



RioTinto



Executive Summary

Background



Gain **visibility** over workforce



Dashboard providing **insights**

3 Key Insights



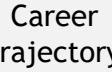
Diverse workforce



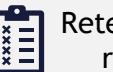
Pay mismatch
Career mobility
Talent development



Employee performance drivers



Career
trajectory



Retention
risk



Location



Employment
duration



Job
responsibility

Performance /
Grade

3 Recommendations



Embark on further study
with **broader dataset**



Attract younger talents (20+ years
old) to improve age diversity



Engage with "cruisers" in workforce to
enhance potential & performance

3 Impacts



Begin objective, effective
and **efficient talent conversations**



Cluster employees
by profiles for **targeted talent development**



Act **pre-emptively** to retain high potential
talents

How might we empower Rio Tinto HR to visualize their workforce, so that insights can be generated, for better communication across employees, HR and leadership?



Achieve empowerment, not just visibility

- Develop a tool for not just timely, but pre-emptive and effective discussions between HR and workforce



Foster engagement, growth and belonging

- Unlock the value from employee data
- Uncover next steps to promote workforce diversity, performance and retention



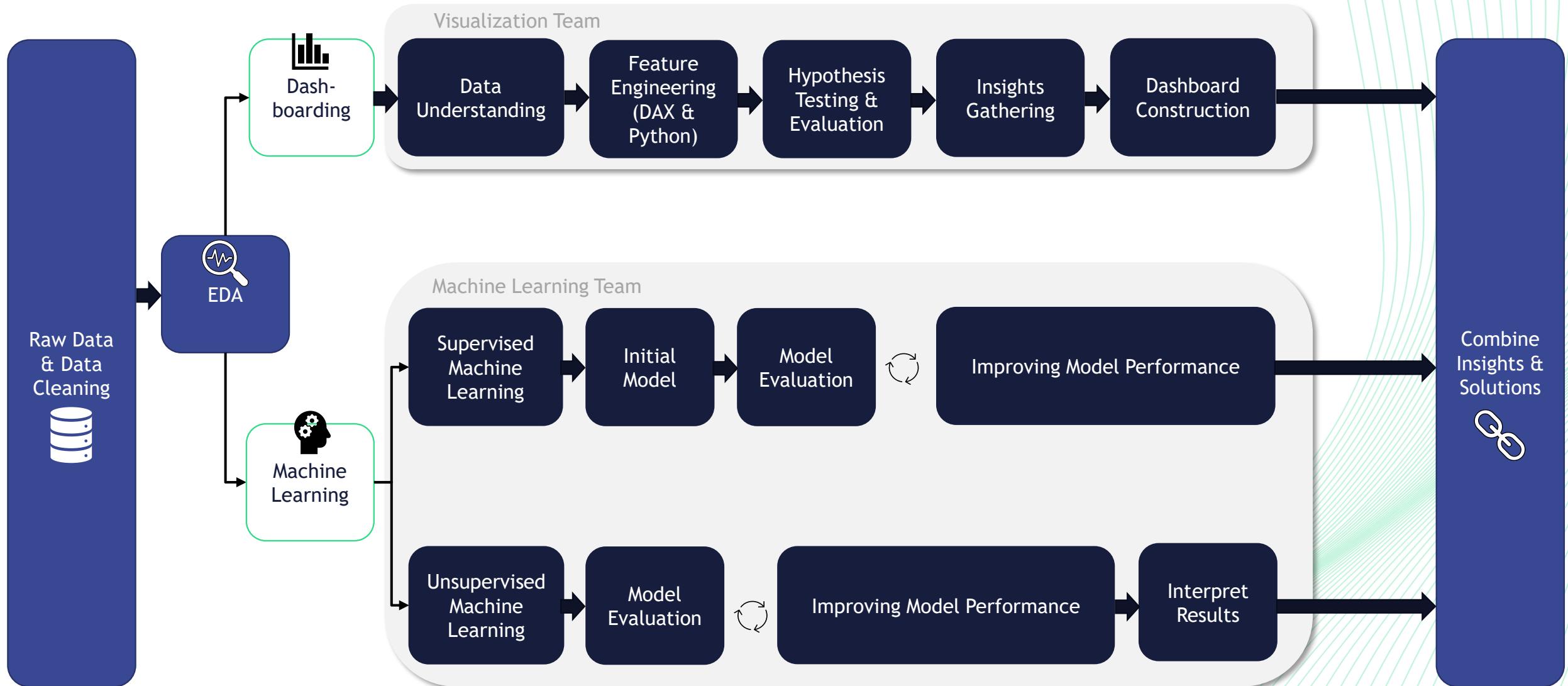
End reliance on the line managers

- Predictive analysis using employee data
- Data-driven recommendations provided

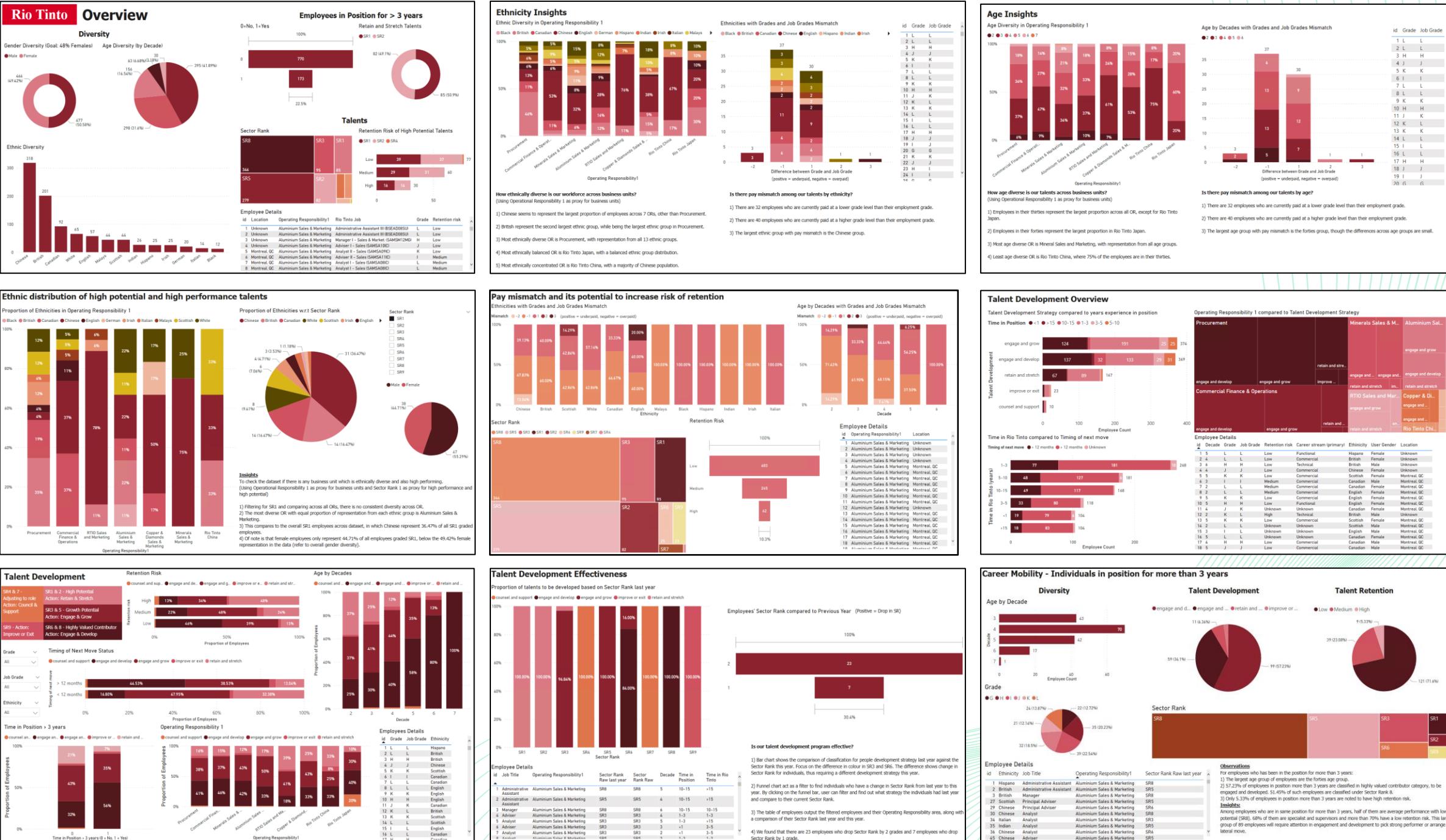
Analytical Objectives:

