CIRCULAR SYSTEM
HEAVY MACHINERY

Photo by Komatsu

Heavy Machineries – Circular System Characteristics

System characteristics:

Mining industries have a need for heavy machinery. Urban mining and circular economy principles have reached the sector. The analysis of world biggest facilitator (P&H Joy Global Group) as part of global player Komatsu (60.000 staff, Japanese headquarter) is at the center of the analyzed system.

Availability/Role of recycling technology:

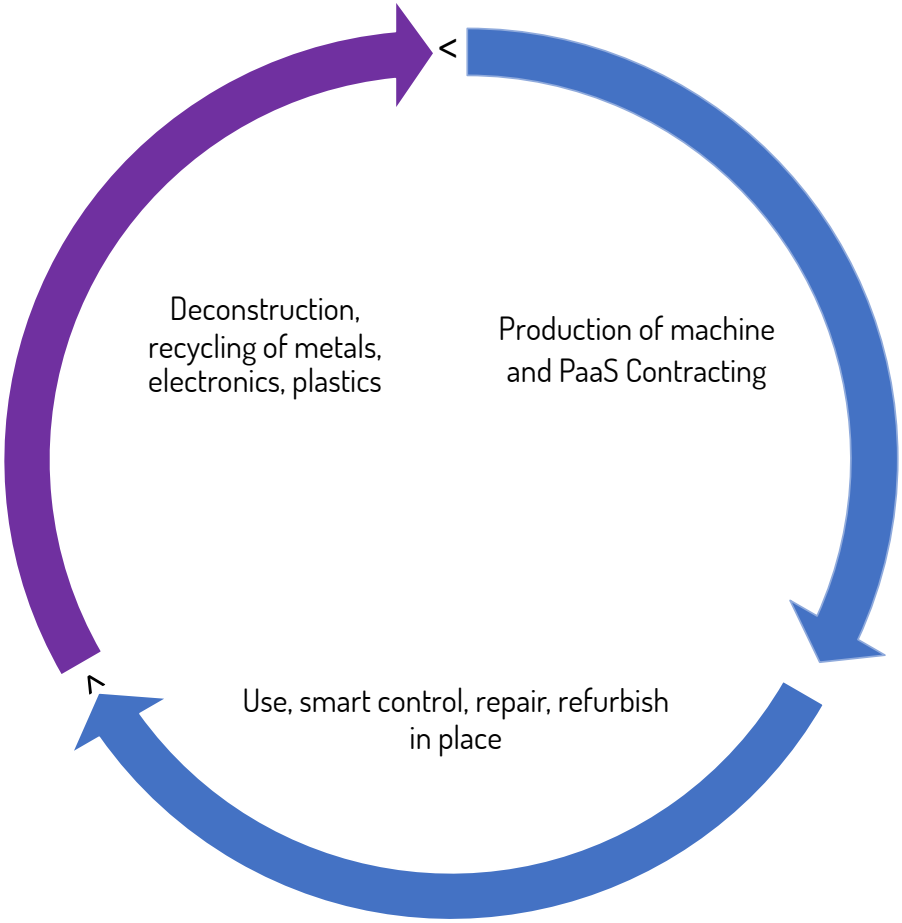
- Product durability and recyclability is given, 100 % refurbishment/recycling.

Maturity of market:

- Highly specified production, fully digitized, facility management of system relevance.
- Only one competitor who offers a PAAS as business model (Caterpillar), leasing has been established for financing machinery (37 companies).
- P&H has 2.600 staff in services, in 30 Locations, and a new focus on mineral recycling.
- Decrease of underground mining by 17%; growth of over ground mining since 2011 by 40 – 50%.

Policy intervention type/regulations/directives:

- History of the company 120 years, all capacities on board, proved collective learning (from craftsmanship to a digital age of building and maintaining smart machines), facilitation as an inherent factor for machine processing.
- Financial needs – leveraging equity in balance sheets after world financial crisis in 1930s (P&H).
- Service company was founded by need of facilitating machinery services as part of public services – this was an important experience for P&H Joy Global and for their Japanese mother Komatsu. "Product as a service" was developed due to the positive effects on equity.
- Following Japans strategy to 100 % asphalt recycling, Komatsu evolved a vision for urban mining machines, that can be mined themselves.



