

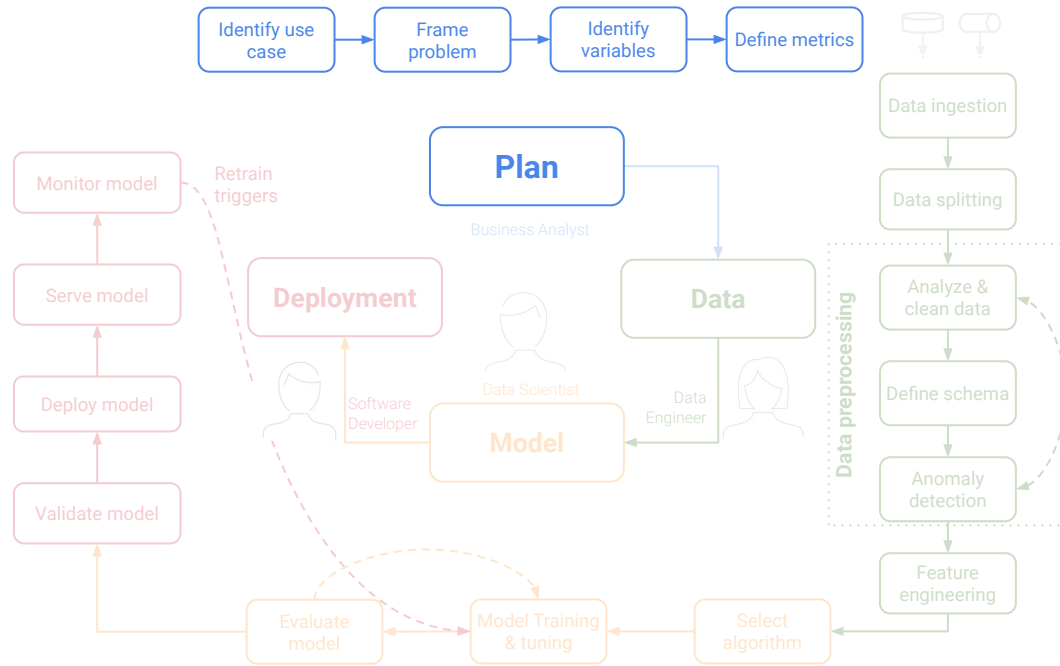
Data Science Lifecycle

Planning phase

Prof. Dr. Jan Kirenz
HdM Stuttgart

Data Science Lifecycle

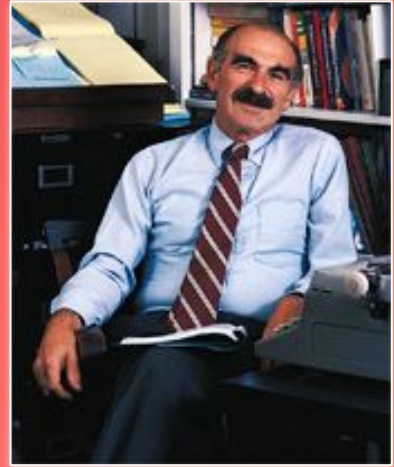
Plan | Data | Model | Deployment



Customer centricity

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

1960



T. Levitt

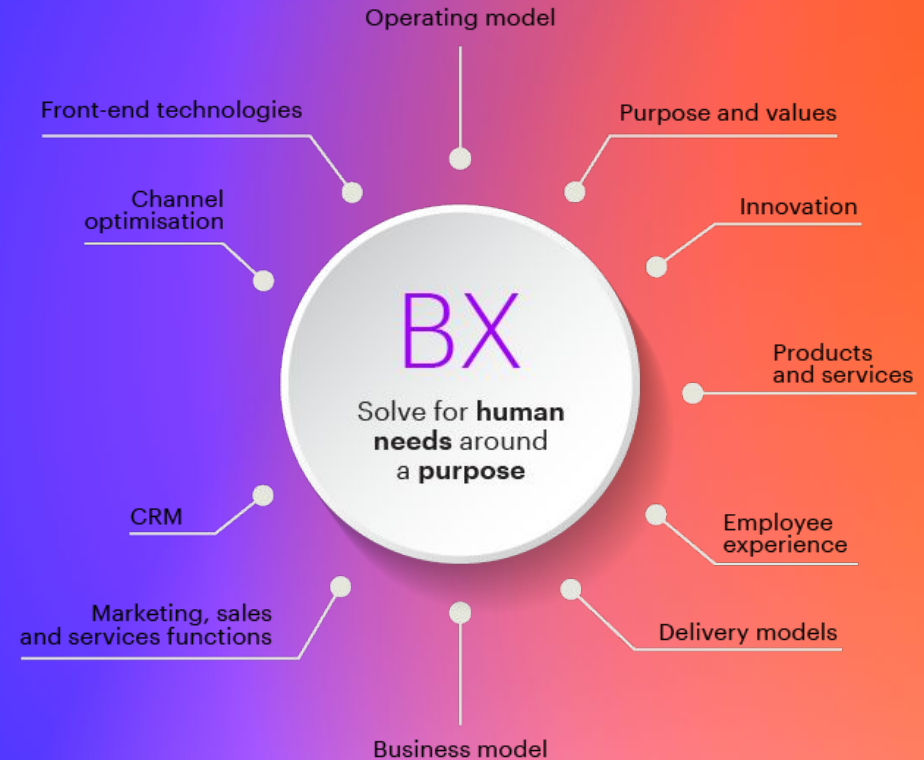
From customer experience (CX) to business of experience (BX) **2021**



From customer experience (CX) to

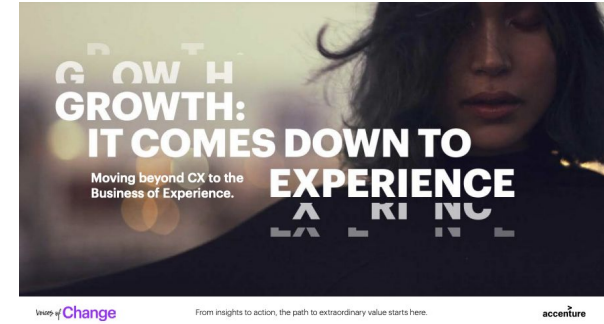


business of experience (BX) **2021**





	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.

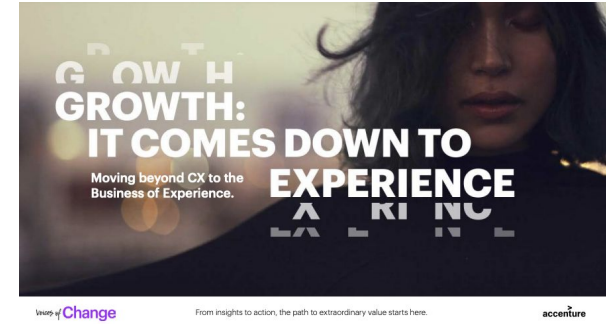


<https://www.accenture.com/de-de/insights/interactive/business-of-experience>



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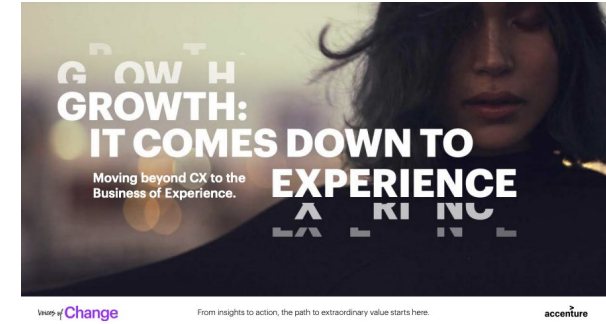


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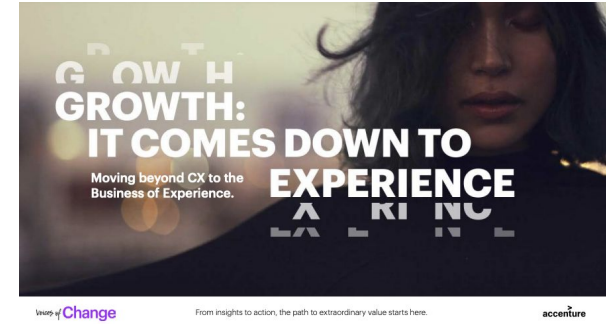


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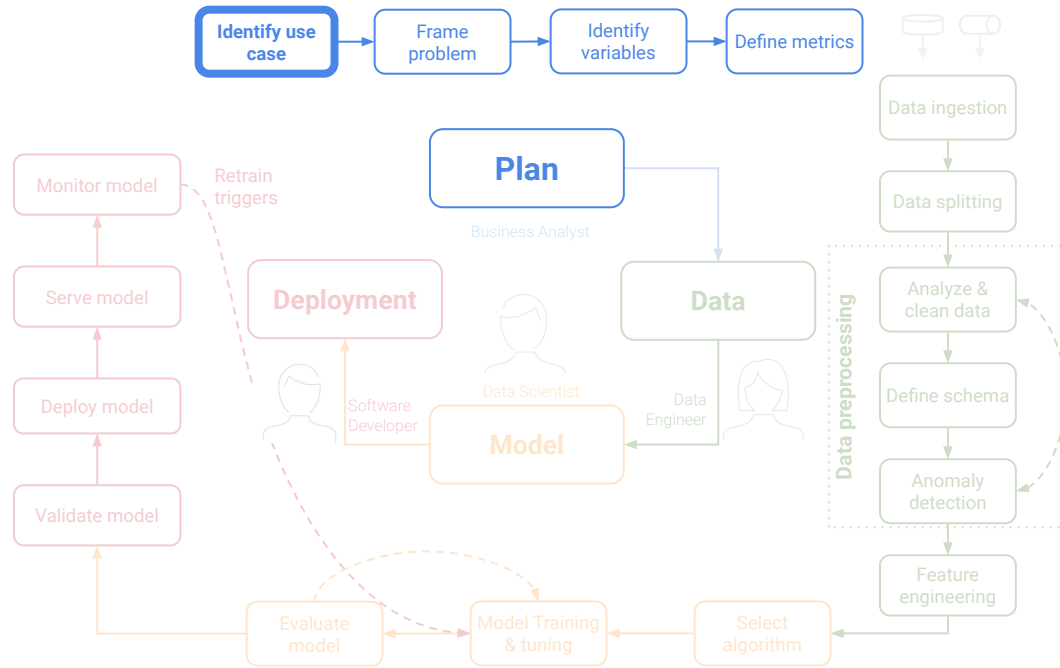
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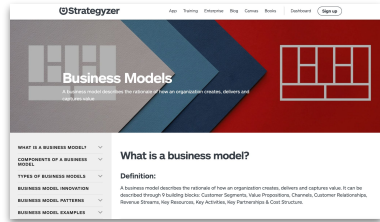
Data Science Lifecycle

Plan | Data | Model | Deployment



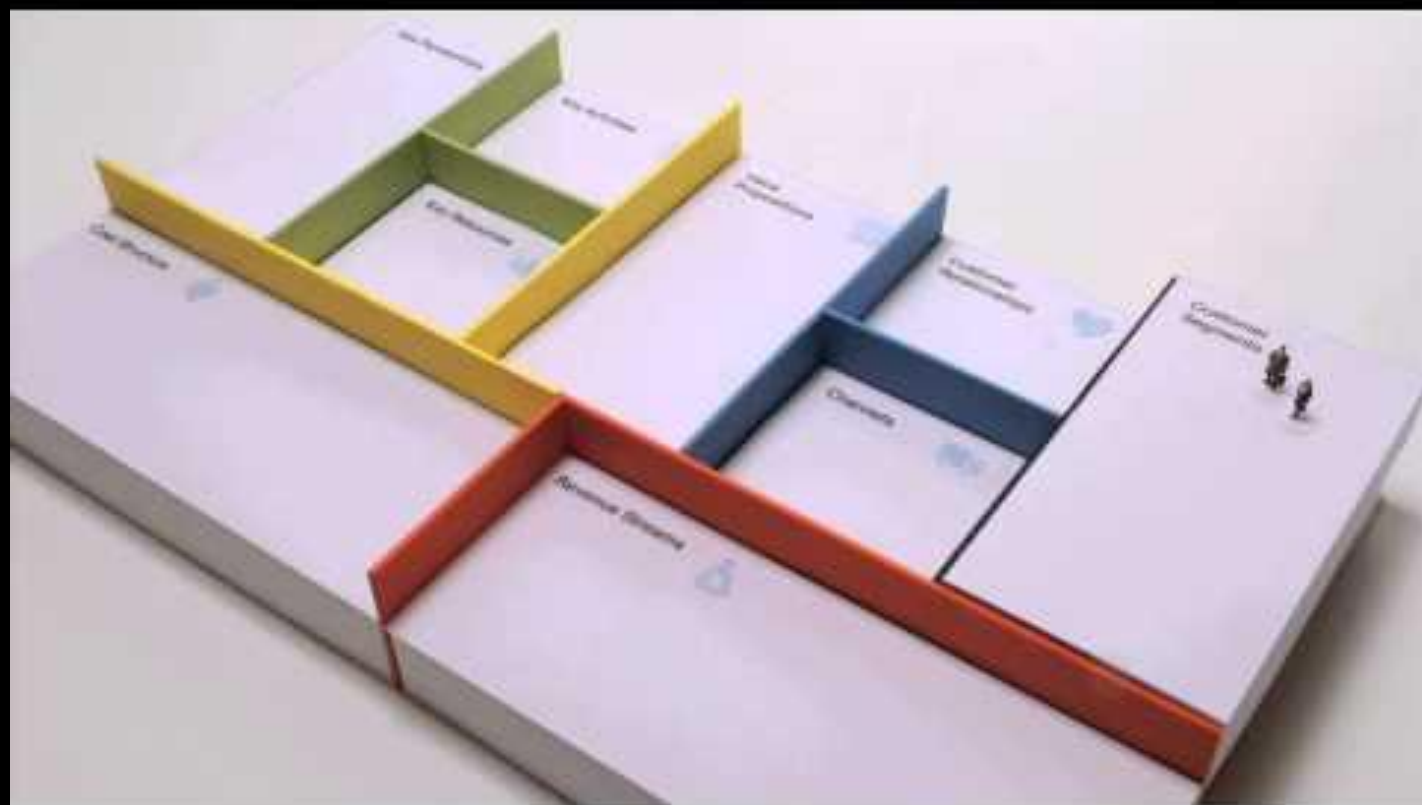
Business Model Canvas

A business model describes the rationale of how an organization creates, delivers and captures value.

