



Fin-Tech HO 2020 RegTech workshop I

BIG DATA & ANALYTICS

**Data Science and AI for Credit Risk Management:
the first european
Fintech rating agency**

Valentino Pediroda, CEO modefinance

modefinance





Introduction:

- Credit Risk management historical background
- Scoring models
- Evolution



Current Credit Risk Management challenges



MORE methodology



Who is modefinance



What is credit scoring

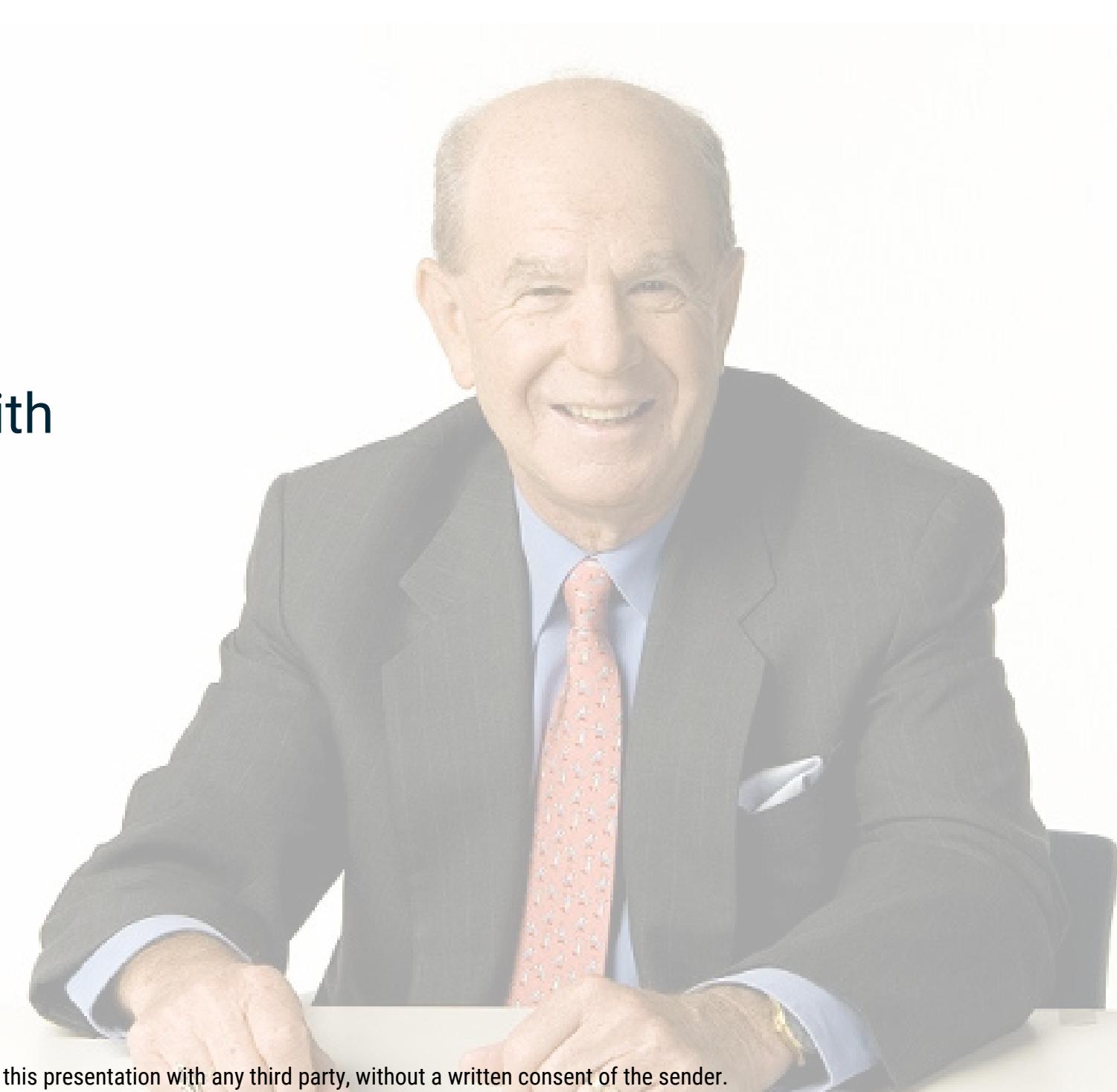
Credit scoring is an opinion of the economic and financial quality of a company based on relevant risk factors.

MORE Rating Class	Rating Macro class	Assessment
AAA	Healthy companies	The company's capacity to meet its financial commitments is extremely strong. The company shows an excellent economic and financial flow and fund equilibrium.
AA		The company has very strong creditworthiness. It also has a good capital structure and economic and financial equilibrium. Difference from 'AAA' is slight.
A		The company has a high solvency. The company is however more susceptible to the adverse effects of changes in circumstances and economic conditions than companies in higher rated categories.
BBB	Balanced companies	Capital structure and economic equilibrium are considered adequate. The company's capacity to meet its financial commitments could be affected by serious unfavourable events.
BB		A company rated 'BB' is more vulnerable than companies rated 'BBB'. The company faces major ongoing uncertainties or exposure to adverse business, financial, or economic conditions.
B	Vulnerable companies	The company presents vulnerable financial signals. Adverse business, financial or economic conditions will be likely to impair the company's capacity to meet its financial commitments.
ccc		A company rated 'CCC' has a dangerous disequilibrium in its capital structure and financial fundamentals. Adverse market events or inadequate management are highly likely to affect the company's solvency.
CC	Risky companies	The company shows signals of high vulnerability. In the event of adverse market and economic conditions, the company's strong disequilibrium could increase.
C		The company shows considerable danger signs. The company's capacity to meet its financial commitments is very low.
D		The company no longer has the capacity to meet its financial commitments.

A different Probability of Default (within one year, two years and three years) is associated with each Credit Rating class (indicated by symbols: traditional AAA to D).

The true pioneer of credit scoring models: **Edward I. Altman**, professor of Finance at the Stern School of Business at New York University, developed a model called **Z-Score** published in 1968, which allowed to predict with statistical techniques the probability of business failure in subsequent years.

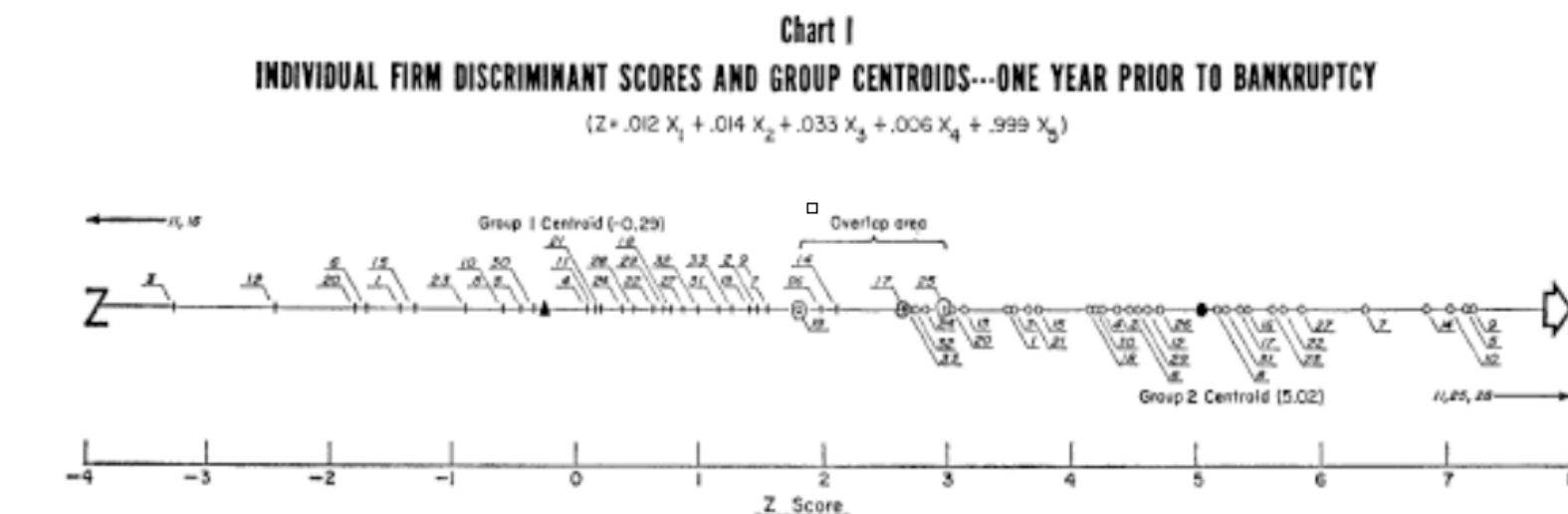
The test was developed by analyzing the balance sheet data of 33 failed companies and 33 solid companies with a degree of **accuracy of 95%**.



key factors

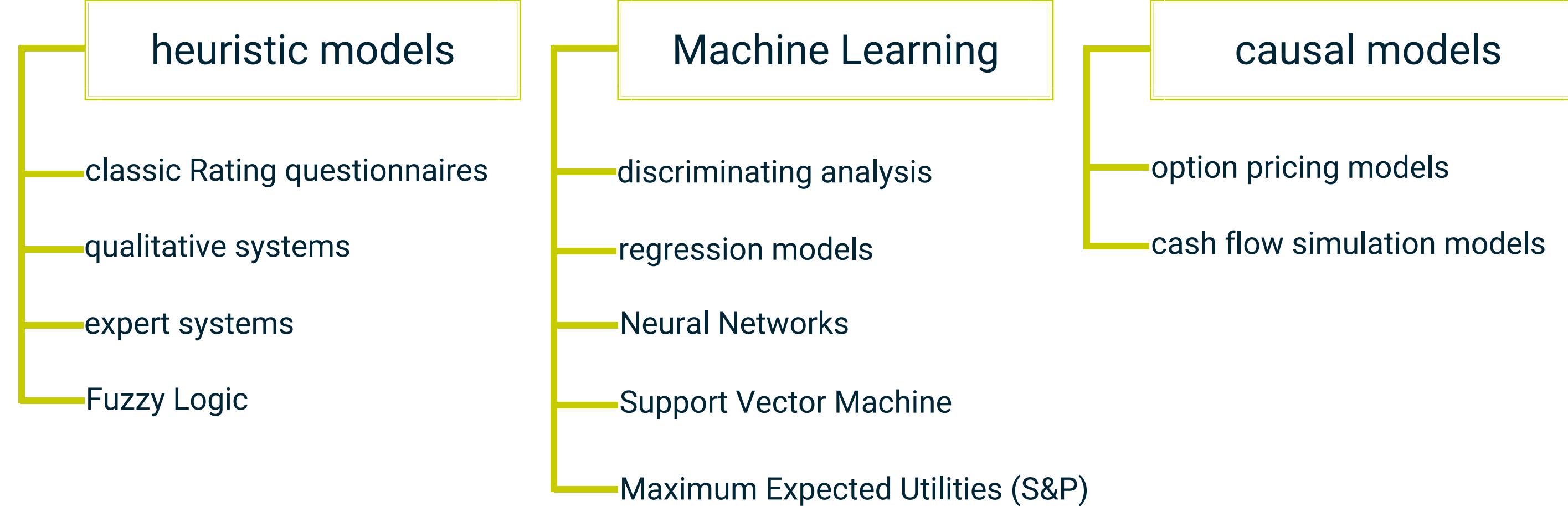
Altman's work shows the **key factors** characterizing each and any credit scoring technique:

- 1) To define and choose **variables**;
- 2) To choose **a model**;
- 3) To select a **data sample** on which to build the model;
- 4) To apply the model on data not used for its construction;
- 5) To **test and validate** the results.



(I) $Z = .012X_1 + .014X_2 + .033X_3 + .006X_4 + .999X_5$
 where X_1 = Working capital/Total assets
 X_2 = Retained Earnings/Total assets
 X_3 = Earnings before interest and taxes/Total assets
 X_4 = Market value equity/Book value of total debt
 X_5 = Sales/Total assets
 Z = Overall Index

SCORING MODELS



hybrid forms
from the integration of a heuristic model and one or more statistical models

