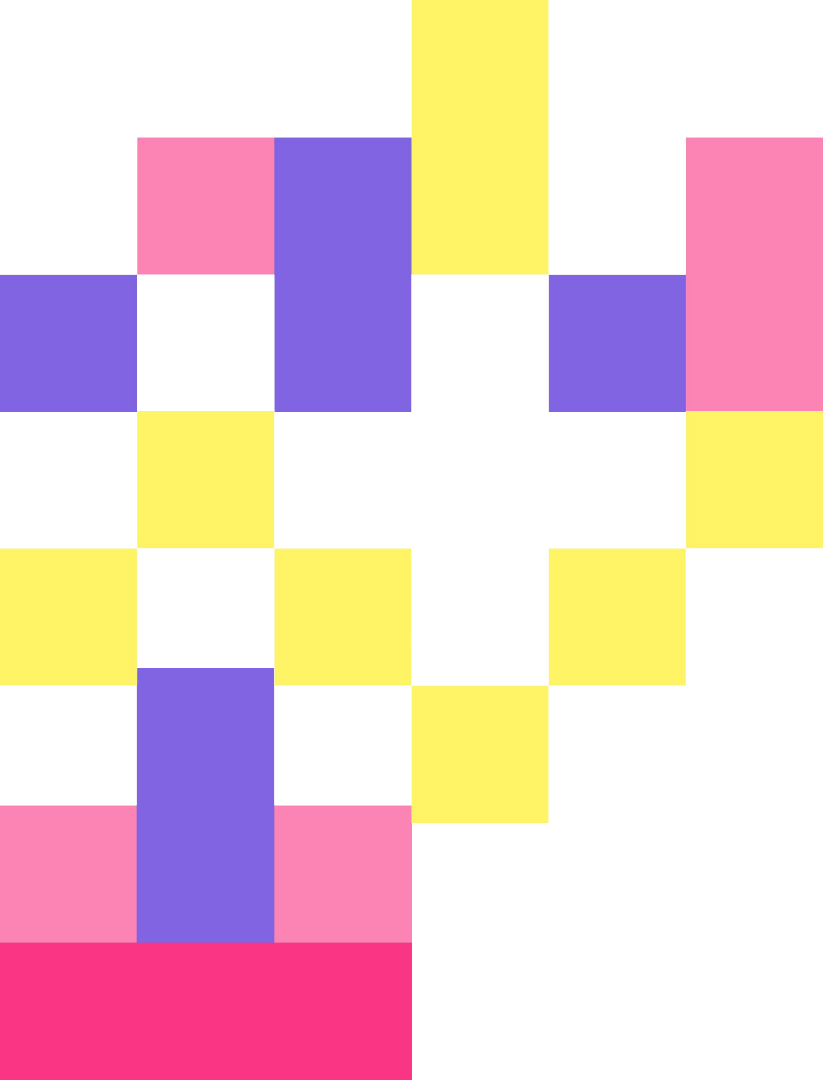


SCIENCE TECH TO **INNOVATION**

OPER.SPACE

ALMA MATER STUDIORUM - UNIVERSITY OF BOLOGNA

OPER.SPACE

DESIGN FACTORY FOR OPEN INNOVATION
ALMA MATER STUDIORUM - UNIVERSITY OF BOLOGNA

We connect universities, businesses and institutions to tackle complex societal problems together through innovation pathways that generate solutions centered on people's real needs

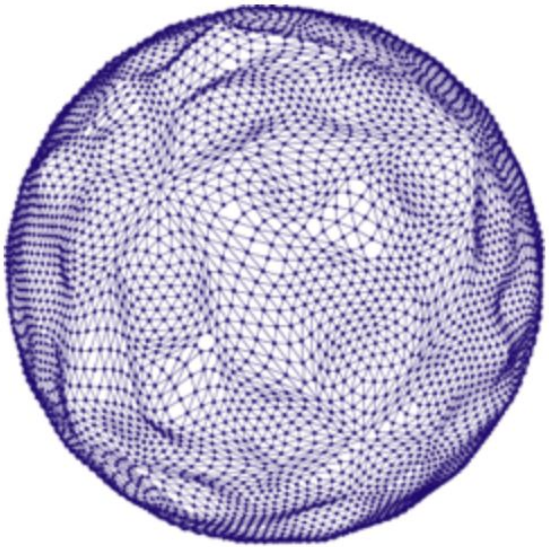
From Open Science to Open Innovation

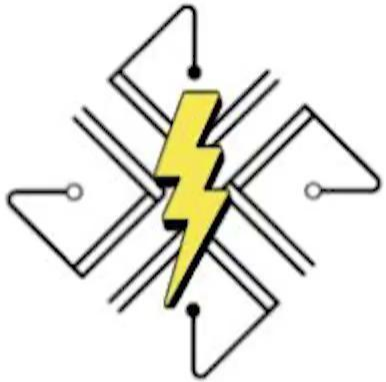
CBI.ATTRACT

© Elise Amendola


© Anna Puliaieva
Hadron Therapy

ATTRACT



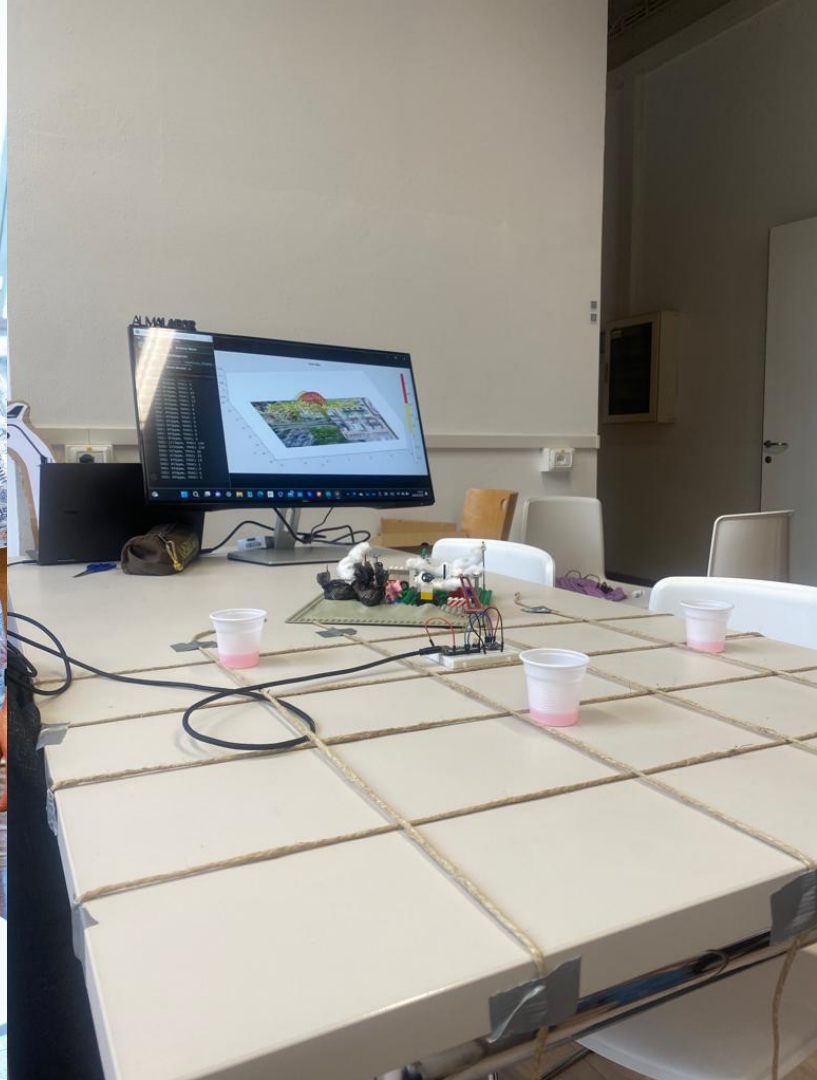


MICROQUAD

SUPERCONDUCTING PHOTON DETECTORS

Stories from CBI.ATTRACT 2022-2023

meeting researchers



Stories from CBI.ATTRACT 2022-2023

building prototypes

DESIGN THINKING

UNDER TECHNOLOGICAL CONSTRAINTS

BUT WHAT HAPPENS WHEN A PROJECT IS CONSTRAINED BY A SPECIFIC TECHNOLOGY?

