

OCTOBER 25, 2023

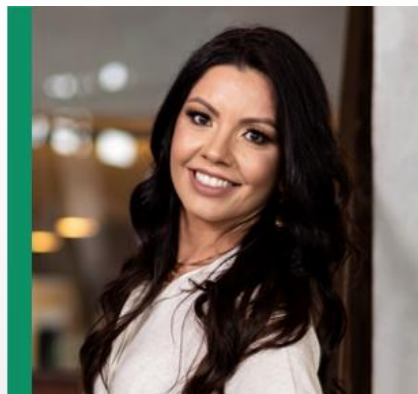
Vale implements a global operations data infrastructure to drive transformation

AVEVA WORLD CONFERENCE 2023

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What we will see TODAY

- 1** Introduction to Vale
- 2** The REdiscover PIMS project
- 3** Technical Implementation
- 4** Use cases



1. Introduction to Vale





Mining is the **basis of a chain** that contributes to the **development** of society. It is present in products that are essential to **people's well-being**.

- **We exist to improve life and transform the future Together.**
- A **global** mining company.
- A company with **strategic** assets.
- One of **the world's largest producers of iron ore, pellets and nickel.**

Take children to school



Bring energy to your home



Exercise your body and mind



Help develop medical devices



Relieve the summer heat



Keep us connected and entertained



Our presence in operations



+20 Open-cast mines



+15 Underground mines



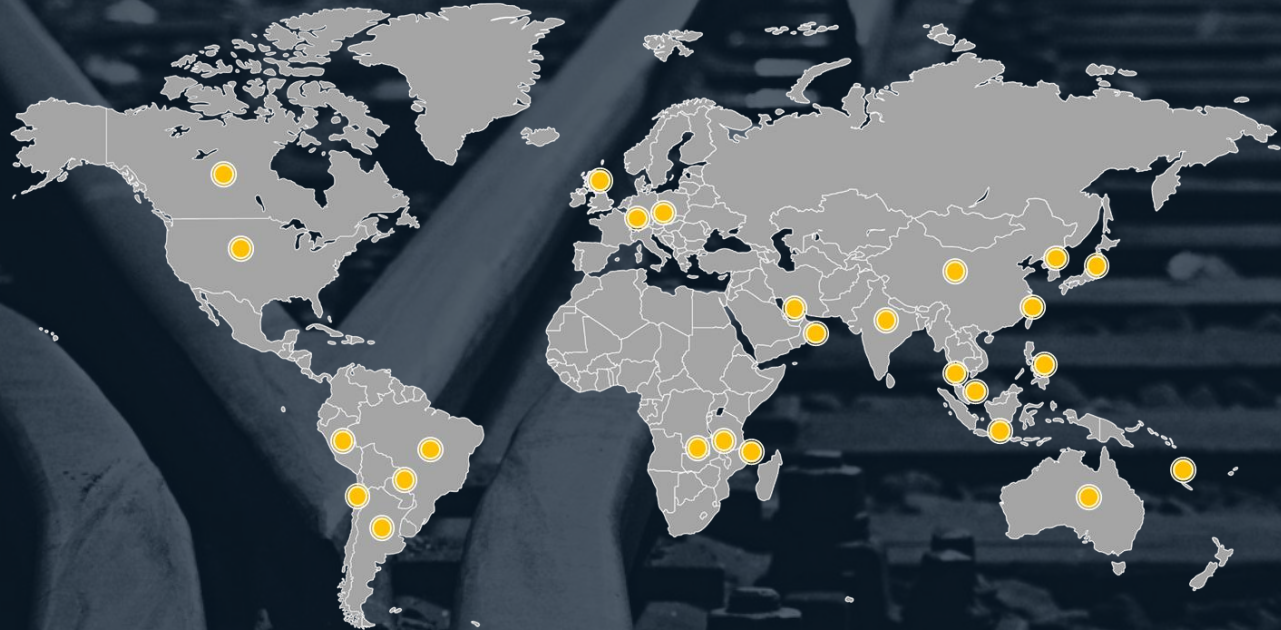
13 Pelletizing plants



2 Railroads



6 Ports of operation



- Iron
- Nickel
- Manganese
- Copper
- Coal

Plant information management systems at Vale (PIMS)

 **2016**

PIMS at all sites, not
all PI System based

29
instances



 **1998**

First AVEVA PI System

82 OPERATIONAL UNITS

AVEVA

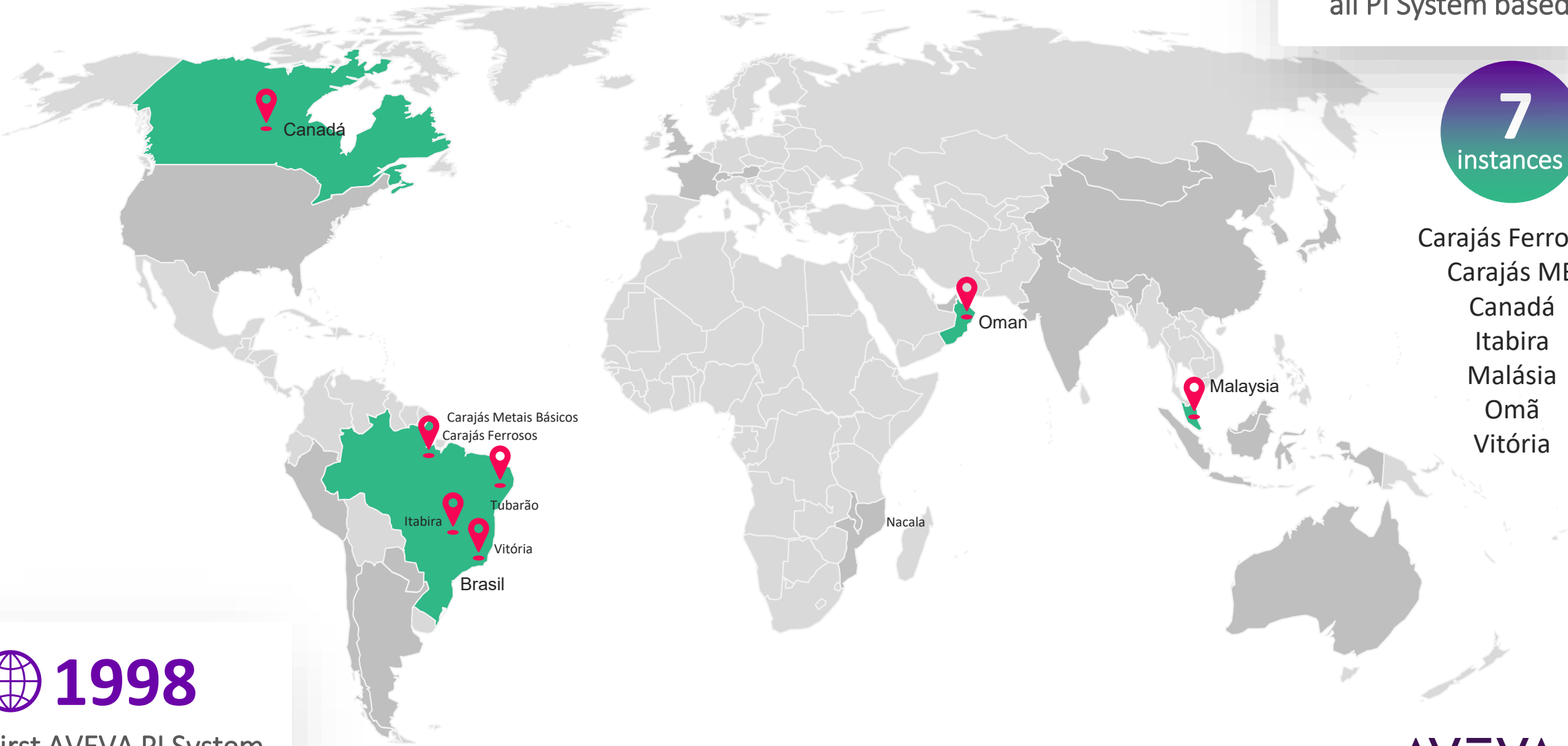
PIMS transformation plan

 **2016**

PIMS at all sites, not all PI System based

7
instances

- Carajás Ferrosos
- Carajás MB
- Canadá
- Itabira
- Malásia
- Omã
- Vitória



 **1998**

First AVEVA PI System

82 OPERATIONAL UNITS



Data democratization at Vale delivers efficiency gains and reductions in costs and time

