Workshop with Perdue University

Prof. Dr. André Krischke

Sommersemester 2026
12. Mai 2026

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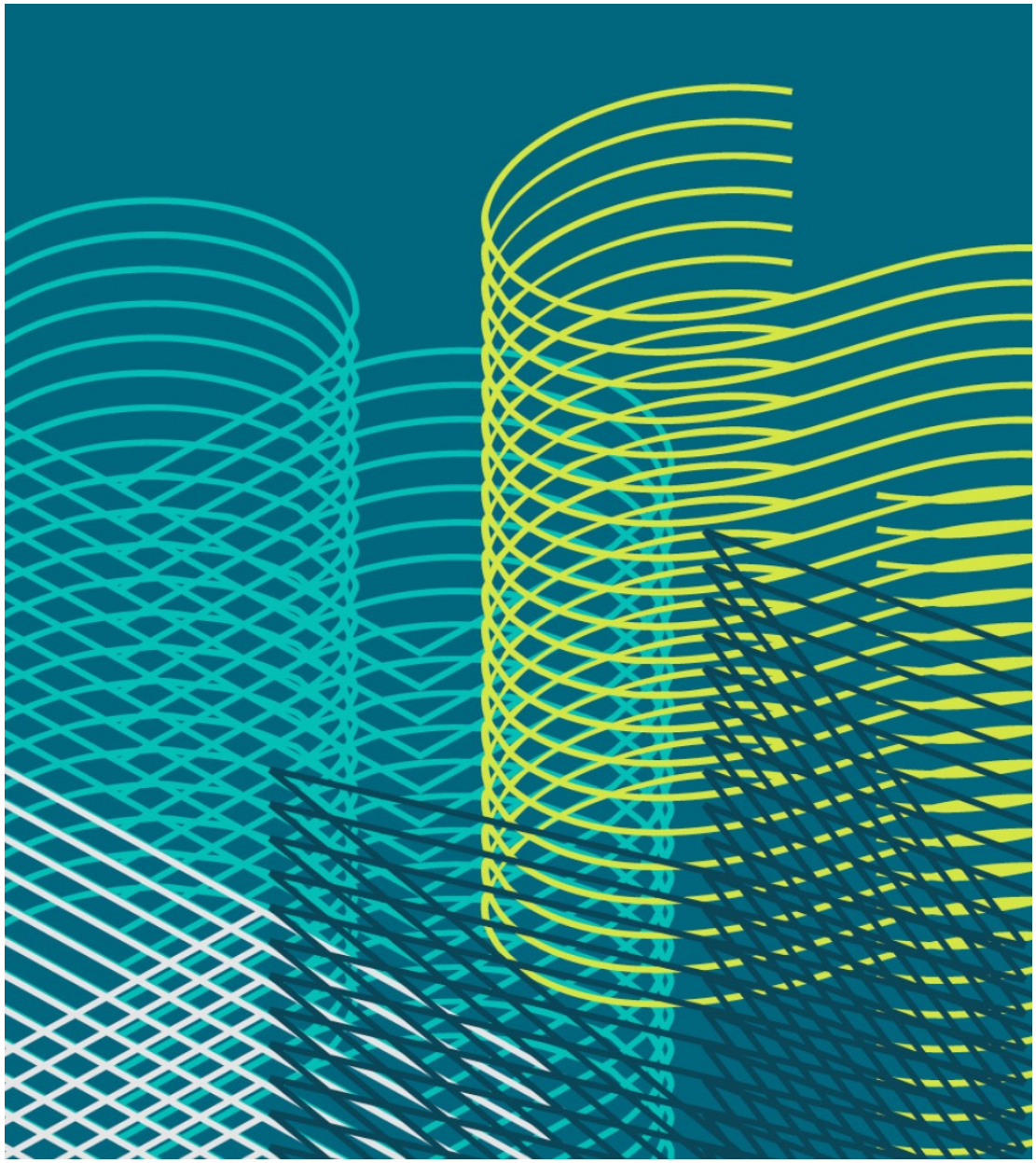

CORE Question

Business Analytics im Supply Chain Management – **MOTIVATION & INTRODUCTION**

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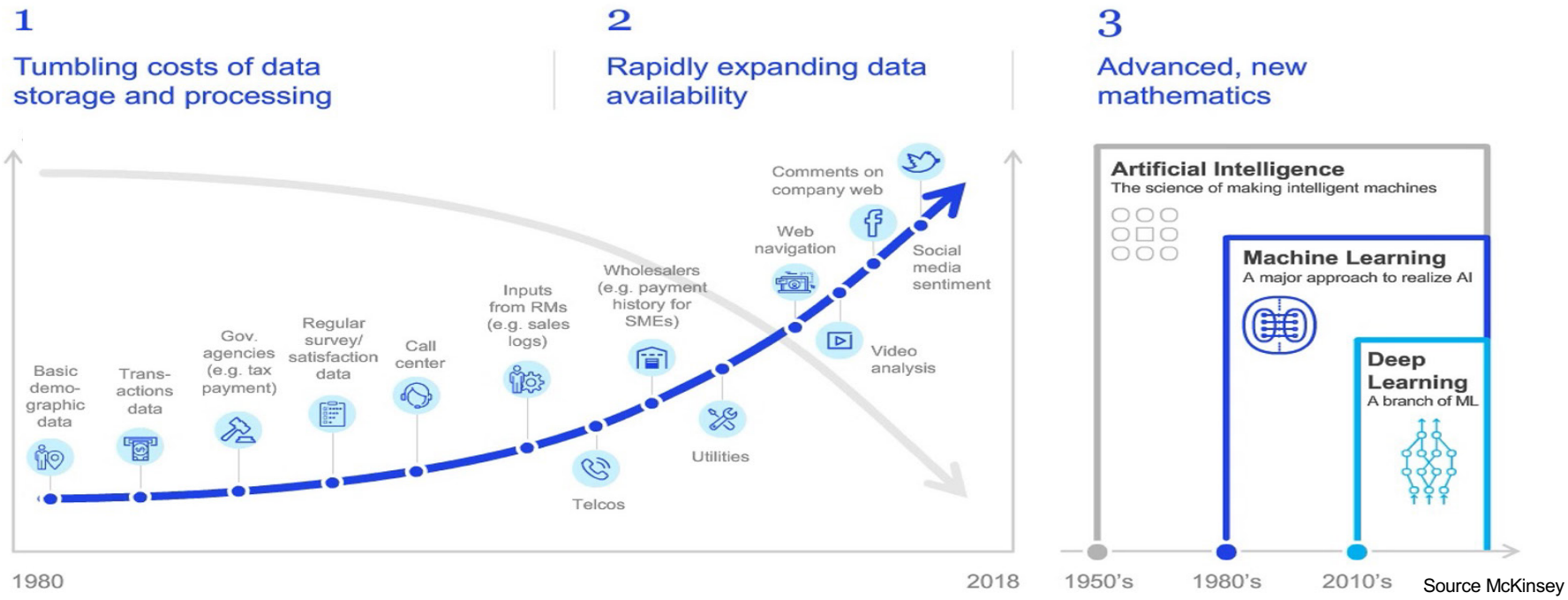
Summary Relevance – Combination of three underlying trends

