Introductory Data Science for Managers and Business Leaders - Workshop

Dragan Vukmirović

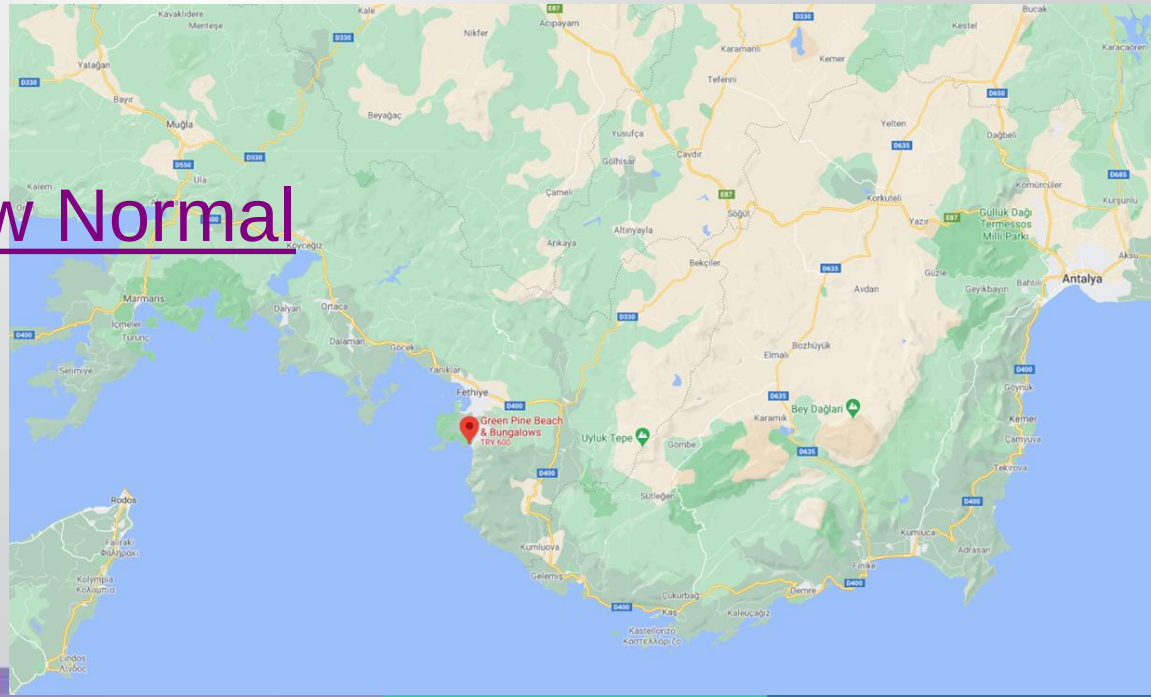
(After pandemic) Motto

symorg 2020

Businesses will need to figure out how to operate in new ways.

In short, resiliency - the ability to absorb a shock, and to come out of it better than the competition - will be the key to survival and long-term prosperity

Welcome to the New Normal



Methodological approach to this tutorial

- "WHY" and "HOW" approach, by desire to present basic idea in a way so:
  - Making a clear distinction between explanation and speculation
  - Using of mathematics and statistics without impressing rather than clarifies
  - Avoid the misuse of language by overloading established technical terms
    - Inspired on Lipton & Steinhardt

Expected tutorial outcomes

- acceptance an easy-to-understand the basic presented concepts

- A practical introducing in Data Science and its business applications:
  - basic knowledge and confidence, and
  - need for potential digital transformation of your organization into an innovative, efficient, and sustainable company of the future

by implementing a data science concept – creating value through data.

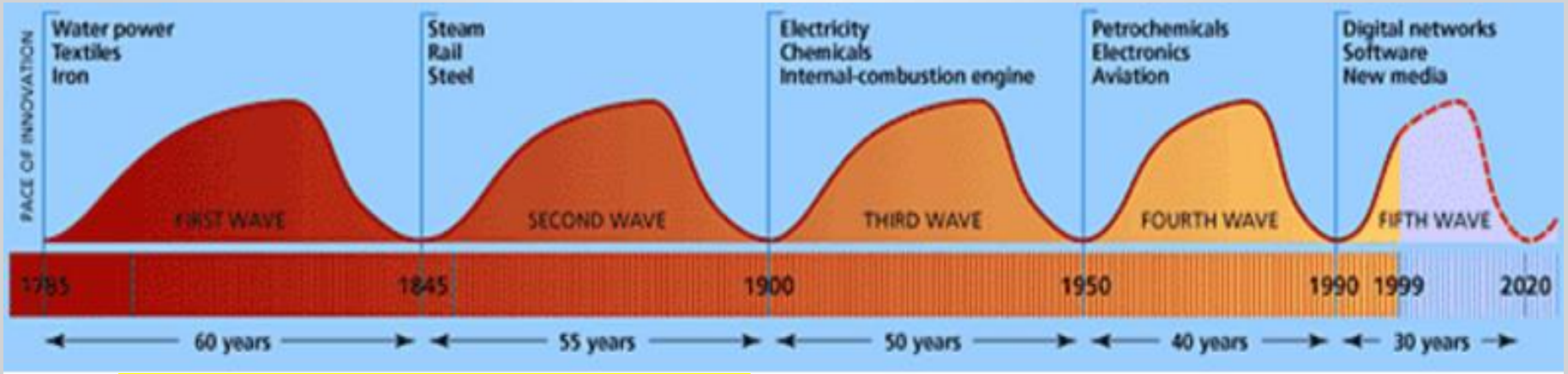
Topics

- Information Revolution, The Fourth Paradigm, Big Data, Data Science, Artificial intelligence.
- Business transformation
- Data Science in organizations
- Business Analytics
- MIP - Prototype of the Model of Intelligent Enterprise
- Building a Data Science team
- Data Scientist - Skills/knowledge needs
- A Review of Future and Perspectives of Data Science
  - Case study: Applications of Data Science in Tekijanka d.o.o.

Joseph Schumpeter (1883 - 1950)

symorg 2020

- creator of the term "*creative destruction*" - a healthy economy can never be in balance, as long as it is "disrupted "by the development of technological innovation
  - According to his approach, the development of the economy and society went hand in hand with the development of technology, and took place in 5 cycles - separate industrial revolutions (“long waves”)
  - Each of these cycles is unique, represents a revolution in itself, is strictly determined by the development of technology and lasts less than the previous



Q: The next wave?

(The Economist, 1999, Feb 18)

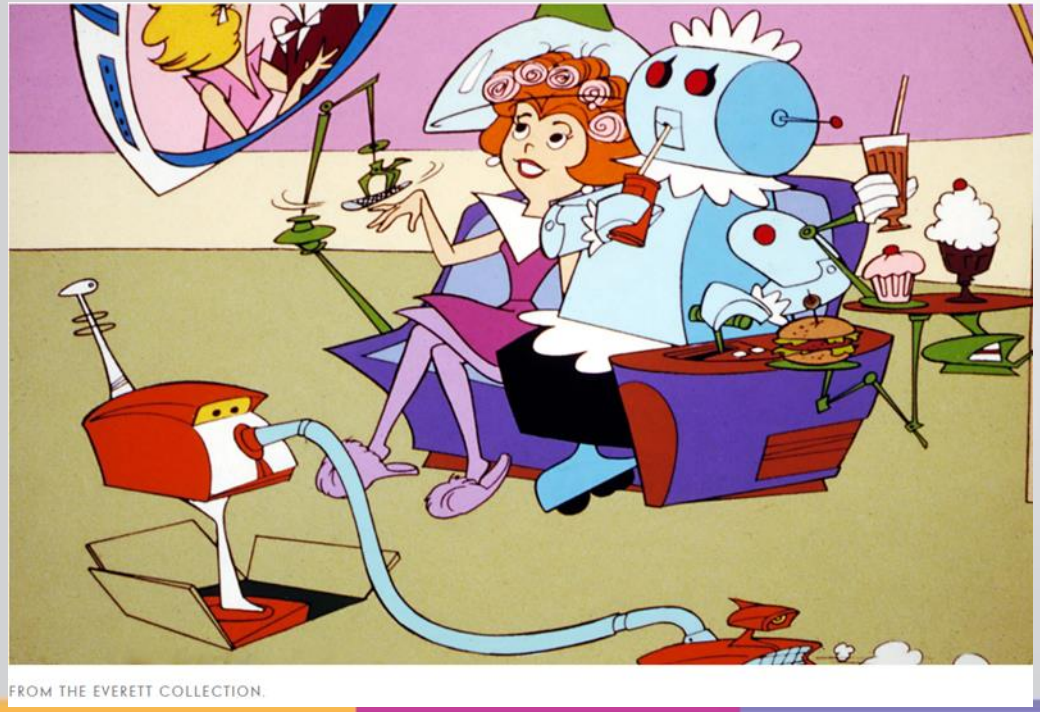
We are living in exponential times!

Q: First expression?

The only constant in business is CHANGE

symorg 2020

- Technology changes everything without our consent.
  - To succeed, you must understand and adapt



June 8-10, 2020
Virtual conference hosted by MIT Technology Review

Brief history of Data science

symorg 2020

- **Data analysis** isn't new - uncovering the insights and trends in data has been around for centuries. The ancient Egyptians applied census data to increase efficiency in tax collection and they accurately predicted the flooding of the Nile river every year (the third century B.C.) (Coursera, 2020)

Data science is a relatively new term. William S. Cleveland coined the term 2001 as part of a paper entitled "*Data Science: An Action Plan for Expanding the Technical Areas of the Field of Statistics*."

- See more: MacTutor History of Mathematics Archive

What is Data Science?

- **Data science is science**: 2002 the International Council for Science actually recognized data science and created a committee for it.

- Data science is the study of large quantities of data, which can reveal insights that help organizations make strategic choices / discover optimum solutions to existing problems

Recommendation

symorg 2020

edx.org/course/intro-to-data-science

EdX and its Members use cookies and other tracking technologies for performance, analytics, and marketing purposes. By using this website, you accept this use. Learn more about these technologies in the Privacy Policy.

University leaders & faculty: Need online content for your next term? Online Campus can help. Learn More.

edX Courses Programs & Degrees Schools & Partners edX for Business Sign In Register

Catalog › Data Analysis & Statistics Courses › IBM's IBM Data Science

Introduction to Data Science

Learn about the world of data science first-hand from real data scientists.

IBM

40,426 already enrolled!

Enroll
Starts Sep 4

I would like to receive email from IBM and learn about other offerings related to Introduction to Data Science.

This course is part of a Professional Certificate

About this course

The art of uncovering the insights and trends in data has been around for centuries. The ancient Egyptians applied census data to increase efficiency in tax collection and they accurately predicted the flooding of the Nile river every year. Since then, people working in data science have carved out a unique and distinct field for the work they do. This field is data science and in this course, you will meet some big data science

More about this course

Length:	6 Weeks
Effort:	3–6 hours per week
Price:	FREE Add a Verified Certificate for $39 USD
Institution	IBM
Subject:	Data Analysis & Statistics
Level:	Introductory
Language:	English

What you'll learn

- Definition of data science and what data scientists
- Tools and algorithms used on a daily basis within the field
- Skills needed to be a successful data scientist
- The role of data science within a business
- How to form a strong data science team

Data Science vs. Statistics?

- "Statistics" means the practice or science of collecting and analyzing numerical (**structured**) data

- "Data Science" uses scientific methods to liberate and create meaning from raw (**unstructured**) data.

What is really new?

- Computing power
- New tools (cheap & free)
- Cloud technology
- Knowledge & Skills (Science 4.0)

Source: StockCard.io / Image: created using Tailorbrands

The Fourth Paradigm of Science

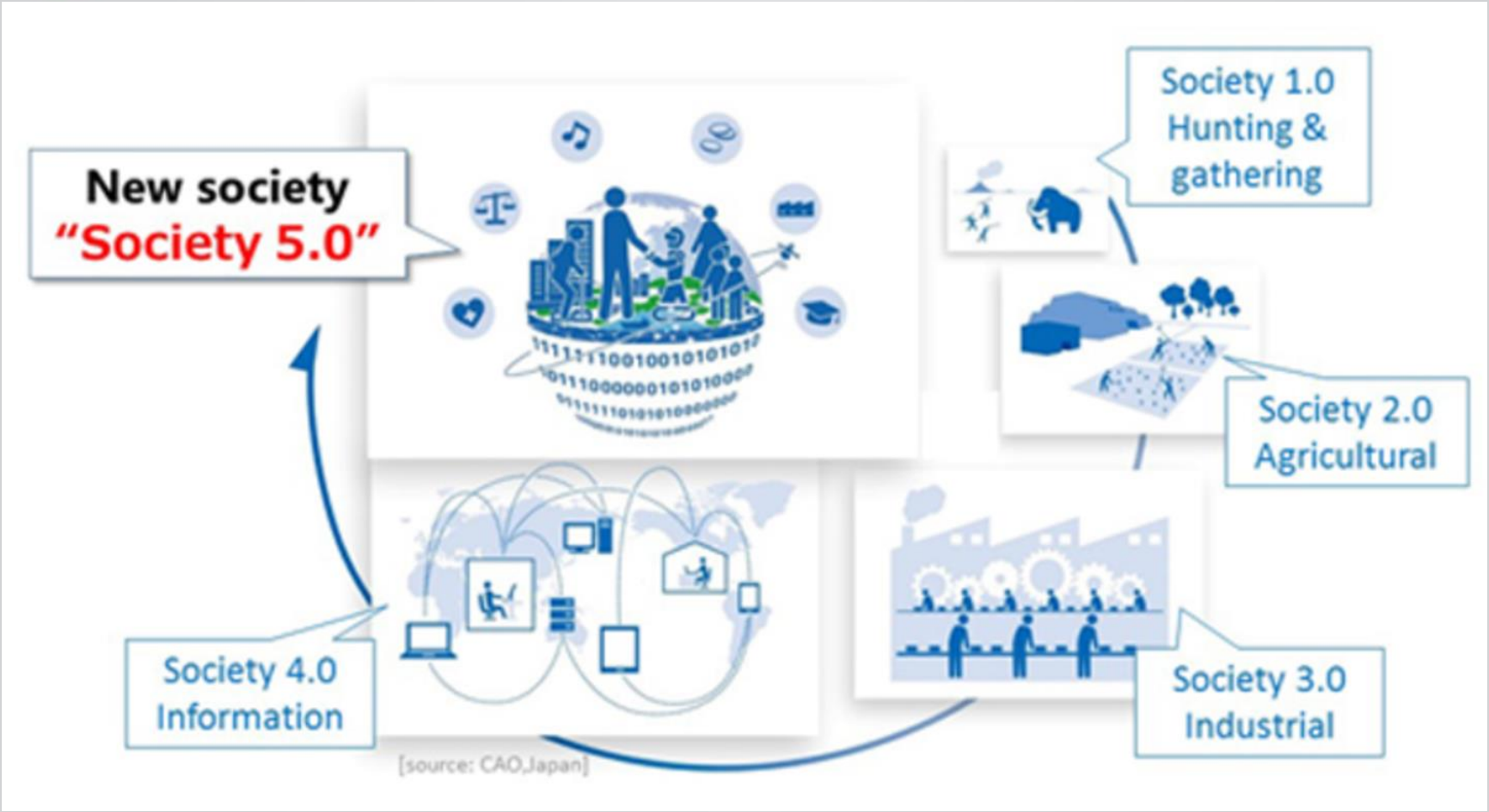
1. Thousand years ago – **Experimental Science**
   - Description of natural phenomena
2. Last few hundred years – **Theoretical Science**
   - Newton's Laws, Maxwell's Equations…
3. Last few decades – **Computational Science**
   - Simulation of complex phenomena
4. Today – **Data-Intensive Science**
   - Scientists overwhelmed with data sets from many different sources
     - Data captured by instruments
     - Data generated by simulations
     - Data generated by sensor networks
   - ➢ eScience is the set of tools and technologies to support data federation and collaboration
     - For analysis and data mining
     - For data visualization and exploration
     - For scholarly communication and dissemination

Astronomy has been one of the first disciplines to embrace data-intensive science with the Virtual Observatory (VO), enabling highly efficient access to data and analysis tools at a centralized site. The image shows the Pleiades star cluster form the Digitized Sky Survey combined with an image of the moon, synthesized within the WorldWide Telescope service.