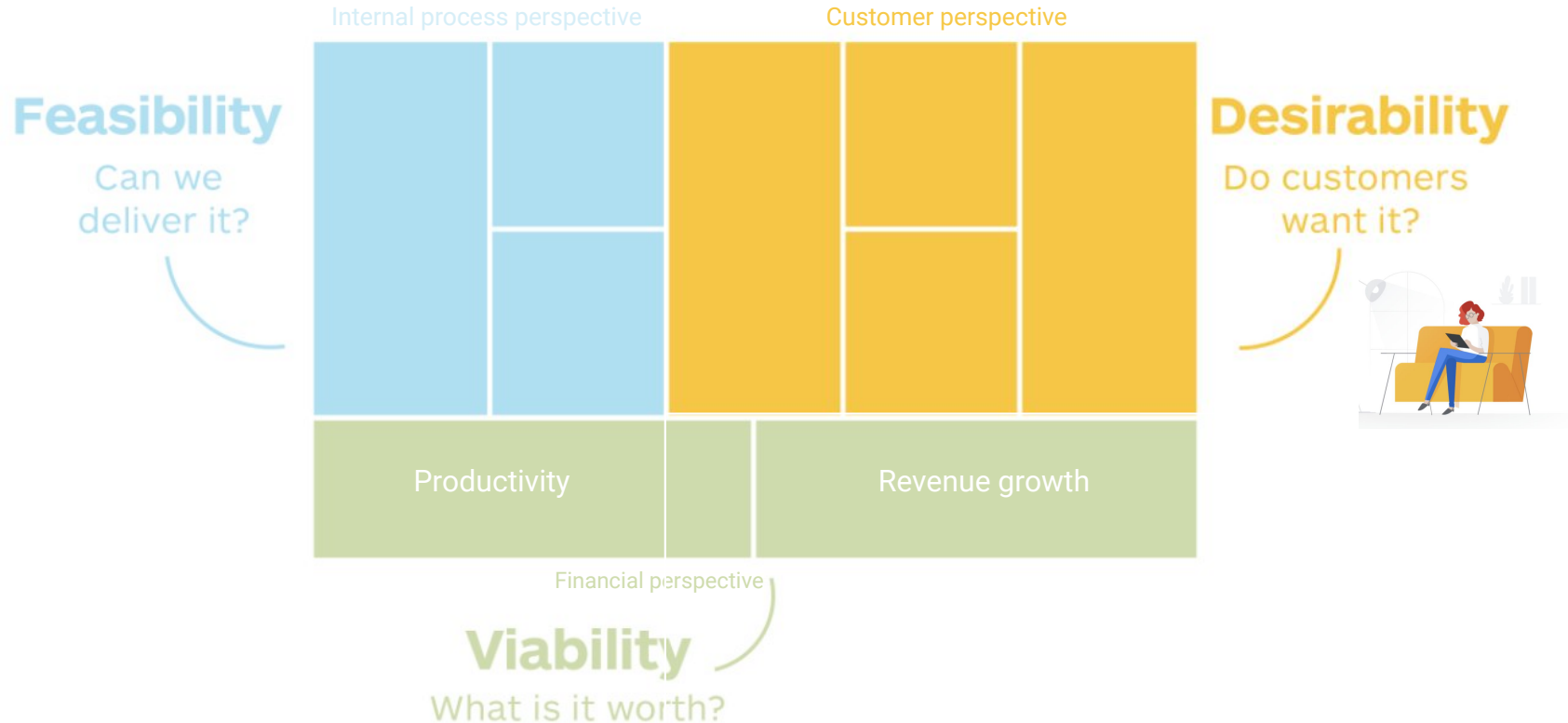


<https://www.strategyzer.com/expertise/business-models>

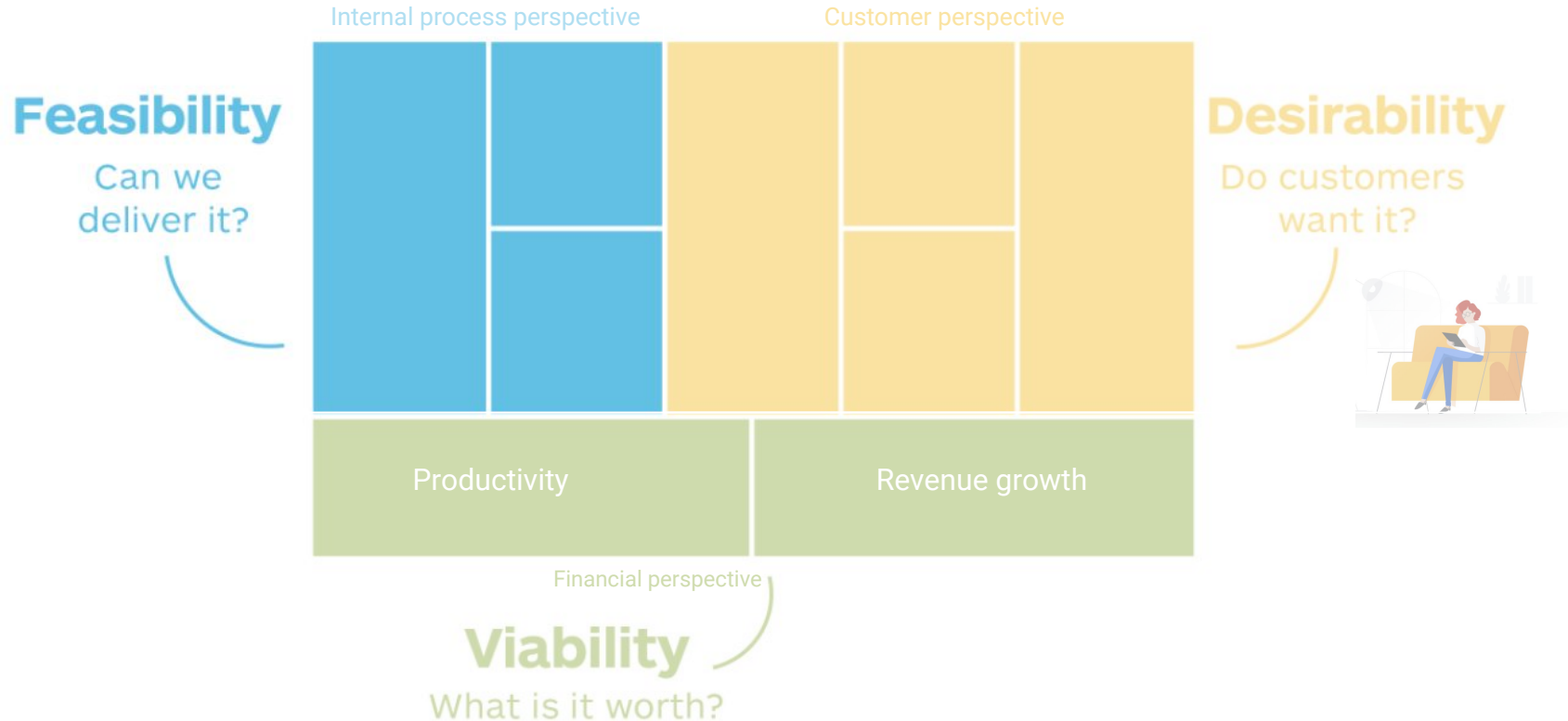
Gain insights about the essential building blocks of your business model to discover new growth opportunities



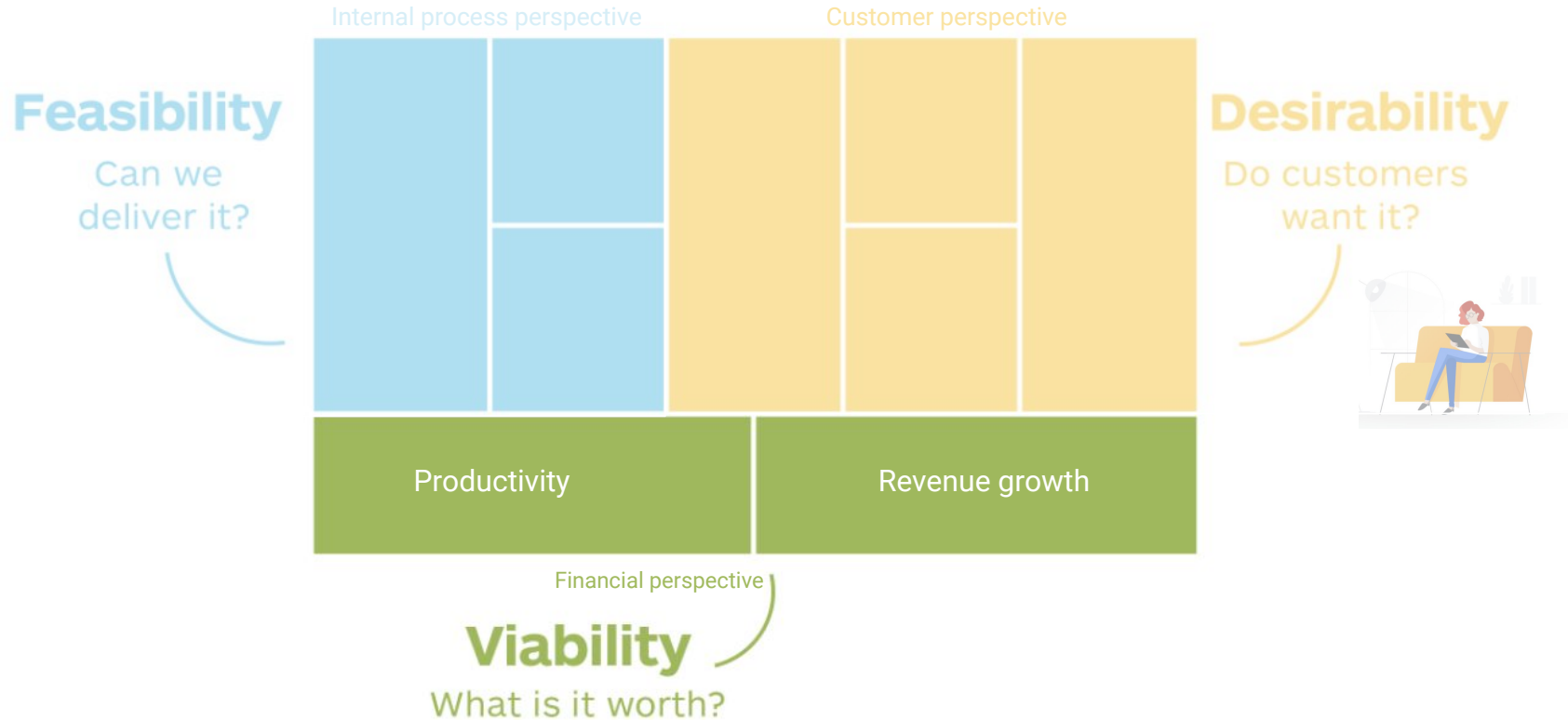
How do we create, deliver and capture value?



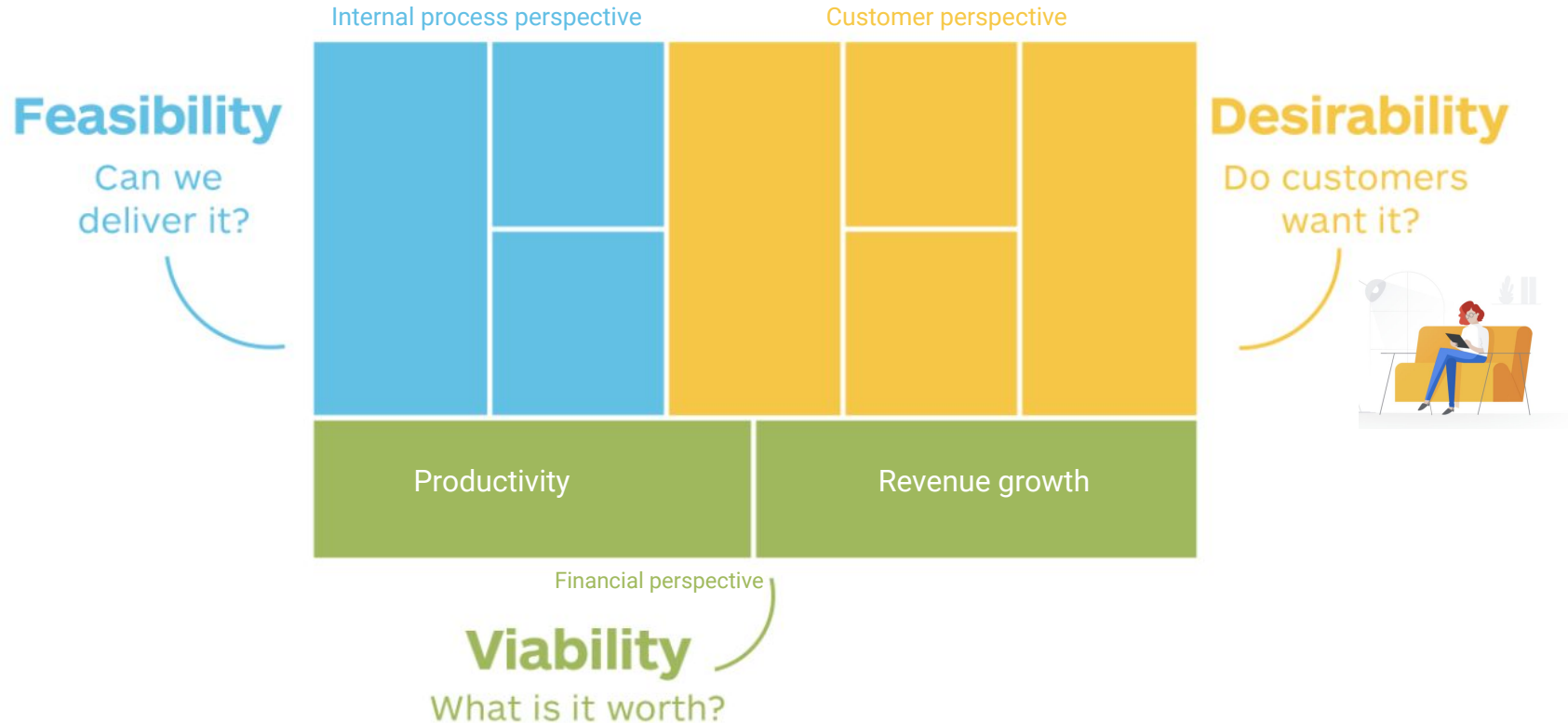
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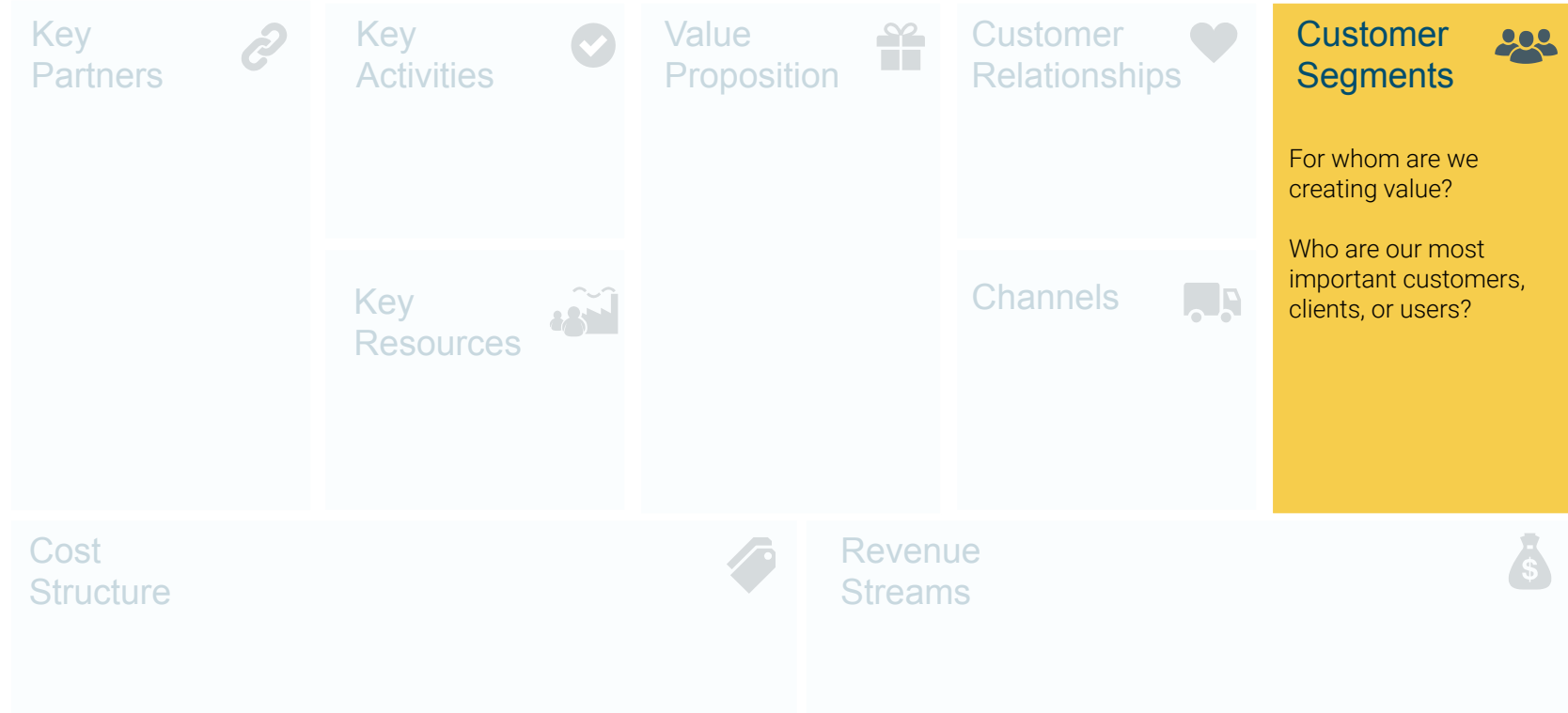
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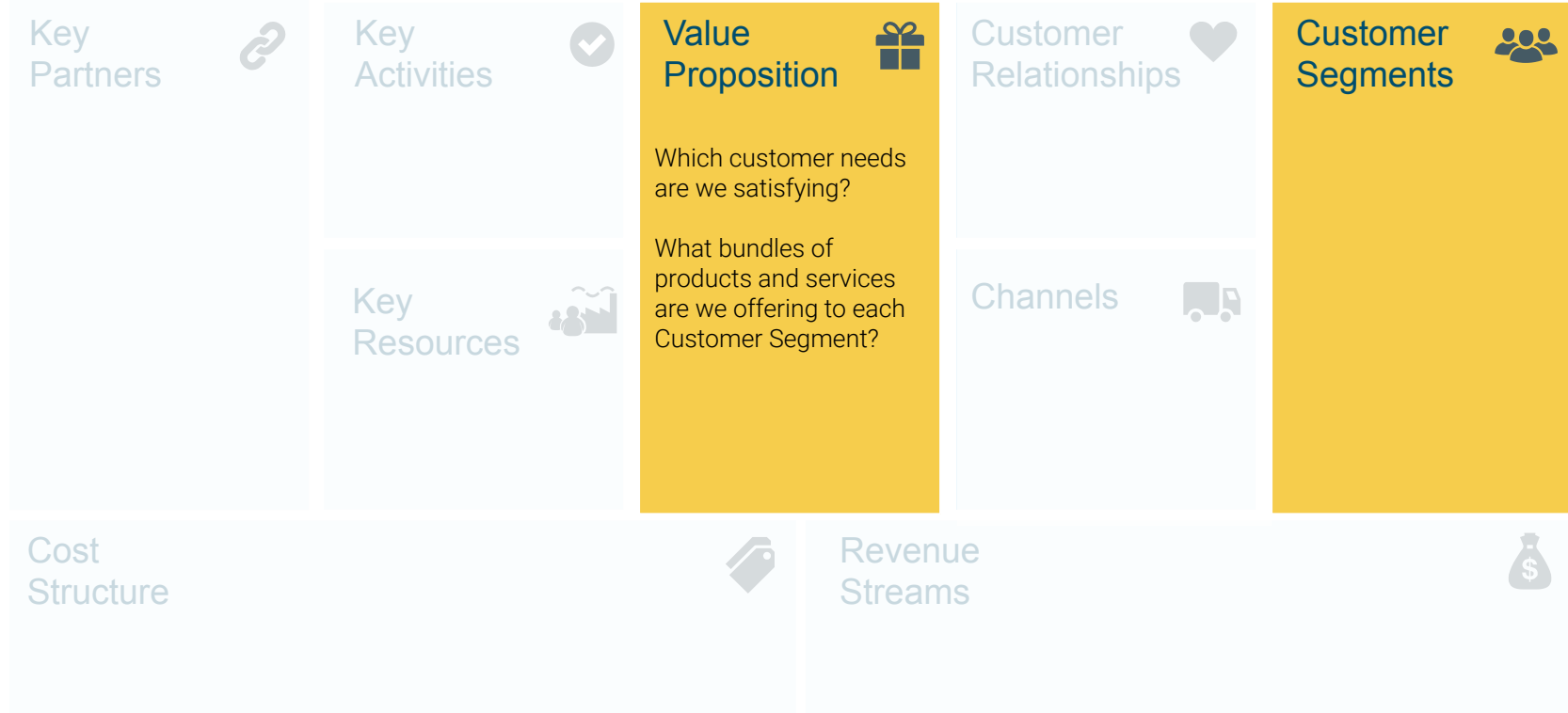
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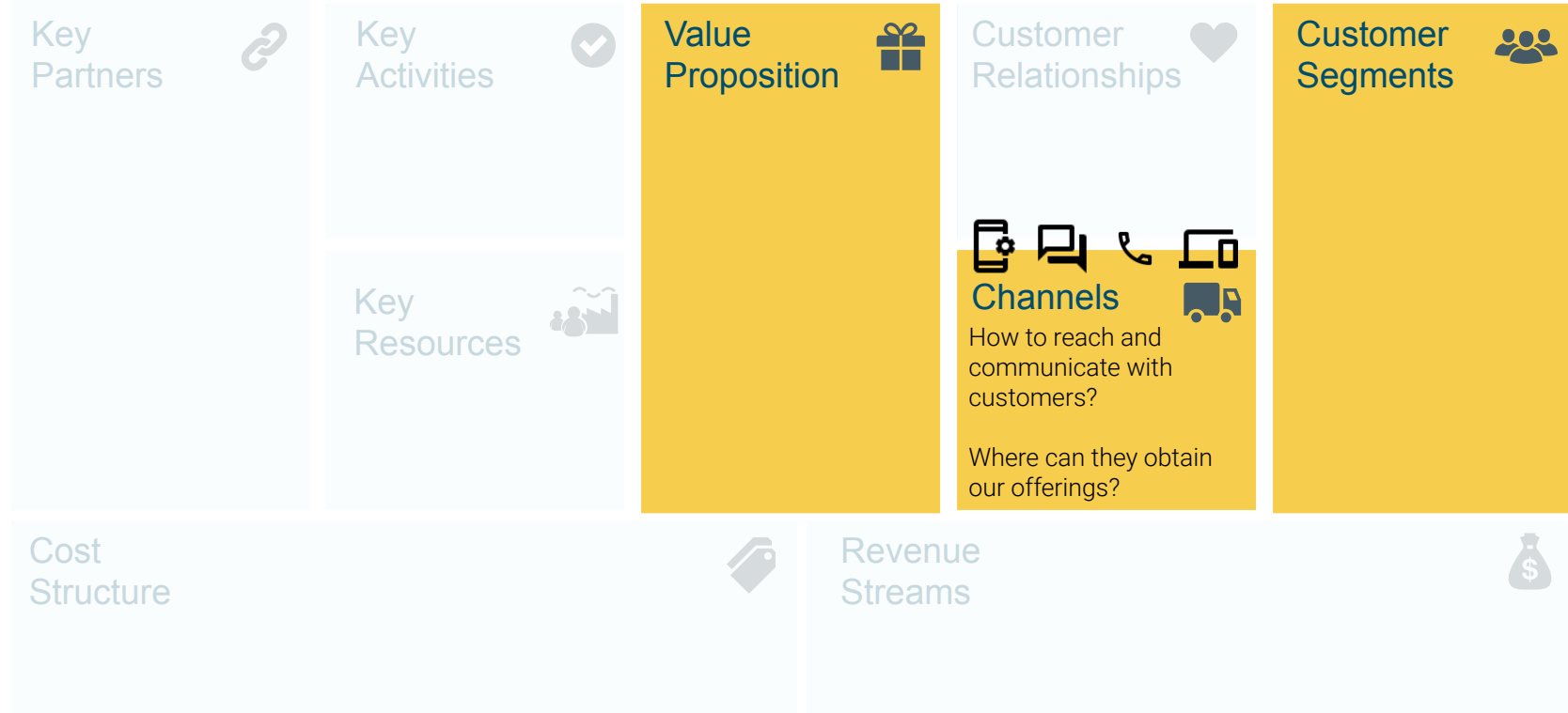
Customer Segments