In the context of ongoing **digital transformation**, business analytics has become a central **source of sustainable competitive advantage** and a key link between available data and innovative business models



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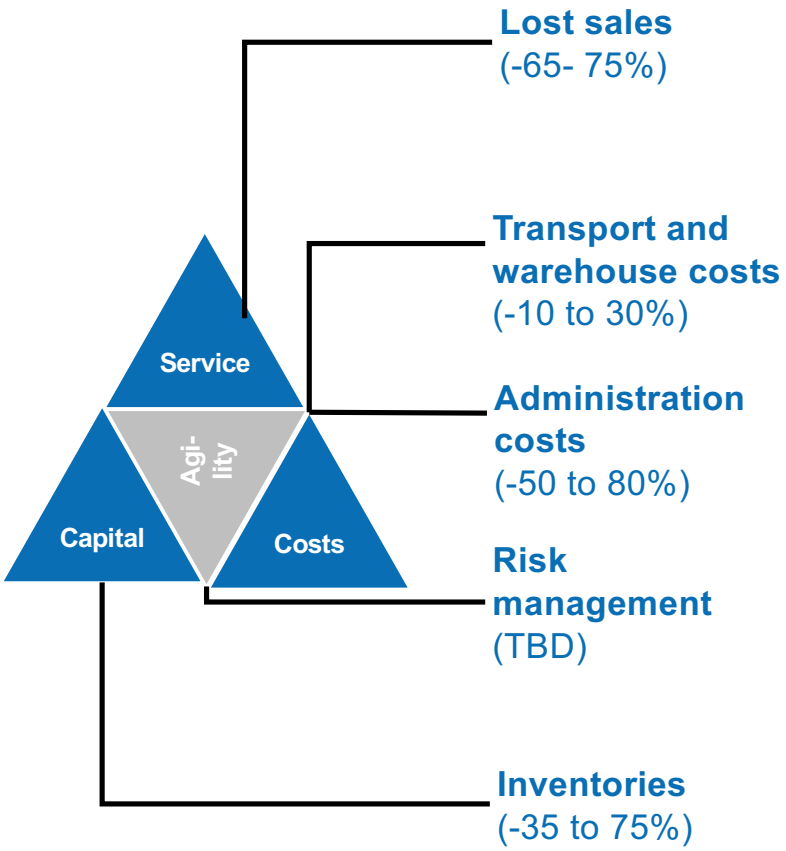
Business Analytics – The (promised) business value



- **Demand sensing** and shaping to reduce wrong promise to the customer, wrong inventory profiles
- **Optimizing the network** to lower total costs
- **Automatization** to lower planning effort by 80 to 90%
- **Prescriptive simulation** will enable organization to prevent or react faster to disruptions
- **Predictive analytics** will significantly reduce uncertainty and lowering safety stock

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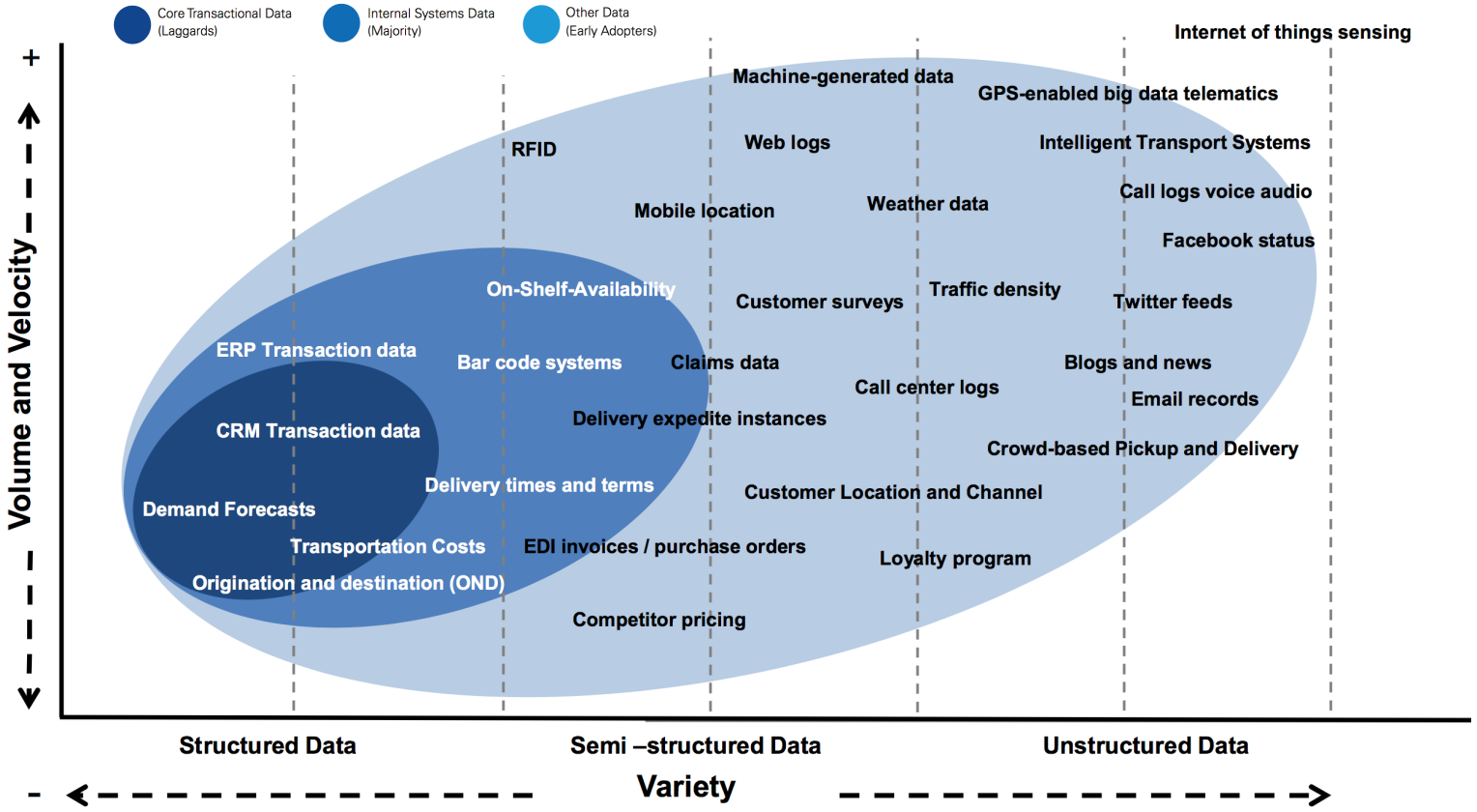
Knut Alicke, Daniel Rexhausen and Andreas Seyfert , Supply Chain 4.0 in consumer goods, 2016

