

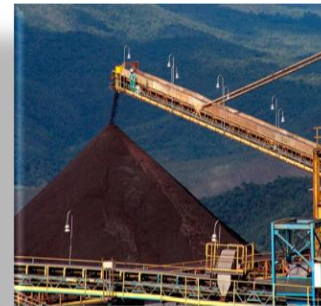
VALE BRICK FACTORY

Our first circular economy initiative



Vale is global mining company, which has several assets in different countries around the world

- ▣ Vale is a world leader in the production of iron ore
- ▣ In 1942, Vale started its operation in Brazil
- ▣ Vale has a huge logistic systems integrated to the mine, including railways, maritime terminals, and ports
- ▣ Vale`s product portfolio: iron ore, pellets, sand

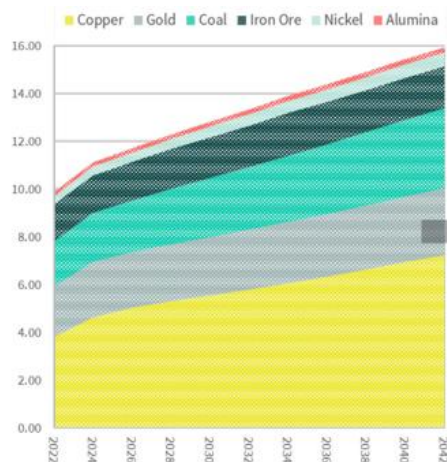


*Vale has more than **20** mines in Brazil with capacity to produce **350-400 Mty** of Iron Ore*

