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PRODUCT SPECIFICATIONS

Team 2

Program

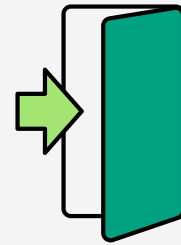
- **About us**
- **What are specifications and when are established?**
- **Establishing target specifications**
 - S** • Prepare the list of metrics
 - T** • Collect Competitive Benchmarking Information
 - E** • Set ideal and marginally acceptable target values
 - P** • Reflect on the results and the process
 - S** • Reflect on the results and the process
- **Setting the final specifications**
 - S** • Develop technical models of the product
 - T** • Develop a cost model of the product
 - E** • Refine the specifications, making trade-offs where necessary.
 - P** • Flow down the specifications as appropriate
 - S** • Reflect on the results and the process



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About us



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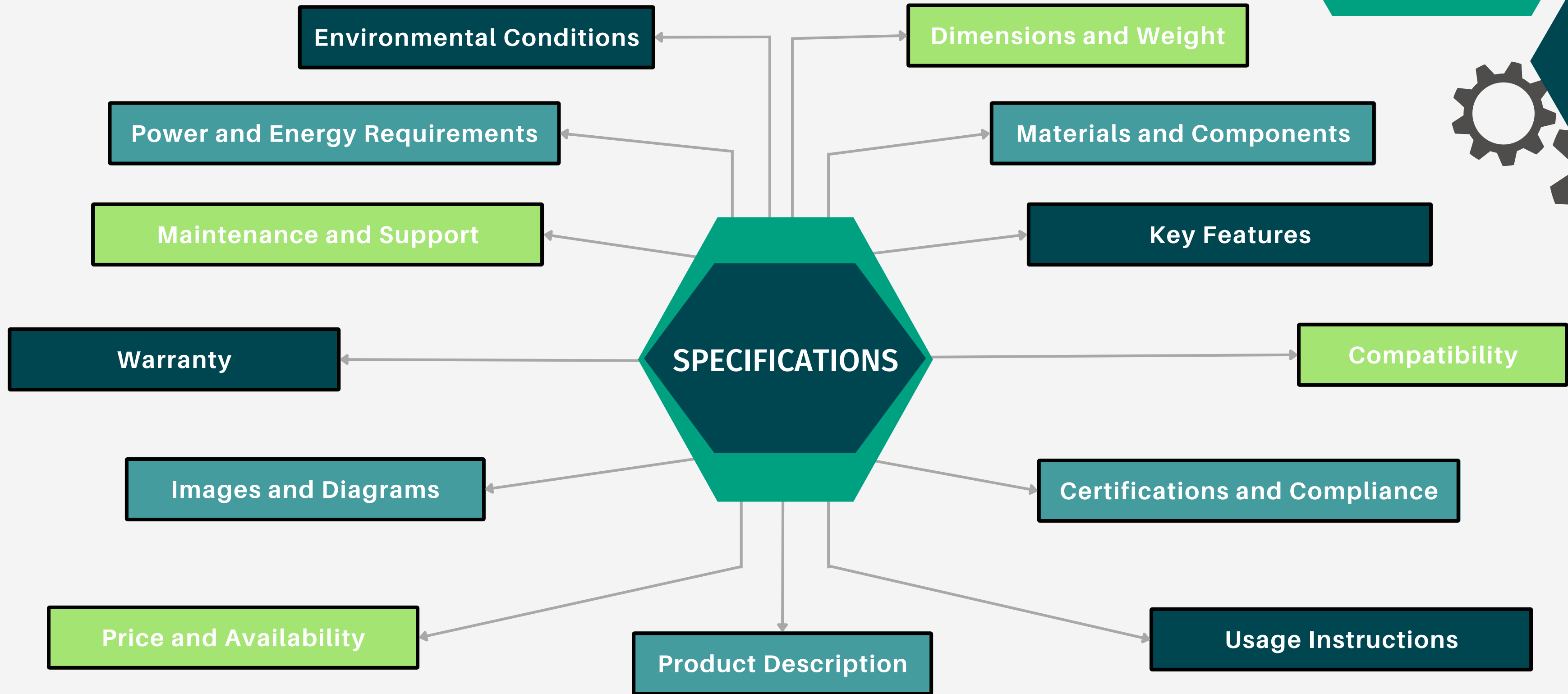
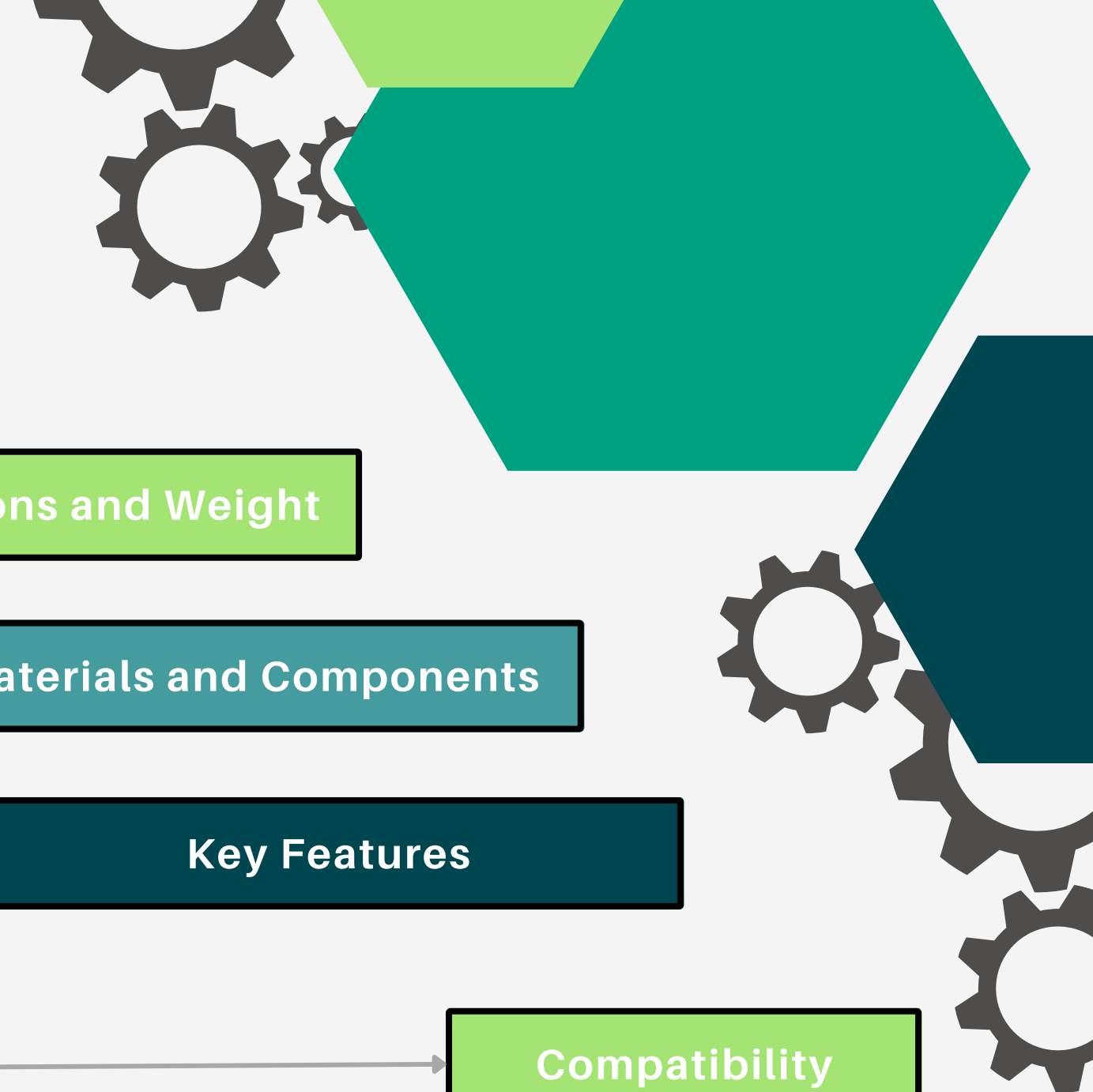




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WHAT ARE SPECIFICATIONS?