Sources: Sustainability 2017, 9(2), 256; Journal of Cleaner Production 37 2012, 19e28, Fachausschuss legierter Schrott , BDSV Bundesvereinigung Deutscher Stahlrecycling- und Entsorgungsunternehmen e.V. ,Joy Global Balance Sheet 2017, Komatsu 2020

S W O T Heavy Machineries

Strength

1. Closed loop product
2. Technical cycle, C2C
3. High equity in balance sheets
4. Implementation of digital technologies is possible
5. "As a business" models are possible

Weakness

1. Craftsmen capabilities are needed, but scarce
2. Facilitation of a network of service locations might drive cost with old machinery
3. Hight dependencies of customers to systemic solutions

Opportunity

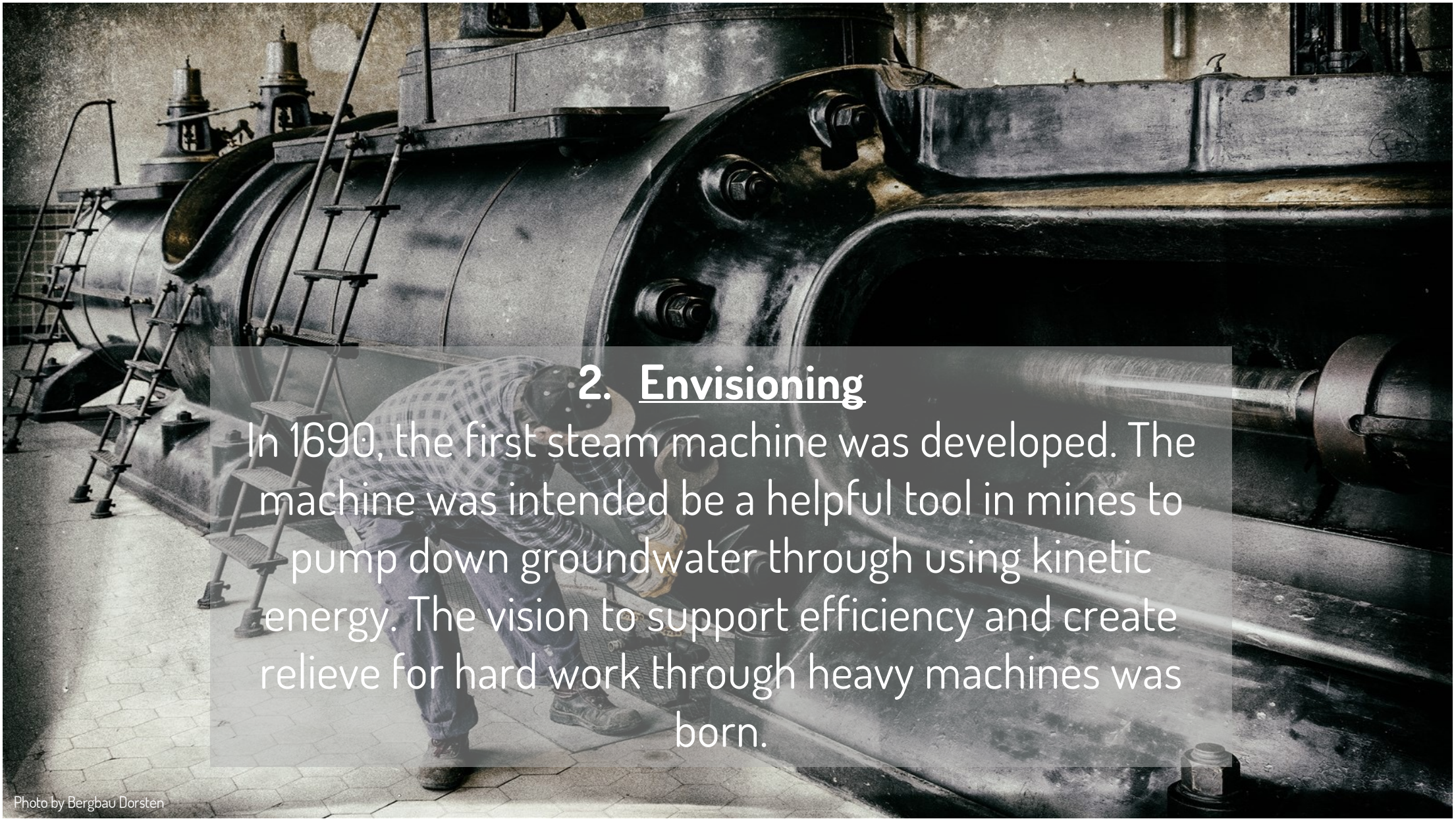
1. Market growth in an urban mining circular economy
2. Transformation of mineral and fossil mining businesses into circular mining businesses possible

