



Rijkswaterstaat
*Ministry of Infrastructure
and Water Management*



Circular design & innovative approaches to collaboration for infrastructure replacement and renovation projects

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Our network



Main road network
3.000 km



Main waterway network
3.500 km



Main water system
90.000 km²



Total number of bridges and viaducts

- Netherlands: 40.000 objects
 - Other governments: ~35.000 objects
 - Rijkswaterstaat: ~5000 objects → ~3000 Viaducts
 - Construction between 1960 en 1980
- Enormous replacement and renovation task
 - Big challenge
 - Large market potential
 - High urgency



"To realise Paris goals"

- 2020: -20% CO₂
- 2030: Energy neutral
- 2030: Climate neutral

"No waste"

- 2030: RWS works circular
- 2030: -50% use of raw materials
- 2050: No waste

"Sustainable area development"

- Integral sustainable approach towards area development, multiple use of available space
- In collaboration with stakeholders

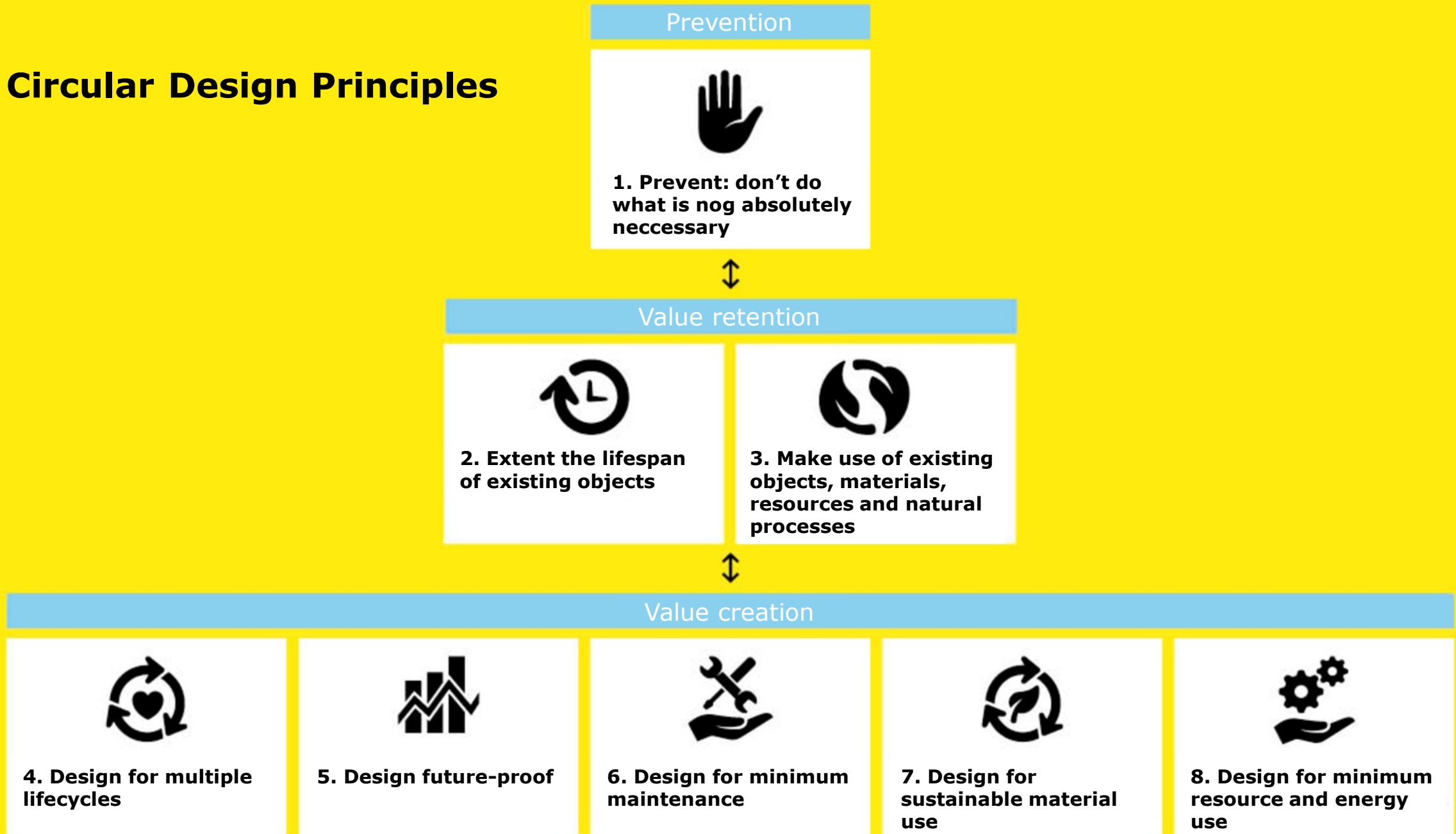
Ambition

In 2030, Rijkswaterstaat works in a completely circular way via the intensive re-use of raw materials and by producing as little waste as possible.