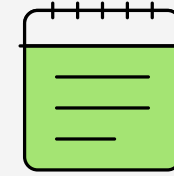




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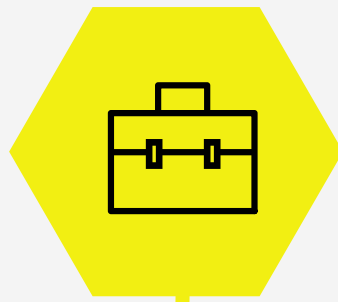
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WHEN ARE SPECIFICATIONS ESTABLISHED?



1

Identify
Customer Need



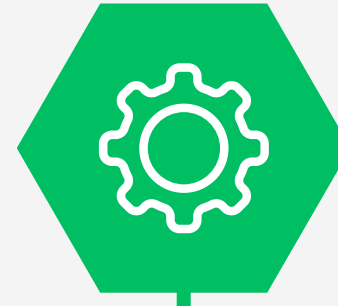
2

Establish Target
Specifications



3

Generate
Product Concept



4

Select Product
Concept(s)



5

Test Product
Concept(s)



6

Set Final
Specifications



7

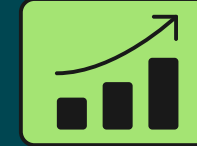
End of
Development



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ESTABLISHING TARGET SPECIFICATIONS



Set ideal and marginally acceptable target values

4.

Reflect on the results and the process

3.

Collect competitive benchmarking information

2.

1.

Preprepare the list of metrics



STEP 1

PREPARE THE LIST OF METRICS

WHAT ?

Metrics should directly reflect the degree of customer satisfaction and are nothing more than a number. They can be in absolute value or as a percentage.

WHY ?

Metrics are essential for understanding, improving, and guiding decisions in business and product development, acting as a map in an unfamiliar terrain.






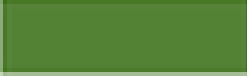

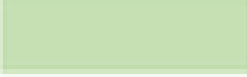
Step 1



Step 1

The needs-metrics matrix

 Boston Dynamics		METRIC					
		DRIVE SYSTEM	GEOMETRICAL DEXTERITY	PATH MEASURING SYSTEM	ROBOT SIZE	MATERIAL OF ROBOT	WEIGHT OF ROBOT
N E E D	1. PAYLOAD	STRONG	WEAK	WEAK	MODERATE	STRONG	WEAK
	2. ACCURACY	MODERATE	MODERATE	STRONG	WEAK	WEAK	MODERATE
	3. LIFE-EXPECTANCY	MODERATE	WEAK	WEAK	WEAK	MODERATE	WEAK
	4. VELOCITY OF ROBOT	MODERATE	STRONG	MODERATE	MODERATE	MODERATE	WEAK
	5. PROGRAMMING FLEXIBILITY	WEAK	STRONG	STRONG	WEAK	WEAK	MODERATE
	6. TOTAL COST	MODERATE	WEAK	WEAK	STRONG	STRONG	WEAK

 STRONG
 MODERATE
 WEAK

Step 1

Table of GUIDELINES

01

Metrics should be complete

02

Metrics should be dependent, not independent variables

03

Metrics should be practical

04

Some needs cannot easily be translated into quantifiable metrics

05

The metrics should include the popular criteria for comparison in the marketplace

STEP 2

COLLECT COMPETITIVE BENCHMARKING INFORMATION



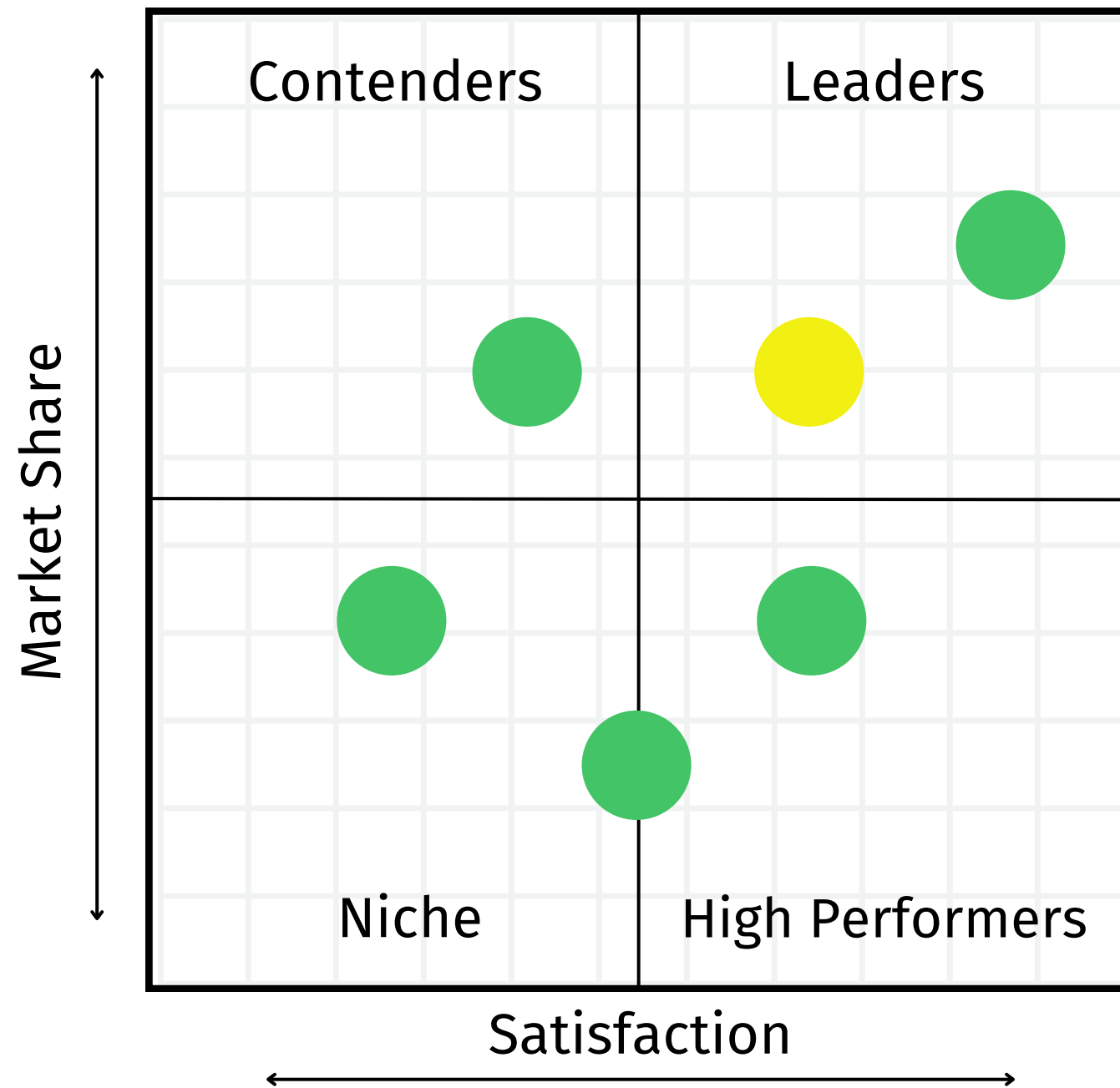
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Step 2