Science must move from data to information to knowledge

Source: Tony Hey Corporate Vice President Microsoft External Research

Japan is preparing for Society 5.0



Education 4.0 / Society 5.0

symorg 2020

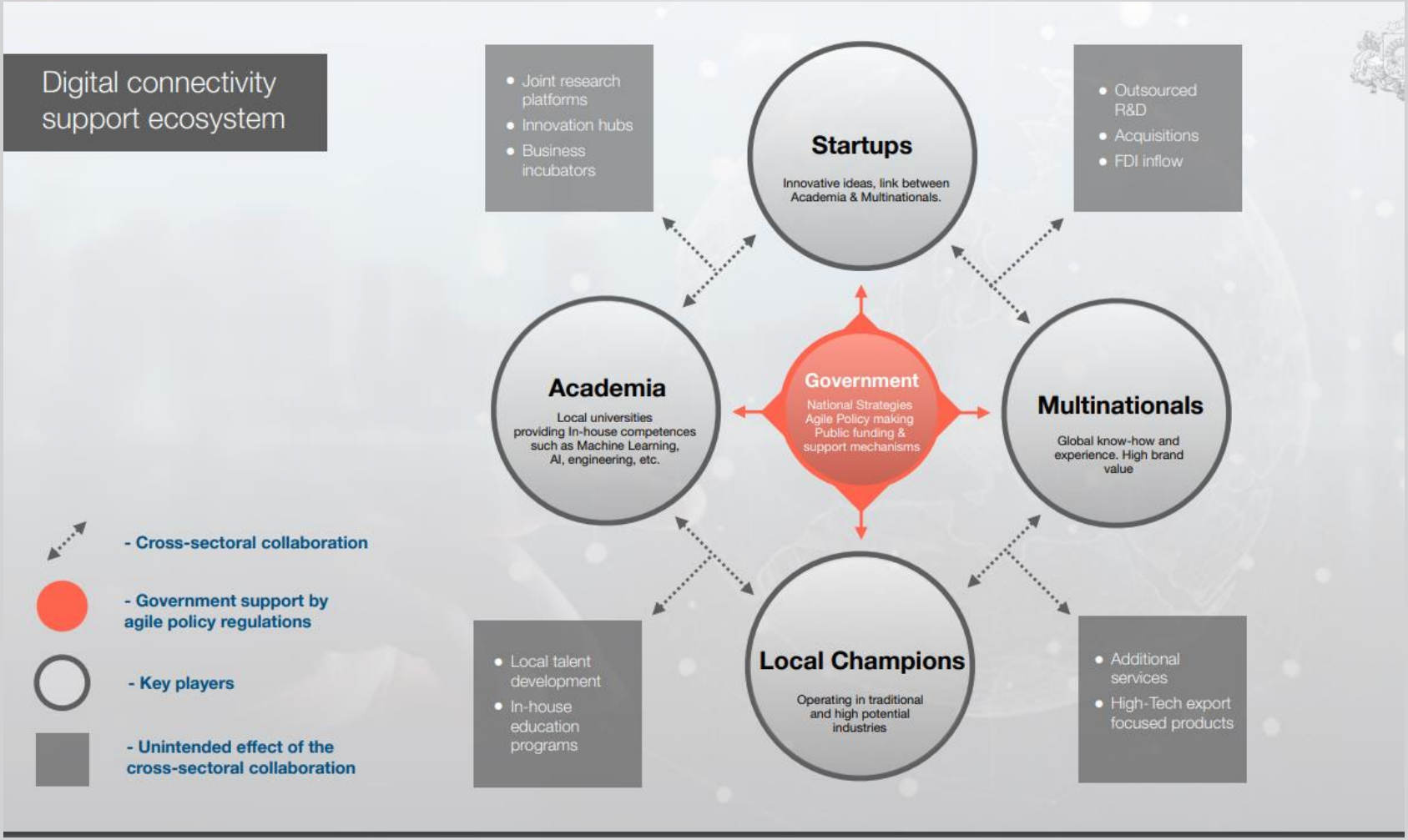
- *“In the era of Google, people no longer need to memorize every single fact. Many tasks today are best carried out by computers,*

… we have to give students the skills to both survive that changing society and for them to lead that change”.

- Japan’s former education minister Yoshimasa Hayashi

CS: Latvia

symorg 2020



Ready for business transformation?

symorg 2020

- Now we have the computational capabilities: higher processing capacity, faster processing speed, and higher energy efficiency and building new software that makes such faster, better, and more efficient data capture, storage, processing, and analyzing possible
- We can take really large data sets from different sources and instead of taking a sample and trying to test some hypothesis we can take really, really large (un)structured data sets and look for patterns.
- New paradigm: from hypothesis testing to finding patterns

Implementing AI technology

symorg 2020

- A study by IDC (2019) found that 60% of global organizations reported changes in their business model that were associated with AI adoption.

A quarter of the organizations surveyed reported a 50% failure rate due to **unrealistic expectations**

AI early adopters

symorg 2020

- Almost two-thirds (65 percent) report that AI technologies are enabling their organizations to move ahead of the competition.
- 63 percent of the leaders already view AI as “very” or “critically” important to their business success, and that number is expected to grow to 81 percent within two years.

  - Deloitte’s State of AI in the Enterprise, 2nd Edition, March 2020

Artificial Intelligence

- There is no single uncontested definition of what constitutes AI and the term is used liberally to describe anything from routine data analysis to complex deep neural networks.
- In general, most people would agree that the fundamental goals of AI are to enable machines to have cognition, perception, and decision-making capabilities that previously only humans or other intelligent creatures have.

DS vs. AI

symorg 2020

- **AI** includes everything that allows computers to learn how to solve problems and make intelligent decisions.

Both AI and Data Science can involve the use of big data, that is significantly large volumes of data.

"Beyond automating tasks, the other more remarkable impact of AI on an enterprise will be on decision-making: Large organizations still struggle to make good decisions on time."

—Jay Dwivedi, president, xInvest Consultants

(Hupferm, 2020)

Big Data

- We have lots and lots of data that traditional techniques just couldn't really store and handle.

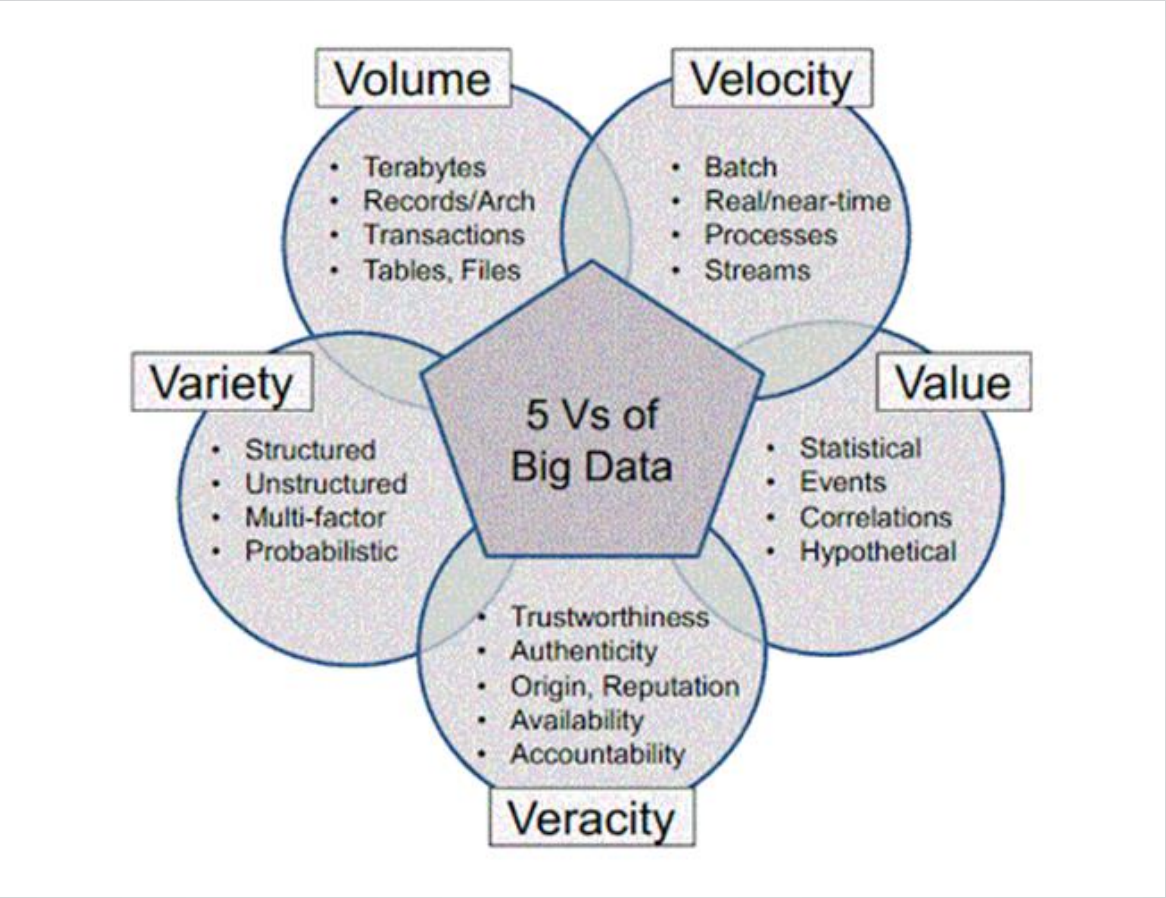
The **all data** must be categorized, analyzed, and visualized.

- This gives organizations more ways to connect with their customers and enrich the services they offer.

Big data is data that exceeds the processing capacity of conventional database systems

(Wilder-James, 2014)

Big data dimensions (3 - 5V)

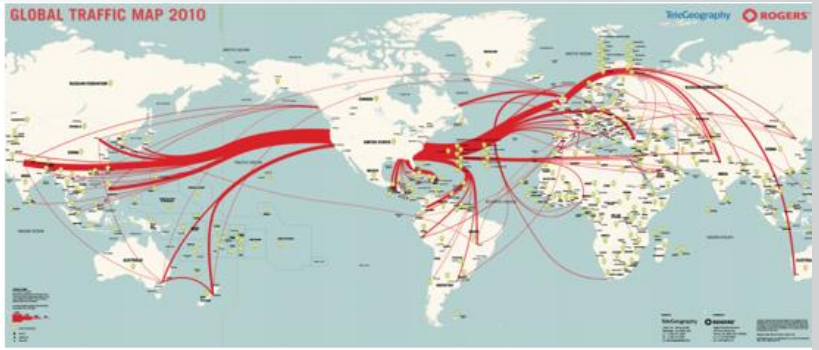


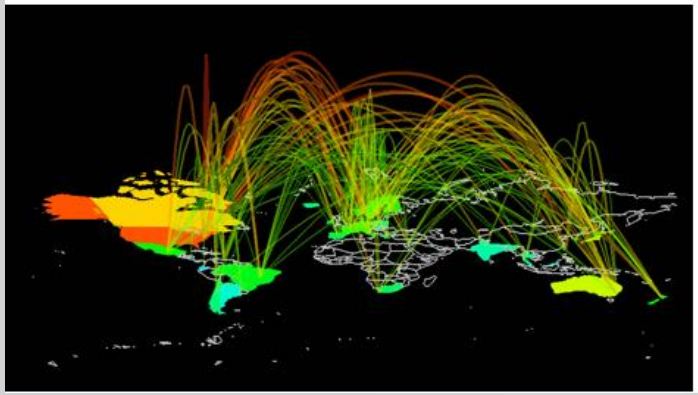
(Demchenko et al., 2013)