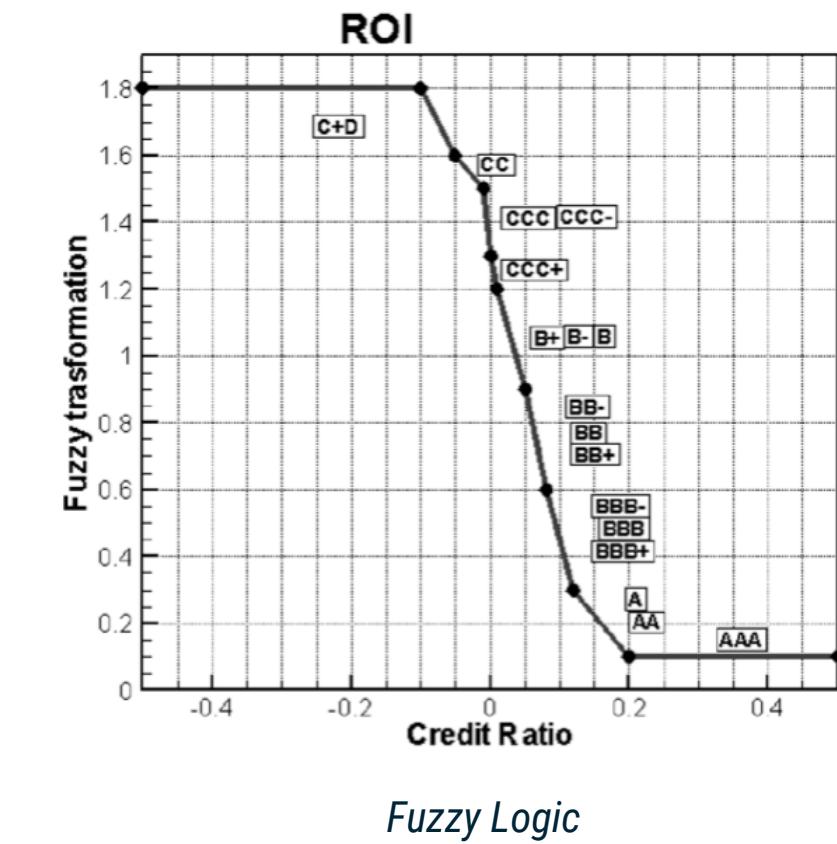
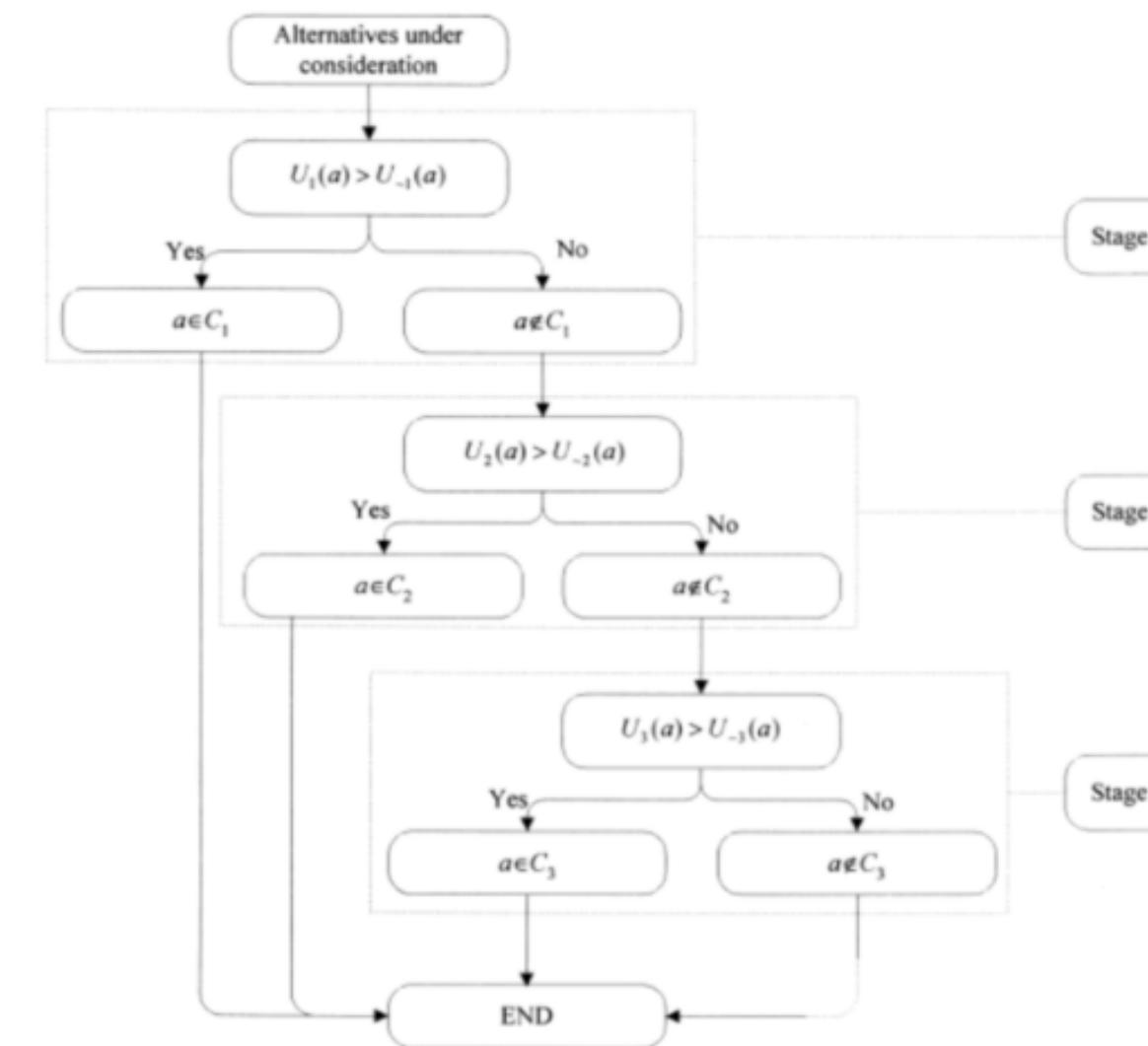
heuristic models

Heuristic models try to make the knowledge gained in previous experiences methodical.

This means that, by exploiting the techniques and the analytical skills that some analysts have learned during their professional career, these models aim, by the maximum scientific rigor, to **make objective the rules that are actually subjective**.

ratio	grade
ROI > 10%	5
5% > ROI > 10%	4
1% > ROI > 5%	3
0% > ROI > 1%	2
ROI < 0%	1

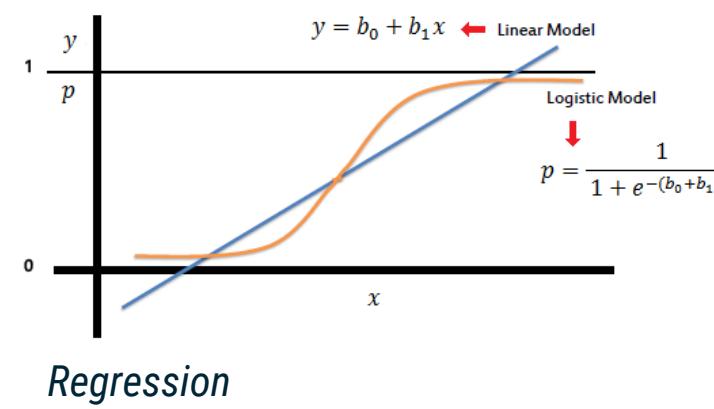
qualitative system



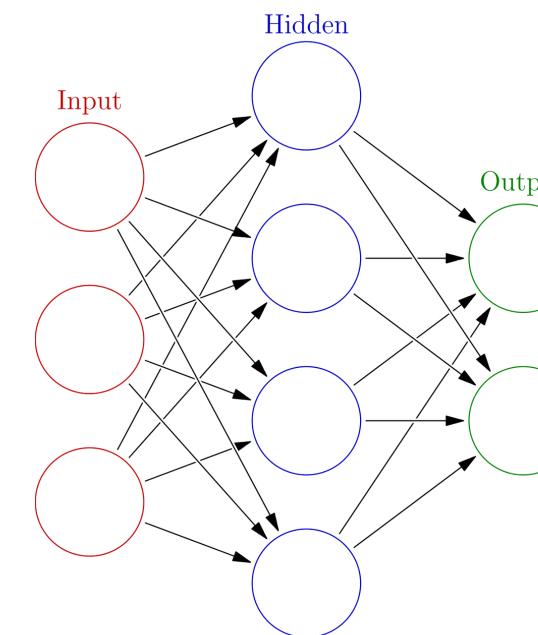
machine learning

Unlike heuristic methods, which arise from subjective experience gained from credit assessment experts, **Machine Learning models** "learn" from data contained in appropriately created sample sandboxes: complete and accurate financial statements of healthy companies and insolvent companies.

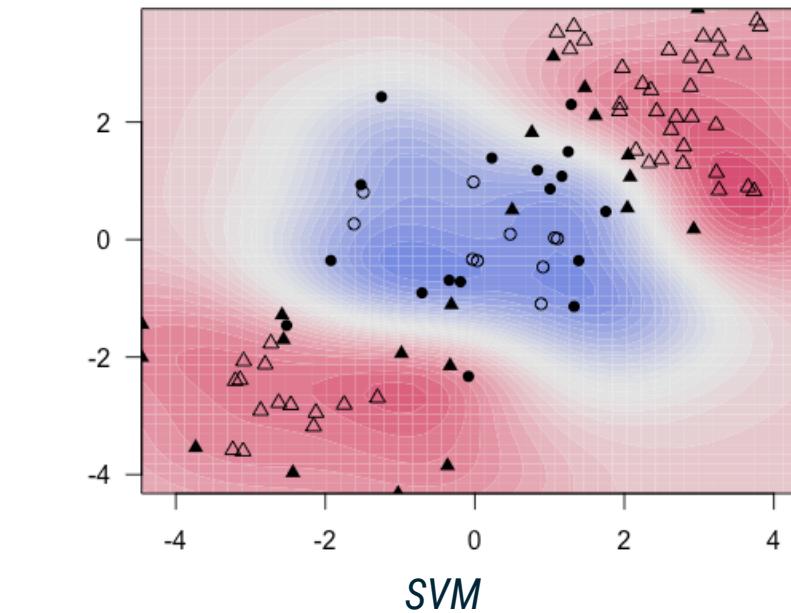
This means that, by means of statistical procedures, these models seek to **verify hypotheses** on the potential creditworthiness of the companies.



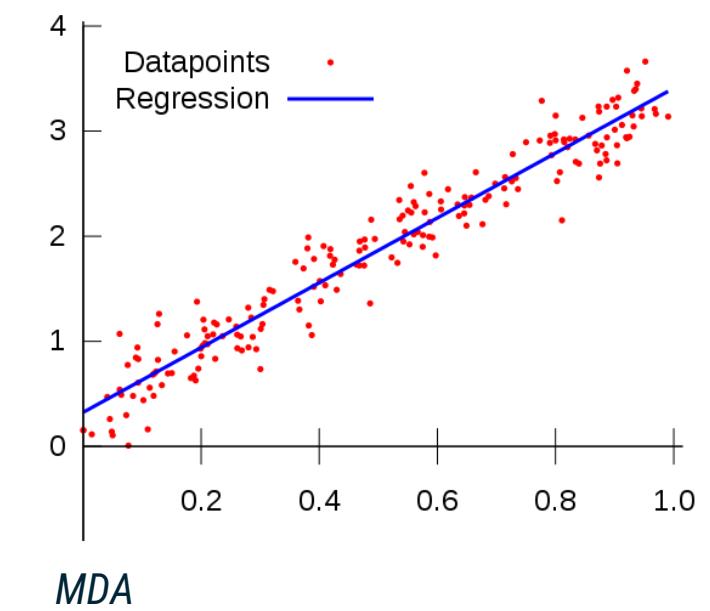
Regression



Artificial Neural Network



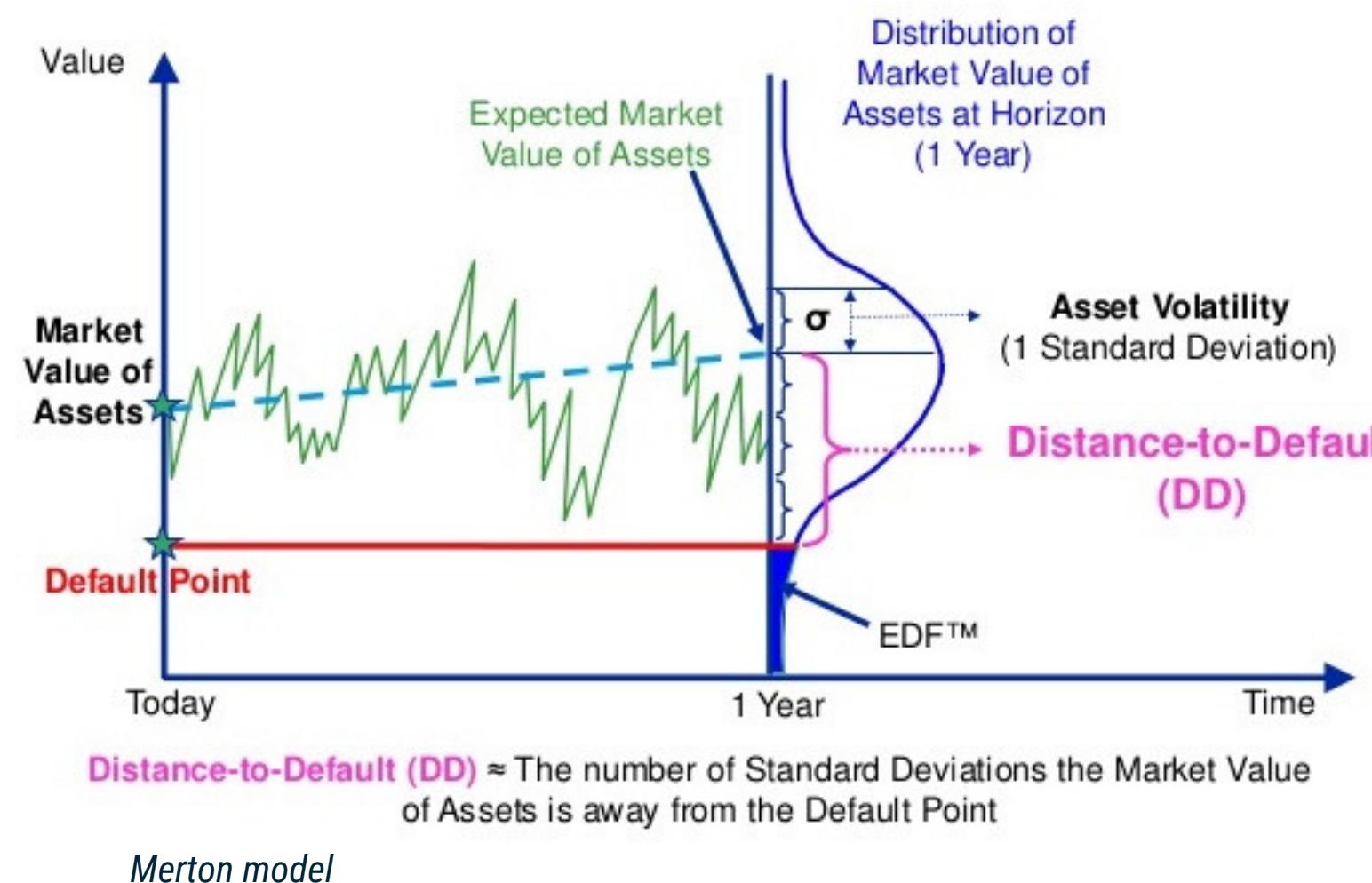
SVM



MDA

Causal models, even by complex and sophisticated mathematical algorithms, get to the evaluation of the creditworthiness of the analyzed companies **using already known finance theories and principles**.

This means that, for the development of such models, we do not go through the analysis and the "understanding" of a training set of data.



Merton model (1974):

Basically it is assumed that the company finances itself through a loan obtained from a bank or through the issue of a bond.

The default occurs based on the following condition: *if at maturity the value of the assets is insufficient to repay the creditors, the company goes bankrupt.*

All the illustrated models have pros & cons.
So which is the best one to obtain a good scoring model?

A hybrid model is preferred!

There are 4 factors that have strongly driven the evolution of credit management processes:

- 1) the theoretical and applicative development of credit risk management logics;
- 2) the definition and implementation of supervisory regulations;
- 3) the rethinking of risk management logics that move from a portfolio management approach to an individual pricing approach;
- 4) the growing complexity of bank lending.

MAIN PROBLEMS

!?

different accounting standards

!?

different economical behavior for the different countries

!?

different economical behavior for the different sectors

!?

missing financial data for bankrupted companies

!?

"holes" in financial data (BS, P&L)

!?

companies without financials

How can we develop a credit score model to overstep these problems?