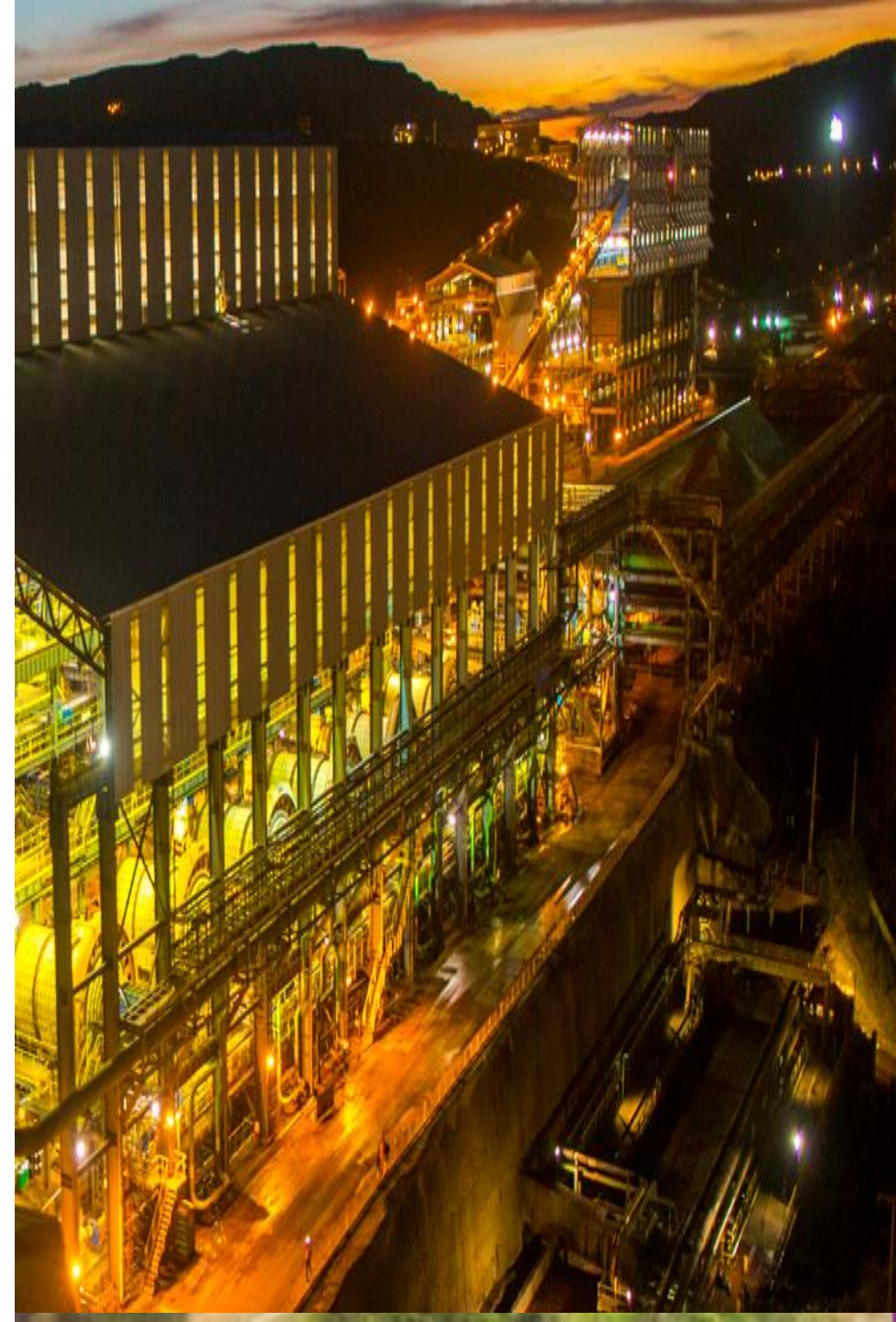
Challenge

- Implement a robust and secure data infrastructure providing high-quality, real-time data for users across 80 global operating units.
- Use standardization of data solutions across the global enterprise to ensure data quality and accelerate data-driven decision making.

Solution

- Centralization and standardization of Vale's global Plant Information Management Systems (PIMS) based on AVEVA™ PI System™ and its off-the-shelf native interfaces to collect data at the source.

Results



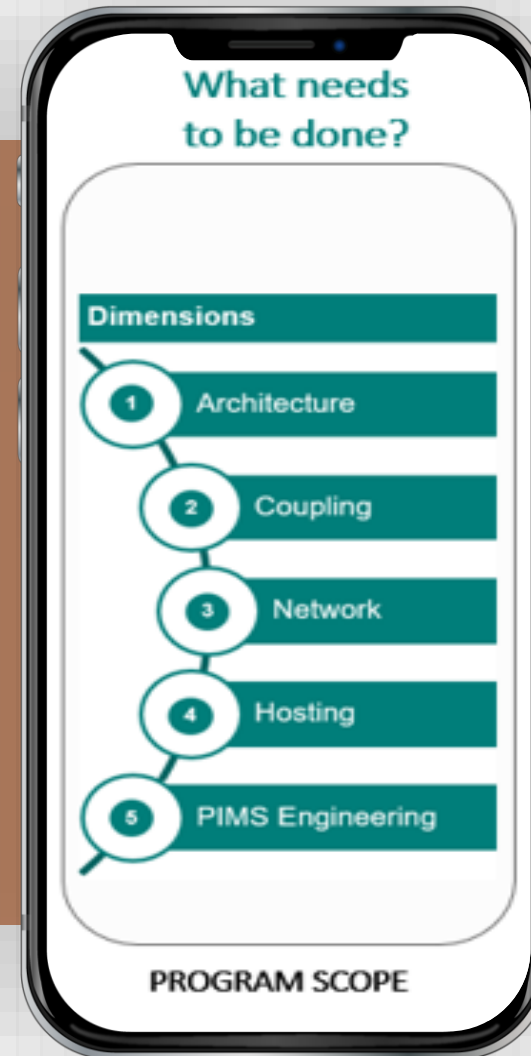
2. The REdiscover PIMS project (Plant information management system)

REdiscover strategy

Our Mission



To be Vale's
master source of
temporal data



REdiscover Program Structure



Squads



➤ **CUSTOMIZATIONS**

➤ **CLIENT TOOLS**

➤ **HARBOR**

➤ **INFRASTRUCTURE**

➤ **INTERNATIONAL**

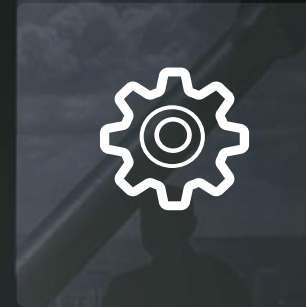
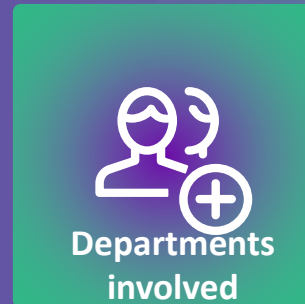
➤ **IRON ORE BENEFICIATION**

➤ **PELLETIZING**

➤ **POLICIES & STANDARDS**

➤ **RAILWAY**

REdiscover Program Structure



➤ **ARCHITECTURE**

➤ **AUTOMATION**

➤ **BUSINESS SOLUTIONS**

➤ **END USERS**

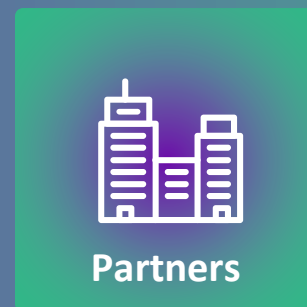
➤ **HOSTING**

➤ **NETWORK**

➤ **OPERATIONS / BUSINESS**

➤ **SAFETY**

REdiscover Program Structure



➤ **Accenture**

➤ **Algar**

➤ **Aveva**

➤ **DXC**

➤ **Radix**

➤ **TCS**

REdiscover Program Structure



➤ **Hybrid Project (Agile and Waterfall)**

➤ **Devops**

➤ **+100 People**

REdiscover Program Structure



Program
Challenges

- **Change of roadmap (location of operation)**
- **Execution time (3 years): expiration date of previous PIMS**
- **Architecture, infrastructure, and security changes happening in the enterprise**
- **Change in delivery strategy**
- **Treating the unknown**
- **Lack of availability of change agents**
- **User engagement**
- **Budget**

Journey of AVEVA PI System at Vale



1998

2020

2023



Rediscover
PIMS

IT'S OFFICIAL!!!

We are 100% PI System!



AVEVA

Our numbers!