- Derive drivers for employee performance
- Derive drivers for employee retention
- Identify gaps in career mobility, workforce diversity and talent development practices

Overall Analytical Workflow



Dashboard at a glance...



Rio Tinto is fairly diverse, but more effort needed to improve diversity in high-potential and high-performance bracket.

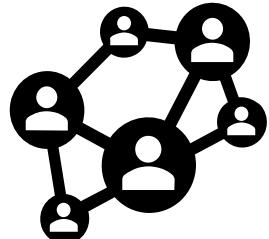
Rio Tinto

Gender



49% Females

Age by Decade & Ethnicities across OR1



Rio Tinto is **ethnic diverse** but not **age diverse**
(3 out of 8 have 50% employees in their 30s)

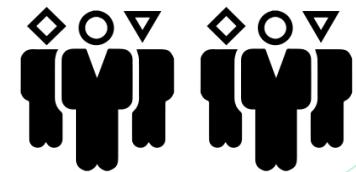
High Potential and High Performance (SR1)

Female Representation



44% Females

Ethnic Diversity in SR1



Inconsistent
Ethnic Diversity

36%
Chinese

Presence of pay mismatch and its relevance to increased retention risk



- No specific ethnicity and age discrimination
- Spread across all ethnicities and age



Underpaid	2 grades	3 grades
Ethnicity	Scottish (14%)	English (20%)
Age	50s (6%)	30s (5%)

ALL who are **underpaid**
are performers & outperformers



are in **SR9**
(underperforming & low potential)

32%

performers & outperformers
with pay mismatch have
medium to high retention risk

Talent Development strategies¹ could be more directed and focused

By grouping employees into Rio Tinto's talent development plan based on their SR, from the dashboard, we derived that:

1



'retain and stretch' more **common** among **younger employees**

- counsel and support
- engage and develop
- engage and grow
- improve or exit
- retain and stretch

2

Timing of next move	Retain and Stretch	Engage and Grow
< 12 months	32%	47%
> 12 months	13%	38%

Higher proportion of employees who should be **groomed** in their current position, expected to move in < 12 months.

3



26 employees due to **move within 6 months**

However
Currently planned to move in
> 12 months

4

By comparing with last year's development plan:

30
Employees

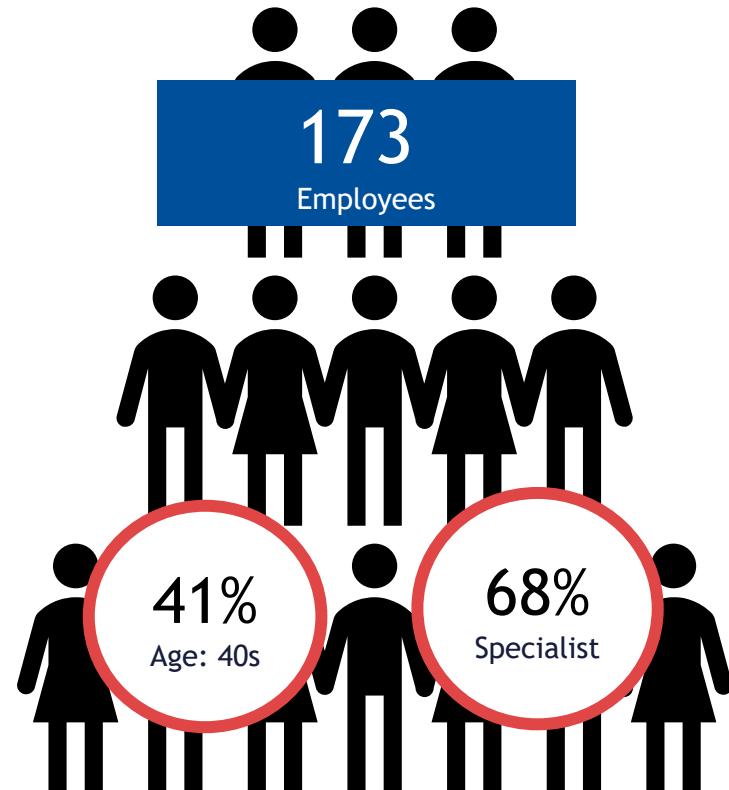
SR



7 employees SR decrease by 1

Career mobility is present but for 'stuck' employees, engagement and development should be given

For Employees who have been in their position for more than 3 years (stuck):



(In position for more than 3 years)

The insights we derived were:

Sector Rank

57%

SR6 & SR8

Retention Risk

51%

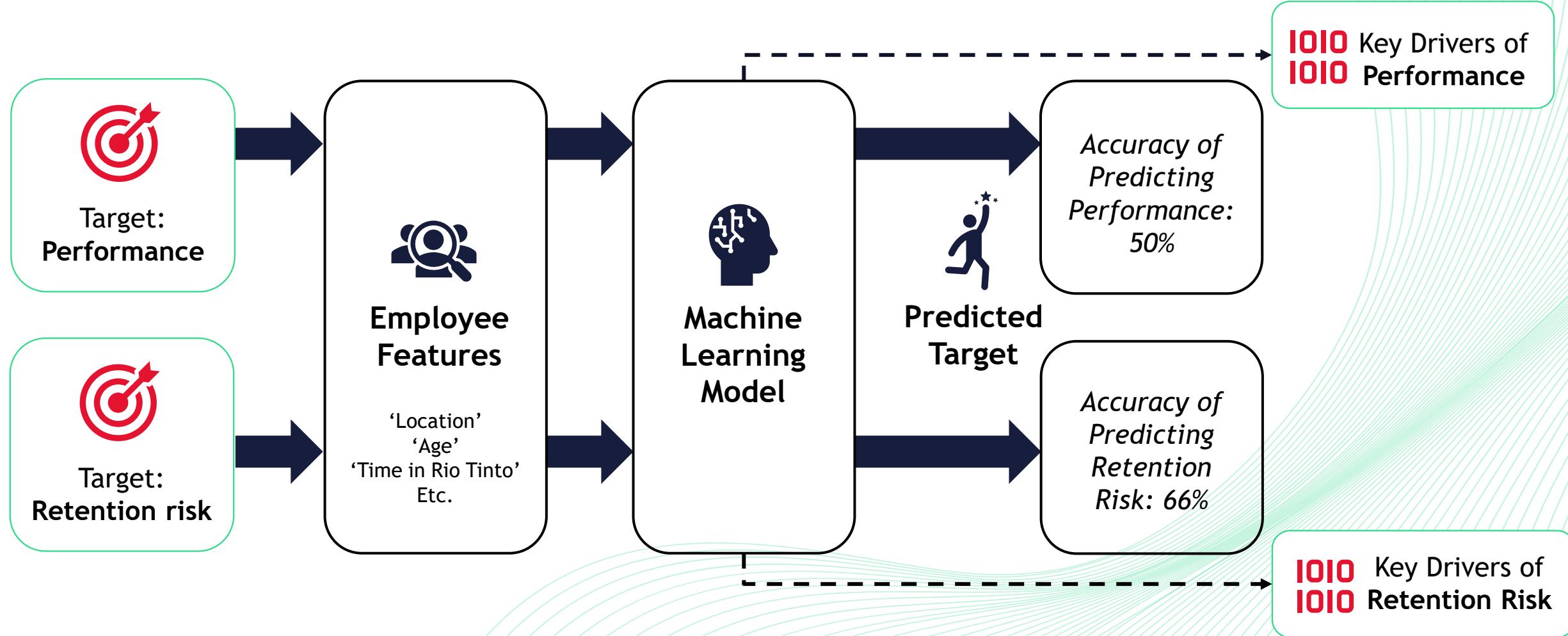
Low

From the dashboard:

We **identified** the 89 employees who requires **early intervention, attention on engagement and development** to **promote better performance** and exposure to other positions.

Machine Learning

Utilizing Supervised Machine Learning to identify key drivers of Performance & Retention Risk



An employee's career trajectory, retention risk and location are key drivers of Performance

Career Trajectory



If an employee:

- is targeted to move in the next 12-months,
 - has a suggested next job, and
 - has not been in their position for >3 years,
- they tend to have **HIGHER** performance

Employees with a promising career trajectory tend to have **HIGHER performance**

Retention Risk



If an employee:

- has a higher risk of attrition,

they tend to have **HIGHER** performance

Employees that are at a higher risk of attrition tend to have **HIGHER performance**

Working in HQ



If an employee:

- works in Australia,

they tend to have **LOWER** performance

There is a correlation between working in Rio Tinto's HQ and **LOWER employee performance**

Correlation of Features vs. Target Variable (Performance):

-1.0 +1.0: Target vs. Feature correlation

Feature Importance

1

2

3

4

5

Target/Feature

Ready for Promotion

Retention Risk

Works in AU

Change of Responsibilities

Years in Position > 3

Performance

(Ready for P, Higher Performance)

(Higher RR, Higher Performance)

(Works in AU, Lower Performance)

(Has CoR, Higher Performance)

(>3 years, Lower Performance)

An employee's work duration, performance, grade and responsibility are key drivers of Retention Risk

Duration



If an employee:

- have been working in Rio Tinto for a long time; and
- has been in the same position for more than 5 years,

they tend to have **LOWER** Retention Risk

Employees working for a long duration tend to have **LOWER retention risk.**

Performance/Grade



If an employee:

- has a higher performance; and
- has a higher job grade,

they tend to have **HIGHER** Retention Risk

Employees with a higher performance and job grade tend to have **HIGHER retention risk.**

Responsibility



If an employee:

- is in charge of Sales & Marketing in Copper & Diamonds (S&M CD),

they tend to have **HIGHER** Retention Risk

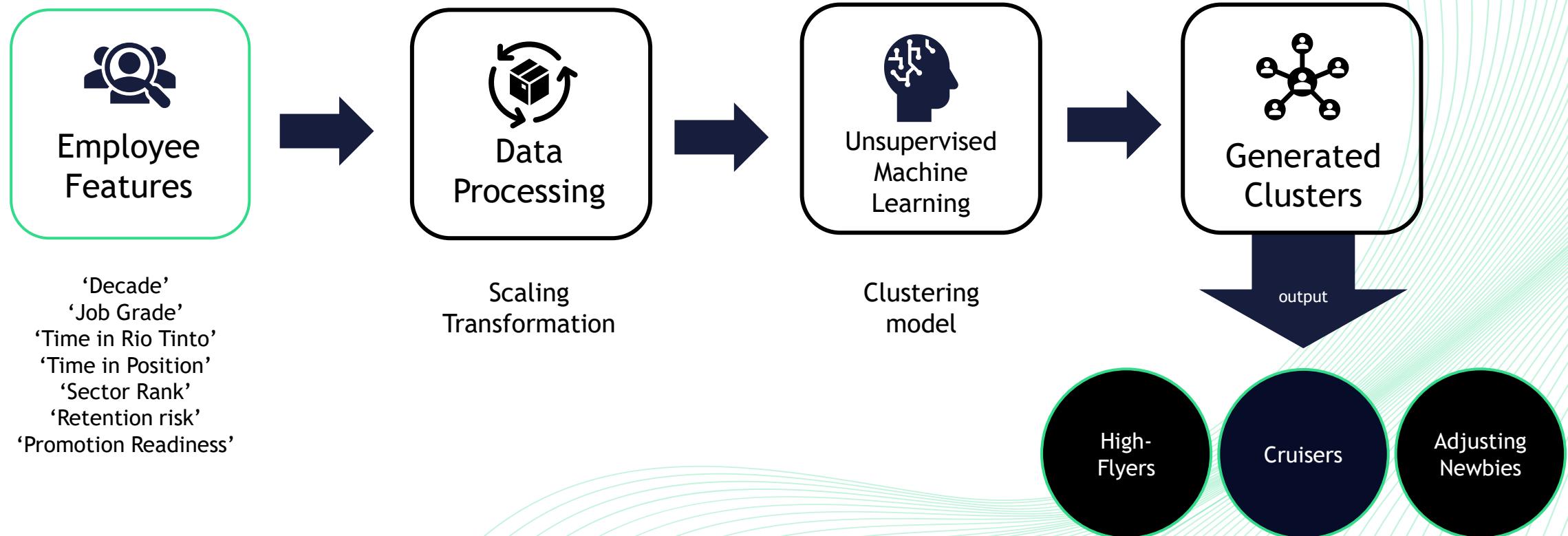
There is a correlation between working in S&M CD and **HIGHER retention risk.**

Correlation of Features vs. Target Variable (Retention Risk):

-1.0 +1.0: Target vs. Feature correlation

Feature Importance	1	2	3	4	5
Target/Feature	Years in Rio Tinto	Performance	Years in Position >5	Copper & Diamonds Sales & Marketing (CD S&M)	Job Grade
Retention Risk	(Higher Years, Lower Risk)	(Lower Performance, Higher Risk)	(>5 Years in Position, Lower Risk)	(Works in CD S&M, Higher Risk)	(Higher Job Grade, Higher Risk)

Utilizing Unsupervised Machine Learning to effectively segment employees based on profile



Understanding employee cluster profiles for more effective talent conversations

“

Can't wait for the next promotion. Or I might just accept the offer from another company!