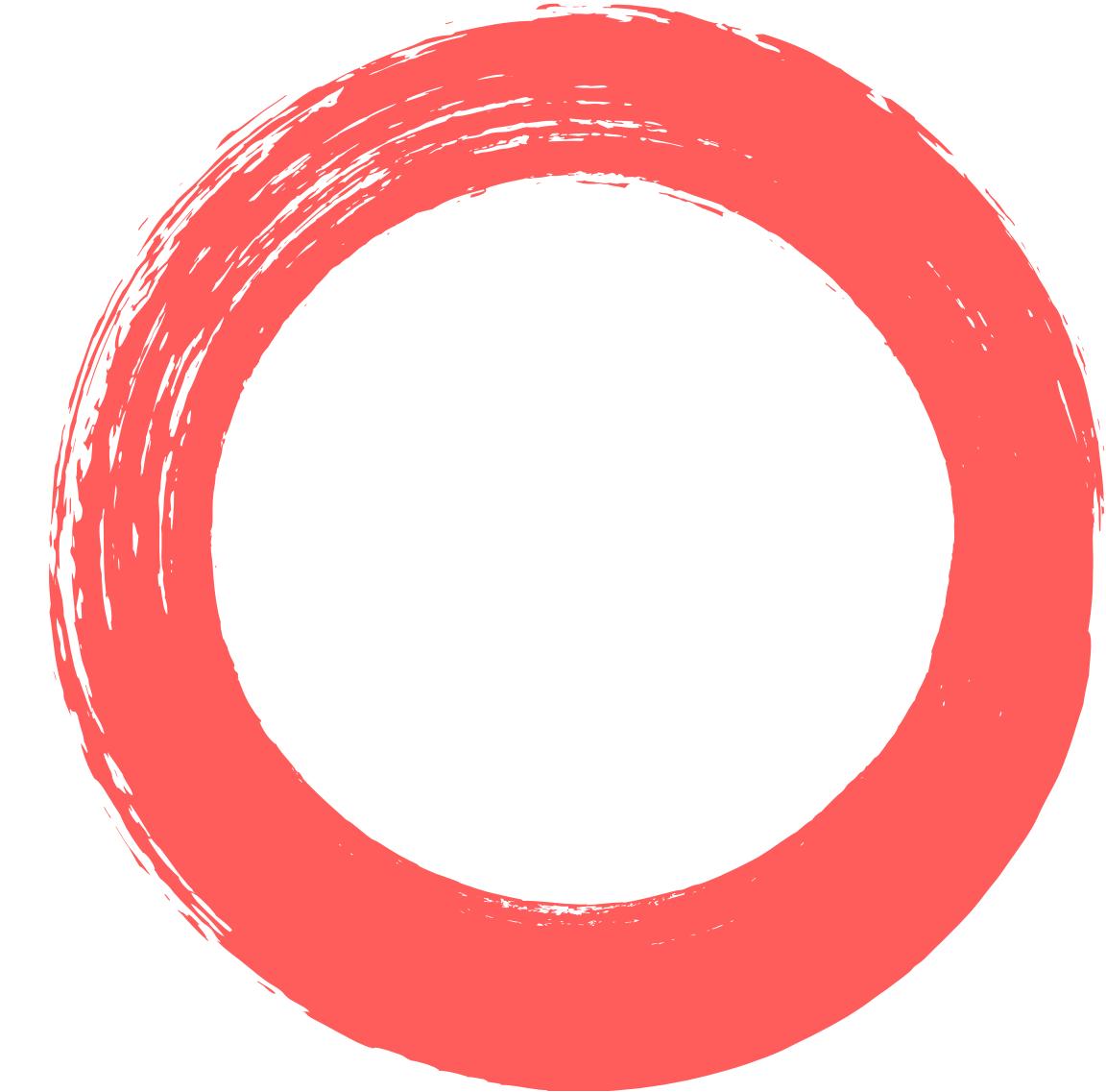
challenge details: numbers



65'000 listed
companies:
all the information
available



25million companies:
public information available



300million companies:
no balance sheet data

Mainly 2 different standards exist: Continental and Anglo-Saxon.

The main difference is the classification of the costs.

Sales	115,368	Revenues growth (%)	-
Revenues growth (%)	-5	Other revenues +/- variation in inventories and contract in progress + Fixed assets	-
Other revenues +/- variation in inventories and contract in progress + Fixed assets own construction capitalized	3,811	own construction capitalized	-
Operating revenue / turnover	119,179	Operating revenue / turnover	32,664
Total costs	114,312	Total operating costs	30,150
Costs growth (%)	-2	Costs growth (%)	4
Service costs	24,147	Service costs	-
Material costs	80,899	Material costs	-
Costs of employees	9,266	Costs of employees	-
EBITDA	4,867	EBITDA	-
Depreciation	1,686	Depreciation	-
EBIT	3,181	EBIT	2,514
Financial P/L	-2,966	Financial P/L	-585
Financial revenue	133	Financial revenue	0
Financial expenses	3,099	Financial expenses	585
Interest paid	3,116	Interest paid	-
P/L before tax	215	P/L before tax	1,929
Extr. and other P/L	-1,063	Extr. and other P/L	462
Extr. and other revenue	60	Extr. and other revenue	1,282
Extr. and other expenses	1,123	Extr. and other expenses	821
P/L before tax + Extr. and other P/L	-849	P/L before tax + Extr. and other P/L	2,391
Taxation	448	Taxation	0
P/L for period	-1,297	P/L for period	2,391
30/06/2013			
Costs of Good Sold		Costs of Good Sold	26,454
Gross Profit		Gross Profit	6,210
Other Operating Expenses		Other Operating Expenses	3,697

How can we **minimize the difference** in the credit scoring based on the different accounting standards?

Mainly we have to develop **2 different models with different financial ratios.**

Ratio for financial interest coverage:



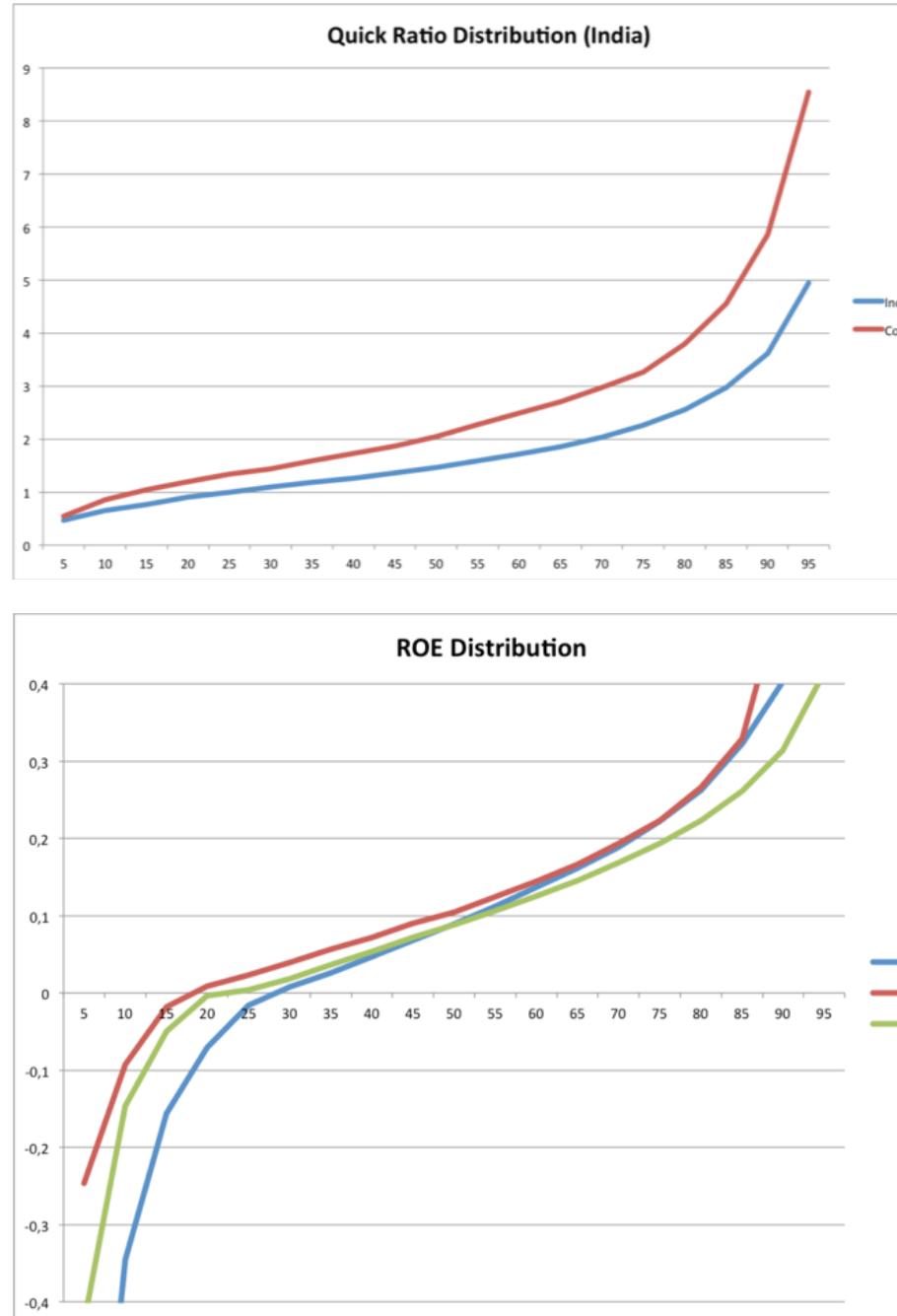
Continental:
EBIT/Interest paid



UK:
GrossProfit/Interest paid

IMPORTANT: in many cases the account doesn't depend on the country, but it is a company choice (Netherlands, Russia, etc.), with consequent IT difficulties.

companies with public data



Balance Sheet

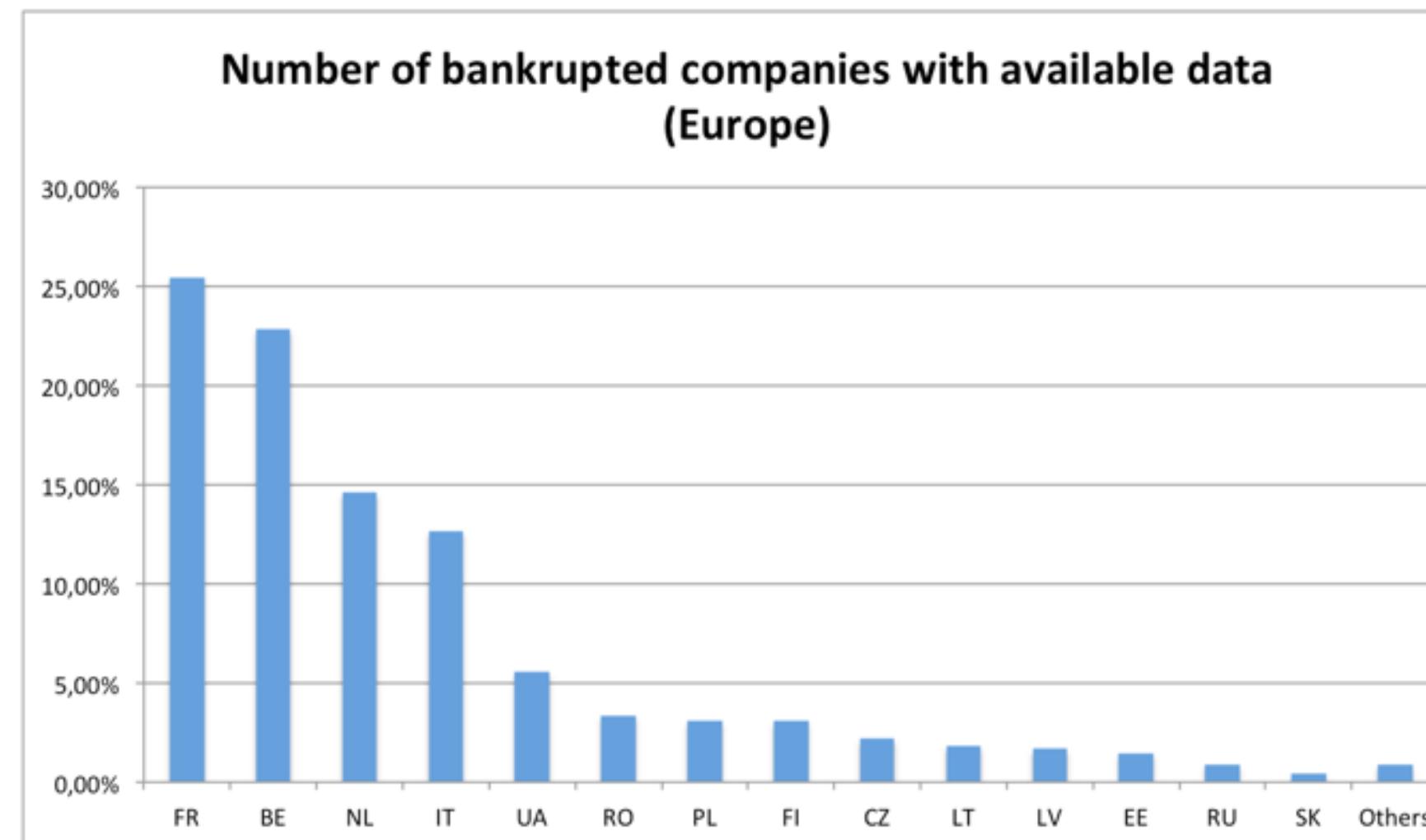
	31/12/2017	31/12/2016	31/12/2015
BALANCE SHEET (th €)			
Accounting practice	Local GAAP	Local GAAP	Local GAAP
Exchange rate EUR - EUR	1	1	1
Number of months	12	12	12
Total assets	8,466	8,893	7,792
Fixed assets	8,127	8,256	7,688
Intangible fixed assets	19	9	11
Tangible fixed assets	8,108	8,246	7,677
Other fixed assets	0	0	0
Current assets	339	638	104
Stocks	0	0	0
Debtors	-	-	-
Other current assets	-	-	-
Cash & cash equivalent	237	538	24
Shareholders funds	4,633	4,577	440
Capital	808	808	208
Other shareholders funds	3,825	3,769	232
Total liabilities	3,834	4,316	7,352
Non current liabilities	3,546	3,870	6,768
Long term debt	3,405	3,753	6,675

Income Statement

	31/12/2017	31/12/2016	31/12/2015
INCOME STATEMENT (th €)			
Accounting practice	Local GAAP	Local GAAP	Local GAAP
Exchange rate EUR - EUR	1	1	1
Number of months	12	12	12
Sales	2,042	1,714	284
Revenues growth (%)	19	504	-
Other revenues +/- variation in inventories and contract in progress + Fixed assets own construction capitalized	5	18	225
Operating revenue / turnover	2,047	1,732	509
Total costs	-	-	-
Costs growth (%)	-	-	-
Service costs	-	-	-
Material costs	-	-	-
Costs of employees	-	-	-
EBITDA	473	434	102
Depreciation	-	-	-
EBIT	181	-10	-234
Financial P/L	-113	-114	-125
Financial revenue	7	0	0
Financial expenses	120	114	125
Interest paid	120	114	125
P/L before tax	68	-124	-359
Extr. and other P/L	0	0	0
Extr. and other revenue	0	0	0
Extr. and other expenses	0	0	0
P/L before tax + Extr. and other P/L	68	-124	-359
Taxation	13	3	0
P/L for period	56	-127	-359

- different accounting standards;
- different economical behavior for different countries, sectors and industries;
- missing financial data for bankrupted entities;
- “holes” in the balance sheet data (i.e. BS, P/L).

