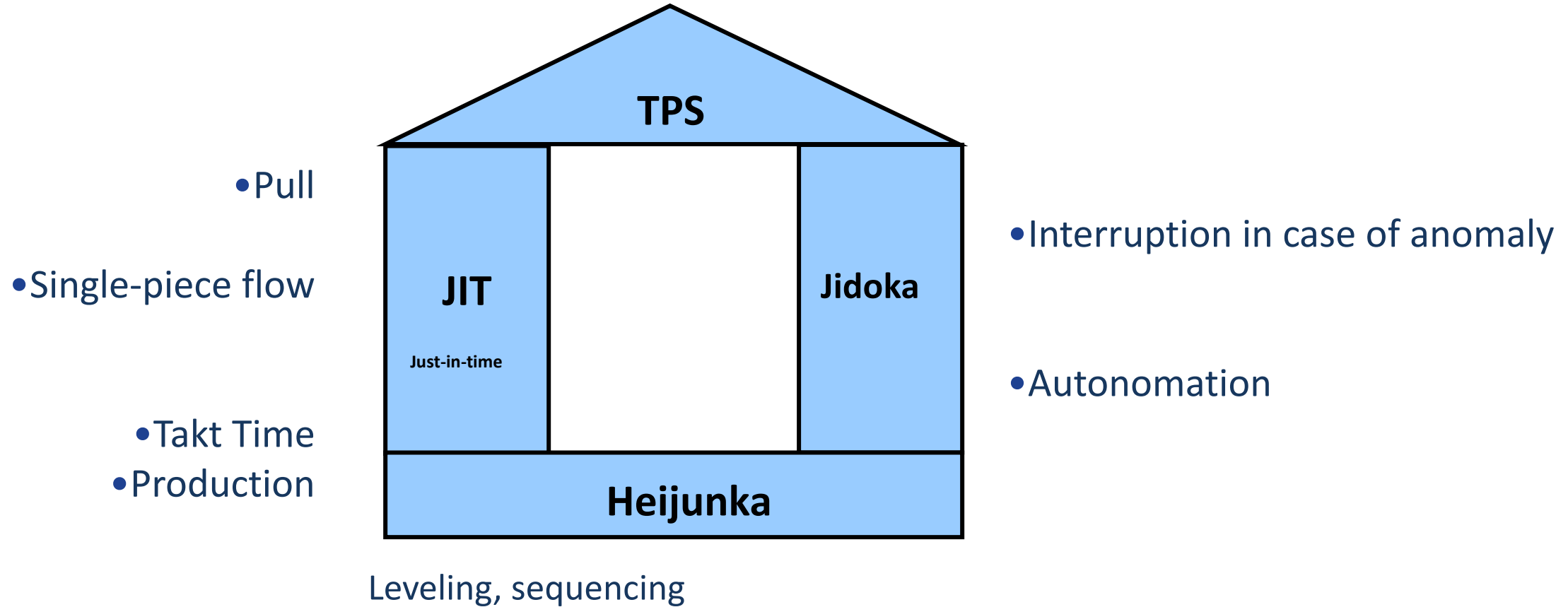
Financed with the profits from looms sold in England; Sakichi Toyoda decided to use the profits to invest in the automobile market: Toyota is founded

1990

Womack and Jones define the concept of Lean, introducing TPS to the West.



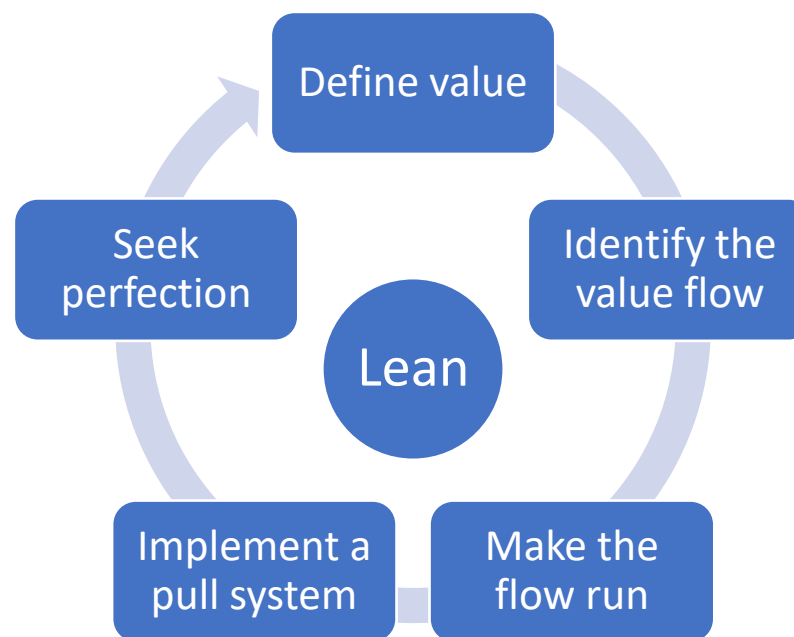
The origins of Lean... The Toyota House



TPS is a system, not just a set of tools



CREATE VALUE
By eliminating waste



- Step 1: Specify Value** – Define value from the customer’s perspective.
- Step 2: Map** – Identify and eliminate waste in the value stream.
- Step 3: Flow** – Streamline processes and improve lead times.
- Step 4: Pull** – Allow customer demand to drive production.
- Step 5: Perfection** – Continuously improve to meet customer needs





Six Sigma: The History

The methodology known as Six Sigma was developed thanks to the work of key figures, including Mikel Harry, Bill Smith, and Bob Galvin, at Motorola.

In the mid-1980s, under the leadership of President Bob Galvin, Motorola raised the bar by starting to measure process defect levels in parts per million rather than in percentages.

In the first 15 years of Six Sigma implementation, Motorola reported savings of \$16 billion.



The milestones of Six Sigma at Motorola:

- 1986**: Introduction of the Six Sigma method
- 1987**: Definition of the goal to reach 3.4 ppm (parts per million) defect rate by 1992
- 1988**: Motorola wins the Malcolm Baldrige National Quality Award in the USA
- 1991**: Introduction of Six Sigma Black Belt experts
- 1992**: New goals to reduce lead time and costs
- 1998**: Six Sigma goals extended to the 8 main Corporate Business Processes
- 1999**: Introduction of the Balanced Scorecard
- 2006**: Motorola continuously improves the method, tools, and "quality tools"

The Six Sigma approach spread, over the years, to other major companies such as General Electric, Honeywell, and Microsoft.





Six Sigma: The Aim

Six Sigma is an intelligent business management system that, using "data and facts," puts the customer first.

Improve Customer Satisfaction

Reduce defects, scrap, waste, and all operations that consume time and resources but do not add value to the product.

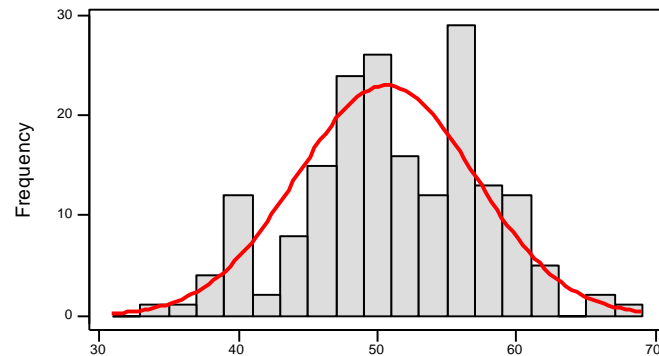
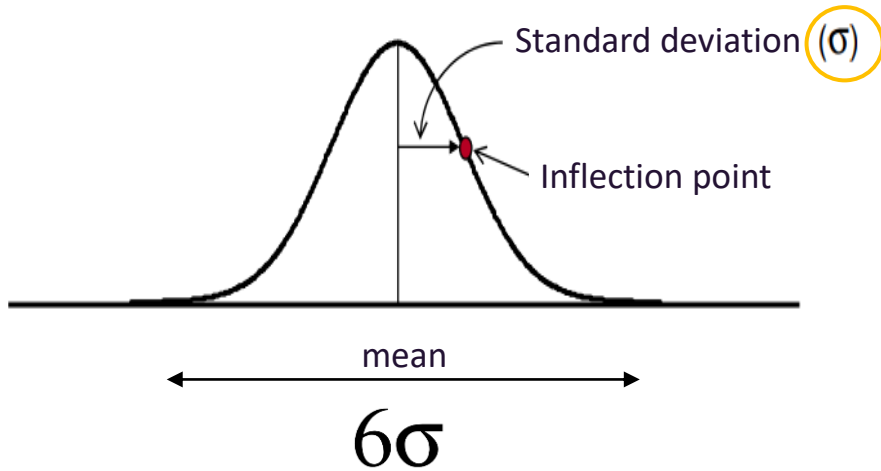
Accelerate business processes

The methodology aims, through significant use of **statistics**, to help and improve the production system to achieve an ambitious goal: **Zero Defects**.

Although not truly zero, in reality, the goal of reaching 3.4 defective parts per million opportunities is still a remarkable objective.



Six Sigma: The Name



Sigma in statistics represents the measure of a process's standard deviation, i.e., the variation of a parameter from its mean

Six is the target quality level to achieve and maintain (the more sigmas there are, the more stable the process is).

A "**Six Sigma**" quality indicates 6 standard deviations, that is a precision rate of 99.99966%, equivalent to no more than 3.4 defects per million opportunities.



Six Sigma: The Framework

The standard approach model of Six Sigma is defined as DMAIC.

DMAIC is an acronym: Define, Measure, Analyze, Improve, and Control:

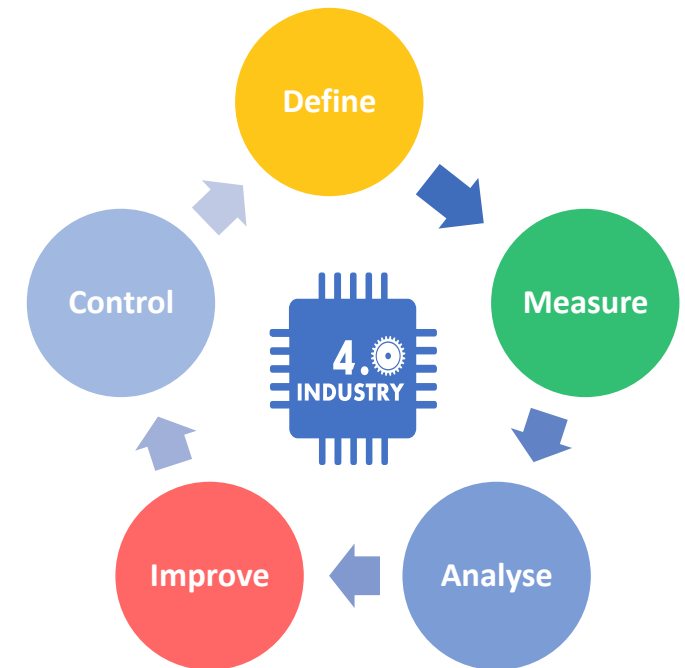
Define the project objectives and customer (internal and external) requirements.

Measure the process to determine current performance.

Analyze and determine the root cause of defects.

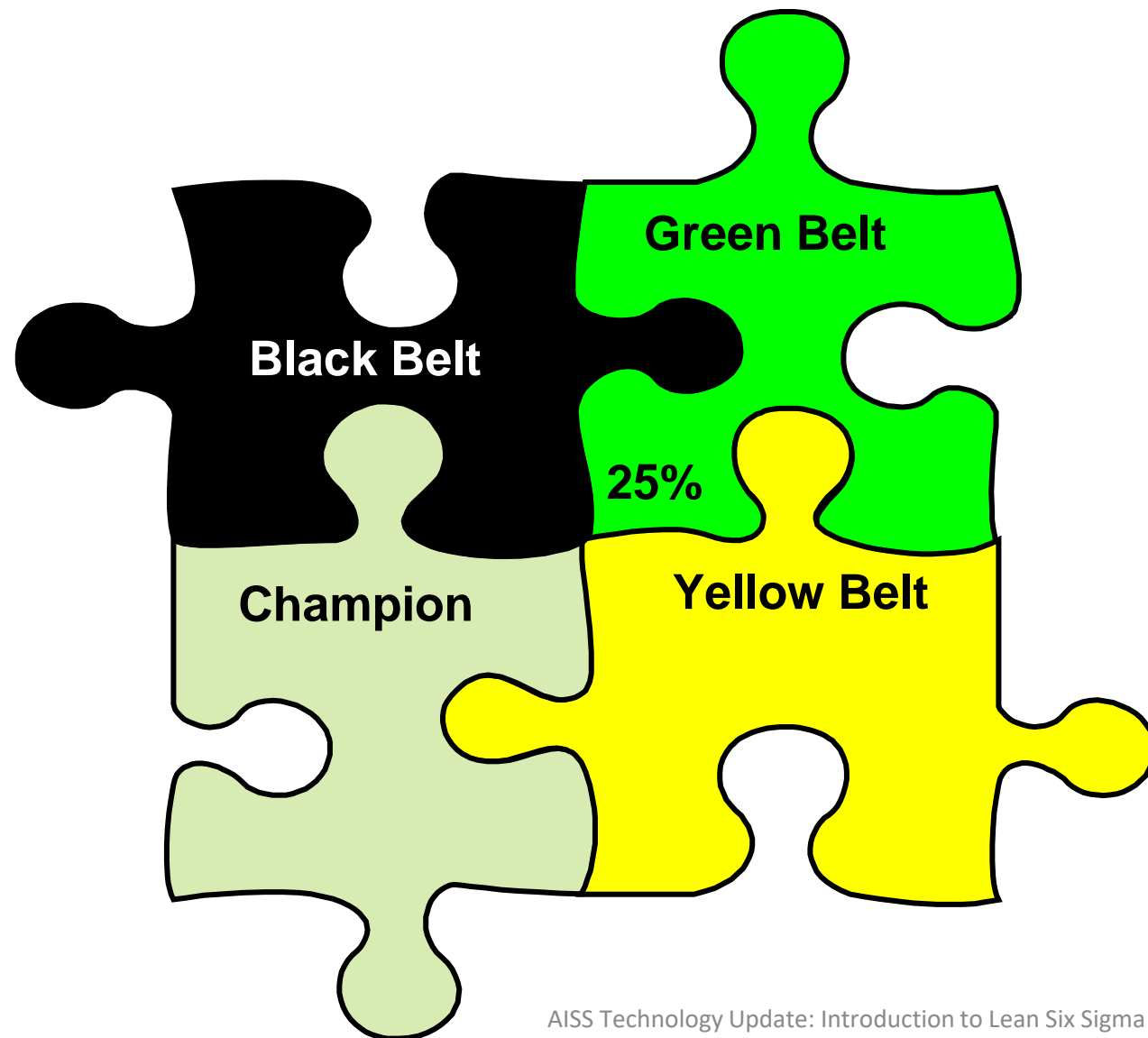
Improve the process by eliminating defects.