In 2050, Rijkswaterstaat is circular

→ We need a different approach

Circular Design Principles





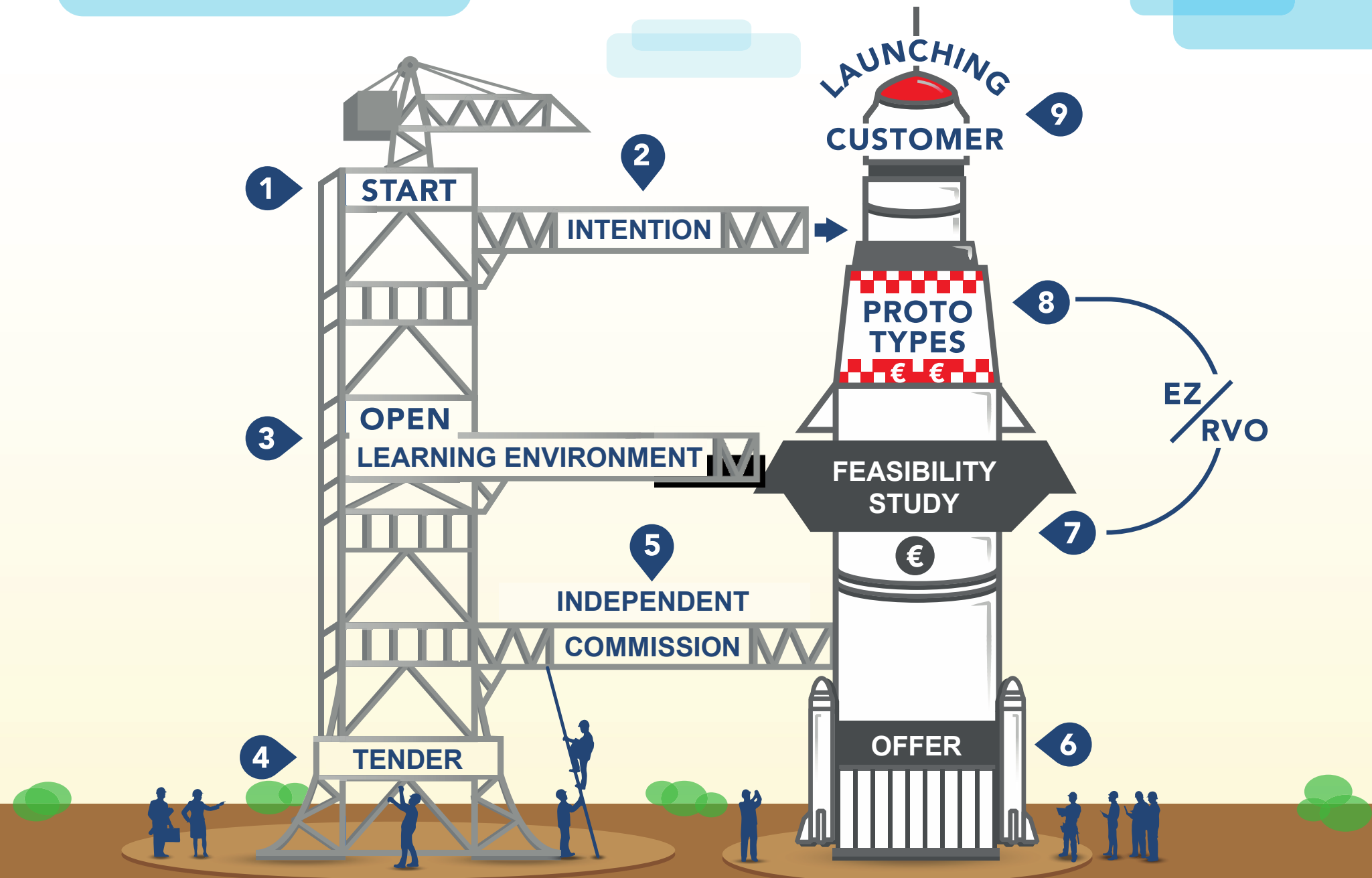