Business Analytics Relevanz – New dimension of data availability

- Only 15% transactional data from internal IT-systems
- About 80% of potential data is unstructured
- Most of the customer interface data - at the top right - are high volume but unstructured



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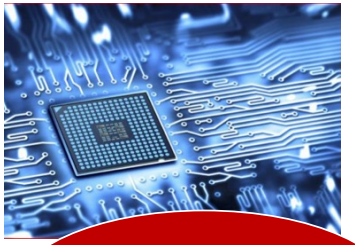
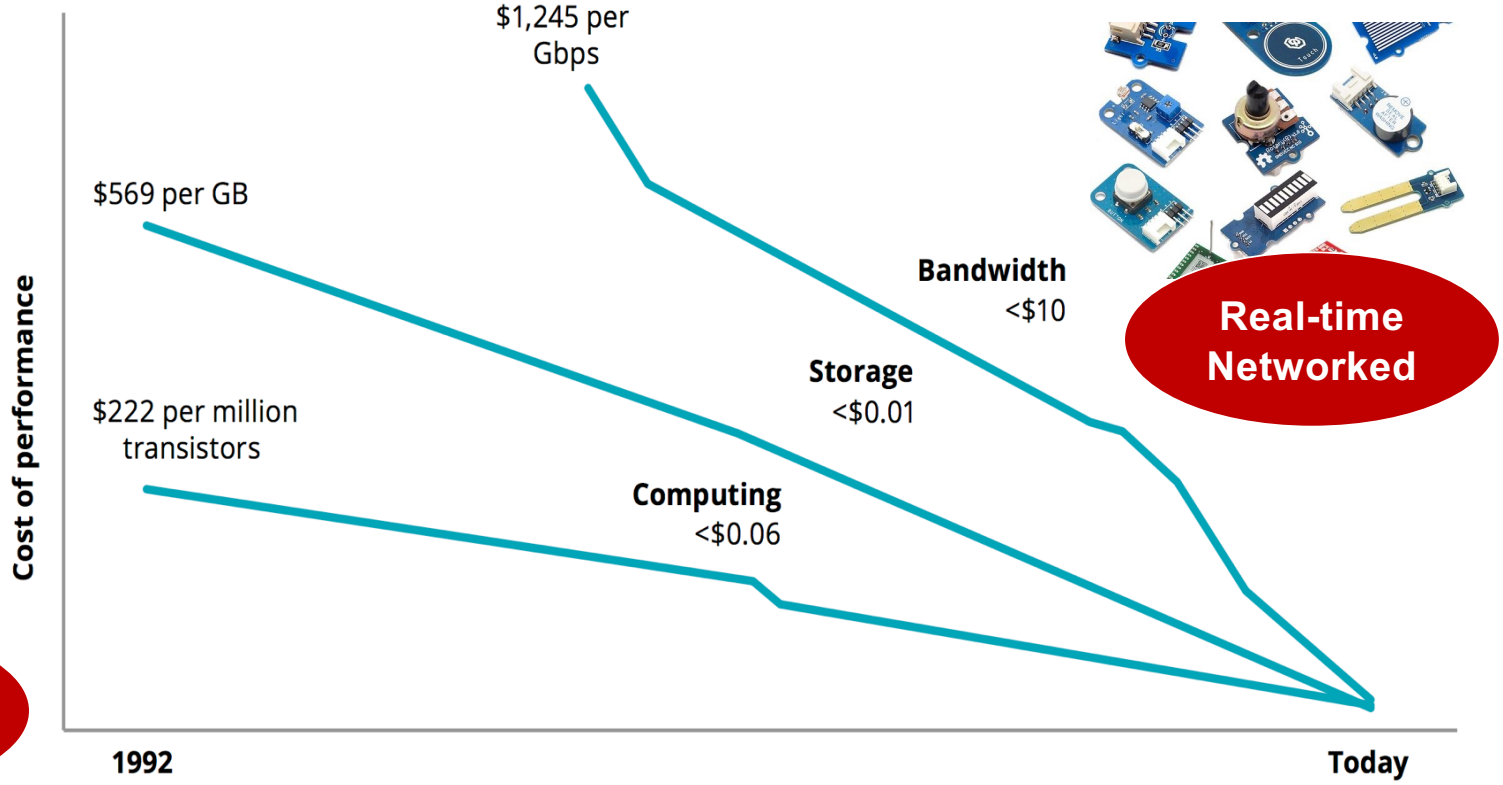
Quelle: Rosados, BIG DATA ANALYTICS IN SUPPLY CHAIN MANAGEMENT: TRENDS AND RELATED RESEARCH, 6th International Conference on Operations and Supply Chain Management, Bali, 2014

Business Analytics – Exponential cost degression for data storage, data transport and computing power

More data



Faster processing



Real-time Networked

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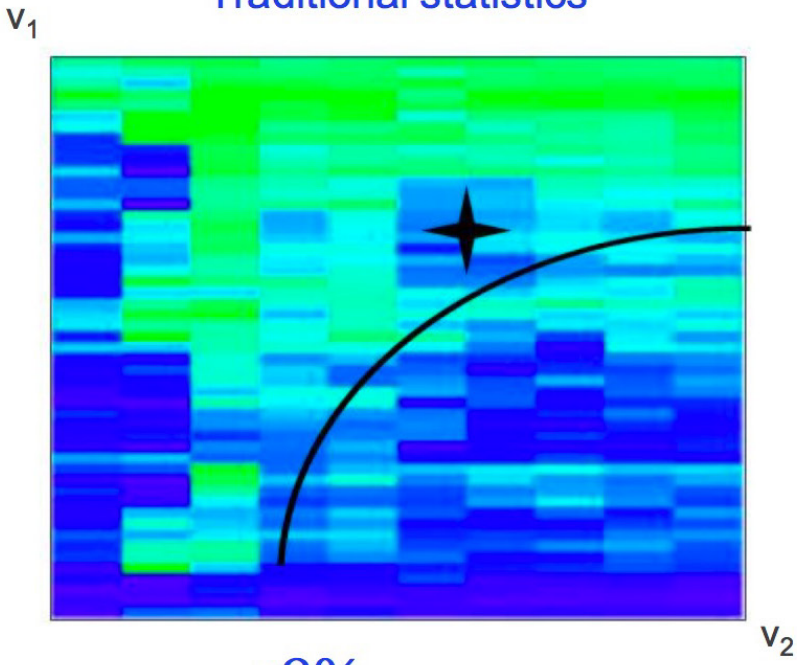
Source: Deloitte Insides - The rise of the digital supply network, 2016