Threat

1. Losing customers for good if the service does not provide, what has been promised

Source: BDSV, Cao et. al 2012, Deng et. al 2015, Deng 2017, Joy Global Inc. 2012, Hendrys 2020


1. Nature Science
The discovery that natural materials can be used to make tools builds the foundation for the later invention of machineries at all.
Photo by Medienservice Sachsen



2. Envisioning

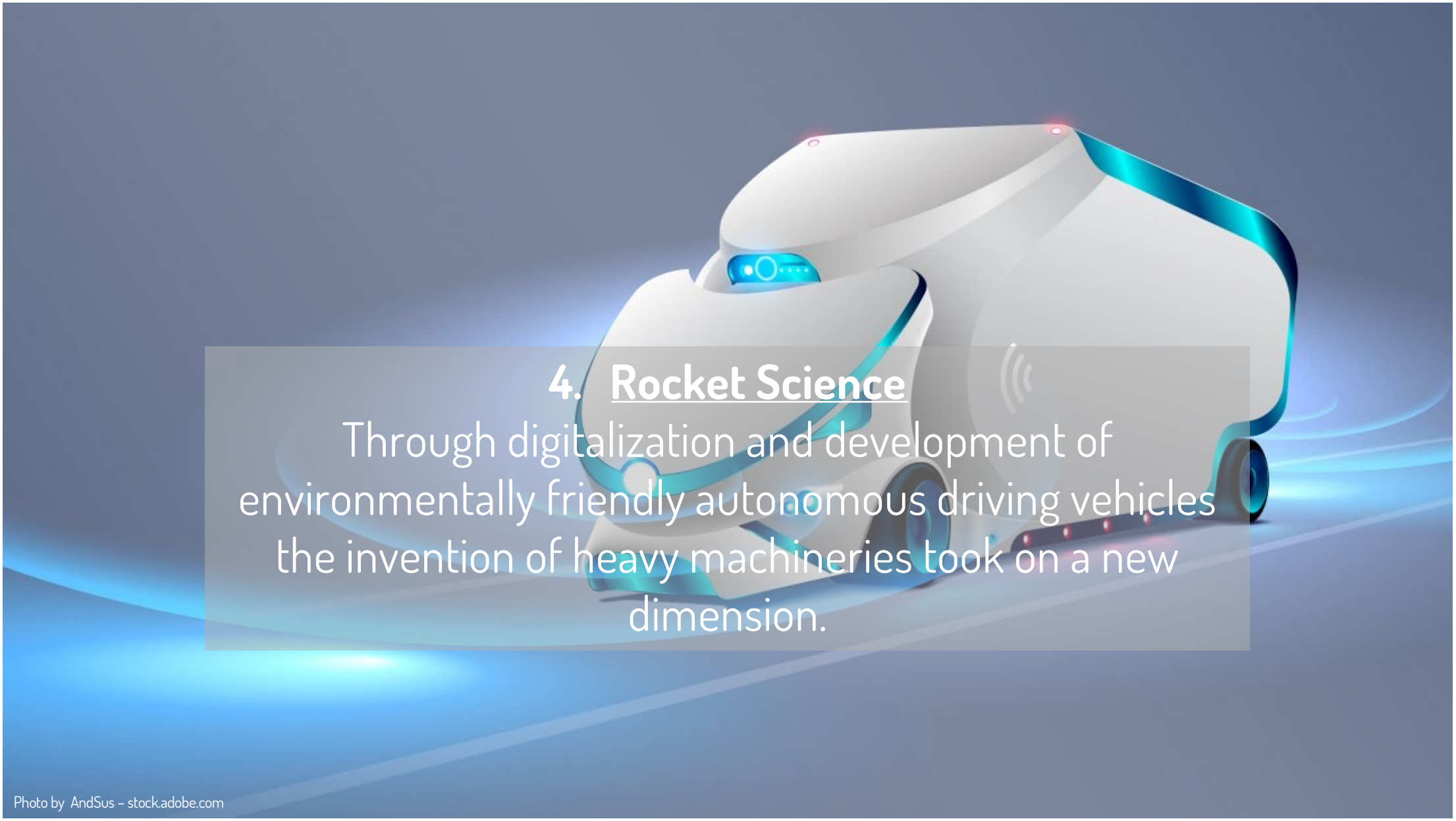
In 1690, the first steam machine was developed. The machine was intended be a helpful tool in mines to pump down groundwater through using kinetic energy. The vision to support efficiency and create relieve for hard work through heavy machines was born.