TECH TO MARKET

TECH TO MARKET

PROCESS

An **adapted design thinking process** to **find** and **design** a suitable application for a given technology (Cocchi, Dosi, and Vignoli 2023)

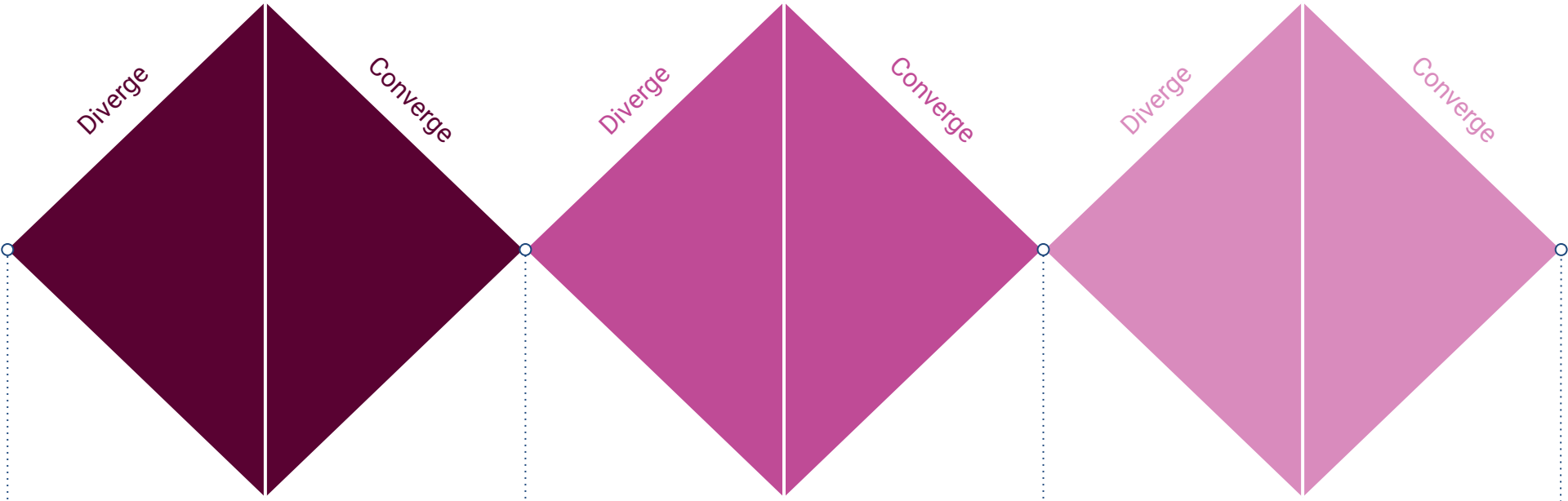
Finding a suitable technology application: exploring the opportunities of the technology and steering its development (Savino, Messeni Petruzzelli, and Albino 2017)

Designing a suitable technology application: embedding the technology into a new product, service, or system to solve a particular problem (Dell'Era et al. 2017)

Opportunities identification

User research

Solution concept design



Challenge:
Finding and designing new applications for a technology

Expected outcome:
Identification of new, innovative, and feasible scenarios (fields of application) for the technology

Expected outcome:
Identification of problems and needs of users that can be addressed through the introduction of the tech within the selected scenario

Expected outcome:
Designing a feasible, desirable, and viable solution concept based on the technology

TECH TO MARKET

TOOLKIT

Stage	Phase	Examples of tools
Opportunities identification	Diverge	Desk research, benchmarking, mind map, **technology functions**
	Diverge-Converge	**Interviews with technological and contextual experts**
	Converge	**Evidence-Problem-Opportunity frame**
User research	Diverge	Stakeholder mapping, Ethnographic interviews, Observations
	Converge	Personas, How might we questions
Solution concept design	Diverge	Brainstorming, Rapid prototyping
	Converge	Test of rapid prototyping, Business Model Canvas

TOOLKIT

TECHNOLOGY FUNCTIONS

To unlock the potential of technology, we could focus on what technologies do rather than what they are

This is not a screw.
This is a way to **join two or more elements, reversibly**

TOOLKIT

TECHNOLOGY FUNCTIONS

To unlock the potential of technology, we could focus on what technologies do rather than what they are

This is not a mic.
This is a way to **amplify the voice**

TOOLKIT

TECHNOLOGY FUNCTIONS

Function #1

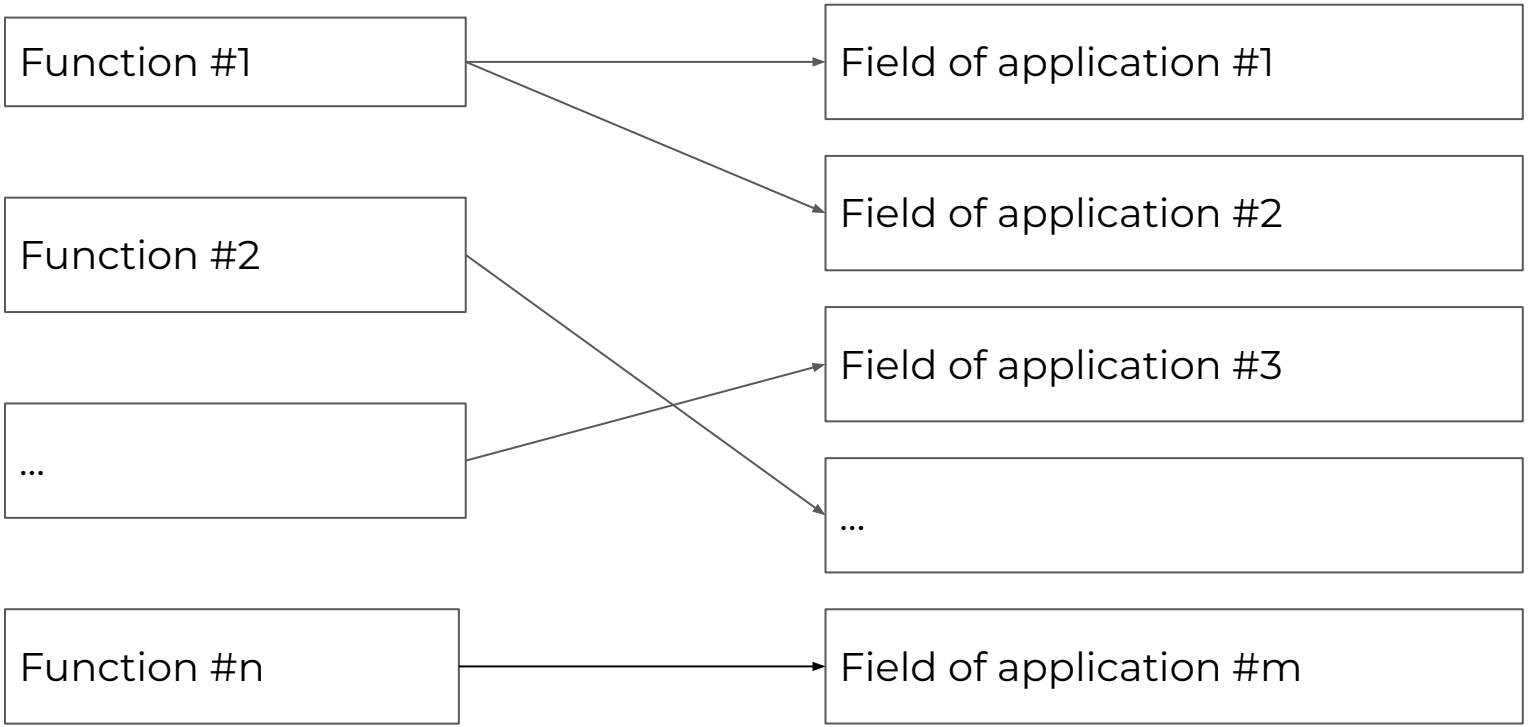
Function #2

...

Function #n

TOOLKIT

TECHNOLOGY FUNCTIONS → FIELDS OF APPLICATION



TOOLKIT

INTERVIEWS WITH TECH AND CONTEXTUAL EXPERTS

Speaking with experts in a particular field accelerates the general understanding of the field, offers information on the most advanced developments, and provides guidance on where to look for additional information

It is beneficial to understand the topic from the expert's perspective. The interview works as a guided conversation where a combination of essential information, facts, expert opinions, and interesting insights are gathered and shared

Kumar (2012)

TOOLKIT

INTERVIEWS WITH TECH AND CONTEXTUAL EXPERTS

1) Identify technological and contextual experts

Using a combination of internet searches, discussions with colleagues, literature searches or other means, compile lists of people who are recognized as technology experts and experts in the field in which you think the technology could be useful

Try to interview more than one expert in each field. Compare the views of several experts on a given topic to get a full picture of the context. Highlight points of agreement and differences that may merit further investigation

TOOLKIT

INTERVIEWS WITH TECH AND CONTEXTUAL EXPERTS

2) Prepare the interview protocol

Read articles, books, blogs, and news written by technology experts to familiarize yourself with their perspectives. Prepare questions you hope to get answered during the course of the interview

TOOLKIT

INTERVIEWS WITH TECH AND CONTEXTUAL EXPERTS

3) Conduct the interview

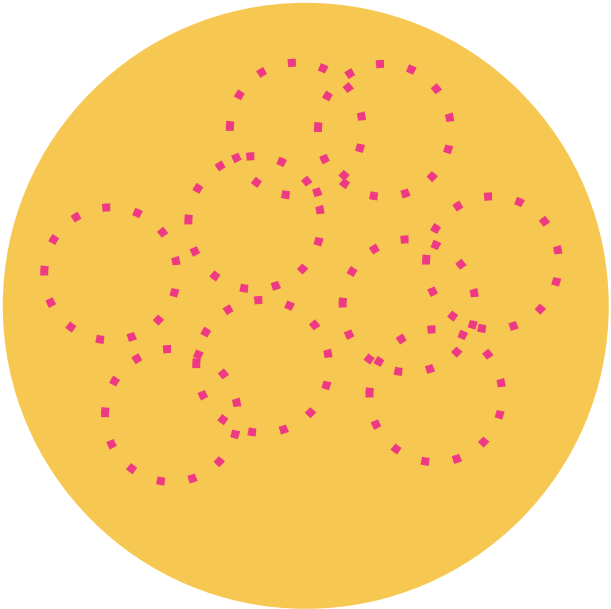
Use prepared questions to guide the interview. The conversation should focus on essential information, facts, or the expert's opinions as needed.