Competitive Landscape

● Your company ● Competitors



Step 2



Step 2



ANYmal

Mobility

Stability

Sensor



Spot

Environmental
resistance

Adaptability

Vision

Step 2



**Voliro & Shell &
Intertek**



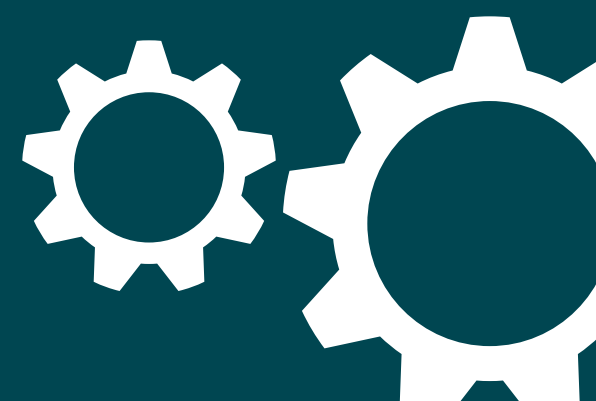
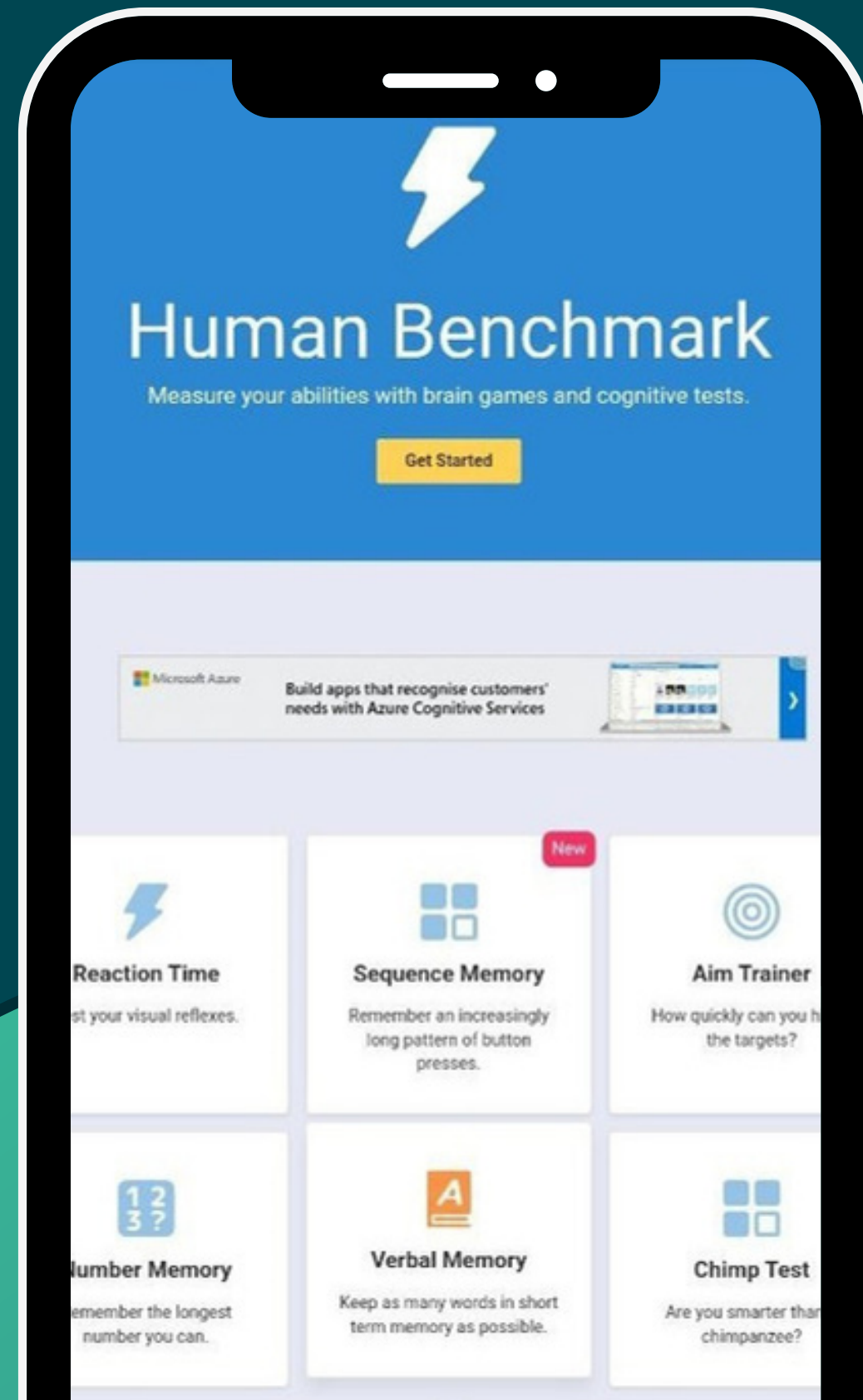
ANYmal



**Waygate
Technologies and
PETRONAS**



Test Yourself



STEP 3

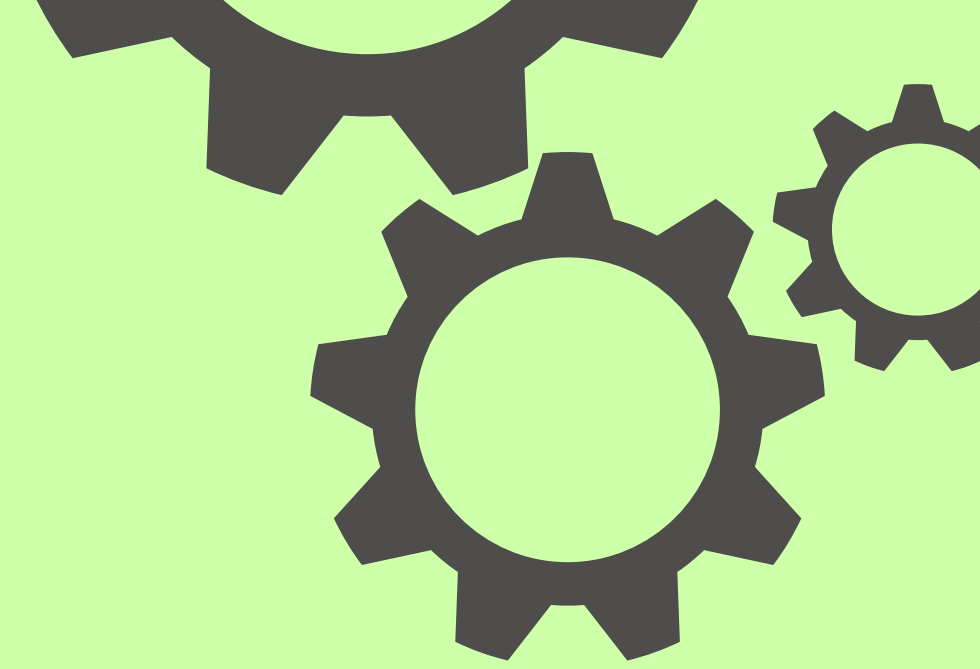
Set ideal and marginally acceptable target values