Advanced methods – Illustration of the power of advanced analytics

ILLUSTRATION
Insurance Industry

Traditional statistics

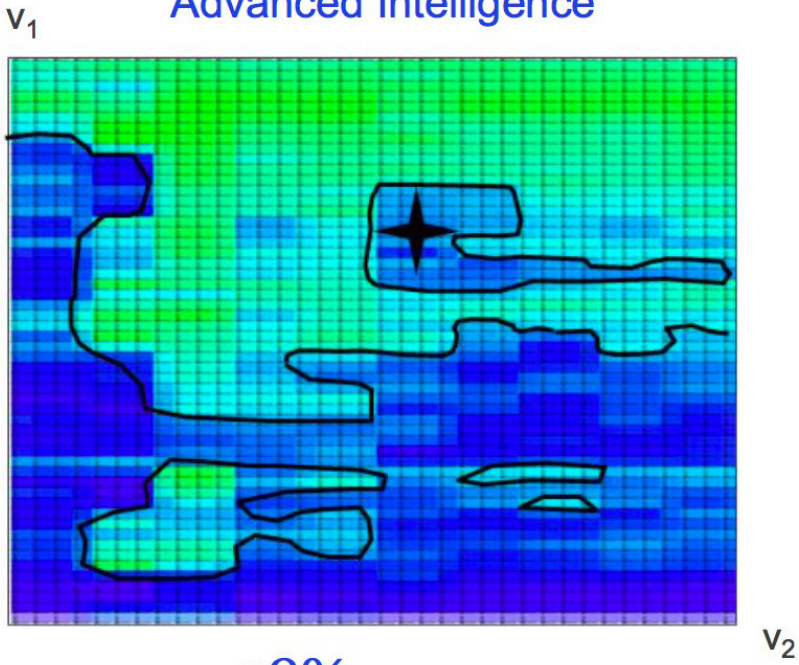


78% accuracy

Traditional stats fit a predetermined "shape" onto the data: a square peg in a round hole!

✗ **No mortgage provided**

Advanced Intelligence



98% accuracy

Machine learning identifies complex patterns without clinging to any predetermined corset

✓ **Mortgage provided**

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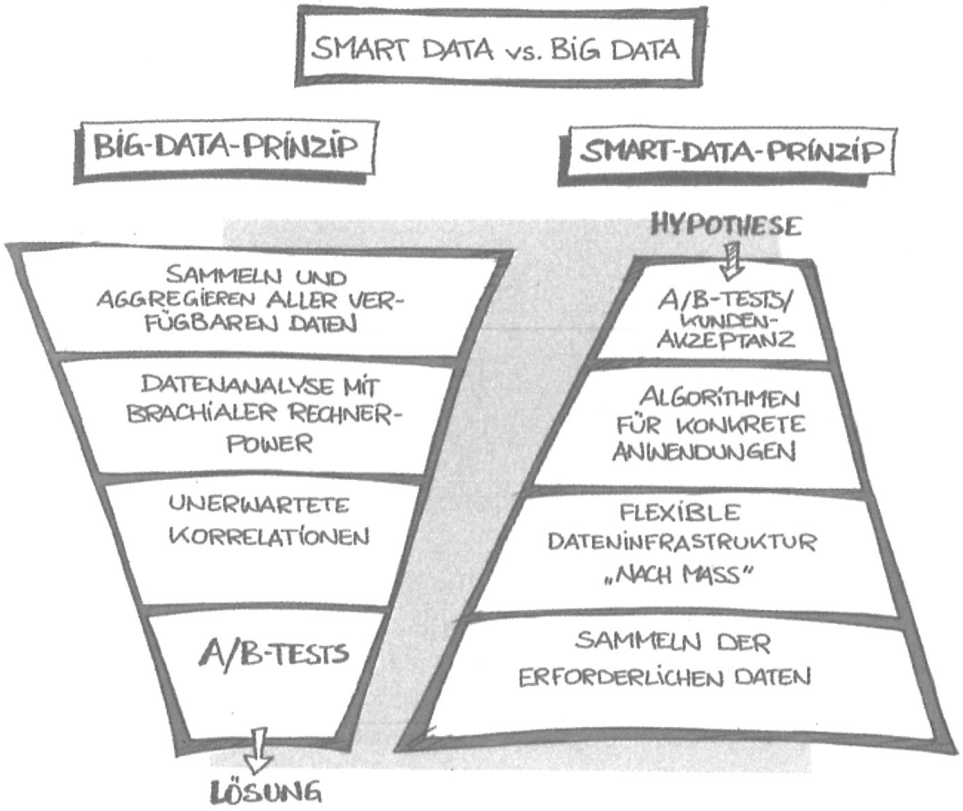
McKinsey, Crossing the AI Frontier , McKinsey Analytics & McKinsey Global Institute , 2018

BIG Data vs. SMART DATA

start with hypothesis to select method and data in a smart way

Albert Einstein: *"If I had only one hour to solve problem, I would spend 55 minutes trying to find right question"*



Source: Bloching, Smart Data, 2015

- May companies invested a lot of resources and money in tools and expert WITHOUT great success
- These companies tended to start with the DATA instead of the relevant QUESTIONS
- Tools like database, tools to clean the data, statistical packages (R or Python) are less important than the method

.... better focus on SMART DATA

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Business Analytics – What skills are necessary?

