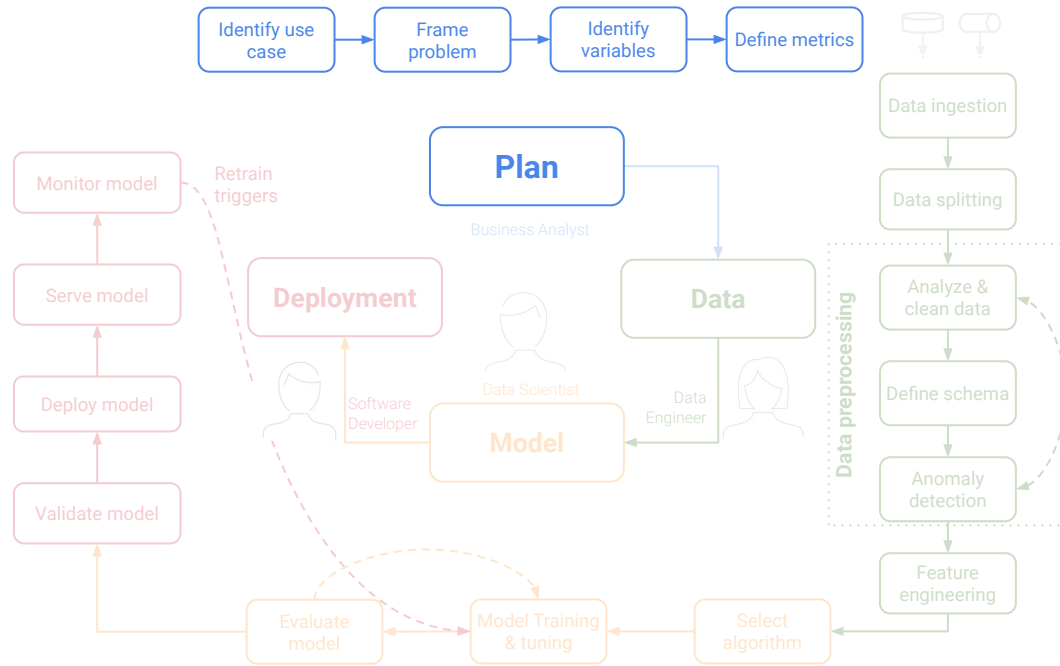# Data Science Lifecycle

Planning phase

Prof. Dr. Jan Kirenz
HdM Stuttgart

Data Science Lifecycle
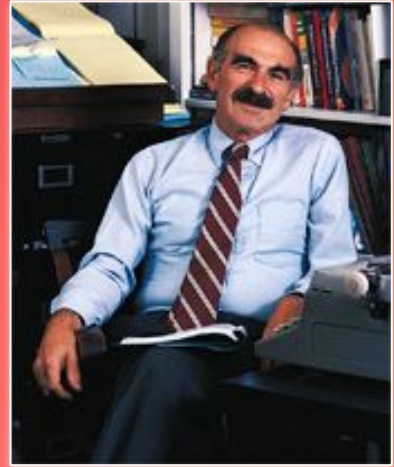
Plan | Data | Model | Deployment

Customer centricity

1960

Companies are too focused on producing goods or services and don't spend enough time understanding what customers want or need.
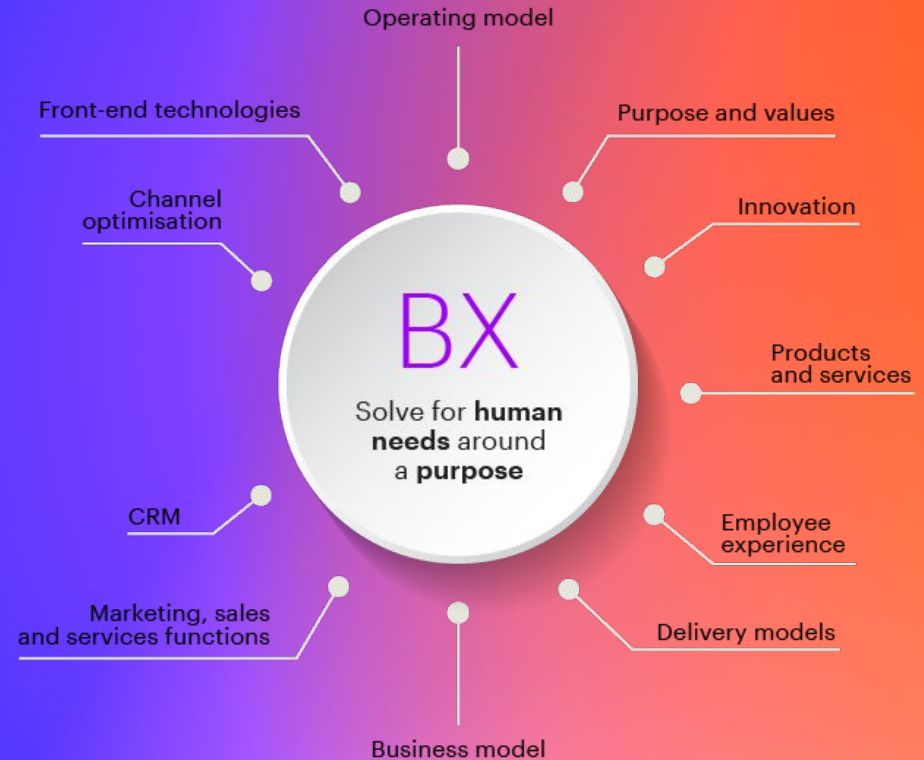
T. Levitt

From customer experience (CX) to business of experience (BX) **2021**

CX

Optimise **customer touchpoints** around product and services

- Front-end technologies
- Channel optimisation
- CRM
- Marketing, sales and services functions

BX

Solve for **human needs** around a **purpose**

- Operating model
- Front-end technologies
- Purpose and values
- Channel optimisation
- Innovation
- Products and services
- CRM
- Employee experience
- Marketing, sales and services functions
- Delivery models
- Business model