Photo by Bergbau Dorsten

3. Investment

As coal mining started to be a very lucrative business, investments in specialized heavy machines increased due to promising returns.

Photo by Blog Part Solutions



4. Rocket Science

Through digitalization and development of environmentally friendly autonomous driving vehicles the invention of heavy machineries took on a new dimension.

Photo by AndSus – stock.adobe.com

5. Resource Scarcity

CO2 pricing and environmental regulations led to higher costs in coal mining and steel production.

Photo by Dominik Vanyi on Unspash

6. Cognition for System Relevance

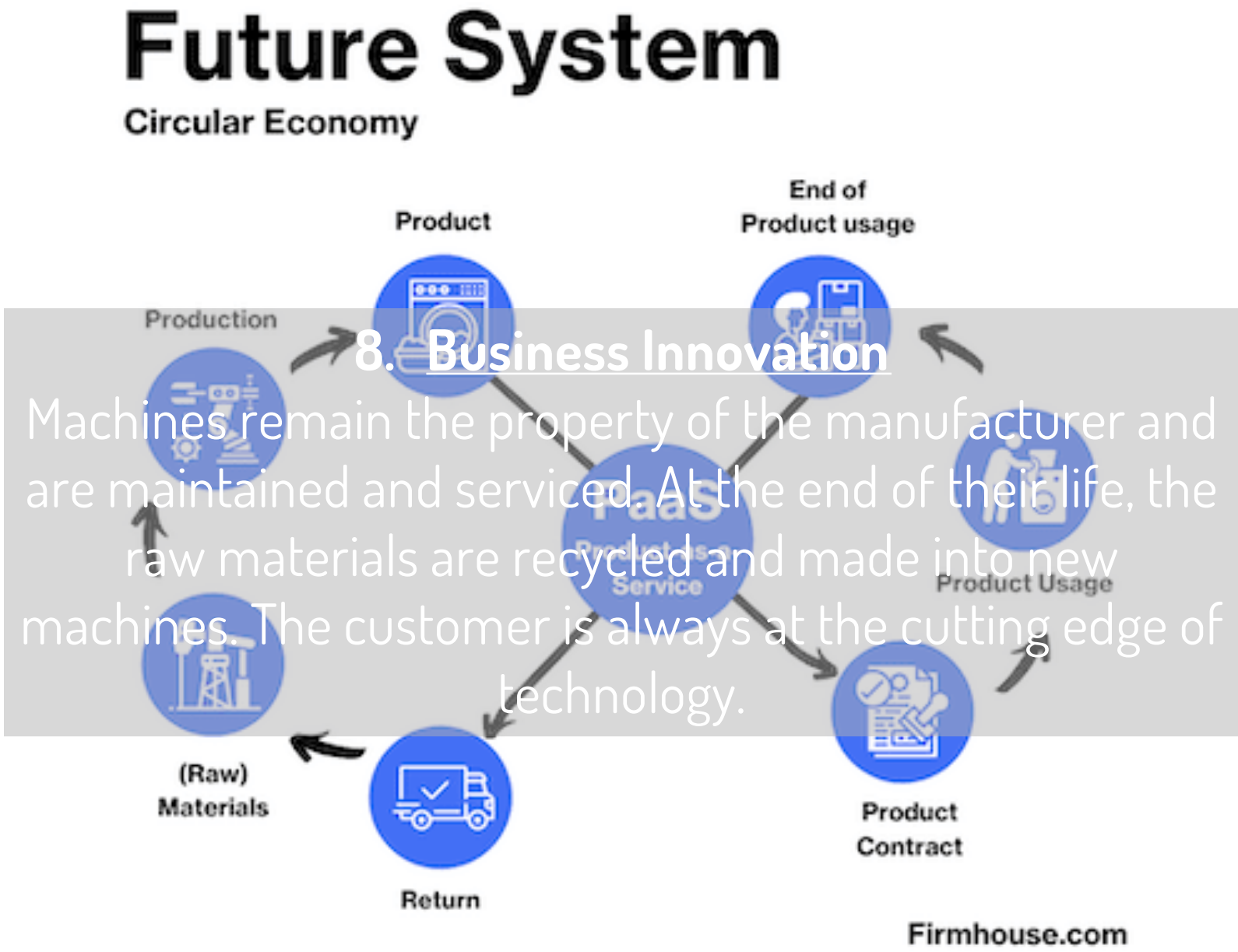
Low investment by the customer frees up funds to finance innovations. Research and development remain in one hand.

Photo by Komatsu

7. Technical Innovation

Service, maintenance and repair is at the place of use. Value retention and modernization extend the service life of the machines.