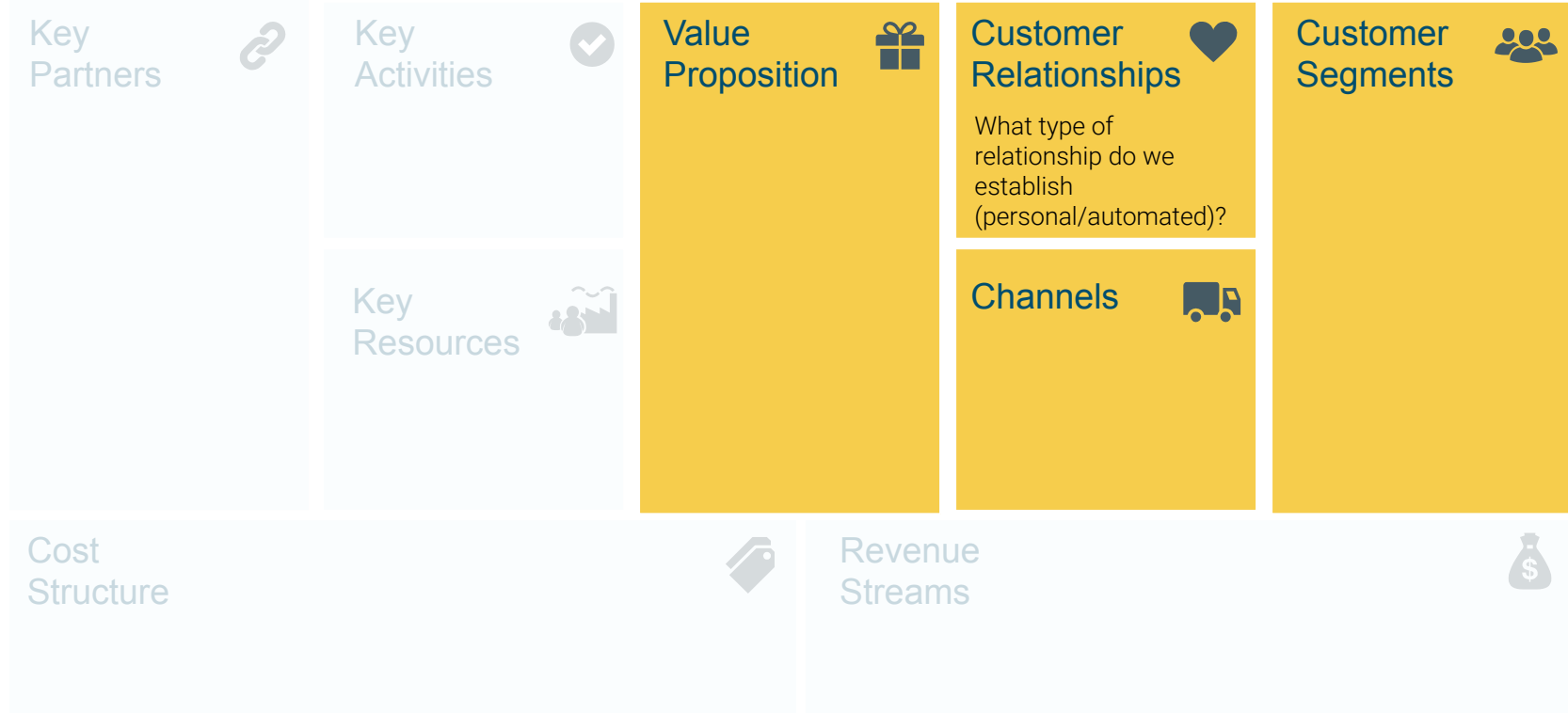
Value Proposition



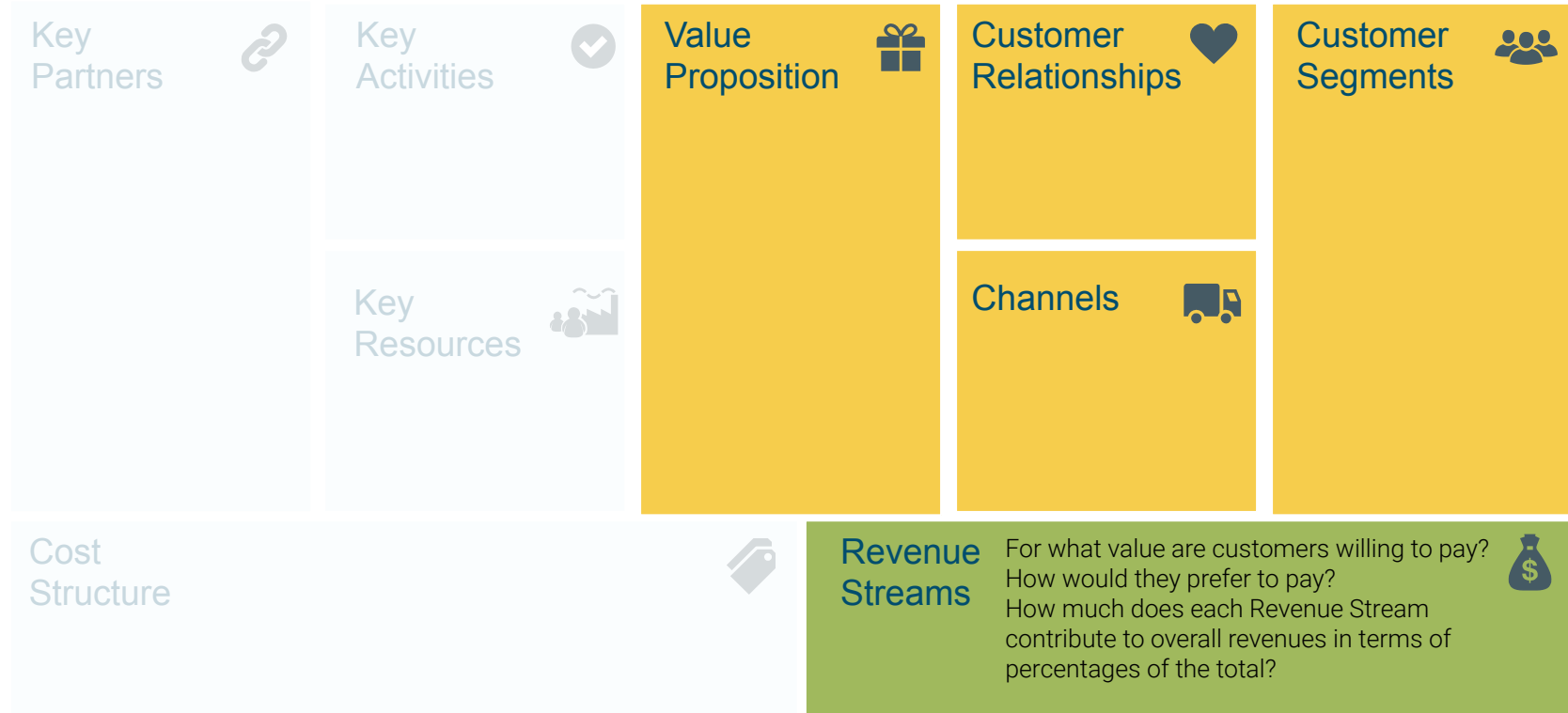
Channels



Customer Relationships



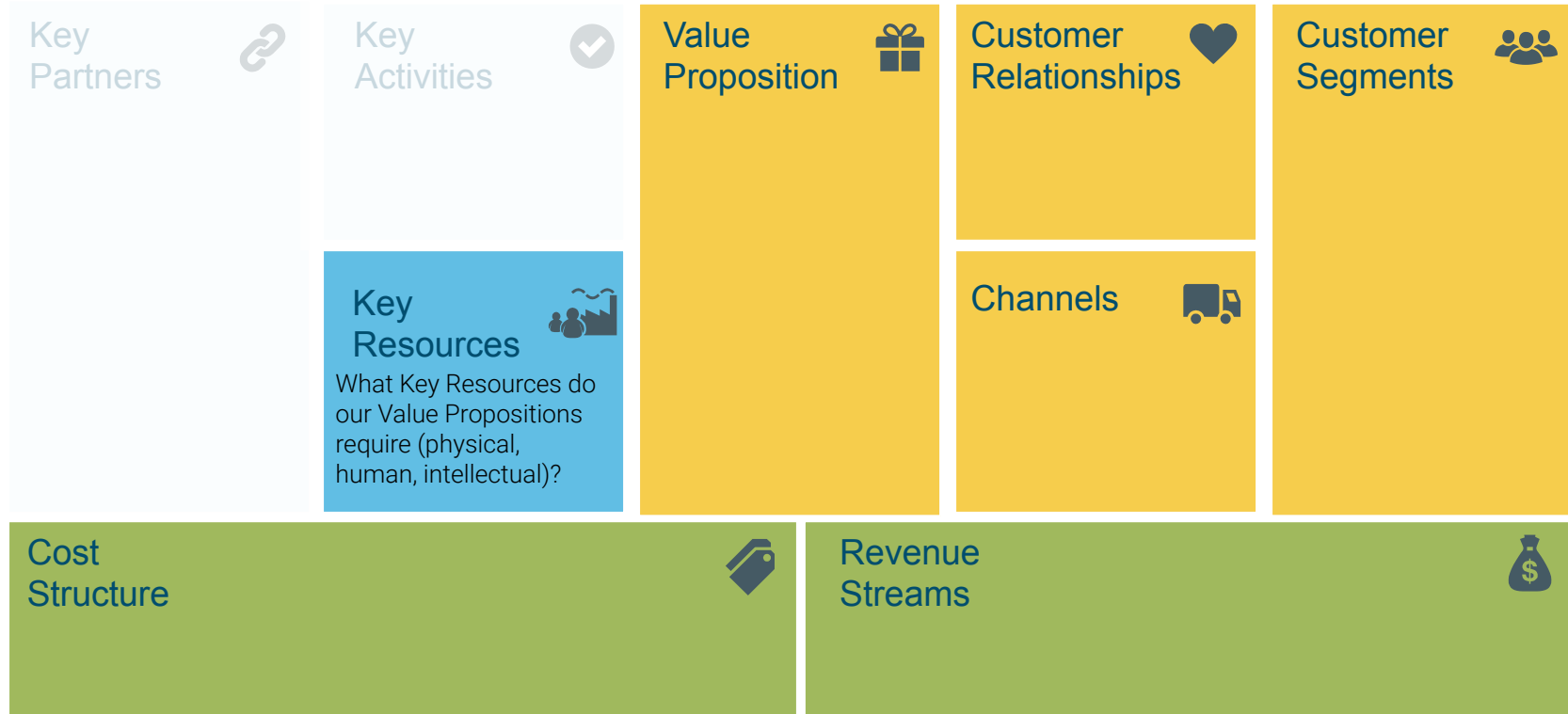
Revenue Streams



Cost Structure



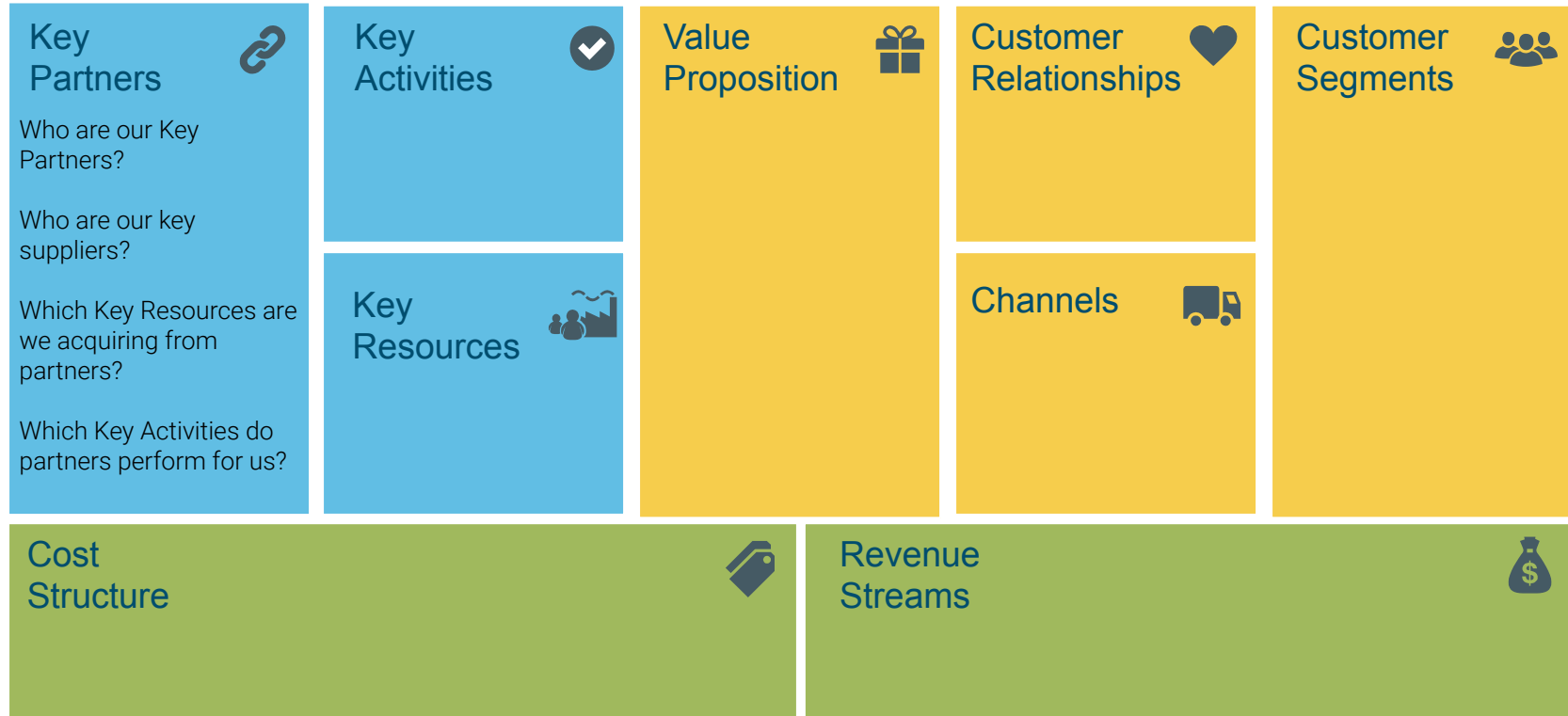
Key Resources



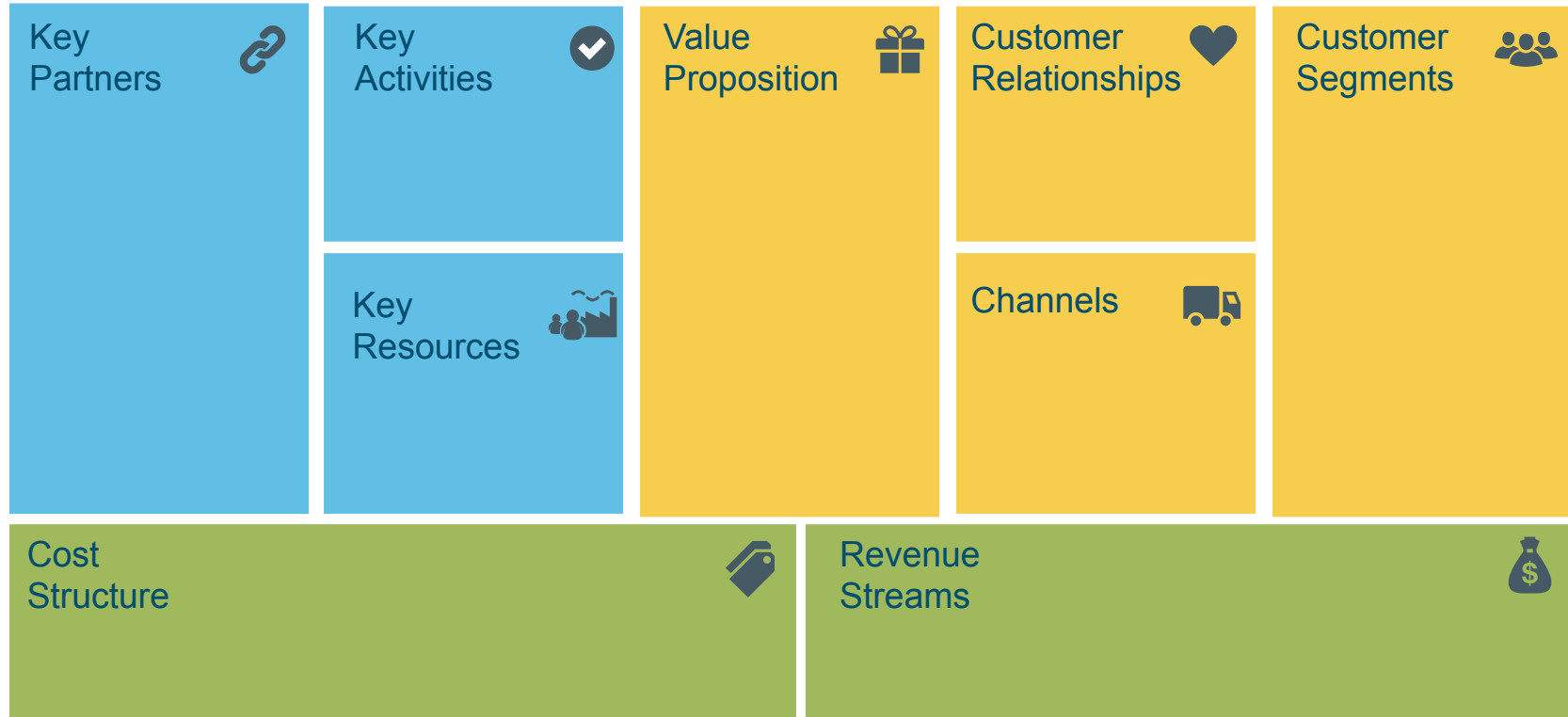
Key Activities



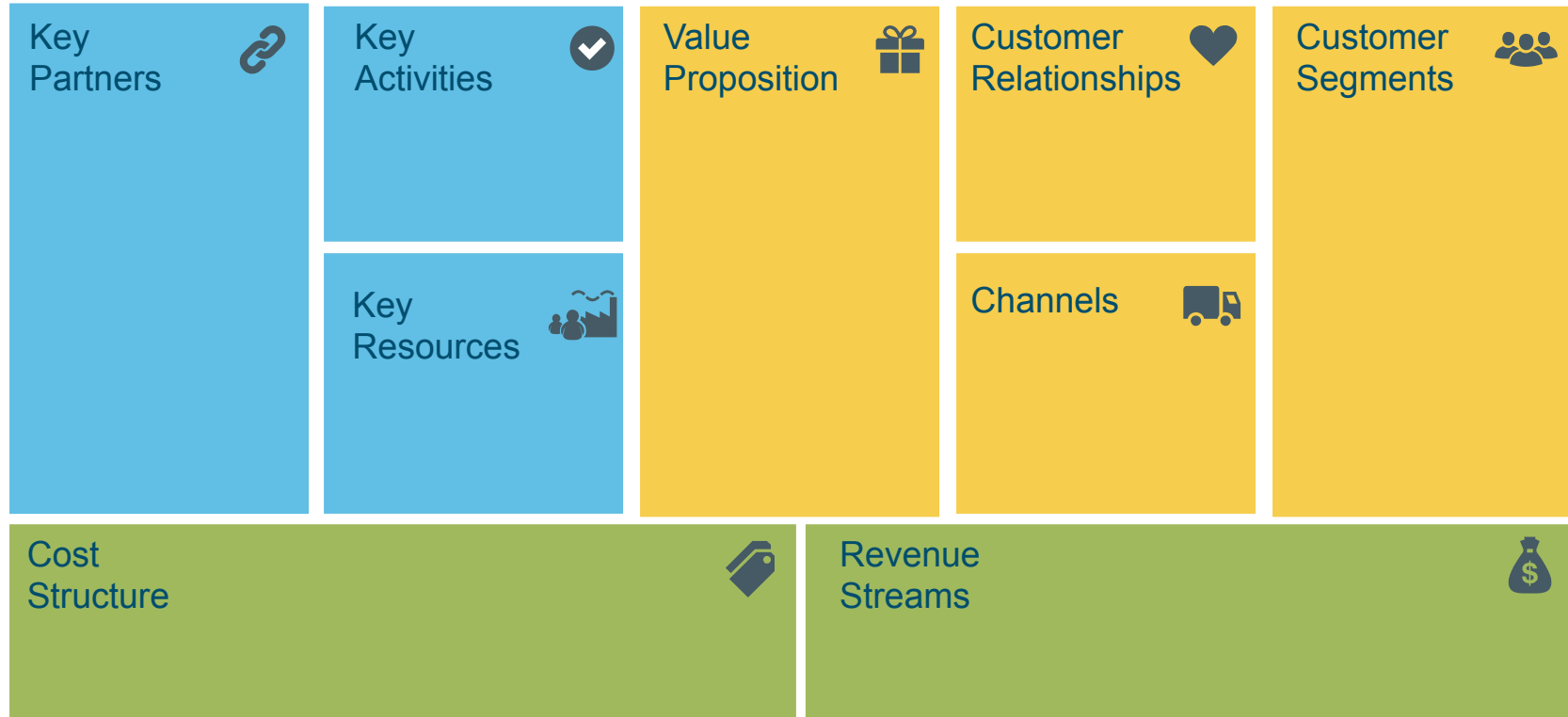
Key Partners

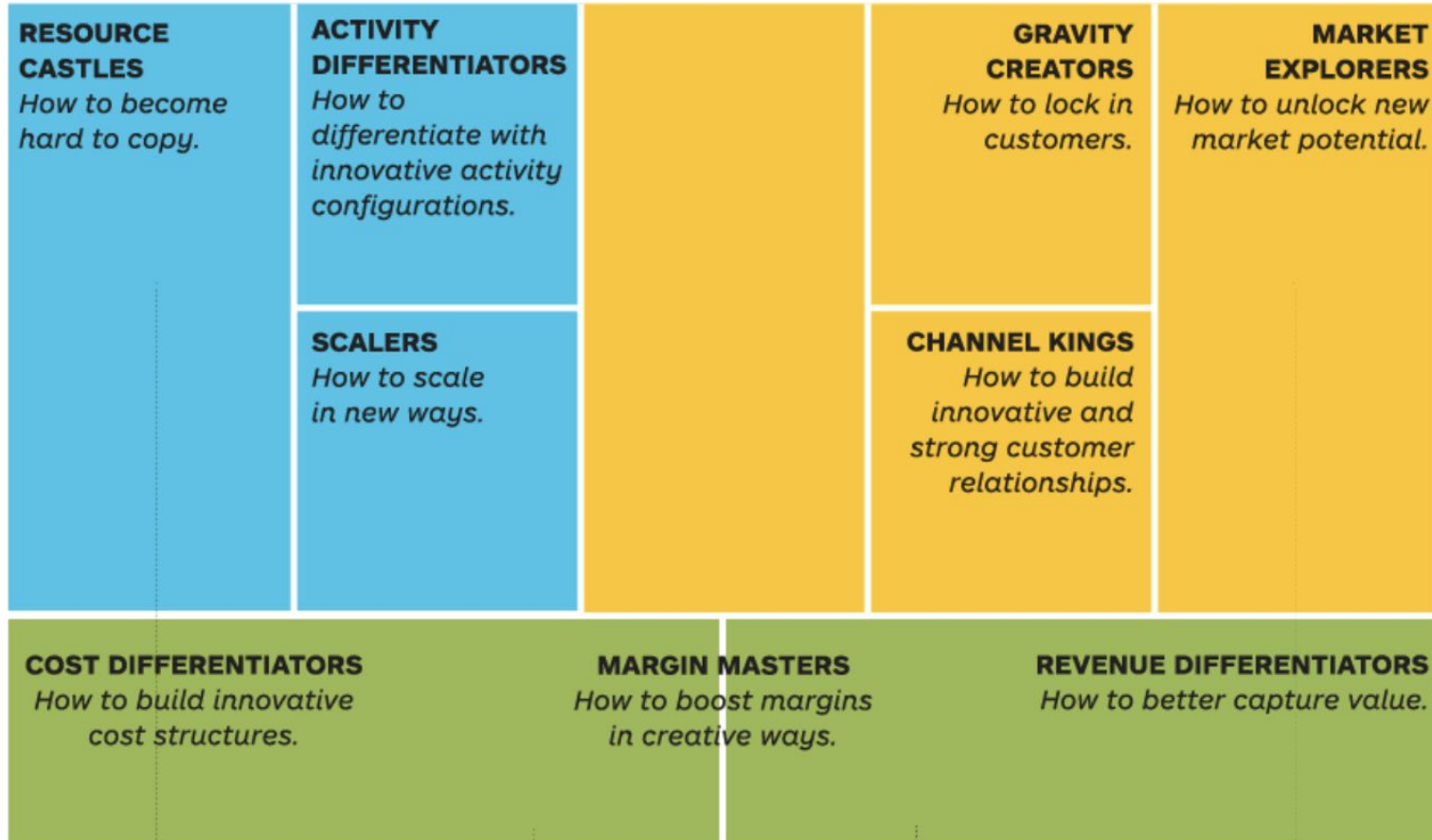


Business Model Canvas



Business Model Canvas





Some examples

Key questions we will cover

Key Partners



Key Activities



Key Resources



Value Proposition



Which customer needs are we satisfying?

What bundles of products and services are we offering to each Customer Segment?

Customer Relationships



What type of relationship do we establish (personal/automated)?

Channels



How to reach and communicate with customers?

Where can they obtain our offerings?

Customer Segments



For whom are we creating value?

Who are our most important customers, clients, or users?

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?

How to optimize our value proposition?

How to build innovative and strong customer relationships?

How to unlock new market potential?

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, regression, classification**)

Cost Structure



Revenue Streams

Pricing and customer behavior research (conjoint analysis, modeling)



How to better capture value and boost margins?