Using early prototypes can help you to validate or reject your hypotheses more quickly. You can use early prototypes to present your ideas to technology and context experts in a more tangible way. This allows you to see their reactions at first hand and to ask them about the reasons for those reactions

TOOLKIT

EVIDENCE-PROBLEM-OPPORTUNITY FRAME

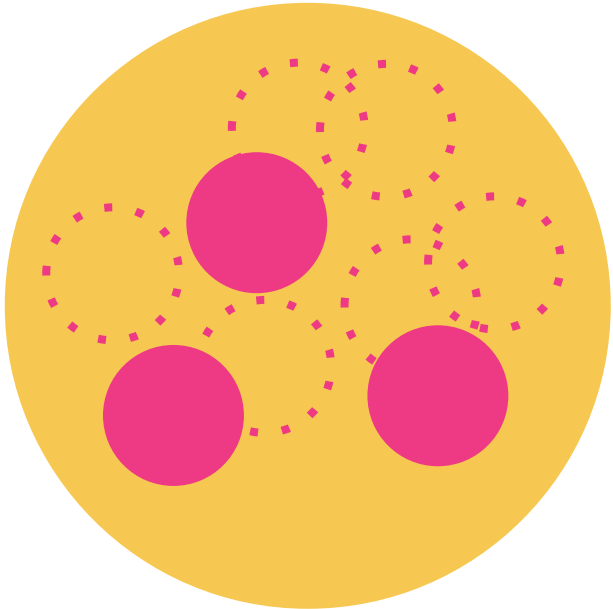
There are several opportunities out there, and some of those make more sense to you...



TOOLKIT

EVIDENCE-PROBLEM-OPPORTUNITY FRAME

...But how do you prove that the opportunities you have identified are real and relevant?



TOOLKIT

EVIDENCE-PROBLEM-OPPORTUNITY FRAME

Evidence

This section should contain all of the evidence that can be used to prove that your opportunities are solid, real and relevant

- Quotes from interviews
- Pictures/Observations
- Trends
- Facts

Problem/Need

What is the problem/need to be addressed?
Who is interested in solving it?
Why?

Opportunity

What can be achieved if this problem/need is satisfied?
Who will benefit?

CASE STUDY: SENS-IN BOLTS

OPEN INNOVATION PROGRAM “SUGAR”, 2018

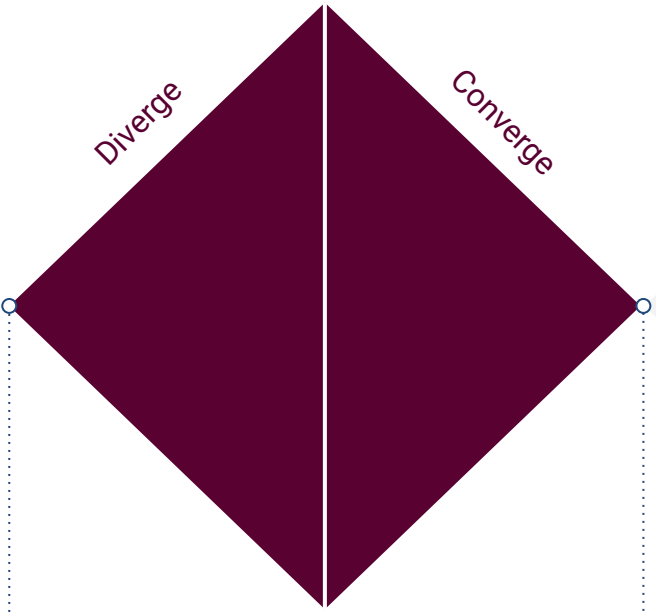
Sens-In Bolt ®

Poggipolini S.p.A. has created a start-up company for the development of "smart bolts", called SENS-IN. SENS-IN was the first intelligent fastener able to communicate in real time a current status or a warning. The smart bolt was used in many industries, but Sens-In was looking for other applications and users

Sens-In Bolt ®

How might we find and design new applications for the Sens-In bolt technology?

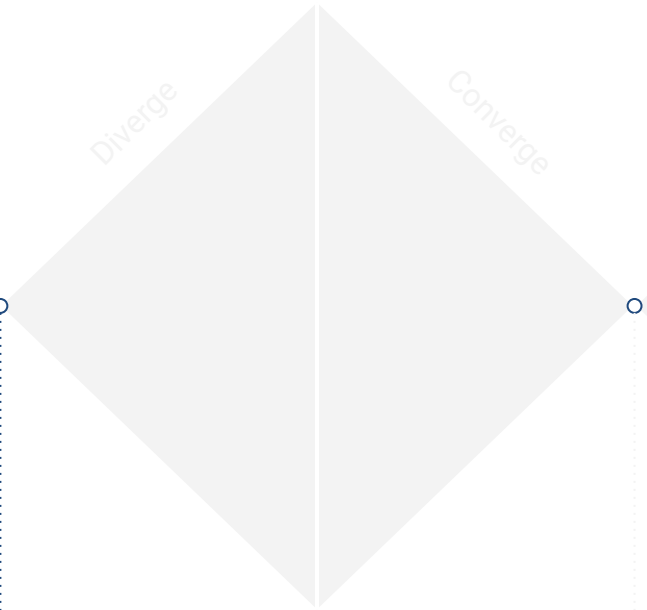
Opportunities identification



Challenge:
Finding and designing new applications for a technology

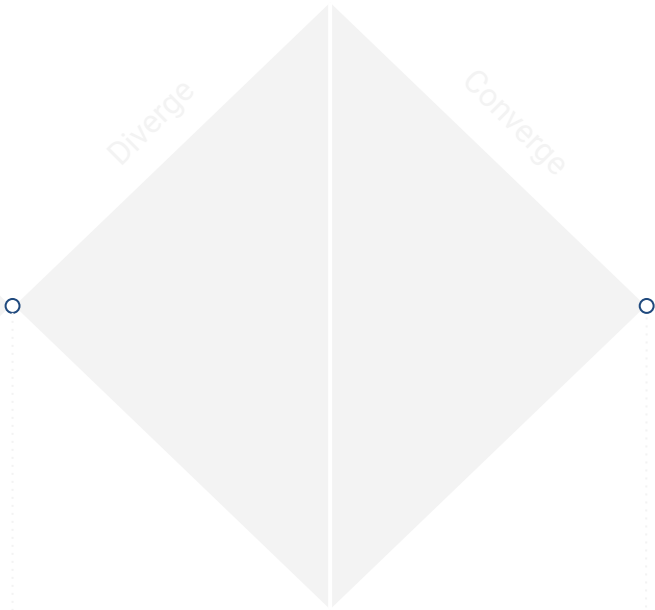
Expected outcome:
Identification of new, innovative, and feasible scenarios (fields of application) for the technology

User research



Expected outcome:
Identification of problems and needs of users that can be addressed through the introduction of the tech within the selected scenario

Solution concept design



Expected outcome:
Designing a feasible, desirable, and viable solution concept based on the technology

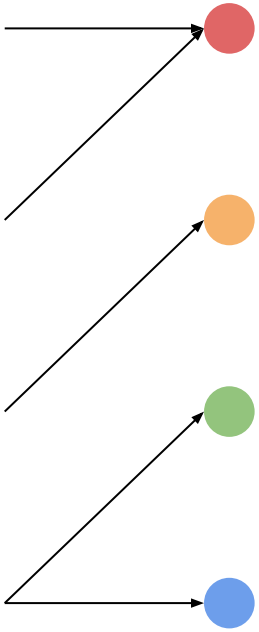
Smart bolt functions

Communicate the current status of the structure

Communicate the current status of the fastener

Collect accurate and reliable data

Automatic data collection and sharing



Smart bolt abilities

Increase the safety of critical structures

Replacement of monitoring methods based on human senses

Monitoring of places hard to physically inspect

Enable real-time response from automated systems

Possible fields of application

Bridges

Roads

Amusement park

Energy pipeline

Biomedical plants

Domotic

Auton. cars

INFRASTRUCTURES
Bridges

BIOMEDICINE
Plates

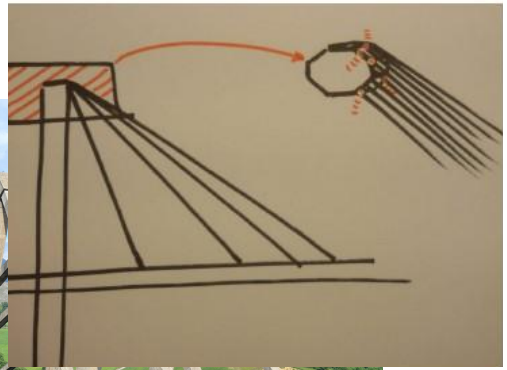
ENERGY
Pipework

INFRASTRUCTURES

Bridges

Evidence

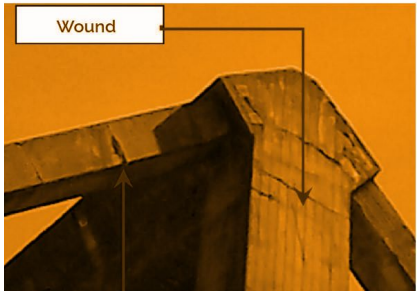
- **5000 km are closed** due to landslides, subsidence and safety problems
- **There is no local and internal maintenance for bridges:** maintenance is only carried out externally