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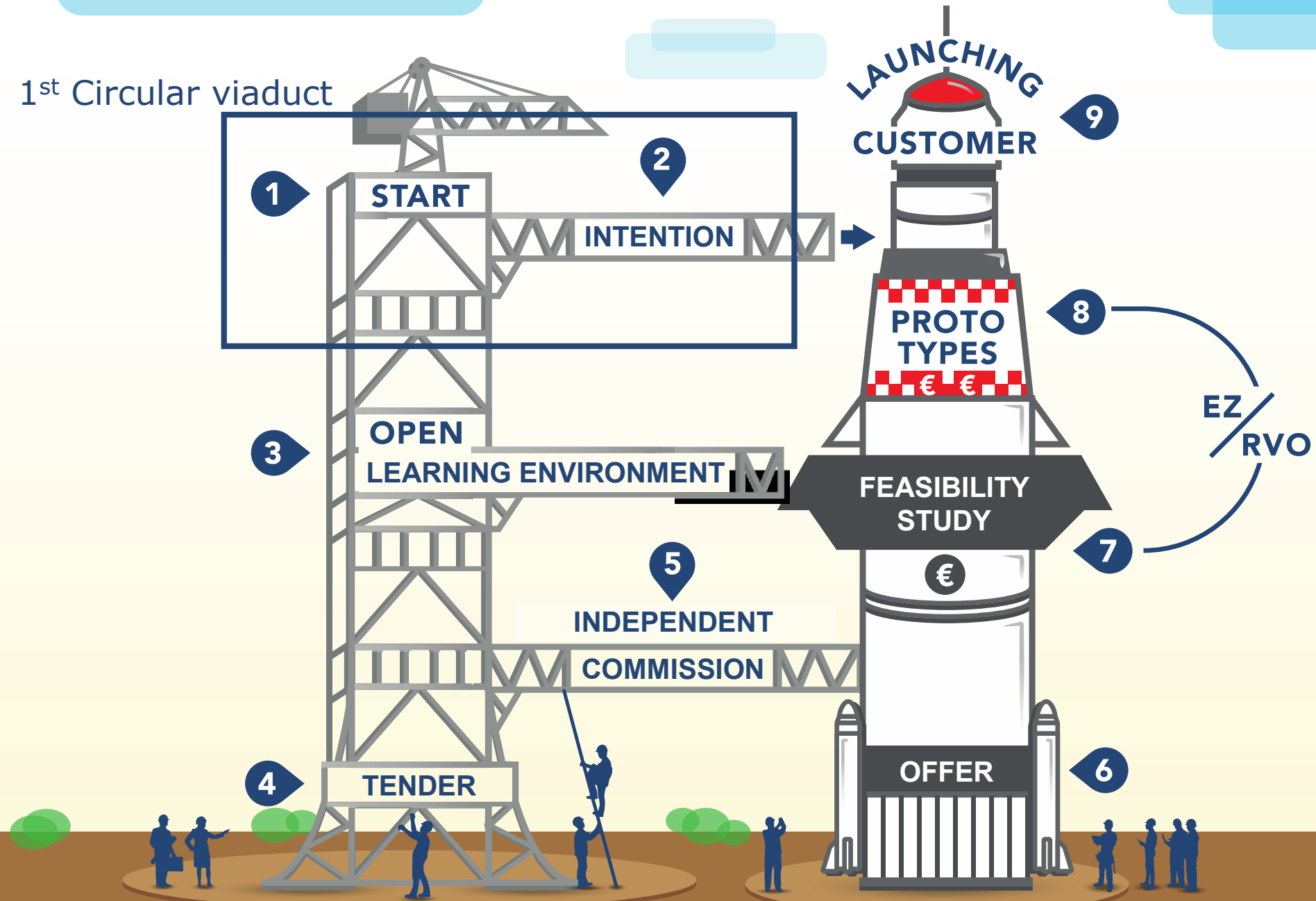
Transition to Circular Viaducts