- There is no one "one size fits all" solution, regardless of context/domains
- In the current upheaval in the context of digital transformation, however, **technical aspects are often over-emphasized** and business aspects are underemphasized
- Therefore, business analytics is becoming the central competence for managers

Above all be able to lead a business analytics team

- *What business problems are to be solved?*
- *What resources (data, IT, personnel) are necessary?*
- *Which algorithms are used to obtain the evidence?*
- *How should raw evidence be prepared to convince managers that algorithms can be used for problem solving?*
- *How can the analytics algorithms be embedded in business processes (operational analytics) with the aim of autonomous decisions in real time?*

Validation by process (CRISP)

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CORE Question

Business Analytics im Supply Chain Management – **Structuring the methods**

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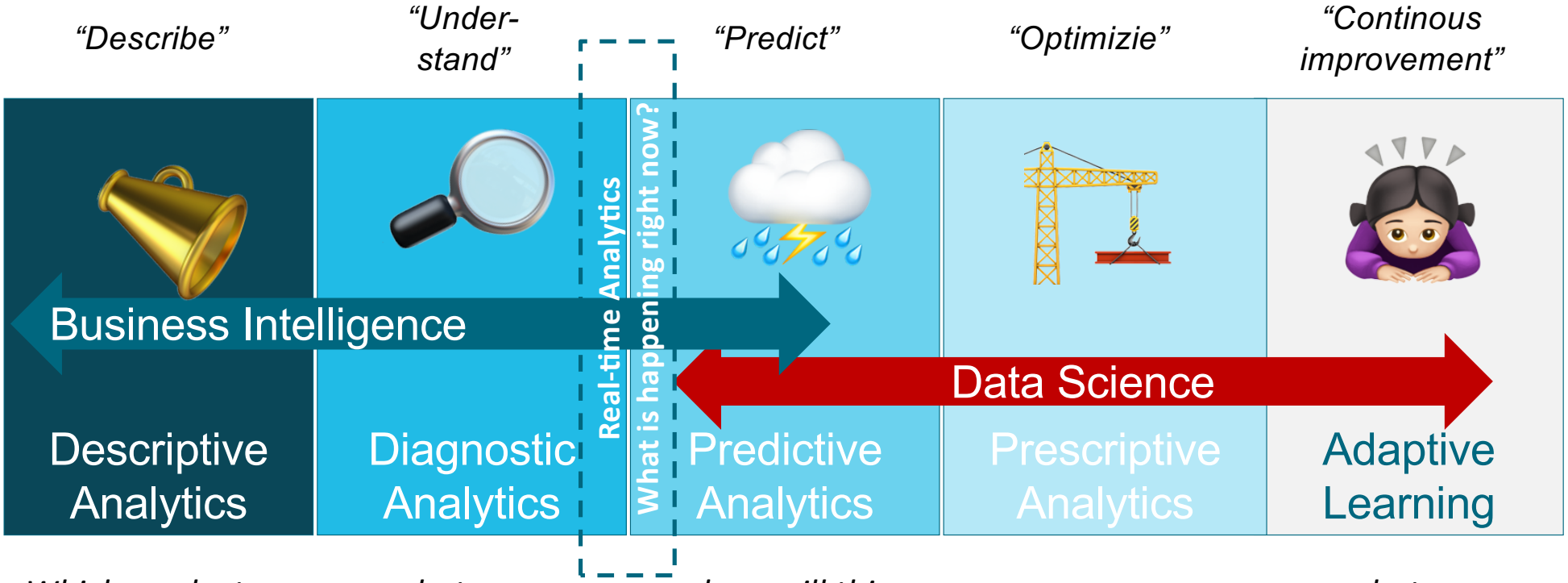
Business Analytics – Conceptual limitation and delimitation



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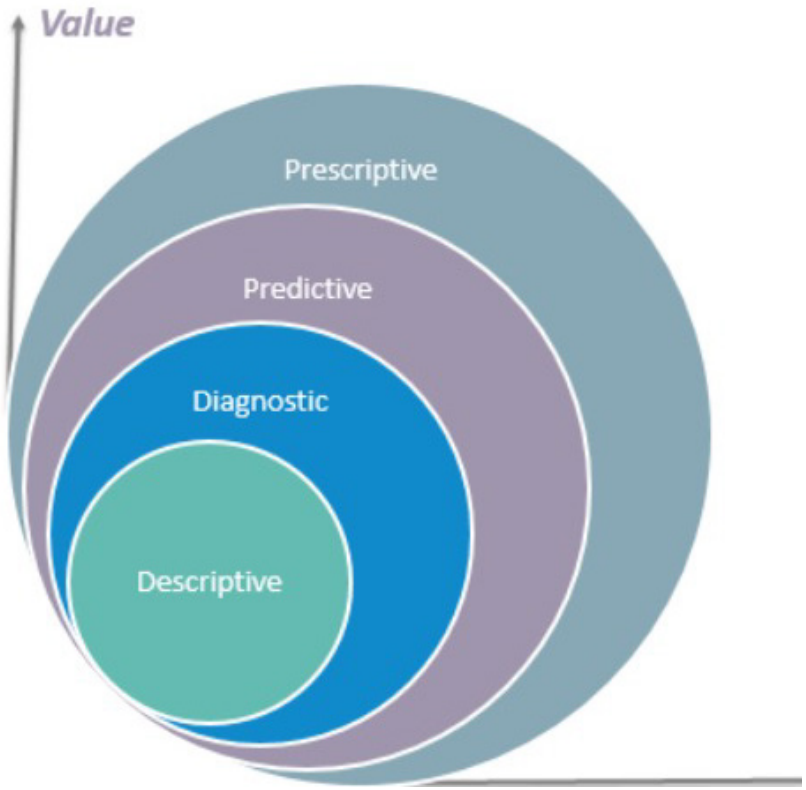
Business Analytics – A nested rather than linear approach