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Step 3



**Targets
Values**

**Marginally
acceptable**

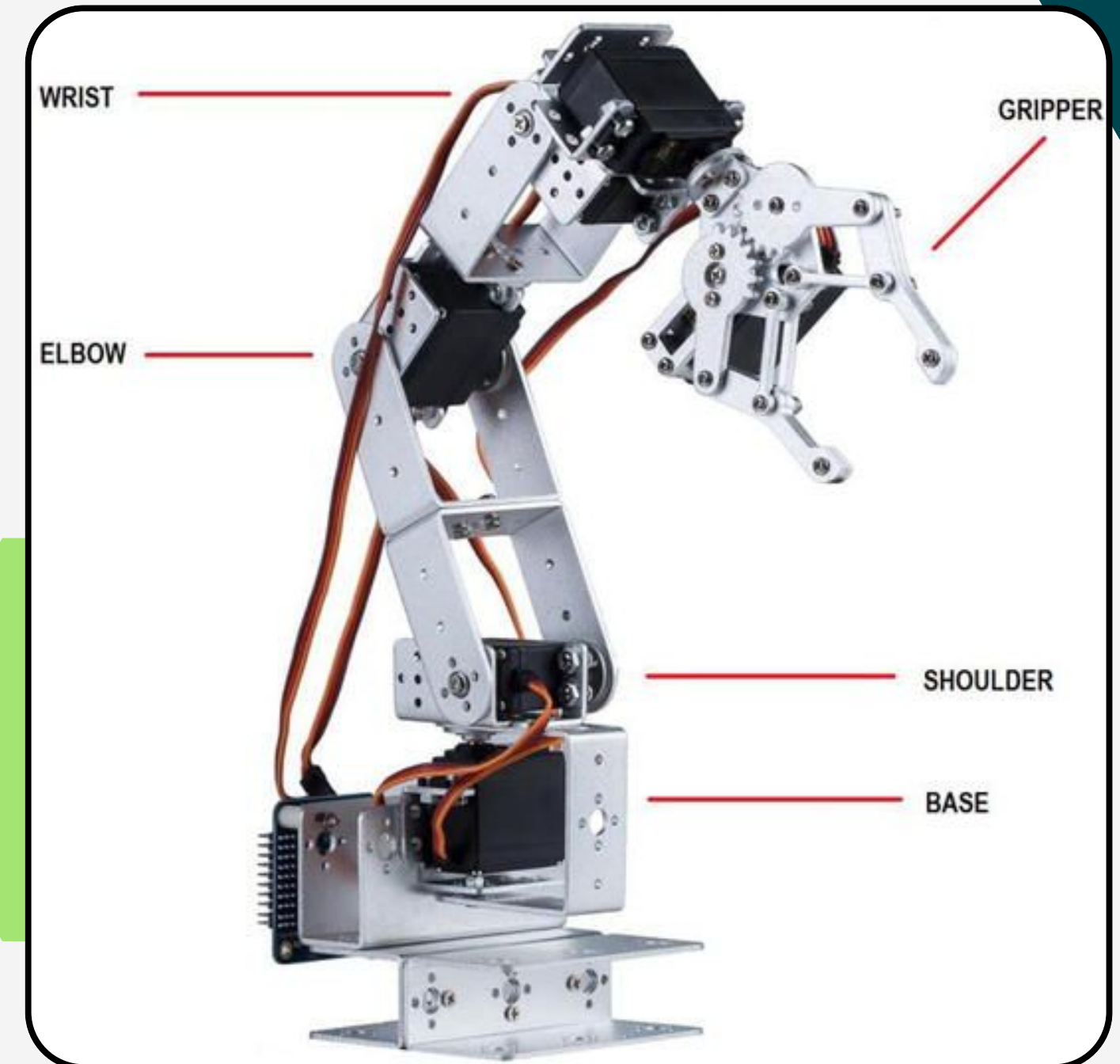
Ideal



Step 3

Target values for a metric CLASSIFICATION

- **AT LEAST**
- **AT MOST**
- **BETWEEN**
- **EXACTLY**
- **SET OF DISCRETE VALUES**



STEP 4

REFLECT ON THE RESULTS AND THE PROCESS

An assessment on the specifications set

- **Any specification missing ?**
- **Any specification useless or incomplete ?**
- **Do they define a viable product ?**



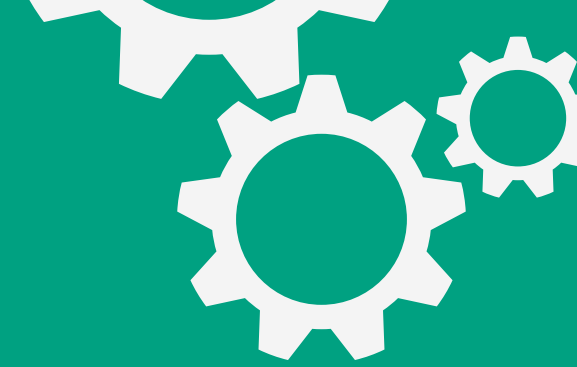
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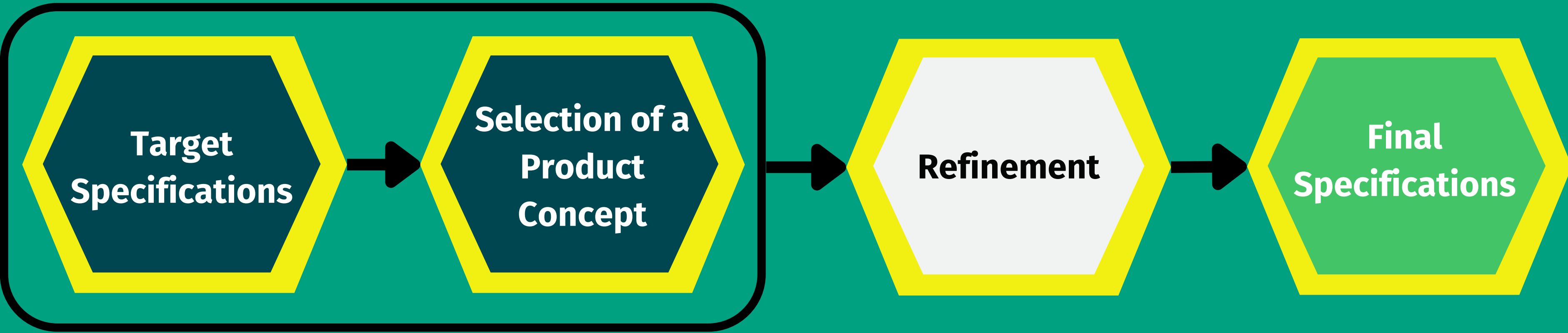


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SETTING THE FINAL SPECIFICATIONS





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SETTING THE FINAL SPECIFICATIONS

Refinement

CONSTRAINS

- Technology
- Production costs

TRADE-OFFS

- Metric-Metric
- Metric-Cost

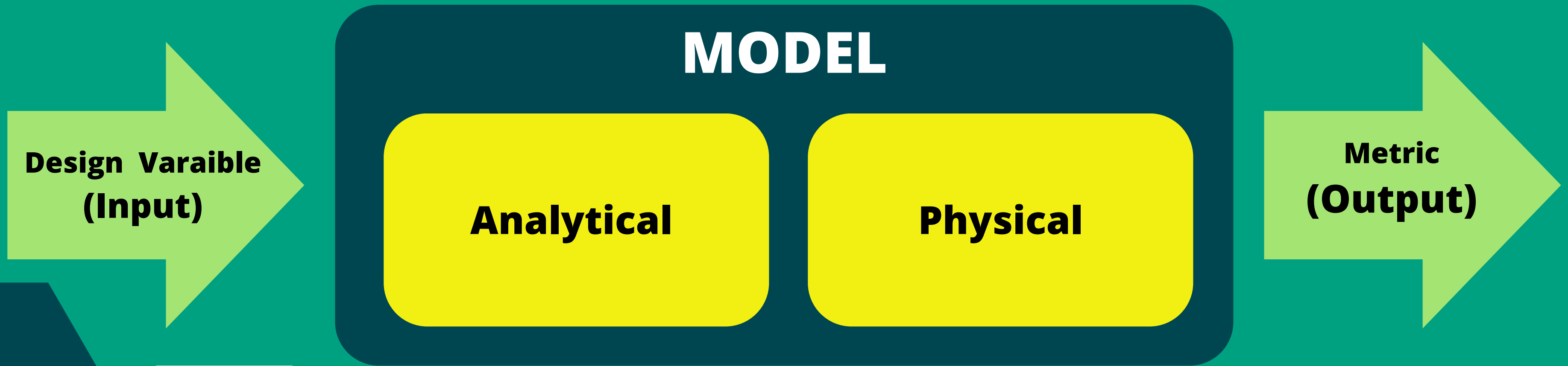
Five-step Process

- 1. Develop technical models of the product**
- 2. Develop a cost model of the product**
- 3. Refine the specifications, making trade-offs where necessary.**
- 4. Flow down the specifications as appropriate**
- 5. Reflect on the results and the process**