Control the future performance of the process.





Six Sigma: The Working Team



Teamwork!





Lean & Six Sigma



Taken individually, the two methodologies have limitations

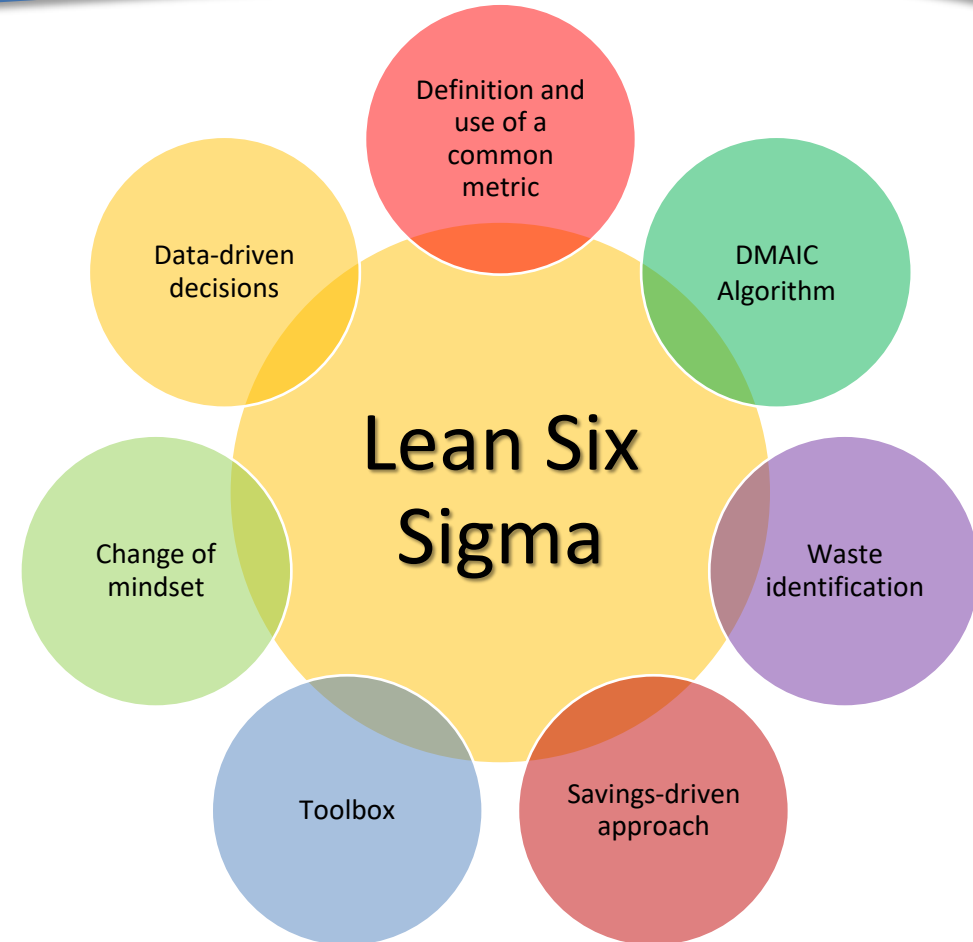
- Lean does not focus on statistics, showing limitations (e.g., unpredictable events, pandemics, geopolitical issues),
- Six Sigma focuses on eliminating defects but lacks a reference model (thus, it could optimize processes that still contain waste).

Together, they complement each other.



The Lean Six Sigma approach

1. Focus on the customer
2. Identify the value stream: "hear" the voice of the customer (VOC) within the actual process
3. Organize, improve, and streamline the process flow
4. Eliminate waste and unnecessary steps
5. Data-driven decision making
6. Involvement of people
7. Address all improvement activities in a systematic and structured way



Goal: To achieve a product of the highest quality, at the lowest possible cost, with minimal waste, and in the shortest time possible.



Traditional Approach vs Lean Six Sigma Approach

	Traditional approach	Lean Six Sigma Approach
Problem	Focused on symptoms	Focused on the causes
Behavior	Reactive	Proactive
Decisions	Based on impressions	Based on data
Supplier selection	Cost	Capability



LSS + I4.0 *interaction*



Real-time data-driven decision-making increases and implements the responsiveness required by modern competitiveness in SMEs or large companies.



Data-driven Six Sigma reduces the chance of defects by reducing variability in production processes → Business Data Analytics that extracts information from AI, machine learning. Data-driven decision-making is much more reliable and powerful than a mere opinion.



...In summary:

Lean Manufacturing: basic tools that reduce waste and non-value-added activities. (Objectives: versatility, operational efficiency, flexibility, waste reduction, etc.).

Six Sigma is a quality improvement system based on DMAIC, aimed at reducing defects in processes.

Industry 4.0 creates innovative production systems to increase efficiency and customer satisfaction; it combines various technological tools (Additive Manufacturing, Cyber-Physical Systems, Data Analytics, Simulation, IoT, etc.).

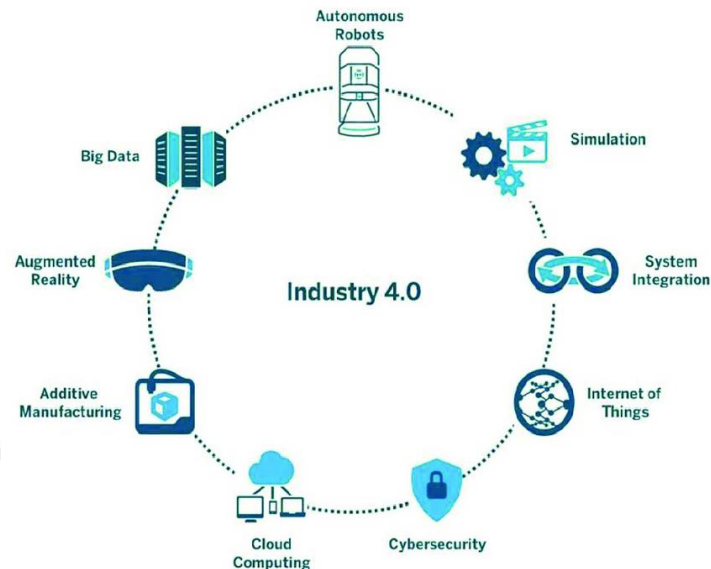
Industry 4.0 and the new frontiers of LSS

The simultaneous implementation of I4.0 and LSS might allow for greater benefits than those achievable if pursued independently of each other.

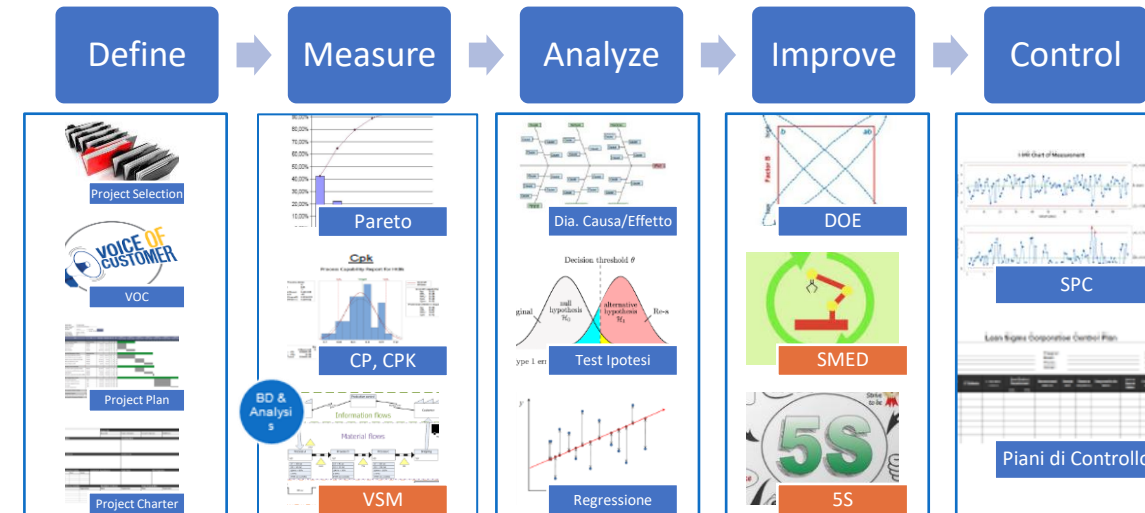
**McKinsey & Company (2017)*

LSS&KNIME FRAMEWORK

- A workflow that guides the user step by step
- Components dedicated to each phase
- AI support

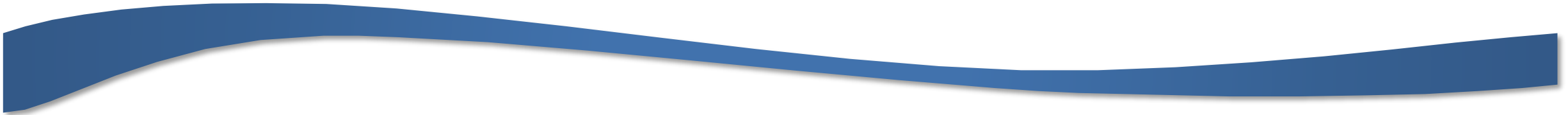


Lean Six Sigma Example Framework (Orange → LEAN)



Industry 4.0 and the new frontiers of LSS: The simultaneous implementation of Industry 4.0 (I4.0) and Lean Six Sigma (LSS) potentially allows for greater benefits than those achievable from I4.0 and LSS projects pursued independently of each other.

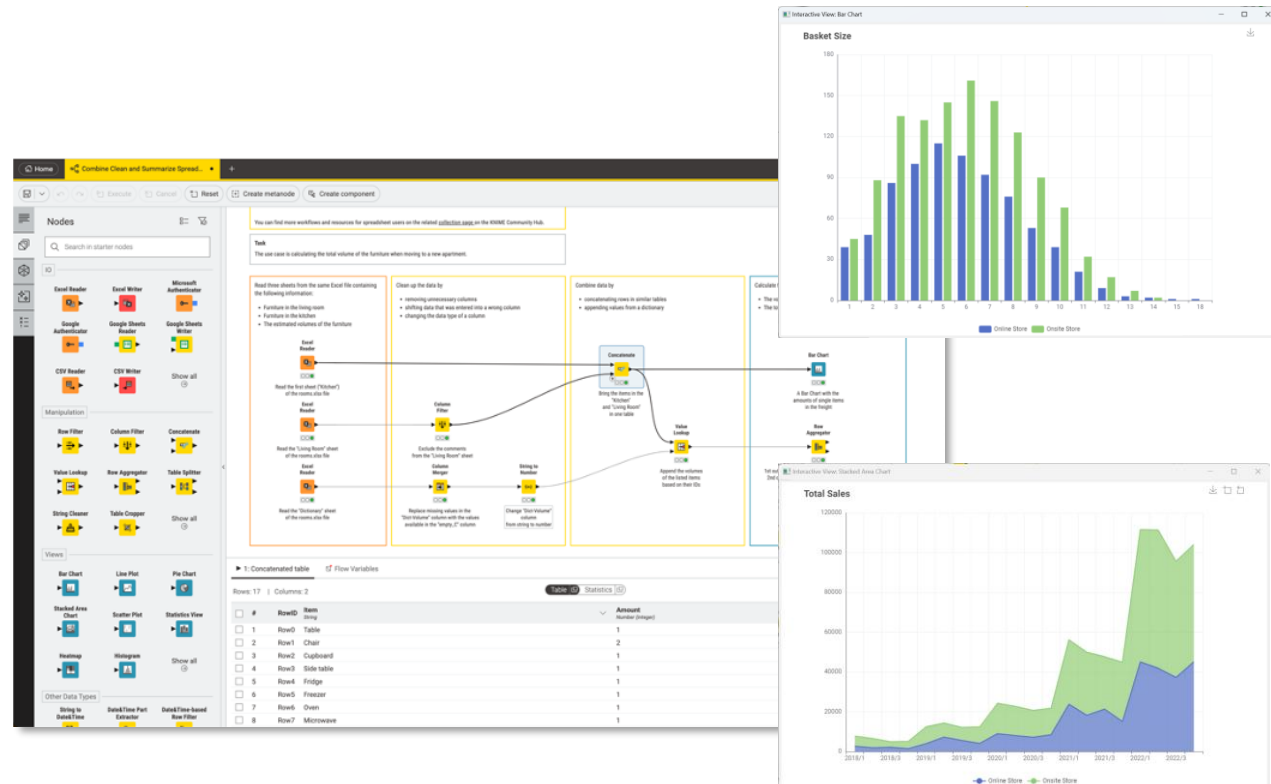
KNIME Analytics Platform





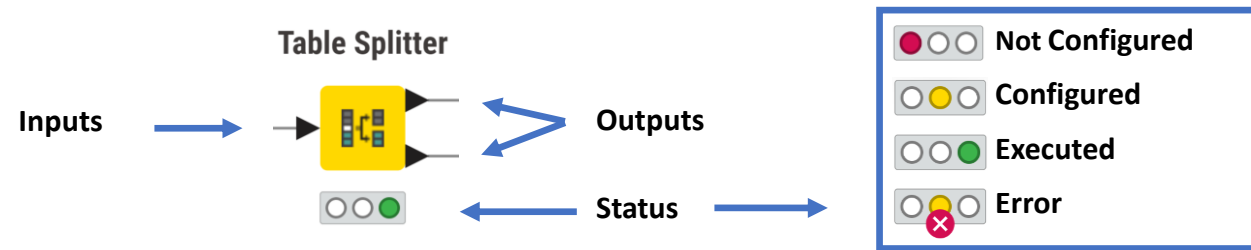
KNIME Analytics Platform

- A tool to make sense of your data
 - Data analysis, Data Science, Data Engineering
 - Transformation, visualization, reporting
- Open source
- Visual programming paradigm
 - No coding required