Descriptive Analytics: Understanding what has happened

„Which products are frequently purchased together?“

Diagnostic Analytics: Explaining why it happened

„… what are the reasons for this fact?“

Predictive Analytics: Forecasting what will happen

„… how will this trend develop in the future and what are the effects on SCM?“

Prescriptive Analytics: Recommending what actions to take

„… which products should be bought together for maximal profit?“

Sources: Types of Data Analysis in Data Science and Its Applications

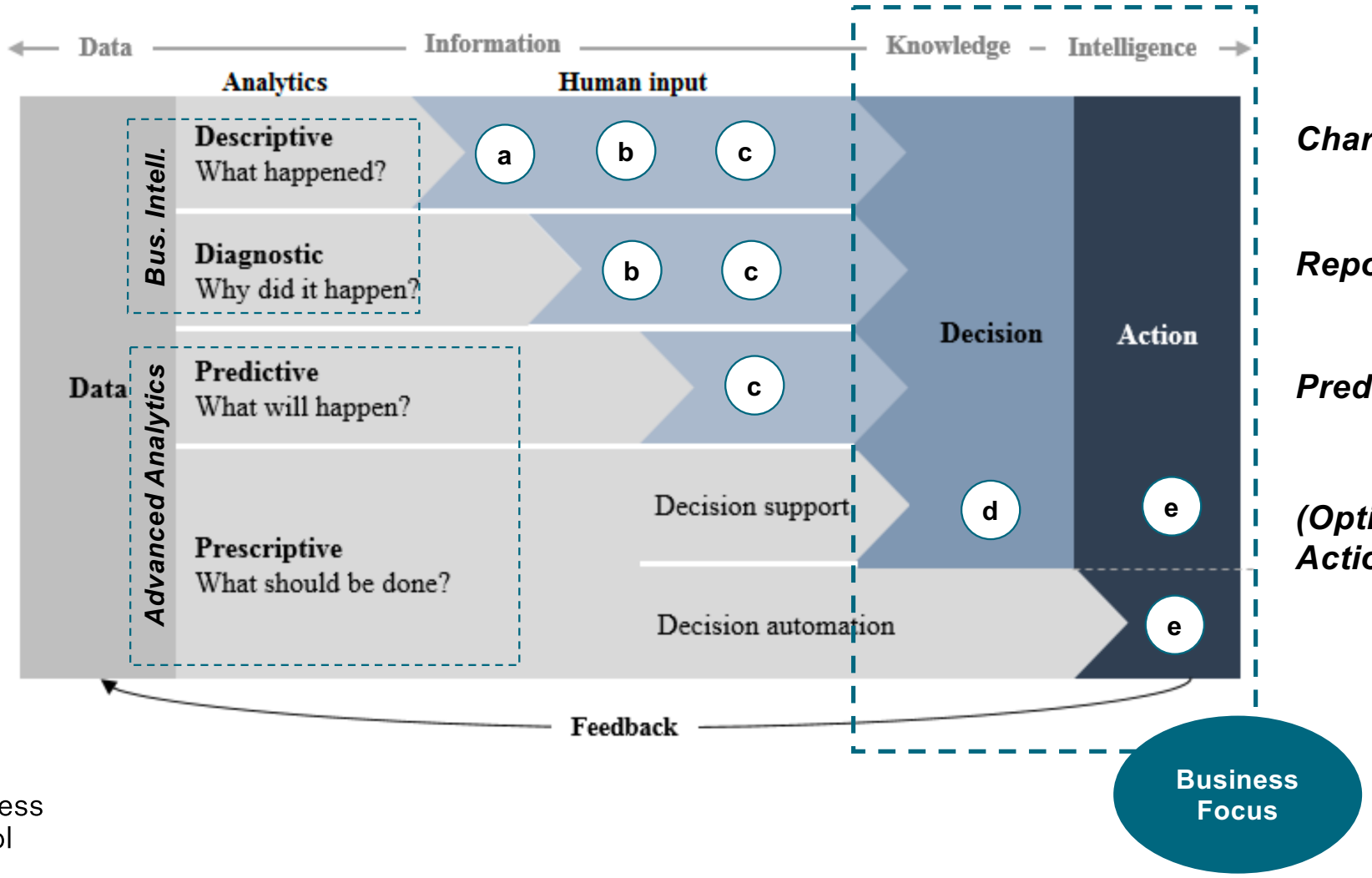
Business Analytics – Problem solving Process

Human in the Loop (x)

Mapping of relevant characteristics for Description model

Cause-and-effect relationship for Explanatory Model

Objective function for Decision-making Model



Charts

Reports

Predictions

(Options) Actions

Herschel, G. & Davis, M. 2015. Understanding the Spectrum of Analytics Capabilities. Gartner.

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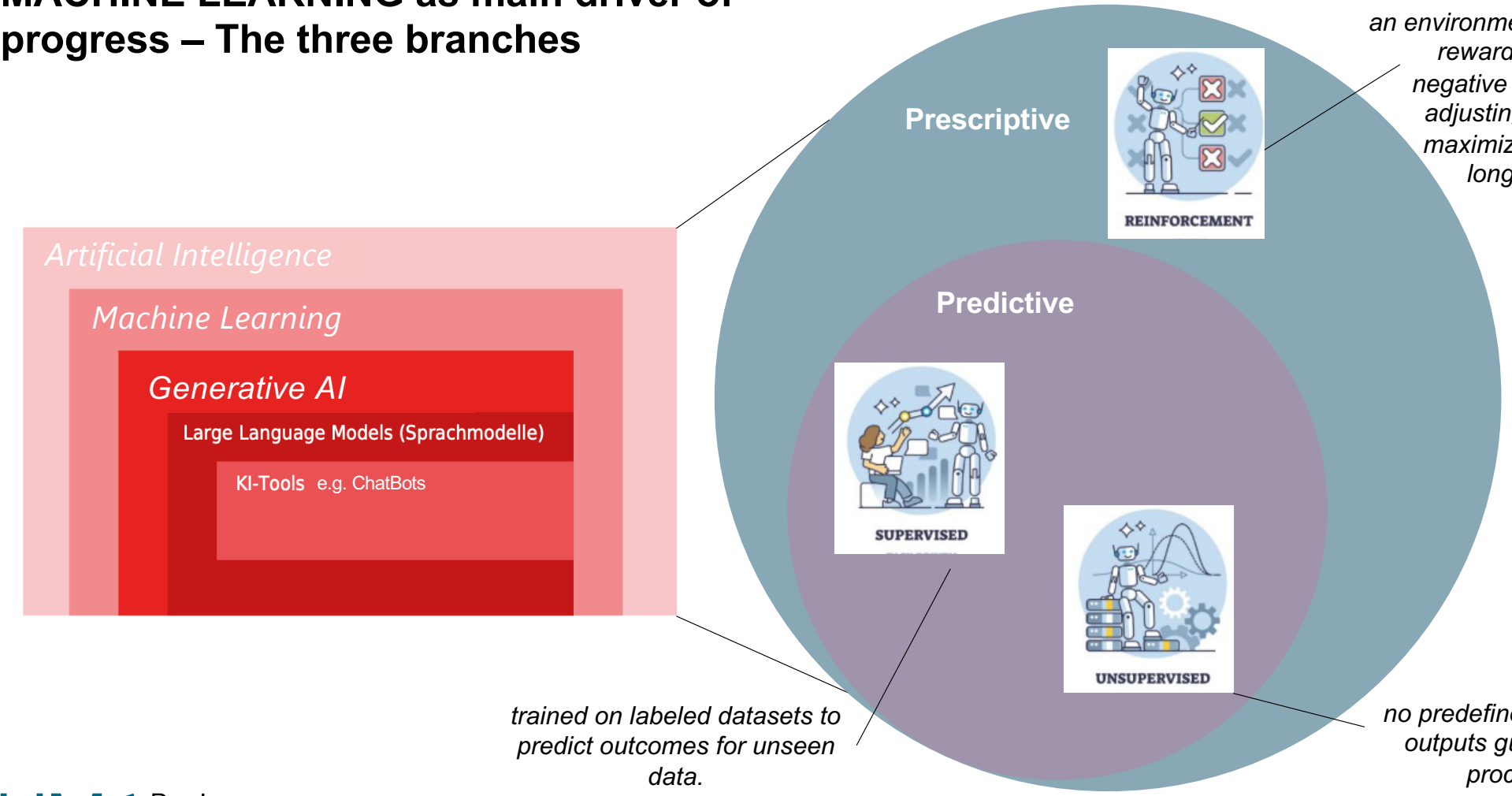
MACHINE LEARNING as main driver of progress – The three branches



agent learns sequential decisions interacting with an environment, receiving rewards (positive or negative signals), and adjusting its policy to maximize cumulative long-term reward

trained on labeled datasets to predict outcomes for unseen data.