STEP 1



DEVELOP TECHNICAL MODELS OF THE PRODUCT

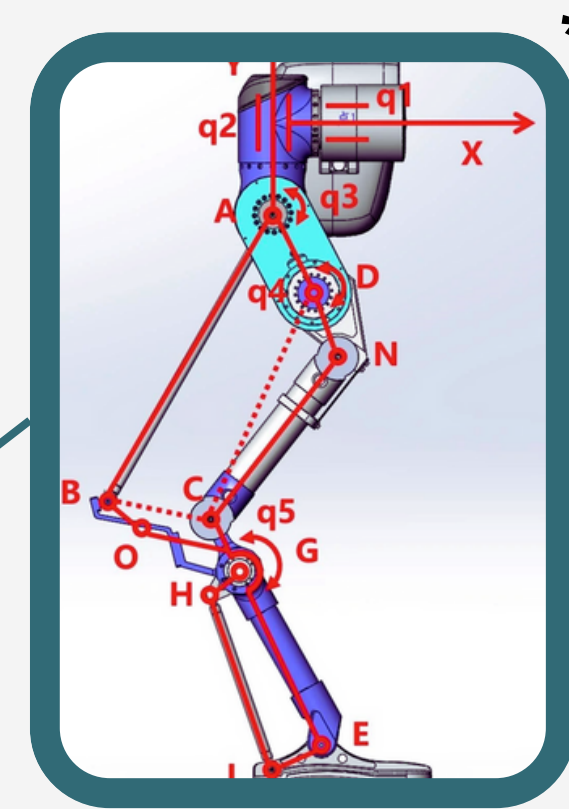


“ Prototyping ”

Step 1

Analytical model

- Model equations
- Computer simulation
- Computer models

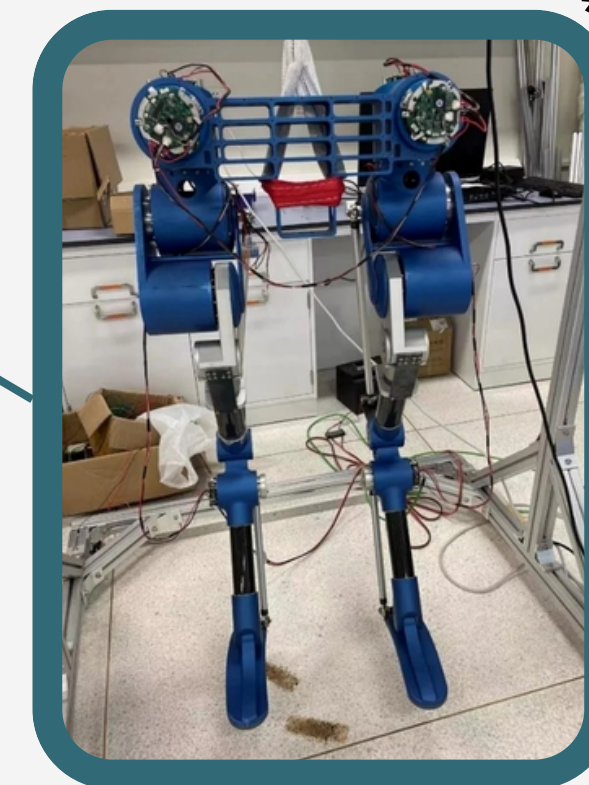


Focused

Comprehensive

Physical model

- Tangible artifacts



** Biped Robot Based on Spring Mass Model*
<https://www.azorobotics.com/Article.aspx?ArticleID=488>

STEP 2

DEVELOP A COST MODEL OF THE PRODUCT

How much do you think the Spot and ANYmal robots cost?



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STEP 2

DEVELOP A COST MODEL OF THE PRODUCT

How much do you think the Spot and ANYmal robots cost?

\$74,500



\$150,000



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Why are these robots so expensive??

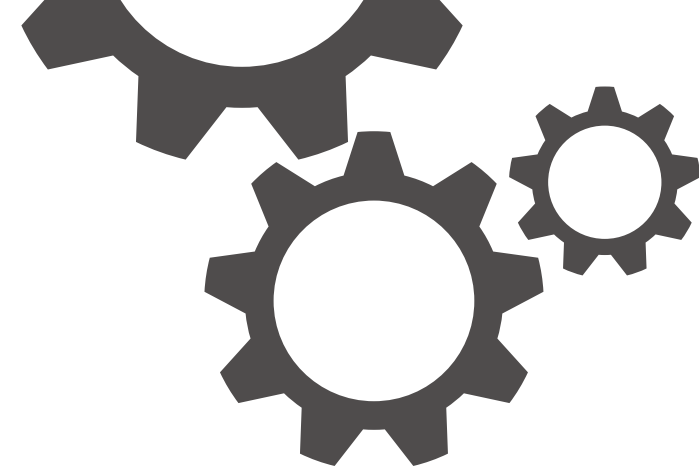
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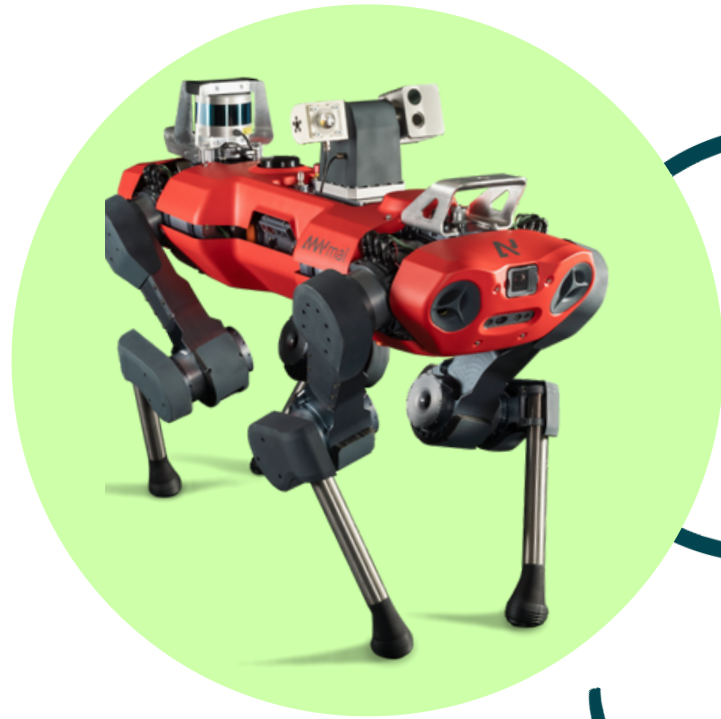