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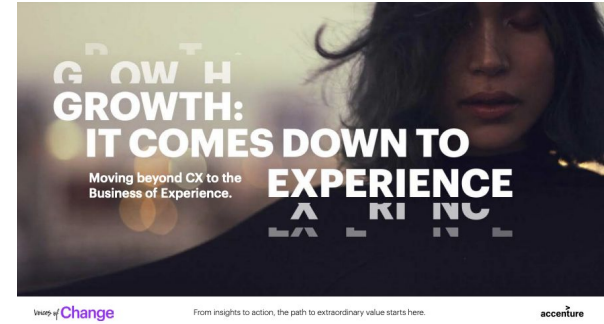|	CX thinking	BX thinking	Ways BX comes to life
CEO	Maximize profitability.	Profit from purpose + experience.	Prioritizing purpose, innovation and delivering holistic experiences to drive business success (i.e., profit).
Marketing and Brand	Making people want things.	Making things people want.	Shaping brand evolution by recognizing brand is built on experiences that connect customers to what they want, not the other way around.
Sales	Focus on the product the company wants to sell.	Focus on the outcome the customer wants.	Ensure the experience is available at defining moments that matter in a consumer's life
Product Development	Making products easy to use.	Making products that continually adapt to how customers use them.	Investment in insight/design research combined with big data to spot user-driven opportunities.
Talent	Using traditional metrics based on employee performance within a function (onboarding, annual reviews, etc.)	Inspiring and incentivizing behaviors that drive better outcomes for the entire organization.	Empowering employees to feel accountable for customer outcomes.
Tech and Data	Enabling business processes at greater scale.	Enabling customer-centricity at greater scale.	Unlocking efficiencies that can be reinvested to drive continuous performance and innovation.
Operations	Providing efficiency for the company that often limits growth.	Providing efficiency for the customer and the experience that enables them to drive growth.	Measuring customer operational efficiency, engaging operations in innovation from the get-go.
Supply chain	Moving products and goods to consumers.	Making it easy for consumers to get products and services when and where they want them.	Providing customers with visibility into sourcing and progress of their orders, and innovating last-mile experience to exceed expectations.

GROWTH: IT COMES DOWN TO EXPERIENCE

Moving beyond CX to the Business of Experience.

Voices of Change

From insights to action, the path to extraordinary value starts here.

accenture

https://www.accenture.com/de-de/insights/interactive/business-of-experience

https://www.accenture.com/us-en/insights/interactive/business-of-experience

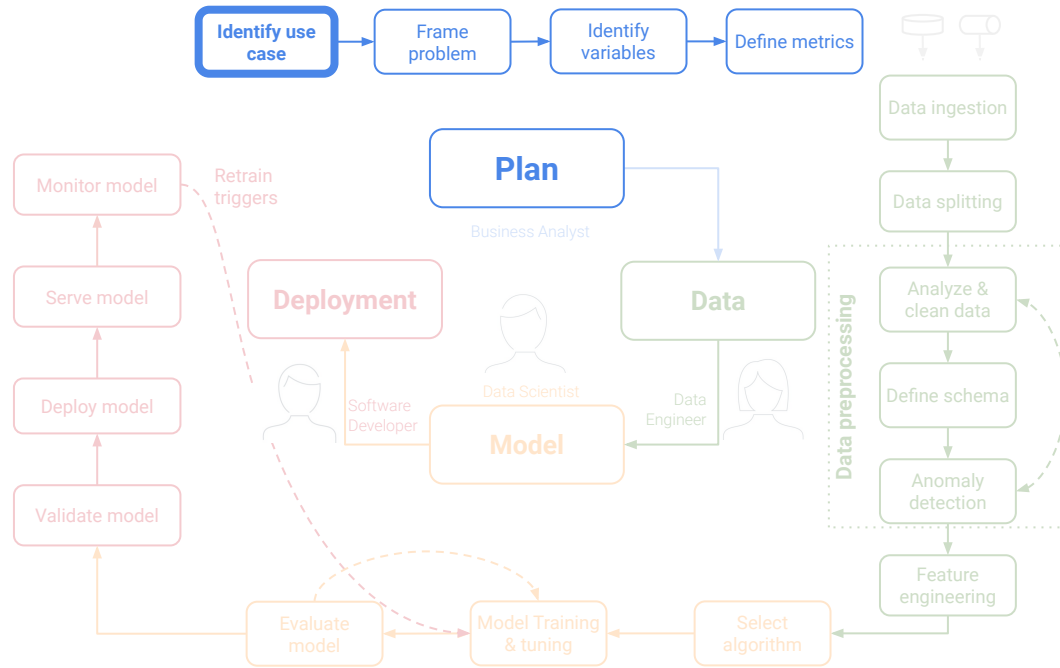|	CX thinking	BX thinking	Ways BX comes to life
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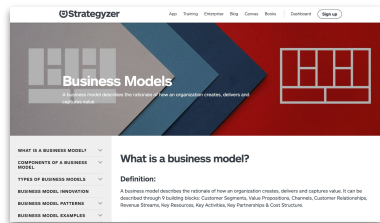
Data Science Lifecycle