no predefined "correct" outputs guiding the process

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Machine learning algorithms are used for both predictive and predictive analytics

Data Science – Typical methods of the application classes

Cluster analyses = identification of clusters as subsets that have a high internal homogeneity; Classes are clusters named from them ("customer segmentation")

- Classic k-means algorithm or fuzzy variant (fuzzy c-means)
- k-Medoid methods and special variants of this process class such as PAM and CLARANS
- Expectation Maximization
- Agglomerative clustering as a variant of hierarchical clustering
- Density-based clustering such as the DBSCAN algorithm
- Use of Artificial Neural Network Architectures for Clustering
- Self-organizing cards
- Neuronal gases
- Adaptive Resonance Theory (ART Networks)

Classification= Predictive models based on a training matrix that are used to predict the class attribute of an instance that is not part of the training matrix;

- The k-Nearest Neighbour (kNN) method, an instance-based method
- The generation of decision trees, (e.g. ID3 and C4.5 algorithm)
- Probability-based method (e.g. Naive Bayesian algorithm)
- Use of artificial (forward-facing) neural networks
- Support Vector Machines.

Prediction of numerical values = Acquisition of forecasting models for forecasting numerical values

- Linear Regression – Regression Trees
- Forward-facing neural network
- k-Nearest Neighbour
- Time Series Analysis Class

Association analyses = Used to find relevant relationships between arbitrary attributes of a data matrix

- A priori procedure
- Frequent Pattern Growth

Text & Web-Mining = Finding Relevant Patterns in Texts (from the Web)

- Web Content Mining
- Web Usage Mining
- Web Structure
- … Many special procedures

Quelle: Cleve, Lämmle: Data Mining, 2024 (Kap 3)

CORE Question

Business Analytics im Supply Chain Management – **ISB CASE and CRISP Process**

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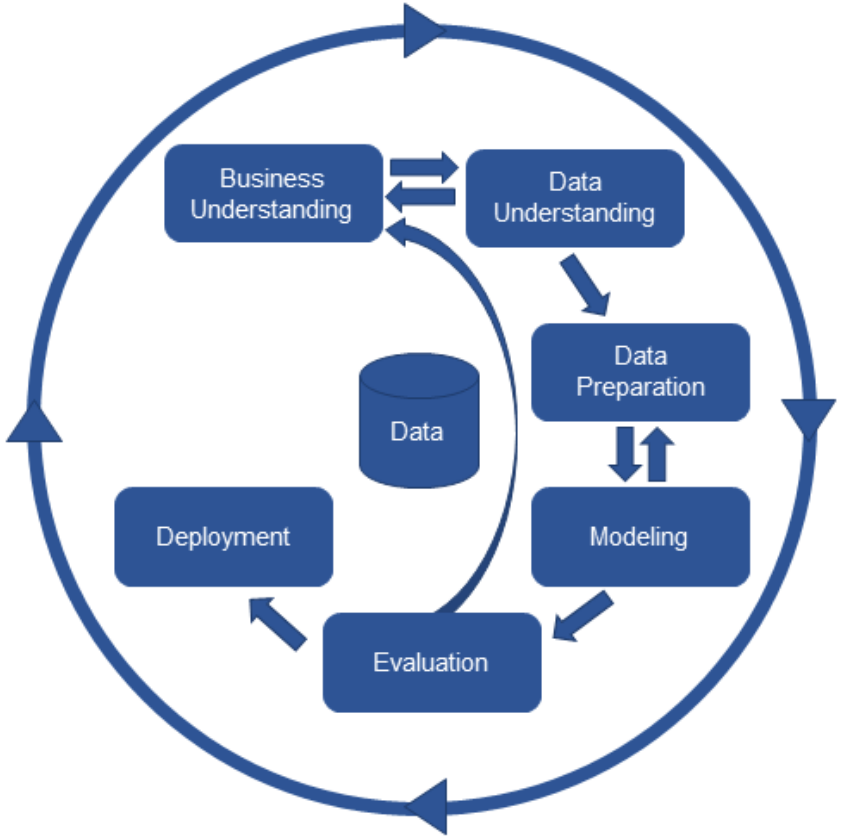
CRISP* – Process for Data Mining



The CRISP-DM data mining process

- Understanding of tasks
- Data Understanding
- Data preparation
- Modelling
- Assessment
- Application

Focus is on the "technical" process of data mining

*) Cross Industry Standard Process for Data Mining

Data science is a research process, not a software development process

CRISP - Typical problems faced in business analysis projects

Problem source	Project owner perspective	Analyst perspective
Communication	Project owner does not understand the technical terms of the analyst	Analyst does not understand the terms of the domain of the project owner
Lack of understanding	Project owner was not sure what the analyst could do or achieve Models of analyst were different from what the project owner envisioned	Analyst found it hard to understand how to help the project owner
Organization	Requirements had to be adopted in later stages as problems with the data became evident	Project owner was an unpredictable group (not so concerned with the project)

While the time spent on project and data understanding compared to data preparation and modeling is small (20% : 80%) ..,
the importance to success is just the opposite (80% : 20%)