materials
robustness

workload

user friendly

customization

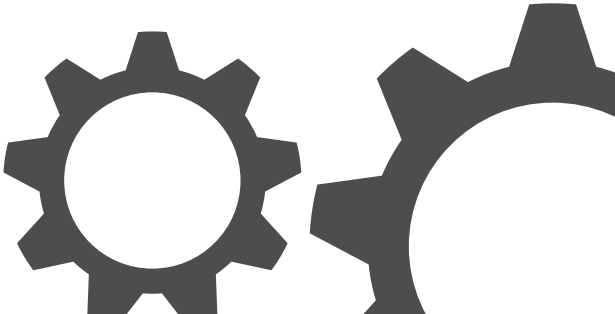
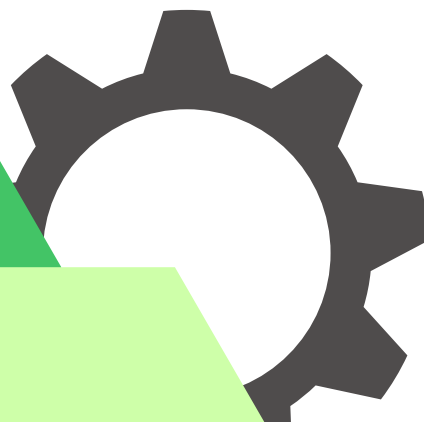


advanced
mobility

advanced sensors

battery autonomy

specialized
applications



Cost modeling 101

Adequate profits

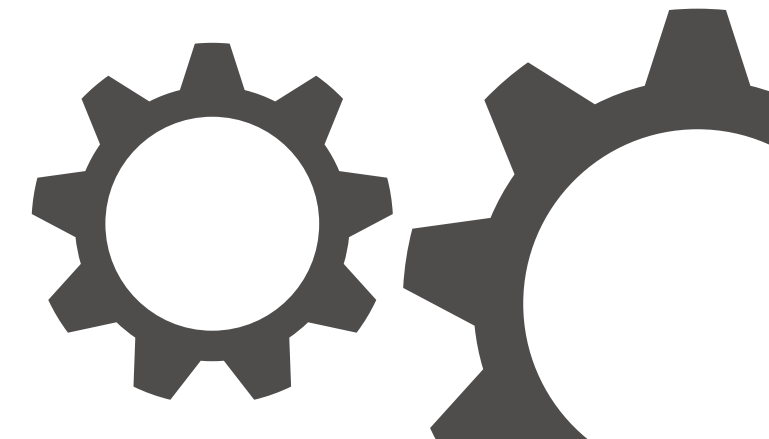
keeping in mind a range of uncertainty in the estimates

Iterative bill of materials

unknown number/type of components in the final product

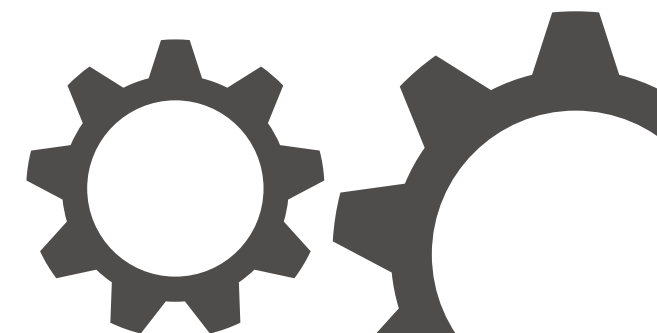
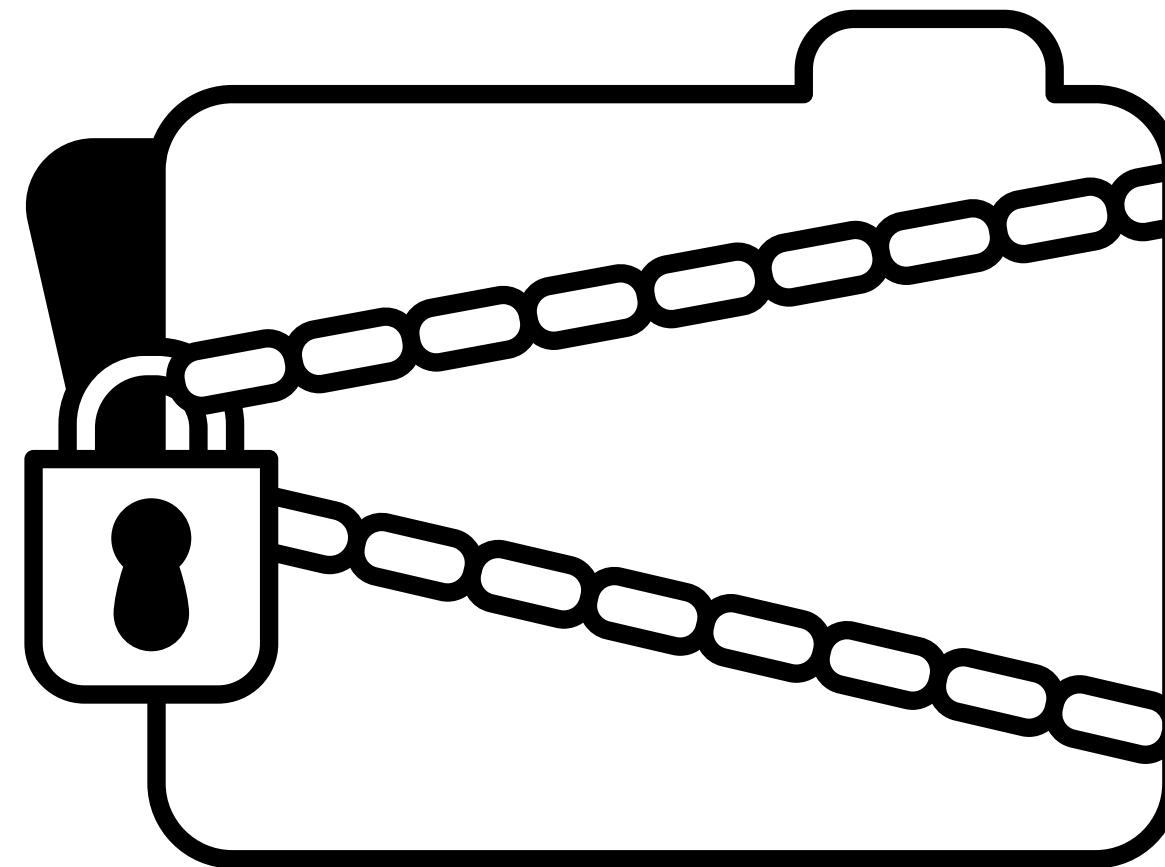
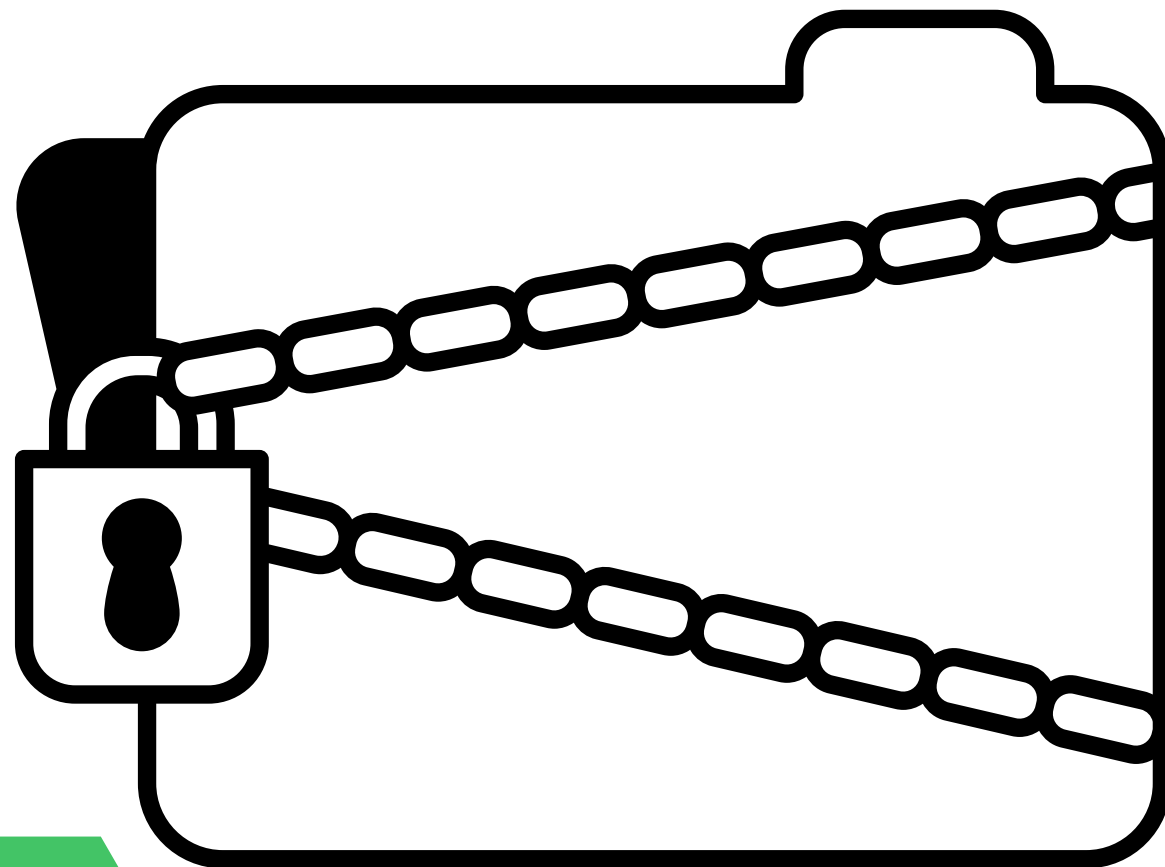
Target Cost