Photo by Krampitz Tanksystem GmbH



8. Business Innovation

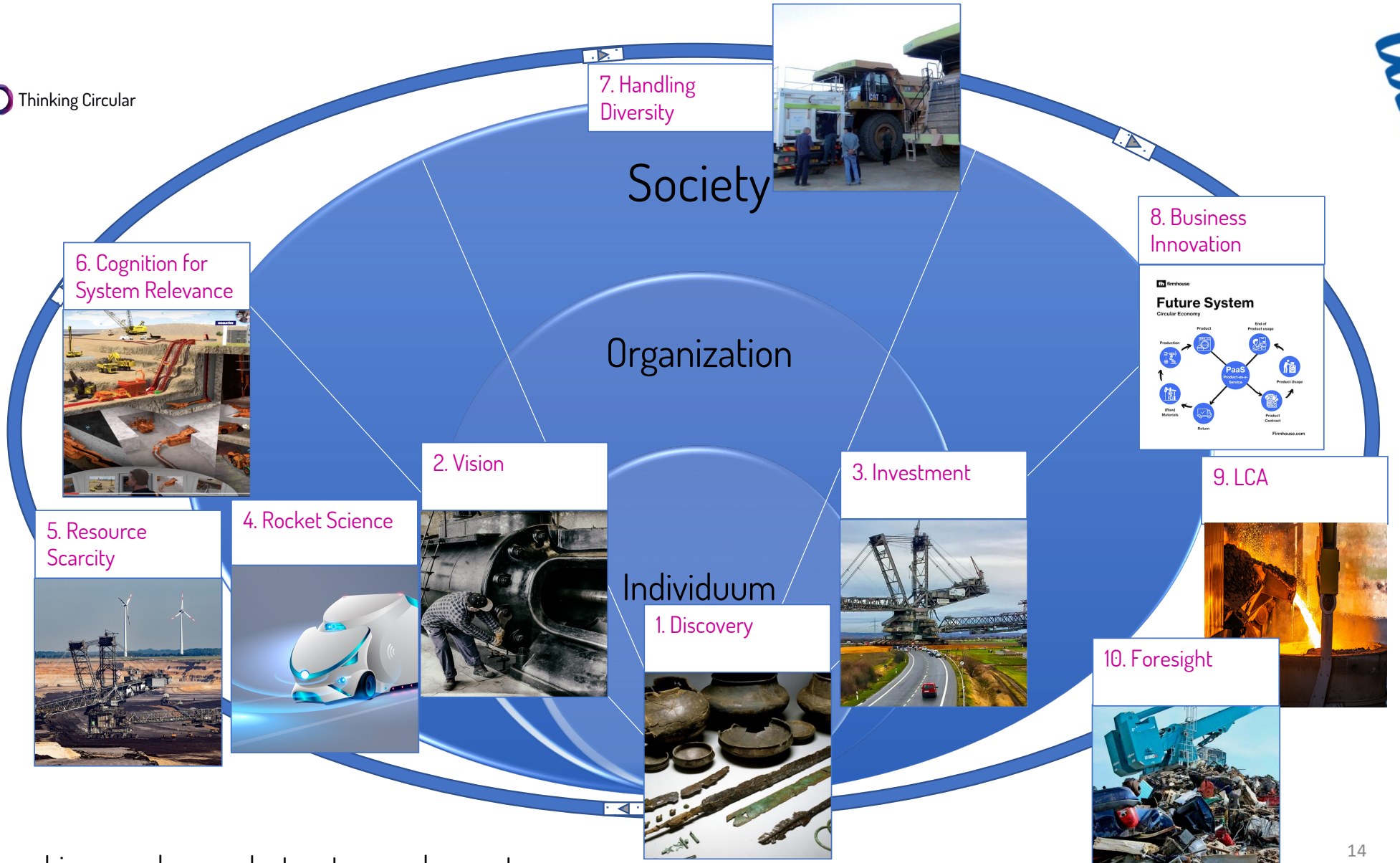
Machines remain the property of the manufacturer and are maintained and serviced. At the end of their life, the raw materials are recycled and made into new machines. The customer is always at the cutting edge of technology.


9. Life Cycle
Raw materials from machines at the end of their useful life are recovered and reused.
Foto von yasin hemmati auf Unsplash

10. Forecast

Raw materials are not disposed of after they have been used. Raw material recovery from landfills secures the demand in production.

Thinking Circular



Heavy machinery cycle – product system evolvement

Thank you for your attention

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