Unfortunately not in every country there are public information on defaulted companies. This missing data limits the typology of credit scoring models which can be used.



Solution:

Impossible to use models which are based on understanding the differences between active companies and defaulted (Machine Learning methods).

Impossible to translate a model from a country to another one.

We can use only methods which try to mimic the financial analyst behavior.

Unfortunately we could also find holes in financial data, and this again limits the choice of credit scoring models.

Total assets	
Fixed assets	
Intangible fixed assets	844
Tangible fixed assets	330
Other fixed assets	-
Current assets	
Stocks	514
Debtors	194
Other current assets	250
Cash & cash equivalent	69
	59
Shareholders funds	508
Capital	133
Other shareholders funds	375
Total liabilities	390
Non current liabilities	-
Long term debt	-
Other non-current liabilities	-
Current liabilities	-
Loans	-
Creditors	-
Other current liabilities	-
Total share. funds & liab.	311

Solution:

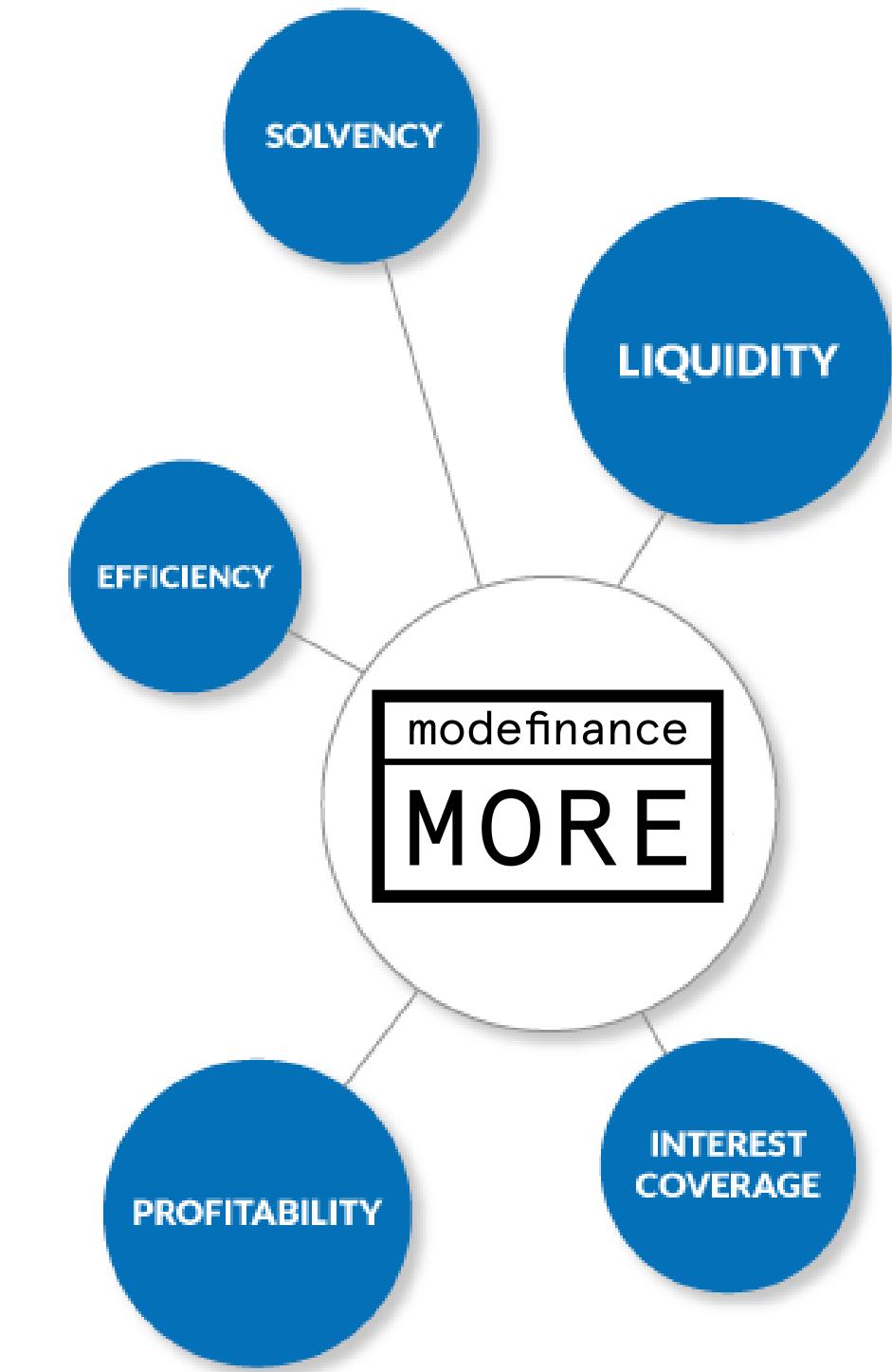
Impossible to use models which are based on understanding the differences between active companies and defaulted (Machine Learning methods).

Impossible to translate a model from a country to another one.

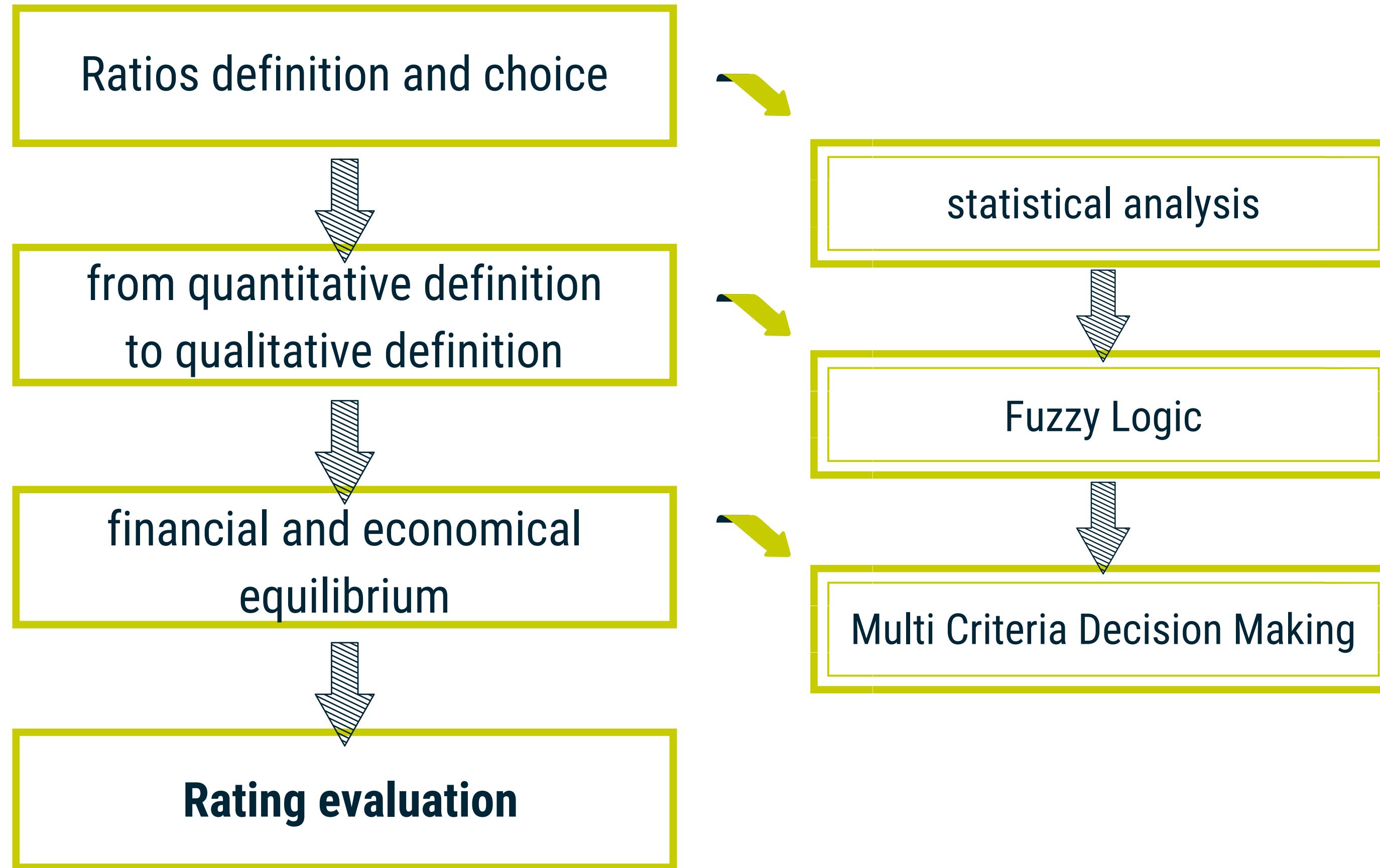
We can use only methods which try to mimic the financial analyst behavior.

modefinance's answer to these challenges:
developing our own technology, the Multi Objective
Rating Evaluation.

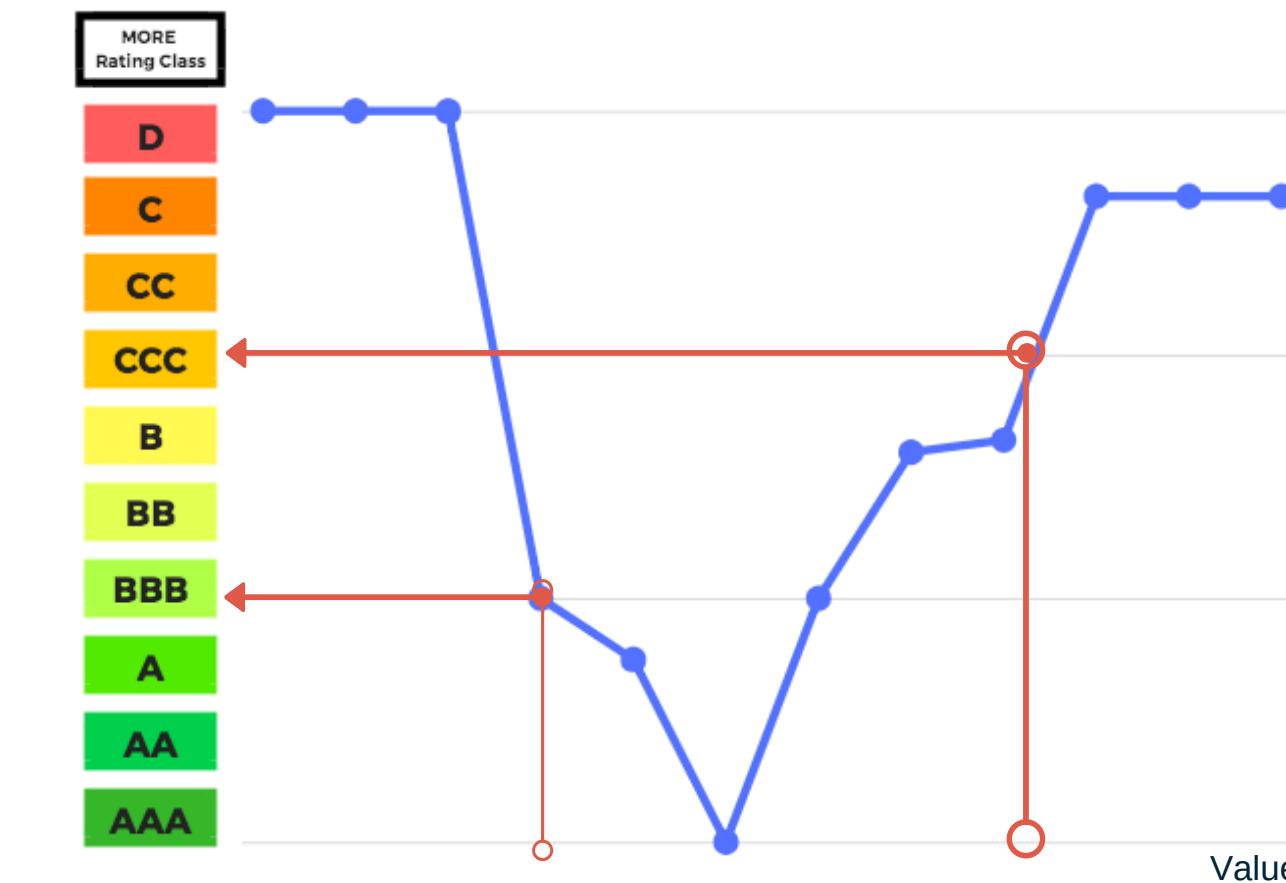
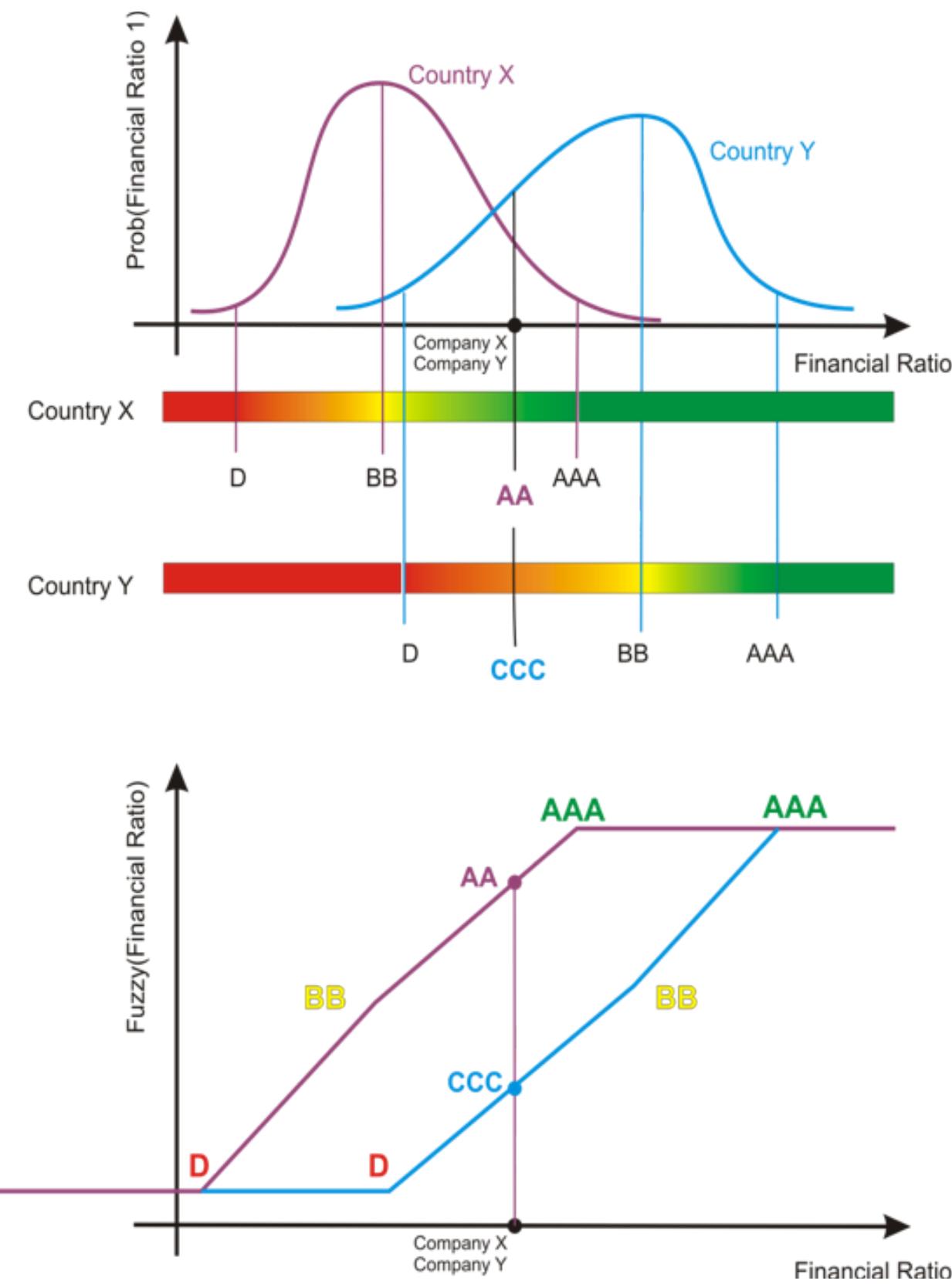
MORE is a **hybrid model**:
Artificial Intelligence methods on available data,
integrated with a Game Theory model for data
aggregation, based on Fuzzy sets for the quantitative
to qualitative data translation.