looking for a competitive price



In the end, which robot would you buy?

- How many pieces do you think were sold, each year, since the release date of the product?



In the end, which robot would you buy?

- How many pieces do you think were sold, each year, since the release date of the product?

BostonDynamics



- **400 pieces
per year**

AMRbotics

- **400 pieces
per year**

STEP 3

REFINE THE SPECIFICATIONS, MAKING TRADE-OFFS WHERE NECESSARY

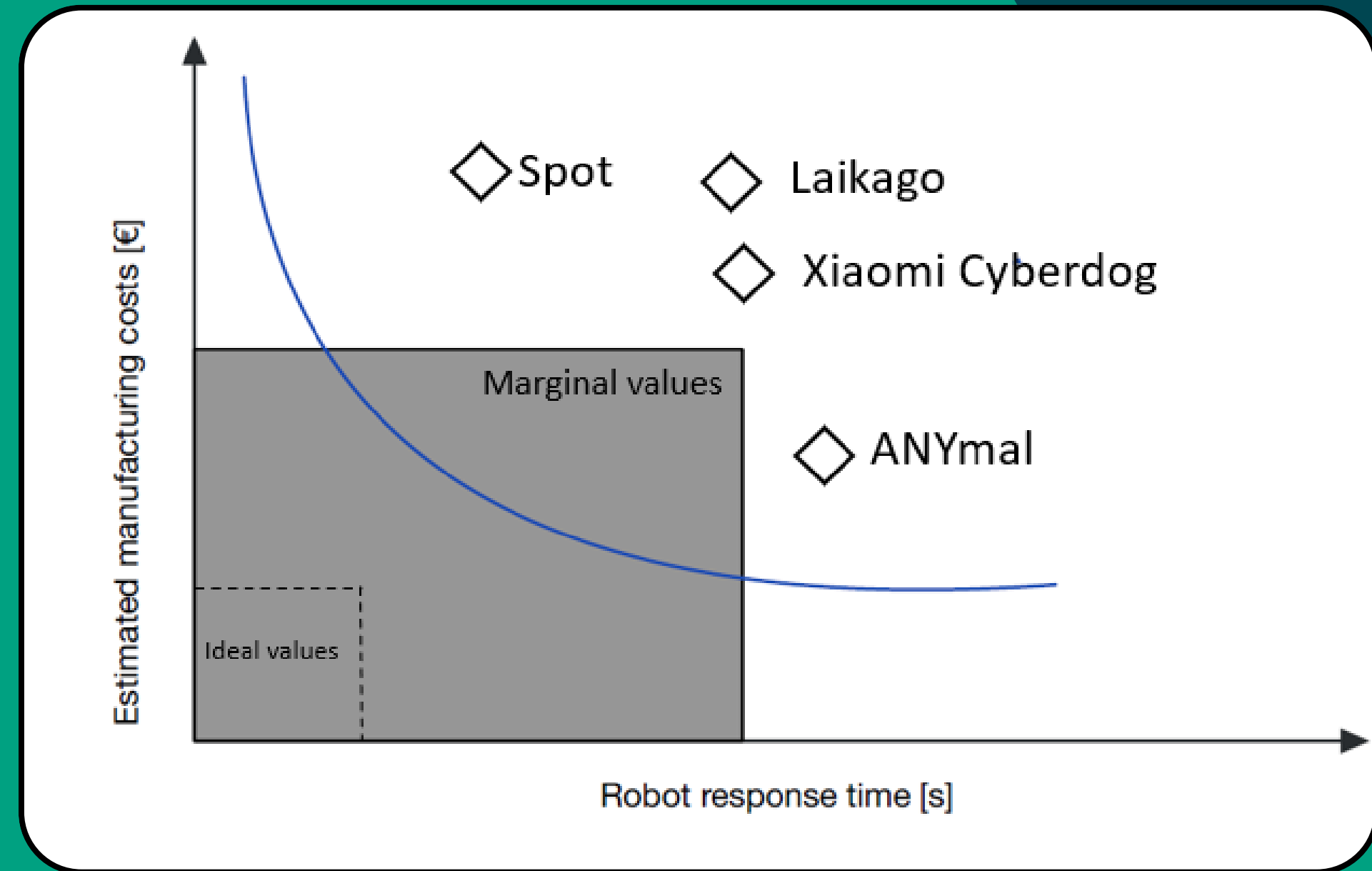
- **Redefinition of final specifications**
- **Specification convergence and customer needs**
- **Competitive map/trade-off map**