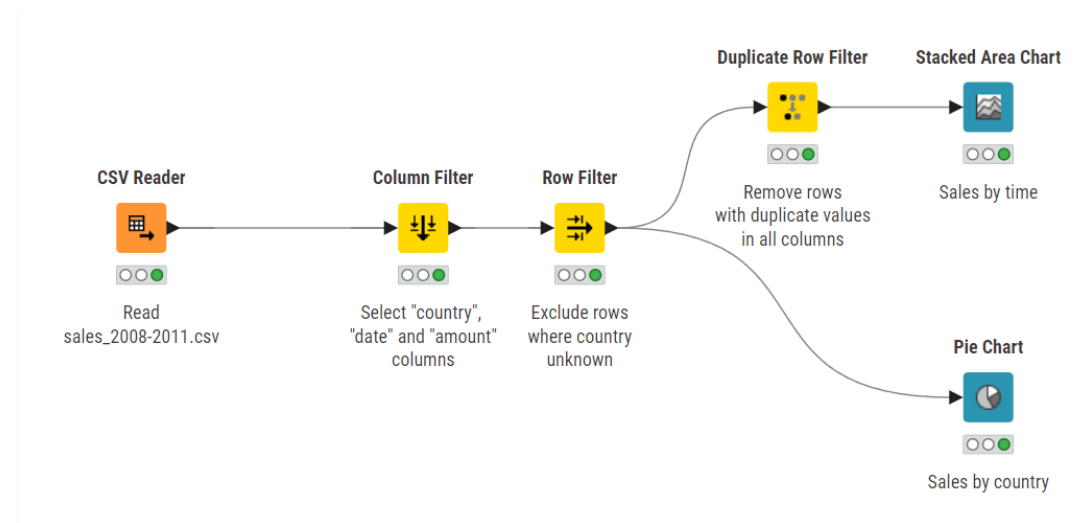




- **NODES** perform tasks on data



- Nodes are combined to create **WORKFLOWS**





KNIME Analytics Platform

The screenshot shows the KNIME Analytics Platform 5.0 interface. The top navigation bar includes a 'Home' button, the title 'KNIME Analytics Platform 5', and links for 'Help', 'Preferences', and 'Menu'. The left sidebar has a 'Recent' section with links to 'Local space' and 'KNIME Community Hub'. The main content area is titled 'Welcome' and features three example workflow cards: 'Combine Clean and Summarize Spreadsheet Data', 'Countif and Sumif', and 'Non-standard format Spreadsheet'. Below these is a link to 'Show me more examples on the KNIME Community Hub'. The bottom section, 'Recently used workflows and components', lists three workflows: 'Combine Clean and Summarize Spreadsheet Data' (Local space, 2 minutes ago), 'Non-standard format Spreadsheets' (Local space, 1 hour ago), and 'Countif and Sumif' (Local space, 1 hour ago). A '+ Create new workflow' button is located in the top right of the main content area.

Home KNIME Analytics Platform 5 ? Help ⚙ Preferences ☰ Menu

Recent

Local space KNIME Community Hub

Welcome Dismiss examples ✕

Combine Clean and Summarize Spreadsheet Data

Countif and Sumif

Non-standard format Spreadsheet

→ Show me more examples on the KNIME Community Hub

Recently used workflows and components + Create new workflow

Combine Clean and Summarize Spreadsheet Data	Local space	2 minutes ago
Non-standard format Spreadsheets	Local space	1 hour ago
Countif and Sumif	Local space	1 hour ago

Open an example workflow

Browse local space

Create new workflow

Open recent workflows



KNIME Analytics Platform

Application tabs

Workflow editor

Node monitor

Home

Combine Clean and Summar...

+

Help

Preferences

Menu

Execute

Cancel

Reset

Create metanode

Create component

56%

Info

Nodes

Explorer

K-AI

Monitor

Excel Reader

This node reads Excel files (xlsx, xlsxm, xlsb, and xls format). It can read a single or multiple files at the same time, however reading only one sheet per file. The supported Excel types that can be read in are string, number, boolean, date, and time but not pictures, diagrams, etc.

The data is read in and converted to the KNIME types string, integer, long, double, boolean, local date, local time, and local date&time. Upon execution, the node will scan the input file to determine number and types of the columns and output a table with the auto-guessed structure and KNIME types.

Formulas can also be read in and reevaluated if desired. The performance of this node is limited (due to the underlying library of the Apache POI project). Reading large files takes a long time and uses a lot of memory (especially files in xlsx format when formula reevaluation is enabled).

The dialog of this node shows a *preview* and the *file content*. While the preview shows the table that will be read in having the settings applied and is updated once a setting is changed, the file content shows the content of the file as it is displayed in Excel. This allows finding row numbers and column names easier to specify different settings.

This node can access a variety of different [file systems](#). More information about file handling in KNIME can be found in the official [File Handling Guide](#).

Ports Options Views

Task

The use case is calculating the total volume of the furniture when moving to a new apartment.

Read three sheets from the same Excel file containing the following information:

- Furniture in the living room
- Furniture in the kitchen
- The estimated volumes of the furniture

Clean up the data by

- removing unnecessary columns
- shifting data that was entered into a wrong column
- changing the data type of a column

Combine data by

- concatenating rows in similar tables
- appending values from a dictionary

Following results:

- The volume by furniture type
- The total volume of all furniture

Excel Reader

Read the first sheet ("Kitchen") of the rooms.xlsx file

Excel Reader

Read the "Living Room" sheet of the rooms.xlsx file

Excel Reader

Read the "Dictionary" sheet of the rooms.xlsx file

Column Filter

Exclude the comments from the "Living Room" sheet

Column Merger

Replace missing values in the "Dict Volume" column with the values available in the "empty_C" column

String to Number

Change "Dict Volume" column from string to number

Concatenate

Bring the items in the "Kitchen" and "Living Room" in one table

Value Lookup

Append the volumes of the listed items based on their IDs

Bar Chart

A Bar Chart with the amounts of single items in the freight

Row Aggregator

1st output port: Sum up volumes of the listed items.
2nd output port: Calculate the grand total volume of all items.

► 1: File Table

Flow Variables

Rows: 9 | Columns: 2

Table

Statistics

#	RowID	Item	Amount
1	Row0	Table	1
2	Row1	Chair	2
3	Row2	Cupboard	1
4	Row3	Side table	1
5	Row4	Fridge	1



KNIME Analytics Platform

The screenshot shows the KNIME Analytics Platform interface. The top bar includes a 'Home' button, a project name 'Combine Clean and Summar...', and navigation links for 'Help', 'Preferences', and 'Menu'. Below the top bar is a toolbar with icons for saving, undo, redo, and executing all nodes. The left sidebar contains a 'Nodes' panel with a search bar and a list of node categories: IO, Manipulation (with sub-categories like Column, Row, Table, PMML, Expression, etc.), Views, Analytics, DB, KNIME Hub, Other Data Types, Structured Data, Scripting, Tools & Services, Community Nodes, KNIME Labs, Workflow Control, Workflow Abstraction, and Reporting. The main workspace displays a workflow diagram with nodes like 'Excel Reader', 'Column Filter', 'Column Merger', 'String to Number', 'Concatenate', 'Value Lookup', 'Bar Chart', and 'Row Aggregator'. Two yellow callout boxes are present: one pointing to the 'Nodes' panel with the text 'Search and browse nodes', and another pointing to the workflow diagram with the text 'Drag and drop a node to add it to the workflow'. At the bottom of the interface, a message states: 'To show the node output, please select a configured or executed node.'

Search and browse nodes

Drag and drop a node to add it to the workflow

To show the node output, please select a configured or executed node.



KNIME Analytics Platform

KNIME Analytics Platform

Home Combine Clean and Summar... Help Preferences Menu

Local space

Example Workflows > Basic Examples

Explorer

Building a Simple Classifier

Combine Clean and Summarize Spreadsheet D...

CountIf and SumIf

Data Blending

Non-standard format Spreadsheets

Visual Analysis of Sales Data

Browse workflows in your local space

Read three sheets from the same Excel file containing the following information:

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- The estimated volumes of the furniture

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Bar Chart

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Row Aggregator

1st output port: Sum up volumes of the listed items.
2nd output port: Calculate the grand total volume of all items.

To show the node output, please select a configured or executed node.

The space explorer opens in the folder of the current workflow



KNIME Analytics Platform

KNIME Analytics Platform

Home Combine Clean and Summar... + Help Preferences Menu

Workflow monitor

Node errors

Excel Reader

Execute failed: The specified file Rooms.xlsx does not exist.

Click to highlight the failing node in the workflow

List error and warnings in the workflow

Workflow diagram showing nodes: Excel Reader, Column Filter, Column Merger, String to Number, Concatenate, Value Lookup, Bar Chart, and Row Aggregator.

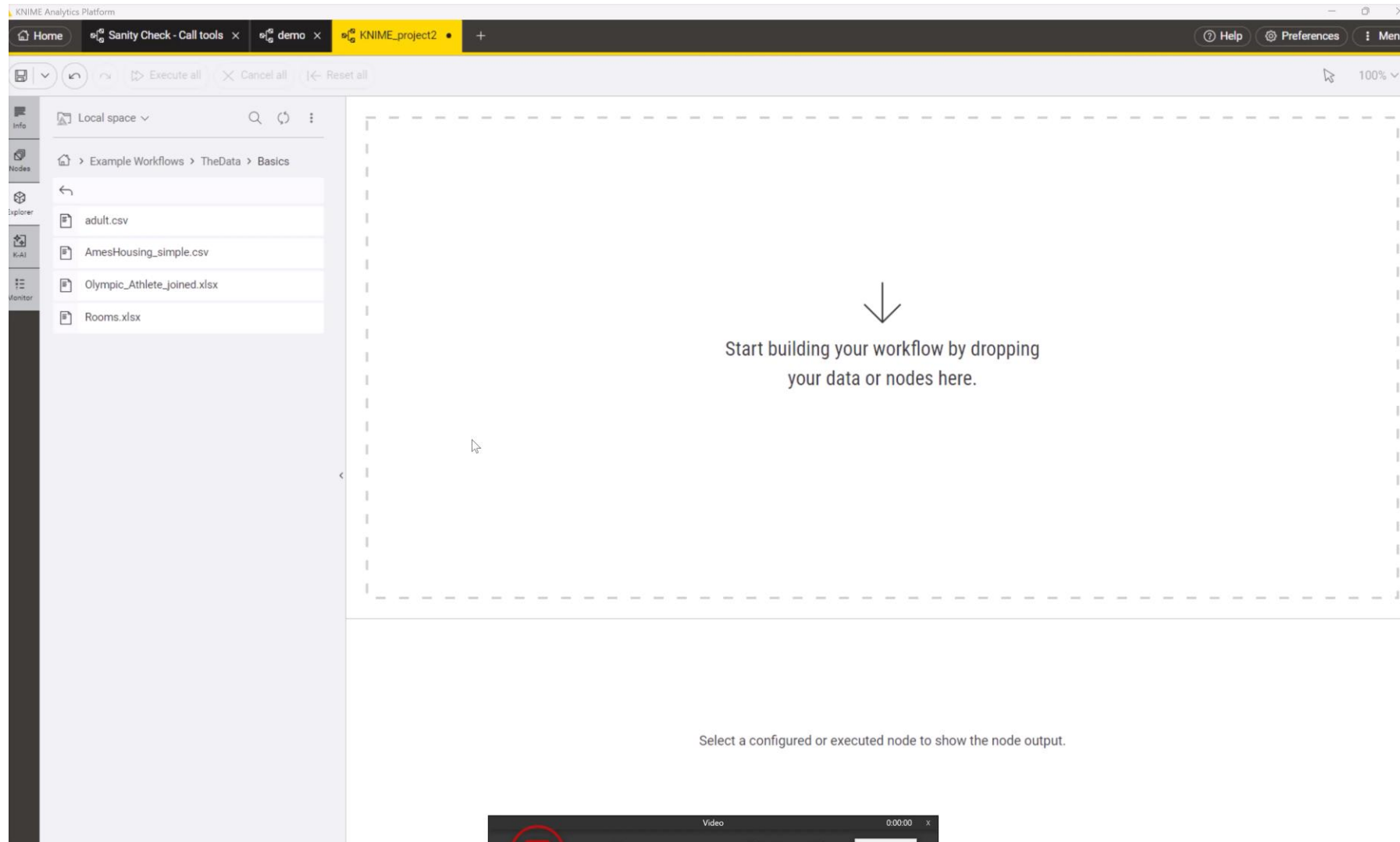
1: File Table Flow Variables

To show the port output, please execute the selected node.