10.432
USERS



2.608
USERS SCREENS



90+
REPORTS



550
USERS TRAINED LAST
YEAR



830.000
TAGS COLLECTED



89.864
TAGS CALCULATED



+39
NATIVE
INTEGRATION



+56
CUSTOMIZED
INTEGRATIONS

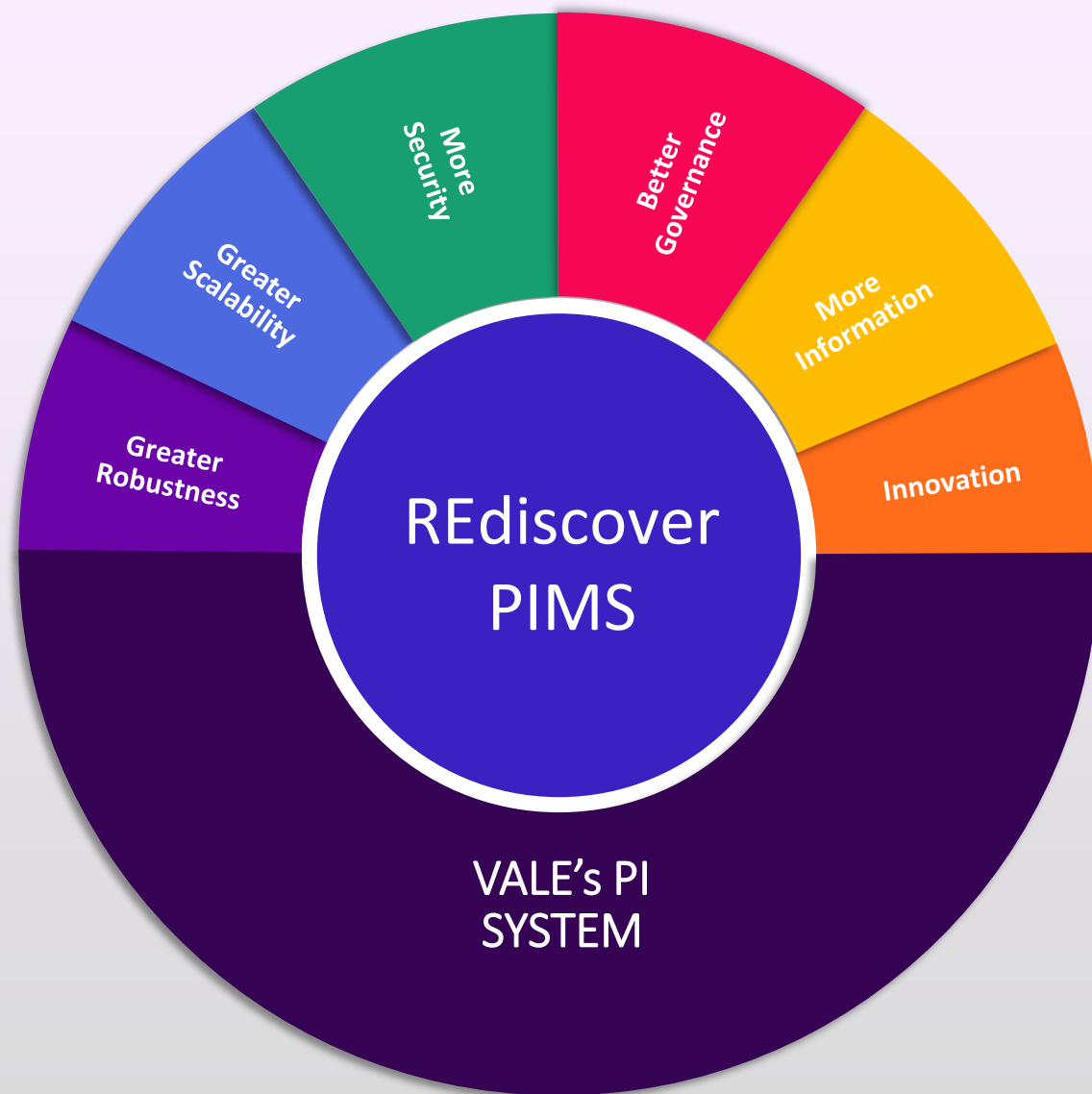


43
APPLICATION
SERVERS

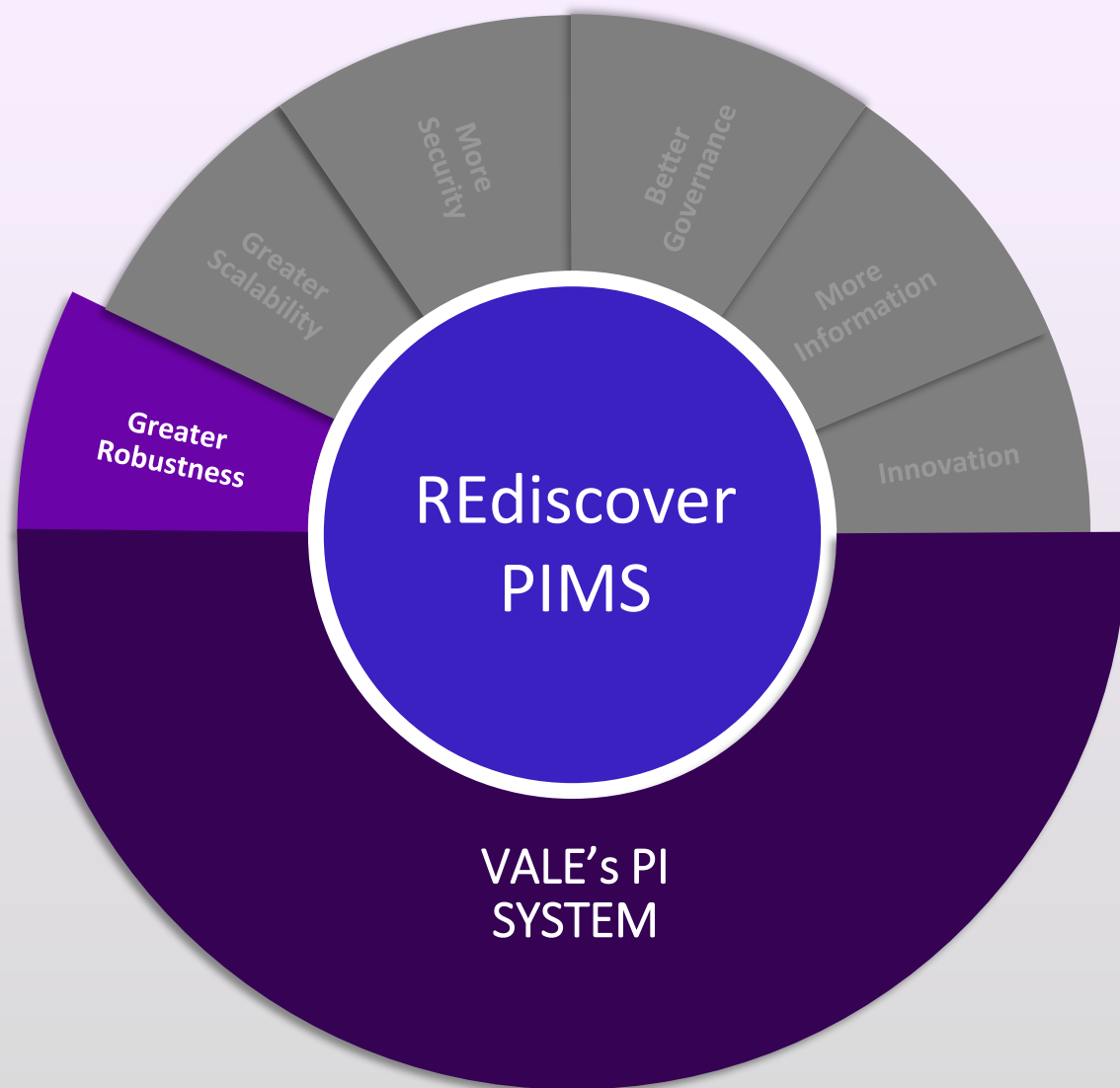


97 / 173
COLLECTION SERVER / INSTANCES

3. Technical Implementation



REdiscover PIMS

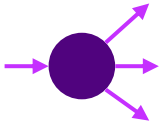


Greater Robustness

Greater robustness with high availability



Windows Failover Cluster



Network Load Balance




Microsoft SQL Server AlwaysOn Availability


SQL AlwaysON



PI Collective



PI Interfaces

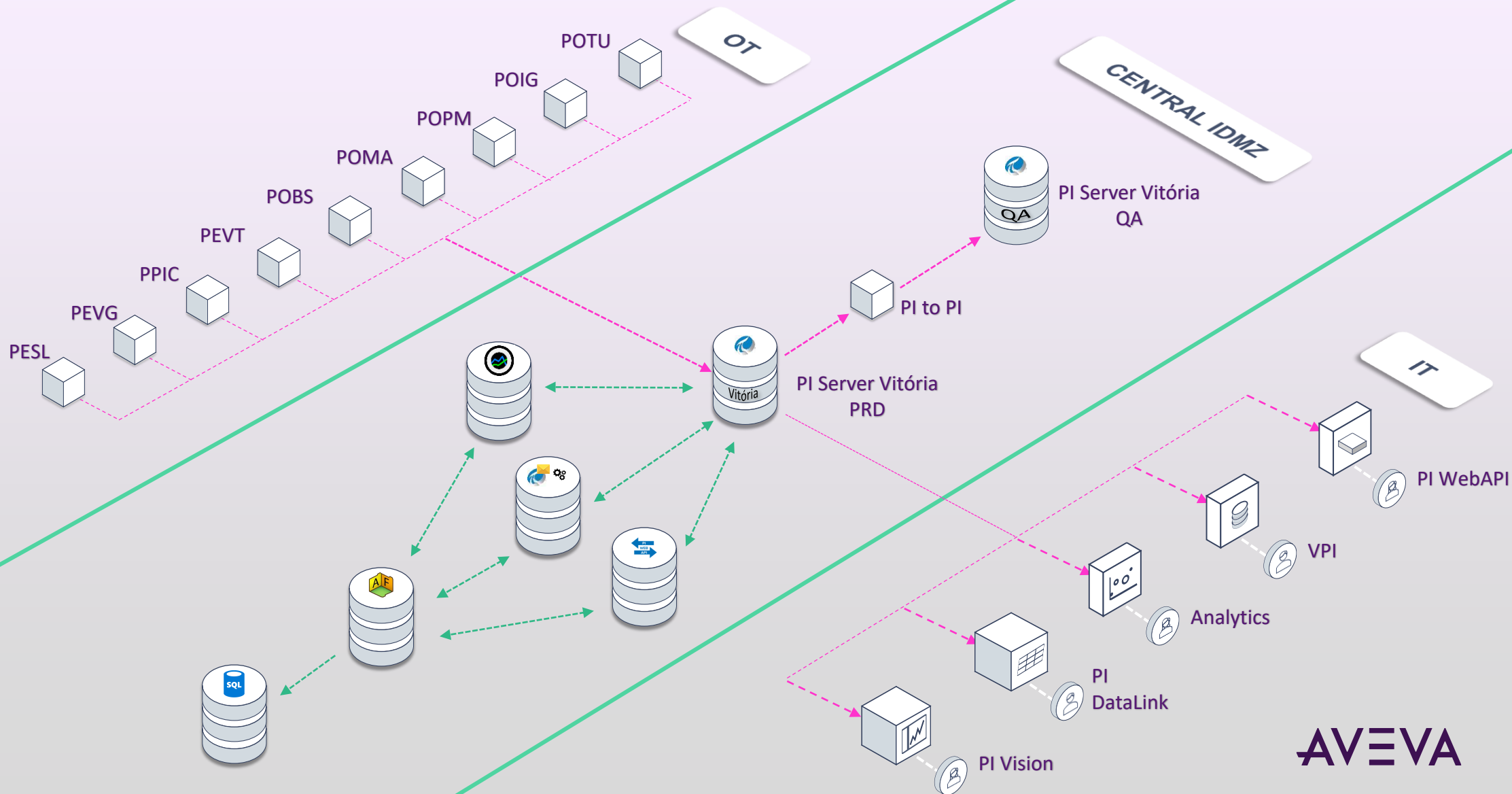