Business paradigms have changed

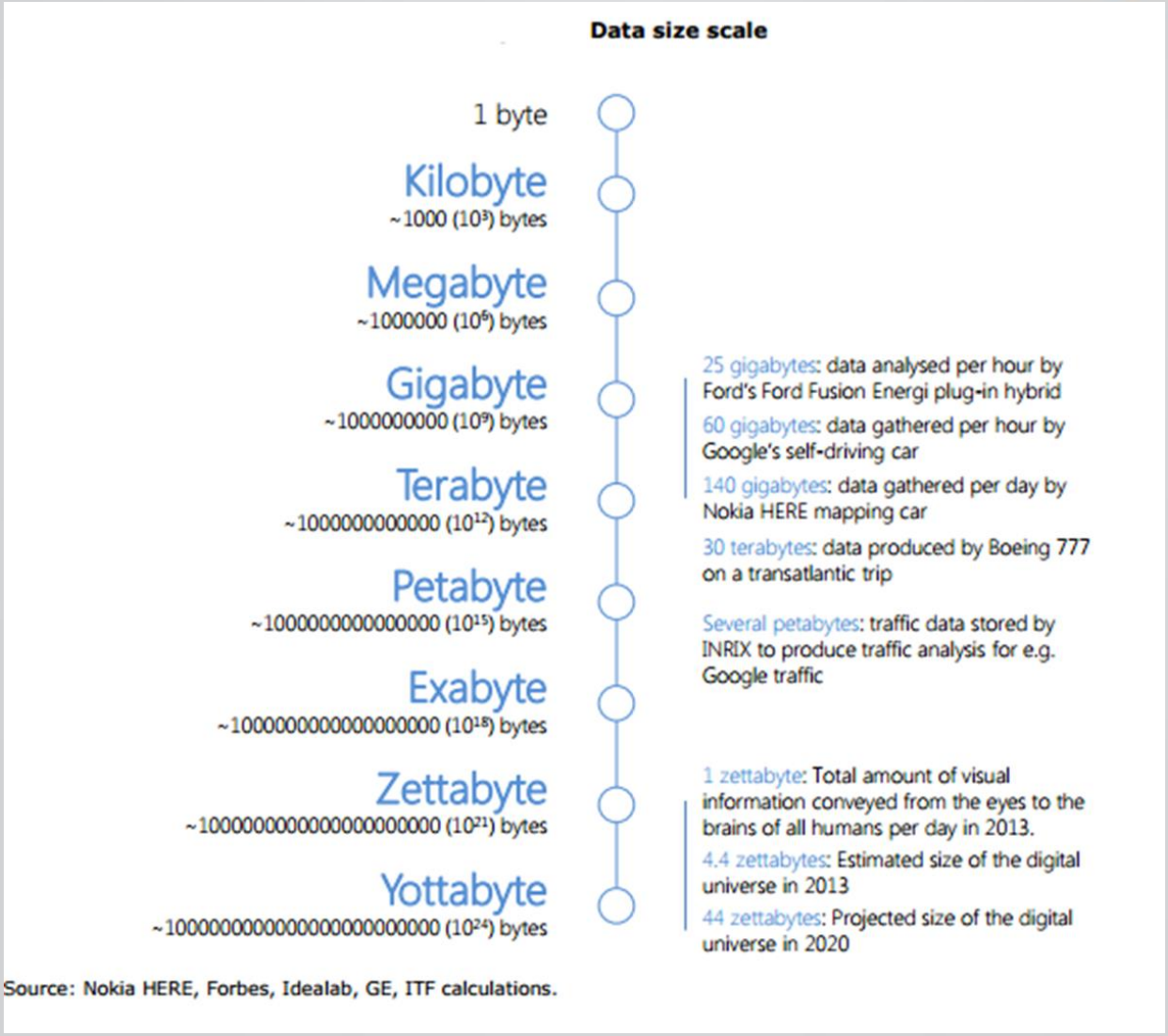
symorg 2020

- In 1990 data were scarce - interpretation was readily available
- In 2020 data are everywhere - interpretation is scarce





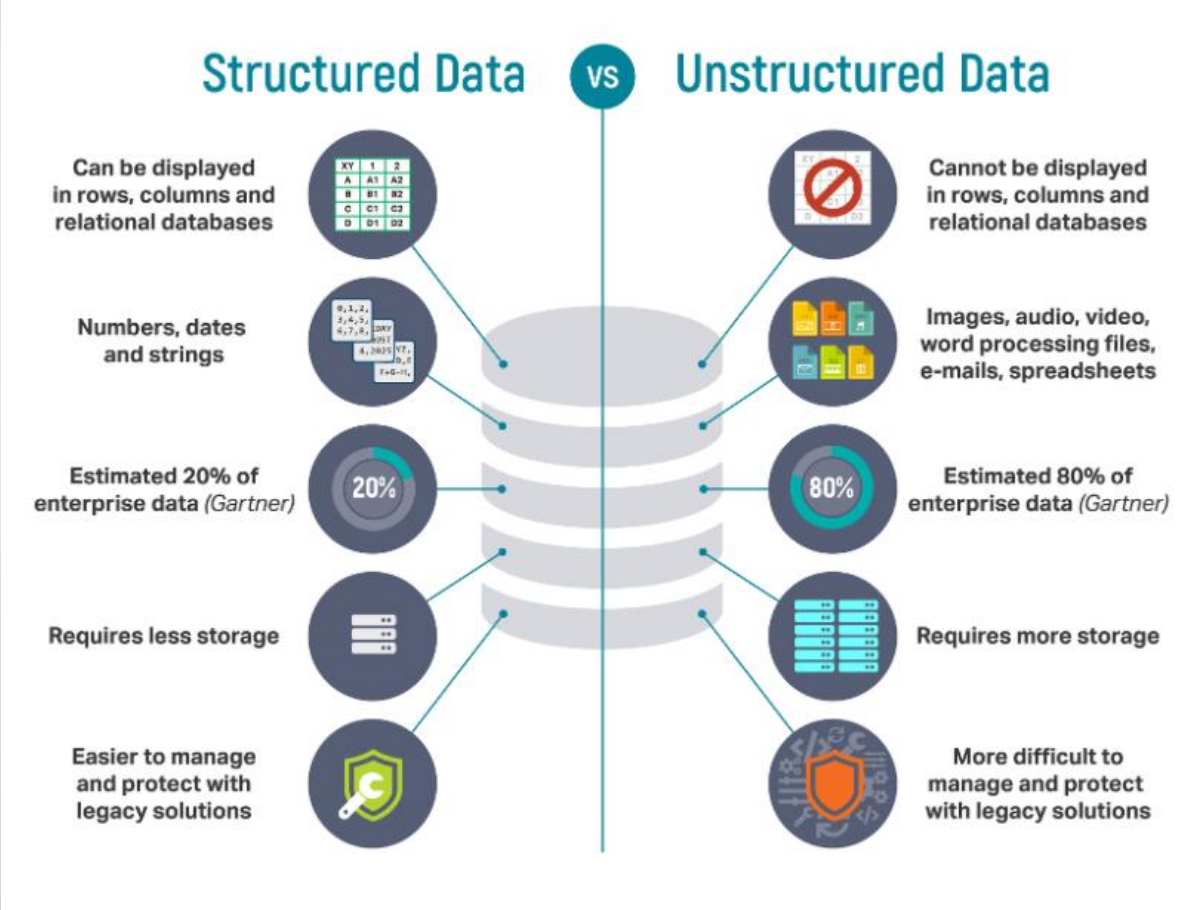
Volume



(NOESIS, 2018)

Variety

- The DATA has increasingly become "**unstructured**":
  - *Text*
  - *Audio*
  - *Video,*
  - *Image,*
  - *Geospatial*
  - *Internet data:*
    - Click streams
    - Log files



https://www.igneous.io/blog/structured-data-vs-unstructured-data

The Potential of Big Data & Data Science

It will be the difference of driving a car by night versus driving by day;
In traditional approach you see only what your headlights illuminate and now you can see the whole landscape.

Rather than looking at segments, classifications, regions, groups, or other summary levels you'll have insights into ***all*** the individuals, ***all*** the products, ***all*** the parts, ***all*** the event, ***all*** the transactions, etc.

Not everyone is happy

symorg 2020

There is a gap between the rate at which technology develops and the rate at which society develops. We need to take care not to fall into that gap.

LOUISA HEINRICH

You?

([Vogels](), at al., 2020)

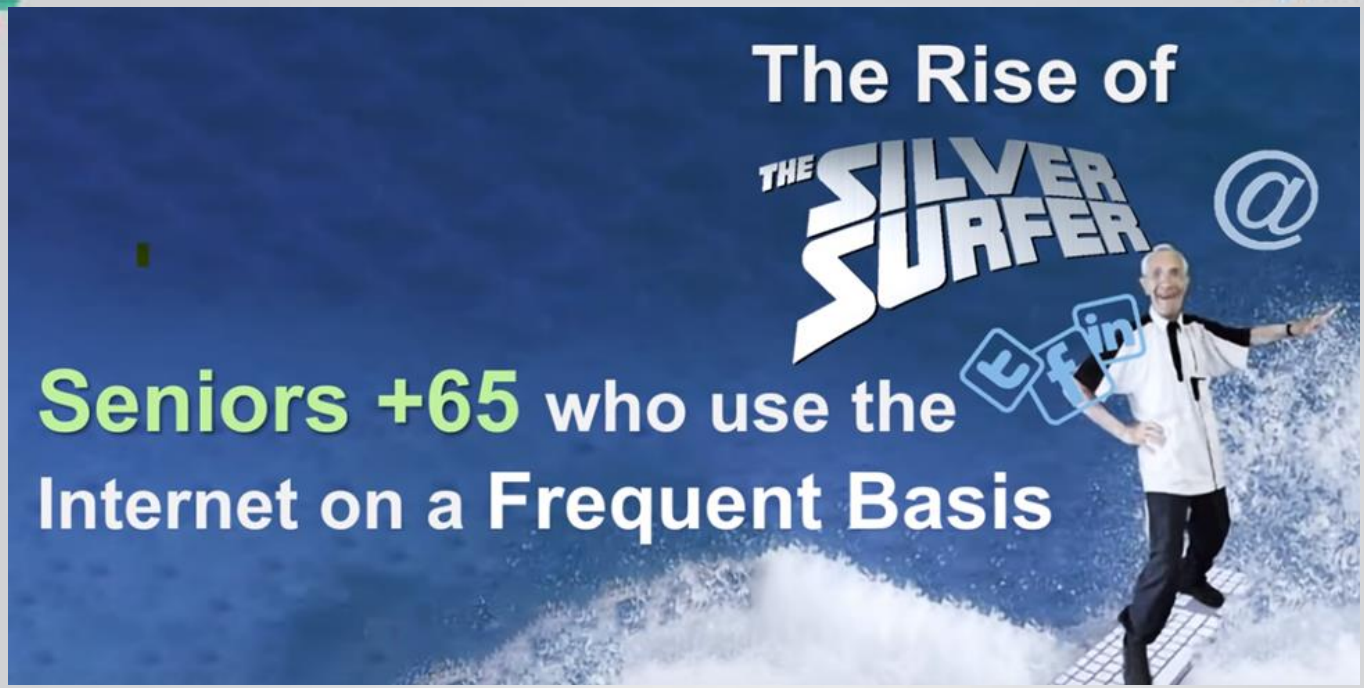
Message

symorg 2020

"Because all the peoples of the world are part of one electronically based, intercommunicating network, young people everywhere share a kind of experience that none of the elders ever had. . . This break between generations is wholly new: it is planetary and universal"

Cultural anthropologist Margaret Mead, 1970

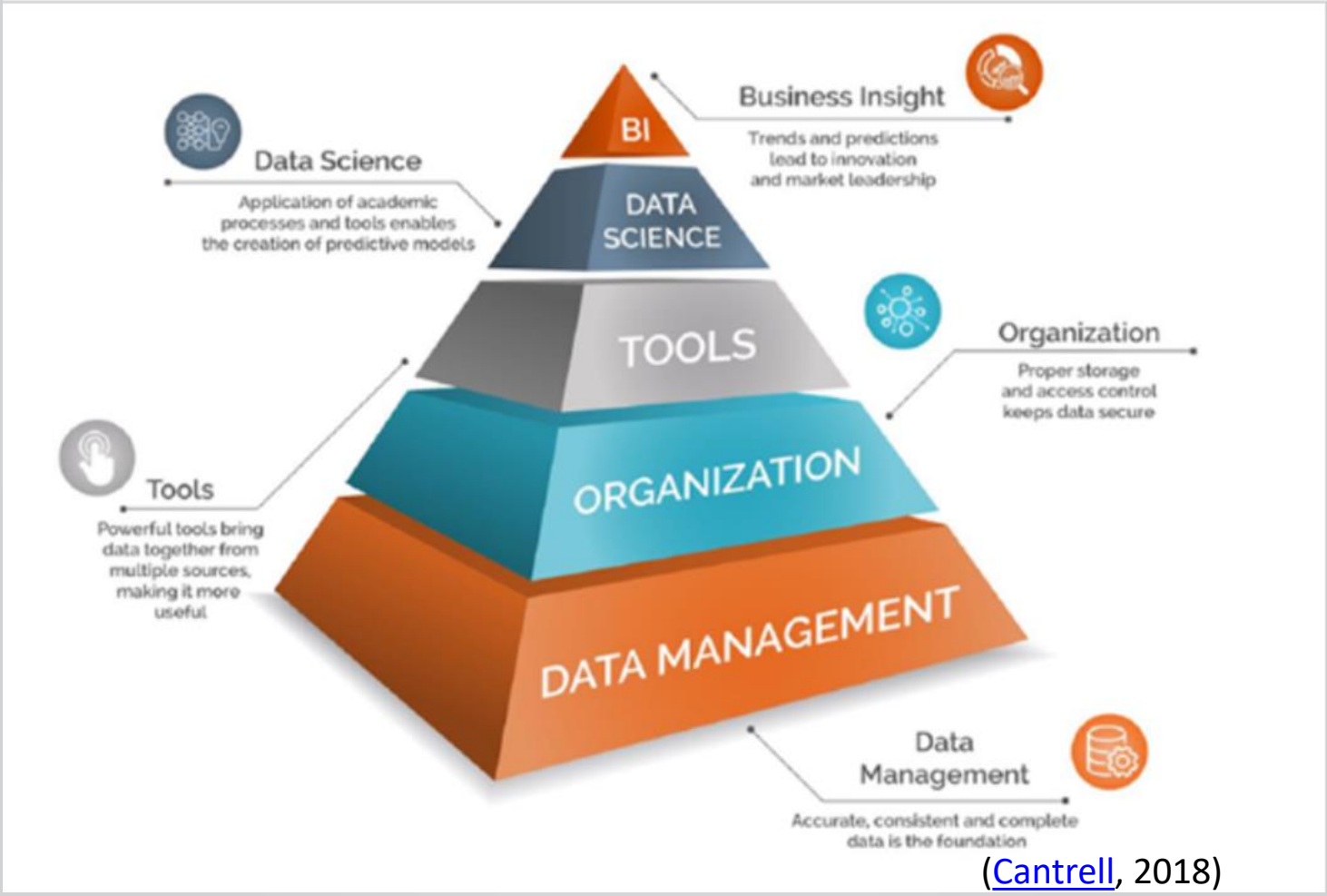
(Shift Happens 2018 act)



(Did You Know 2019)

Q: What are they still not using?
They have to lag in something

Data Science in organizations



(Cantrell, 2018)

Digital transformation of organizations

- It is not simply duplicating existing processes in digital form - It is an **organizational and cultural change** driven by Data Science with fundamental changes to their approach towards data, employees, and customers and
  - ➢ changing the way organizations understand the world!!!
  - – impacts every aspect of the organization, so it is handled by decision makers at the very top levels to ensure success

Not only in business organizations

Data Science in organizations

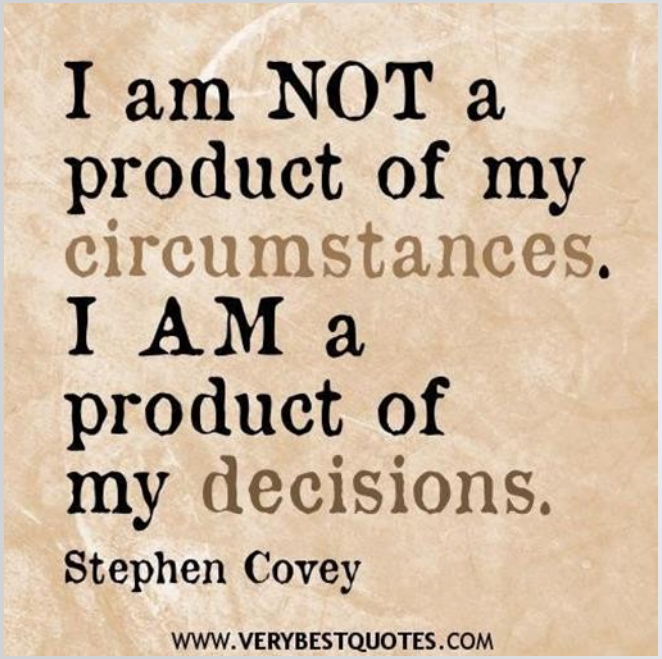
- **Way of thinking about the data**
- Adding to the knowledge of the organization by investigating data and exploring the best way to use it to provide value to the business:
  - understand business environments,
  - analyze existing issues, and
  - reveal previously hidden opportunities.