Plan | Data | Model | Deployment

Business Model Canvas

A business model describes the rationale of how an organization creates, delivers and captures value.
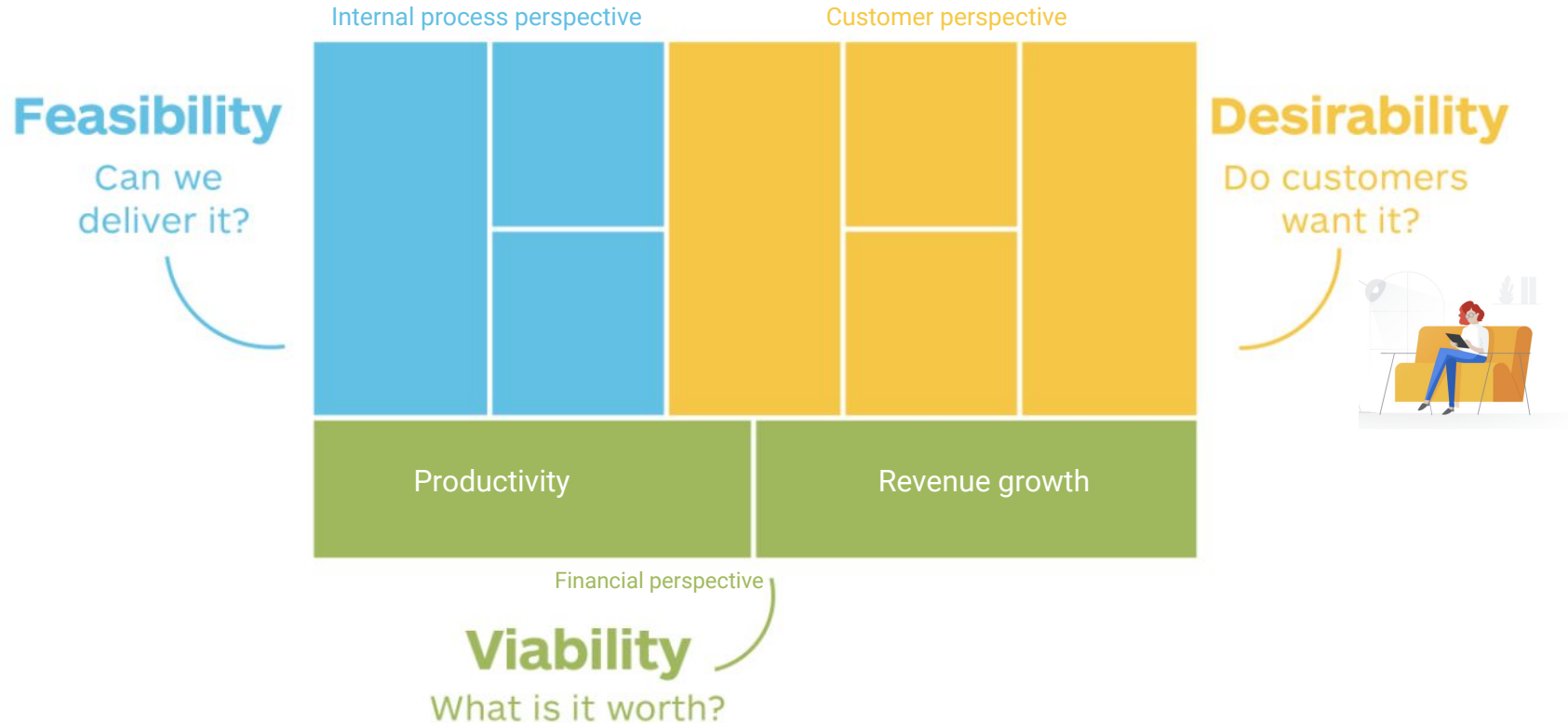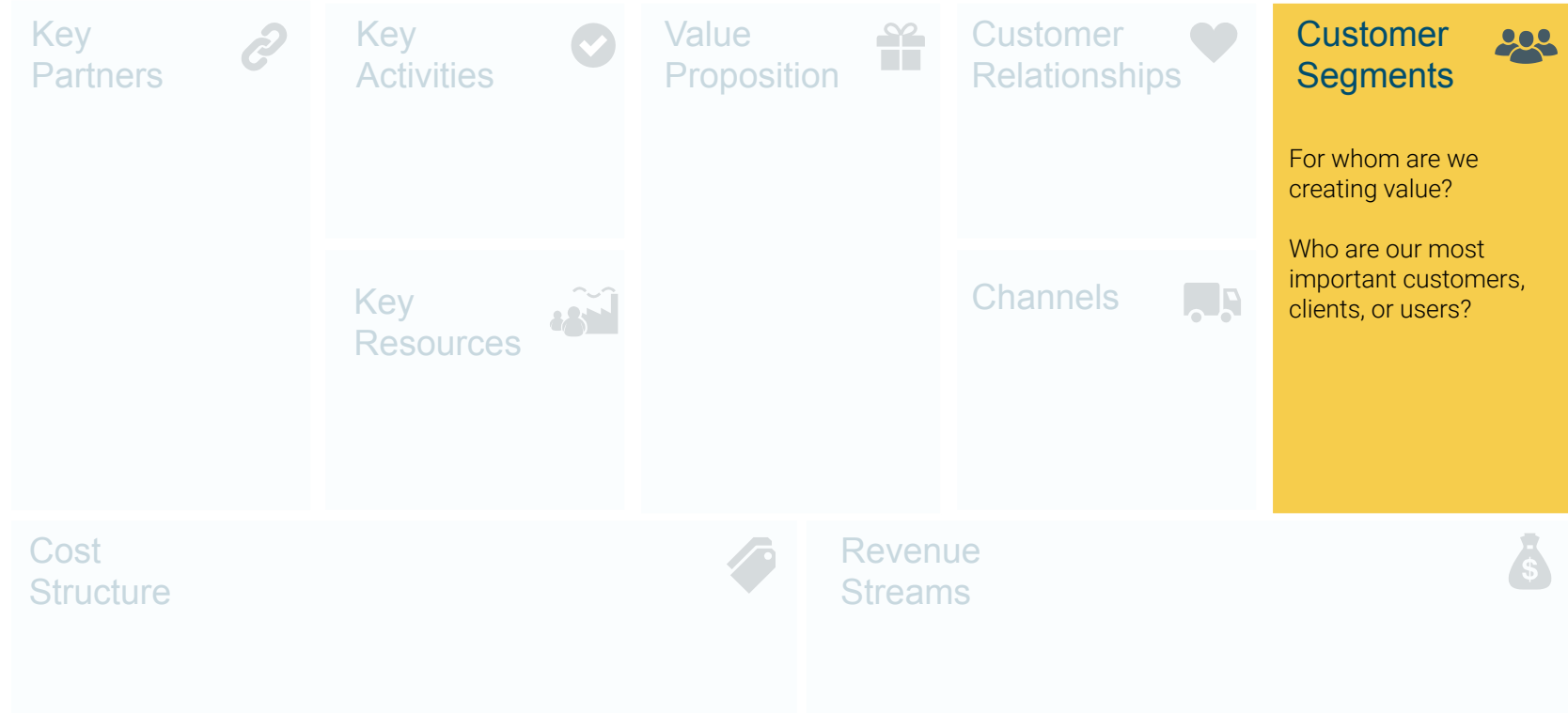
Gain insights about the essential building blocks of your business model to discover new growth opportunities

How do we create, deliver and capture value?