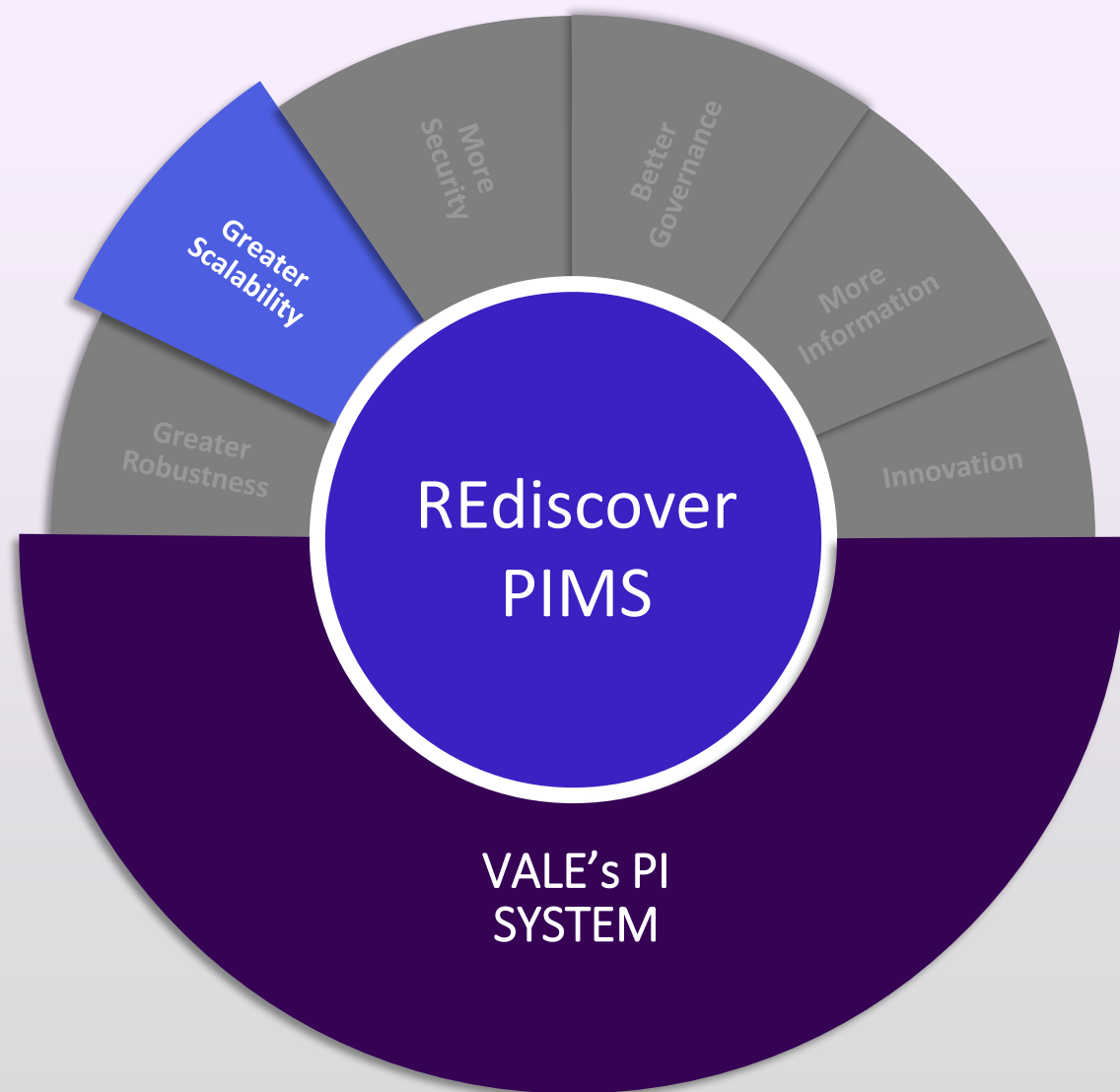
Backup

AVEVA PI System	
1 Pair	AVEVA PI Server data archive
1 Pair	AVEVA PI Server asset framework
1 Pair	AVEVA PI Vision
1 Pair	PI Web API
1 Pair	AVEVA PI Server analytics, notifications
1 Pair	SQL Server
1 Pair	PI-to-PI

PI System Vitória

HIGH AVAILABILITY INFRASTRUCTURE





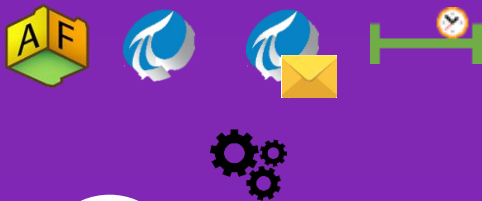
Greater Scalability

Greater scalability leveraging native integrations



82

Native Solutions



24 ROLLOUTS

10

Native Integration Using PI Web API



12 ROLLOUTS

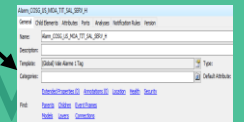
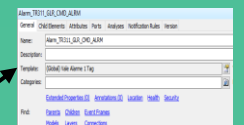
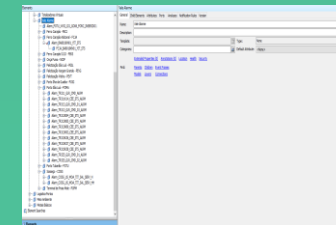
Solutions and integrations with various systems:

Laboratory Systems

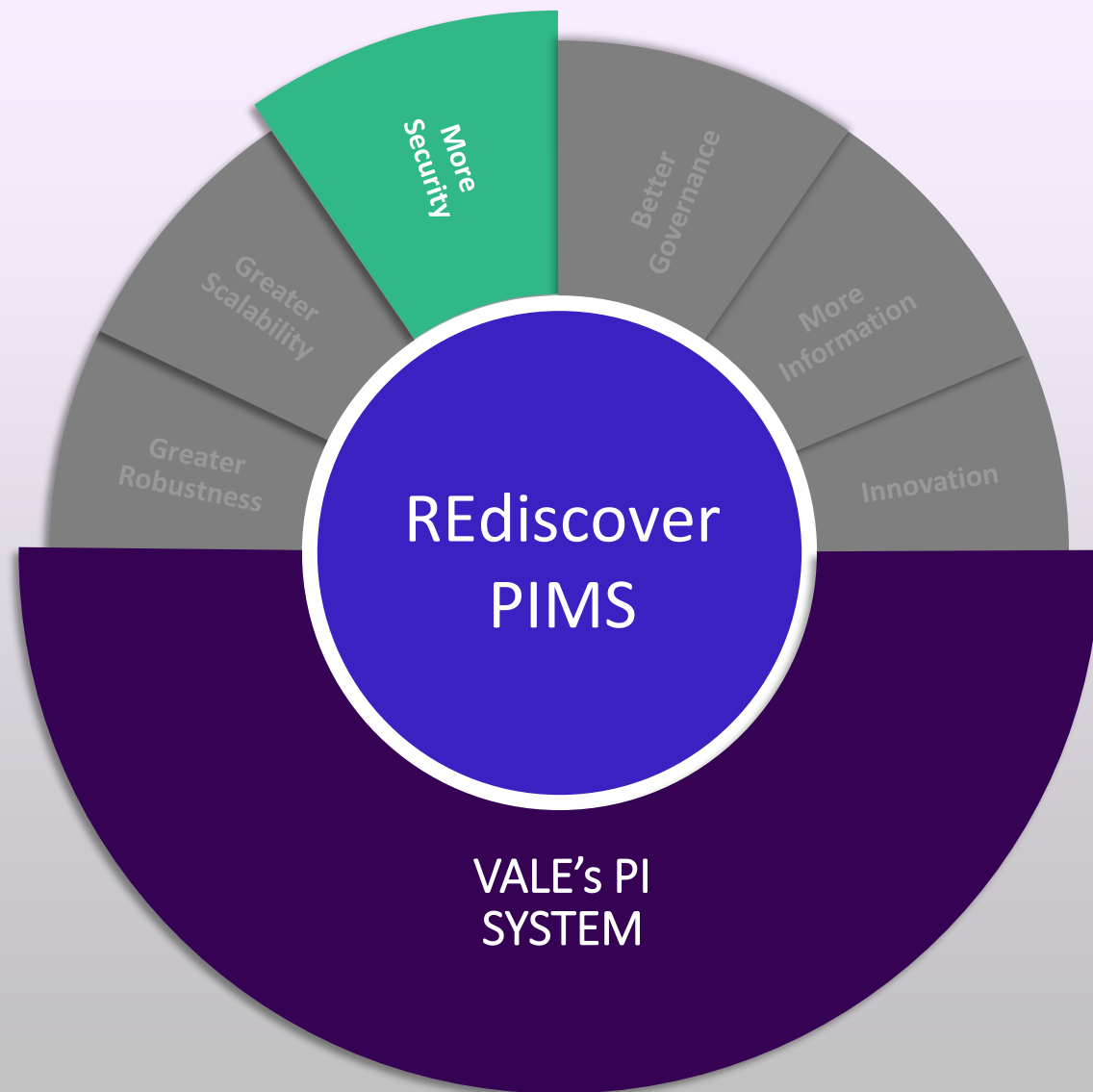
Security Systems

Power Systems

Environmental Systems



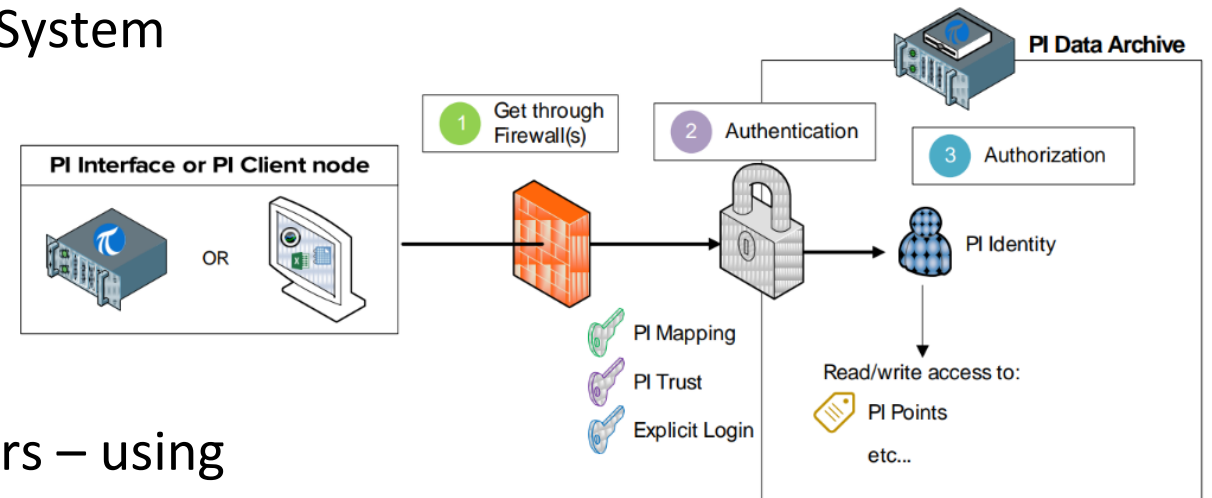
AV

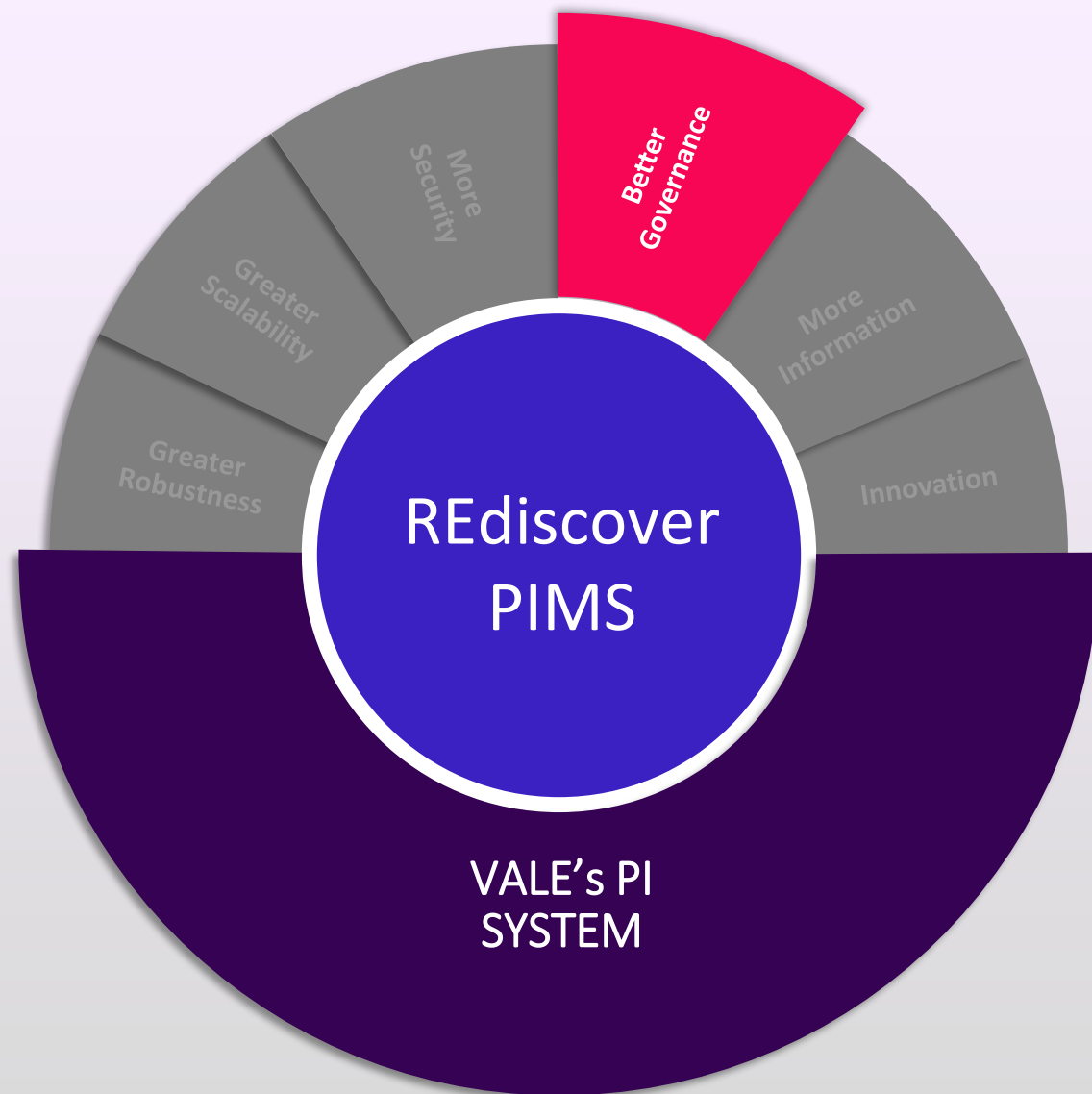


More Security

More security with layered architecture

- Standardized control access with domain groups related in one-to-one identities in AVEVA PI System and WIS model.
- Use of PI Mapping instead of PI Trust
- Addressed vulnerabilities and risk controls;