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Key Partners



Key Activities



Key Resources



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Key Partners



Key Activities



Key Resources



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Revenue Streams

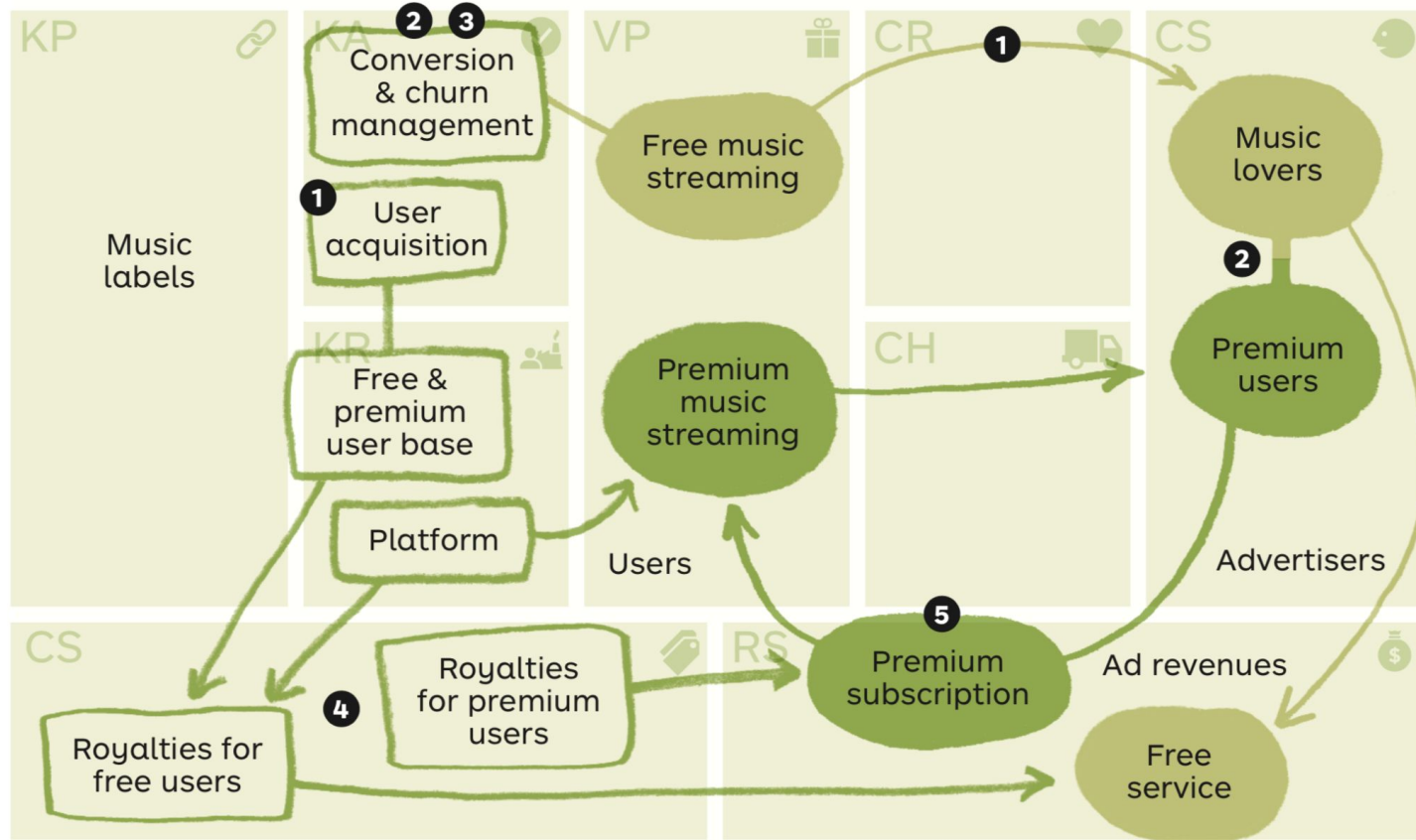
Pricing and customer behavior research (conjoint analysis, modeling)



How to better capture value and boost margins?

How to
identify
valuable
projects?

Examples



Spotify

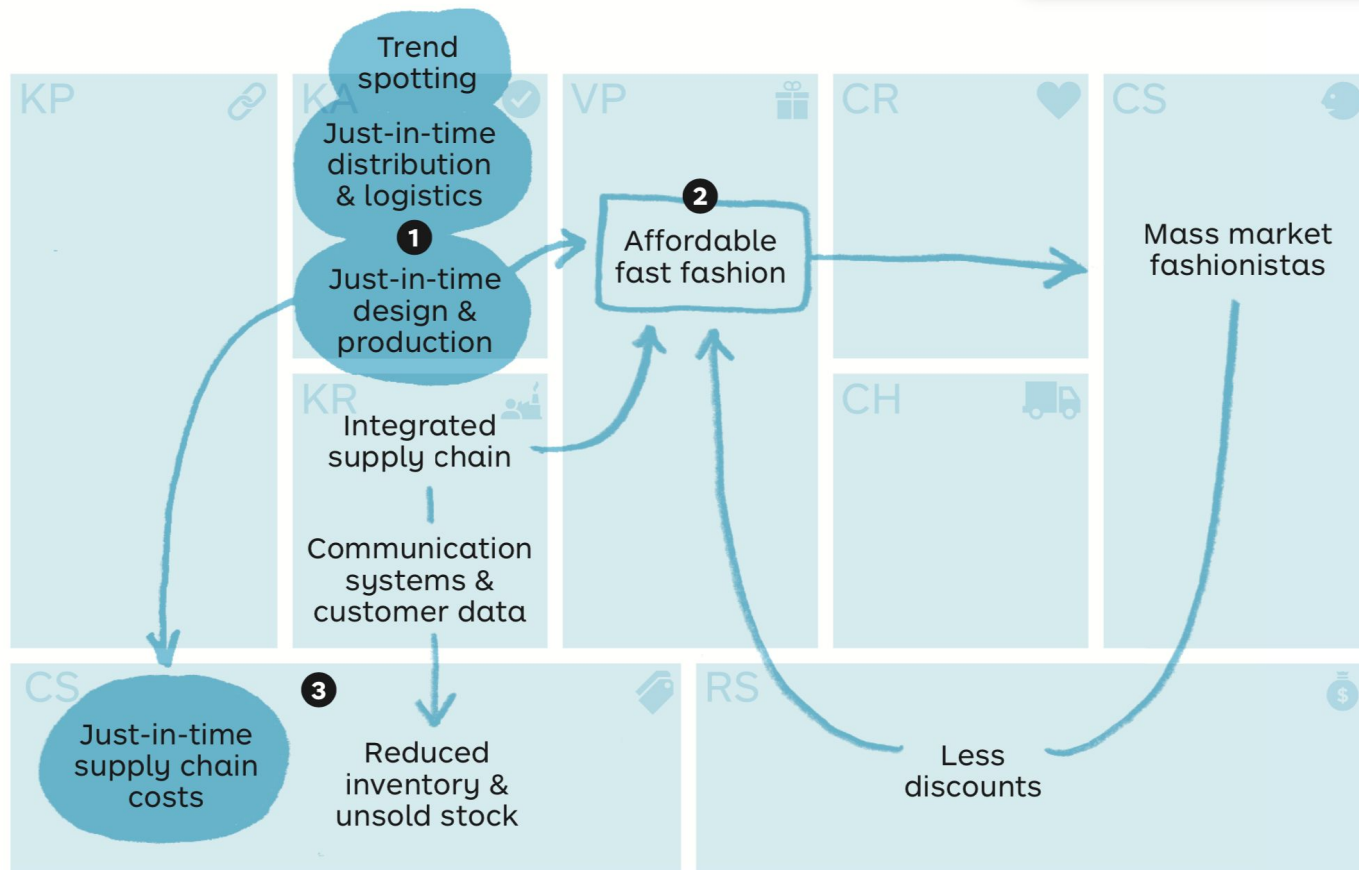
How to select valuable projects?

Streaming provider or Ecommerce retailer
looking to increase sales

- Better recommender system
- Better search
- Improve catalog data
- Price optimization

Questions

- What projects should we work on?
- What are the metrics for success?
- What are the resources (data, time, people) needed?



Zara: Optimize activities for speed

Example

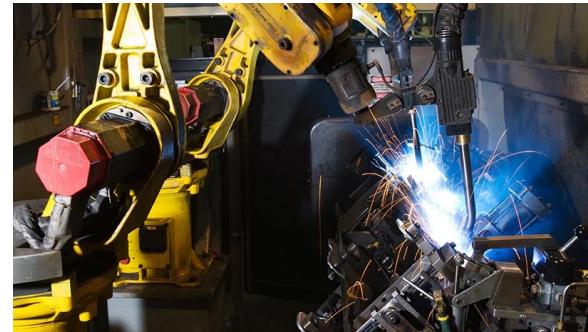


At 52 factories around the world, John Deere uses the Gas Metal Arc Welding (GMAW) process to weld mild- to high-strength steel to create machines and products.

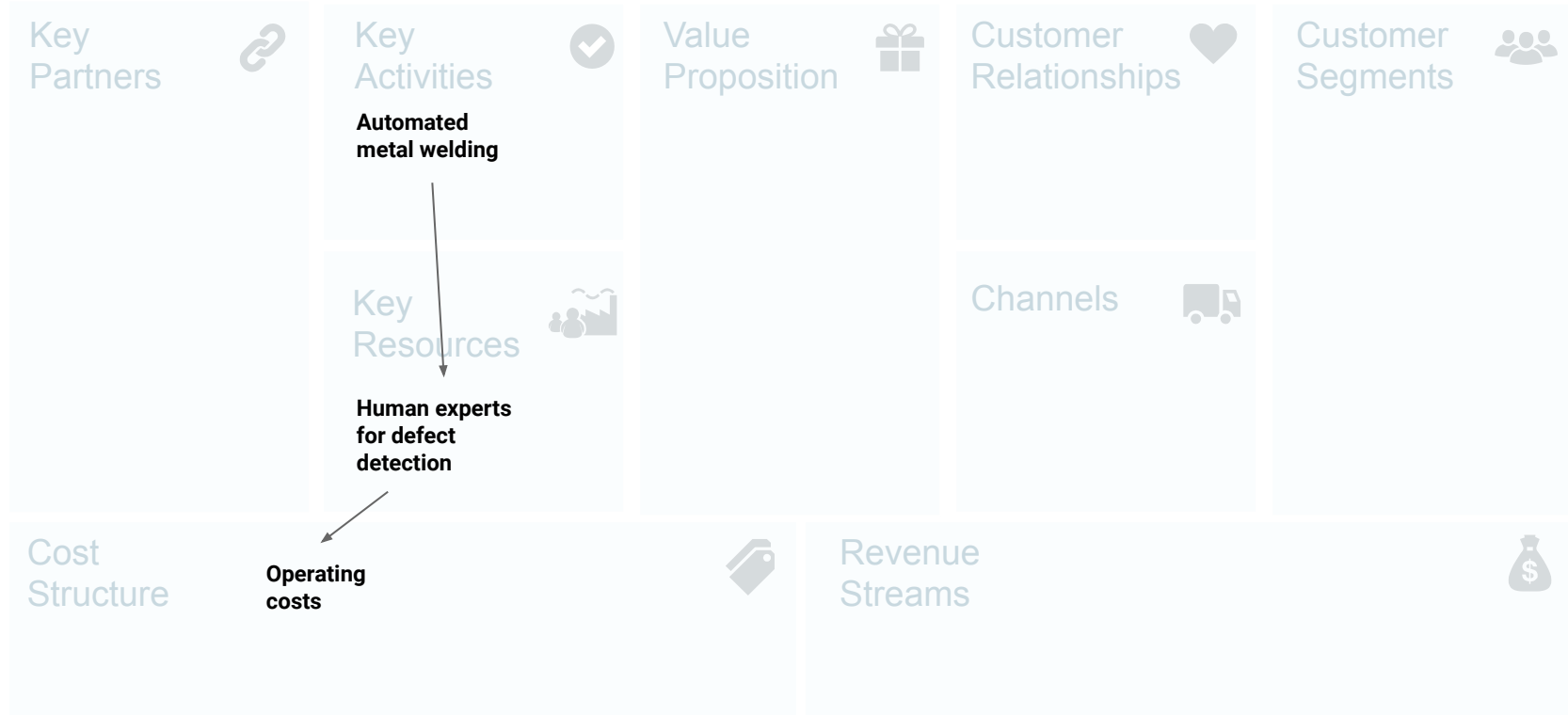
In these factories, hundreds of robotic arms consume millions of weld wire pounds annually.

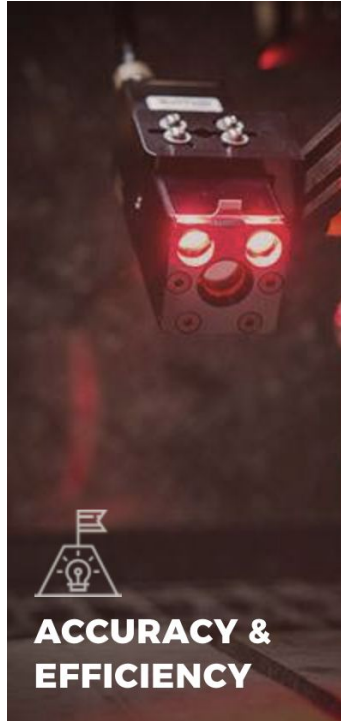
One common welding challenge felt across the industry is porosity, in which cavities in the weld metal are caused by trapped gas bubbles as the weld cools. The cavities weaken the weld strength.

Traditionally, GMAW defect detection has been a manual process requiring highly skilled technicians.



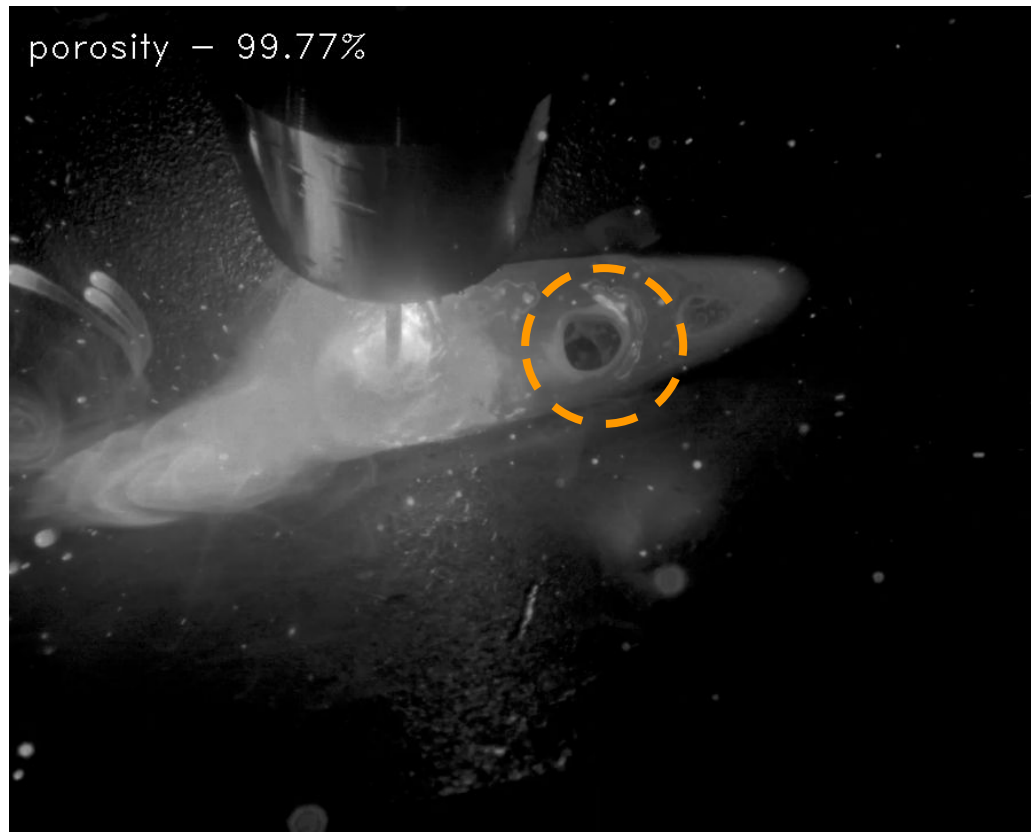
Business Model Canvas





MeltTools
Focused Welding Solutions

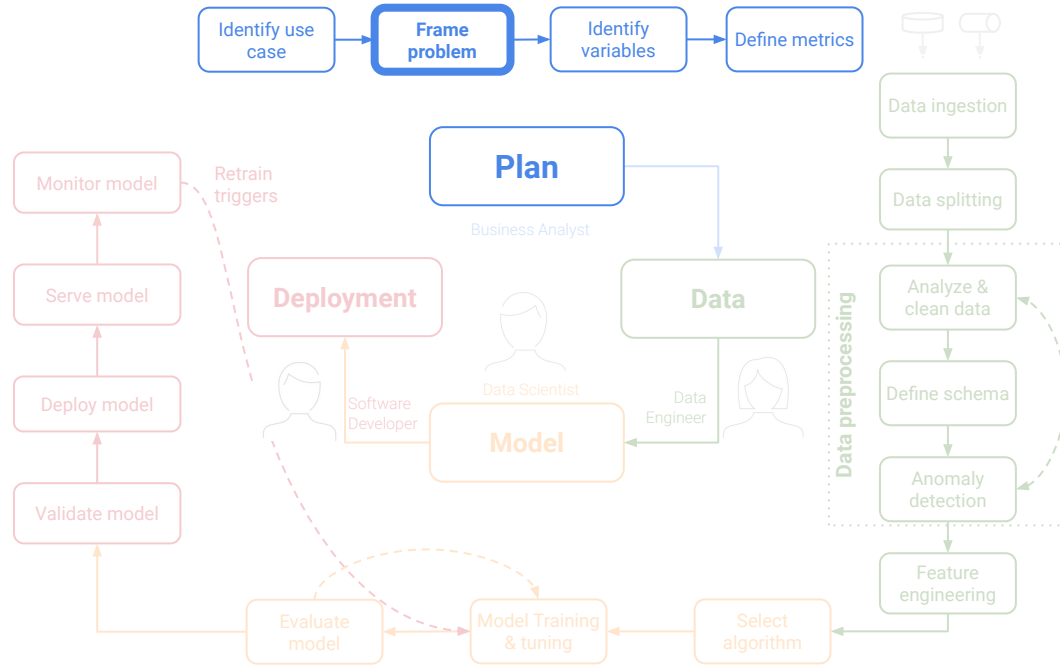
Visualizing welding in-process



Porosity weld recognition model

Data Science Lifecycle

Plan | Data | Model | Deployment



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:

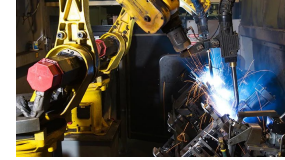
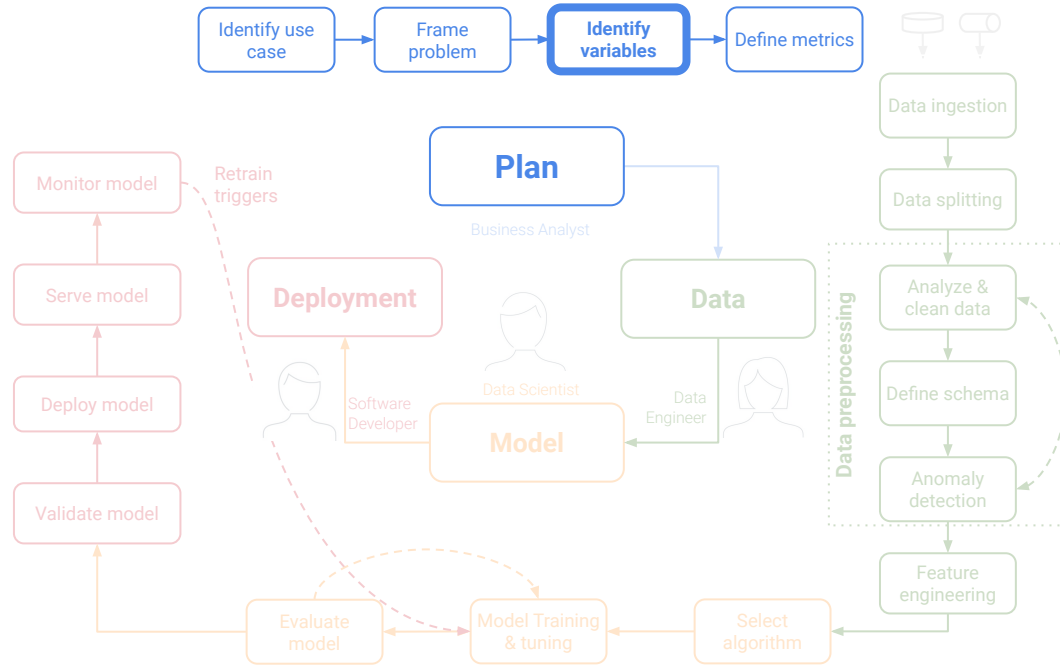


Image: Freepik.com

- 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

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4 Major **types** of data science projects



	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

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



Computer vision



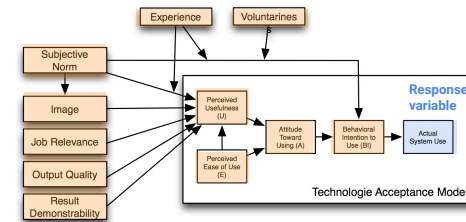
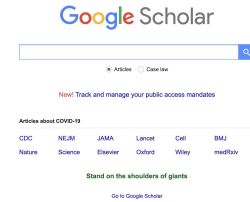
Natural language processing



Audio processing

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

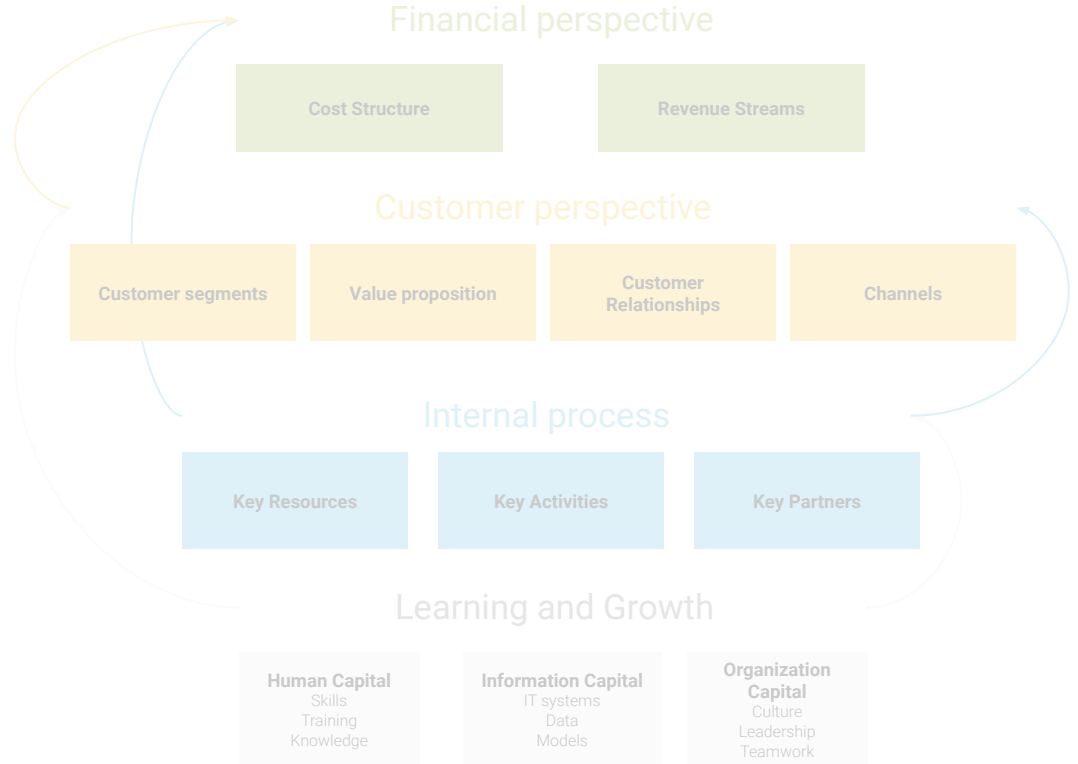
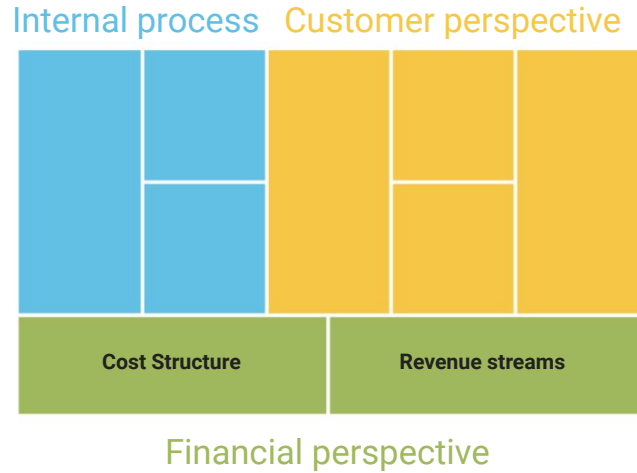
- **Goal:** show the primary variable of interest (**response variable**) and possible factors (**explanatory variables**)
 - **explanatory variable** → might affect → **response variable**
- Speak to **domain experts**
- Do **literature research** (e.g., using google scholar) to identify possible relationships between variables
- In business use cases you can also use a **strategy map**



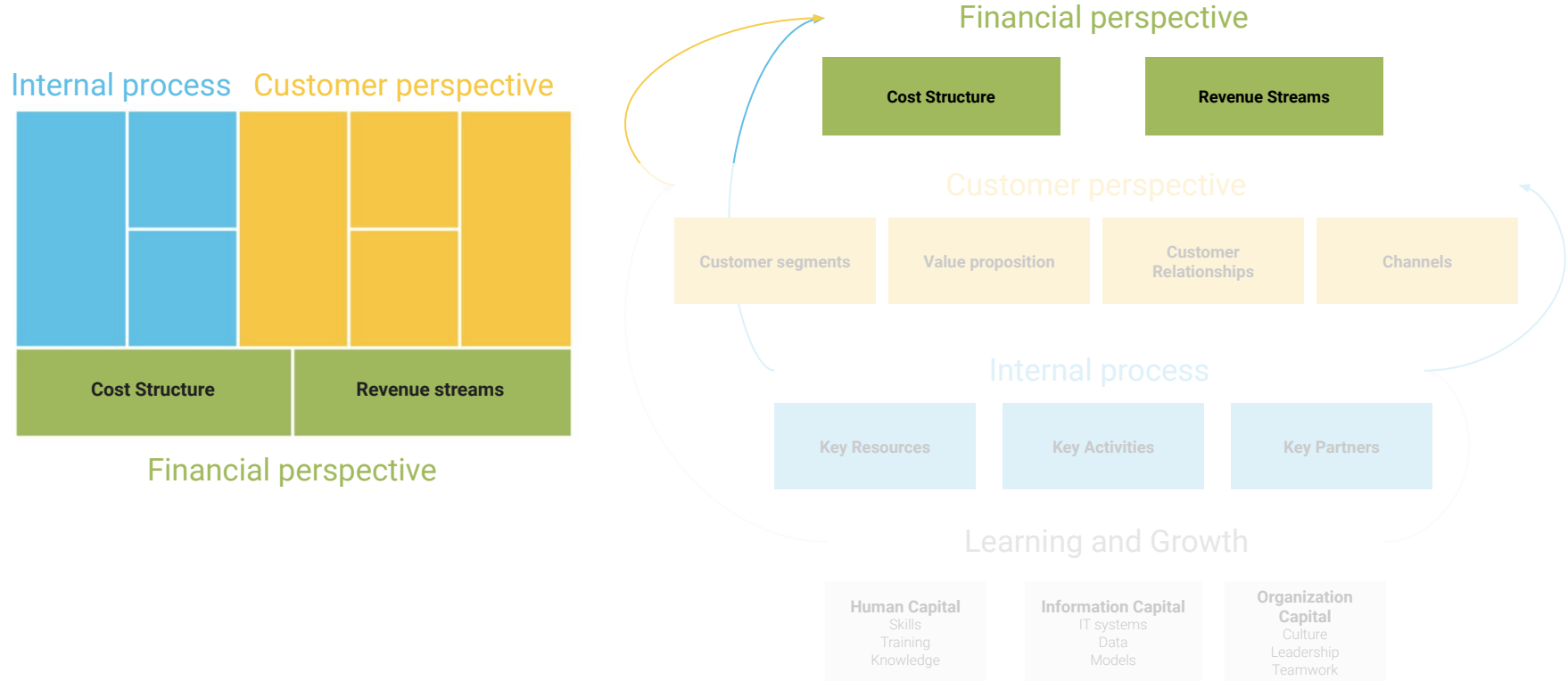
Venkatesh & Davis (2000)