Prototype ➤ Open Learning Environment ➤ SBIR



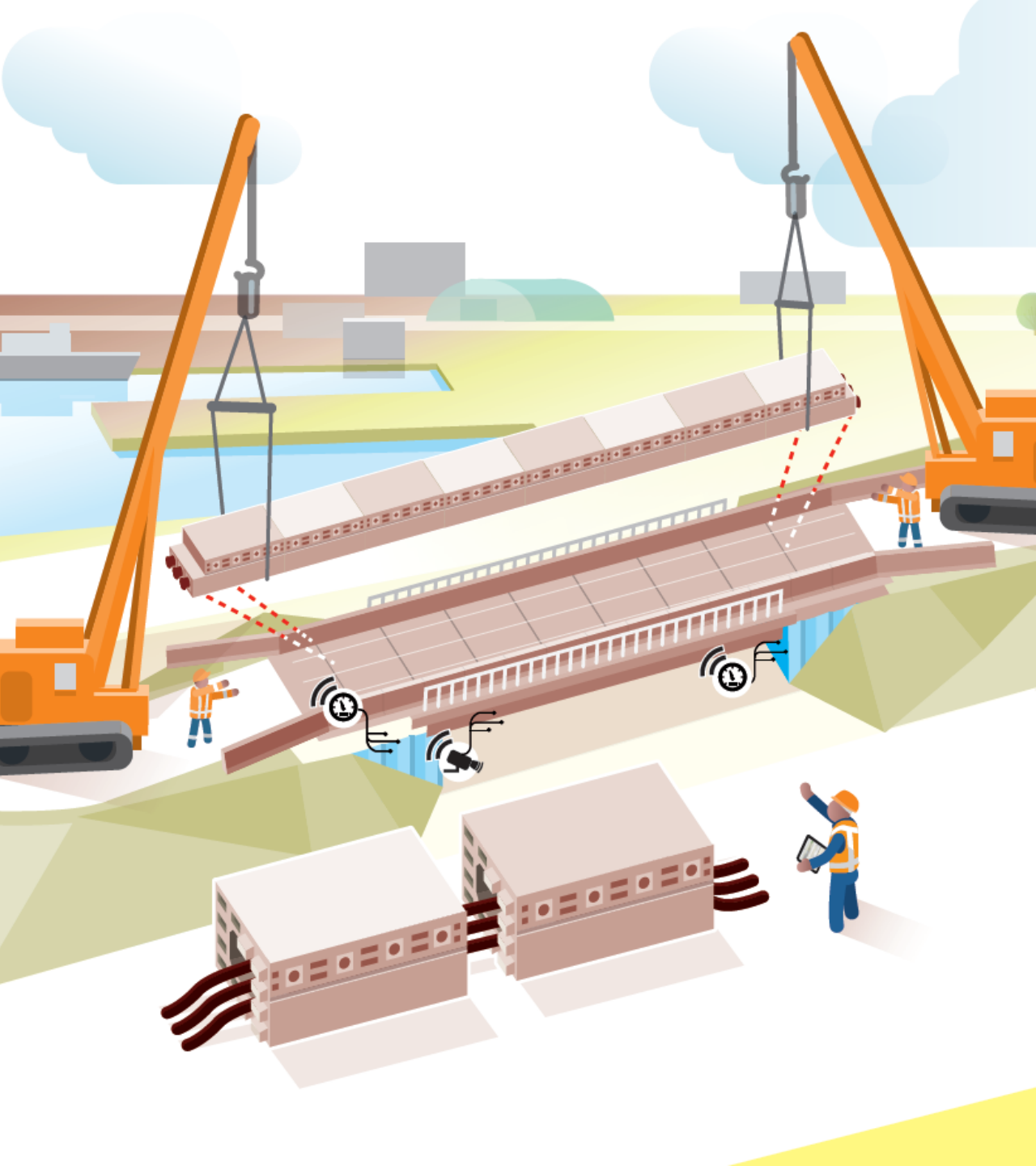


1st Circular viaduct





Prototype 1st circular viaduct



Prototype 1st circular viaduct

- Reusable elements



Prototype 1st circular viaduct

- Reusable elements
- Coöperate as equal partners

Van Hattum en Blankevoort



Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

CONSOLIS
SPANBETON



www.rijkswaterstaat.nl/zakelijk/innovatie-en-duurzame-leefomgeving/duurzame-leefomgeving/circulaire-economie/bouw-circulair-viaduct-bij-kampen/inn

Bouw circulair viaduct bij Kampen

- ✓ Rijkswaterstaat wil in 2030 circulair werken.
- ✓ Nederland wil een CO2-reductie van 49% in 2030.
- ✓ Samen met de marktpartijen willen we onze infrastructuur zo ontwikkelen dat straks alle materialen en grondstoffen herbruikbaar zijn en we geen fossiele energiebronnen meer gebruiken.