"Every activity of management is based on decision" - P.F. Drucker

The better the quality the information obtained the better quality the decision - Data driven approach

- Q: What to do if no way to get the information?
  - Go with your best estimate of the probability.

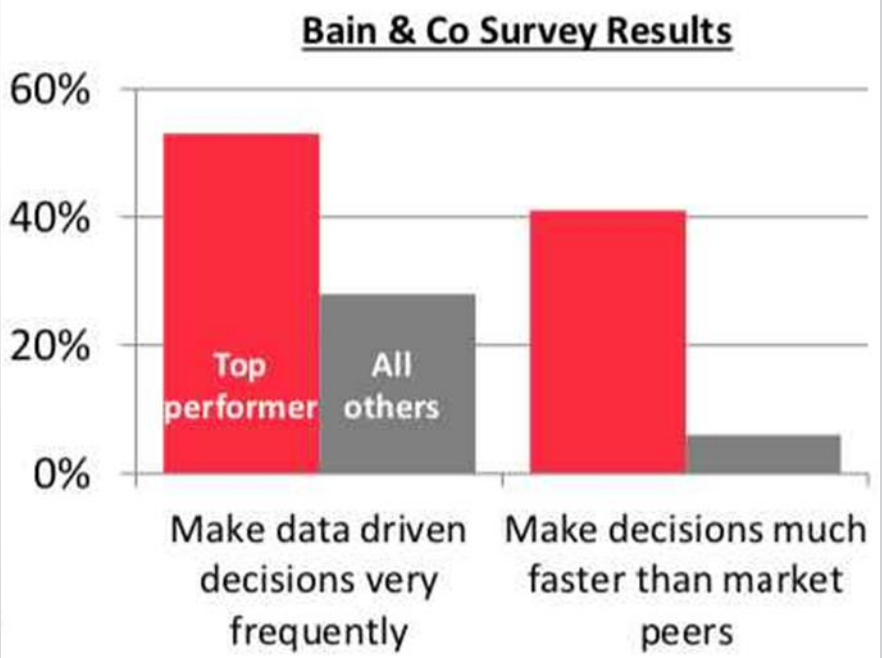
Q: Problems you encounter in the decision-making process?



Problems identified:

symorg 2020

- Data collection
- Models on which decision-making is based
- Reporting

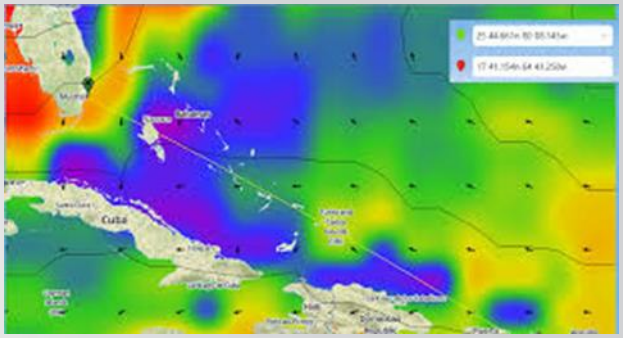


(Fradin, 2019)

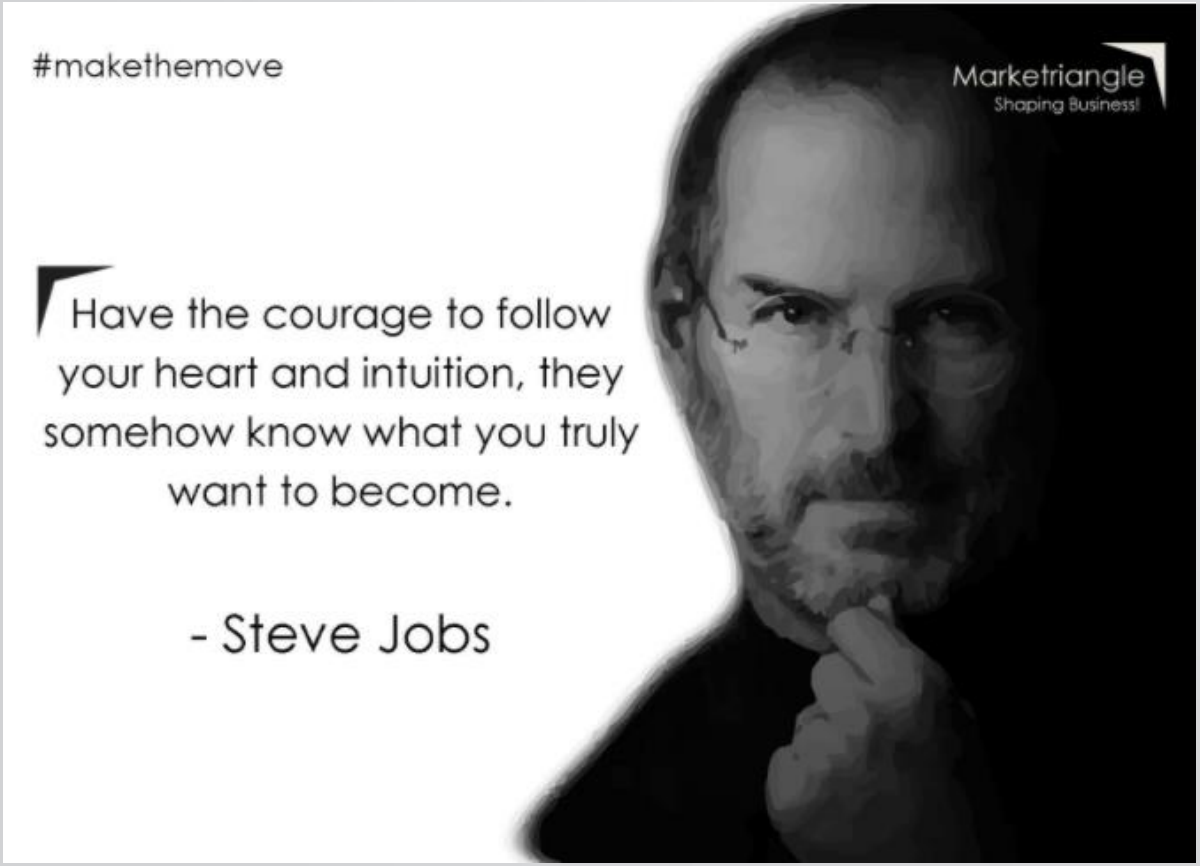
Data collection: Big Data - Sources

symorg 2020

- Sensor equipment
- Global Positioning Systems (GPS)
- Social media
- Mobile networks
- Satellite
- CCTV technology
- Forecast systems
- Internet
- Vehicle diagnostics
- Applications
- Traditional enterprise data from operational systems
- Commercial external data
- …



Models on which decision-making is based



Business Analytics

- Business analytics is a field that drives practical, data-driven changes in a business.
- It is a practical application of statistical analysis that focuses on providing actionable recommendations. Analysts in this field focus on how to apply the insights they derive from data.
- Their goal is to draw concrete conclusions about a business by answering specific questions about why things happened, what will happen and what should be done.

(Masters In Data Science, 2020)

Predictive Analytics

Criteria	Predictive Analytics	Prescriptive Analytics	Descriptive Analytics
Asking the right question	What will happen?	What should be done?	What happened and why?
Tools and methodologies	Statistical modeling and simulation	Heuristics and optimization models	Data aggregation and mining
Application	Make informed decisions about future	Making complex time -sensitive decisions	Summarizing business results

(Intellipaat, 2017)

Data Science: An Artificial Ecosystem

always use business and predictive analytics to extract knowledge

But DS is not:

- just machine learning or just statistics
- all about prediction
- only about data analysis
- a discipline that sits merely within STEM fields.
- not even a single discipline by itself.

Business Analytics and AI

symorg 2020

‘Garbage in, garbage out’

- If you put poor, partial, flawed data into a computer it will mindlessly follow its programming and output poor, partial, flawed computations. (British Computer Society)

- “AI is a statistical inference technology that learns by example - if we allow AI systems to learn from ‘garbage’ examples, then we will end up with a statistical-inference model that is really good at producing ‘garbage’ inferences.” (Saran, 2020)

Extract knowledge – Dr. Fayyad told…

- "Astronomers are really, really good at extracting structure from image data. They think of the Sky Survey as a way of collecting layers of resolution data about billions of stars and other objects, which is very similar to how businesses deal with their customers. You know very little about the majority of your customers, and the data you have is noisy, incomplete and potentially inaccurate. It's the same with stars.
- When the astronomers need to take a deeper look, they use a much higher resolution telescope that has a much narrower field of view of the sky. You're looking at a very tiny proportion of the universe, but you're looking much deeper, which means that you get much higher resolution data about those object in the sky. When you have higher resolution data, a lot of objects that were hardly recognizable in the main part of the survey become recognizable. You can see whether they are stars or galaxies or something else".

(Minelli & Chambers, 2013)

http://www.skysurvey.org/survey/

The Photopic Sky Survey is a 5,000 megapixel photograph of the entire night sky stitched together from 37,440 exposures, http://www.skysurvey.org/survey/

Data science project

XLVI Simpozijum o operacionim istraživanjima
SYM-OP-IS 2019
Kladovo, 15-18.9.2019.
UNIVERZITET U BEOGRADU
FAKULTET ORGANIZACIONIH NAUKA

MIP - PROTOTIP MODELA INTELIGENTNOG PREDUZEĆA

(Vukmirović et al., 2019)

IQcorp = f (data,knowledge)

- ✓MIP model for the implementation of artificial intelligence in small and medium enterprises in order to improve business performance

- Ho: **The main goal of the company is to increase corporate intelligence, which is defined as a function of knowledge based on data**
- by implementing the Data Science concepts

MIP - Prototype of the Model of intelligent enterprise

MIP = ƒ (data, model, reengineering)

- is based on the main postulates of the fourth paradigm:

New technologies lead to a new way of thinking and doing business, resulting in new business models

MIP - IMPLEMENTATION PROCESS

- an iterative approach in the function of maximizing *IQcorp* through the endless process of learning and improving the organization:

1. Self-evaluation of company IQ
2. Company needs assessment
3. Reengineering an existing organization
4. DS model development
5. DS model Implementation
6. Project evaluation
7. Project improvement

CS: Tekijanka d.o.o.

symorg 2020

- Retail sale in non-specialized stores with food, beverages or tobacco predominating
- Medium legal entity
- Average number of employees: 445

1. Self-evaluation of company IQ

- Target group: management at all levels.
- Procedure: Assessing company IQ through corporate intelligence assessment - in terms of how much smarter and faster a company, as an organized system, reacts than the person who manages it.
- Research result:

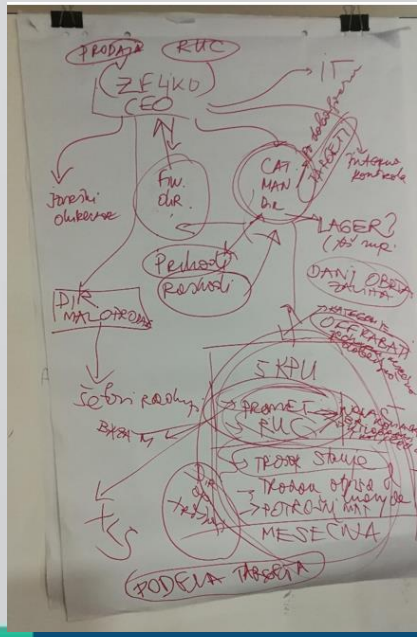
  Assessment (levels) of company IQ

Tekijanka: Self-evaluation of company IQ

symorg 2020

Result: Medium

- HUBIE – ERP system used by Tekijanka
- All orders are done manually in ERP (without computers recommendation) for all 6.000 to 7.000 products assortment



2. Company needs assessment

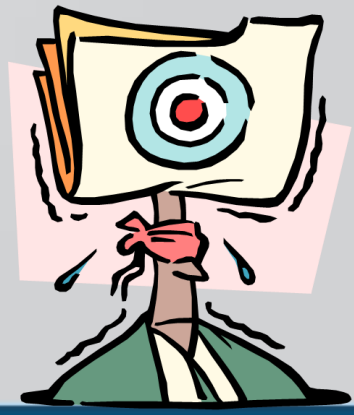
- Every Data Science project aims to fulfill a goal

Objectives and Key Results" (OKRs) - set at the beginning of the project and define the end-goal

- Objectives are the "What". What is the goal of the project? They…
- Key Results are the "How". How do we reach the project goal? They…

Every Data Science project should start with defining a measurable metric:

- The goal of the project is to fulfill this metric.
- This goal steers the actions of your project.



"If your competitors are applying AI, and they're finding insight that allow them to accelerate, they're going to peel away really, really quickly"

– Deborah Leff, CTO for data science and AI at IBM, on stage at Transform 2019.

The biggest challenges

symorg 2020

1. **Data lake** - Business owners can have a vision, but without the data to support that, any AI/DS projects will not be feasible.
2. **Education** - Business leaders also **need training** It's not always easy to understand the way new technologies works.
3. **Unrealistic expectations**

Inspired by Larry Pizette, the head of data science at Amazon's Machine Learning Solutions Lab

Start with a pilot project

Data lakes

- Many organizations started implementing data without a clear idea of what to do with the data collected. "*Let's just collect everything*"
- The point of a data lake is to have all the company's data in one place, it is still vital to design it with specific projects needs.
- *Not planning is almost like creating a new "Untitled Folder" and then copying and pasting the entirety of the company's data in there.*

The key: ensure well-defined the metadata

Tekijanka: Company needs assessment

symorg 2020

If you can't measure it, you can't improve it.

1. If we are unable to measure our costs, we are unable to reduce them;
2. If we are unable to measure our profits, we are unable to increase them.