- Technological upgrade of 40 collection servers – using regional HCIs with high Availability and redundancy;
- Placement of PI Servers infrastructure in Central/Regional IDMZs bringing adherence to the target architecture



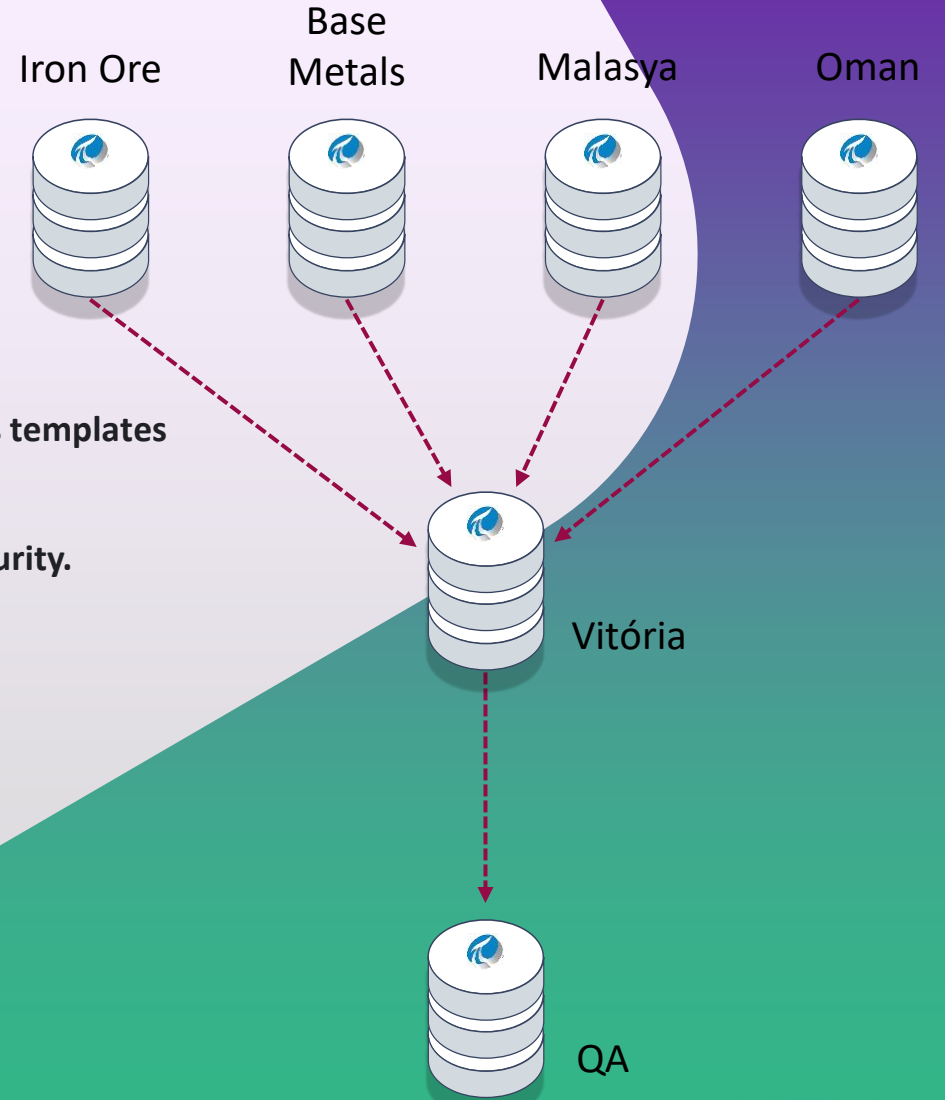


Better Governance

Better governance through central control



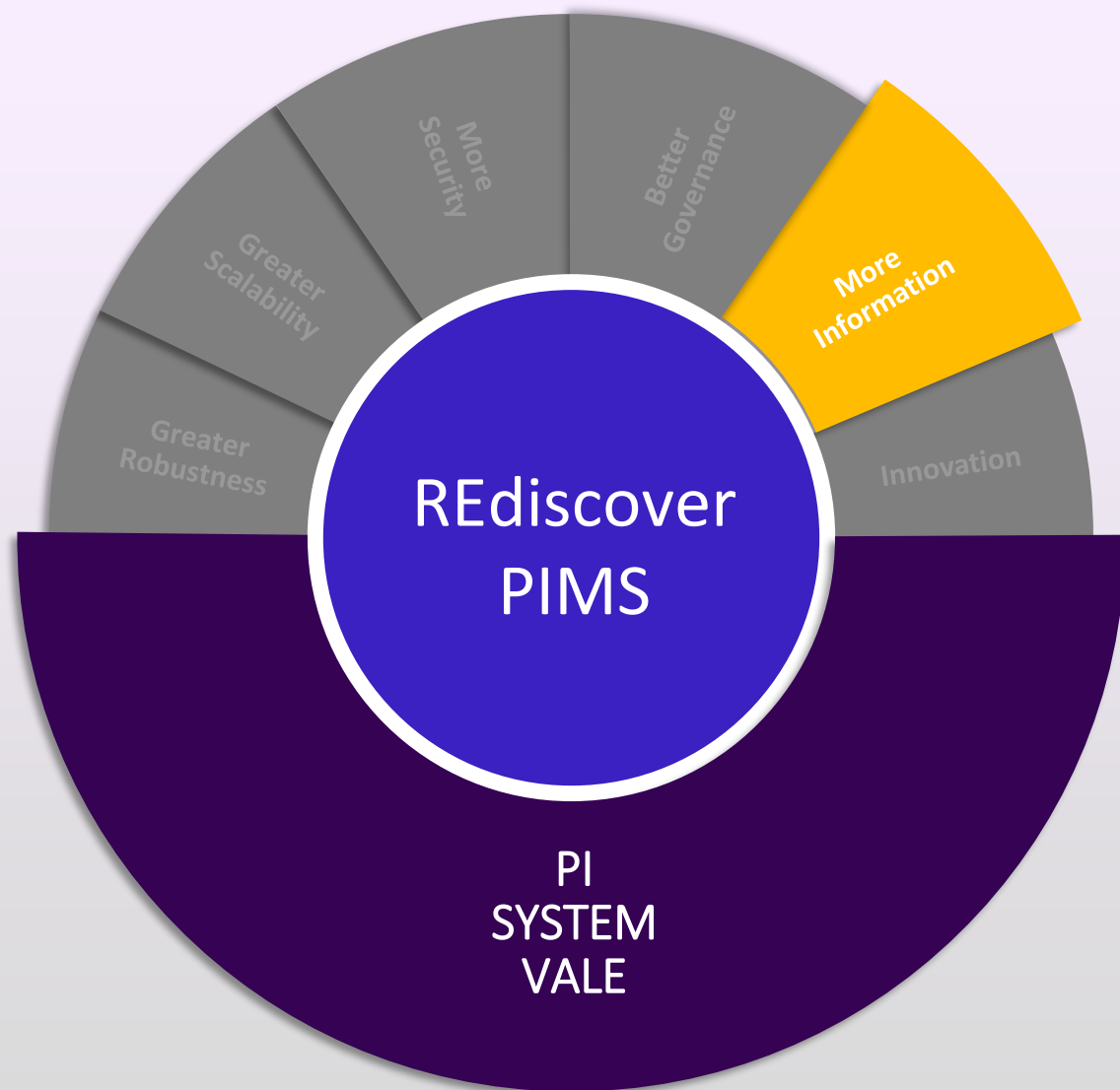
Centralized environment, centralized Governance.