Highest retention risk



Medium retention risk

“

I've only been here for around 1 year... still adjusting to everything. Lots to learn and get used to. I wonder what's next for me in the company.

“

Been in the company for more than 10 years and in this position more than 4... I'm so comfortable.

Lowest retention risk



Adjusting Newbie
MEDIUM PERFORMANCE



Cluster	Profile	Age by Decade	Pay Grade	Years in Rio Tinto	Years in Position	Sector Rank	Retention Risk	Promotion Readiness	
0	High flyers	Younger	Low-Medium Pay	Short-medium service	Medium service	Highest Performance	Highest Retention risk	High readiness	Low
1	Cruisers	Older	Low Pay	Long service	Long service	Lowest Performance	Lowest Retention risk	Low readiness	Low-Medium
2	Adjusting Newbies	Younger	High Pay	Short service	Short service	Medium Performance	Medium Retention risk	Not ready	Medium High

Action points based on insights derived from analysis



Recommendations



- Ethnic diversity in RTIO Sales and Marketing; skewed towards “Chinese”
- Underperformance in Australia (lower SR)



Engagement

- Address the 26 employees (SR4, 7, 9) with mobility issues
- Review and address the pay mismatch we identified
- Review the employees identified as “stuck” with avg. performance (SR8)
 - Longer-term, leverage on the clustering model to identify these “cruisers”



Recruitment

- Target 20-year-olds to improve age diversity; RT Japan has ~60% employees in their 40s



Training

- Conduct training for line managers to align understanding on SR ranking criteria



Area(s) for improvement

- Larger dataset (analysis was conducted on ~950 observations post-cleaning)
- Increase granularity of data (e.g. Age, Time in Rio Tinto/Position)
- More informative features (e.g. KPIs met?, employee satisfaction level, managerial reporting structure, etc.)



Operationalize

- Utilize a fuller dataset with more granular and informative employee characteristics
- Estimate cost/benefit of models for impact analysis
- Create a detailed business plan and engage with key stakeholders across the firm to be submitted for approval

02

ANNEX



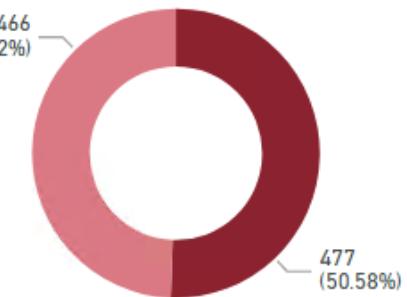
1.0 Power BI

Rio Tinto Overview

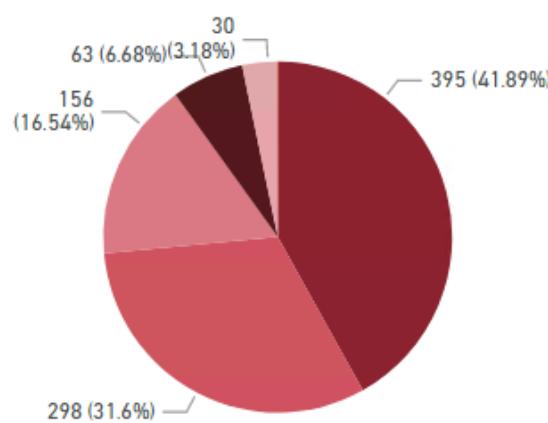
Diversity

Gender Diversity (Goal: 48% Females)

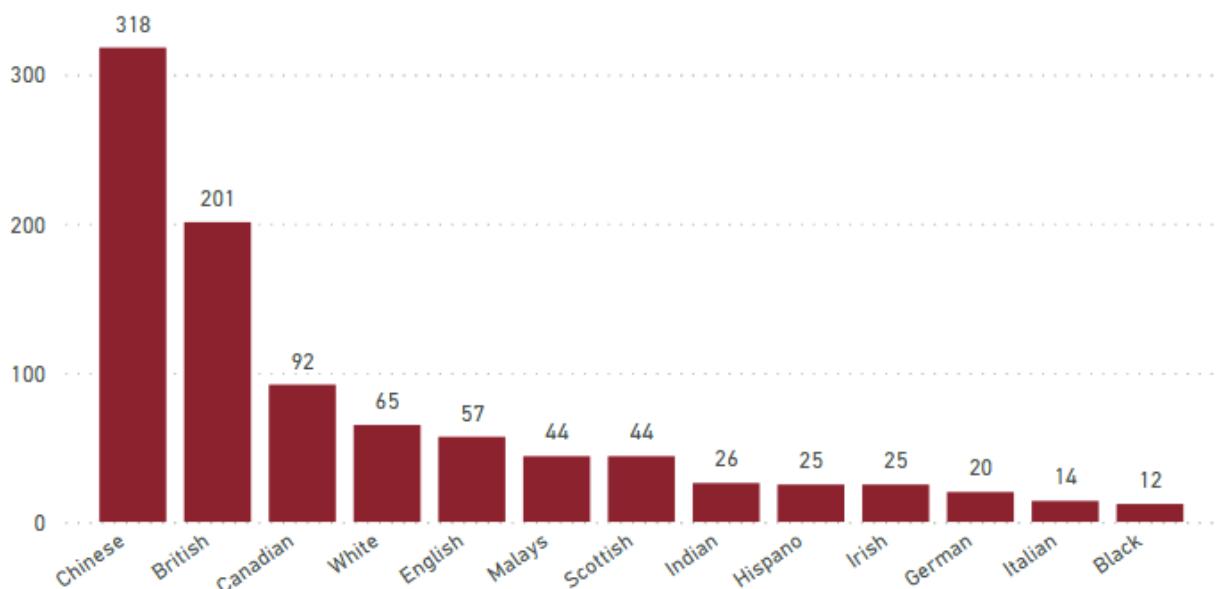
Male Female



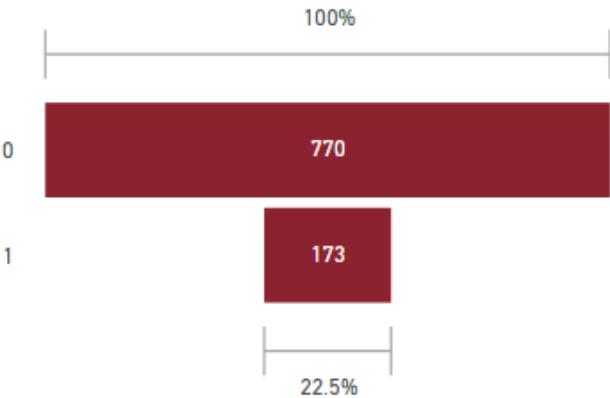
Age Diversity (by Decade)