The mining sector challenge is big, if we do nothing

GLOBAL ANNUAL TAILINGS PRODUCTION

2022 - 2042



Source: ICMM, 2022

PROJECTED TAILINGS GENERATION

2022 - 2042



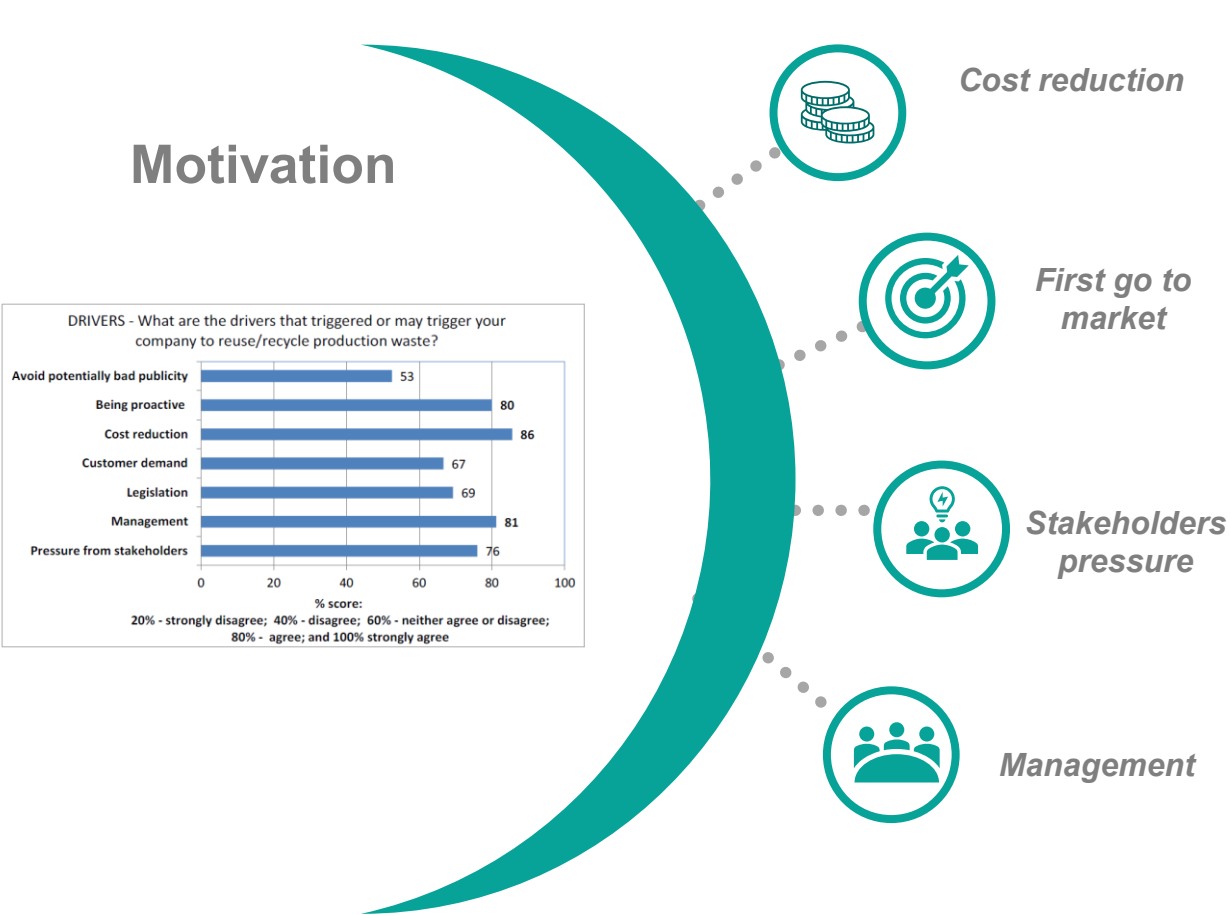
EQUIVALENT TO



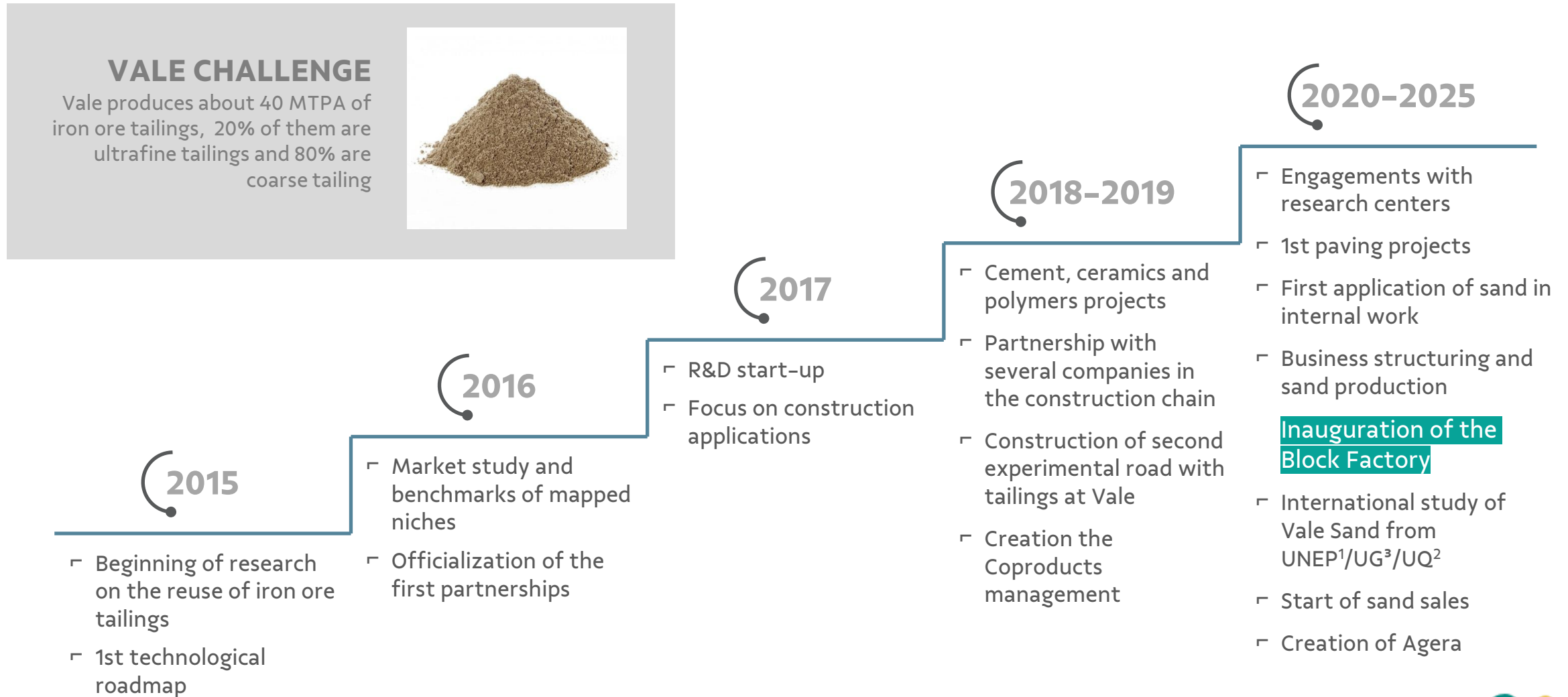
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Wine bottles