"*Half the money I spend on advertising is wasted; the trouble is I don't know which half*"

John Wanamaker (1838-1922)

To-do list

symorg 2020

Principles of Supply Chain Management Checklist	
☐	Adapt your supply chain based on the needs of customer segments (by product, industry, or trade channel)
☐	Customize logistics network for each of the above segments
☐	Align demand planning across the supply chain, so that all partners benefit by not keeping unneeded stock on hand
☐	Differentiate products SKUs close to the customer for choice, and standardize SKUs to deliver to many different regions while meeting different regulations
☐	Outsource strategically while keeping core competencies in-house
☐	Develop information tech that supports multi-level decision making, and tie it into business processes so you fully understand your deficiencies and needs
☐	Adopt both financial and service metrics using "Time-Driven Activity-Based Costing" which determines your customers' profitability and drives value

(Smartsheet, 2020)

Tekijanka: Data Science project

symorg 2020

The **main goal** of the implementation: Reducing costs and increasing the level of customer and employee satisfaction in the company.

The main target: Efficient exchange of information (sales data) between retail stores (RS) and the Central Warehouse (CW) in order to quickly respond to the information that enters it.

Operational goal: Defining the optimal - minimum level of stocks at the level of RS and level CW.

Operational task: determining the optimal level of stock, at 2 levels:

- in the central warehouse and
- retail store.

Adapt your supply chain based on the needs of customer segments (by product, industry, or trade channel)

3. Reengineering an existing organization

- transformation of business processes through the transition to a new technological paradigm based on the basic postulates of the fourth scientific paradigm.

- It is not enough to harmonize technological solutions, it is necessary to establish such an organization that different sectors within companies cooperate to ensure data collection and use.

- digital transformation related to people, processes and technology.

Reengineering – business transformation

symorg 2020

DS implementation is not just another technology project

Traditionally, businesses choose either the classic waterfall approach of linear tasks, or the agile approach, where teams review and evaluate solutions as they are tested out.

Implementing DS requires a different approach – to look at a problem and see if there's a way to solve it by reframing the business process itself.

Enterprises need to embrace three concepts

1. Understand the human impact
2. Lead with design thinking
3. Learn to embrace failure

"We don't have a choice on whether we digitally transform us - the choices is how well we do it"

symorg 2020

Erik Qualman

- The key is not only understanding data science, IoT, mobile, AI, Blockchain…, but, more importantly, understanding how they all work together

- **Today's leaders are made—not born!**

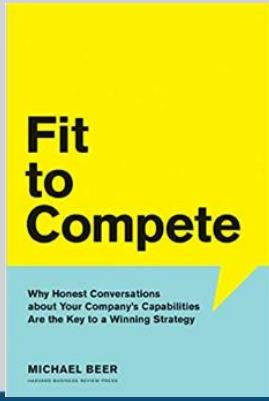
  - Brigette Hyacinth (Author of Leading the Workforce of the Future)

The Key to a Winning Transformational Strategy

symorg 2020

Why so many organizational transformations fail:

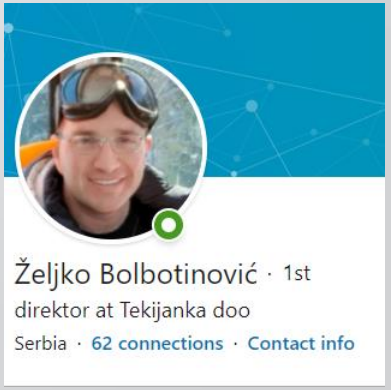
- **First,** a transformational strategy that aims to take advantage of new technology and market innovations must involve the whole organization
- **Second,** the transformative strategy can only succeed if the people affected by these changes feel involved in the process, and encouraged to discover problems and correct them



Tekijanka: Reengineering of existing organization

- Switching to own supply - introduction of a central warehouse

- CEO: "*Who manages the company - the one who manages its supply chain*"



Step 4. DS model development

Gartner predicted that through 2017, 60% of big data projects failed to go beyond piloting and experimentation, and will be abandoned.

Basic reasons for failure (McKinsey, 2016):

- lack of strategy,
- insufficient support from top management,
- lack of experts,
- inadequate organizational structure and technological infrastructure

There's no single blueprint for beginning a DS project

symorg 2020

never mind ensuring a successful one but these 10 questions will help guide you to success:

1. Is this your organization's first attempt at a DS project?
2. What business problem do you think you're trying to solve?
3. What types and sources of data are available to you?
4. What types and sources of data are you allowed to use?
5. What is the quality of your organization's data?
6. What tools are available to extract, clean, analyze and present the data?
7. Do your employees possess the right skills to work on the data analytics project?
8. What will be done with the results of your analysis?
9. What types of resistance can you expect?
10. What are the costs of inaction?

MIP: DS model development

Steps in Implementation

symorg 2020

No.	Step	Definition	Responsibility
a.	Selection of initial business problem / opportunity for initial implementation.	Business problem	Top management
b.	Creating an internal implementation team consisting of: Mid-level management in charge of business process, Domain expert, IT experts, analytics experts (data)	Internal team for the implementation	Middle level management
c.	Decision on the approach of implementation: within the company or outside (outsource) or combine	Team for the implementation	Top management
d.	Selection of the appropriate platform and model of business analytics (DS Model)	Selected solution	Team for the implementation
e.	Development of the selected solution – DS Model	DS Model Development	Team for the implementation

Start with pilot - Small DS projects

- Unlike AI/Big Data projects, which often involve dozens of people with disparate agendas, politics, enormous budgets, and high failure rates, the probability of success Small DS projects is high.
- Small DS projects build the organizational data muscle that helps the entire company learn what it takes to succeed with data, gain needed skills, build confidence, and breed the kind of culture that big data demands.
- Also, with many individuals worrying that they will be replaced by automation or that their jobs will change in ways beyond their control, participating in Small DS projects enables everyone to take proactive steps toward building their data literacy and deal with their own fears.

Pilot - Small DS projects

1. **Eliminating hidden data factories**: Poor data quality is the norm, and the goal is to reduce the non-value-added work needed to deal with errors and less important data.
2. **Reducing wasted time**: People waste a lot of time for meetings at the beginning – try to reduce that time.
3. **Implement the KISS principle**

Recomm. Get everyone involved — yourself included

Tekijanka:

symorg 2020

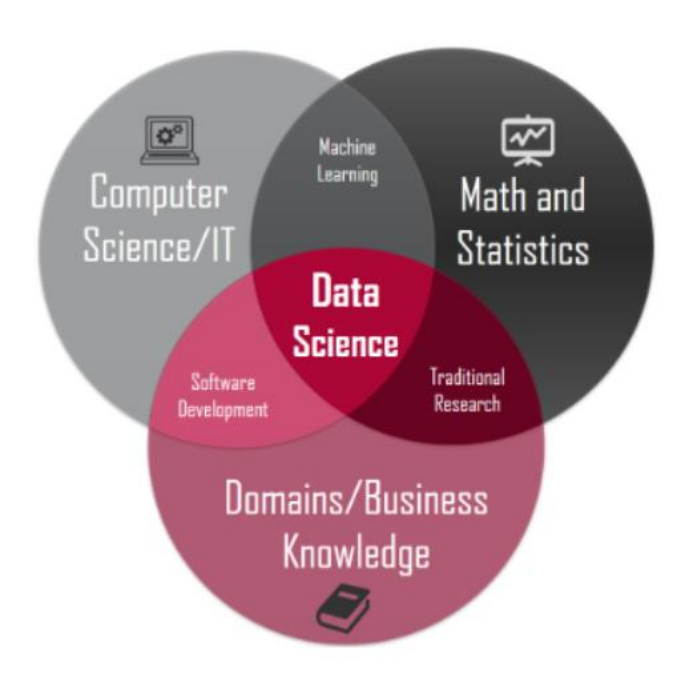
a. Selection of Business problem for initial implementation

- **Fruit and vegetable supply**
  - Main features and challenges?
  - Supply chain leaders need a way to refine the short-term forecast, to reflect the realistic demand of product

Tekijanka

symorg 2020

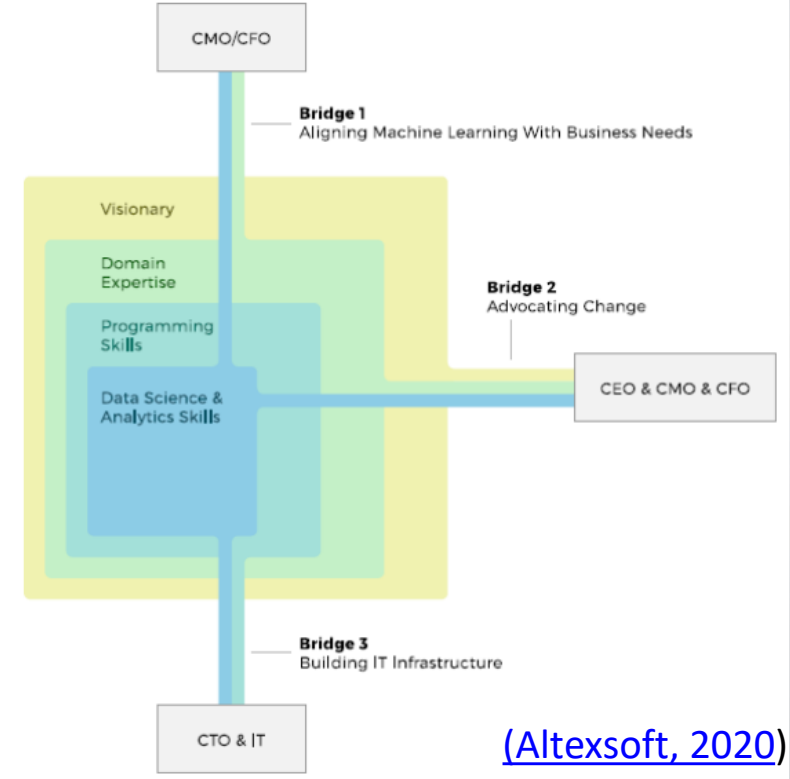
b. Internal Team for the implementation



- Domain/Business expert
- Computer Science/IT expert
- Programmer – Software Developer

(Dhungana, 2019)

Chief Analytics Officer



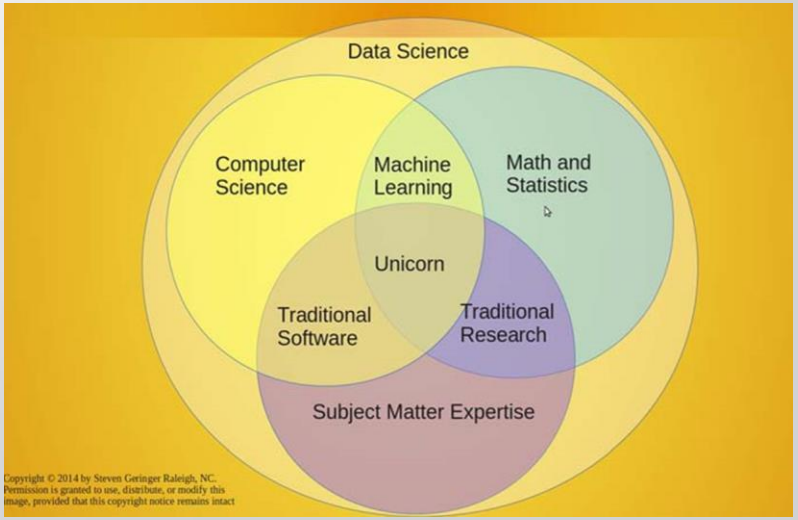
(Altexsoft, 2020)

- multidisciplinary function: to bridge between business values and data science capabilities.
- The person should take a lead and reconcile the efforts of information technology department, data science, marketing, and stakeholders to build and develop a data strategy.

Data Scientist - Skills/knowledge needs

symorg 2020

- Mathematics (Linear Algebra and Calculus)
- Statistics
- Programming (Python, R, Julia, Scala, etc.)
- SQL
- Data Wrangling and preprocessing
- Data visualization
- Supervised Learning
- Unsupervised Learning
- Deep Learning
- Big Data platform (Spark or Hadoop)
- Cloud computing
- Communication skills



Good DSs

- have unwavering respect for the one golden rule of their profession: do not come to conclusions beyond the data (and prevent your audience from doing it, too)
- use softened, hedging language. For example, not “we conclude” but “we are inspired to wonder”.
- discourage leaders’ overconfidence by emphasizing a multitude of possible interpretations for every insight.

Tekijanka:

c. Decision on the approach of implementation

- Combined method: in-house with the outsourcing of Chief Analytics Officer and Data scientist

Team for the implementation:

1. Domain/Business expert
2. Data scientist
3. Computer Science/IT expert
4. Programmer – Software Developer
5. Chief Analytics Officer

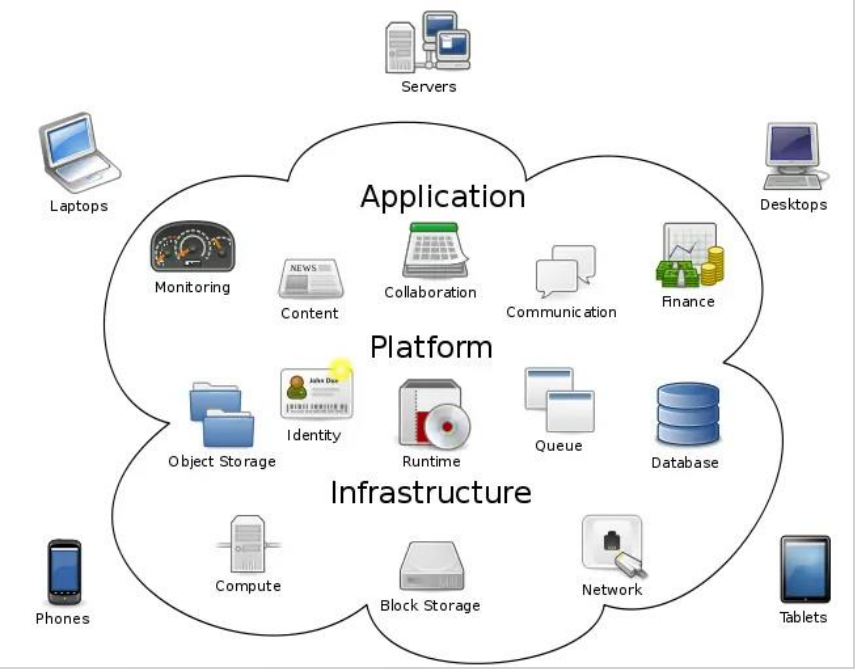
d. Selection of the appropriate platform

symorg 2020

Cloud computing allows you to set up a virtual office with flexibility of connecting to your business anywhere, any time by using mobile devices, **and access to data is even easier.**

Benefits:

- **Reduced IT costs**: the cost of system upgrades, new hardware and software may be included in contract, wages for expert staff, energy consumption, etc.
- **Scalability**
- **Business continuity**
- **Collaboration efficiency**
- **Flexibility of work practices**
- **Access to automatic updates**