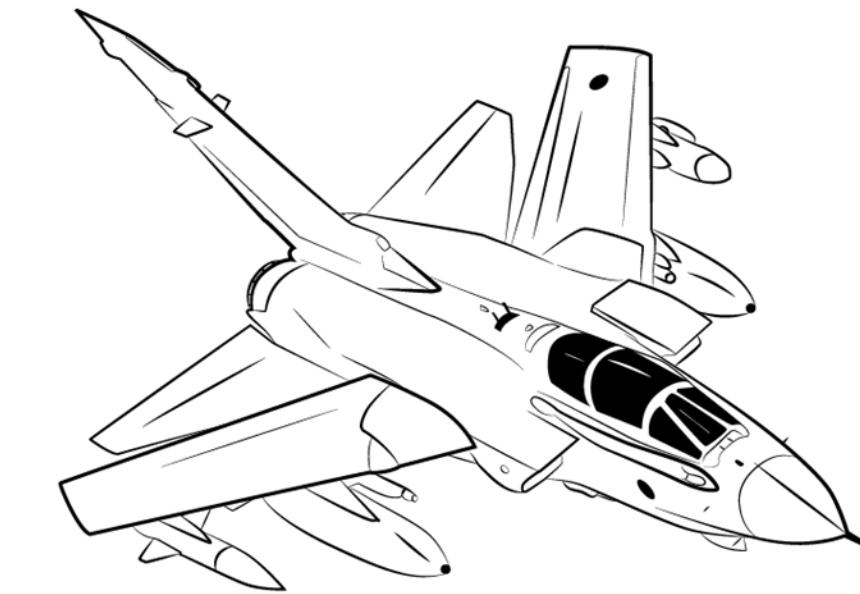
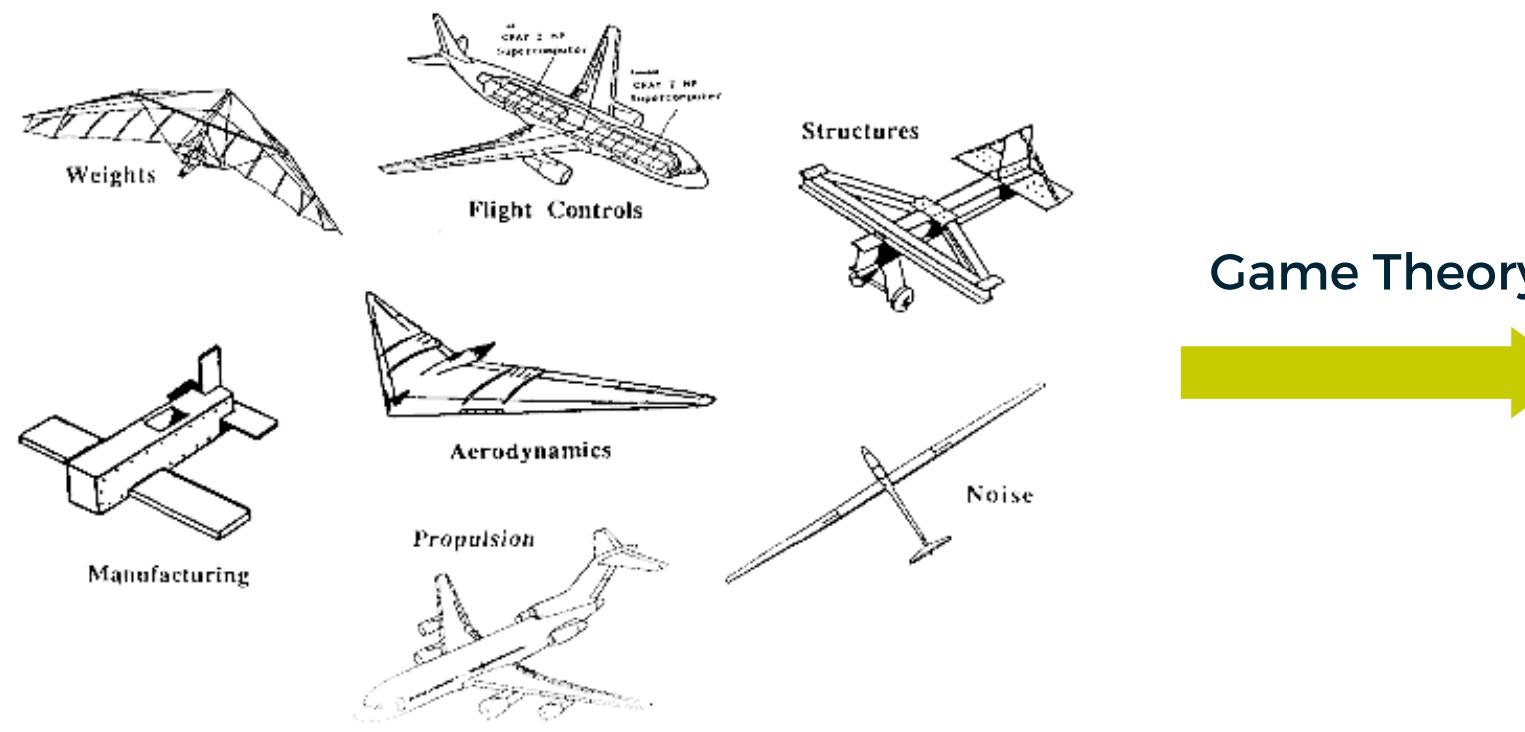
MORE: the logic



Fuzzy Logic



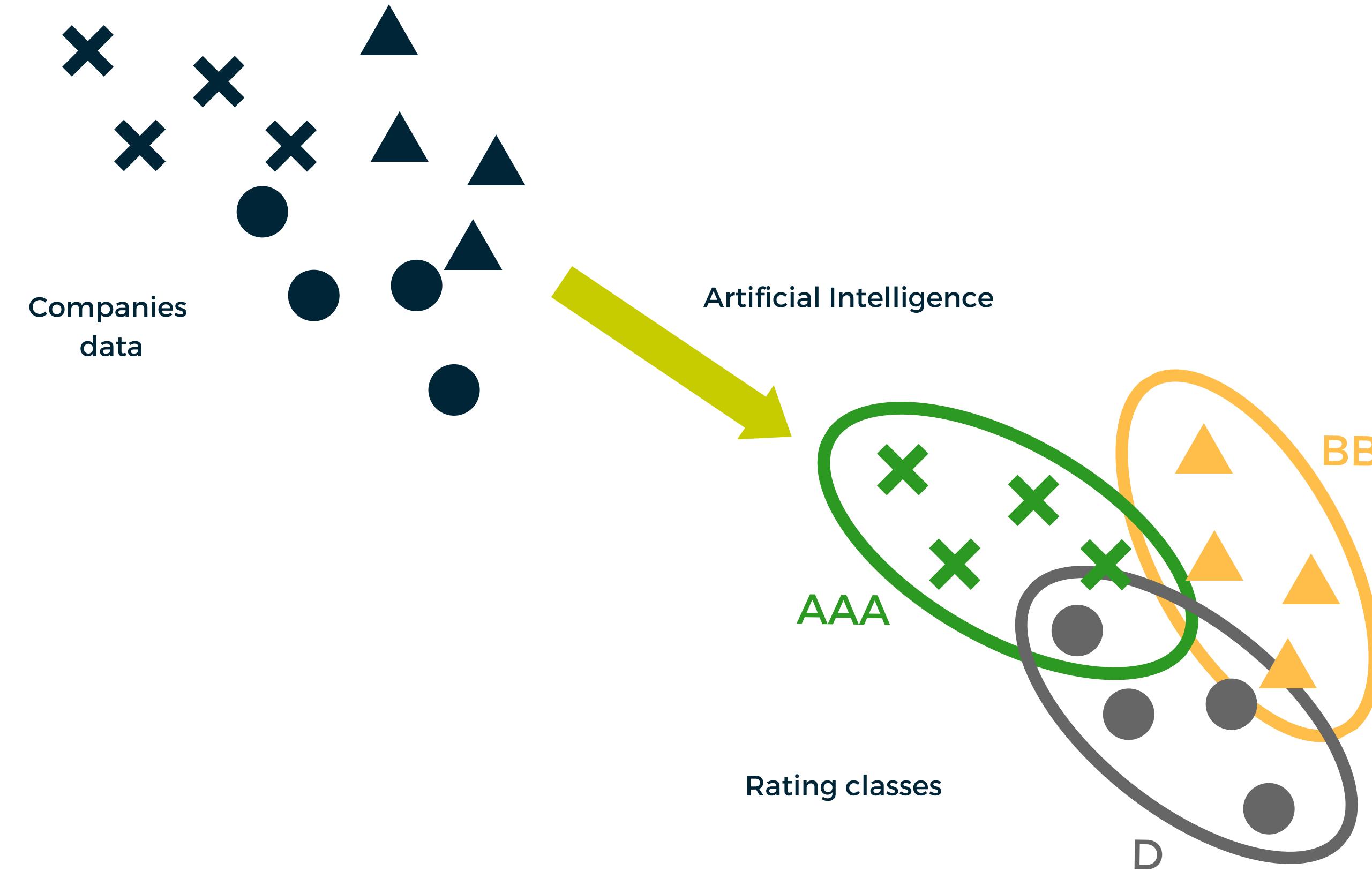
Game Theory



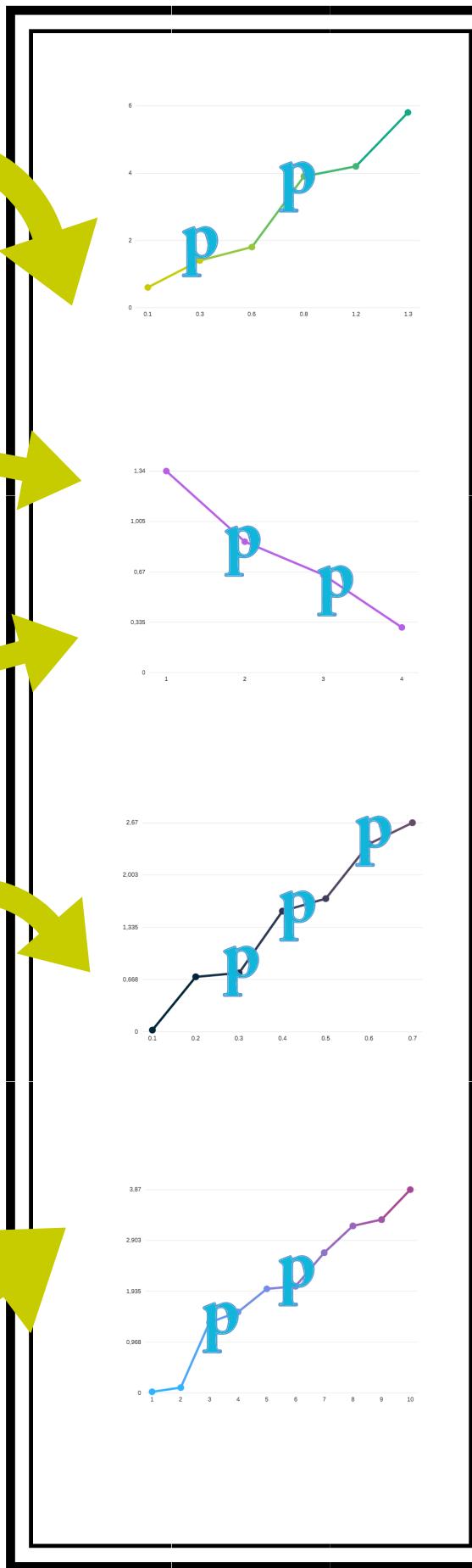
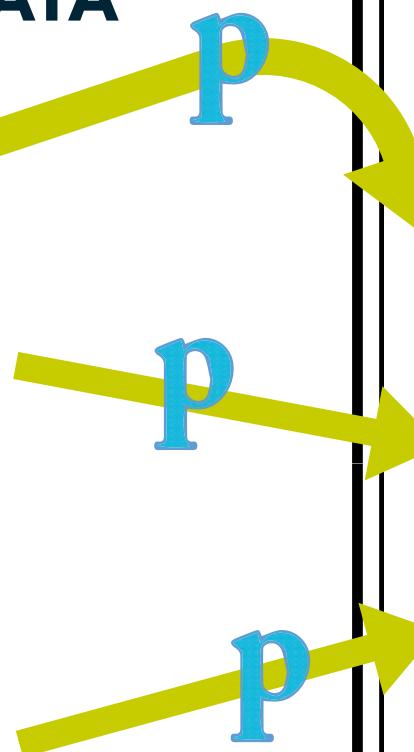
Applying Game Theory allows to balance the different needs and aspects, to obtain the best solution fit, any sector or scope.