By Glabb - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=26048597

Problems

- **Maintenance by visual inspection:** Interventions only after damage



"Emergency is not only a question of money, but also of the resources needed to ensure control and maintenance to guarantee safety on the roads"
President of [omitted]

Monitor the resisting force and deformation of the pins to which the bars are locked to:

1. **Monitor bridge deformation**
2. **Avoid field inspections**

Opportunity

BIOMEDICINE

Plates

Evidence

Every plate needs screws:

- Used to support broken bones
- Approximate way of installing screws
- Breaking the plate is more important than breaking the screw
- Screws are made of titanium, carbon, or tantallium

Problems

Broken screws and plates:

- Physical and psychological damage
- Health risks
- Requires a new operation

“Screws often break. If we can, we remove them. Otherwise, we leave them in ”
Traumatologist

Monitor the load on each bolt to:

1. **Predict breakage**
2. **Check the condition of the plates**

Opportunity

ENERGY

Pipework

Evidence

“*I have to shut down my chemical plant again if the external maintenance team hasn't done a good job***”** Chemical Engineer

2846 chemical companies in Italy
Source: Federchimica Confindustria

From 1 to 5 kms of pipes in each plant with more than 100 flanged connections

From 4 to 28 bolts in every flanged connection

Problems

Disconnected flanges cause loss of highly flammable and chemical fluids

- Safety issues: Possibility of accidents
- Production delays

Monitoring residual torque force and stem deformation in a flange connection to:

1. **Assist the plant manager in checking maintenance**
2. **Improve the extraordinary maintenance of pipelines**

Opportunity

INFRASTRUCTURES

Monitor the resisting force and deformation of the pins to which the bars are locked to:

1. Monitor bridge deformation
2. Avoid field inspections

BIOMEDICINE

Monitor the load on each bolt to:

1. Predict breakage
2. Check the condition of the plates

ENERGY

Monitoring residual torque force and stem deformation in a flange connection to:

1. Assist the plant manager in checking maintenance
2. Improve the extraordinary maintenance of pipelines

Selection of the field of application

Following feedback from the company, the team decided to take up **INFRASTRUCTURES** as the most promising opportunity area...

...but instead of focusing on bridges, the team decided to focus on...

The maintenance of roller coasters

Who are the **actors** involved **in roller coasters?**

Among them, **who could benefit from the introduction of Sens-In bolts?** Why? What are their needs?

How might we solve their problems and meet their needs by introducing Sens-In bolts?

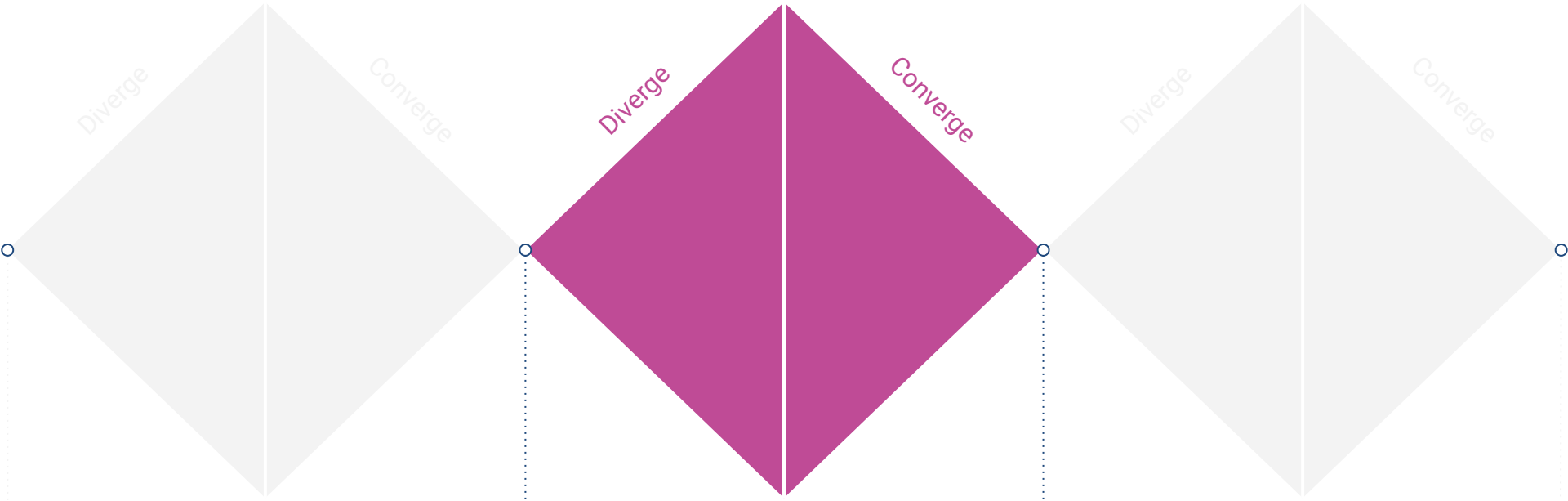
Opportunities identification

Diverge

Converge

Challenge:
Finding and designing new applications for a technology

User research



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Expected outcome:
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Solution concept design

Diverge

Converge

Expected outcome:
Designing a feasible, desirable, and viable solution concept based on the technology

A technician doing the maintenance on a kart.
Hakugei, Nagashima Spa Land - Japan

CHECKING (AS-IS)

Sight

Hearing

Touch

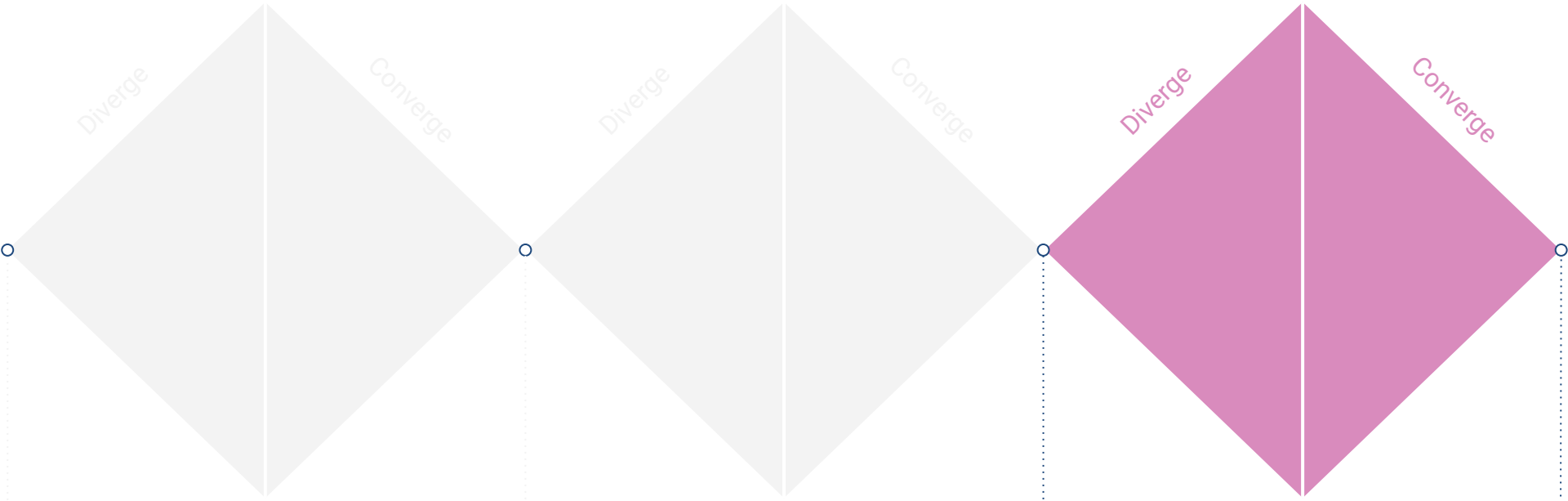
REPORTING (AS-IS)

How might we help Ben, amusement park technician, to collect the right maintenance information and send it to the supervisor efficiently?