Strategy Mapping

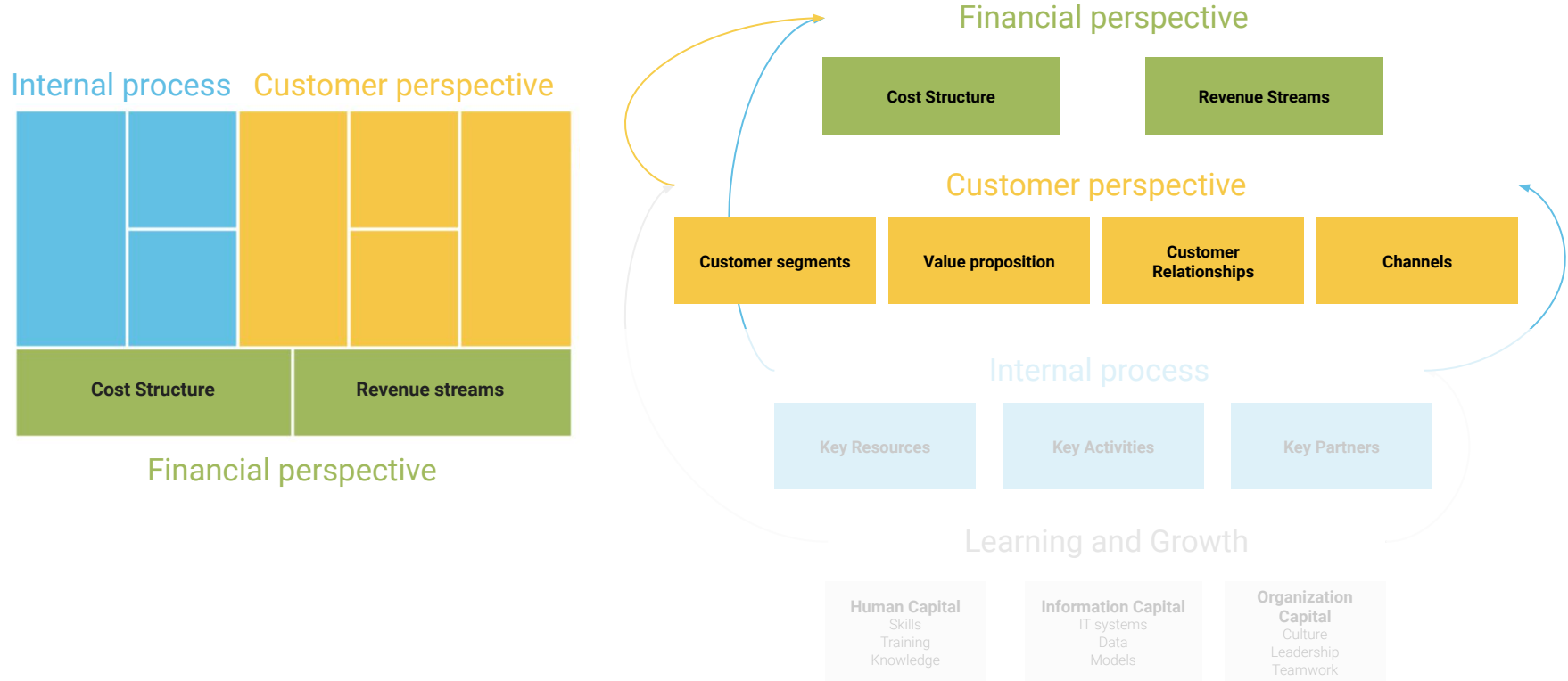
From BMC to Strategy Map



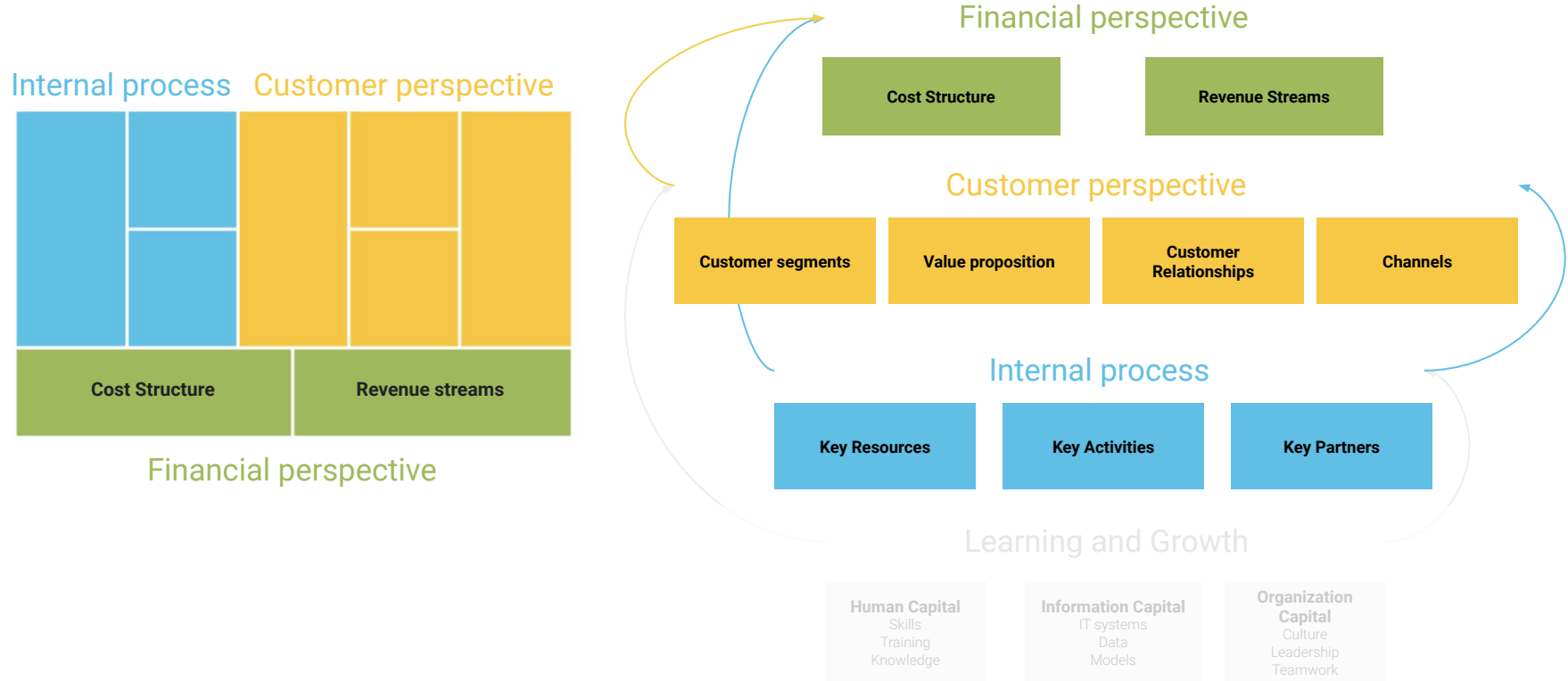
Financial perspective



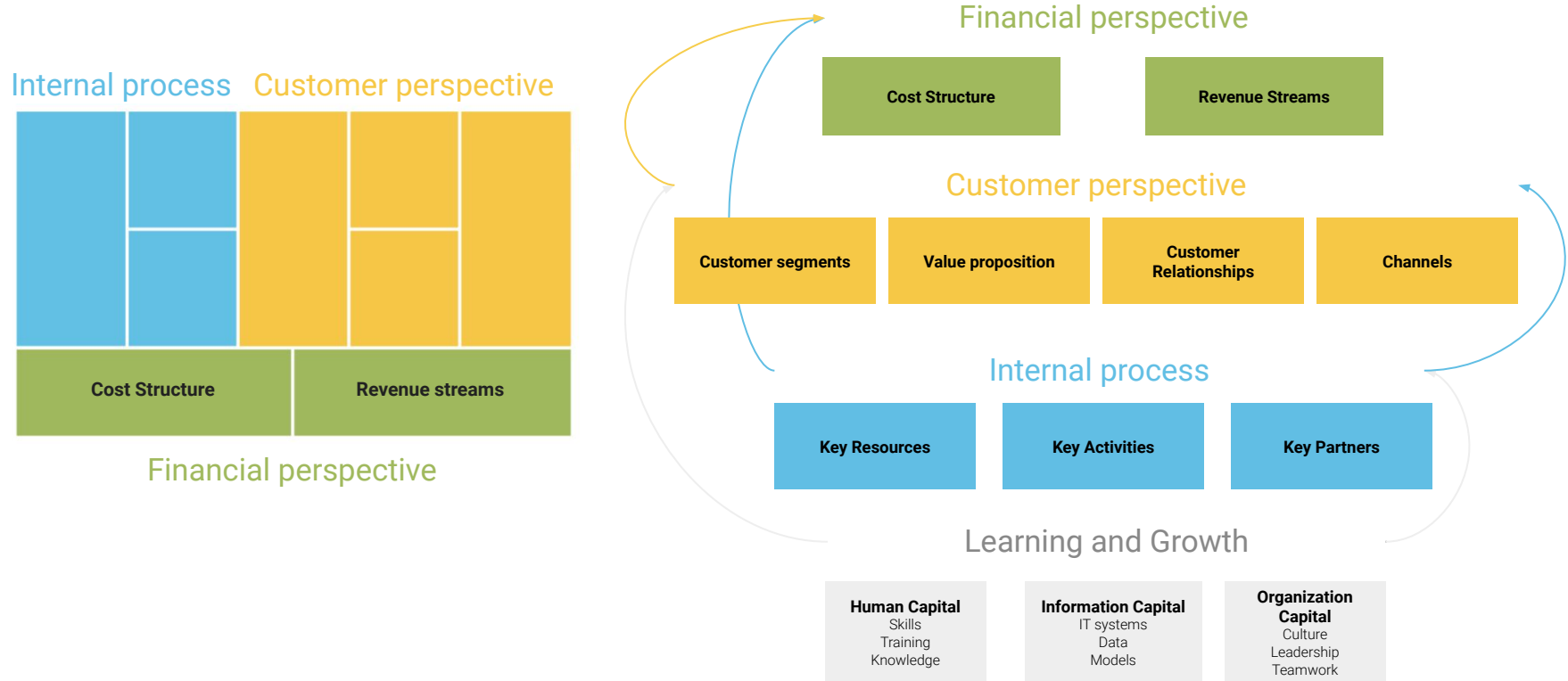
Customer perspective is our focus

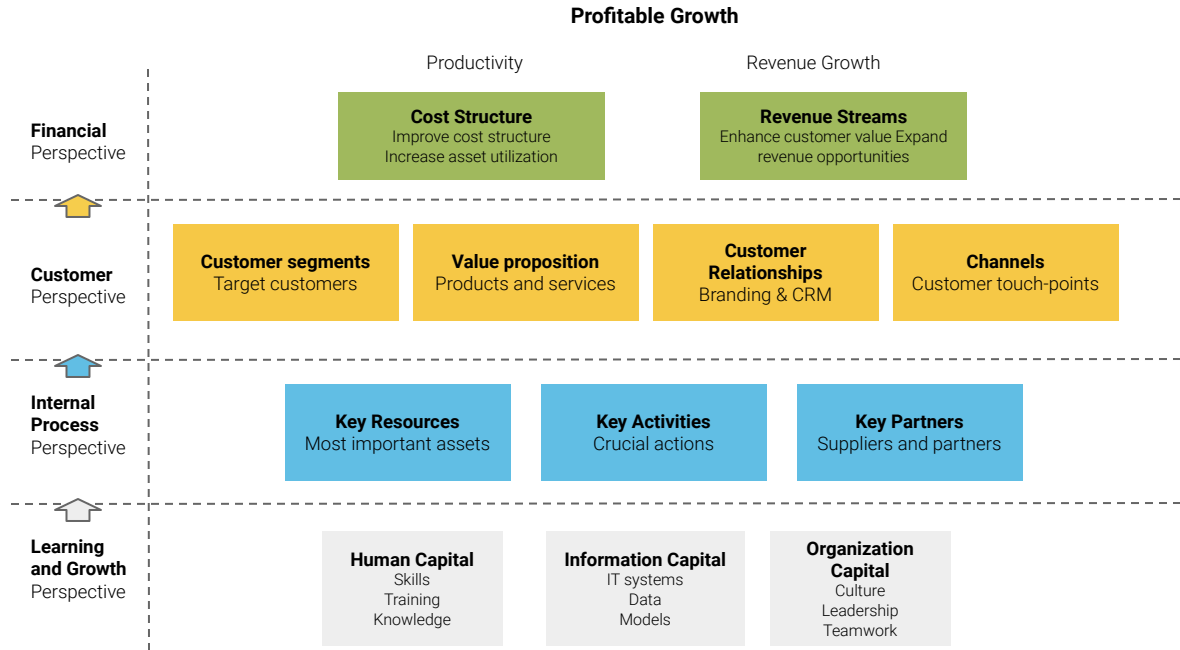


Internal processes



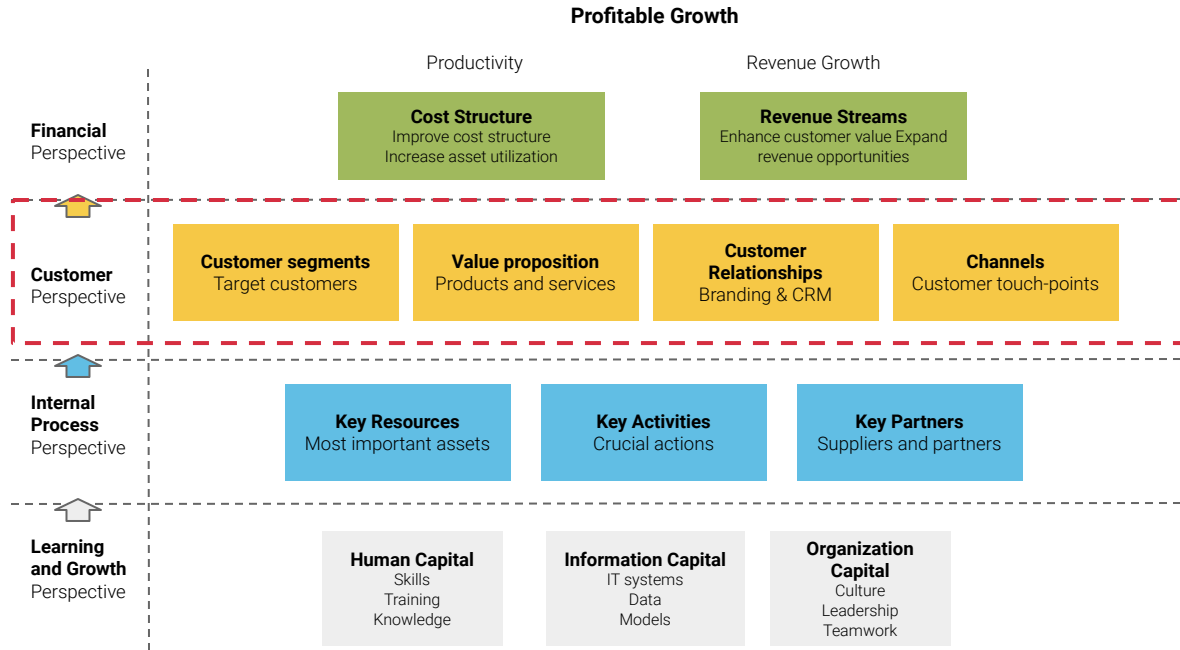
Learning and growth is the basis





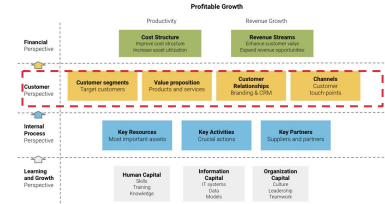
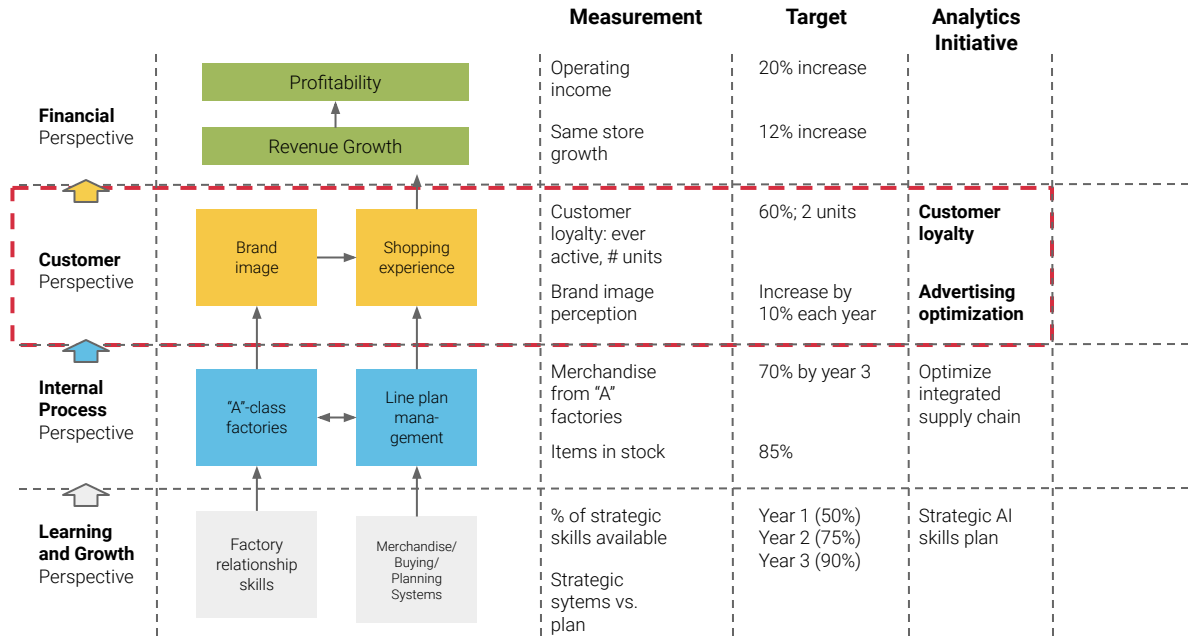
Strategy Map

Example



Customer perspective

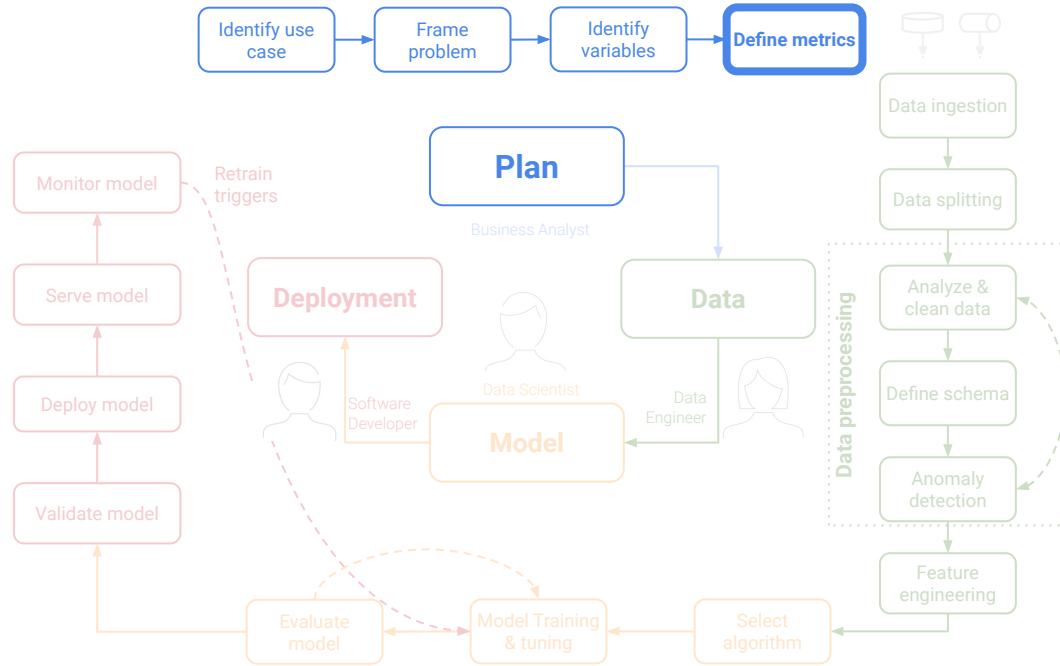
Example



Customer perspective

Data Science Lifecycle

Plan | Data | Model | Deployment



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:

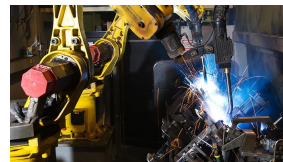


Image: Freepik.com

- 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% >

Define **success metrics** (anticipated outcomes)

Example

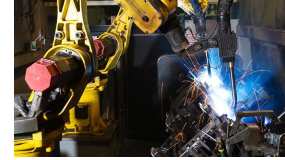


Image: Freepik.com

1) **Success metrics**

Our success metrics are < ... >

2) **Key results (KR) for the success metrics:**

Our key results (KR) for the success metrics are < ... >

3) **Model failure**

Our model is deemed a failure if < ... >

1) Success metrics

Our success metrics are

< **reduced operating costs & reduced downtime** >

2) Key results (KR) for the success metrics:

Our key results (KR) for the success metrics are

< **20% less labor costs and a reduction of downtime by 10%** >

3) Model failure

Our model is deemed a failure if

< **we only reduce operating costs by 15% or have a downtime reduction of 5%** >

How to select
between
multiple
initiatives?