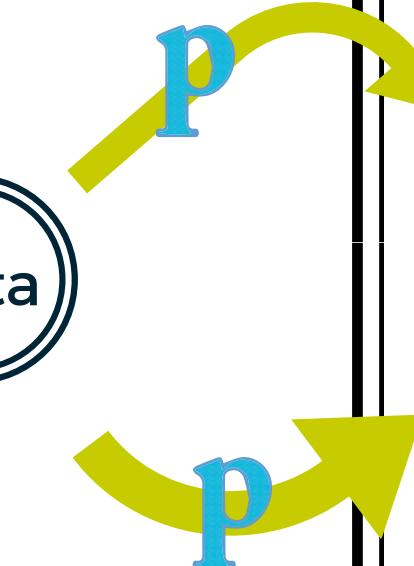
Artificial Intelligence



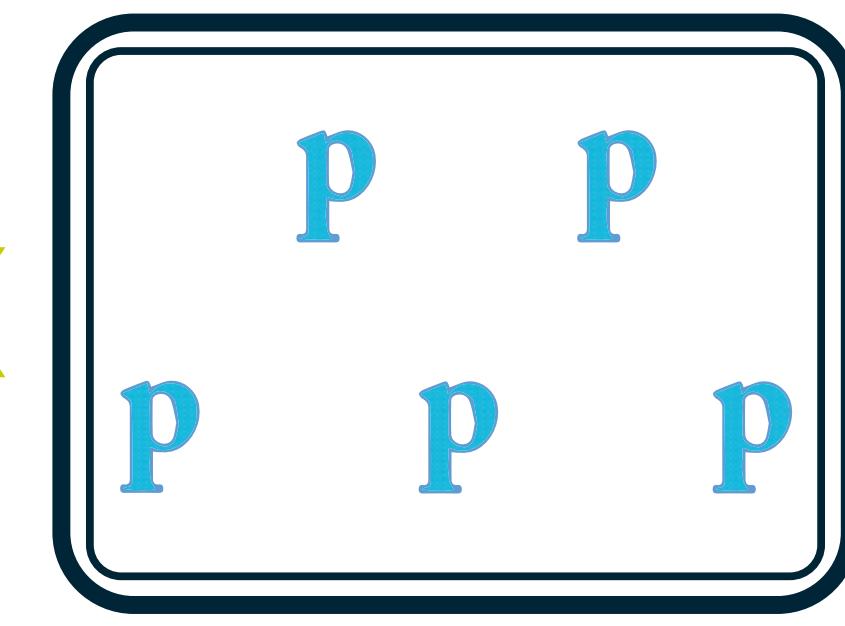
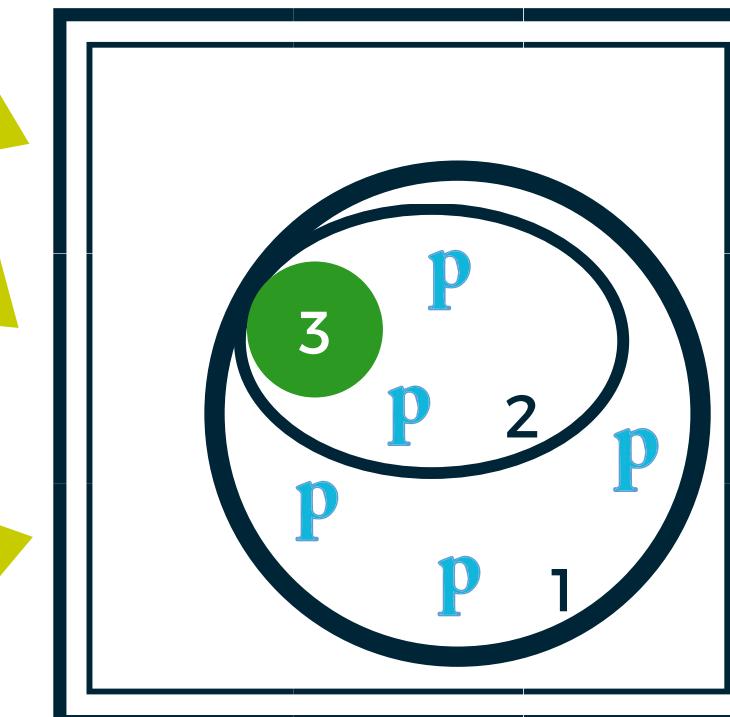
STRUCTURED DATA



UNSTRUCTURED DATA



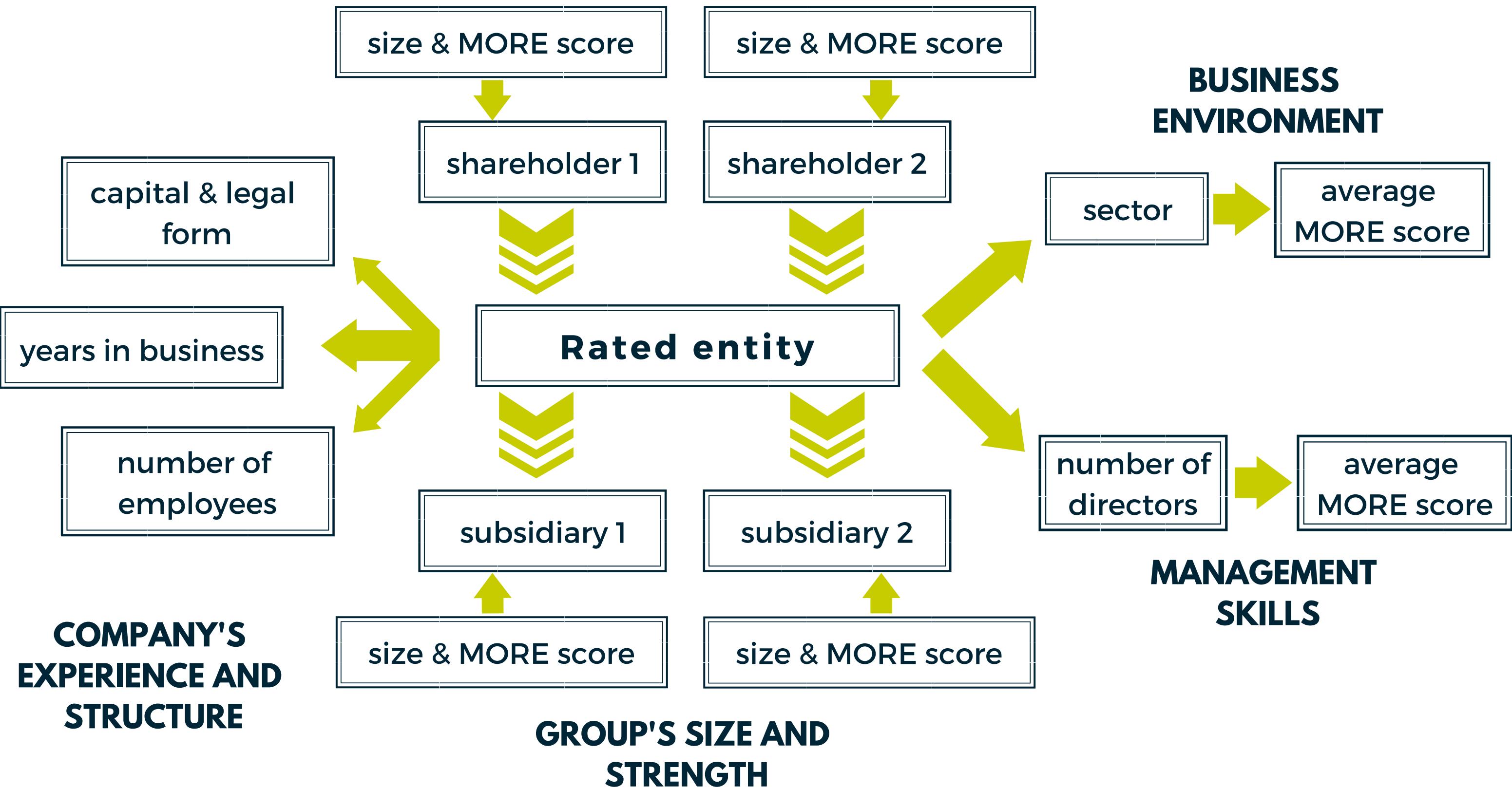
GAME THEORY MODEL



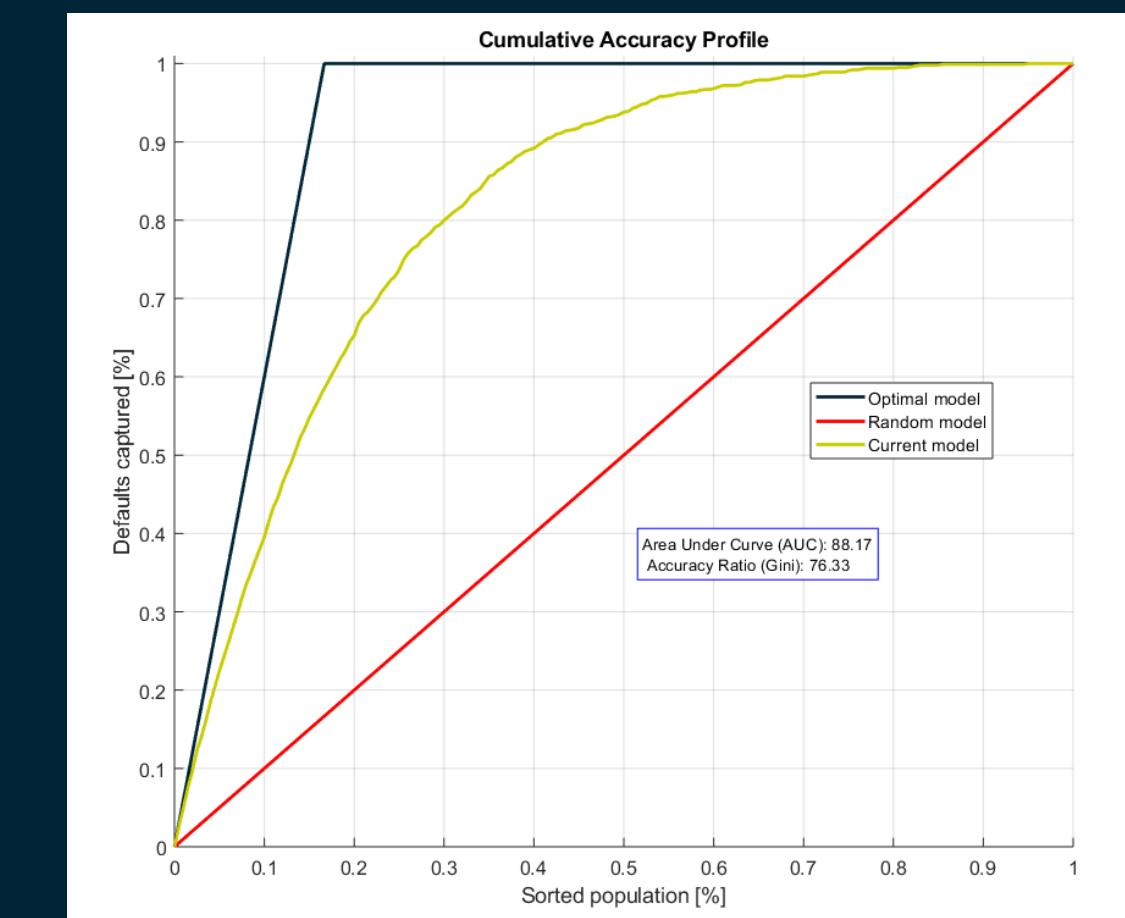
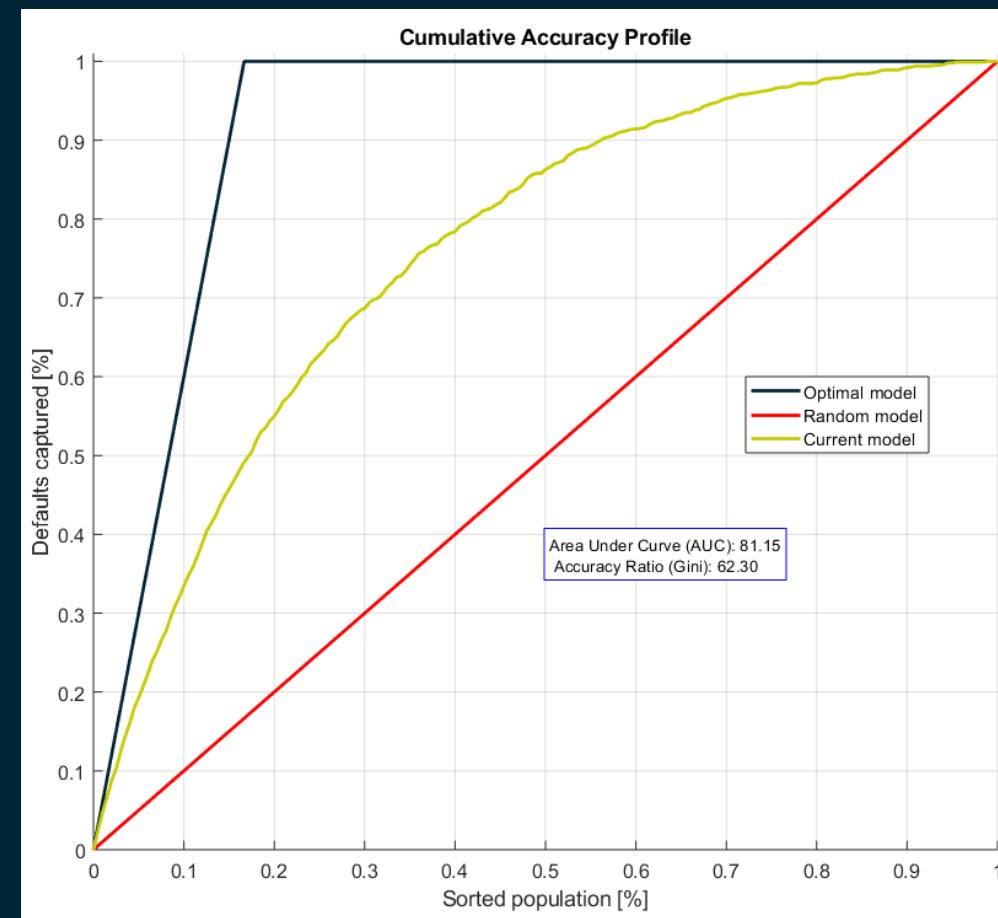
ARTIFICIAL
INTELLIGENCE