Opportunities identification

User research

Solution concept design



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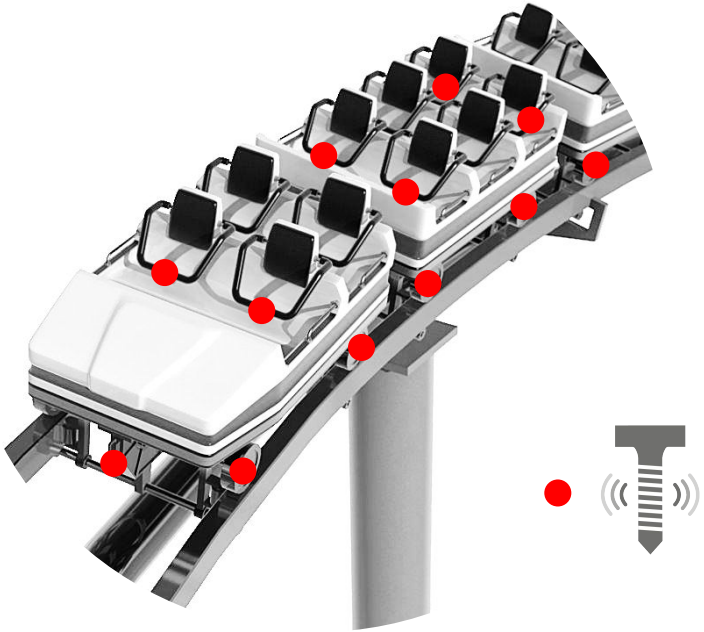
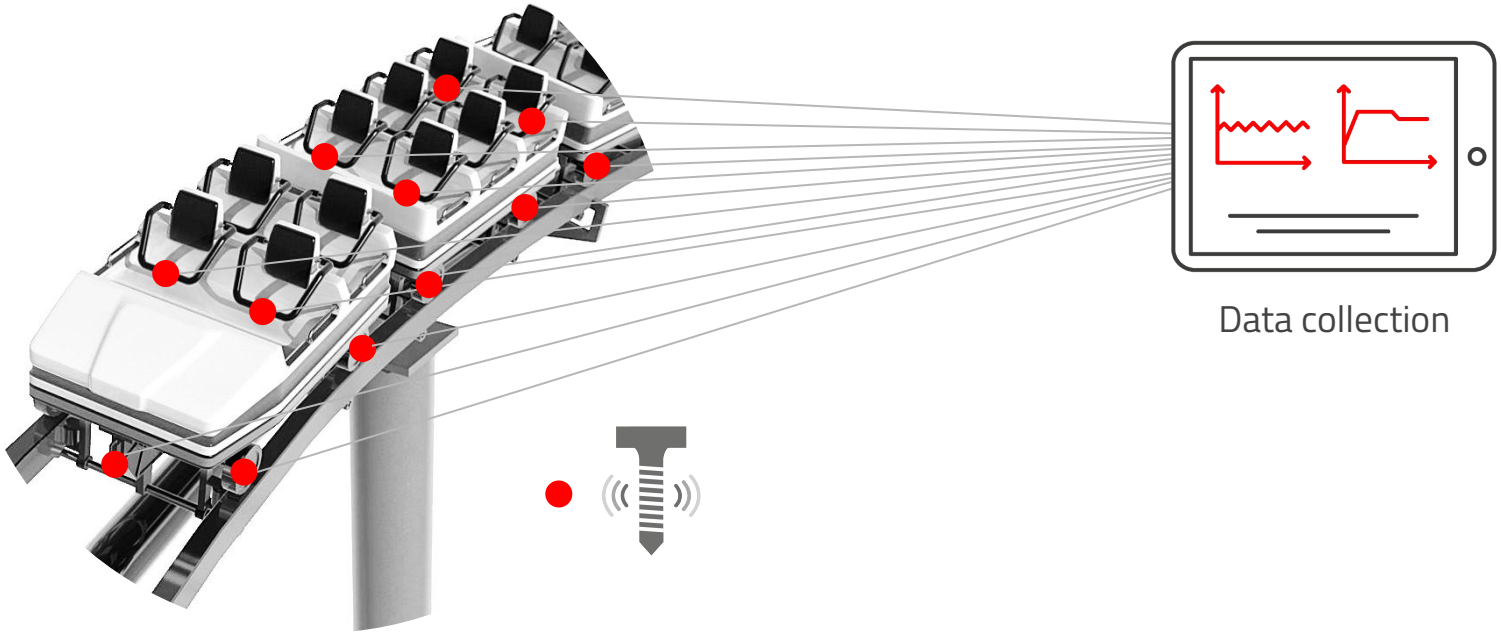
https://sugar-network.org/projects/