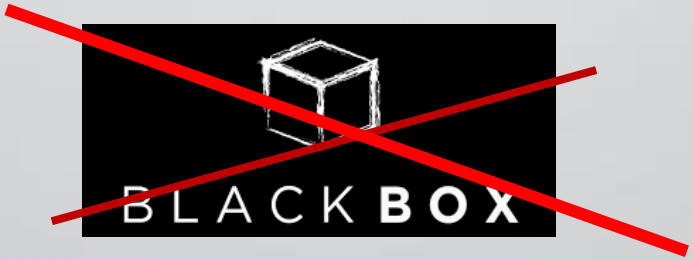
(Fastmetrics, 2020)

Tekijanka

d. Selection of the appropriate platform and initial DS model

- Existing ERP solution (HUBIE)
- Microsoft Teams
- ML
- Time Series analysis

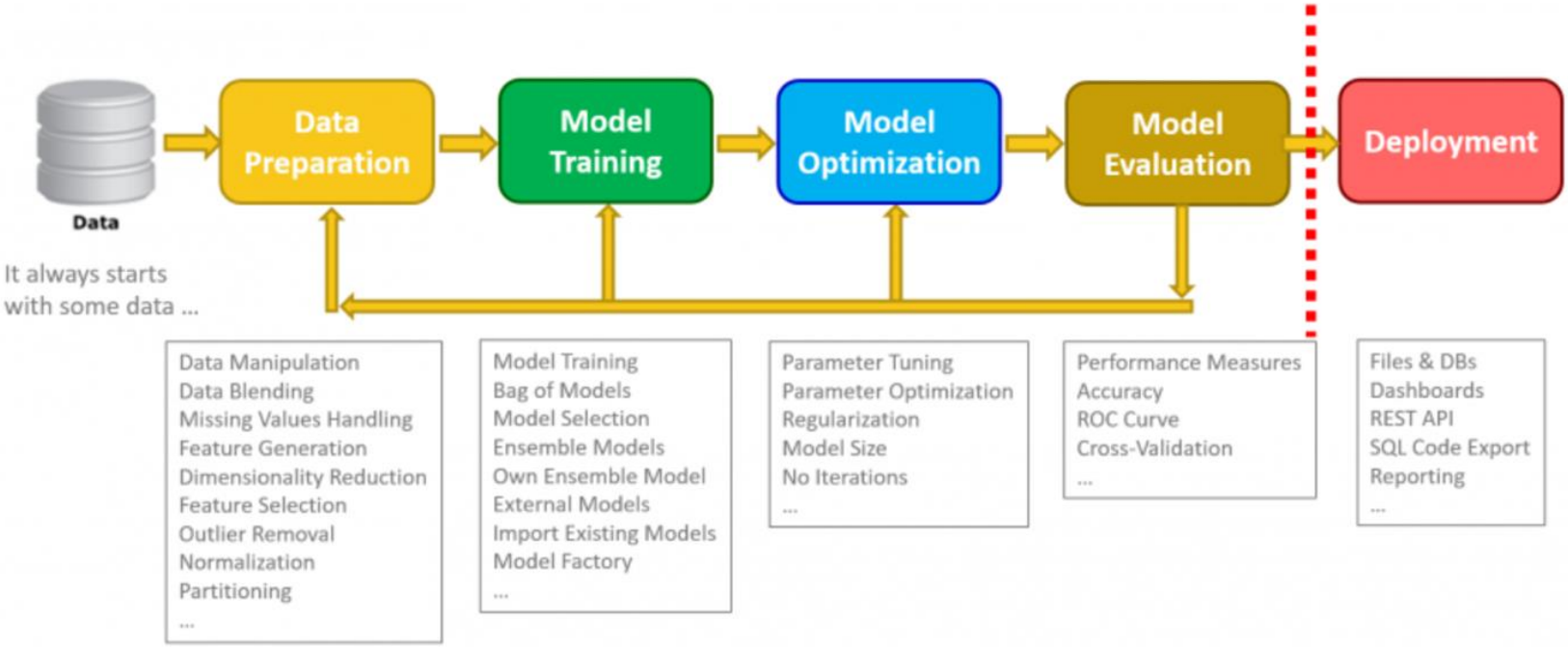
Building an tailor-made solution / model



e. Development of the selected solution

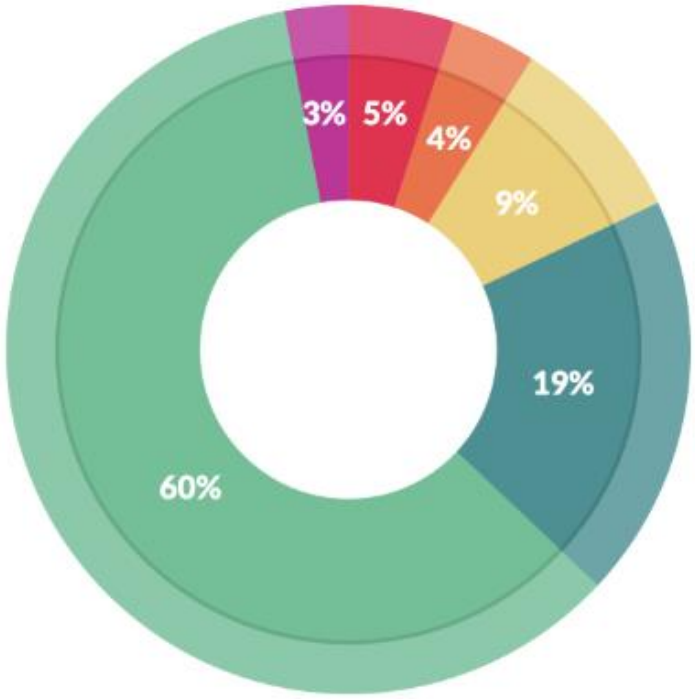
symorg 2020

DS Model



https://www.knime.com/blog/analytics-and-beyond

Data Scientists



What data scientists spend the most time doing

- *Building training sets: 3%*
- *Cleaning and organizing data: 60%*
- *Collecting data sets; 19%*
- *Mining data for patterns: 9%*
- *Refining algorithms: 4%*
- *Other: 5%*

[taken from CrowdFlower]

Domain/Business expert

- must confirm the data quality

Tekijanka

e. Development of the DS model

DS project: Fruit and vegetable supply - Tekijanka

Forecast models

- Traditional models (*Forecasting)* planning based on previous demand
- *Demand sensing* models: use of data science and real-time data to calculate forecasts goes back to using updated data (based on reading additional inputs and signals from the internal and external environment) to create more accurate, short-term forecasts
- *Superforecasting* –"*Demand driven forecasting*" the future concept of demand management. A successful forecast takes into account data on the actual (desired) customer demand for the product

Starting point

- We started with the construction of a combined model (C MODEL) that is implemented for the CW level, by combining Traditional Modeling (TM) with the elements of Demand Sensing models (DeSe)

Model development

- For the TM component we planed to use data from the previous 5 years and apply traditional statistical methods: time series analysis (trend component analysis by moving average method, etc.) and descriptive analysis .
- The DeSe component refers to the domain of the model that is not covered by the previously mentioned statistical methods. It includes the impact of promotion, the emergence of a new product, the impact of the macro environment (new competitors, socio-economic trends in the market, etc.)

The initial mathematical formulation of the model

C MODEL = (TM + DeSe)*ew

ek - forecast weighting component, which is performed based on the input of domain expert knowledge (ew) from internal company sources (marketing, sales, procurement, logistics, finance).

- It was necessary to determine the forecasting period (daily, weekly, monthly, between two deliveries) according to the determined unit of measure

The procedure

- ✓ the gradual model implementation in order to evaluate the forecast, through three steps:

1. Introduce only the TM component into the model:

C MODEL (1) = TM

2. Weigh K MODEL (1) domain expertise:

C MODEL (2) = TM * ek

3. Add the DeSe component and thus complete the model:

C MODEL = (TM + DeSe) * ek

4. DS model Implementation

Why do 87% of data science projects never make it into production?

3 ways to get started

symorg 2020

and avoid becoming one of the 87%:

1. Pick a small project to get started - don't try to boil the ocean, but choose a pain point to solve, where you can show demonstrable progress.
2. Ensure you have the right team, cross-functionally, to solve this.
3. Leverage third parties and folks like IBM and others to help accelerate your journey at the beginning.

- Chris Chapo, Senior Vice President data and analytics at Gap

Recomm. KISS princip

We cannot always explain how an AI system made a decision.

- Very complex systems, such as those based on neural networks, can make it hard to follow the logic of the system

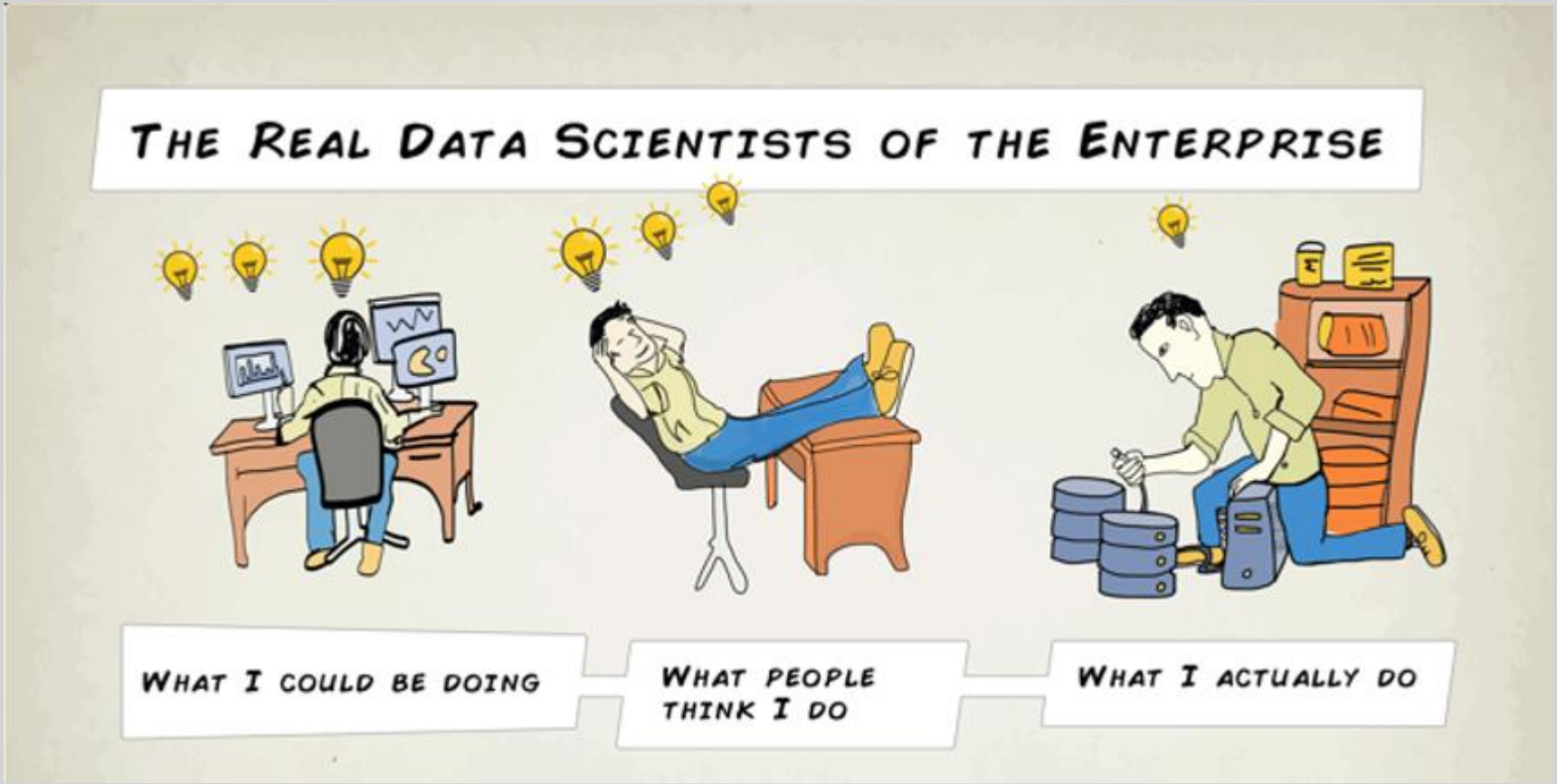
- “If you stick with a simpler model which is inherently interpretable, you are not going to sacrifice that much on accuracy but you are going to keep the benefits of understanding the variables you are using and understanding how the model works.”
  - Dr Reuben Binns, Postdoctoral Research Fellow in AI, ICO

Tekijanka:

symorg 2020

4. DS model Implementation

DS model Implementation



https://www.tamr.com/blog/real-data-scientists-enterprise/

Tekijanka: Model Evaluation

- For now, the evaluation is scheduled to be carried out a posteriori, by comparing data from the previous period (t-2) and measures the difference in output in relation to the actual business results in the period (t-1).
  - If satisfactory results are not obtained (in line with the expectations of the internal implementation team), it is recommended to enter new data and re-evaluate in subsequent iterations.
  - In case no improvement is still achieved, a solution is sought in returning to the previous phases of the model in order to introduce new solutions, primarily in the selection of the BA model.

5. Project evaluation

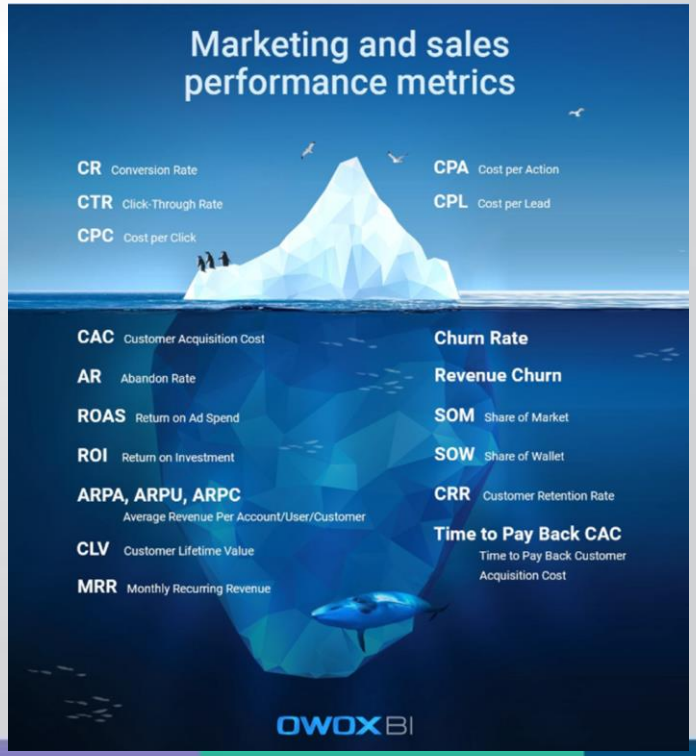
Ten red flags signaling DS project will fail

1. The executive team doesn't have a clear vision for its advanced-analytics programs
2. No one has determined the value that the initial use cases can deliver in the first year
3. There's no analytics strategy beyond a few use cases
4. Analytics roles—present and future—are poorly defined
5. The organization lacks analytics translators
6. Analytics capabilities are isolated from the business, resulting in an ineffective analytics organization structure
7. Costly data-cleansing efforts are started en masse
8. Analytics platforms aren't built to purpose
9. Nobody knows the quantitative impact that analytics is providing
10. No one is hyper focused on identifying potential ethical, social, and regulatory implications of analytics initiatives

Tekijanka: 5. Project Evaluation

symorg 2020

- What is the best indicator of the success of a project?
- The quantitative impact on business operations



6. DS project improvement

- The phases of evaluation and improvement of the model take place practically in parallel.
- Improving the output performance of MIP, is based on the theoretical definition of **machine learning**, so that the model learns from previously obtained results. Therefore, it is necessary to provide new sets of input data, which achieves repetitiveness and continuity in the functioning of the model.
- Long-term monitoring of effects (quantitative impact) is one way to measure efficiency and improve the model.