Execute

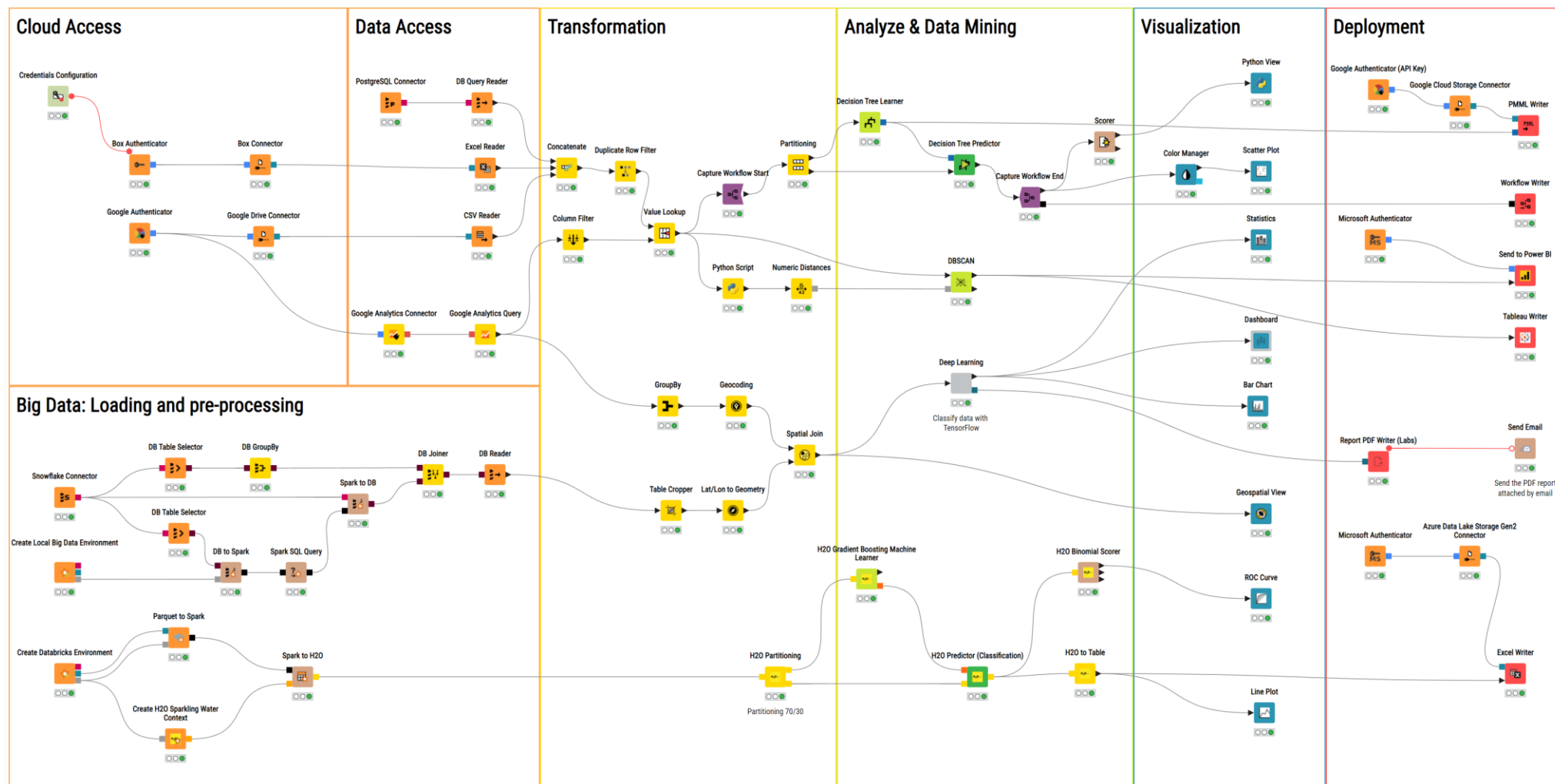


KNIME Analytics Platform





> 4k Nodes





KNIME Machine Learning Cheat Sheet

Cheat Sheet: Machine Learning with KNIME Analytics Platform

SUPERVISED LEARNING

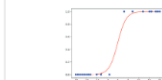
Supervised Learning: A set of machine learning algorithms to predict the value of a target class or variable. They produce a mapping function (model) from the input features to the target class/variable. To estimate the model parameters during the training phase, labeled example data is needed in the training set. Generalization to unseen data is evaluated on the test set data via scoring metrics.

CLASSIFICATION

Classification: A type of supervised learning where the target is a class. The model learns to produce a class score and to assign each vector of input features to the class with the highest score. A cost can be introduced to penalize one of the classes during class assignment.

Decision Tree: Follows the G4.5 decision tree algorithm. These algorithms generate a tree-like structure, creating data subsets, aka tree nodes. At each node, the data are split based on one of the input features, generating two or more branches as output. Further splits are made in subsequent nodes until a node is generated where all or almost all of the data belong to the same class.

Logistic Regression: A statistical algorithm that models the relationship between the input features and the categorical output classes by maximizing a likelihood function. Originally developed for binary problems, it has been extended to problems with more than two classes (multinomial logistic regression).



Naive Bayes: Based on Bayes' theorem and assuming statistical independence between input features (thus 'naive'), this algorithm estimates the conditional probability of each output class given the vector of input features. The class with the highest conditional probability is assigned to the input data.



Support Vector Machine (SVM): A supervised algorithm constructing a set of discriminative hyperplanes in high-dimensional spaces. In addition to linear classification, SVMs can perform non-linear classification by implicitly mapping their inputs into high-dimensional feature spaces, where the two classes are linearly separable.



K-Nearest Neighbor (KNN): A non-parametric method that assigns the class of the k most similar points in the training data, based on a pre-defined distance measure. Class attribution can be weighted by the distance to the k-th point and/or by the class probability.

NUMERIC PREDICTION & CLASSIFICATION



Artificial Neural Networks (ANN, NN): Inspired by biological nervous systems, Artificial Neural Networks are based on architectures of interconnected units called artificial neurons. Artificial neurons parameters and connections are trained via dedicated algorithms, the most popular being the Back-Propagation algorithm.



Deep Learning: Deep learning extends the family of ANNs with deeper architectures and additional paradigms, e.g. Recurrent Neural Networks (RNN). The training of such networks, has been enabled by recent advances in hardware performance as well as parallel execution.

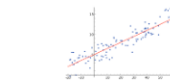


Generalized Linear Model (GLM): A statistics-based flexible generalization of ordinary linear regression, valid also for non-normal distributions of the target variable. GLM uses the linear combination of the input features to model an arbitrary function of the target variable (the link function) rather than the target variable itself.

NUMERIC PREDICTION

Numeric Prediction: A type of supervised learning for numeric target variables. The model learns to associate one or more numbers with the vector of input features. Note that numeric prediction models can also be trained to predict class scores and therefore can be used for classification problems too.

Linear/Polynomial Regression: Linear Regression is a statistical algorithm to model a multivariate linear relationship between the numeric target variable and the input features. Polynomial Regression extends this concept to fitting a polynomial function of a pre-defined degree.



Regression Tree: Builds a decision tree to predict numeric values through a recursive, top-down, greedy approach known as recursive binary splitting. At each step, the algorithm splits the subsets represented by each node into two or more new branches using a greedy search for the best split. The average value of the points in a leaf produces the numerical prediction.



TIME SERIES ANALYSIS

Time Series Analysis: A set of numeric prediction methods to analyze/predict time series data. Time series are time ordered sequences of numeric values. In particular, time series forecasting aims at predicting future values based on previously observed values.



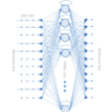
Auto-Regressive Integrated Moving Average (ARIMA): A linear Auto-Regressive (AR) model is constructed on a specified number p of past values, data are prepared by a degree of differencing d to correct non-stationarity, while a linear combination - named Moving Average (MA) - models the q past residual errors. All ARIMA model parameters are estimated concurrently by various algorithms, mostly following the Box-Jenkins approach.



ML-based TSA: A numeric prediction model trained on vectors of past values can predict the current numeric value of the time series.



Long Short Term Memory (LSTM) Units: LSTM units produce a hidden state by processing m x n tensors of input values, where m is the size of the input vector at any time and n the number of past vectors. The hidden state can then be transformed into the current vector of numeric values. LSTM units are suited for time series prediction as values from past vectors can be remembered or forgotten through a series of logic gates.



ENSEMBLE LEARNING

Ensemble Learning: A combination of multiple models from supervised learning algorithms to obtain a more stable and accurate overall model. Most commonly used ensemble techniques are Bagging and Boosting.

BAGGING

Bagging: A method for training multiple classification/regression models on different randomly drawn subsets of the training data. The final prediction is based on the predictions provided by all the models, thus reducing the chance of overfitting.

Tree Ensemble of Decision/Regression Trees: Ensemble model of multiple decision/regression trees trained on different subsets of data. Data subsets with less or equal rows and less or equal columns are bootstrapped from the original training set. Final prediction is based on a hard vote (majority rule) or soft-vote (averaging all probabilities or numeric predictions) on all involved trees.

Random Forest of Decision/Regression Trees: Ensemble model of multiple decision/regression trees trained on different subsets of data. Data subsets with the same number of rows are bootstrapped from the original training set. At each node, the split is performed on a subset of sorted features from the original input features. Final prediction is based on a hard vote (majority rule) or soft-vote (averaging all probabilities or numerical predictions) on all involved trees.



Custom Ensemble Model: Combining different supervised models to form a custom ensemble model. The final prediction can be based on majority vote as well as on the average or other functions of the output results.



XGBoost: An optimized distributed library for machine learning models in the gradient boosting framework, designed to be highly efficient, flexible, and portable. It features regularization parameters to penalize complex models, effective handling of sparse data for better performance, parallel computation, and more efficient memory usage.



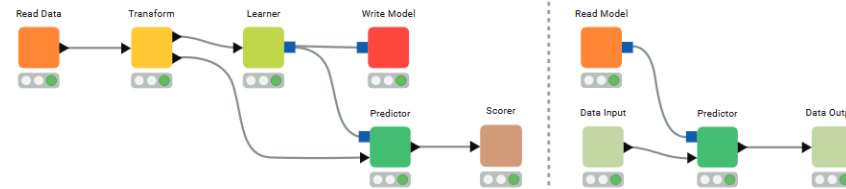
BOOSTING

Boosting: A method for training a set of classification/regression models iteratively. At each step, a new model is trained on the prediction errors and added to the ensemble to improve the results from the previous model state, leading to higher accuracy after each iteration.

Gradient Boosted Regression Trees: Ensemble model combining multiple sequential simple regression trees into a stronger model. The algorithm builds the model stagewise. At each iteration, a simple regression tree is fitted to predict the residuals of the current model, following the gradient of the loss function. This leads to an increasingly accurate and complex overall model. The same regression trees can also be used for classification.

Gradient Boosted Regression Trees: Ensemble model combining multiple sequential simple regression trees into a stronger model. The algorithm builds the model stagewise. At each iteration, a simple regression tree is fitted to predict the residuals of the current model, following the gradient of the loss function. This leads to an increasingly accurate and complex overall model. The same regression trees can also be used for classification.

TRAINING



EVALUATION

Evaluation: Various scoring metrics for assessing model quality - in particular, a model's predictive ability or propensity to error.



Confusion Matrix: A representation of a classification task's success through the count of matches and mismatches between the actual and predicted classes, aka true positives, false negatives, false positives, and true negatives. One class is arbitrarily selected as the positive class.



Accuracy Measure: Evaluation metrics for a classification model calculated from the values in the confusion matrix, such as sensitivity and specificity, precision and recall, or overall accuracy.



Cross-Validation: A model validation technique for assessing how the results of a machine learning model will generalize to an independent dataset. A model is trained and validated N times on different pairs of training set and test set, both extracted from the original dataset. Some basic statistics on the resulting N error or accuracy measures gives insights on overfitting and generalization.



Numeric Error Measures: Evaluation metrics for numeric prediction models quantifying the error size and direction. Common metrics include RMSE, MAE, or R^2. Most of these metrics depend on the range of the target variable.



ROC Curve: A graphical representation of the performance of a binary classification model with false positive rates on the x-axis and true positive rates on the y-axis. Multiple points for the curve are obtained for different classification thresholds. The area under the curve is the metric value.



DEPLOYMENT

Resources

• **E-Books:** Learn even more with the KNIME books. From basic concepts in 'KNIME Beginner's Luck', to advanced concepts in 'KNIME Advanced Luck', through to examples of real-world case studies in 'Practicing Data Science'. Available for purchase at knime.com/knimepress

• **KNIME Blog:** Engaging topics, challenges, industry news, and knowledge nuggets at knime.com/blog

• **KNIME Hub:** Search, share, and collaborate on KNIME workflows, nodes, and components with the entire KNIME community at forum.knime.com

• **KNIME Forum:** Join our global community and engage in conversations at forum.knime.com

• **KNIME Server:** The enterprise software for team-based collaboration, automation, management, and deployment of data science workflows as analytical applications and services. Visit knime.com/server for more information.

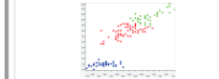
UNSUPERVISED LEARNING

Unsupervised Learning: A set of machine learning algorithms to discover patterns in the data. A labeled dataset is not required, since data are ultimately organized and/or transformed based on similarity or statistical measures.

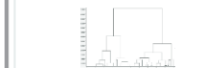
CLUSTERING

Clustering: A branch of unsupervised learning algorithms that groups data together based on similarity measures, without the help of labels, classes, or categories.

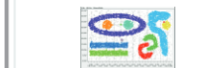
k-Means: The n data points in the dataset are clustered into k clusters based on the shortest distance from the cluster prototypes. The cluster prototype is taken as the average data point in the cluster.



Hierarchical Clustering: Builds a hierarchy of clusters by either collecting the most similar (agglomerative approach) or separating the most dissimilar (divisive approach) data points and clusters, according to a selected distance measure. The result is a dendrogram clustering the data together bottom-up (agglomerative) or separating the data in different clusters top-down (divisive).



DBSCAN: A density-based non-parametric clustering algorithm. Data points are classified as core, density-reachable, and outlier points. Core and density-reachable points in high density regions are clustered together, while points with no close neighbors in low-density regions are labeled as outliers.



Self-Organizing Tree Algorithm (SOTA): A special Self-Organizing Map (SOM) neural network, its self-structure is grown using a binary tree topology.

Fuzzy c-Means: One of the most widely used fuzzy clustering algorithms. It works similarly to the k-Means algorithm, but it allows for data points to belong to more than one cluster, with different degrees of membership.

RECOMMENDATION ENGINES

Recommendation Engines: A set of algorithms that use known information about user preferences to predict items of interest.

Association Rule: The node reveals regularities in co-occurrences of multiple products in large-scale transaction data recorded at points-of-sale. Based on the a-priori algorithm, the most frequent itemsets in the dataset are used to generate recommendation rules.

Collaborative Filtering: Based on the Alternating Least Squares (ALS) technique, it produces recommendations (filtering) about the interests of a user by comparing their current preferences with those of multiple users (collaborating).



KNIME Connectors Cheat Sheet

Cheat Sheet: Connectors with KNIME Analytics Platform

ACCESS

Environments

Create Local Big Data Environment
Creates a fully functional local big data environment including Apache Hive, Apache Spark, and HDFS. Allows opening Spark WebUI and sharing Spark workflows. Ideal for test runs.

Create Databricks Environment
Creates a Databricks Environment connected to an existing Databricks cluster.

Create Spark Context Local
Creates a new Spark context via Apache Livy. Requires access to a remote file system in order to exchange temporary files between KNIME and the Spark context running on the cluster.

Most Reader nodes can read both local and remote data. They connect to remote data sources via dynamic ports. These can be activated by clicking the three dots in the node lower left corner.

Most Reader nodes have their corresponding Writer nodes. Similar to Reader nodes, most Writer nodes support writing the data directly to remote locations via dynamic ports.

Authentication

Google Authentication
Authenticates against Google API services, via the "Authenticate" button's pop-up window. The Google Authentication (API Key) node performs the same authentication via a P12 key.

Microsoft Authentication
Authenticates against Microsoft Azure and Office 365 cloud services via a number of interactive authentication options.

Amazon Authentication
Authenticates against Amazon services.

FILE SYSTEMS

Files

Table Reader
Reads data from a table file. Table files are saved using a KNIME proprietary format, include the file structure, and are optimized for space and speed. Other nodes are available to read tabular formatted files, e.g., Parquet or ORC files.