For a company to reuse its tailings in the long term, it will depend on whether or not the reuse makes economic sense



More than 10 years, Vale is researching new opportunities to transform iron ore tailings into new products and new business



Vale generates three different types of tailing in Brazil, and each type can generate one or more circular products after some treatments

	Coarse tailing	Ultrafine tailing	Total tailing
	10-20% Fe ₂ O ₃	39% Fe ₂ O ₃	15-30% Fe ₂ O ₃
	80-90% SiO ₂ 90% < 0,150 mm	50% SiO ₂ 90% < 0,038 mm	70-85% SiO ₂ 75% < 0,150 mm
	14-30% moisture 	20-25% moisture 	14-30% moisture 
	 <i>Ore- Sand 01</i>	  <i>Clay Iron ore</i>	 <i>Ore-Sand 02</i>

Vale Circular
Products

There are many opportunities to use iron ore tailings and consequently ore-sand. However, civil construction is the biggest market, and it can address a huge volume



5º CONGRESSO LUSO-BRASILEIRO DE MATERIAIS DE CONSTRUÇÃO SUSTENTÁVEIS
CONGRESSO CONSTRUÇÃO 2024
6-8 de Novembro, IST, Lisboa, Portugal

REJEITO DE MINÉRIO DE FERRO COM ELEVADO TEOR DE FINOS EM SUBSTITUIÇÃO TOTAL DO AGREGADO MIÚDO PARA FABRICAÇÃO DE PAVER: PROPRIEDADES MECÂNICAS, MICROESTRUTURAIS, DE DURABILIDADE E PROJEÇÃO DE CONSUMO

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Mineralogical, chemical, physical and microstructural analysis of iron ore tailings with high fines content

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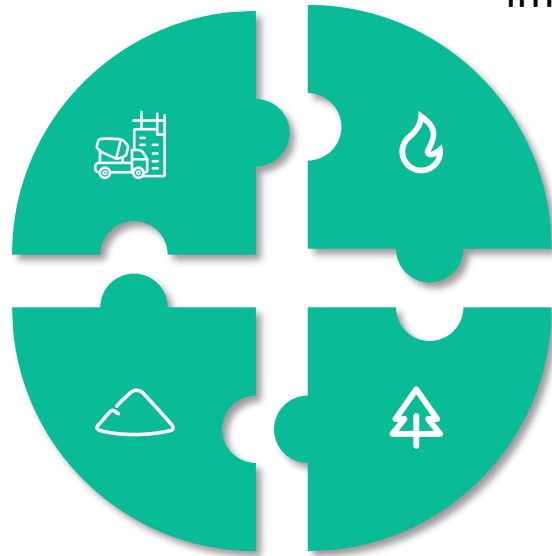
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Vale Brick Factory is a new way to do business

MOTIVATING FACTORS

Increasing the
knowledge for Vale

Improving the social
image for Vale



Low complexity
technology

Model with Less
legal requirements



+ Safer

+ Sustainable

+ Inclusive

+ Innovative

Pico Brick Factory was the first industrial concrete brick which uses ore-sand (and in the beginner tailings as it is) as raw material



Pico Brick Factory
Pico Mine
Minas Gerais/Brazil

It was the breakthrough that proved for Brazilian Market that tailings can be reused



NOT AN EASY JOURNEY

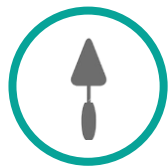
Pico Brick Factory is Vale`s first iron tailing reuse initiative and it has only women taking care of all factory processes