Ethnic Diversity



0=No, 1=Yes



Employees in Position for > 3 years

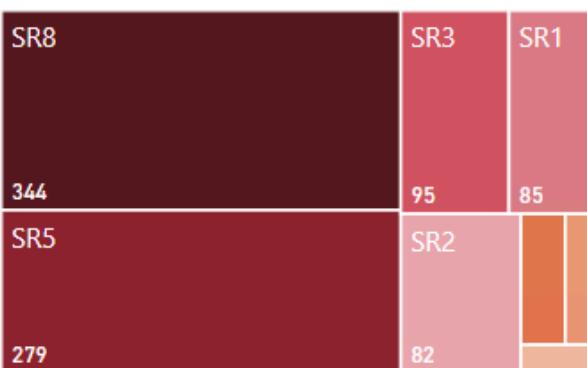
Retain and Stretch Talents

SR1 SR2



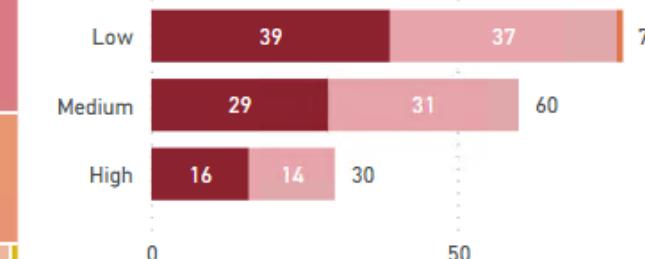
Talents

Sector Rank



Retention Risk of High Potential Talents

SR1 SR2 SR4

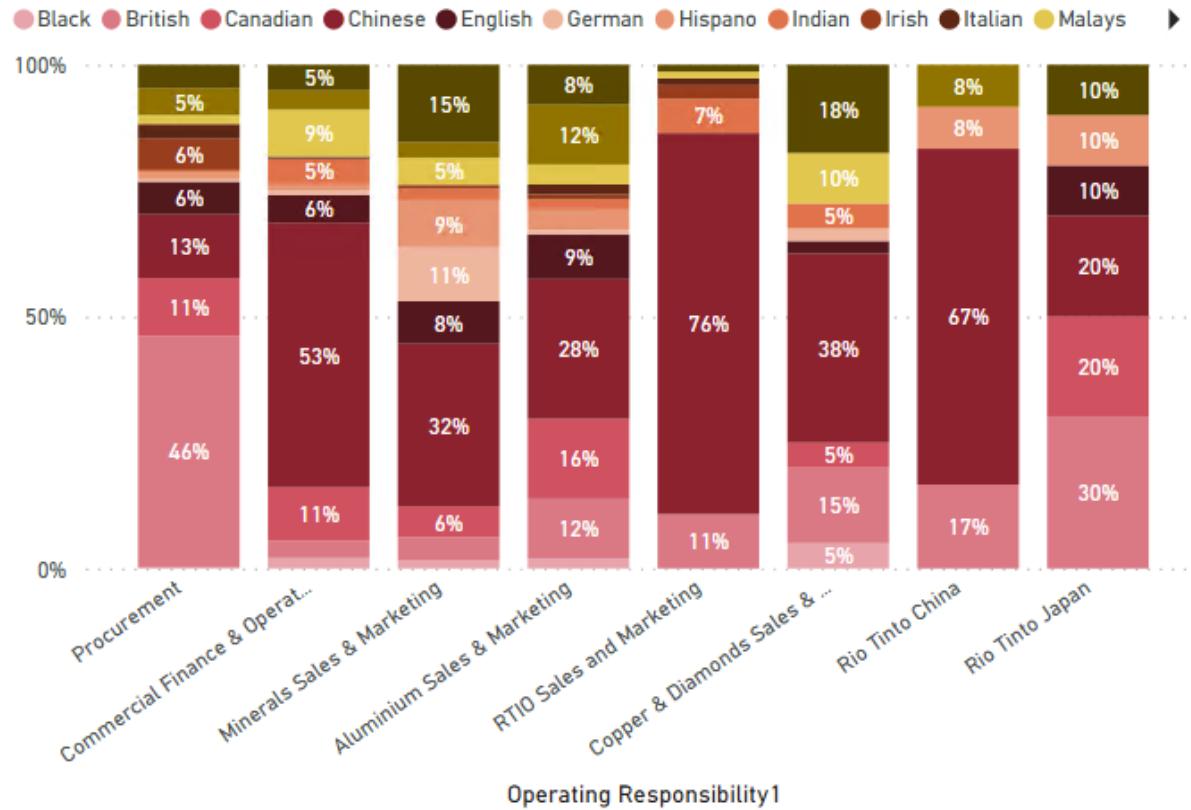


Employee Details

id	Location	Operating Responsibility1	Rio Tinto Job	Grade	Retention risk
1	Unknown	Aluminium Sales & Marketing	Administrative Assistant III (BSEAD08SU)	L	Low
2	Unknown	Aluminium Sales & Marketing	Administrative Assistant III (BSEAD08SU)	L	Low
3	Unknown	Aluminium Sales & Marketing	Manager I - Sales & Market. (SAMSM12MG)	H	Low
4	Unknown	Aluminium Sales & Marketing	Adviser I - Sales (SAMSA10IC)	J	Low
5	Montreal, QC	Aluminium Sales & Marketing	Analyst II - Sales (SAMSA09IC)	K	Low
6	Montreal, QC	Aluminium Sales & Marketing	Adviser II - Sales (SAMSA11IC)	I	Medium
7	Montreal, QC	Aluminium Sales & Marketing	Analyst I - Sales (SAMSA08IC)	L	Medium
8	Montreal, QC	Aluminium Sales & Marketing	Analyst I - Sales (SAMSA08IC)	L	Medium