Image Reader
Reads PNG and SVG images, as well as ZIP files containing images, by browsing over the file system. Similar reader nodes read images from URLs, URIs, or Paths in the input table.

Audio Reader
Reads audio files into a data cell. It is often used together with the Audio Viewer node to play audio files.

File Reader
Reads all text files, particularly character separated files, such as CSV files. Other similar reader nodes are dedicated to reading special file formats, like Excel or CSV files.

Text Parser
Parses textual content and metadata and extracts embedded files and attachments from more than 280 file formats. Also provides an authentication option for encrypted files.

Network Reader
Reads and creates a graph file with the Network Writer node.

OCR Reader
Reads textual data straight out of document copies or photos using the Tesseract OCR library.

JSON Reader
Reads either the whole JSON document or the selected part of the document, specified with a JSONPath query. The XML Reader node reads XML documents.

Web Log Reader
Reads Apache log files.

MDX Reader
Reads the measurement data of one or more channels of an ASAM MDX file, either fully or in part.

SDF Reader
Loads molecules from MDL Structure-Data Files (SDF).

Integrations

Python Source
Executes a Python script in a local Python environment. Supports Python 2 and 3 and Jupyter notebooks import.

R Source (Table)
Reads diverse data sources from R into a KNIME Table.

H2O Misp Reader
Reads H2O's Generated MOJO models.

SAS/STAT Reader
Reads data from sas7bdat files.

Index Reader
Reads Lucene table index.

Cloud Storage Systems

Dedicated Connector nodes connect to remote file systems, specify the working directory with a UNIX-like syntax, and allow downstream nodes to access the remote file system just as a local one, e.g., to read or write files and folders, browse, list files, copy, move, etc. The connection is closed when the Connector node is reset or the workflow is closed.

Azure Data Lake Storage Connector
Google Cloud Storage Connector
Amazon S3 Connector
Google Drive Connector
SharePoint Online Connector
Azure Blob Storage Connector

Distributed File Systems

Dedicated Connector nodes connect to a specific distributed file system (HDFS, WebHDFS, HTTPFS, Databricks, ...), and require a limited number of settings e.g., hostname and credentials.

HDFS Connector
HDFS Connector (WebHDFS)
Databricks File System Connector

DATABASES

Dedicated Connector nodes connect to a specific SQL, noSQL, or big data platform, and require a limited number of settings e.g., hostname and credentials.

SQL

DB Connector
Creates a connection to a JDBC database of your choice. Requires you to upload an appropriate driver and provide the JDBC URL.

Oracle Connector
Snowflake Connector
PostgreSQL Connector
MySQL Connector
H2 Connector
SQLite Connector
Microsoft Access Connector
Microsoft SQL Server Connector

NoSQL

MongoDB Connector
OrientDB Connector
Neo4j Connector

Big Data

Vertica Connector
Impala Connector
Hive Connector

DB Table Selector
DB Reader

SERVERS

KNIME Server Connector
Connects to a KNIME Server using the server URL & credentials. Allows downstream nodes to access the server as a file system.

SAP Reader (SAP HANA)
Accesses and loads data from various SAP systems (e.g., SAP S/4HANA, SAP BW, SAP R/3) via the Theobald Xtract Universal Server.

SMB Connector
Connects to a remote SMB server. Allows downstream nodes to access the server as a file system.

WEB SERVICES

Services

KNIME REST Client Extension
Calls a REST service in the GET, POST, PUT, DELETE, or PATCH mode. Can send one single service request set in the configuration window, or multiple service requests stored in a column of the input table. Options to set authentication, request header, & response header are available.

KNIME Twitter Connector Extension
Connect to Twitter's API, retrieve tweets, users, or post new tweets. Require credentials for the Twitter's Developer account.

SPARQL Endpoint
Connects to a SPARQL endpoint. Can be then used with Semantic Web nodes.

Triple File Reader
Reads triples stored in a file (.ttl, .rdf, .rj, .nt, .trig, .trix).

Memory Endpoint
Provides an in-memory Semantic Web endpoint. Supports default and named graphs and works with all offered Semantic Web nodes.

KNIME Scheduling Integration
Interact with Salesforce's REST API performing authentication and SOQL queries execution.

Web

Webpage Retriever
Retrieves web pages by issuing HTTP GET requests and parsing the requested HTML webpage from one or more URLs. The output can be returned in an XHTML or String format.

RSS Feed Reader
Connects to an RSS Feed URL, parses the RSS feeds, and retrieves the metadata. The results can be saved as String, Document, XML, or HTTP response code columns.

These nodes connect to web servers and specify a working directory with a UNIX-like syntax. The downstream nodes can then access the files on the server (FTP, SSH protocols) or read single files from a server (HTTP(S) protocol). The connection is closed when the Connector node is reset or the workflow is closed.

HTTP(S) Connector
SSH Connector
FTP Connector

Cloud Services

Google Sheets Connector
Connects to Google Sheets. Depending on the authentication method, the sheet should be either opened with a Google account or shared with a service account.

Google Analytics Connector
Connects to Google Analytics API.

KNIME Amazon Machine Learning Integration
Interacts with AWS AI/ML-Services like AWS Comprehend, AWS Translate, and AWS Personalize. The authentication via Amazon Authentication is required.

MODELS

Model Reader
Reads KNIME formatted models generated with any of the Learner nodes. The PMML Reader node reads PMML formatted models.

Keras Network Reader
Reads a Keras deep learning network. A pre-trained network can be read from an HDFS (h5) file. A network specification without weights can be read from JSON or YAML files.

TensorFlow Network Reader
Reads a TensorFlow deep learning network of the SavedModel format from a directory or zip file.

TensorFlow 2 Reader
Reads a TensorFlow 2 deep learning network from a file or folder. The model should be saved as an HDFS (h5) file, a SavedModel file, or zip file of a SavedModel.

Word Vector Model Reader
Reads word vector models saved by the Word Vector Writer Node, models in .txt, .csv, or .bin.gz formats.

BERT Model Selector
Downloads BERT models from TensorFlow Hub and HuggingFace to the disk. The cached model can be then used with the BERT Classification Learner node.

OpenNLP NER Model Reader
Reads OpenNLP named entity tagging models.

Resources

E-Books: KNIME Advanced Luck covers advanced features & more. Practicing Data Science is a collection of data science case studies from past projects. Both available at knime.com/knimepress

KNIME Blog: Engaging topics, challenges, industry news, & knowledge nuggets at knime.com/blog

E-Learning Courses: Take our free online self-paced courses to learn about the different steps in a data science project (with exercises & solutions to test your knowledge) at www.knime.com/knime-self-paced-courses

KNIME Hub: Browse and share workflows, nodes, and components. Add ratings, or comments to other workflows at hub.knime.com

KNIME Forum: Join our global community & engage in conversations at forum.knime.com

KNIME Server: For team-based collaboration, automation, management, & deployment check out KNIME Server at www.knime.com/knime-server

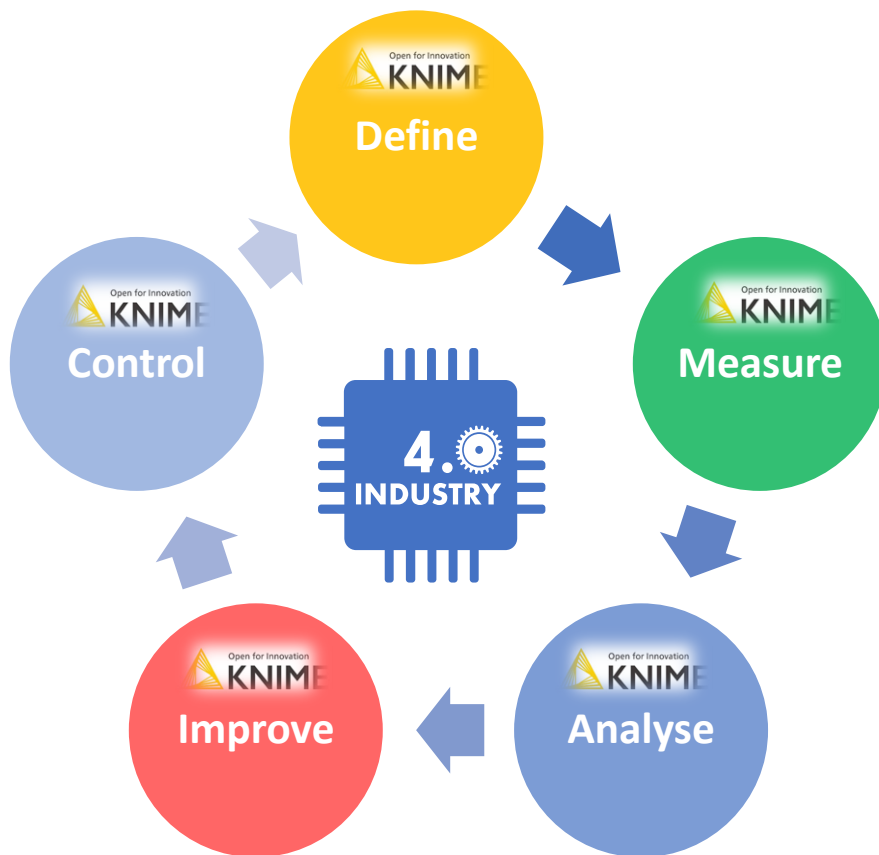
Note: Missing your favorite source? This list is just an extract of the whole set of the connector nodes currently available within KNIME Analytics Platform. Besides, new connector nodes are being created as we speak.

Lean Six Sigma with KNIME





DMAIC 4.0: EXAMPLE



Goal: Introduce KNIME in all phases of the LSS DMAIC framework



1. DEFINE LLS 4.0

DEFINE

Collecting specs, goals, and requirements.
Here we built a data app to collect all
required information for the project.

List Box Widget



Value Selection Widget



Date&Time Widget



String Widget




Autocomplete Text Widget



Data App



**Progetto LSSGB- Scaletta Camper**
Project Charter

Version:
1,1

Titolo:
Riduzione costi di produzione su scalette appendici

Problem Statemen
Su questa tipologia di prodotto si rileva una criticità sul prezzo di vendita rispetto ai costi di produzione. Si rileva anche un eccessivo numero di scarti su alcuni componenti, in particolare nei piedini in Heramid A Nat e sui componenti di alluminio a causa della scarsa qualità del materiale base e del trattamento di ossidazione anodica. Si rileva una criticità relativa ai tempi e costi di approvvigionamento.

Project Goal
Ridurre i costi di produzione e approvvigionamento in modo da rendere la fornitura più sostenibile

mpatto Diretto (misurabile)
riduzione scarti, riduzione costi di acquisti e logistica, riduzione costi manodopera, riduzione stock semilavorati.

Impatto Strategico
Cercare di fidelizzare il cliente per riuscire ad integrare le forniture di strutture cinture

Team Leader
Viscio G.

Tel.

Mail

Membri del Team

Tel.

Mail

Proprietario del processo
Viscio G.

Tel. Proprietario del processo

Mail proprietario del processo

Champion
Viscio G.

Tel. Champion

Mail Champion



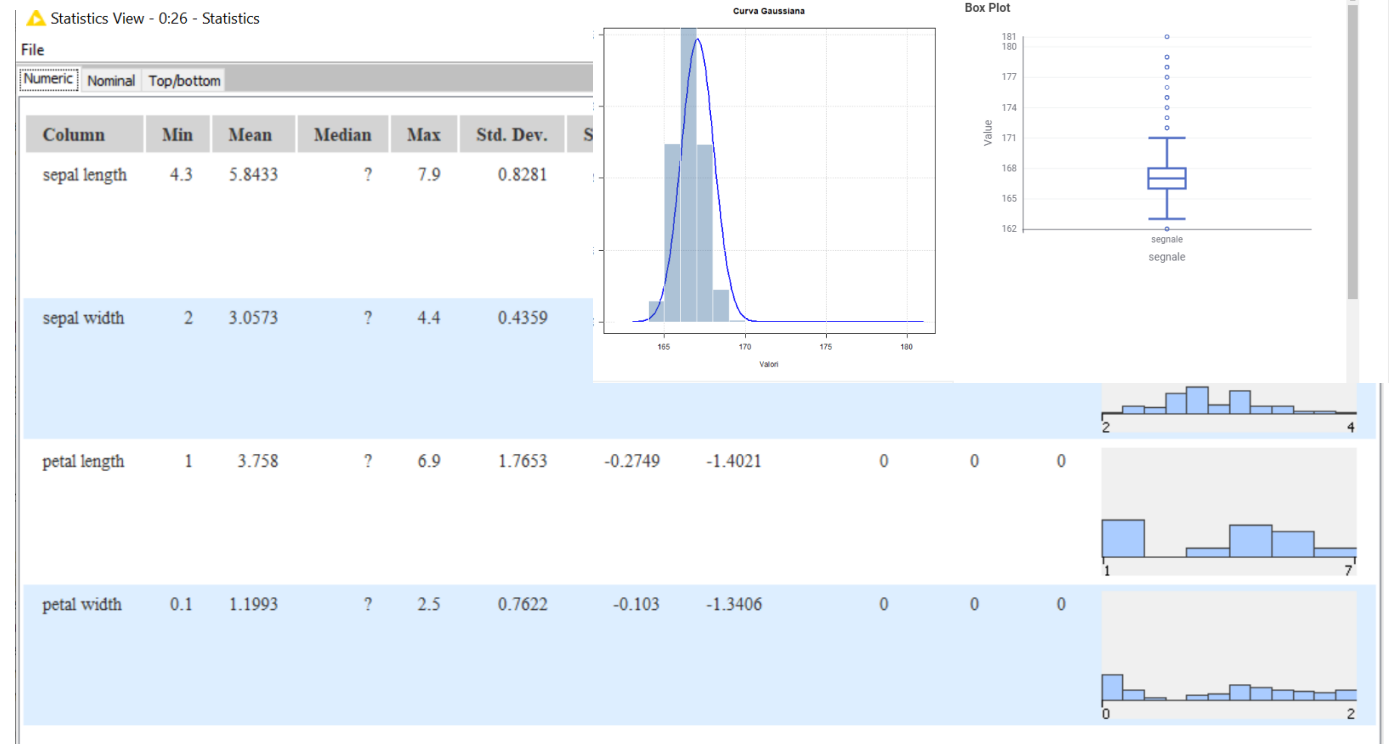
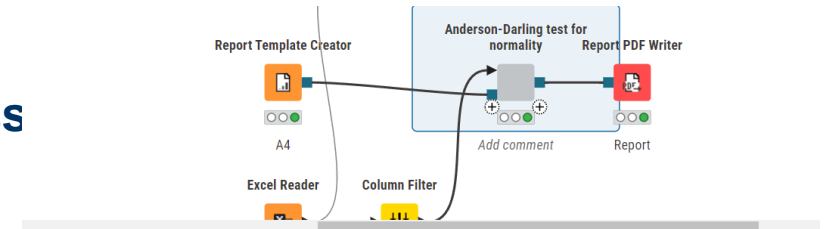
2. MEASURE LSS 4.0

MEASURE

Measure the process to determine current performance

- Collect data
- Check data quality (e.g. no missing values, outliers, range, histograms, ...)
- Clean data
- Transform data to extract info

Measurement of process capability.