VALE + CEFET



Reuse up to 30 kt/year tailings



Capacity: 3,8 MM units/year



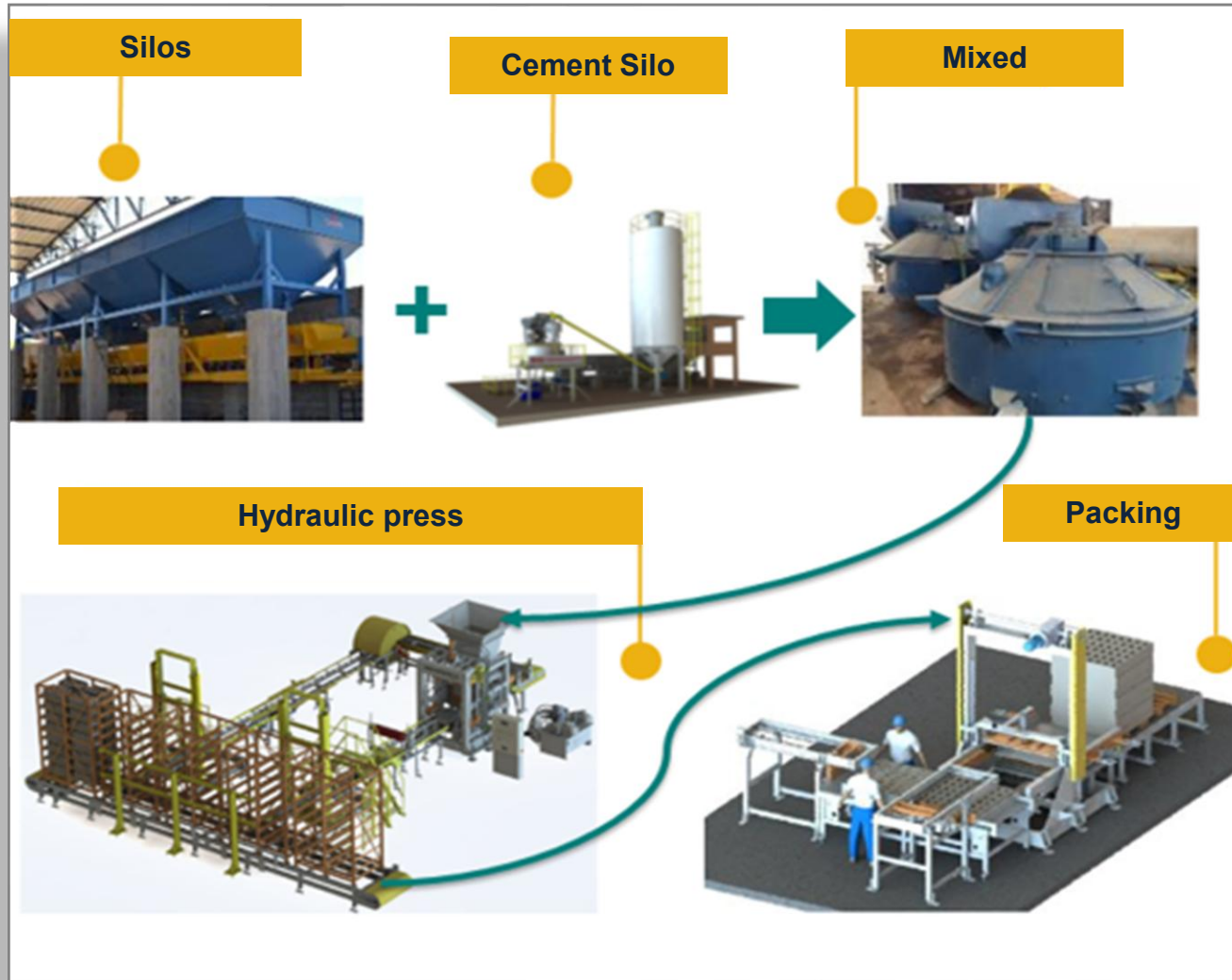
Whole production for communities and internal consumption



Investment: US\$ 6,00 MM



The operation system is simple, automatized and flexible



The operation system uses 5 stages



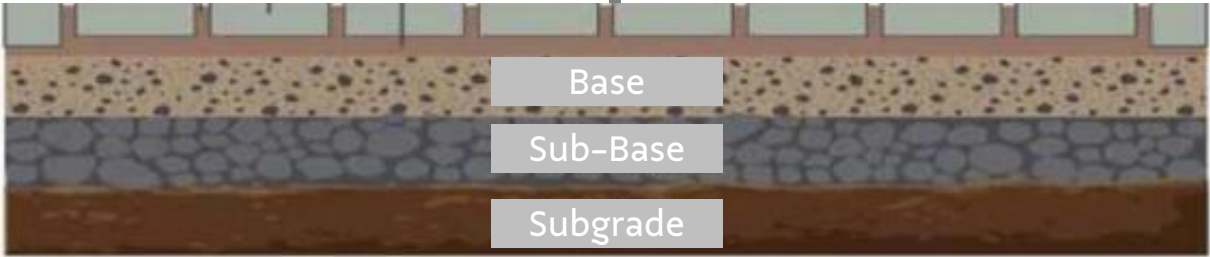
Bricks are cured at room temperature



Coarse iron tailing of Vale replaces all the fine aggregate

Iron tailing replaces 100% of fine aggregate

VALE`s BRICK



Resistance
(28 Days)