Hoe



een 100% circulair viaduct uit betonnen elementen die ongeschonden opnieuw bruikbaar zijn



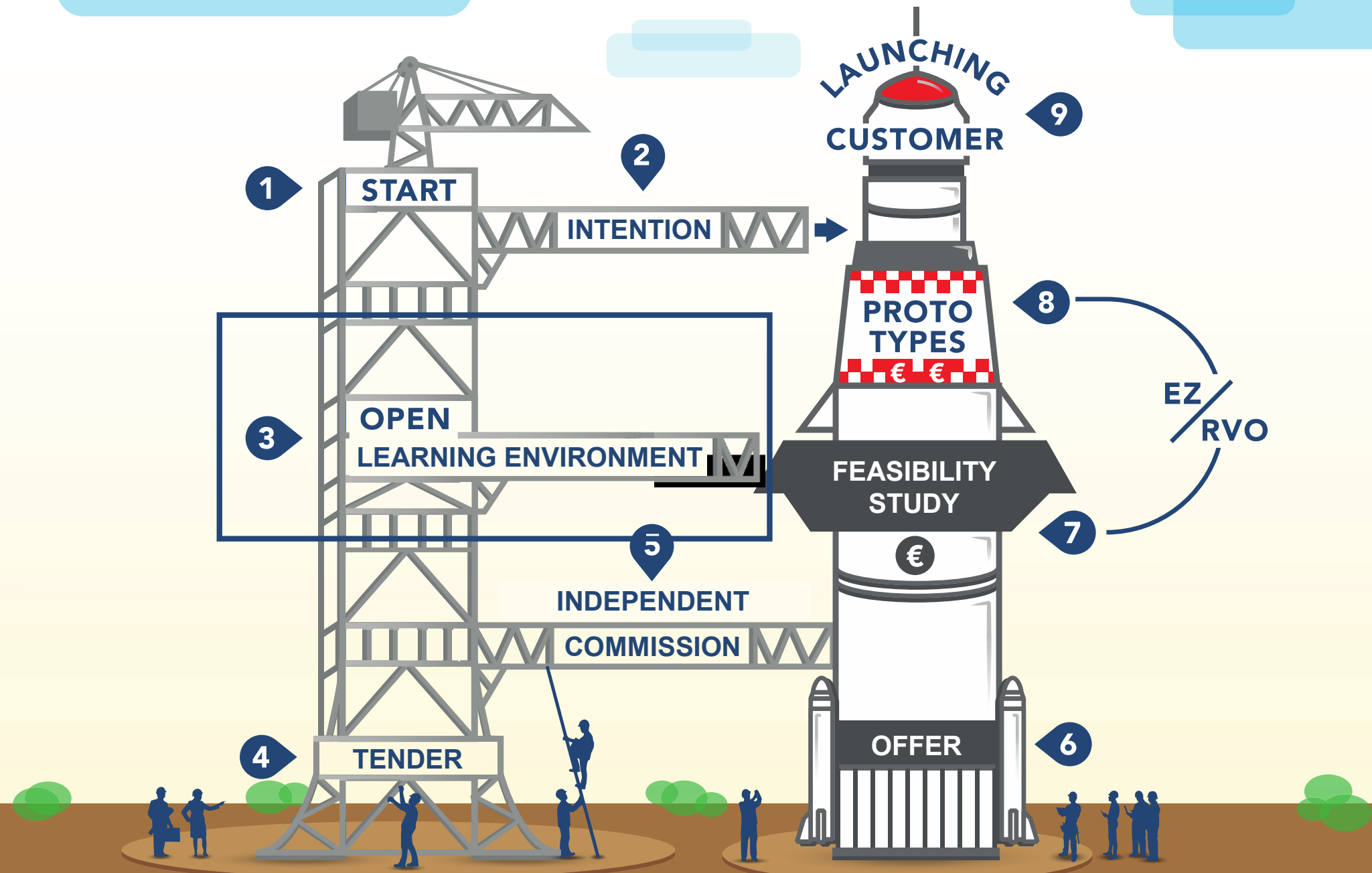
kennisdelen

Belangrijkste inzichten en lessen circulair viaduct

We experimenteerden binnen dit project met nieuwe techniek en een nieuwe manier van samenwerken. In het [integraal advies](#) delen we de belangrijkste inzichten en lessen van het ontwerpen, bouwen, monitoren en demonteren van het viaduct. In de publicatiedatabank van het ministerie Infrastructuur en Waterstaat zijn de [achtergronddocumenten](#) waar we naar verwijzen in het advies en de [ontwerpnota](#) te bekijken.