Internal process perspective

Customer perspective

Feasibility
Can we deliver it?

Desirability
Do customers want it?

Productivity

Revenue growth

Financial perspective

Viability
What is it worth?

r. Jan Kirenz

Customer Segments

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
	Key Resources		Channels	For whom are we creating value? Who are our most important customers, clients, or users?

Cost Structure	Revenue Streams

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Value Proposition

Key Partners 🔗	Key Activities ✓	Value Proposition 🎁	Customer Relationships ♥	Customer Segments 👥
		Which customer needs are we satisfying? What bundles of products and services are we offering to each Customer Segment?		
	Key Resources		Channels 🚚	

Cost Structure 🏷️	Revenue Streams 💰

Channels

Key Partners

Key Activities

Value Proposition

Customer Relationships

Customer Segments

Key Resources

Channels

How to reach and communicate with customers?

Where can they obtain our offerings?

Cost Structure

Revenue Streams

Customer Relationships

Key Partners 🔗	Key Activities ✅	Value Proposition 🎁	Customer Relationships ♥	Customer Segments 👥
			What type of relationship do we establish (personal/automated)?	
	Key Resources		Channels 🚚	

Cost Structure 🏷️	Revenue Streams 💰

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Revenue Streams

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments

Key Resources

Channels

Cost Structure

Revenue Streams — For what value are customers willing to pay? How would they prefer to pay? How much does each Revenue Stream contribute to overall revenues in terms of percentages of the total?

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Cost Structure

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
	Key Resources		Channels	

Cost Structure
What are the most important costs inherent in our business model?
Which Key Resources are most expensive?
Which Key Activities are most expensive?

Revenue Streams

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Key Resources

| Key Partners 🔗 | Key Activities ✓ | Value Proposition 🎁 | Customer Relationships ❤ | Customer Segments 👥 |

Key Resources 🏭

What Key Resources do our Value Propositions require (physical, human, intellectual)?

Channels 🚚

Cost Structure 🏷

Revenue Streams 💰

Key Activities

Key Partners 🔗	Key Activities ✔️ What Key Activities do our Value Propositions require (physical, human, intellectual)?	Value Proposition 🎁	Customer Relationships ❤️	Customer Segments 👥
	Key Resources 🏭		Channels 🚚	

Cost Structure 🏷️	Revenue Streams 💰

Key Partners

Key Partners 🔗	Key Activities ✓	Value Proposition 🎁	Customer Relationships ♥	Customer Segments 👥
Who are our Key Partners? Who are our key suppliers? Which Key Resources are we acquiring from partners? Which Key Activities do partners perform for us?	Key Resources 🏭		Channels 🚚	

Cost Structure 🏷	Revenue Streams 💰

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Business Model Canvas

Key Partners 🔗

Key Activities ✓

Key Resources

Value Proposition 🎁

Customer Relationships ♥

Channels 🚚

Customer Segments 👥

Cost Structure 🏷

Revenue Streams 💰

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RESOURCE CASTLES
How to become hard to copy.

ACTIVITY DIFFERENTIATORS
How to differentiate with innovative activity configurations.

SCALERS
How to scale in new ways.

GRAVITY CREATORS
How to lock in customers.

MARKET EXPLORERS
How to unlock new market potential.

CHANNEL KINGS
How to build innovative and strong customer relationships.

COST DIFFERENTIATORS
How to build innovative cost structures.

MARGIN MASTERS
How to boost margins in creative ways.

REVENUE DIFFERENTIATORS
How to better capture value.

Some examples

Key Partners

Key Activities

Key Resources

Value Proposition

Products & Services
- Concept testing and usability testing (A/B-testing)
- Offer optimization (conjoint analysis)

Brand
- Branding and attitudes research (Text mining, social network analysis)

Customer Relationships

- Customer satisfaction and Loyalty (modeling)

Channels

Customer Experience & Behavior
- Customer experience & behavior (Customer Decision Journey; modeling, association rule mining)

Customer Segments

Customer insights
- Customer needs research (Jobs to be Done)
- Customer segmentation (clustering)

Competitive research
- Market and competitor analysis (market analysis, web scraping, modeling)

Cost Structure

Revenue Streams

Pricing and customer behavior research (conjoint analysis, modeling)

How to identify valuable projects?