FUZZY TRANSFORMATION

companies with no data



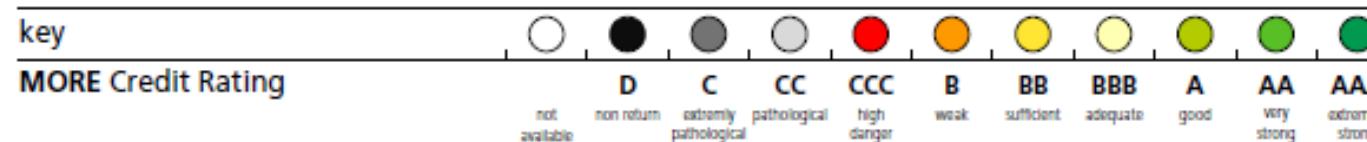
MORE model and methodology permit users to recognize bankrupted companies with the same accuracy in different countries:
the credit scoring evaluation is finally comparable



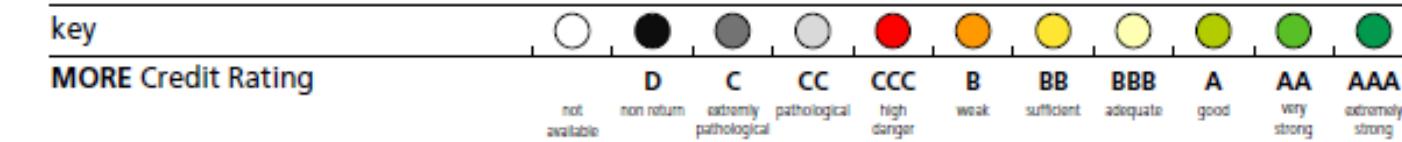
MORE evaluates more than 250million companies and over 60'000 banks worldwide, with NO sector limits nor country borders

BAD vs GOOD: an example

	31/12/2017	31/12/2016	31/12/2015
Turnover (th €)	9,487	2,014	1,064
Rating	C ●	C ●	CC ○
Probability of default	60.88%	73.23%	45.64%
Confidence Level	100%	100%	100%
Solvency ratios			
Leverage ratio	-29.78 ●	-10.02 ●	6.16 ○
Financial Leverage	-3.28 ●	-3.18 ●	2.09 ●
Total asset/Total liabilities	0.97 ●	0.90 ●	1.16 ○
Liquidity ratios			
Current Ratio	0.96 ○	0.89 ○	1.02 ○
Quick Ratio	0.86 ○	0.63 ○	0.64 ○
Cash Cycle Ratio	146.00 ●	151.00 ●	102.00 ○
Profitability ratios			
Return on investment ROI (%)	-6.57 ●	-18.01 ●	-50.42 ●
Return on equity ROE (%)	-165.32 ●	-179.03 ●	-388.60 ●
Asset turnover	1.78 ○	1.15 ○	0.93 ○
EBITDA/Sales	-0.03 ●	-0.14 ●	-0.50 ●
Interest Coverage ratios			
EBIT interest coverage ratio	-9.65 ●	-14.08 ●	-31.17 ●
EBITDA interest coverage ratio	-8.74 ●	-12.14 ●	-28.33 ●
Analysis and trend of financial strength			



	31/12/2017	31/12/2016	31/12/2015
Turnover (th €)	9,637	9,396	9,112
Rating	AA ○	AA ○	AAA ○
Probability of default	0.13%	0.12%	0.08%
Confidence Level	100%	100%	100%
Solvency ratios			
Leverage ratio	0.21 ○	0.21 ○	0.22 ○
Financial Leverage	0.00 ○	0.00 ○	0.00 ○
Total asset/Total liabilities	5.86 ○	5.83 ○	5.58 ○
Liquidity ratios			
Current Ratio	4.67 ○	4.59 ○	4.11 ○
Quick Ratio	3.97 ○	3.79 ○	3.35 ○
Cash Cycle Ratio	-12.00 ○	-14.00 ○	-19.00 ○
Profitability ratios			
Return on investment ROI (%)	10.89 ○	12.40 ○	21.53 ○
Return on equity ROE (%)	9.32 ○	10.56 ○	17.95 ○
Asset turnover	1.10 ○	1.19 ○	1.28 ○
EBITDA/Sales	0.14 ○	0.15 ○	0.21 ○
Interest Coverage ratios			
EBIT interest coverage ratio	2.6E03 ○	1.1E04 ○	1.1E04 ○
EBITDA interest coverage ratio	3.8E03 ○	1.6E04 ○	1.4E04 ○
Analysis and trend of financial strength			



Paying an exceptional attention to detail is crucial for everyone, including a Rating Agency:

- Accuracy
- Transparency
- Independency
- Compliance
- Clear and comprehensible results - NO black box
- Public, certified, reproducible and truthful information
- Quick Rating variations when a parameter changes
- Clear relations, even with entities which have no AI knowledge

DATA SCIENCE AND MACHINE LEARNING IN CREDIT RISK MANAGEMENT

by the first Fintech Rating Agency in Europe

modefinance

credit risk management today: the data gap



LOW FREQUENCY

- information latency
- no consistent updates
- very low predictive value (unable to leverage newsflows and nowcasting)



LOW ACCURACY

- error-prone risk assessment procedures leading to increase in NPLs



COMPLEX PAPER-BASED PROCEDURES

- time-consuming loan request processing
- poor customer experience



LACK OF CUSTOMIZED AND FLEXIBLE SOLUTIONS

- lack of credit risk management solutions able to leverage the new data/big data environment

market trends: the data science perspective



DATA VALUE CAPTURE

- data science tools favor a higher value capture thanks to standard methods to manage data sources (internal and external)



DATA AUTOMATION

- data preparation and data analysis automation are improving current operations and costs base



UNSTRUCTURED DATA INTEGRATION

- data from unstructured sources are managed with big data analytics solutions



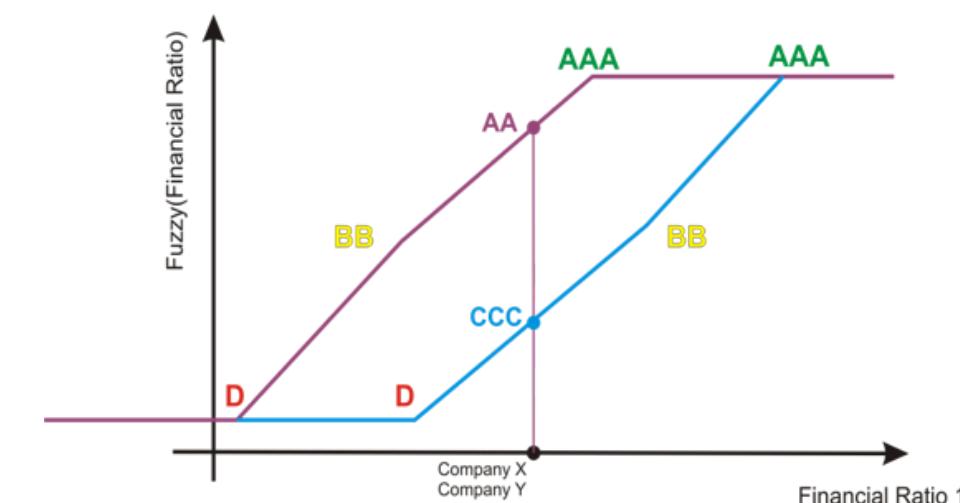
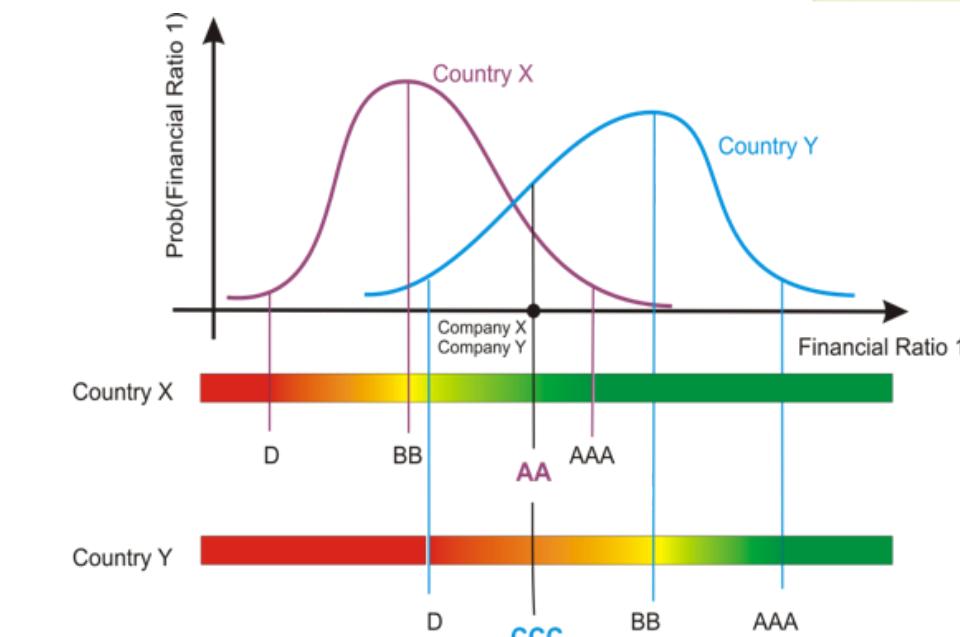
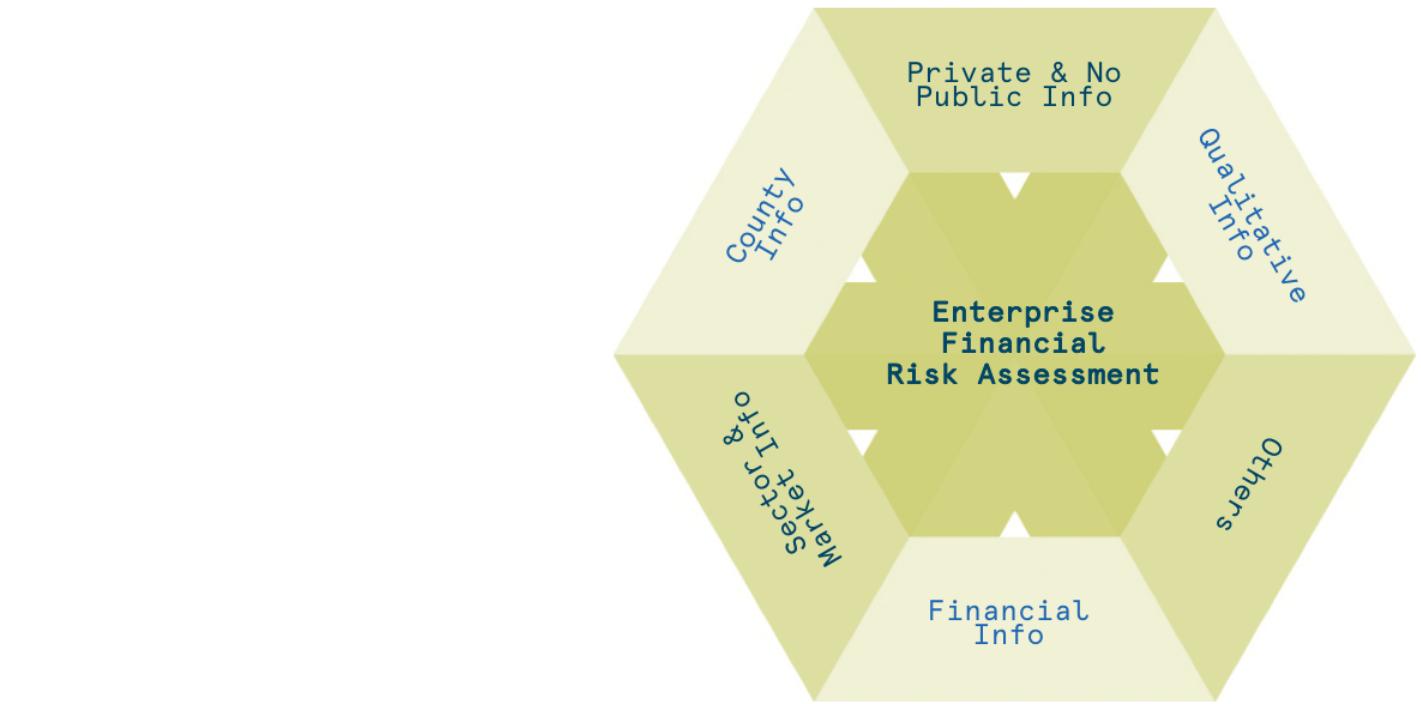
RISK COVERAGE INCREASE

- new data/big data offer the opportunity to evaluate an increasing number of companies

modefinance technology core

modefinance has developed a set of **proprietary** big data methodologies and machine learning algorithms:

- applicable to > 250m corporates and 60k banks worldwide
- reviewed and tested real-time
- certified by ESMA
- capable of quantitative/qualitative data integration
- transparent, no black-box approach, full visibility on explanatory factors



FINTECH APPROACH



modefinance has a unique lean Fintech approach, where 3 departments collide, Fintech, Financial Analysts and IT.

Different sciences (engineering, physics, computer technology, statistics) and professionals are heavily connected and real-time contributing.

A fast information and products circulations, to develop the best solution fit for each client.

The easiest and real-time integration of different technologies.

different markets, different solutions

Banking
Capital markets
Large corporates



oplon Risk Platform

the powerful and reliable AI risk platform whose goal is to secure exposure from counterparty risk, automating internal procedures.

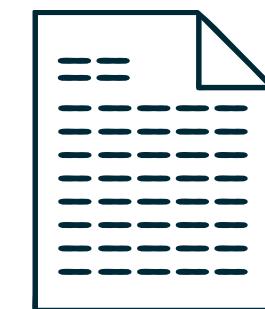
SMEs
Professionals



s-peek

the web and mobile application for Credit Risk Management, to know any European company's Scoring, Credit Limit and financial data.