Future of Data Science

(Dataflair team, 2019)

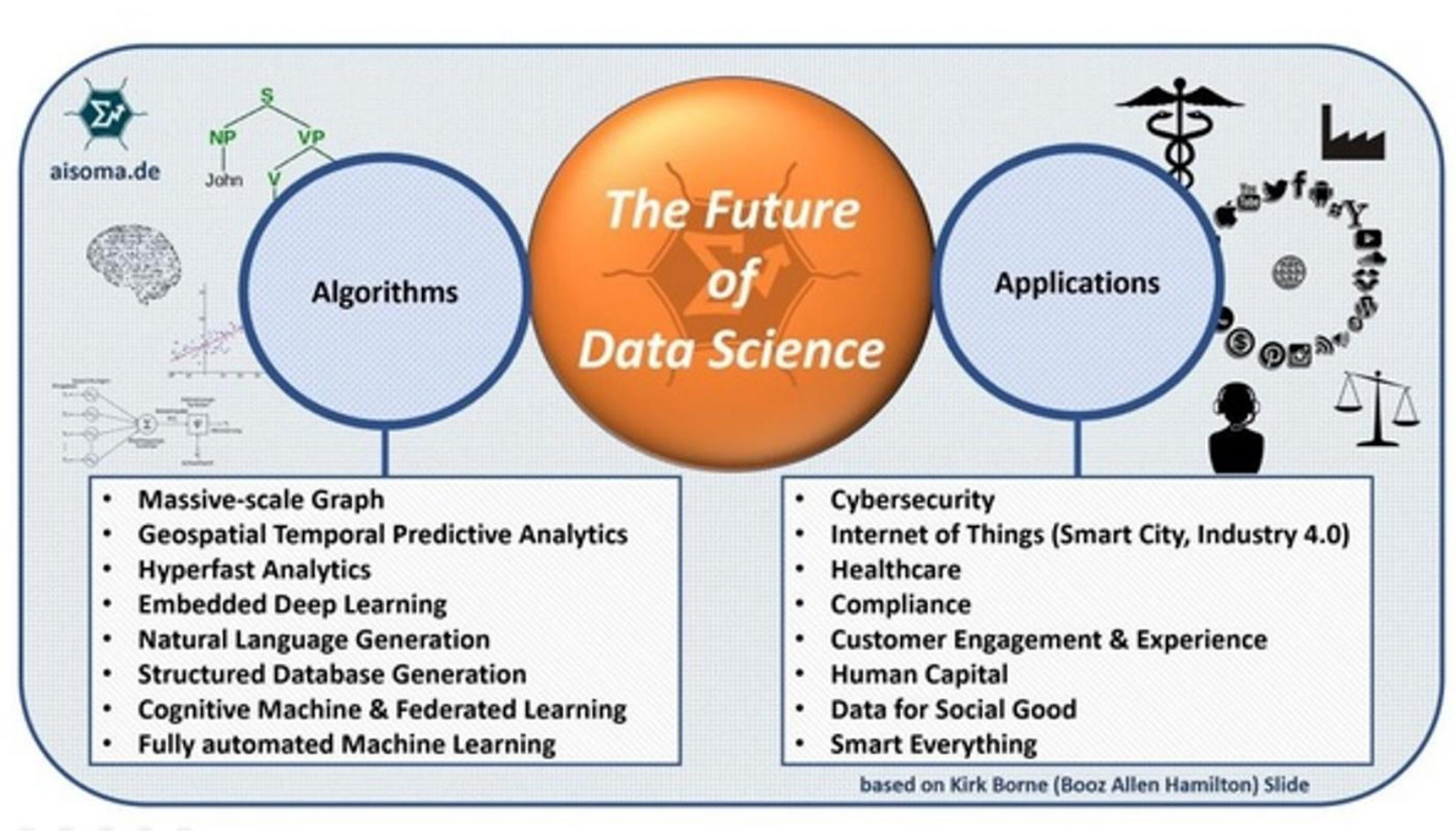
- *"In the next 10 years, Data Science and Software will do more for Medicines than all of the Biological Sciences together"*

  - Vinod Khosla, an American Billionaire Businessman and Co-founder of Sun Microsystems

(Dataflair team, 2019)

The best surveillance systems seamlessly combine data from traditional sources with newer data sets, such as anonymized mobility tracking—and do so in near real time.

Preventing future waves of COVID-19
August 31, 2020 | Executive Briefing, McKinsey



https://twitter.com/KirkDBorne/status/1115673400859615233/photo/1

Future – 4.0 Analytics

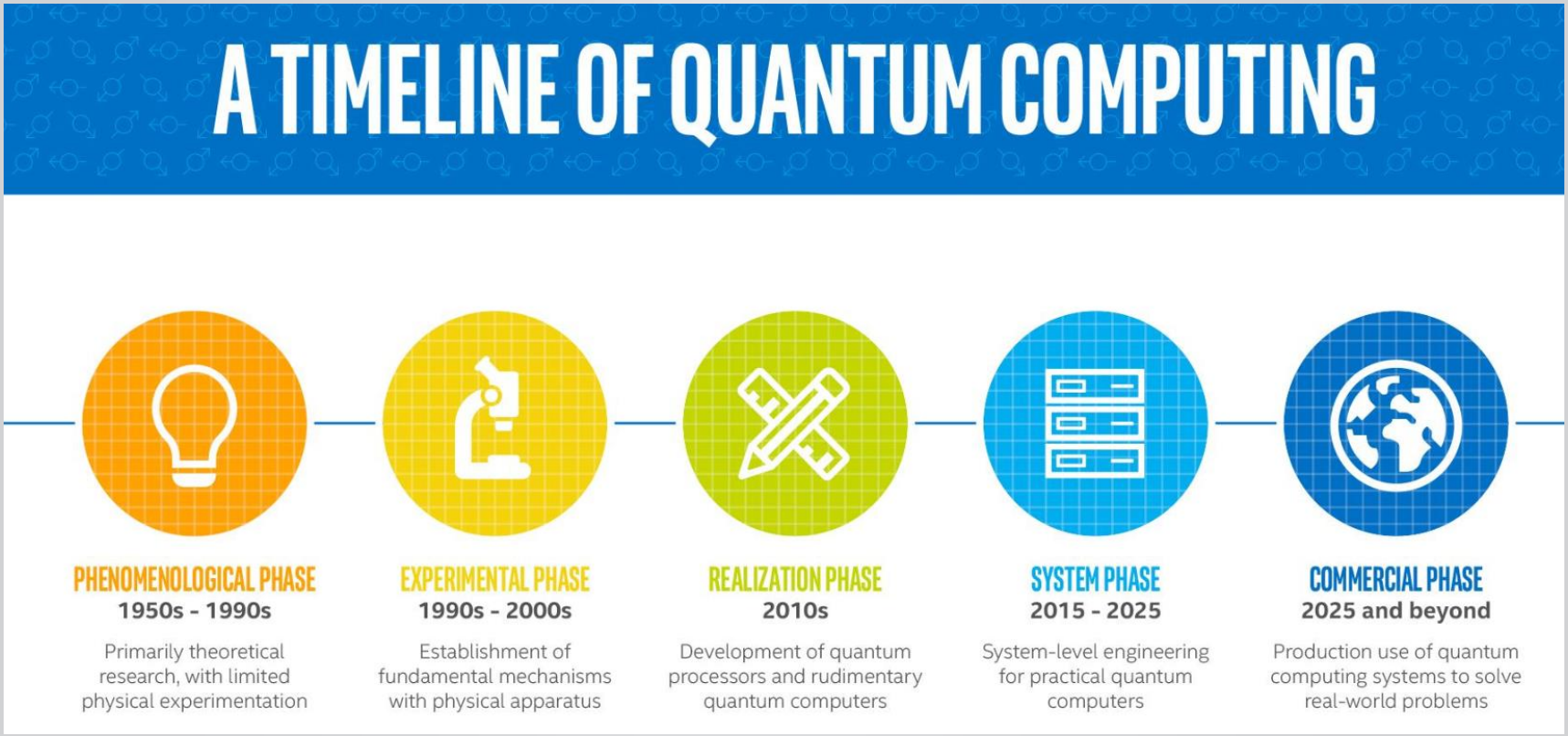
symorg 2020

- Era One: **Artisanal Analytics** - this methodology was primarily geared towards producing insights for internal decision-making using small-scale, structured datasets.
- Era Two: **Big Data Analytics**
- Era Three: **Data Economy Analytics**
- Era Four: **Autonomous Analytics** - machines not only perform the analysis; they also act on the insights, making decisions faster and more efficiently than any human could - Automated Data Science.
  - The Cognitive Era

Thomas Davenport of Babson College, Harvard Business School and the MIT

Future

symorg 2020



https://www.intel.com/content/www/us/en/research/quantum-computing.html

Epilogue

symorg 2020

"The early 20th-century British explorer Ernest Shackleton once noted,

"Optimism is true moral courage."

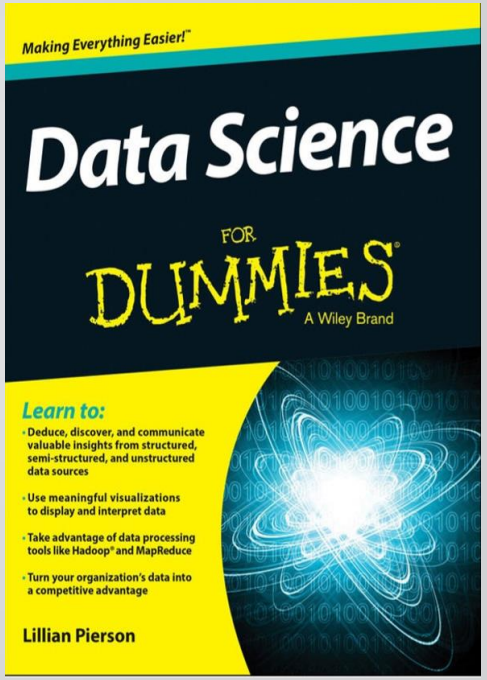
- Optimism and courage: these qualities are needed more than ever as leaders make the decisions that will shape the next normal."

(Be)Ready for the next normal?

POTENTIAL WS OUTCOMES - SUGGESTIONS

symorg 2020

- Understand the basic concepts of Data Science
- Recognize new trends
- Recognize changes in business environment
- Consider a business transformation
- Learn to embrace failure
- Continue with learning
- Disrupt Yourself - or Someone Else Will



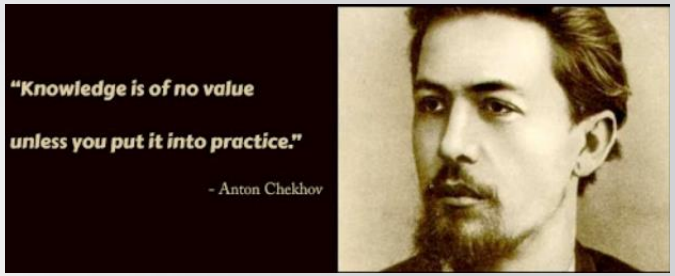
"If we don't disrupt our business, somebody else is going to do it for us"

How NOT to Learn Data Science

symorg 2020

The big 3:

1. Reading and learning without practicing



2. **Creating models in a crazy way**

"All Models are Wrong, but Some are Useful"

– George Box

3. "Yeah, I'm a lone wolf. I can study and do everything by myself"

If you want above-average outcomes, you can’t do average things

Sources

- Altexsoft (2020). Machine Learning: Bridging Between Business and Data Science. Altexsoft. Accessed on October 19, 2020. https://www.altexsoft.com/whitepapers/machine-learning-bridging-between-business-and-data-science/
- Altexsoft (2020a). How to Structure a Data Science Team: Key Models and Roles to Consider. Altexsoft. Accessed on October 19, 2020. https://www.altexsoft.com/blog/datascience/how-to-structure-data-science-team-key-models-and-roles/
- Barsh, J., Brown, L. and Kian, K. (2016). Millennials: Burden, blessing, or both? McKinsey & Company. Accessed on August 15, 2020. https://www.mckinsey.com/business-functions/organization/our-insights/millennials-burden-blessing-or-both
- Cantrell, G. (2020). Data Science: The Lifeblood of the Digital Economy, Jabil. Accessed on August 15, 2020. https://www.jabil.com/blog/data-science-the-lifebl Sauravood-of-the-digital-economy.html
- Chait, G. (2018). Half the money I spend on advertising is wasted; the trouble is I don't know which half. B2B Marketing. Accessed on August 16, 2020. https://www.b2bmarketing.net/en-gb/resources/blog/half-money-i-spend-advertising-wasted-trouble-i-dont-know-which-half
- Chiang, C. (2018). Defining the Terms: Structured Data vs. Unstructured Data. Accessed on October 16, 2020. https://www.igneous.io/blog/structured-data-vs-unstructured-data
- Cleveland, W. (2001). Data Science: An Action Plan for Expanding the Technical Areas of the Field of Statistics. International Statistical Review / Revue Internationale De Statistique, 69(1), 21-26. doi: 10.2307/1403527

Sources

- Coursera (2020). What is Data Science? IBM via Coursera, https://www.coursera.org/learn/what-is-datascience
- CrowdFlower (2016). Data Scientist report. Accessed on October 19, 2020. https://visit.figure-eight.com/rs/416-ZBE-142/images/CrowdFlower_DataScienceReport_2016.pdf
- Da Veiga, C.P., Da Veiga, C.R.P and Ubiratã T. (2016). Demand Forecasting Strategies: understanding the most important concepts. Spaces. Vol. 37 (No. 05) Year 2016, Accessed on October 19, 2020. https://www.revistaespacios.com/a16v37n05/16370506.html
- Dataflair team (2019). Bright and Auspicious Future of Data Science – Learn it Before you Regret. Accessed on October 15. https://data-flair.training/blogs/future-of-data-science/
- Davenport, T. (2016). Four Eras of Analytics and Data Science. Accessed on October 16, 2020. https://slideplayer.com/slide/10193362/
- Demchenko, Y., Grosso, P., Laat, C. de and Membrey, P. (2013). Addressing big data issues in Scientific Data Infrastructure, 2013 International Conference on Collaboration Technologies and Systems (CTS), San Diego, CA, 2013, pp. 48-55, doi: 10.1109/CTS.2013.6567203.
- Dhungana, (2019). On Building Effective Data Science Teams. CraftData Labs. Accessed on October 16, 2020. https://medium.com/craftdata-labs/on-building-effective-data-science-teams-4813a4b82939
- Donoho, D. (2017). 50 year of Data Science. Journal of Computational and Graphical Statistics, 26:4, 745-766. https://doi.org/10.1080/10618600.2017.1384734