Prototype 1st circular viaduct

- Reusable elements
- Coöperate as equal partners
- Public sharing of results





Open Learning Environment

We need a system change, not 1 solution from 1 company

- Open source sharing of knowledge and experience → key to a successful transition
- 60 participants: companies, governments, knowledge institutions
- Joint knowledge development (e.g. business and value cases, circular design)
- Voluntary but not without obligations
- Wider than civil engineering

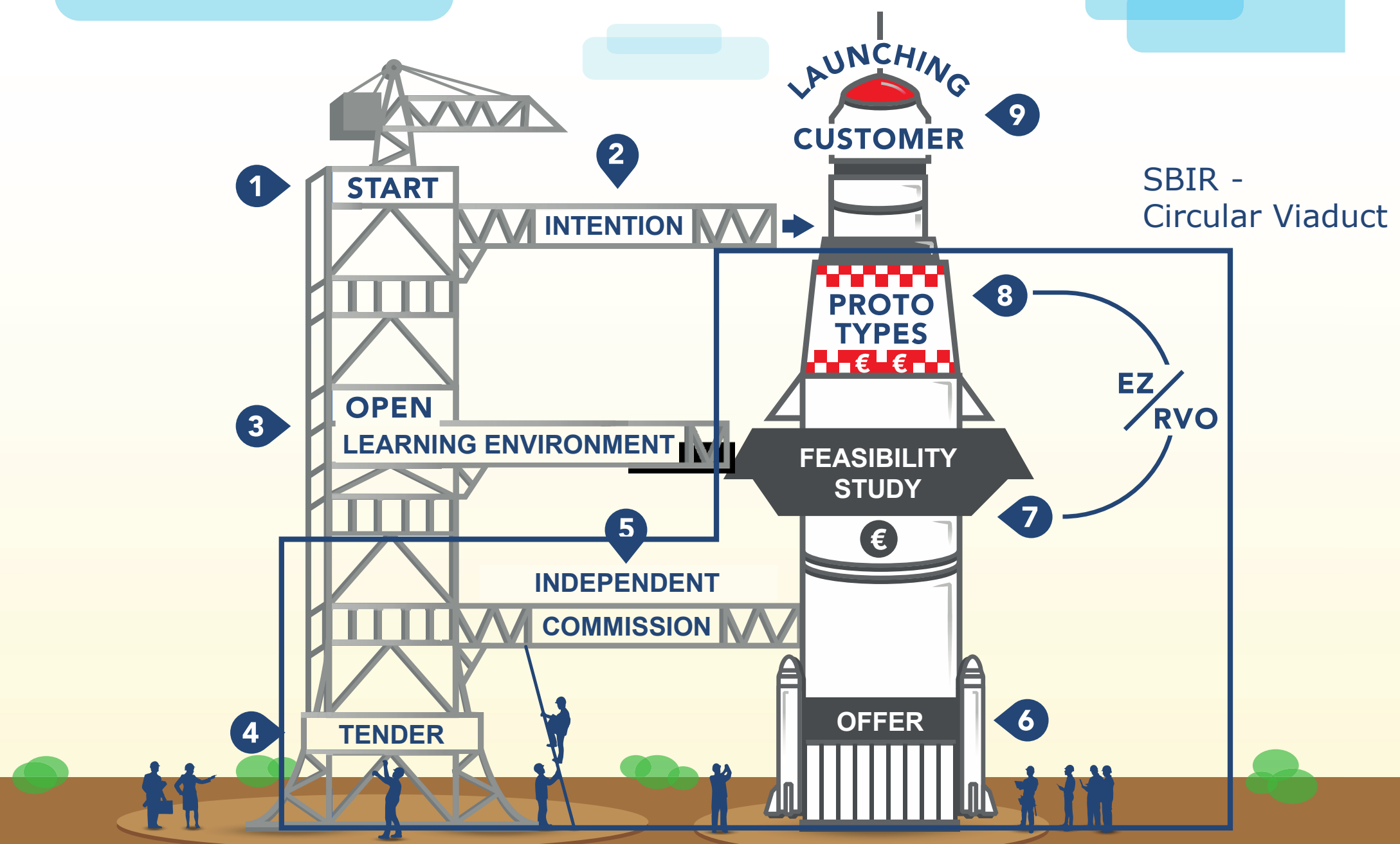


Aim open learning environment

- Apply results in ongoing projects
- Additional incentive to the development of circular viaducts and bridges

Follow-up

- Active support to the development of innovations
→ *Strategic Business Innovation Research (SBIR)*





SBIR

- Innovation competition for societal problems
- Research and development contracts
- Focus on problem definition
- Early financial compensation
- Selection based on
 - Impact
 - Technological feasibility
 - Economic perspective
 - Price (optional)



SBIR - Circular Viaducts

Problem:

Not enough mature circular bridges and viaduct solutions available.