- 01 Centralized environment with system monitoring of critical assets and operations
- 02 Centralized Business Rules Applied via AVEVA PI Server Asset Framework
- 03 Automatic notifications via AVEVA PI Server
- 04 Specific tools monitor AVEVA PI System

- 05 AVEVA PI Server analysis templates
- 06 Windows Integrated Security.





More Information

MORE INFORMATION

Democratization of information with new formats and means of information delivery – enabling large programs at Vale;



 **16 PLANTS**

Monitored using PI System

 **+100 PI SERVERS**

Monitored using PI System

Automatic opening of incidents by PIMS Support time and other engineering queues.

 **500 K**

Process tags were sanitized, Standardized and create

 **+2.4K**

PI Vision Screens

+82 K

Analysis

AND MUCH

 **5 YEARS**

Historical data was migrated

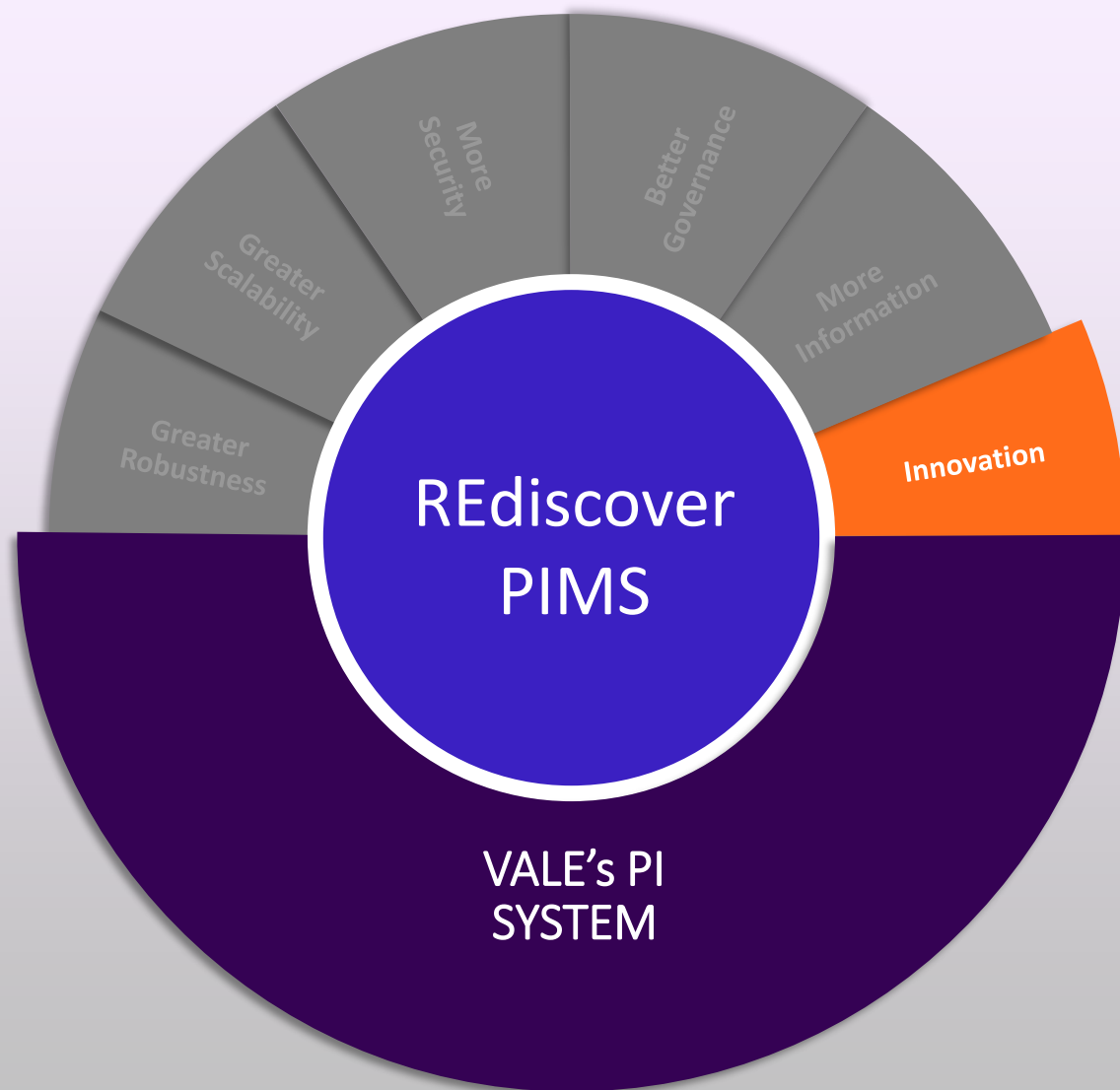
 **+90**

Excel Reports

+ 89 k

Calculated Tags

MORE TO COME



Innovation

INNOVATION

The VPI (Vale PIMS Integrator), which is a high-performance cloud solution based on new technologies that provides a link between the PI System and other external systems and is responsible for hosting several custom solutions or integrations, and, in this way, providing business data to the desired destination.