Prioritization of initiatives

Customer perspective

1. Customer segments initiative
2. Value proposition initiative
3. Channels initiative
4. Customer relationship initiative

Internal process

5. Key activities initiative
6. Key resources initiative
7. Key partners initiative



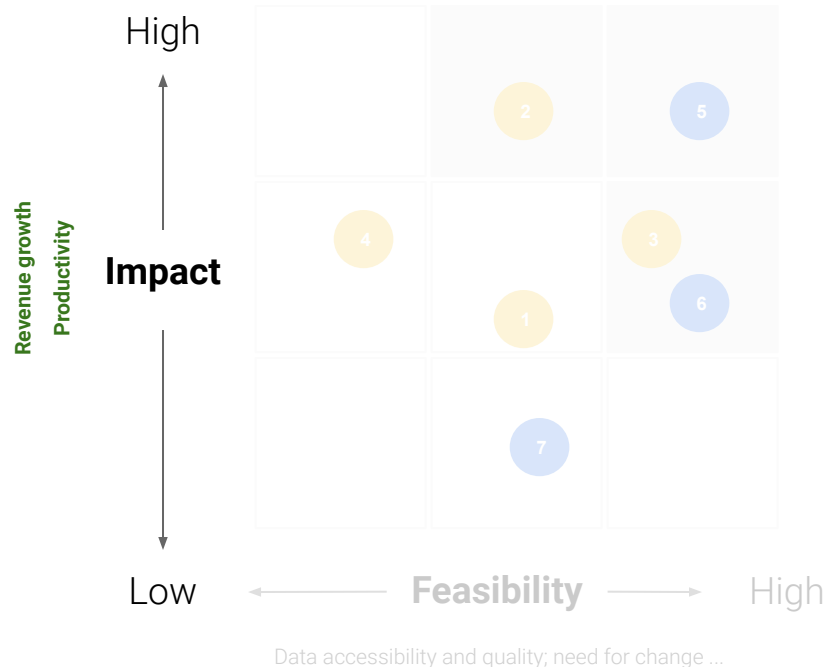
Look for initiatives with high impact

Customer perspective

1. Customer segments initiative
2. Value proposition initiative
3. Channels initiative
4. Customer relationship initiative

Internal process

5. Key activities initiative
6. Key resources initiative
7. Key partners initiative



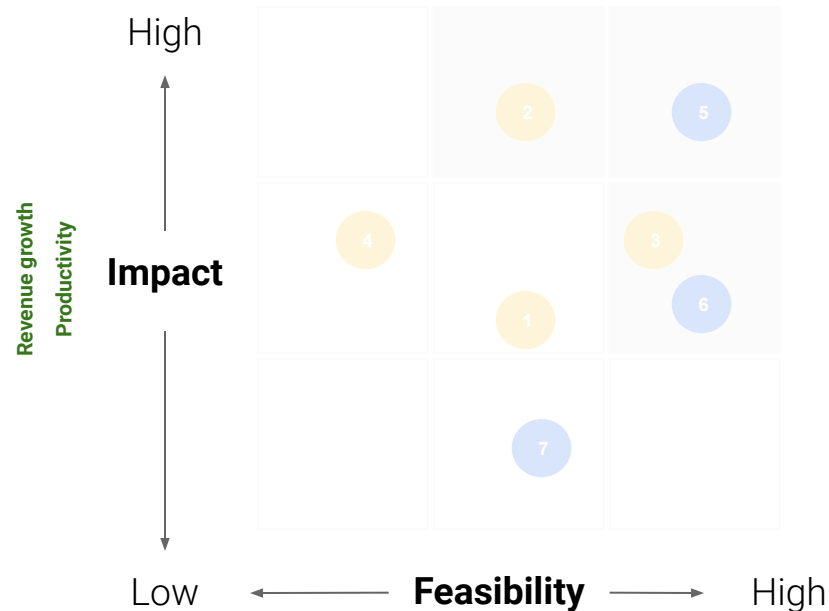
Which also have a high feasibility

Customer perspective

1. Customer segments initiative
2. Value proposition initiative
3. Channels initiative
4. Customer relationship initiative

Internal process

5. Key activities initiative
6. Key resources initiative
7. Key partners initiative



Prioritization of initiatives

Customer perspective

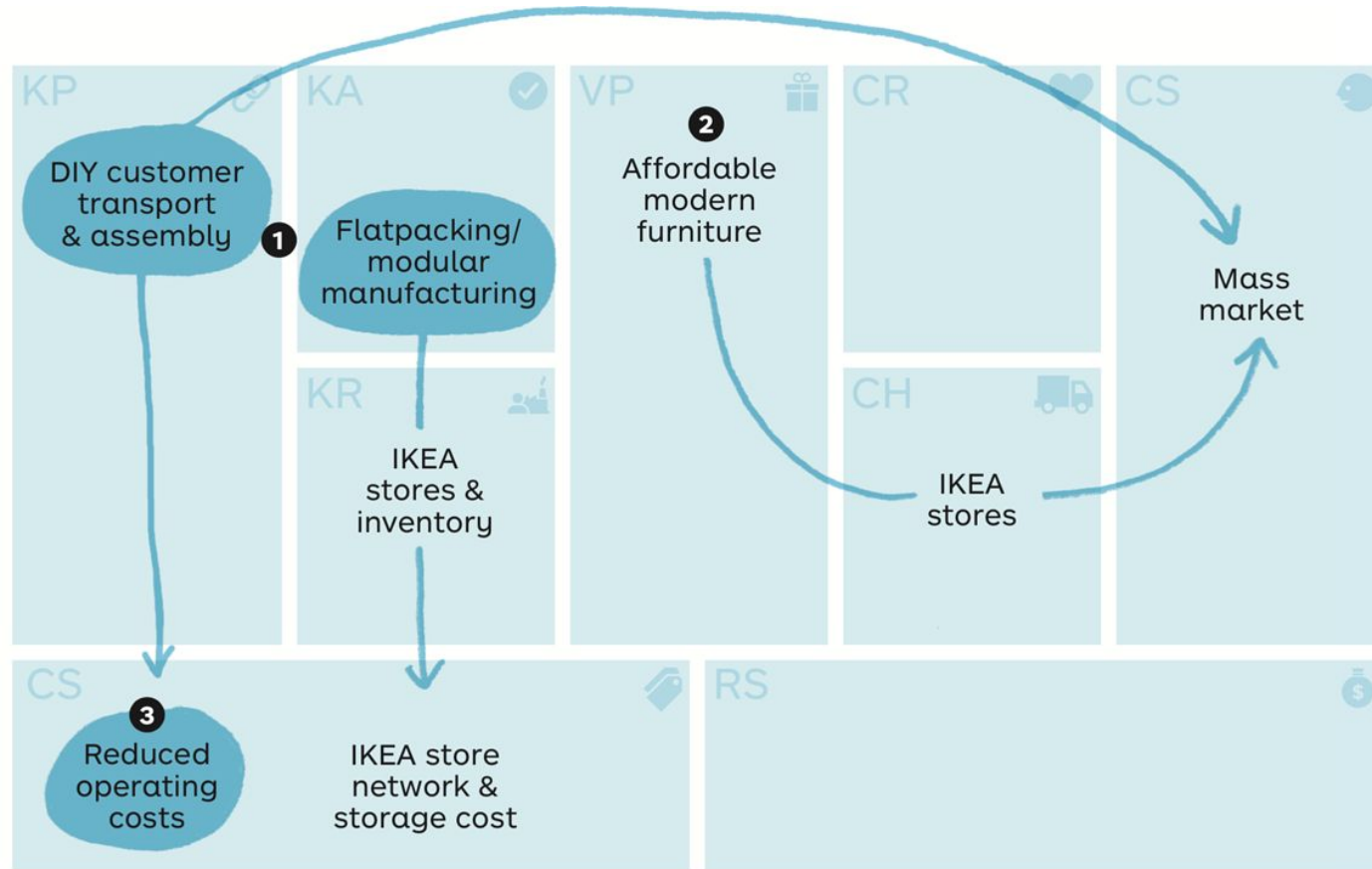
1. Customer segments initiative
2. Value proposition initiative
3. Channels initiative
4. Customer relationship initiative

Internal process

5. Key activities initiative
6. Key resources initiative
7. Key partners initiative



Backup

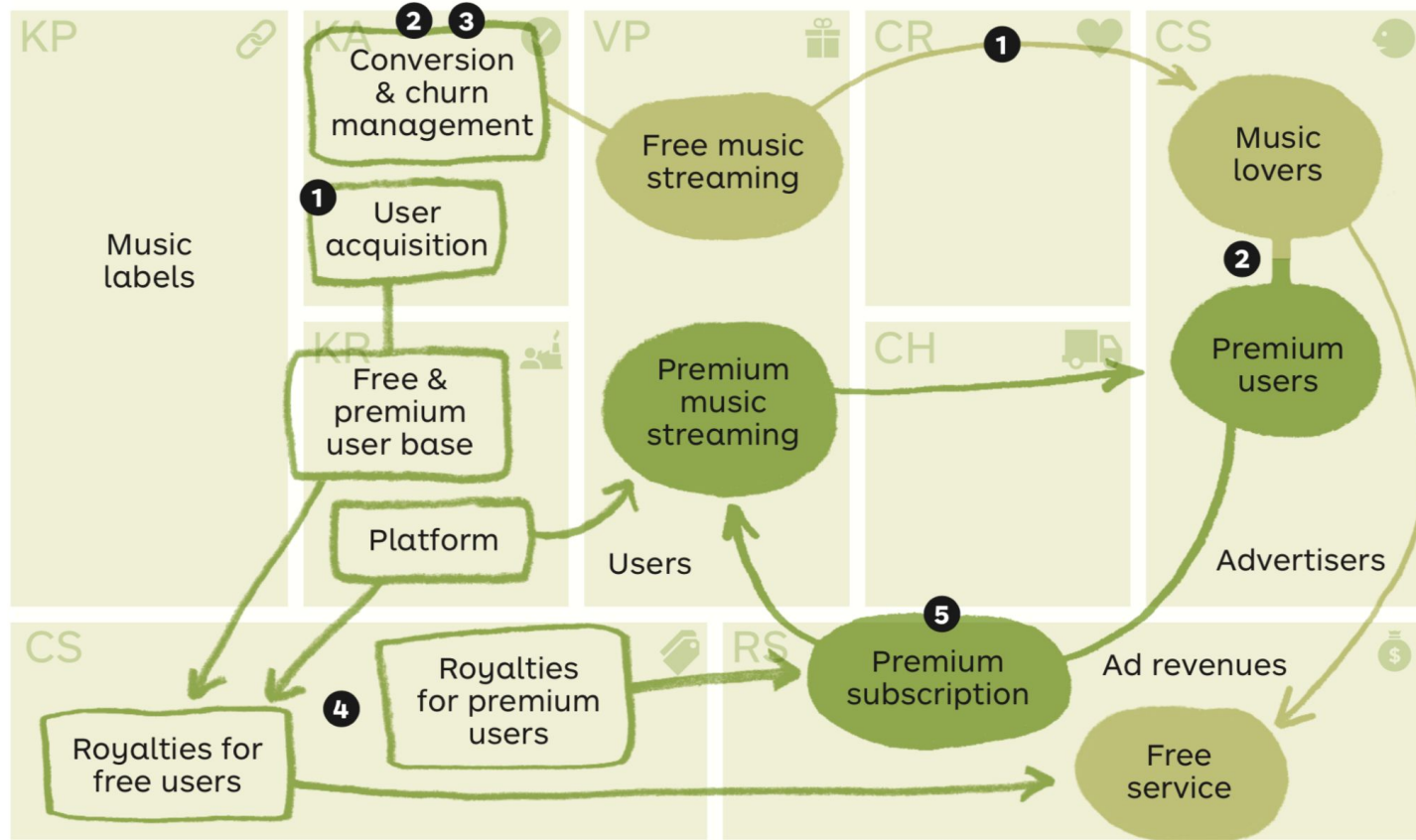


Customer insight:

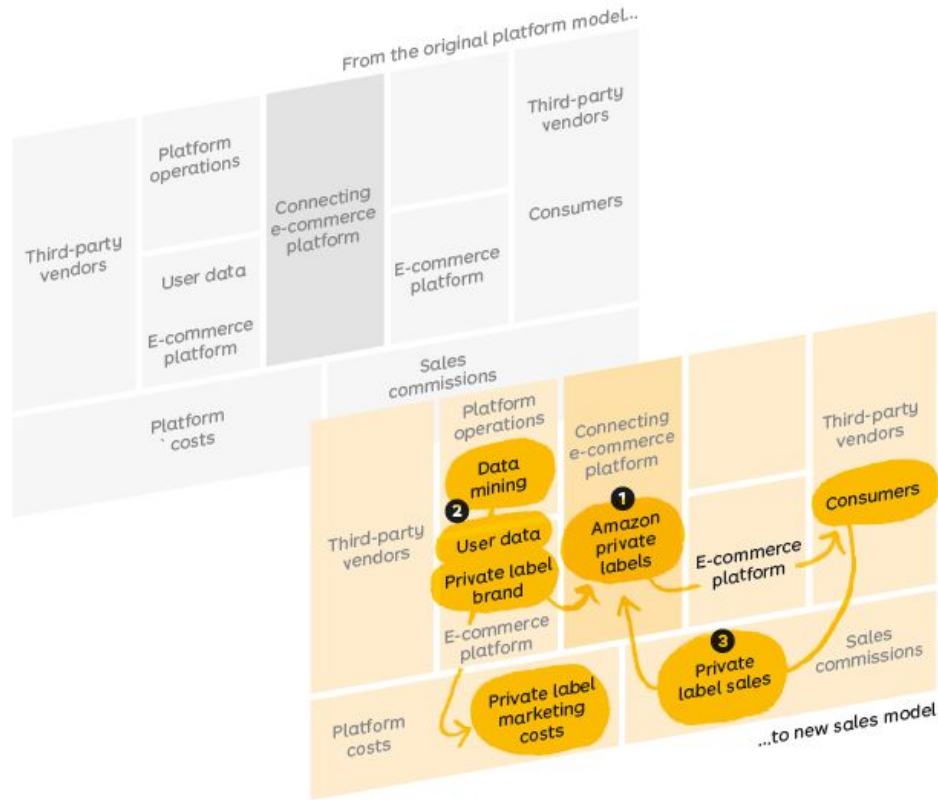
"I actually don't need furniture that will last a lifetime.

But I need modern, **affordable** furniture **right now** so I can stop sitting, eating and sleeping on the floor of this apartment."

Ikea: integrate customer in value chain



Spotify



Amazon private labels

The IoT Business Model Builder

(Bosch IoT Lab & Bosch Software Innovations GmbH)



Dominik Bilgeri

Researcher Bosch IoT Lab
ETH Zurich
dbilgeri@ethz.ch



Veronika Brandt

Senior Expert Business Development
Bosch Software Innovations GmbH
veronika.brandt@bosch-si.com



Marco Lang

Vice President Business Development
Bosch Software Innovations GmbH
marco.lang@bosch-si.com



Jan Tesch

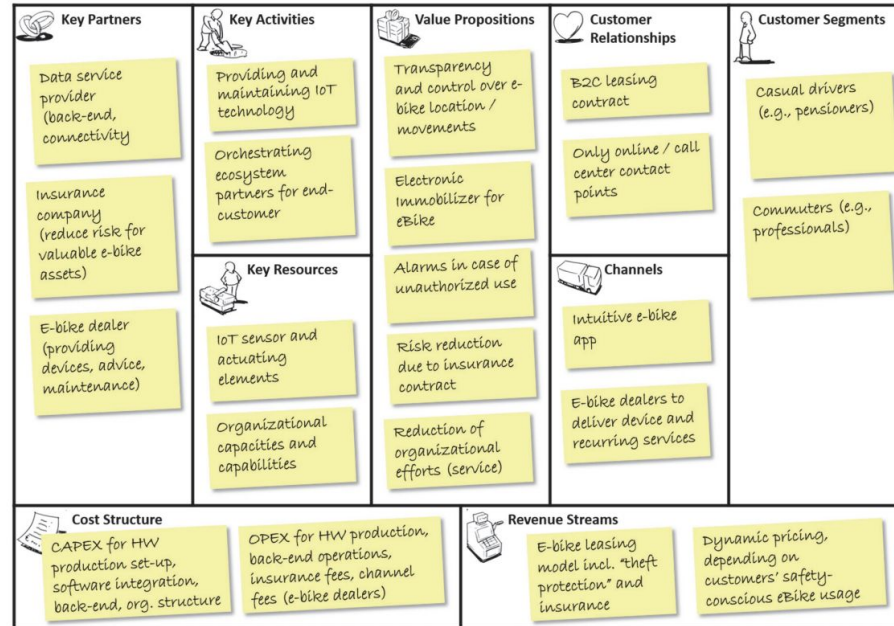
Business Development
Bosch Software Innovations GmbH
jan.tesch@bosch-si.com



Markus Weinberger

Director Bosch IoT Lab
Bosch Software Innovations GmbH
markus.weinberger@bosch-si.com

Business Model Canvas -



<http://www.businessmodelgeneration.com>

Figure 12: Osterwalder canvas for the node "full service provider" from the e-bike example (adapted from Osterwalder & Pigneur, 2010)

Model output

1) **Model output**

The output from the model will be < ... >

2) **Output format**

The output is defined as:

3) **Using the output**

The output from the ML model will be made < ... >

The outcome will be used for < ... >