Banking
Corporates (IPO / Bonds)



certified public Credit Rating

modefinance is an ESMA certified rating agency and provides ratings for companies and financial institutions.

oplon Risk Platform



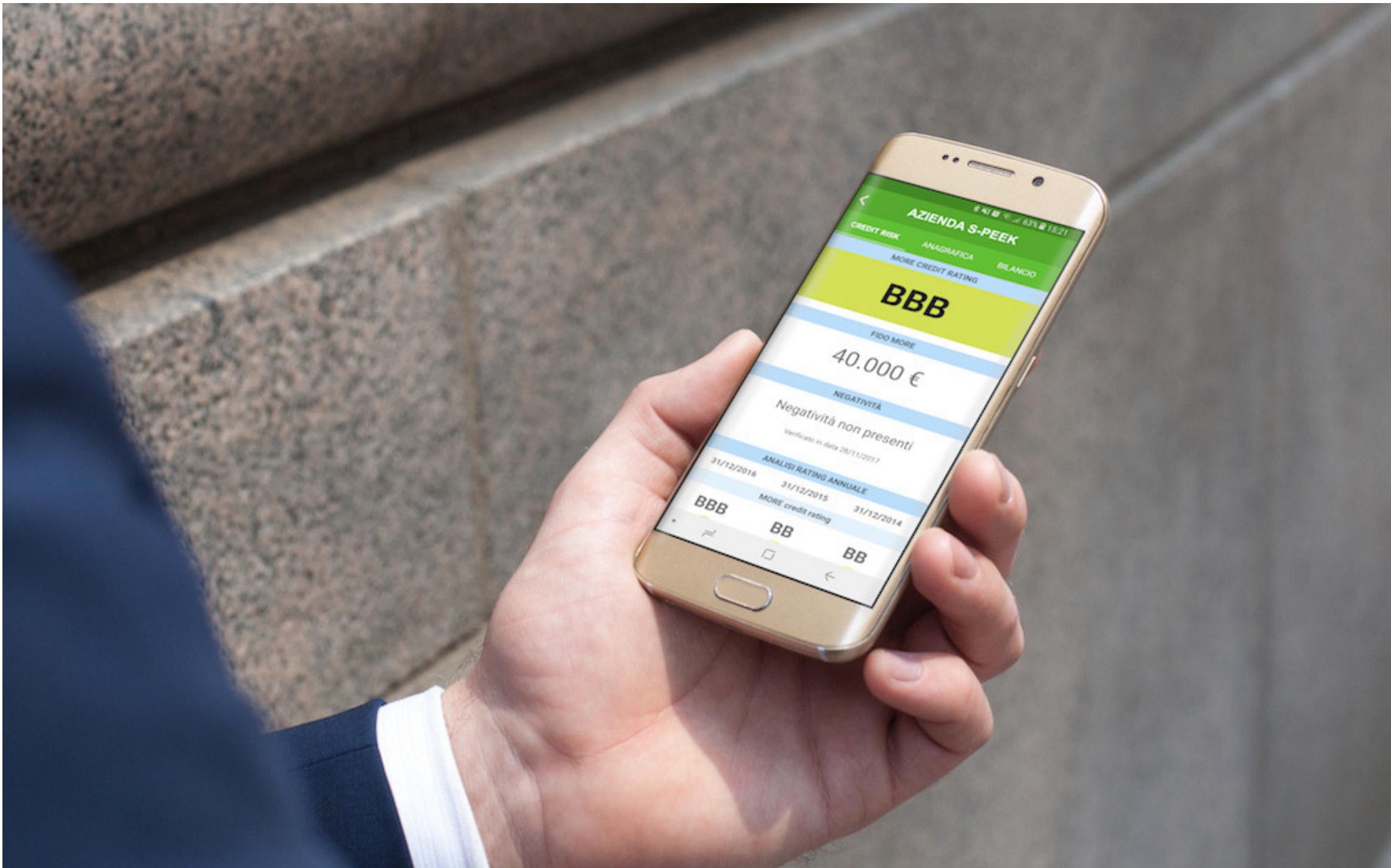
Key features:

- Single data input
- Single platform
- Decision process customization
- Full cycle management: from pre-feasibility to approval

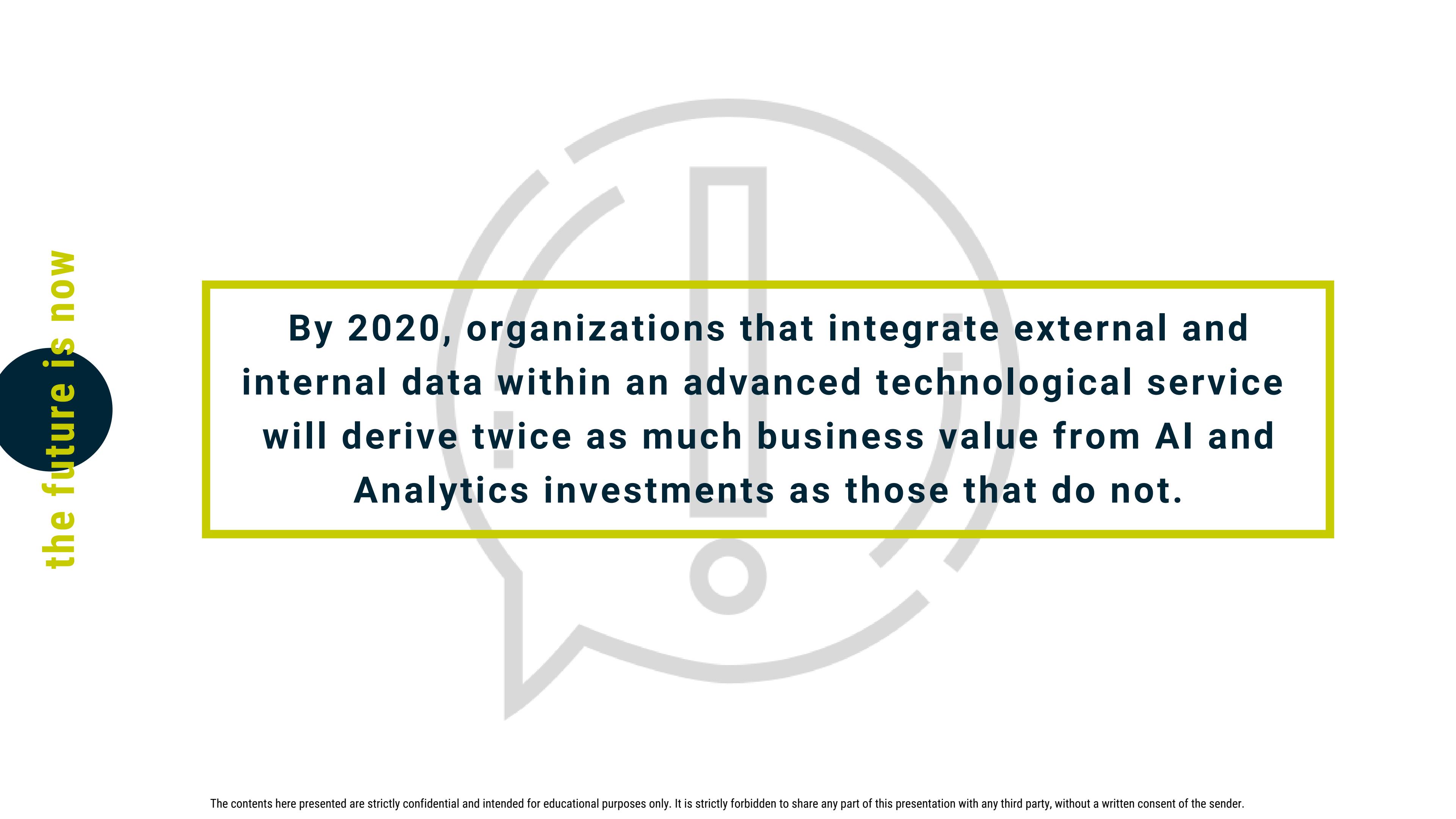
Key benefits:

- Workflow automation and simplification
- Decision making process' time and costs reduction

s-peek app



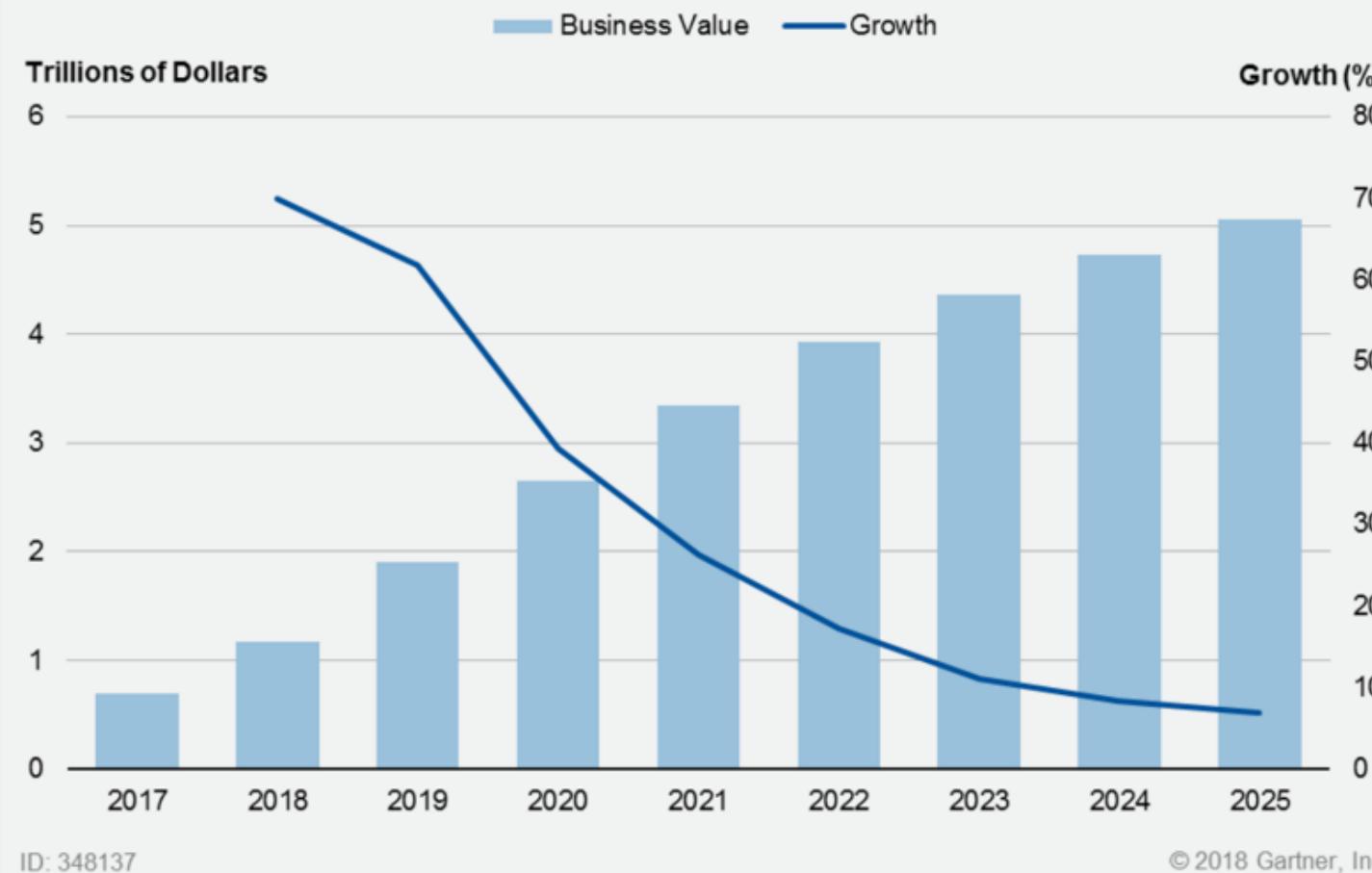
s-peek is a web and mobile application, that allows users to access Credit Scoring, Credit Limit and financial data of **more than 25million companies**, all around EU.



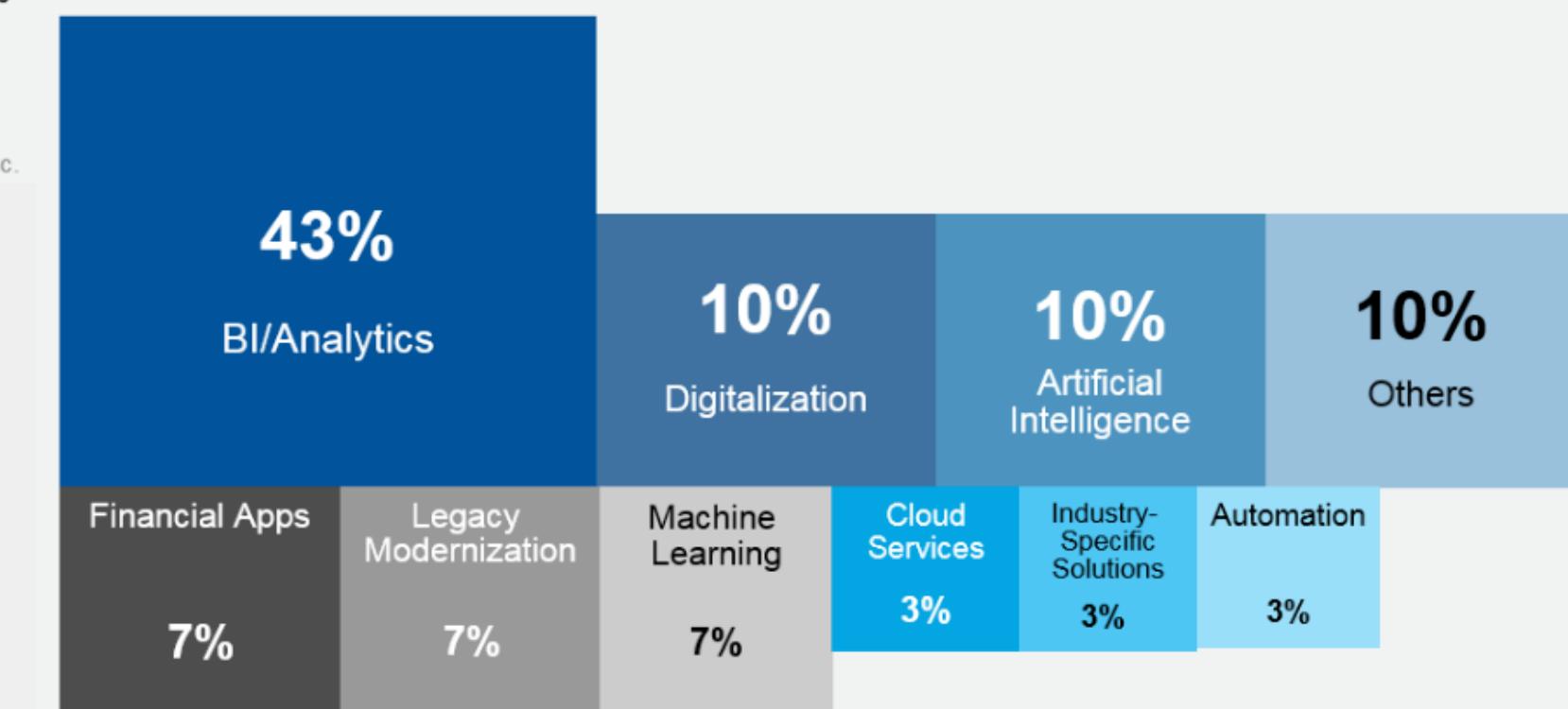
By 2020, organizations that integrate external and internal data within an advanced technological service will derive twice as much business value from AI and Analytics investments as those that do not.

the future is now

Business Value Forecast for AI



Most Important Technology Area



Q. Which technology area do you think is most important to helping your business differentiate and win?

ID: 346874

© 2018 Gartner, Inc.

THANK YOU



Fin-Tech HO 2020
RegTech workshop I

Valentino Pediroda, CEO modefinance

modefinance