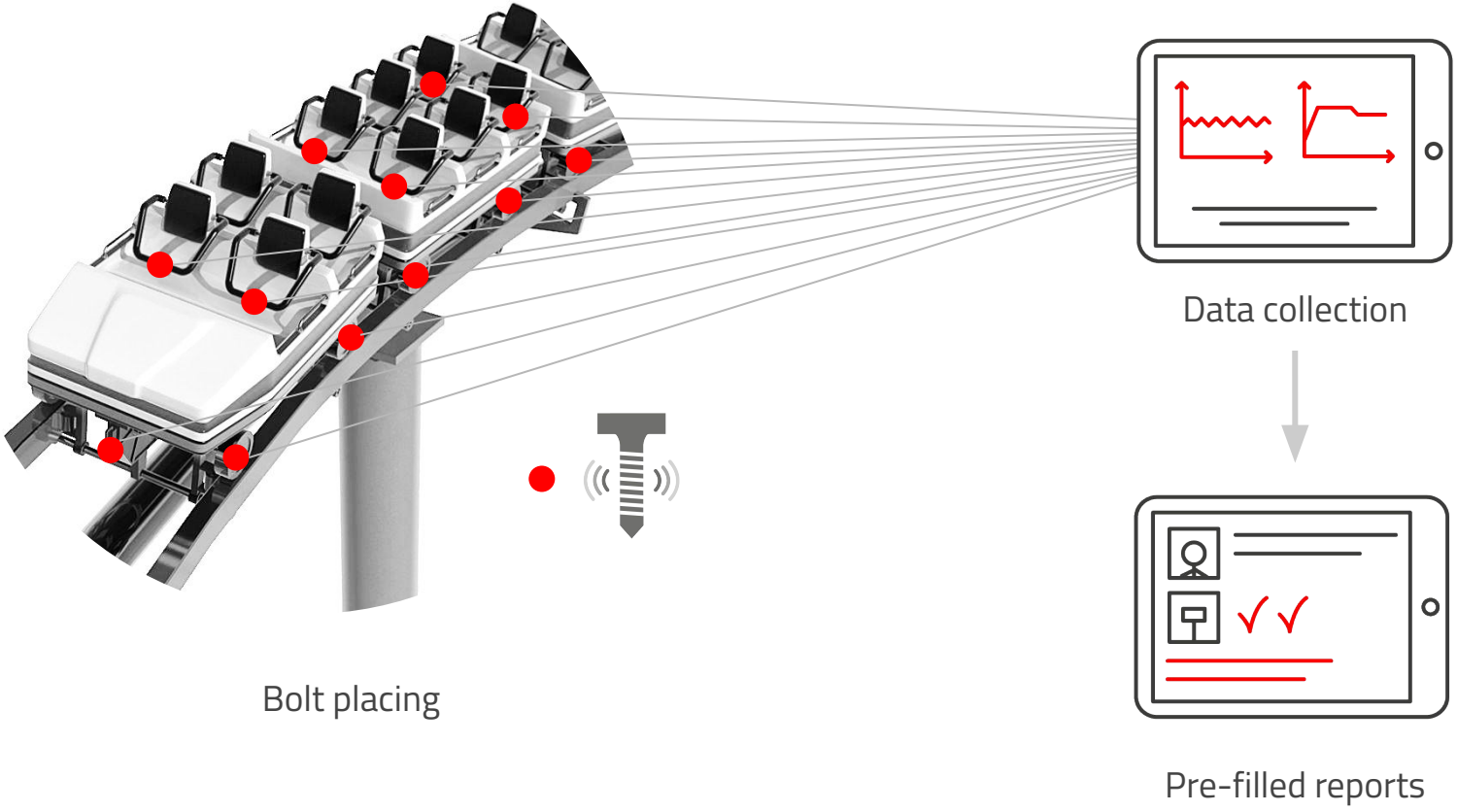


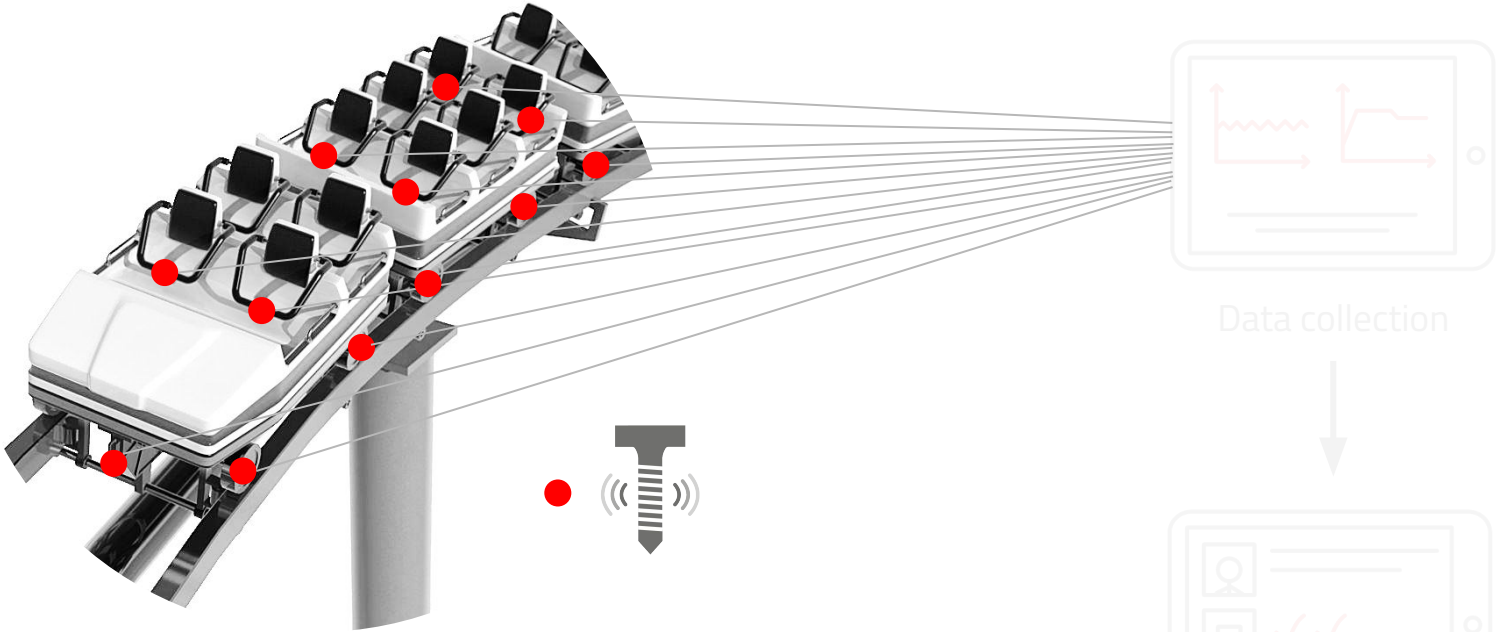
Bolt placing



Data collection

Bolt placing

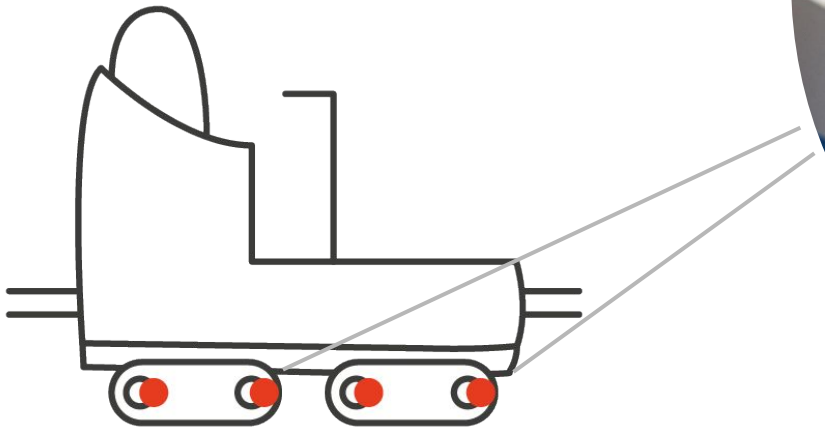

Data collection
Pre-filled reports
Bolt placing



Bolt placing

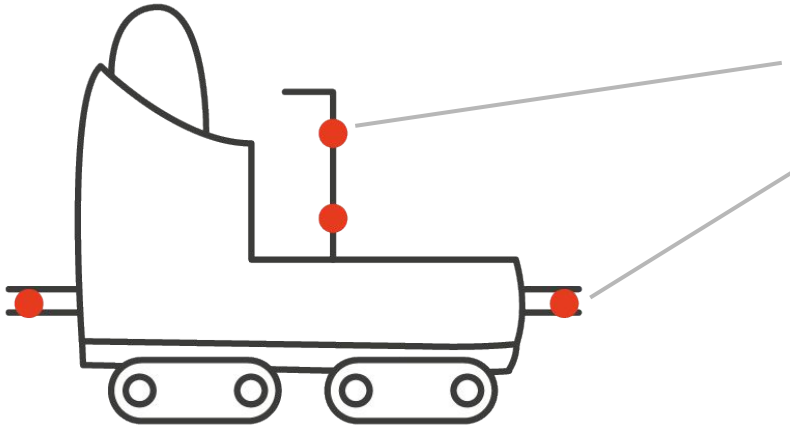
Critical points

Wheels



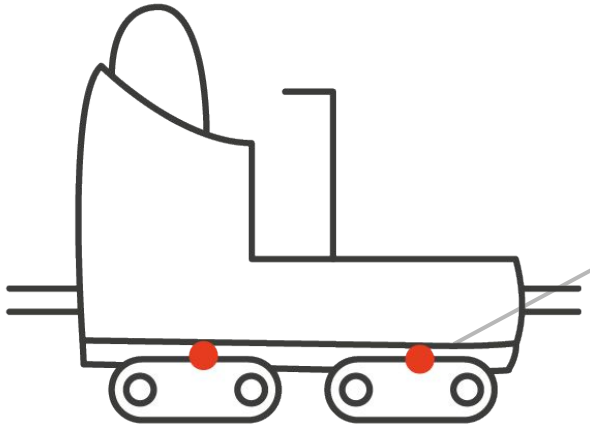
Critical points

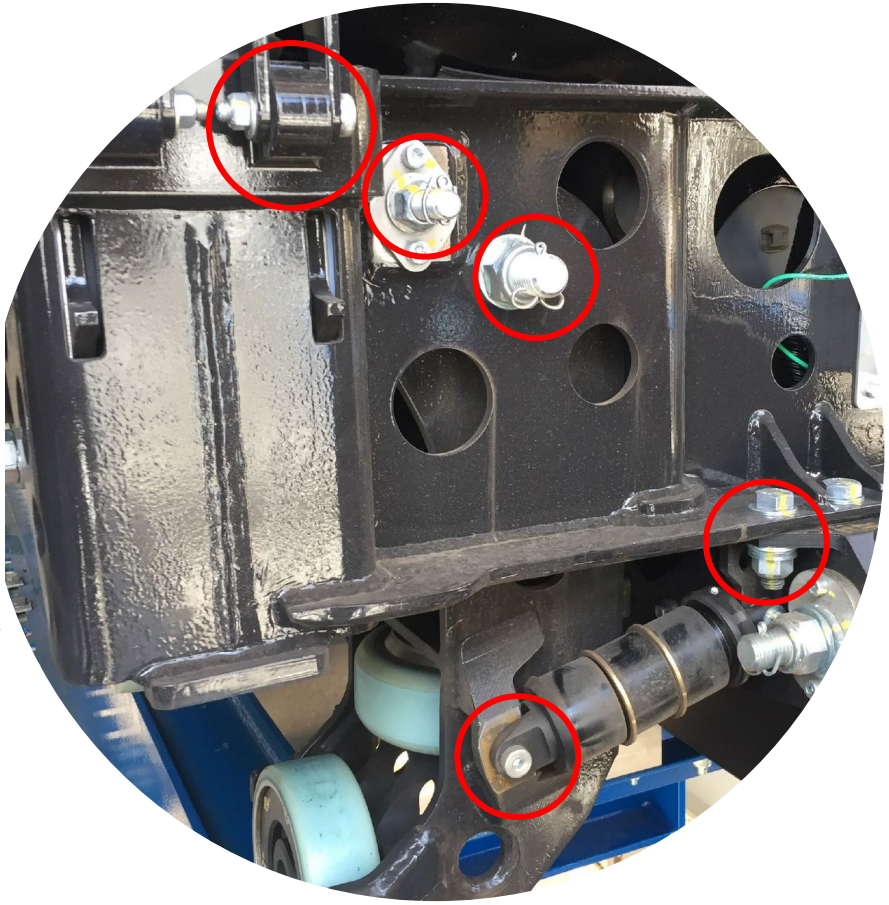
Protection handles and connections

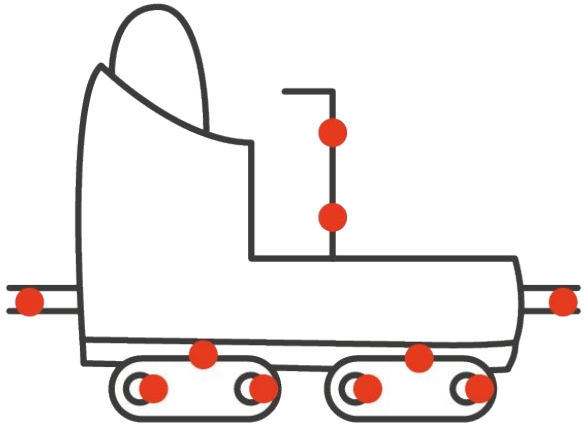


Critical points

Shock absorber





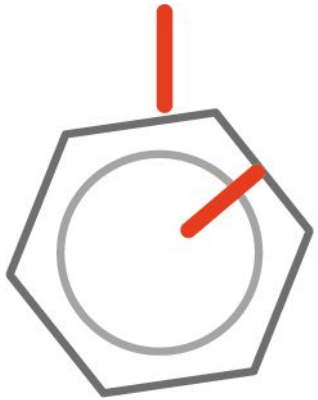


20

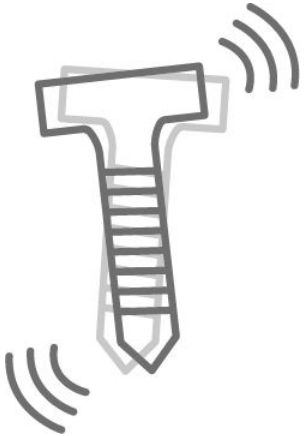
critical bolts per kart

360

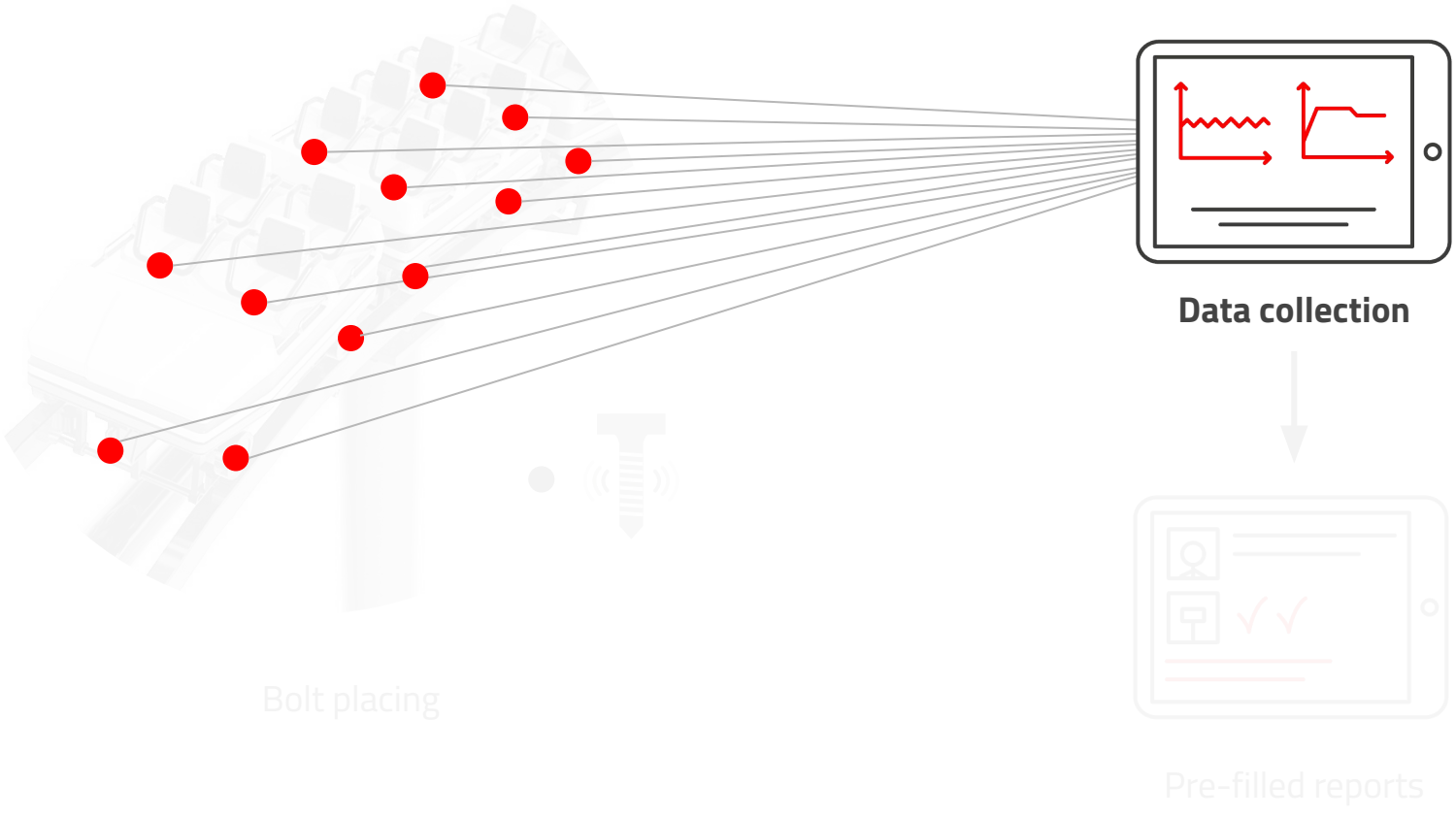
critical bolts
per attraction



Self loosening



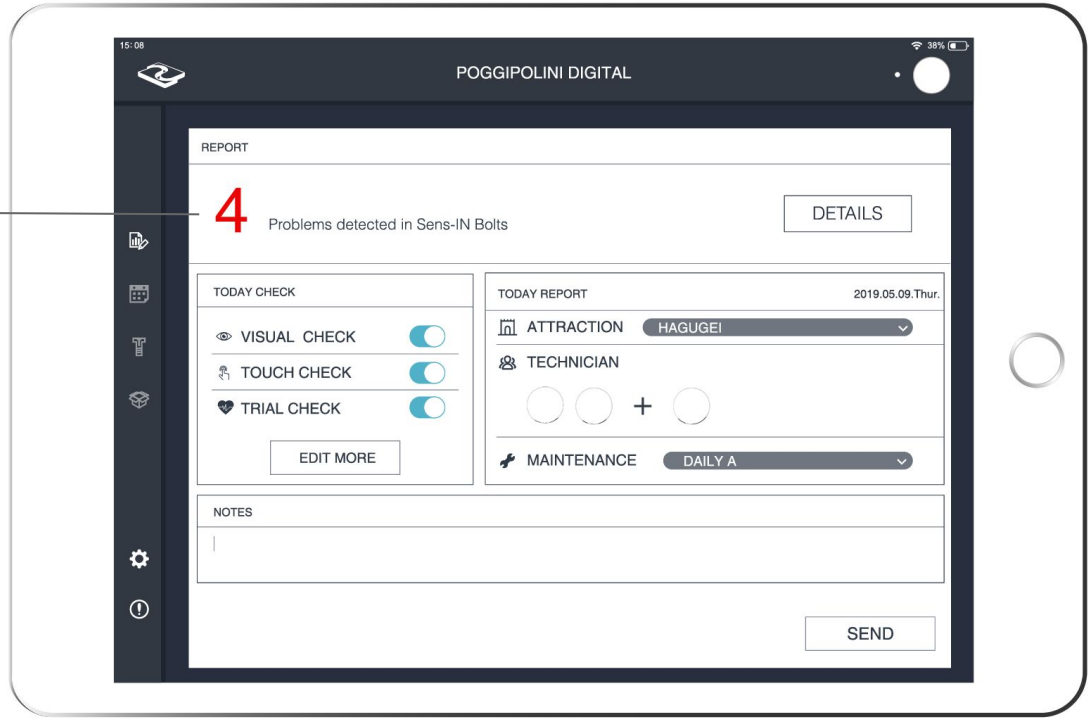
Vibration

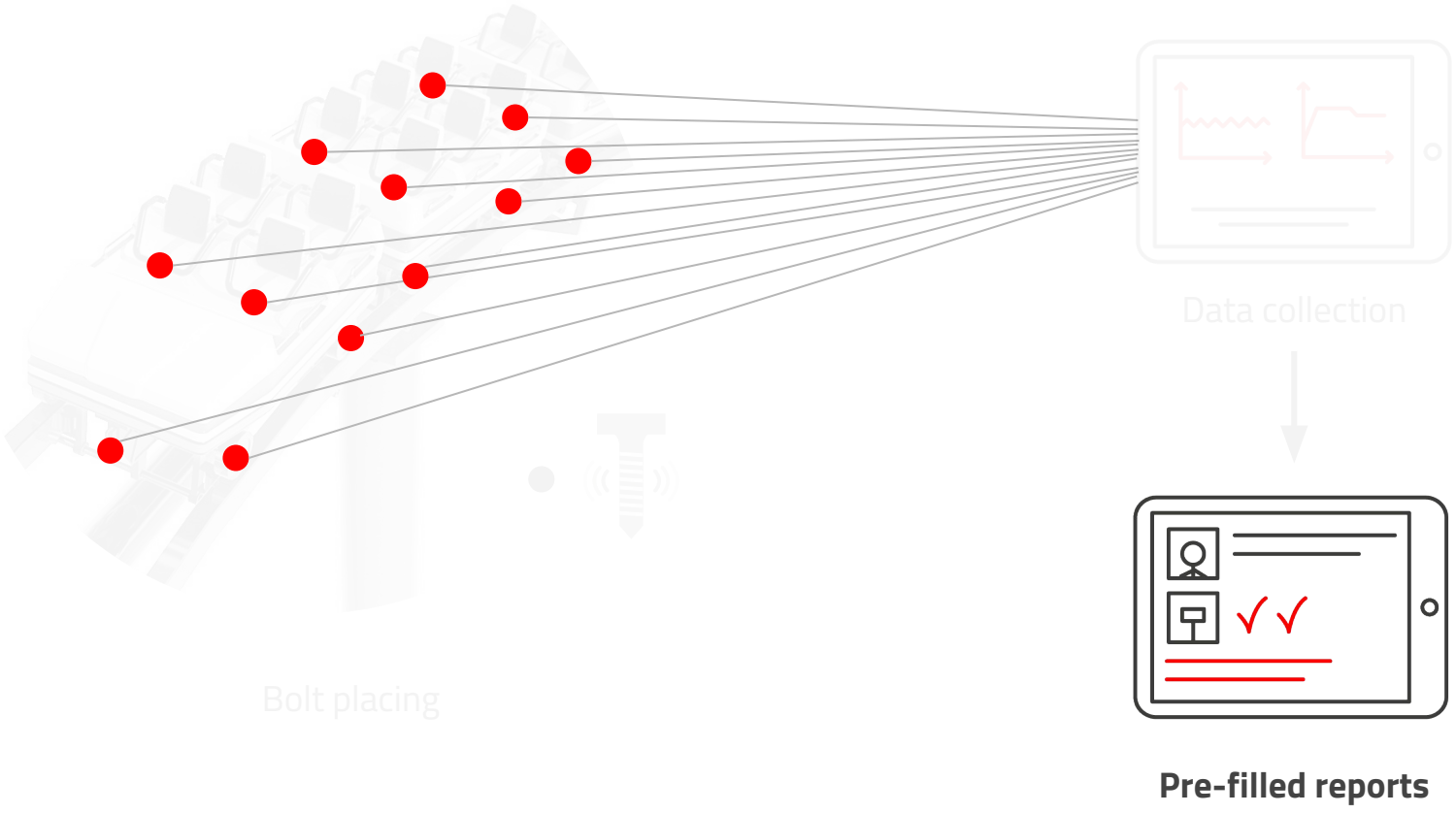

Data collection
Bolt placing
Pre-filled reports