Ethnicity Insights

Ethnic Diversity in Operating Responsibility 1

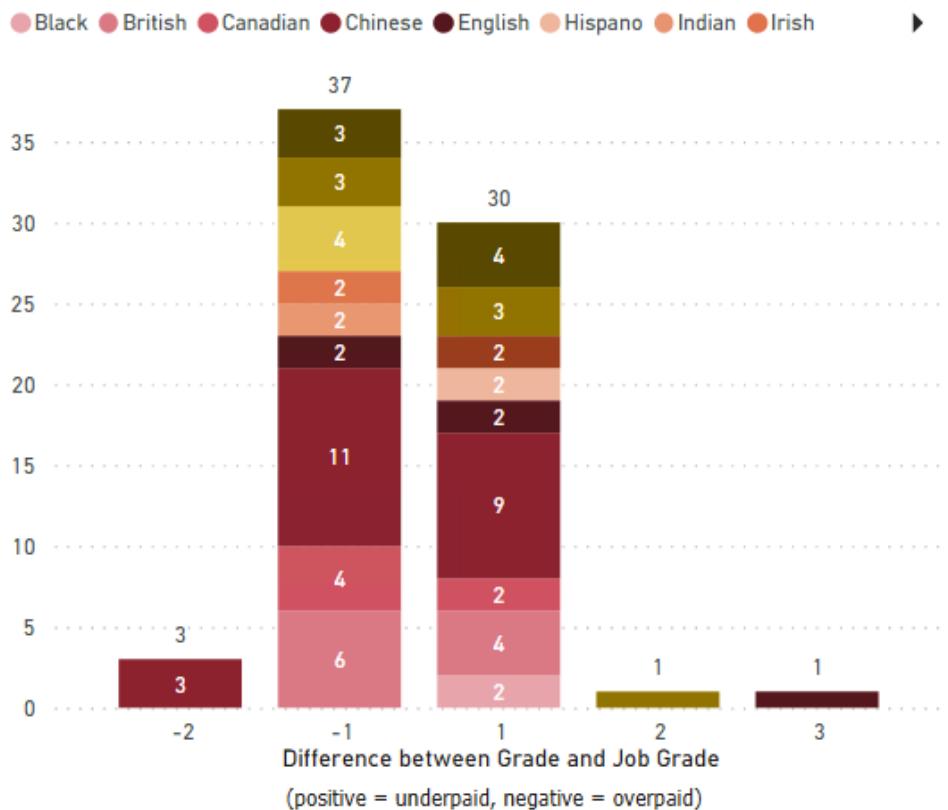


How ethnically diverse is our workforce across business units?

(Using Operational Responsibility 1 as proxy for business units)

- 1) Chinese seems to represent the largest proportion of employees across 7 ORs, other than Procurement.
- 2) British represent the second largest ethnic group, while being the largest ethnic group in Procurement.
- 3) Most ethnically diverse OR is Procurement, with representation from all 13 ethnic groups.
- 4) Most ethnically balanced OR is Rio Tinto Japan, with a balanced ethnic group distribution.
- 5) Most ethnically concentrated OR is Rio Tinto China, with a majority of Chinese population.

Ethnicities with Grades and Job Grades Mismatch



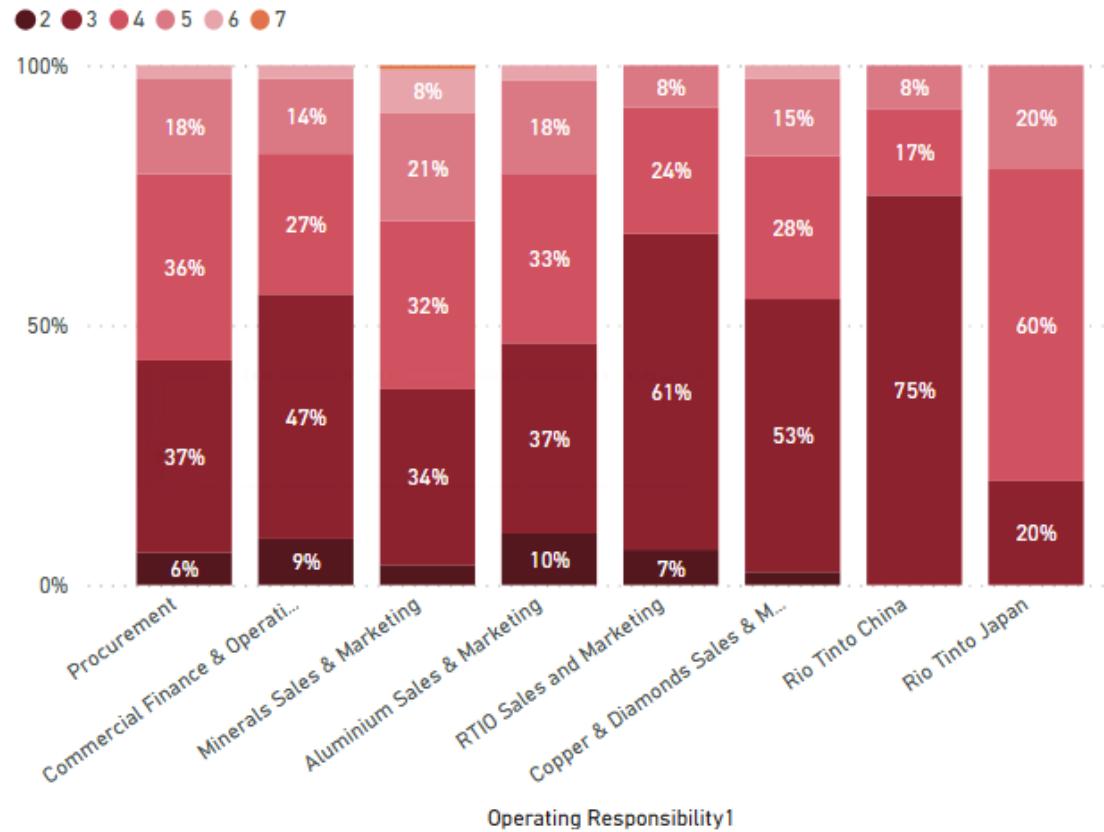
id	Grade	Job Grade
1	L	L
2	L	L
3	H	H
4	J	J
5	K	K
6	I	I
7	L	L
8	L	L
9	K	K
10	H	H
11	J	K
12	K	L
13	K	K
14	L	L
15	I	L
16	L	L
17	H	H
18	J	J
19	I	J
20	G	G
21	K	K
22	J	J
23	H	I
24	I	I
25	C	C

Is there pay mismatch among our talents by ethnicity?

- 1) There are 32 employees who are currently paid at a lower grade level than their employment grade.
- 2) There are 40 employees who are currently paid at a higher grade level than their employment grade.
- 3) The largest ethnic group with pay mismatch is the Chinese group.

Age Insights

Age Diversity in Operating Responsibility 1

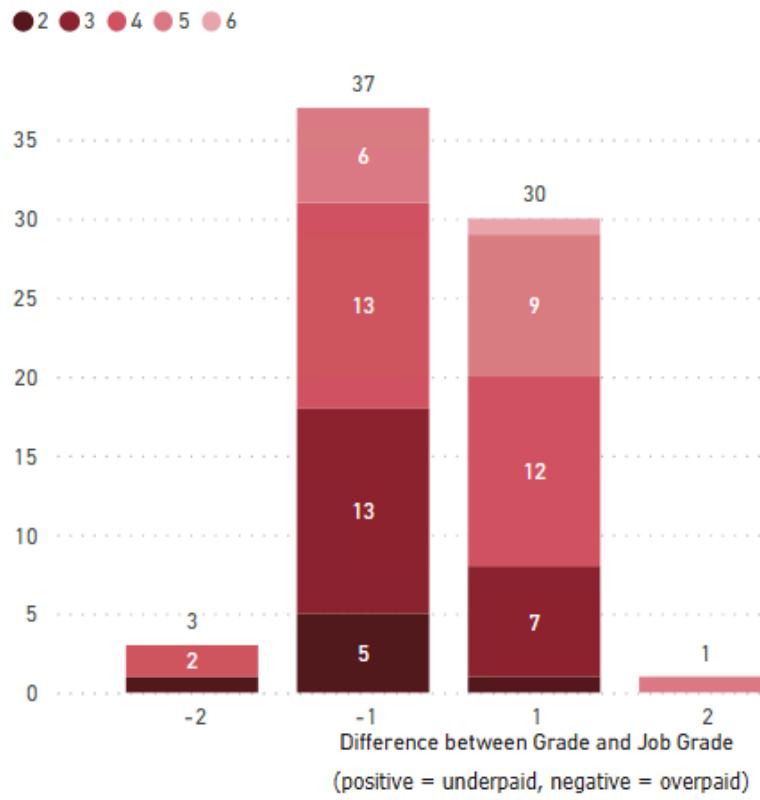


How age diverse is our talents across business units?