Context:

- Focus on scalable circular solutions
- Replacement and renovation task as launching customer
- Ambition: TRL 6/7 → Prototype testing in operational environment

Objective:

Contribute to the development of mature circular bridge and viaduct innovations, which Rijkswaterstaat can procure (as launching customer).



Phased competition

Phase 1: 10 of 32 subscribers selected (€ 90.000)

- Cooperation between Rijkswaterstaat and subscribers. Support by knowledge institutions
- Feasibility study → offer phase 2
- Selection end of phase 1 on the same criteria
 - Impact
 - Technological feasibility
 - Economic perspective
 - Additional: intellectual property rights

Phase 2: 3 subscribers selected (€ 1.5m)

- 3 subscribers with succesfull feasibility study
- Contract for applied research (R&D)
 - Phase 2a: Prototype development
 - Phase 2b: Further development prototype and testing

Phase 3:

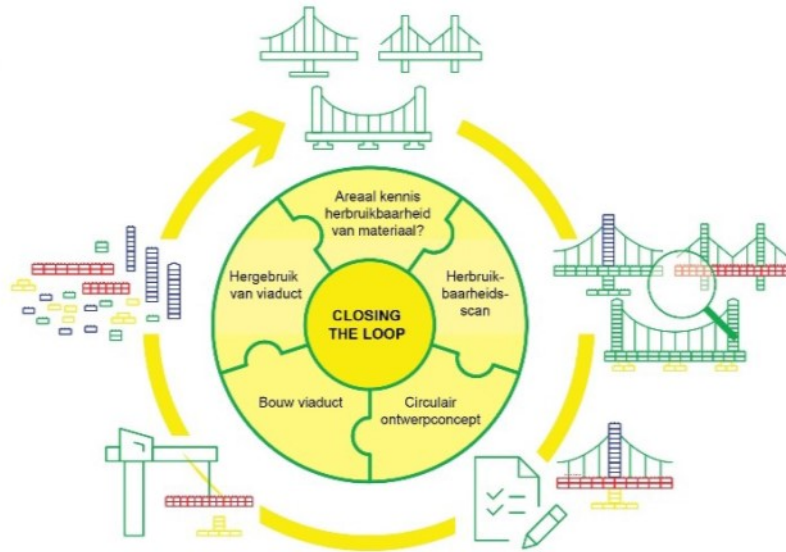
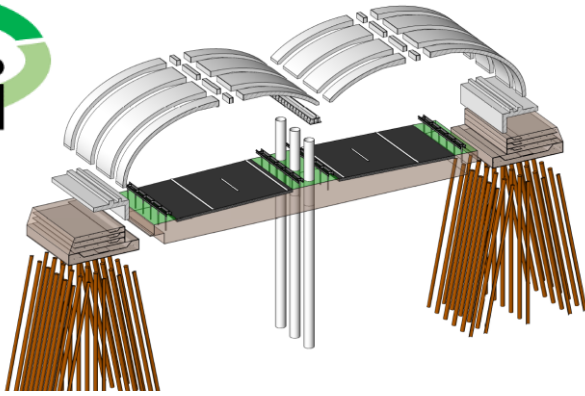
- Commercialisation not part of the SBIR