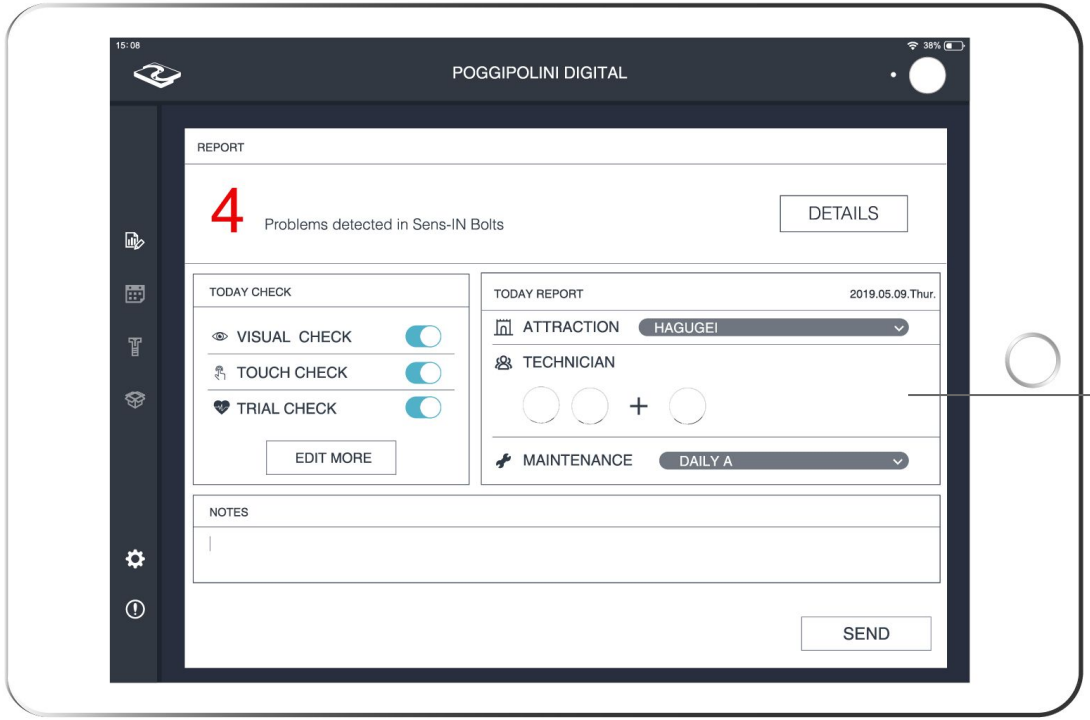
Maintenance department


15:08
38%
POGGIPOLINI DIGITAL
36
ATTRACTION
CAR NUMBER
POSITION
SELF LOOSENING
[kN]
14
12
10
8
6
4
2
0
25
[s]
VIBRATION
[dB]
80
0
-80
25
[s]
Start time
25'
End time
30'

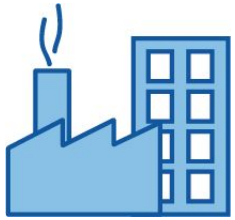
Sens-IN Bolt problems




Data collection
Bolt placing
Pre-filled reports



Report compilation



Manufacturing company

Unique *mechadigital* components

&

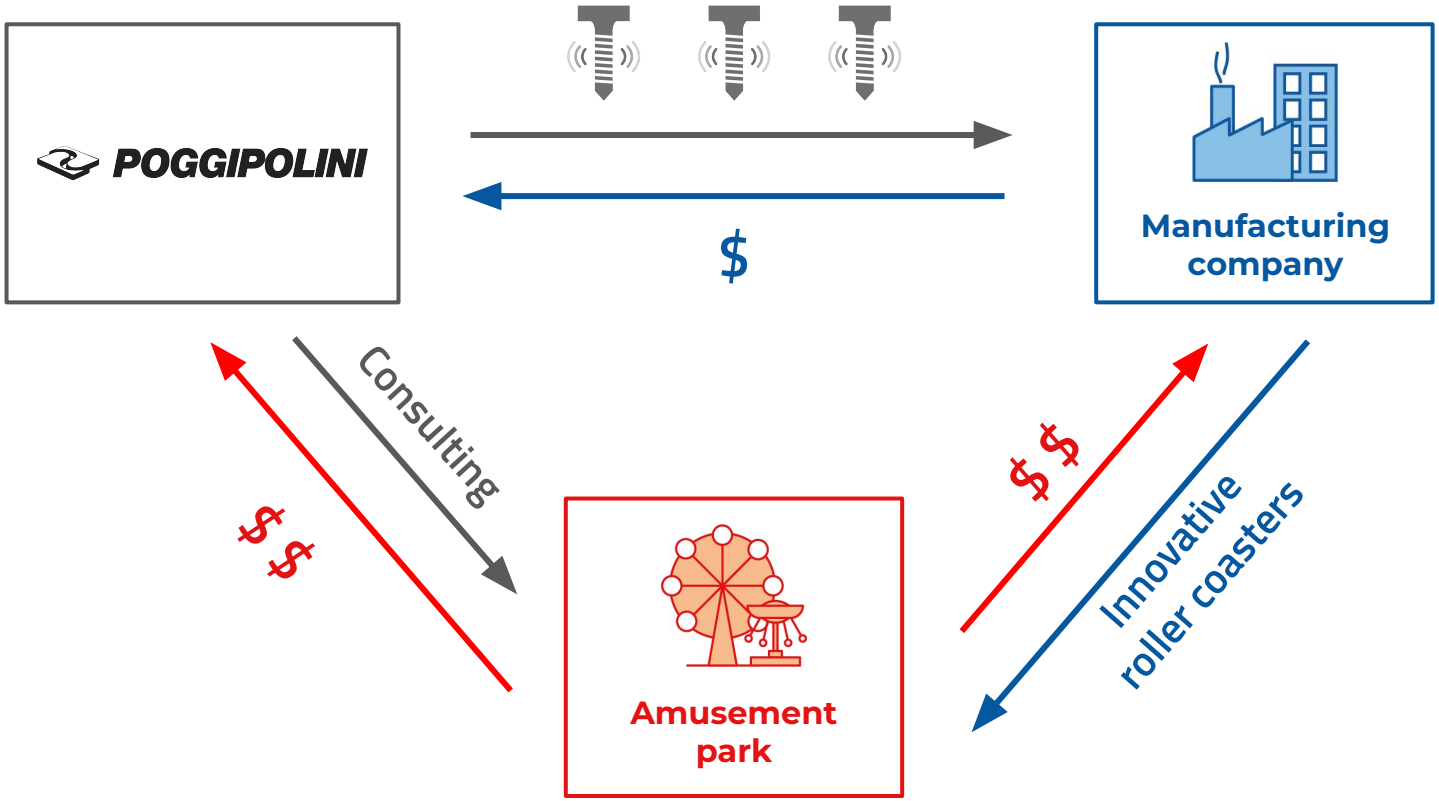
Higher value of roller coasters

Amusement park

Tailored services

&

Maintenance efficiency


POGGIPOLINI
$
Manufacturing company
Consulting
$ $
$ $
Innovative roller coasters
Amusement park

Key partners

- Software company
- Sensors company
- Shipping firm

Key Activities

- Communication activities
- Production
- Training
- Consultancy and assistance

Key Resources

- Investment for communication
- Technicians
- Patents
- Software copy write
- Machinery

Value proposition

Introduction of a tailored service working with a sense-in bolt and a software able to improve the efficiency of maintenance in terms of cost, time and safety and to improve the economic value of roller coasters as well

Customer relationship

- Tailored
- B2B approach
- Customer care

Channels

- Website
- Trade fairs
- Direct research of customer

Customer segments

- Amusement park
- Roller coaster manufacturing companies

Cost structure

- Production and transportation
- Salary
- Software development
- Communication

Revenue stream

- Selling of packages
- Licence fee
- Selling of Sense-IN Bolts


NOTHING IS A MISTAKE.
THERE'S NO WIN
AND NO FAIL.
THERE'S ONLY
MAKE
JOHN CAGE

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THANKS!

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