(Using Operational Responsibility 1 as proxy for business units)

- 1) Employees in their thirties represent the largest proportion across all OR, except for Rio Tinto Japan.
- 2) Employees in their forties represent the largest proportion in Rio Tinto Japan.
- 3) Most age diverse OR is Mineral Sales and Marketing, with representation from all age groups.
- 4) Least age diverse OR is Rio Tinto China, where 75% of the employees are in their thirties.

Age by Decades with Grades and Job Grades Mismatch



id	Grade	Job Grade
1	L	L
2	L	L
3	H	H
4	J	J
5	K	K
6	I	I
7	L	L
8	L	L
9	K	K
10	H	H
11	J	K
12	K	L
13	K	K
14	L	L
15	I	L
16	L	L
17	H	H
18	J	J
19	I	J
20	G	G

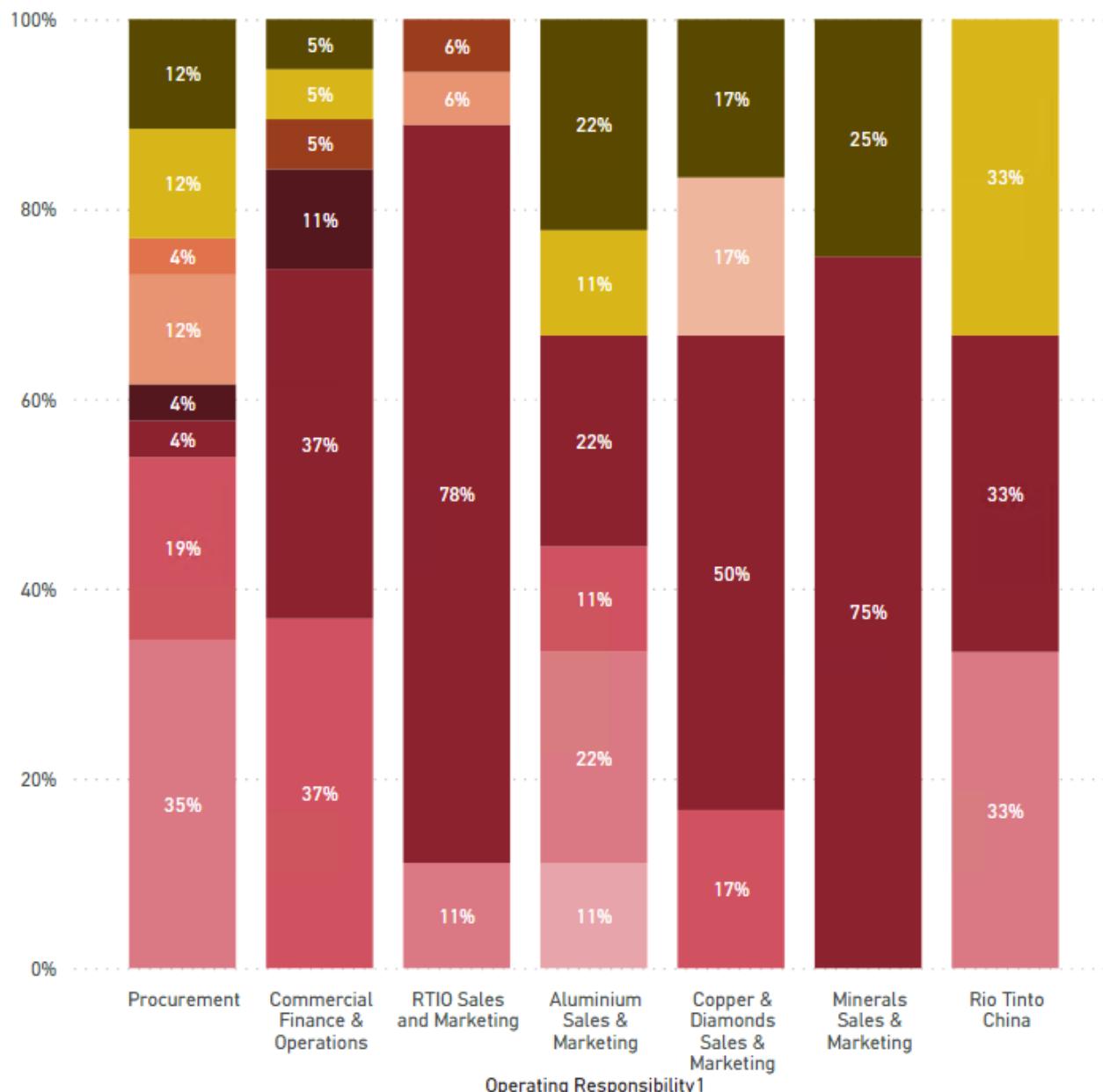
Is there pay mismatch among our talents by age?

- 1) There are 32 employees who are currently paid at a lower grade level than their employment grade.
- 2) There are 40 employees who are currently paid at a higher grade level than their employment grade.
- 3) The largest age group with pay mismatch is the forties group, though the differences across age groups are small.

Ethnic distribution of high potential and high performance talents

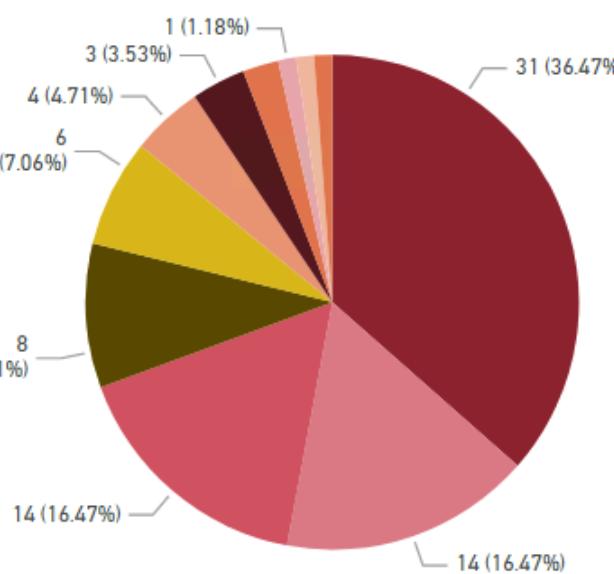
Proportion of Ethnicities in Operating Responsibility 1

Black British Canadian Chinese English German Irish Italian Malays Scottish White



Proportion of Ethnicities w.r.t Sector Rank

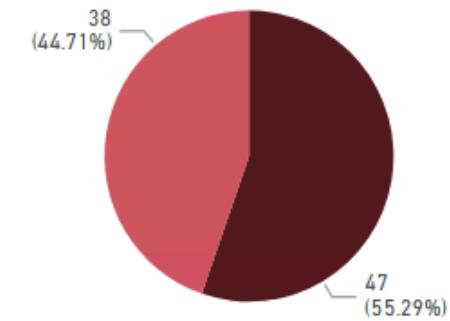
Chinese British Canadian White Scottish Irish English