10 solutions, 3 directions

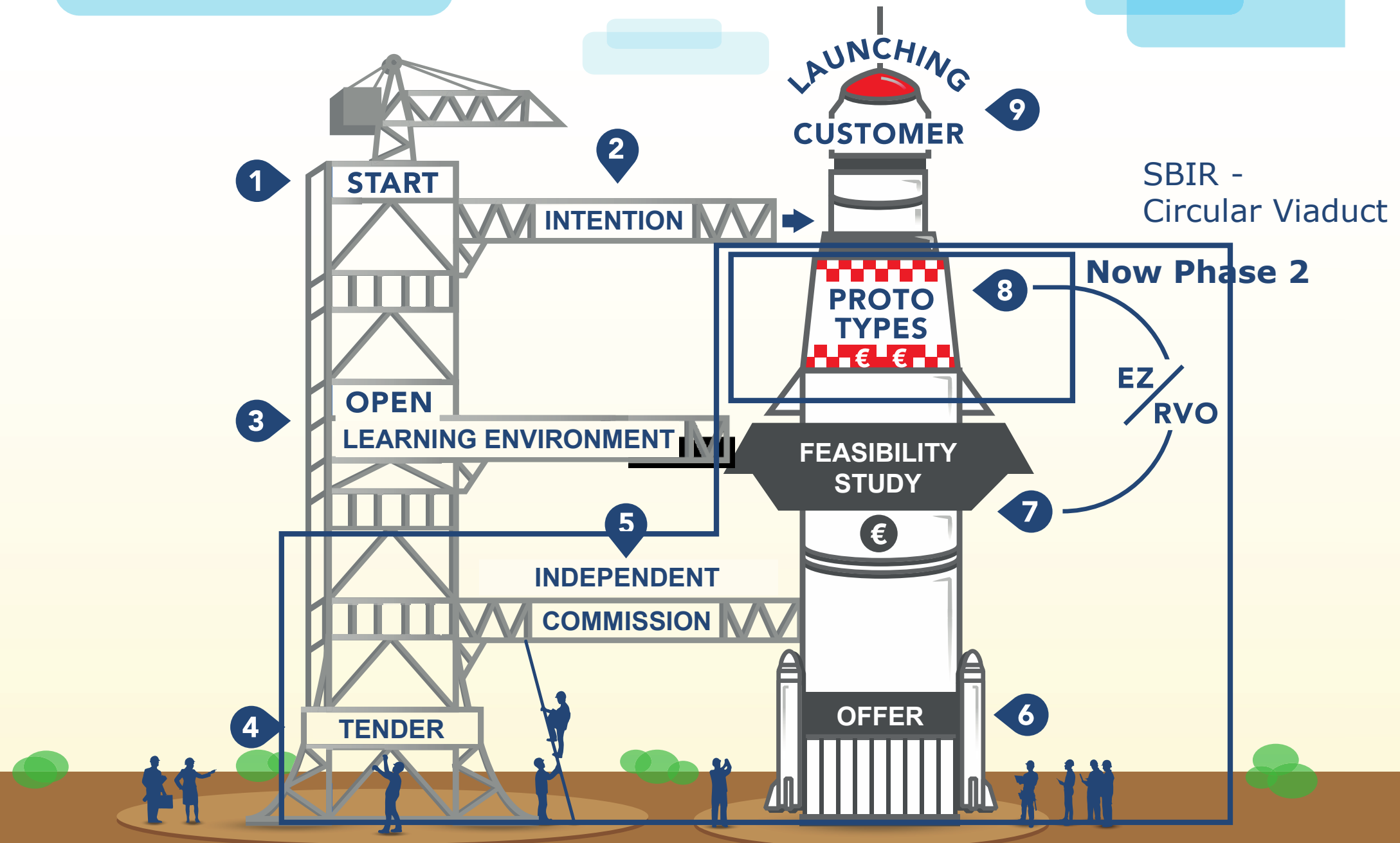
- | | |
|--|----------------------------|
| <ul style="list-style-type: none">• Bridges of Laminated Timber BOLT• Het Biosbased viaduct• Viaductbehout | Biobased |
| <ul style="list-style-type: none">• Closing the loop• Reuse of prefab beams | Reuse |
| <ul style="list-style-type: none">• The circular arch viaduct• Honeycomp• Modulair viaduct Bögl• Variaduct• Vici | Adaptable
(new) |





Results phase 1

- Broad variety of solutions, 3 solution directions
 - 3 Biobased
 - 5 Adaptable (new)
 - 2 Reuse
- Selected
 - VICI: modular arch viaduct
 - Nebest: Closing the Loop
 - Royal Haskoning DHV: reuse of prefab beams
- Not selected: stimulate use of knowledge and further development





Phase 1

- Continuation of Open Learning Environment
 - Knowledge sharing
 - Guidance by Rijkswaterstaat
 - Support by technical experts (Rijkswaterstaat and knowledge institutions)
- Experience phase 1
 - New way of cooperating: learning by doing
 - Still develops competition → less in phase 2?
 - Wide range of solutions → we need all
 - Almost all offers open source → circular transition



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Thank you