35 MPa



- Fine Aggregate: Total Tailings
- Coarse Aggregate: gravel
- Cement: CPII or CPV
- Water



The main challenge lay in the variability of iron ore tailings' particle size, due to the fact that Pico Mine had not yet implemented ore-sand production

1



35 MPa

Moisture (%)	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8			
Aggregate/Cement Rate (%)	3			4			5			3			4			5			3			4			5		
Coarse Aggregate Rate (%)	0,5									0,6									0,7								

2



38 MPa

Moisture (%)	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8			
Aggregate/Cement Rate (%)	3			4			5			3			4			5			3			4			5		
Coarse Aggregate Rate (%)	0,5									0,6									0,7								

3

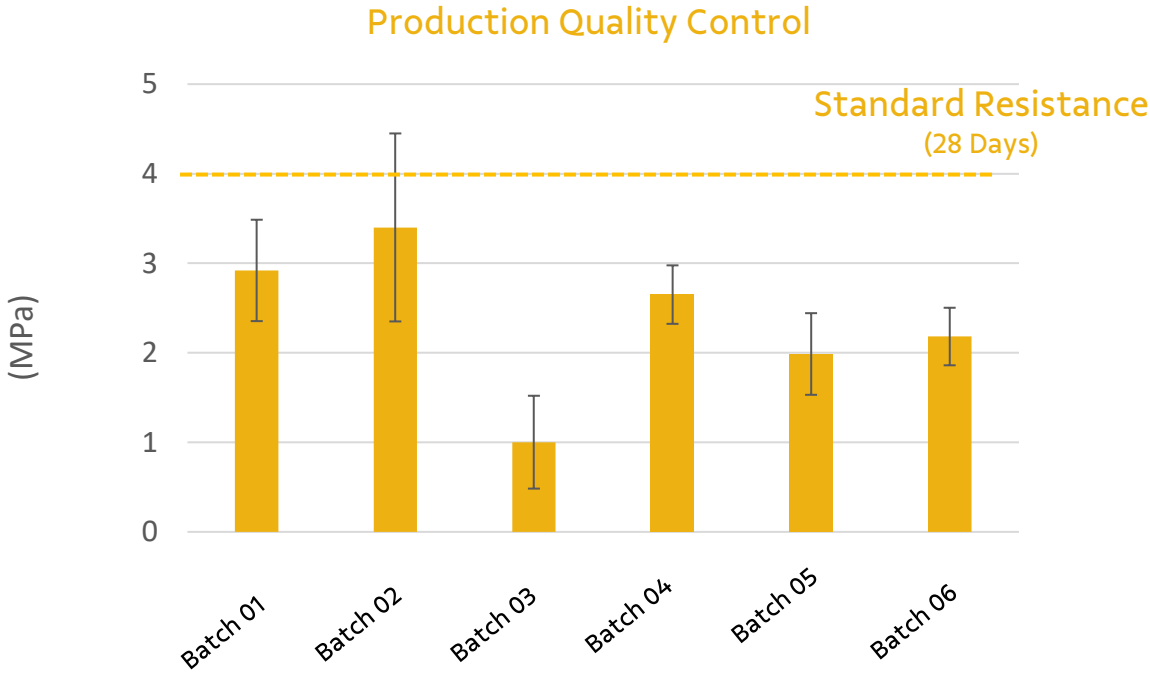


40 MPa

Moisture (%)	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8			
Aggregate/Cement Rate (%)	3			4			5			3			4			5			3			4			5		
Coarse Aggregate Rate (%)	0,5						0,6						0,7														

More than 42 types of mixture made out of iron ore tailings were tested in production line

In addition to pavers, the Brick Factory is also capable of producing concrete masonry units and bond beam blocks



The main challenge is ensuring that the quality of the products matches the standards achieved under laboratory conditions

The researchers and operators are working together to make possible to transfer the technology in real time and to test more 65 types of bricks

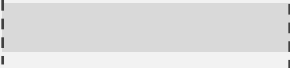


Pico Brick Factory concluded its research phase in December 2022. Since 2023, the plant was transformed into an industrial plant