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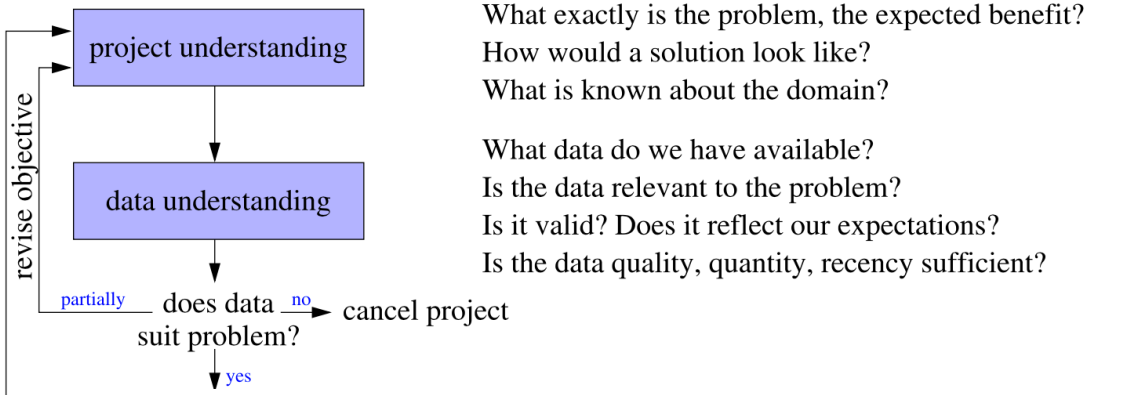
The CRISP process must be placed in the context of business analytics, especially with the help of framing, allocation, and preparation

The CRISP in the context of business analytics



Ressources: data and knowledge, that is, databases and experts who can provide background information

- **Requirements and constraints:** Model, ethical, technical
- **Assumptions:** Uncover implicit and explicit assumptions
- **Risks:** Uncover possible risks of process and solution

**While the time spent on project and data understanding compared to data preparation and modeling is small (20% : 80%) ..,
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In the CRISP process project and data understanding is crucial for project success

ISB Case - ARTIFICIAL INTELLIGENCE FOR IMPROVING THE PROCUREMENT EXPERIENCE OF NON-STOCK ITEMS AT INDIAN RAILWAYS

RLY	SHORTNAME	PUR_DIV	PUR_DIV_NAME	PO_NO	PO_SR	PL_NO	BU	DES	CONSIGNEE	CONS_NAME	
22	BLW	HQ	BLW, VARANASI	03201259101318	1	11284547	1	ELBOW 1/4" X 90 DEGREE -I as per Drg.No. TPL-0081 AL	006600	GSD	
9	WR	89	PCMM CCG	LP185216150239	1	9852NS01	1	PEN DRIVE 16 GB (SANDISK MAKE) ACCEPTED:MAKE/BR	00401	AS(G)	
6	SR	28	CSD/PER	78186690151655	1	90NS	1	BEARING HOUSING OF LONG TRAVEL WHEEL ASSEMBLY	010248	SSE/GC/CW/PER	24-OCT-18 13:08:28
10	ECR	31	CSD/TRS/MGS	31191112100250	1	23564581	1	U-section ring of Tap changer,specification-RDSO drg N	003100	TRS/MGS	13-SEP-19 14:41:32
5	NFR	HQ	Principal Chief Mate	83181126103170	1	83051028	1	SN-68: Printed General Note for Animal/or General Me	000300	GHY	20-DEC-18 15:38:22
10	ECR	HQ	Principal Chief Mate	17185187215807	1	5279N504	1	DGS-1210-28P, Layer 2 Access Switch, Model- D-Link 8	88146	SSE/EXCHANGE/HQ/HJP	26-DEC-18 13:27:21
3	NR	HQ	Principal Chief Mate	09182082105012	1	38125225	1	COUPLER ROD FOR BCN WAGONS DRG. No. WD-0004	002200	JUDW	01-OCT-18 13:01:05
1	CR	HQ	Principal Chief Mate	81181042100842	1	84139237	1	THREAD LOCKER, LOCTITE 222 OF M/S HENKEL ADHESIV	001600	ACL BSL	21-FEB-19 13:12:13
5	NFR	10	TSK-DVN	TS195378100601	2	7831N002	1	Office Chair with Arms and Cushion fitted, Model :- Orn	47107	SSE/TELE/TSK	25-JUN-19 17:28:33
28	NFRCON	HQ	PCMM/CON	03185402100823	1	7805N001	1	DRINKING GLASS 250ml. MAKE BOROSIL	77485	CH.OS/CON/S-I/MLG	03-APR-18 19:16:57
3	NR	38	DSL/AMV	532017548600375	4	17453057	1	ELEMENT FILTER FIBRE GLASS ECC DRG.NO.EMD PT NO.8	003800	DSL/AMV	12-DEC-20 13:15:58
9	WR	HQ	Principal Chief Mate	22183559104450	4	25971890	1	CAPACITOR 0.47 MFD, WORKING VOLTAGE 2000 V, 280	006400	RTM-DL	08-AUG-19 11:15:23
10	ECR	70	DY.CMM(D)/ECR/SPJ	14195009200013	1	4623NS	1	Room Heater(Gopi) or Similar Heating element wattage	85595	SMM/D/SPJ	24-JAN-19 16:24:27
13	NWR	42	CARRIAGE STORES DE	42185828150459	1	4521NS	1	SWITCH PLATE ASSEMBLY CONSISTING OF 01 NO. 5 PIN,	095412	SSE/TRAIN LIGHT/AII	24-SEP-18 17:37:03
12	NCR	22	SMM-D JHANSI	62180290800233	1	11121038	1	WEAR PLATE VERTICAL TO C.Rly. DRG. NO. CI/BE-12, DR	002200	DLS/JHS	25-JUL-18 15:55:43
7	SCR	91	DIVISION /SC	LT196818201750	1	NS	1	CLT-M609X-- Magenta Cartridge for printer Samsung CL	010510	SR.DPO/SC	19-DEC-19 18:09:07
9	W										
8	S										
10	E										
15	S										

CE413A HP 305A MAGENTA Accepted P/A item No 358

CONTACT PIECE FOR CONNECTION BAR OF ROOF LINE TO CEE DRG NO LOCO/3/RE/028 REF-2, Mod.D (Ref: CLWs Specn. No. CLW/ES/C-49, Alt-C).

Nylon tyre & tube for tata sumo size-215/75R 15LT make-CEAT or similar

GASKET FOR ECC DOOR LATCH TO SHED DRAWING NO.DSL/UBL/CP/0718-5.Note: Sample to be approved by consignee prior to bulk supply.

Axle Box Housing to ICF Drg. No. T-0-2-602, Alt-u/14, item No-2, Material and specification as per RDSO spec No. RDSO/2007/CG-08, Amendment slip no.1 of July 2009.

CARTRIDGE BLACK HP 955XL MAKE/BRAND: HP (DEMAND NO: 95195342 DT: 14.06.2019) CONSIGNEE CODE: 091558, ALLOCATION: 20169304, WORK CODE: 16822, EXE COD

Ring tongue type copper terminal end's 16 mm square similar to Dowells cat No. 7128, E-Dia - 10.2 mm. Make- Dowells, Chetna and ascon Make.

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