Laikago



Xiaomi Cyberdog



STEP 4

FLOW DOWN THE SPECIFICATIONS AS APPROPRIATE



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Step 4



“Flow down” specifications



From overall specifications

to

sub-system specifications

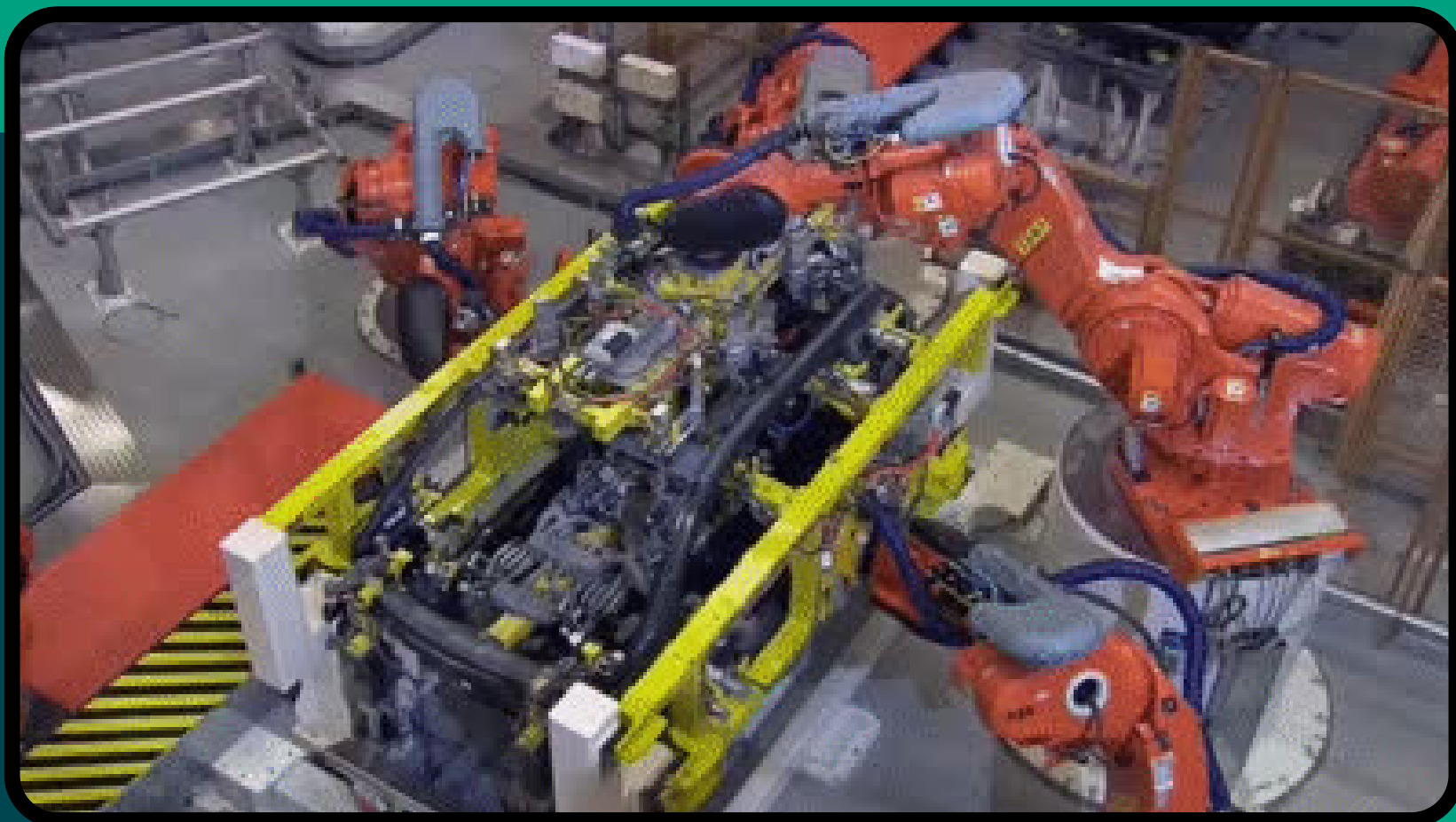


**We need match to reach
design goals**

STEP 5

REFLECT ON THE RESULTS AND THE PROCESS

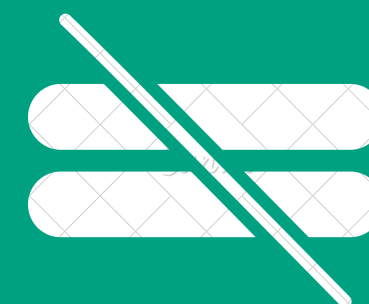
Successful



To review



Specifications



Needs



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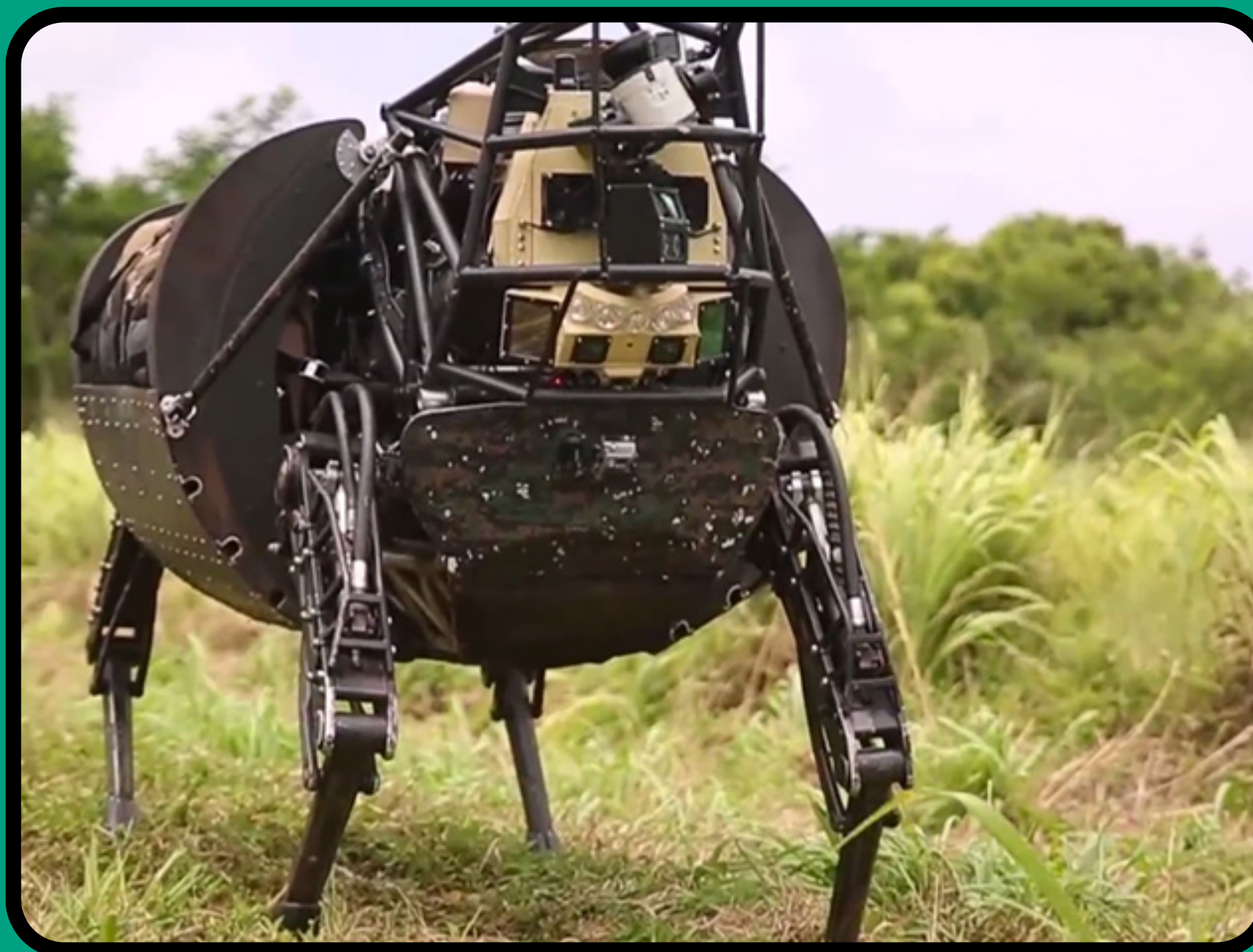
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STEP 5

REFLECT ON THE RESULTS AND THE PROCESS



Velocity



Precision

STEP 5

REFLECT ON THE RESULTS AND THE PROCESS

1 - Make Estimations:

- **Attainable technique**
- **Cost model precision**

2 - Make a marketing analyse :

- **Needs**
- **Game**
- **Competitive product**



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SUMMARY

Trade-off

Metrics

Refine

**Technical
model**

**Target
value**

Specifications

**Cost
model**

Concept

Market

Benchmarking



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Thank you for your attention!

Boston Dynamics

QUESTIONS ?