Statistics



Histogram



Box Plot



Line Plot



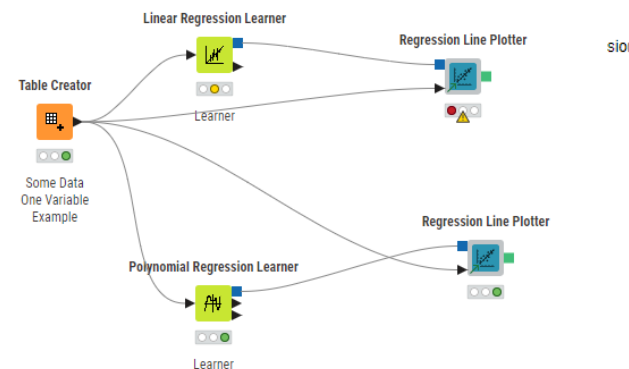
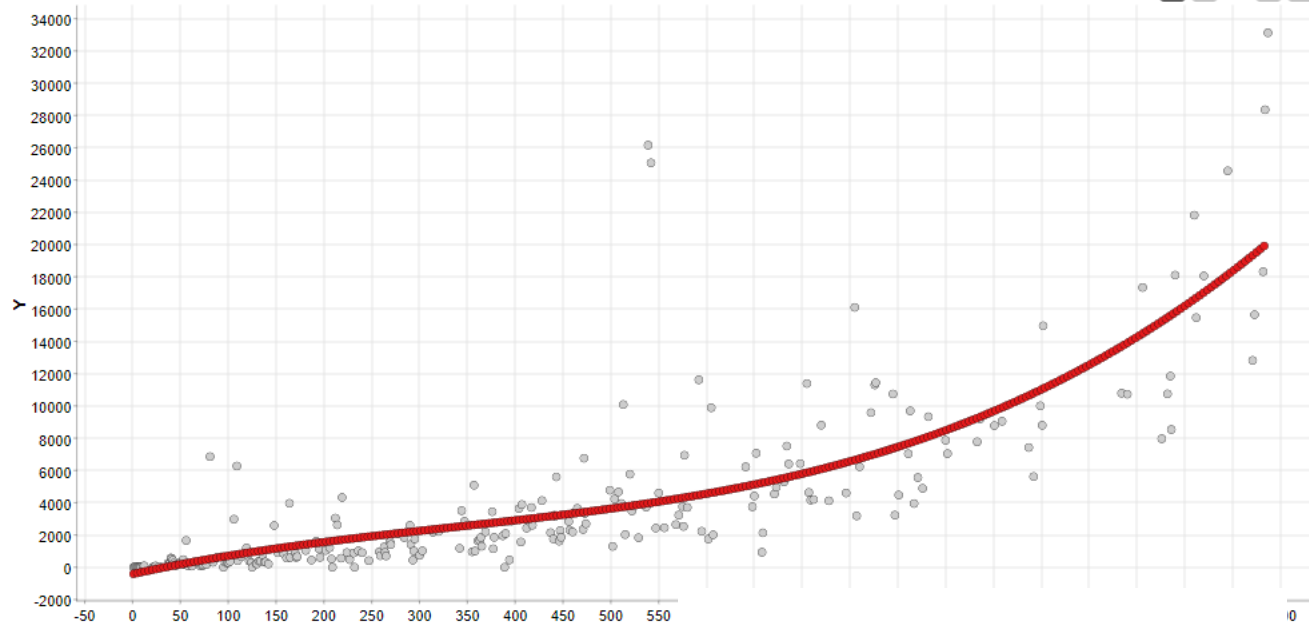
Scatter Plot





3. ANALYZE LSS 4.0

Polynomial Regression Plot (R2:0.6733184376707788)



**Simple and Multiple
Regression Analysis**

Analyze

Analyze and determine the root cause of defects.

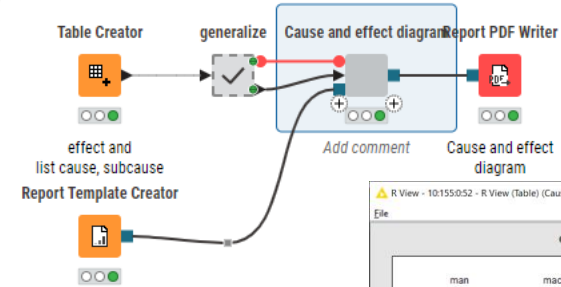
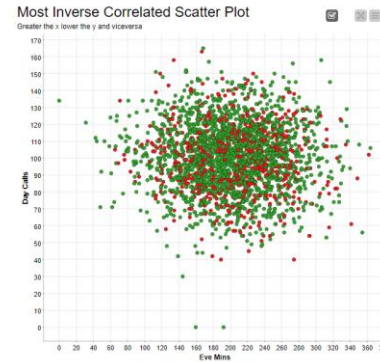
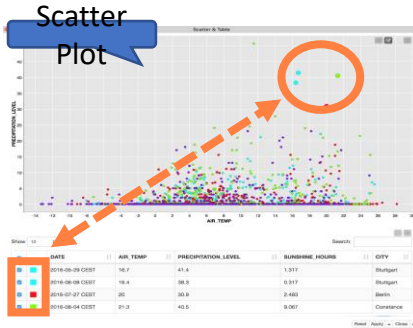
This is main area where KNIME shines:

- Data exploration with charts and plots
- Machine Learning
- Statistics
- Integration with Python and R



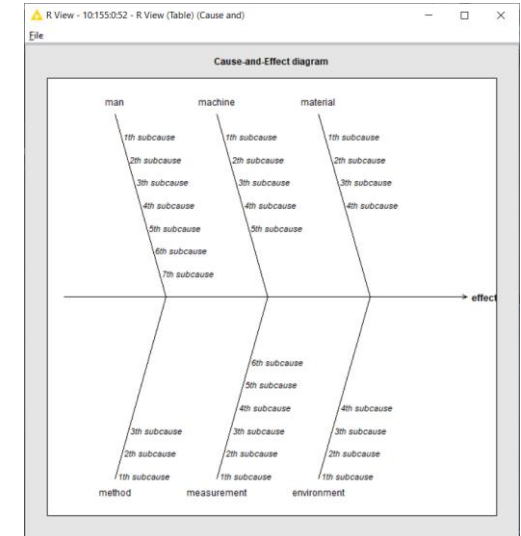


3. ANALYZE LSS 4.0

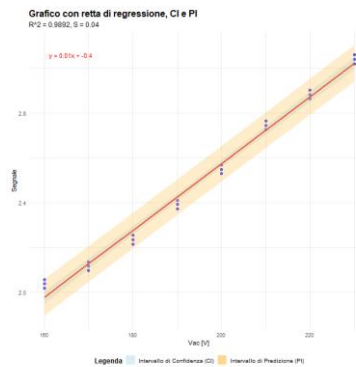


Give priority and analyzing causes

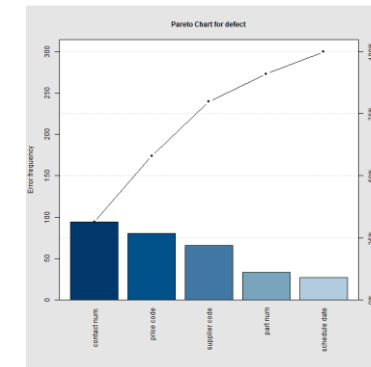
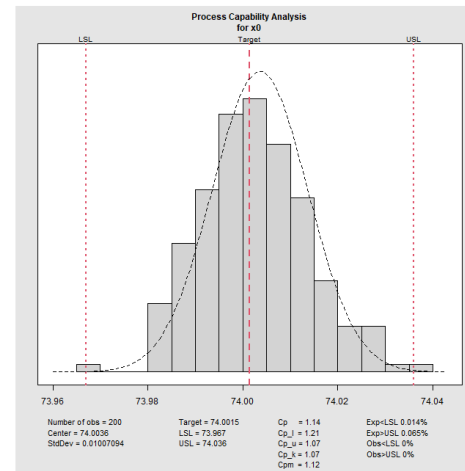
Fishbone



Normal capability Analyze



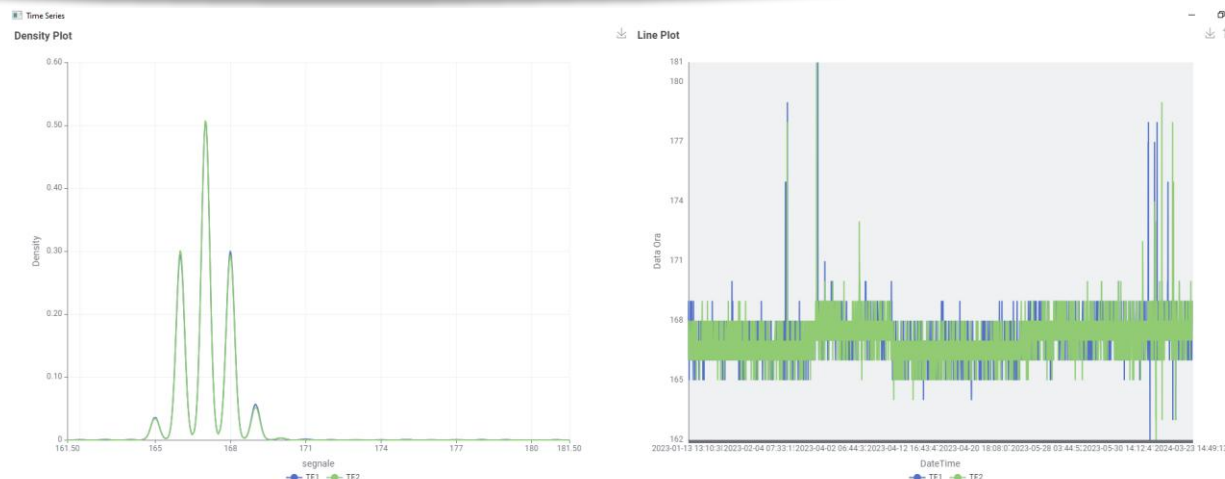
Simple and multiple regression analysis



Pareto



3. ANALYZE & IMPROVE LSS 4.0



Click per aggiornare il grafico

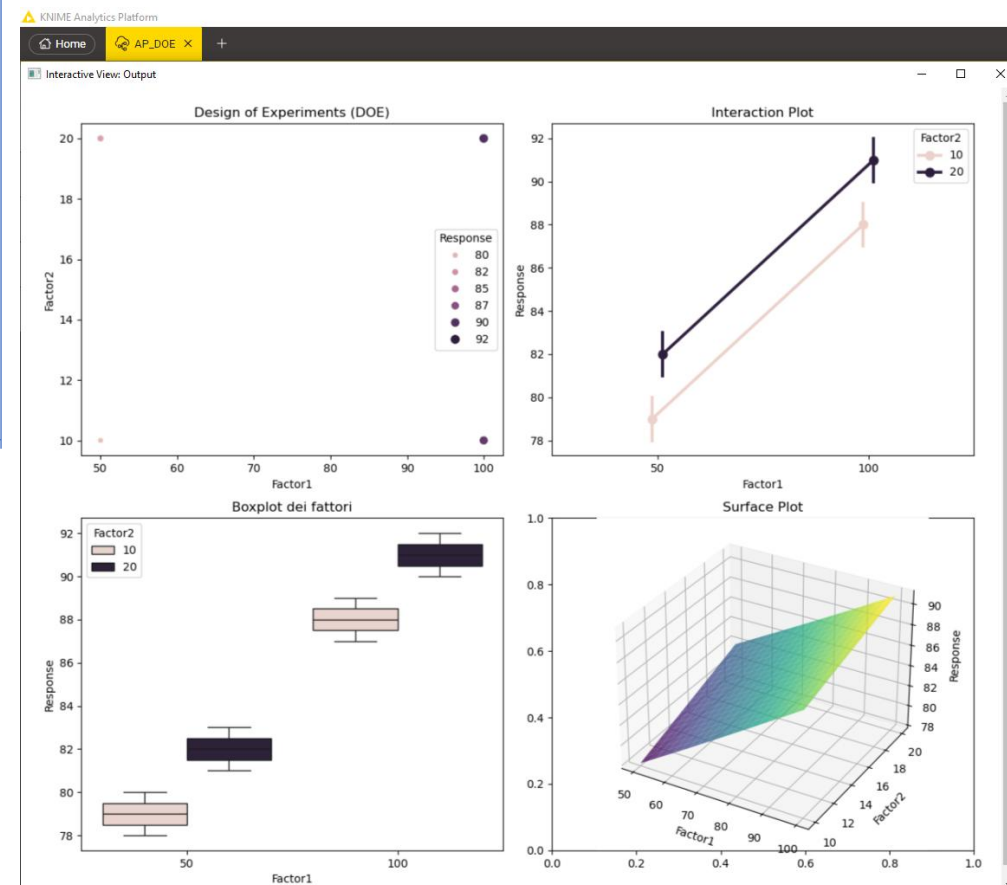
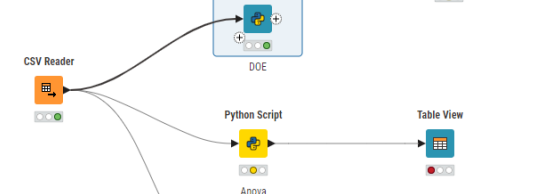
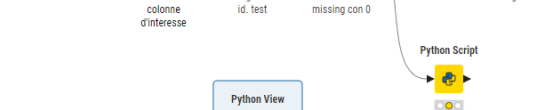
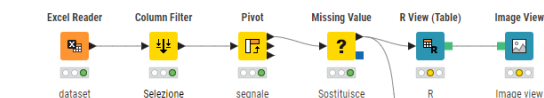
Refresh