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Examples

Spotify

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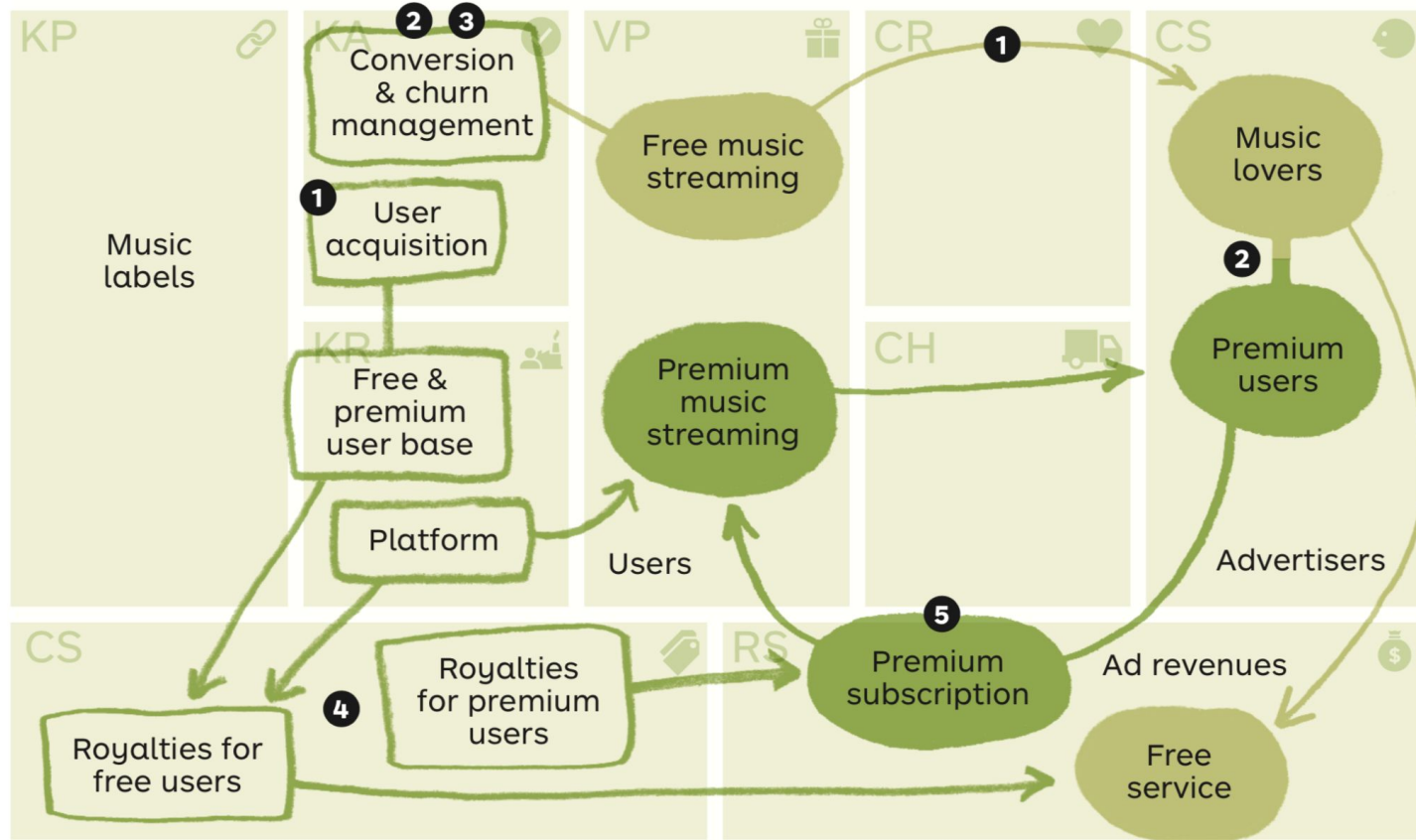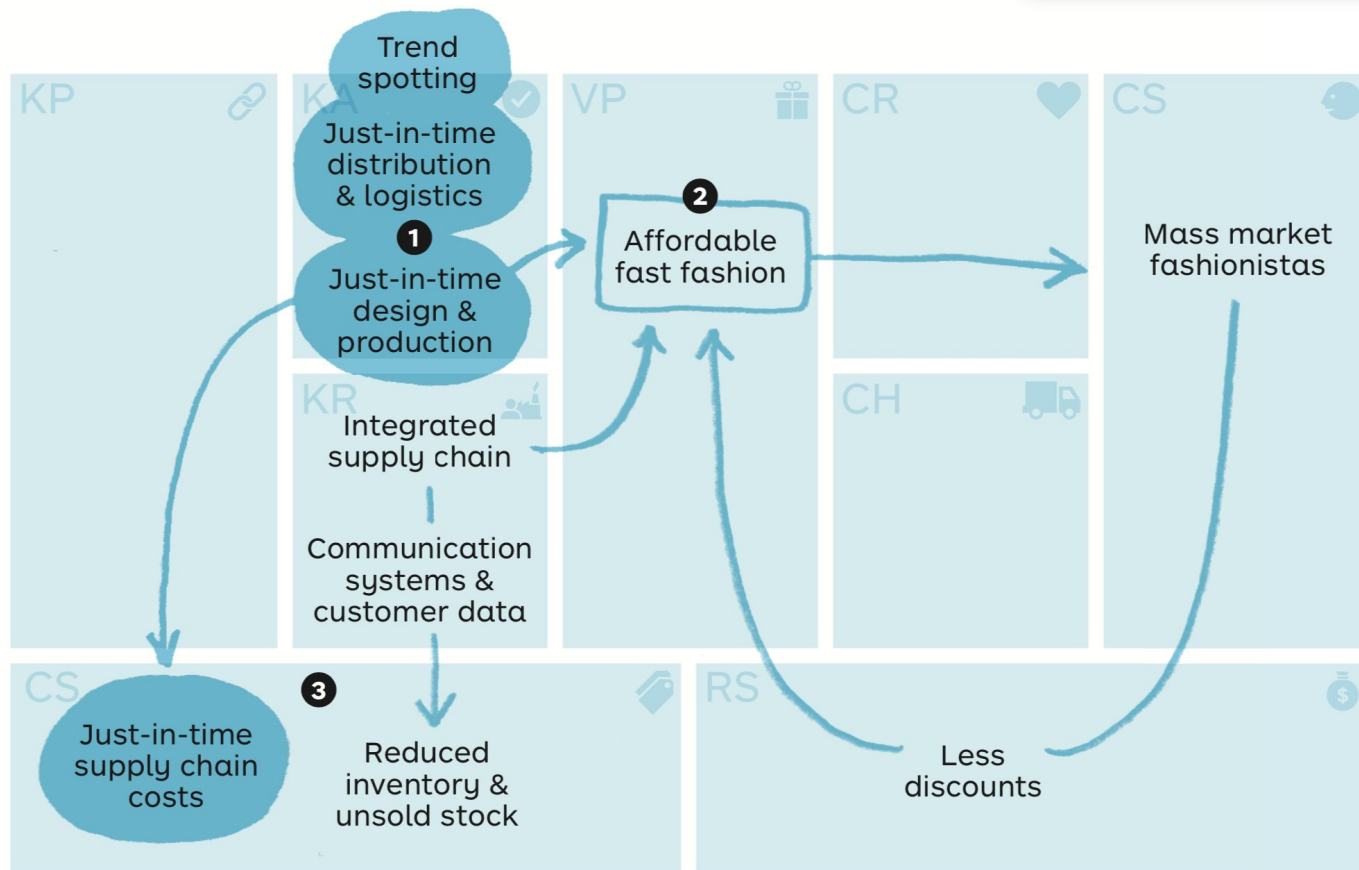
Zara: Optimize activities for speed