Research Plant



PRODUCTION 1,4 MM units/year

RESEARCH CEFET-MG

DESTINATION Just for Vale units

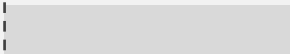
EMPLOYERS Own employees

BUDGET R\$ 26 MM – Capex
R\$ 5 MM– Opex





Industrial Plant



PRODUCTION 3,8 MM units/year

RESEARCH No

DESTINATION Donation and intern use

EMPLOYERS Third- party employees

BUDGET ~ R\$ 7–8 MM

Equipment issues, variability in tailings quality, maintenance demands, high costs, and employee turnover hindered the early stages of the operation



Operational Challenges



High operational costs compared to conventional brick factories



Premature wear of equipment



High variability in tailings during the initial phase, along with challenges in maintaining consistent brick quality control

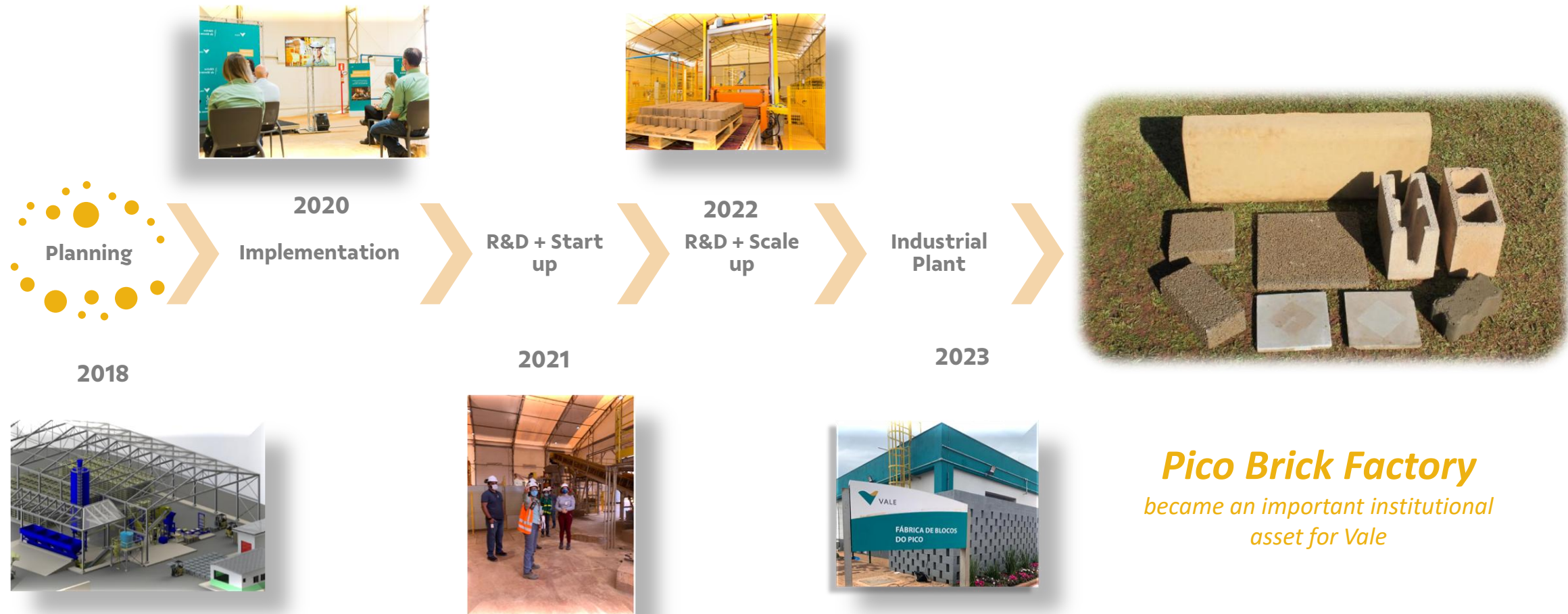


High employee turnover and difficulty in finding women with expertise in this field

Why didn't the Pico Brick Factory become a commercial conventional operation?

- Sharing value with local communities generates greater impact than simply selling bricks
- The external market offers low profit margins for brick sales
- Vale's internal demand for bricks exceeds the current production capacity of the plant
- The Brick Factory is now being used as an educational tool by Vale

Pico Brick Factory stands as a symbol of Vale's transformation in line with its strategy to become a more sustainable mining company



Pico Brick Factory
*became an important institutional
asset for Vale*

Thank you



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