Selezionare data minima

2023-01-27

Data minima: 2023-01-13

Time series



Understand the significant influences

DOE Design of experiment



4.+5. IMPROVE & CONTROL LSS 4.0

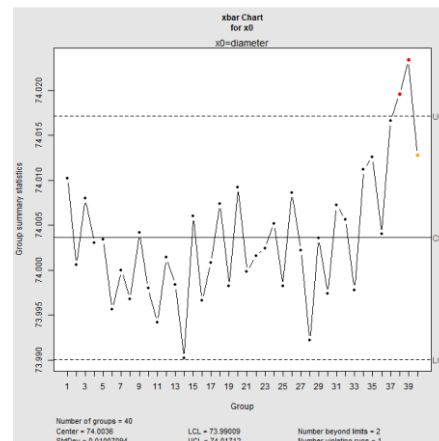
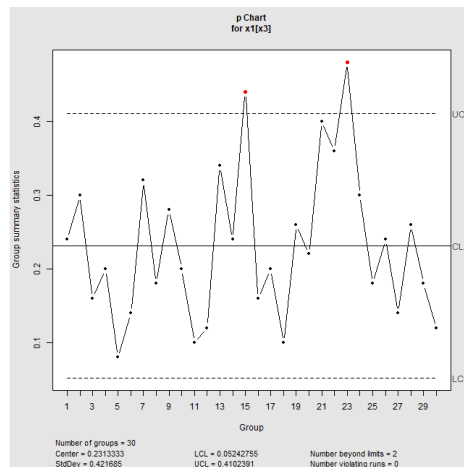
IMPROVE

Improve the process
by eliminating defects

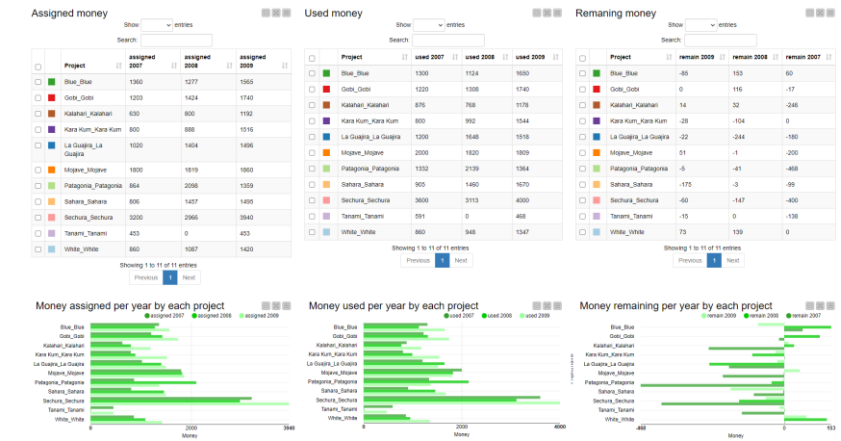
CONTROL

Control the future
performance of the process

Control the process parameters



Project Report: Money Flow

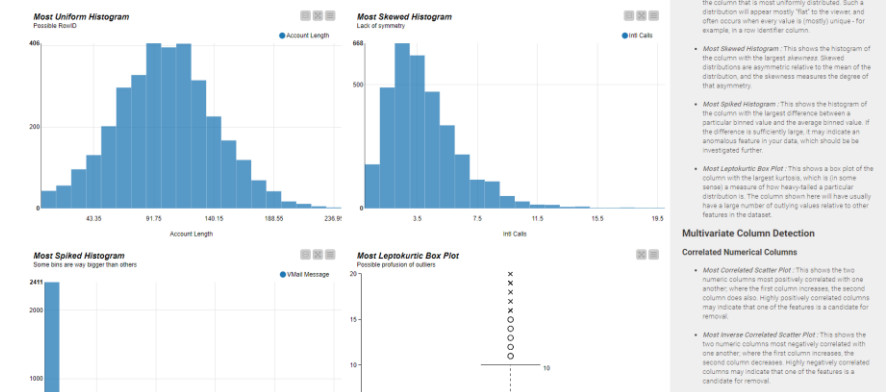


Guided Exploration

The visualizations below were automatically generated to provide insight into your dataset. They were selected by detecting properties and relationships within and between data columns.

Univariate Column Detection

Each visualization takes into account a single column detected by a different statistical test.





Artificial Intelligence (Local & Protected)

Hi! Can I summarize the analyze phase in a project lean six sigma?

Certainly! The Analyze phase in a Lean Six Sigma project is crucial for identifying the root causes of problems and understanding the factors that contribute to process inefficiencies. Here's a summary of the key elements of the Analyze phase:

1. **Data Collection**: Gather relevant data that can help in understanding the current process performance and identifying areas of improvement.
2. **Process Mapping**: Create detailed process maps to visualize the workflow and identify bottlenecks, redundancies, or non-value-added activities.
3. **Root Cause Analysis**: Use various tools and techniques (such as the 5 Whys, Fishbone Diagram, or Pareto Analysis) to identify the root causes of defects or inefficiencies in the process.
4. **Hypothesis Testing**: Formulate hypotheses about potential causes and test them using statistical methods to confirm or refute them.
5. **Data Analysis**: Analyze the collected data using statistical tools to identify patterns, trends, and correlations that can provide insights into the process issues.
6. **Prioritization of Issues**: Rank the identified root causes based on their impact on the process and the feasibility of addressing them.
7. **Documentation**: Document findings, insights, and the rationale behind the conclusions drawn during the analysis.

The goal of the Analyze phase is to gain a deep understanding of the process and the factors affecting its performance, which will inform the subsequent Improve phase where solutions are developed and implemented.

If you need more detailed information, here are some specific tools used in this LLM Prompter know!

OpenAI Authenticator



OpenAI LLM Connector



OpenAI Chat Model Connector



LLM Prompter



Chat Model Prompter



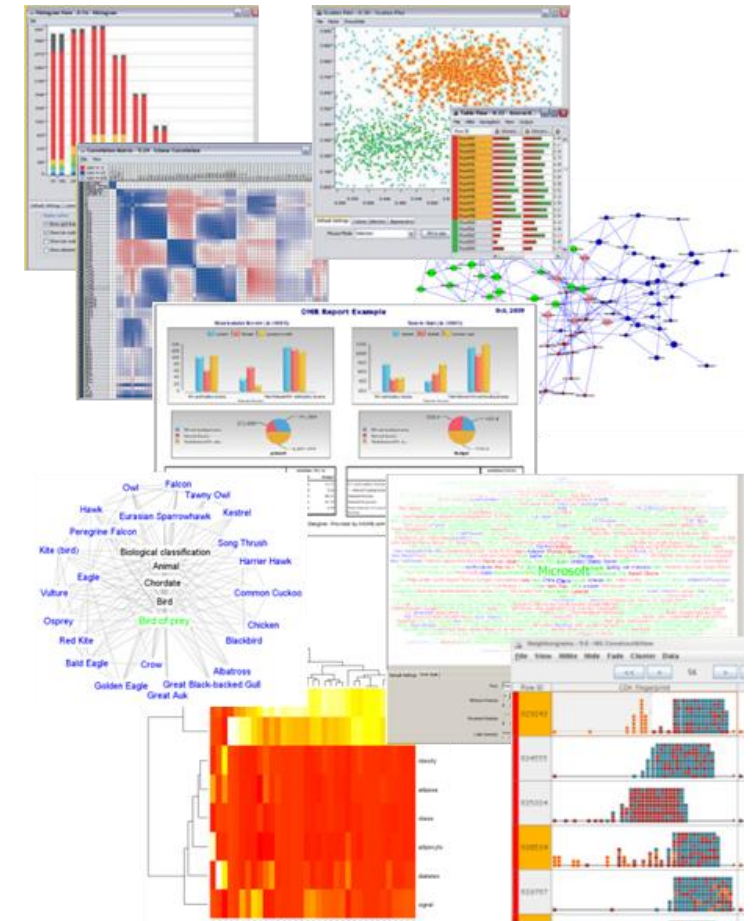
Local GPT4All LLM Connector



Text Embedder

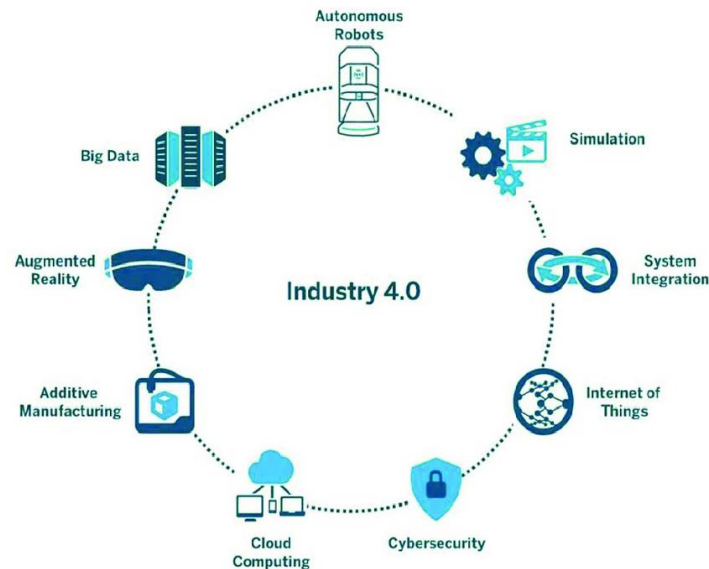


OpenAI Embeddings Connector

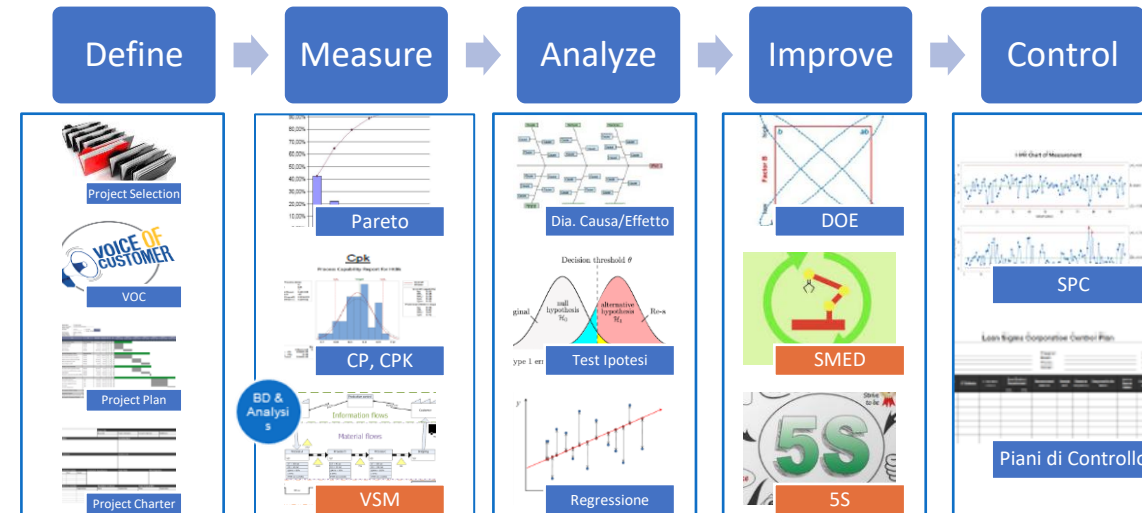


LSS&KNIME FRAMEWORK

- A workflow that guides the user step by step
- Components dedicated to each phase
- AI support



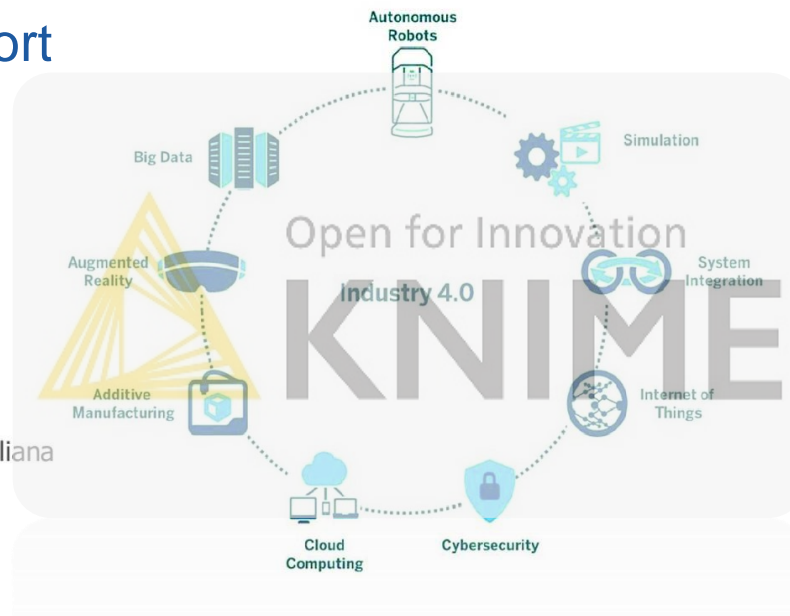
Lean Six Sigma Example Framework (Orange → LEAN)



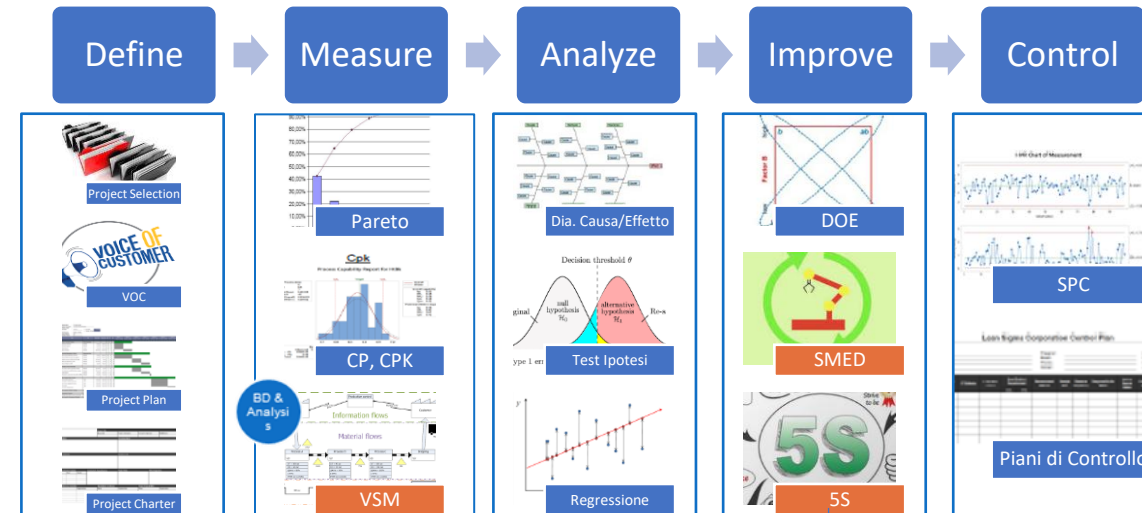
Industry 4.0 and the new frontiers of LSS: The simultaneous implementation of Industry 4.0 (I4.0) and Lean Six Sigma (LSS) potentially allows for greater benefits than those achievable from I4.0 and LSS projects pursued independently of each other.