Business Model Canvas

Key Partners

Key Activities

Automated metal welding

Key Resources

Human experts for defect detection

Value Proposition

Customer Relationships

Channels

Customer Segments

Cost Structure

Operating costs

Revenue Streams

ACCURACY & EFFICIENCY

DETECT DEFECTS
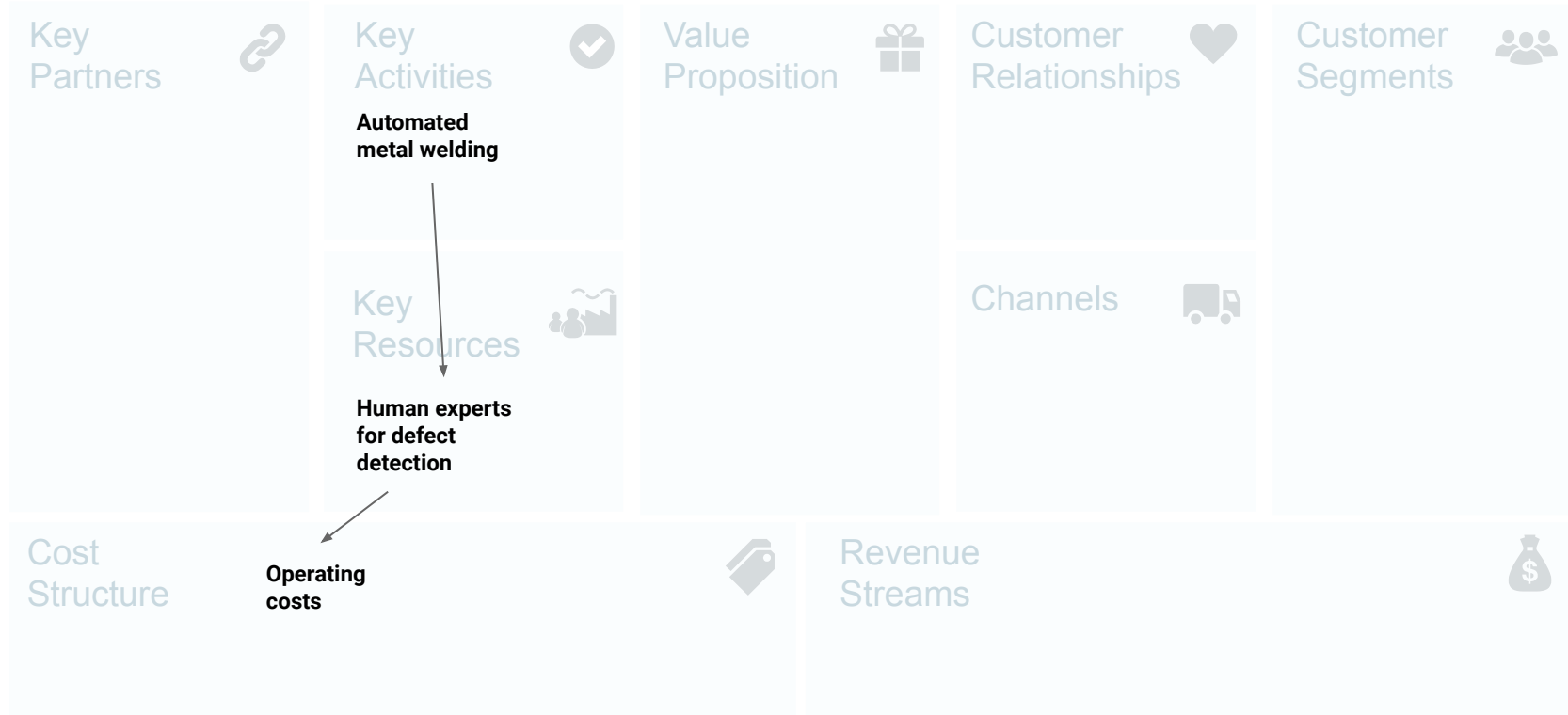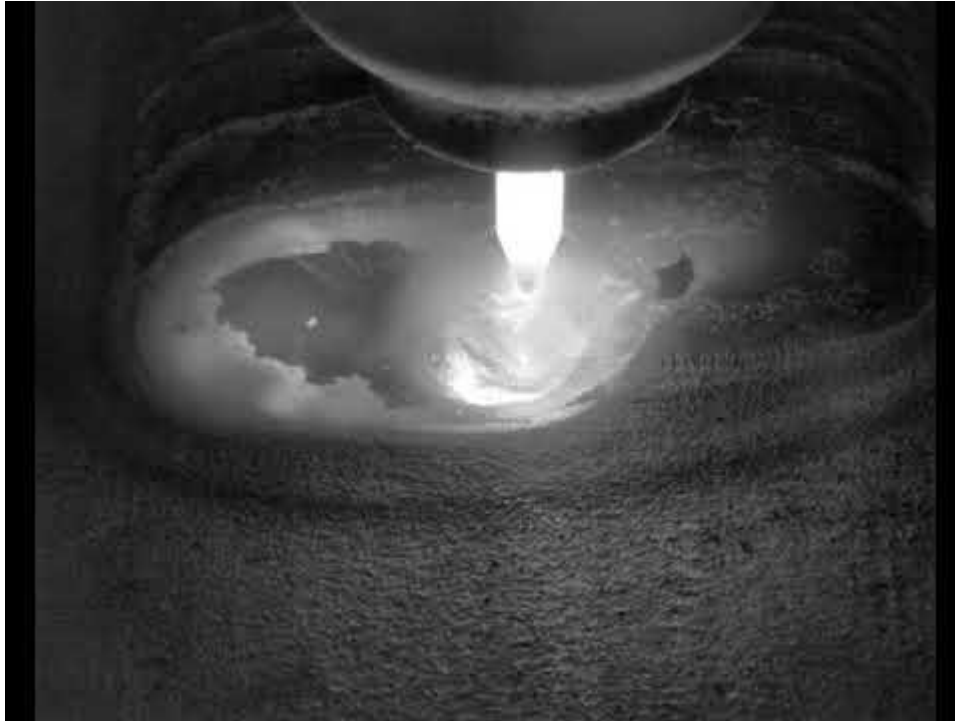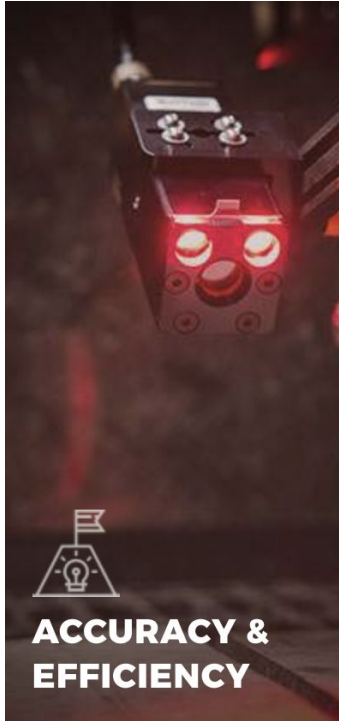
MeltTools
Focused Welding Solutions