Sources

- Evans, L. chair (2020). Artificial Intelligence and Public Standard. A Review by the Committee on Standards in Public Life. Committee on Standards in Public Life. Accessed on October 16, 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/868284/Web_Version_AI_and_Public_Standards.PDF
- Executive Briefing (2020). Preventing future waves of COVID-19: Briefing note #21, August 31, 2020. McKinsey & Company. Accessed on October 19, 2020. https://www.mckinsey.com/business-functions/risk/our-insights/covid-19-implications-for-business
- Fastmetrics (2020). What Is Cloud Computing? How Does 'The Cloud' Work? Accessed on October 16, 2020. https://www.fastmetrics.com/blog/tech/what-is-cloud-computing/
- Fleming, O., Fountaine, T., Henke, N. and Saleh, T. (2018). Ten red flags signaling your analytics program will fail, McKinsey Analytics, Accessed on October 15, 2020 https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/ten-red-flags-signaling-your-analytics-program-will-fail
- FP (2020). How Japan is Preparing its Students for Society 5.0. Foreign Policy, Accessed on August 5, 2020. https://foreignpolicy.com/sponsored/how-japan-is-preparing-its-students-for-society-5-0/
- Fradin, D. (2019). Making Fact Based Decision. Enterprise-wide. Spice Catalyst Team. Accessed on October 15, 2020. https://spicecatalyst.com/making-fact-based-decision-enterprise-wide/

Sources

- Goasduff, L. (2015). Taking a First Step to Advanced Analytics. Gartner. Accessed on October 19, 2020. https://www.gartner.com/smarterwithgartner/taking-a-first-step-to-advanced-analytics/
- Goncalves, G. d S. (2020). How the 80/20 Rule can help decide which skills you need to start a career in Data Science. Using the Pareto Principle to increase your confidence as a Data Scientist. Towards Data Science. Accessed on October 19, 2020. https://towardsdatascience.com/how-the-80-20-rule-can-help-decide-which-skills-you-need-to-start-a-career-in-data-science-fd60766eba05.
- Greenstein, B. (2020). AI is not just another technology project. Venturebeat. The Machine. Accessed on August 16, 2020. https://venturebeat.com/2020/02/23/ai-is-not-just-another-technology-project/
- Harris, J. (2018). To get hired as a data scientist, don't follow the herd. Accessed on October 16, 2020. Towards Data Science. https://towardsdatascience.com/the-economics-of-getting-hired-as-a-data-scientist-e3882933b43c
- Henke, N., Bughin, J., Chui, M., Manyika, J., Saleh, T., Wiseman, B. and Sethupathy, G. (2016). The age of analytics: Competing in a data-driven world. McKinsey Global Institute. Accessed on October 19, 2020. https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/the-age-of-analytics-competing-in-a-data-driven-world
- Hey, T., Tansley, S. and Tolle, K. (2011). Editors: Hey, T., Tansley, T., Tolle, K. M. The Fourth Paradigm: Data-intensive Scientific Discovery. Microsoft Research. Accessed on October 15, 2020. https://www.microsoft.com/en-us/research/wp-content/uploads/2009/10/Fourth_Paradigm.pdf

Sources

- Hodson, J. (2016). How to Make Your Company Machine Learning Ready. Harvard Business Review. Accessed on October 19, 2020. https://hbr.org/2016/11/how-to-make-your-company-machine-learning-ready
- Hong, J. (2020). Data Scientist: The Dirtiest Job of the 21st Century. Towards Data Science. Accessed on August 16, 2020. https://towardsdatascience.com/data-scientist-the-dirtiest-job-of-the-21st-century-7f0c8215e845
- Hupferm, S. (2020). Talent and workforce effects in the age of AI. Insights from Deloitte's State of AI in the Enterprise, 2nd Edition survey. Deloitte. Accessed on October 15, 2020. https://www2.deloitte.com/us/en/insights/focus/cognitive-technologies/ai-adoption-in-the-workforce.html
- Hyacinth, B. (2014). Are Leaders Born or Made? A True Story. Accessed on October 19, 2020. https://www.linkedin.com/pulse/20141026042807-150905450-are-leaders-born-or-made-a-true-story/
- IDC (2019). IDC Survey Finds Artificial Intelligence to be a Priority for Organizations But Few Have Implemented an Enterprise-Wide Strategy. IDC Corporate USA. Accessed on August 5, 2020. https://www.idc.com/getdoc.jsp?containerId=prUS45344519&utm_medium=rss_feed&utm_source=Alert&utm_campaign=rss_syndication
- Intel (2020). Accessed on October 16, 2020. Reinventing Data Processing with Quantum Computing. Intel. https://www.intel.com/content/www/us/en/research/quantum-computing.html

Sources

- Intellipaat (2017. What is Predictive Analytics? Intellipaat. Accessed on October 15, 2020. https://intellipaat.com/blog/what-is-predictive-analytics/
- Kampakis, S. (2020). The Decision Maker's Handbook to Data Science: A Guide for Non-Technical Executives, Managers, and Founders, Second edition, Apress ISBN-13 (pbk): 978-1-4842-5493-6 ISBN-13 (electronic): 978-1-4842-5494-3. https://doi.org/10.1007/978-1-4842-5494-3
- Koetsier, J. (2020). The AI Show: Amazon data science head on the 3 biggest AI mistakes businesses make. Venturebeat. The Machine. Accessed on August 16, 2020. https://venturebeat.com/2020/02/18/podcast-amazons-ml-solutions-lab-head-on-the-biggest-ai-mistakes-businesses-make/
- Kozyrkov, C. (2018). What Great Data Analysts Do — and Why Every Organization Needs Them. Harvard Business Review. Accessed on October 19, 2020. https://hbr.org/2018/12/what-great-data-analysts-do-and-why-every-organization-needs-them
- Latvia (2017). Latvia - Data Driven Nation = Society 5.0. Accessed on October 15, 2020. Cabinet of Ministers. https://www5.jetro.go.jp/newsletter/pow/2018/latvia_presentation.pdf
- Lipton, Z. C. & Steinhardt, J. (2018). Troubling Trends in Machine Learning Scholarship Carnegie Mellon University. Stanford University. Accessed on August 5, 2020. https://arxiv.org/pdf/1807.03341.pdf

Sources

- Mac Kenzie, G. (2020). If You Can't Measure It, You Can't Improve It. GuavaBox. Accessed on August 16, 2020 https://guavabox.com/if-you-cant-measure-it-you-cant-improve-it/
- MacTutor (2020). MacTutor History of Mathematics Archive. School of Mathematics and Statistics, University of St Andrews, Scotland. Accessed on August 5, 2020. https://mathshistory.st-andrews.ac.uk/
- Masters in Data Science (2020). What is Business Analytics? Masters in Data Science. Accessed on October 15, 2020. https://www.mastersindatascience.org/learning/what-is-business-analytics/#:~:text=Business%20analytics%20is%20a%20field,insights%20they%20derive%20from%20data.
- Meng, X.-L. (2019). Data Science: An Artificial Ecosystem. Harvard Data Science Review, 1(1). https://doi.org/10.1162/99608f92.ba20f892
- Minelli, M. & Chambers, M. (2013). Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses. Wiley Publishing Inc.
- NOESIS (2018). Big Data implementation context in transport. Horizon 2020 Research and Innovation Programme. Accessed on October 15, 2020. Accessed on October 15, 2020. https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5bedfd3b8&appId=PPGMS
- ODSC (2018). Four Eras of Analytics and Data Science. ODSC - Open Data Science. Accessed on October 16, 2020. https://medium.com/predict/four-eras-of-analytics-and-data-science-e3f2ba5e89a7

Sources

- Press, G. (2013). Forbes. Accessed on October 15, 2020. https://www.forbes.com/sites/gilpress/2013/05/28/a-very-short-history-of-data-science/#6b29d42055cf
- Provost F. and T. Fawcett (2013). Data Science" for Business by Foster Provost and Tom Fawcett, O'Reilly, 978-1-449-36132-7
- Qualman, E. (2020). Digital Transformation: Design Your Future. Washington Speakers Bureau. Accessed on October 19, 2020. https://www.wsb.com/speakers/erik-qualman/
- Queensland Government (2017). Benefits of cloud computing. Business Queensland. Accessed on October 16, 2020. https://www.business.qld.gov.au/running-business/it/cloud-computing/benefits
- Redman, T. C. and Hoerl, R. W. (2019). Most Analytics Projects Don't Require Much Data. Harvard Business Review, Accessed on October 19, 2020. https://hbr.org/2019/10/most-analytics-projects-dont-require-much-data
- Saran, C. (2020). AI in public service must be accountable. Computer Weekly. Accessed on October 16, 2020. https://www.computerweekly.com/news/252478163/AI-in-public-service-must-be-accountable
- SAS (2018). Building your data and analytics strategy. E-book. SAS. Accessed on October 19, 2020. https://www.sas.com/sas/offers/19/building-data-analytics-strategy-110139.html#formsuccess

Sources

symorg 2020

- Satell, G. (2018). Most AI Projects Fail. Here's How To Make Yours Successful. Digitals Toronto. Accessed on October 19, 2020. https://www.digitaltonto.com/2018/most-ai-projects-fail-heres-how-to-make-yours-successful/
- Silipo, R. (2017). Analytics and Beyond! Accessed on October 19, 2020. https://www.knime.com/blog/analytics-and-beyond
- Smartsheet (2020). Supply Chain Management 101: Principles, Examples, and Templates. Accessed on August 16, 2020. https://www.smartsheet.com/supply-chain-management
- Sneader, K., & Singhal, S. (2020, April 14). The future is not what it used to be: Thoughts on the shape of the next normal. McKinsey & Company. Accessed on August 5, 2020. https://www.mckinsey.com/featured-insights/leadership/the-future-is-not-what-it-used-to-be-thoughts-on-the-shape-of-the-next-normal
- Society 5.0 (2019). Realizing Society 5.0. Accessed on August 5, 2020. https://www.japan.go.jp/abenomics/_userdata/abenomics/pdf/society_5.0.pdf
- Strickland, J. (2015). Data Science and Analytics for Ordinary People, I Lulu, Inc. SBN 978-1-329-28062-5
- Tetlock, P. and Gardner, D. (2016). Superforecasting: The Art and Science of Prediction. RH Books.
- The Economist (1999. Feb 18). Catch the wave. The long cycles of industrial innovation are becoming shorter. The Economist print edition

Sources

- Vazquez, F. (2019). The 3 Biggest Mistakes on Learning Data Science. Accessed on October 16, 2020. https://www.kdnuggets.com/2019/05/biggest-mistakes-learning-data-science.html
- VB Staff (2019). Why do 87% of data science projects never make it into production? Venturebeat. Accessed on October 16, 2020. https://venturebeat.com/2019/07/19/why-do-87-of-data-science-projects-never-make-it-into-production/
- Vogels, E. A., Lee R. and Anderson, J. (2020). Tech causes more problems than it solves. Pew Research Center. Accessed on October 15, 2020. https://www.pewresearch.org/internet/2020/06/30/tech-causes-more-problems-than-it-solves/#:~:text=Louisa%20Heinrich%2C%20a%20futurist%20and,to%20fall%20into%20that%20gap.
- Vukmirović, D., Čomić, T., Bolbotinović, Ž., Dabetić Đ and Jovanović Milenković, M. (2091). MIP - prototip modela inteligentnog preduzeća, Zbornik radova - SYMOPIS 2019 - Универзитет у Београду, Accessed on October 16, 2020. https://rspdf.info/%D0%B4%D0%BE%D0%BA%D1%83%D0%BC%D0%B5%D0%BD%D1%82/cb10c2/zbornik-radova-symopis-2019-%D0%A3%D0%BD%D0%B8%D0%B2%D0%B5%D1%80%D0%B7%D0%B8%D1%82%D0%B5%D1%82-%D1%83-%D0%91%D0%B5%D0%BE%D0%B3%D1%80%D0%B0%D0%B4%D1%83
- Walch, K. (2019). Why Cognitive Technology May Be A Better Term Than Artificial Intelligence. Forbes. Accessed on October 15, 2020. https://www.forbes.com/sites/cognitiveworld/2019/12/22/why-cognitive-technology-may-be-a-better-term-than-artificial-intelligence/#462a7637197c

Sources

- Wilder-James, E. (2014). Defining Big Data. Forbes. Accessed on October 16, 2020. https://www.forbes.com/sites/edddumbill/2014/05/07/defining-big-data/#2aa400b45667
- Wladawsky-Berger, I. (2015). Managing Transformative Initiatives - Some Lessons Learned. Accessed on October 19, 2020. https://blog.irvingwb.com/blog/2015/04/reflections-on-managing-transformative-initiatives.html
- Wladawsky-Berger, I. (2020). The Key to a Winning Transformational Strategy. CIO Journal. WSJ, Accessed on October 19, 2020. https://blogs.wsj.com/cio/2020/02/28/the-key-to-a-winning-transformational-strategy/?guid=BL-CIOB-14878&mod=djemCIO&dsk=y
- Woo, K-J. (2013). Big Data, threats or opportunities? Friday Seminar: Big Data for Policy, Development and Official Statistics. UNSD. New York. Accessed on October 19, 2020. https://www.slideserve.com/wilmet/big-data-threats-or-opportunities
- Zawadzki, J. (2018). The Power of Goal-Setting in Data Science. Towards Data Science. Accessed on October 15, 2020. https://towardsdatascience.com/the-power-of-goal-setting-for-your-data-science-project-9338bf475abd

Sources

symorg 2020

YouTube

- Did You Know 2019 (2019). Accessed on August 15, 2020. https://www.youtube.com/watch?v=bTM06NZOyDQ&t=135s
- RossAndRossIntl (2015). What is Digital Transformation? Explained in less than 90 seconds, YouTube, Accessed on October 15, 2020. https://www.youtube.com/watch?v=GsB1f5uoGWc
- Scott, K. N. (2018). Did You Know (Shift Happens) – 2018 Remix, YouTube, Accessed on August 5, 2020. https://www.youtube.com/watch?v=TwtS6Jy3ll8
- Shift Happens 2018 act (2018). Agility Consulting & Training, YouTube, Accessed on August 15, 2020. https://www.youtube.com/watch?v=bRthSsFFI7Y