17 CUSTOM INTREGRATIONS
BASED VPI



25 ROLLOUTS

- MES Systems
- Hourmeters
- ERP Systems

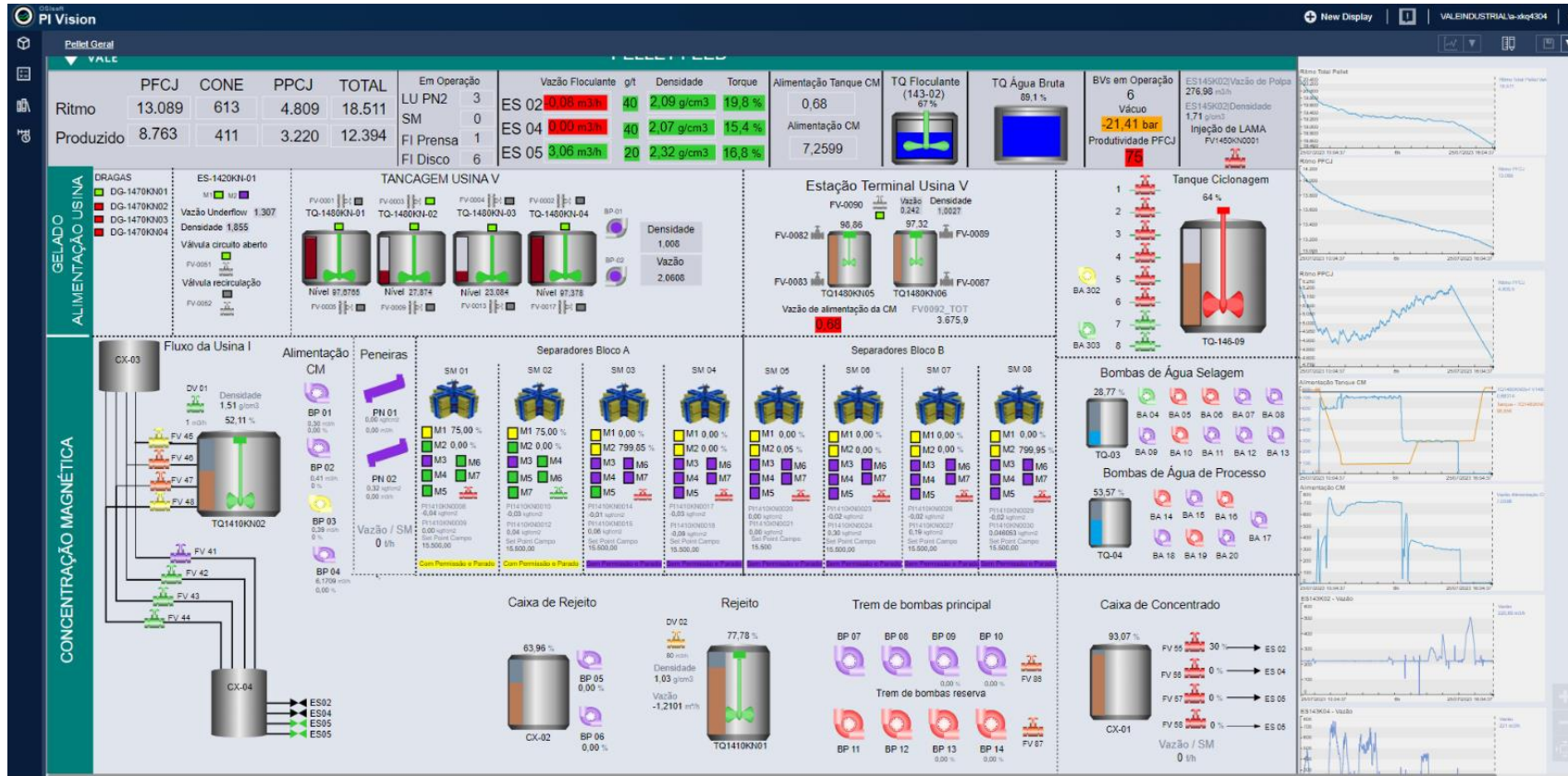
- EventHub
- Car loading

4. Use cases

Use Case 1: Monitoring critical process variables in Carajás

CHALLENGE

- ✓ Managing multiple screens
- ✓ Difficulty accessing information.
- ✓ Difficulty identifying variables outside control limits.



SOLUTION

- ✓ Create single screen in AVEVA PI Vision showing all key process variables.

RESULTS

- ✓ Easy access to information.
- ✓ Consolidation of information.
- ✓ Faster identification of deviations.

Use Case 2: Monitoring Serra Sul's process variables and performance

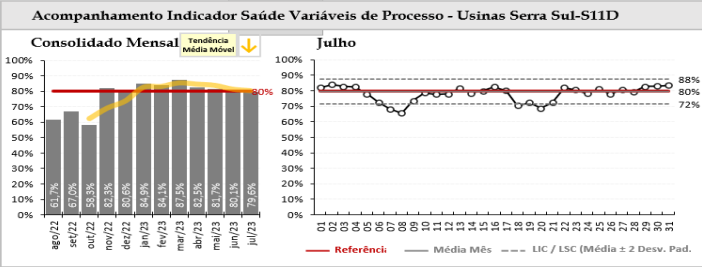
CHALLENGE

- ✓ Monitor the evolution of production by circuit in real time (volume, rates, etc.).

Controle de Processo

Referências:	100,0%	80,0%	Nº Variáveis Avaliadas na Saúde de Processo			
Instalações Unitárias	Variáveis	Monitoramento	TOTAL	NORMAL	ANORMAL	OFFLINE
1 Truckless	73,9%	79,0%	40	20	14	6
2 5ª Britagem	100,0%	68,2%	19	12	3	4
3 TCLD	100,0%	88,5%	43	30	13	0
4 Usinas	100,0%	74,7%	120	67	52	1
Serra Sul-S11D	95,0%	79,6%	222	129	82	5

LEGENDA:
 Mapa de cor: 100% (Verde) - 75% (Amarelo) - 50% (Laranja) - 25% (Vermelho) - 0% (Preto)
 > Nº variáveis avaliadas na saúde de processo
 > TOTAL: quantidade de variáveis acompanhadas
 > NORMAL: quantidade de variáveis com Saúde de processo > 75%
 > Anormal: quantidade de variáveis com Saúde de processo < 75%
 > Offline: quantidade de variáveis (que não operaram no período avaliado).

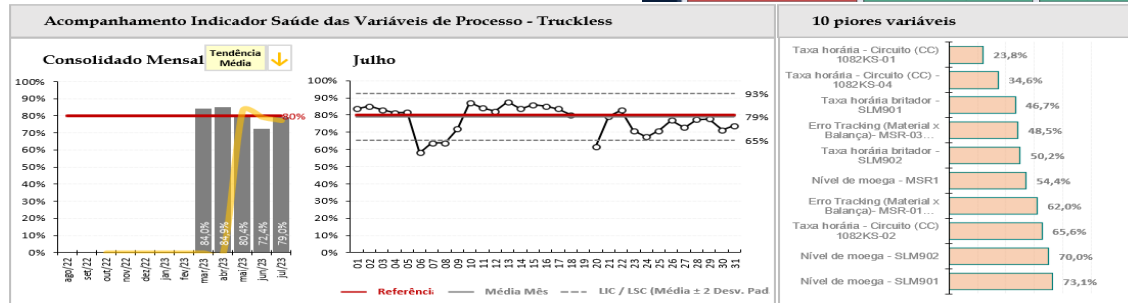


SOLUTION

- ✓ Create dashboard in AVEVA PI Vision with trend graphs for each production unit in real time.

RESULTS

- ✓ Easy access to information.
- ✓ Faster decision making in the event of an operational deviation.



Case:
Crusher 2013BR18

Month / Reference : 23/06

Status: ● ↶

- DATA -



Serra Sul – SS



Tertiary crushing



Usina C



Crusher 2013BR18



[x]



- Yes
- In progress
- No, help chain needed

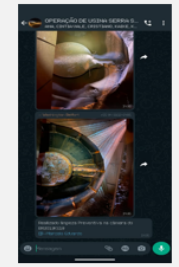
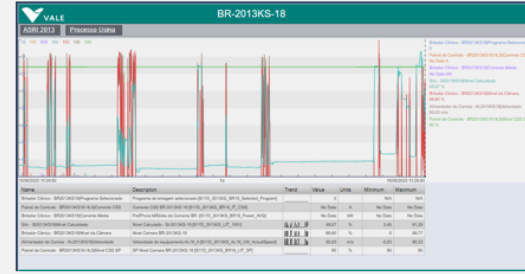
Problem

BR18's health is abnormal. The crusher has a very high downtime rate.



Analyses

- ✓ The crusher was activated very few times, and most of those times there wasn't even time to fill the crushing chamber. Other variables such as chamber level and power also showed health below the parameter.
- ✓ Plant with 16% circulating load with a productivity of 5.5 ton/h and a circulating load of around 0.6 ton/h (all data accumulated on the day) showing how good the processed material is and that there is no need for this crusher to continue damaging our indicators.

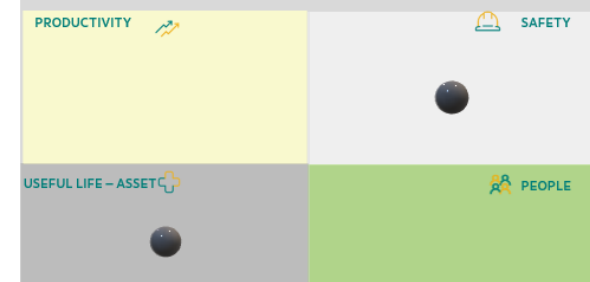


Action Plan

#A	Milestones	Responsible	STATUS
1.1	Contacted Operation/COI	Process	
1.2	Crusher cleaning & inspection required – as an opportunity	Process	
1.3	Cleaning and inspection	Operation	
1.4	Opportunity to Link Timely Stoppages with "Crusher Optimization – Energy Efficiency Opportunity" Work	GER DESENV TECNOLOG ESTRATEGIA	

Results

Put the result and which dimension it impacted (it can be more than one)



Data democratization at Vale delivers efficiency gains and reductions in costs and time

Challenge

- Implement a robust and secure data infrastructure providing high-quality, real-time data for users across 80 global operating units.
- Use standardization of data solutions across the global enterprise to ensure data quality and accelerate data-driven decision making.

Solution

- Centralization and standardization of Vale's global Plant Information Management Systems (PIMS) based on AVEVA™ PI System™ and its off-the-shelf native interfaces to collect data at the source.

Results

- **Democratization of data access across the enterprise.**
- **Increased availability and quality of operations data.**
- **Better governance, scalability, security and support for innovation.**



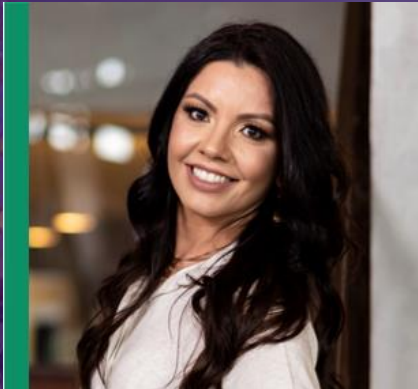
Questions?

Please wait for the microphone.
State your name and company.



Please remember to...

Navigate to this session in the mobile app to complete the survey.



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Thank you!

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AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

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