Visualizing welding in-process
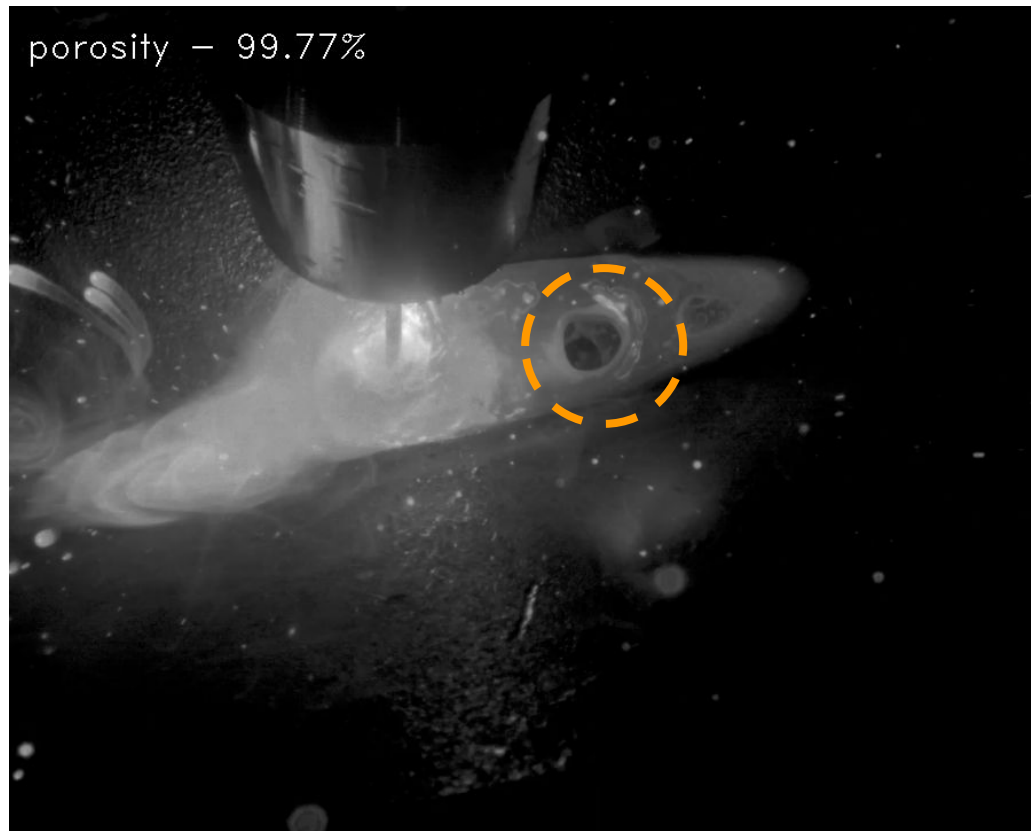
Porosity weld recognition model

Data Science Lifecycle

Plan | Data | Model | Deployment

Identify use case → **Frame problem** → Identify variables → Define metrics

Data ingestion

Data splitting

Plan
Business Analyst

Monitor model — Retrain triggers

Serve model

Deployment

Data
Data Engineer

Data preprocessing

Analyze & clean data

Define schema

Anomaly detection

Deploy model

Software Developer

Data Scientist

Model

Validate model

Feature engineering

Evaluate model → Model Training & tuning → Select algorithm

Provide a statement of what is to be learned and how decisions should be made

Initial problem definition

1) **Specify the use case and target population (or target process)**

   We are investigating < … >

2) **Provide a question and unit of measurement**

   Because we want to find out < … >

3) **Motivate the question and provide a business objective**

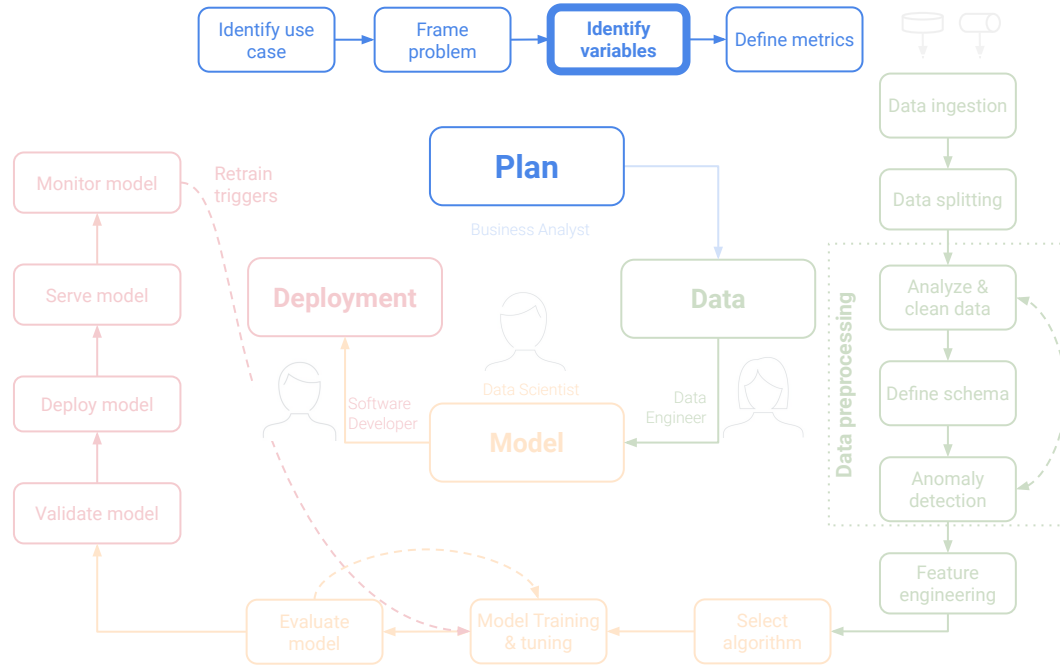   In order to decide < … >

Example:

Image: Freepik.com

1) We are investigating

    <the detection of defects in real time>

    <in our automated manufacturing welding process>

2) Because we want to find out

    <if AI is able to spot defects as they occur>

    <with a precision of at least 95% (detection of defects)>

3) In order to decide

    <if we should replace human experts>

    <which would lead to a cost reduction of 20% (xxx.xxx $) >

Data Science Lifecycle

Plan | Data | Model | Deployment

4 Major **types** of data science projects

Features

Structured data: **Variables**

	Structured data: **Variables**	Unstructured data: **Labels**
Small data (n <= 10,000)	Type A	Type C
Big data (n > 10,000)	Type B	Type D

Feature engineering

Humans label data /
Data augmentation

A "**feature**" refers
to the entire column
in the dataset

Feature = **Variable**

Transaction_id	in_foreign_country	size_compared_to_avg_transaction	fraud?
7485	False	0.8x	False
46854	True	21.2x	True
3521	True	1.1x	False

A "**feature value**"
refers to a single value
of a feature column

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If we have **unstructured data**, we need to identify relevant **labels**

Computer vision

Natural language processing

Audio processing

# For **structured data** problems, we need to identify potentially relevant **variables**

- **Goal**: show the primary variable of interest (response variable) and possible factors (explanatory variables)

  - explanatory variable →might affect → response variable

- Speak to **domain experts**

- Do **literature research** (e.g., using google scholar) to identify possible relationships between variables

- In business use cases you can also use a **strategy map**
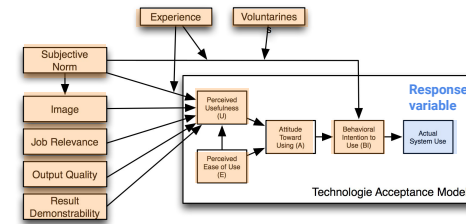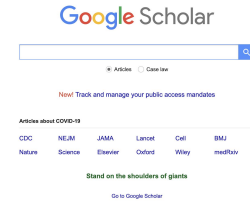
Venkatesh & Davis (2000)

Data Science Lifecycle

Plan | Data | Model | Deployment

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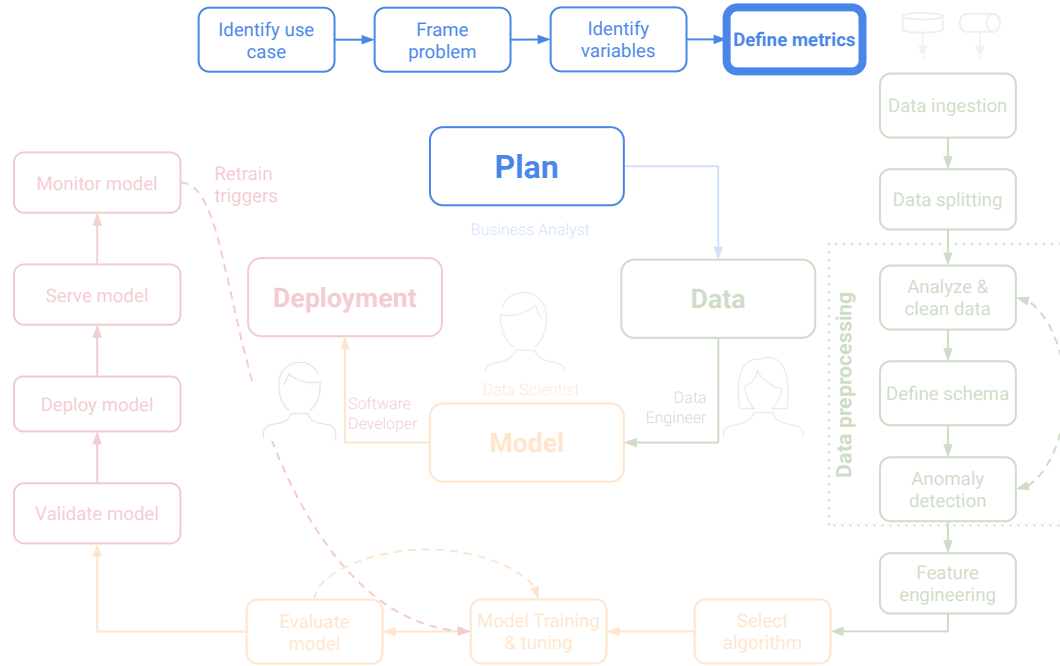
Some initial thoughts

Heuristic

Think about a scenario where you need to deliver the product tomorrow, and you can't use AI. What heuristics would you use? What would you do?

If we didn't use ML, we would < ... >

The Oracle Test

Assume you always had the correct answer. What would you be willing to spend for this perfect information from a model?

If we could obtain perfect information, we would be willing to spend < ... >

Model **problem** definition

1) **Specify the task of your model**

   We want the model to < … >

2) **Provide an ideal outcome (independent of the model itself)**

   Our ideal outcome is <…>

3) **Motivate the question and provide a business context**

   In order to <>

Example:

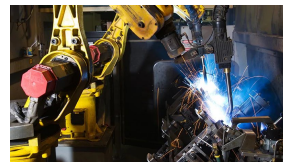Image: Freepik.com

1) Specify the task of your model
   We want the model to
   < detect bad welds (defective joints) in real time>

2) Provide an ideal outcome (independent of the model itself)
   Our ideal outcome is to
    < be able to replace a bad weld immediately without human >

3) Motivate the question and provide a business context
   In order to
   < replace human experts and reduce manufacturing downtime and costs by 20% >