LSS&KNIME FRAMEWORK

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Lean Six Sigma Example Framework (Orange → LEAN)



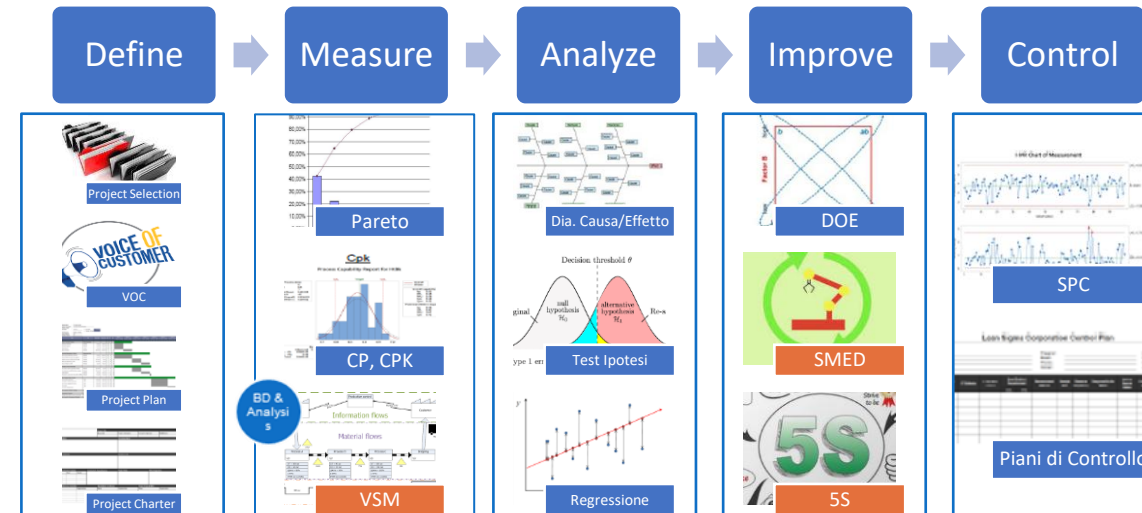
Industry 4.0 and the new frontiers of LSS: The simultaneous implementation of Industry 4.0 (I4.0) and Lean Six Sigma (LSS) potentially allows for greater benefits than those achievable from I4.0 and LSS projects pursued independently of each other.

*McKinsey & Company (2017)

LSS&KNIME FRAMEWORK

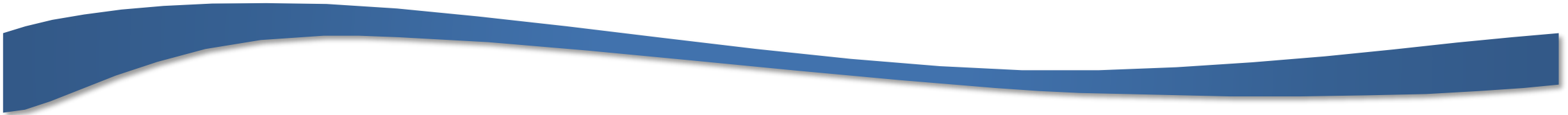
- A workflow that guides the user step by step
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Lean Six Sigma Example Framework (Orange → LEAN)



Industry 4.0 and the new frontiers of LSS: The simultaneous implementation of Industry 4.0 (I4.0) and Lean Six Sigma (LSS) potentially allows for greater benefits than those achievable from I4.0 and LSS projects pursued independently of each other.

Some Projects





Project 1 & 2



Context

- R&D activities related to an electronic board for Boilers.
- Mass production.
- Product for the international market.

Objective

Six Sigma optimization of an electronic circuit for network voltage monitoring using Design of Experiments (DOE)

AISS

Migrate the processed data from Minitab and R to Knime.





Project 3



Context

- Activities in the industrial context within the automotive sector.

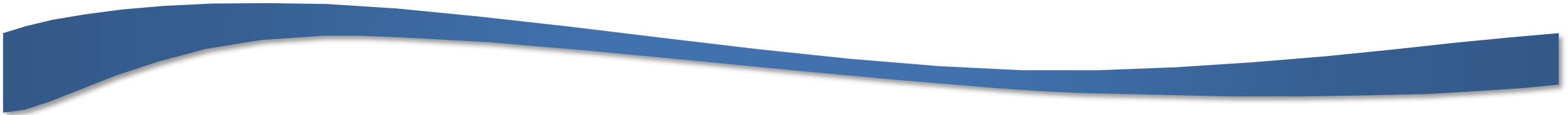
Objective

- AISS
Reduction of production costs for accessories for recreational vehicles (Campers, Caravans).

*First project for Green Belt certification exam with KNIME July 2025.



Conclusions





Conclusions

1. Lean Six Sigma as a quick and flexible management strategy to reduce waste and optimize production
2. AISS aim at spreading LSS knowledge within the Italian industry landscape through courses, certifications, projects, academic collaborations, and conferences
3. KNIME Analytics Platform's GUI is well suited for data analytics also for non-programmers
4. KNIME Analytics Platform as the tool of choice for AISS courses and projects
5. The AISS Technology Update Project, 'Lean Six Sigma with KNIME,' empowers end users to focus on cultural transformation by leveraging the insights enabled through this powerful technological synergy.





AISS upcoming courses (in Italian)



Lean Six Sigma Yellow Belt

May 2025

2 days plus one for certification

Lean Six Sigma Green Belt

June 12/13 – 26/27 and July 10/11, 2025

6 days plus one for certification

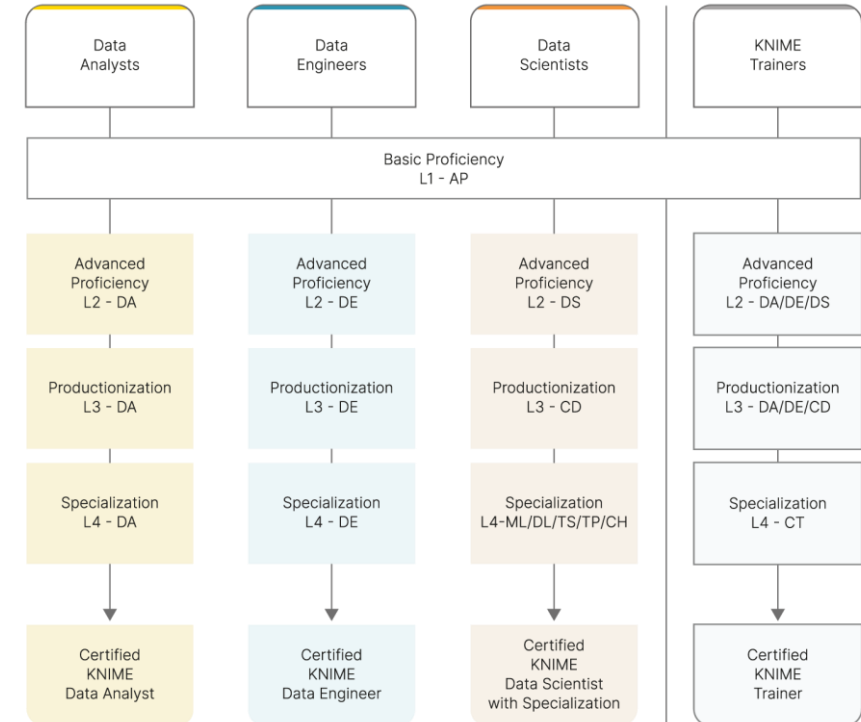
**AISS Technology Update for
Lean Six Sigma**



July 2025



- Courses from level **L1** to level **L4**
- Various professional profiles
- **Self-paced courses**
 - Videos and exercises at your own pace and for free
- **Instructor led courses**
 - Scheduled sessions and guided exercises in paid courses



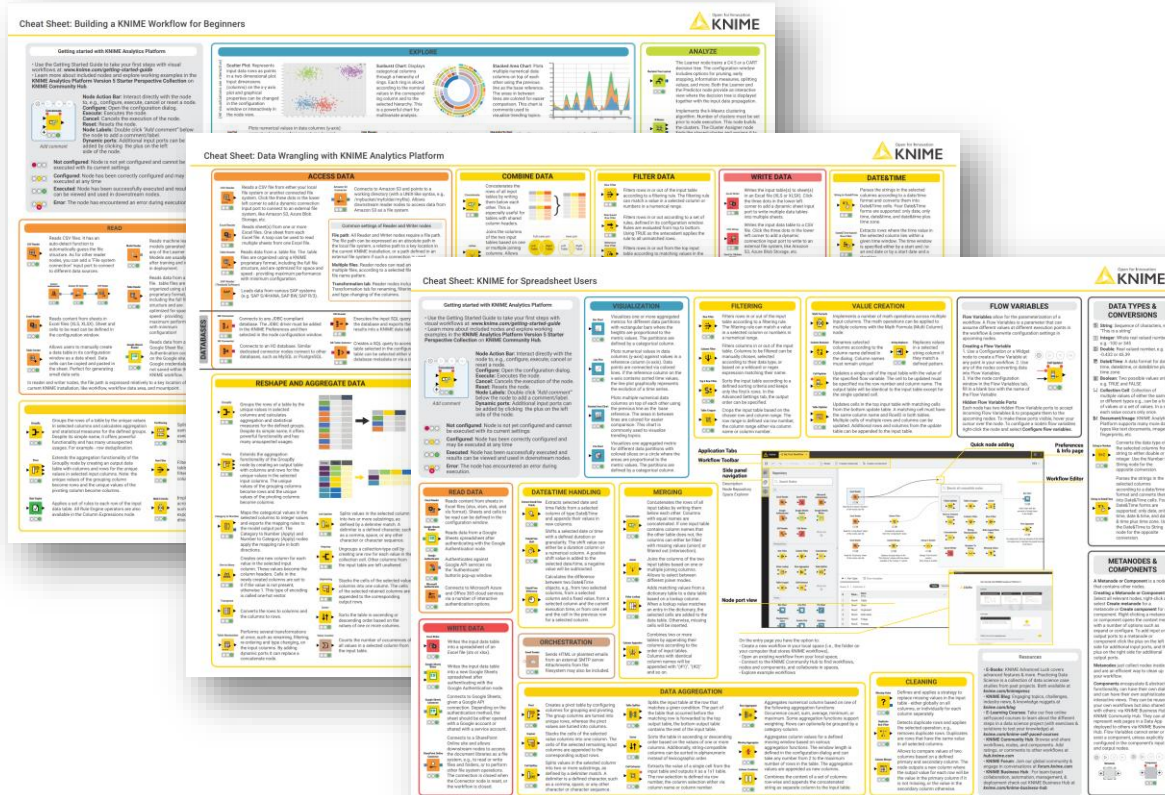
Find the **next course** at: knime.com/learning



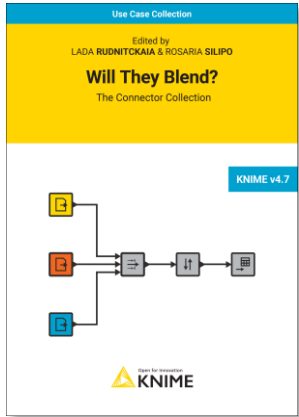
KNIME Cheat Sheets

- Many cheat sheets available for:

- Beginners
- Spreadsheet Users
- Machine Learning
- Data Wrangling
- Orchestration
- and many more...

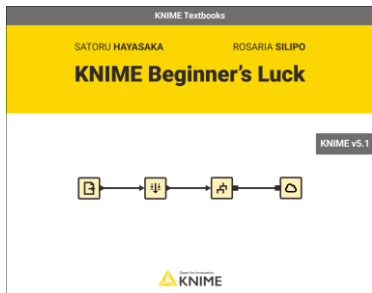


All cheat sheets are available for download at: [knime.com/cheat-sheets](https://www.knime.com/cheat-sheets)



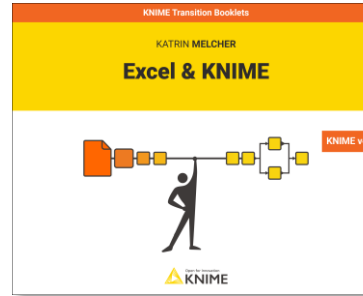
Use Case Collections

Collections of classic and more innovative use cases around specific topics



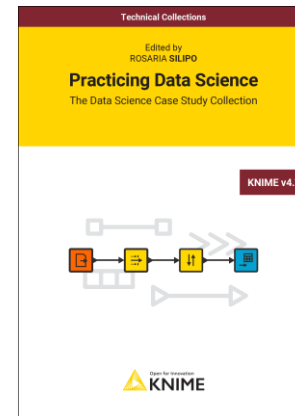
Textbooks

Well structured schoolbooks with plenty examples



Transition Booklets

Offer an easy onboarding into KNIME from other tools



Technical Collections

Collections of specific technical topics to keep you up to date

All KNIME Press books are available for download at: knime.com/knimepress



“Just KNIME It” Challenges

Starts May 14th!

- The best way to keep on learning
- Weekly challenges to test your knowledge
- Easy, medium and hard challenges for any level
- Discuss the solution with the community
- Post your solution and climb the Leaderboard



Find the **challenges** at: knime.com/just-knime-it



Data Connect in Rome – May 26th

 **DIPARTIMENTO
DI SCIENZE
INGEGNERISTICHE**

 Open for Innovation
KNIME

26 Maggio 2025 ore 16.00

Terrazza Prati - via Plinio, 44 - Roma

**Data Connect:
UniMarconi.**

Arricchire i workflow di KNIME
con l'intelligenza artificiale

<https://www.meetup.com/italy-knime-users/events/307101160>

Q & A





Contacts

Visit our website:  www.aiss.it

Consult the course catalog:  <https://www.aiss.it/catalogocorsi>

Contact us:  info@aiss.it  3204267676

Thank you!!



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