Sector Rank

SR1
SR2
SR3
SR4
SR5
SR6
SR7
SR8
SR9

Male Female



Insights

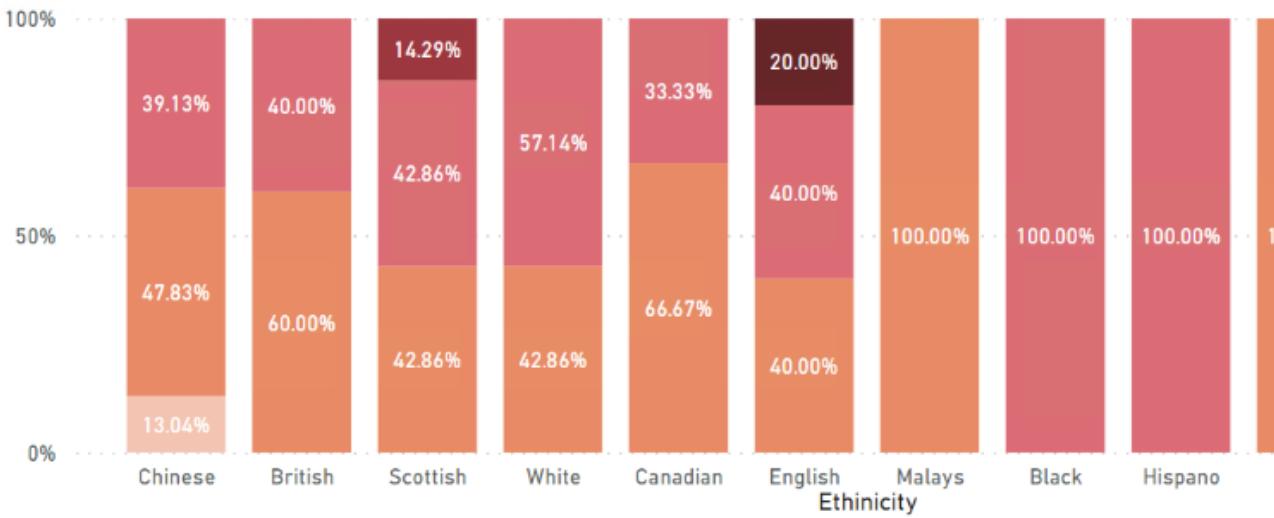
To check the dataset if there is any business unit which is ethnically diverse and also high performing.
(Using Operational Responsibility 1 as proxy for business units and Sector Rank 1 as proxy for high performance and high potential)

- 1) Filtering for SR1 and comparing across all ORs, there is no consistent diversity across OR.
- 2) The most diverse OR with equal proportion of representation from each ethnic group is Aluminium Sales & Marketing.
- 3) This compares to the overall SR1 employees across dataset, in which Chinese represent 36.47% of all SR1 graded employees.
- 4) Of note is that female employees only represent 44.71% of all employees graded SR1, below the 49.42% female representation in the data (refer to overall gender diversity).

Pay mismatch and its potential to increase risk of retention

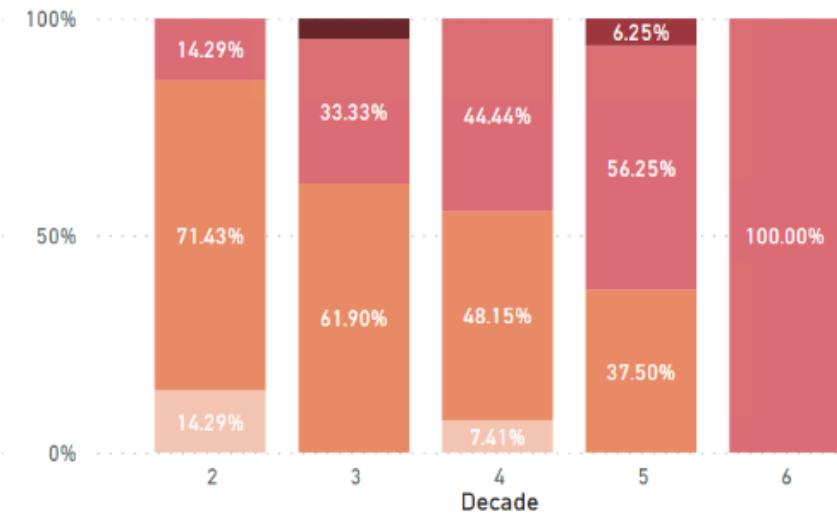
Ethnicities with Grades and Job Grades Mismatch

Mismatch ● -2 ● -1 ● 1 ● 2 ● 3 (positive = underpaid, negative = overpaid)



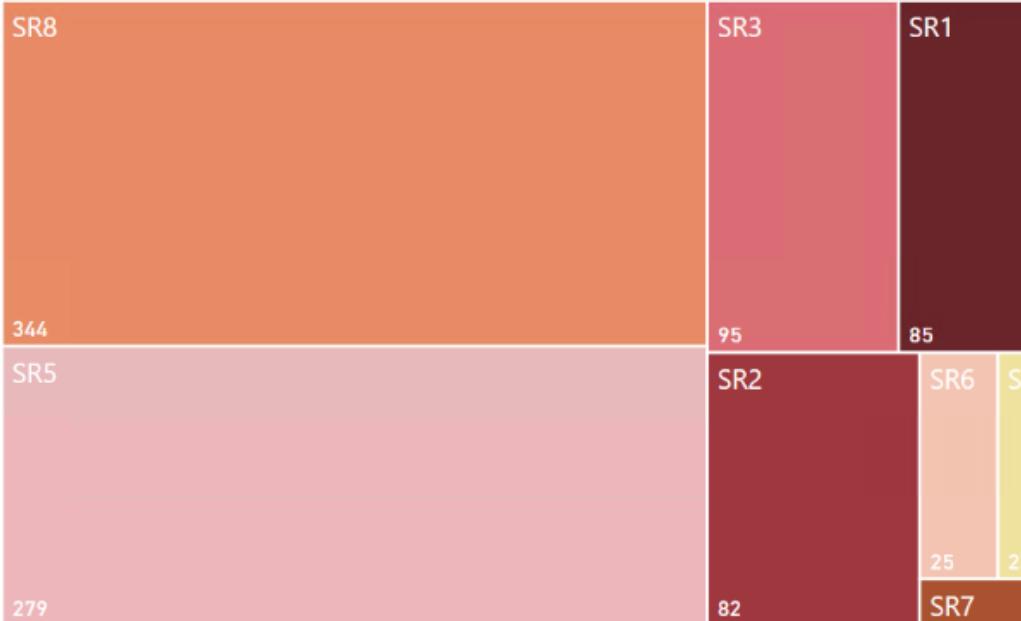
Age by Decades with Grades and Job Grades Mismatch

Mismatch ● -2 ● -1 ● 1 ● 2 ● 3 (positive = underpaid, negative = overpaid)

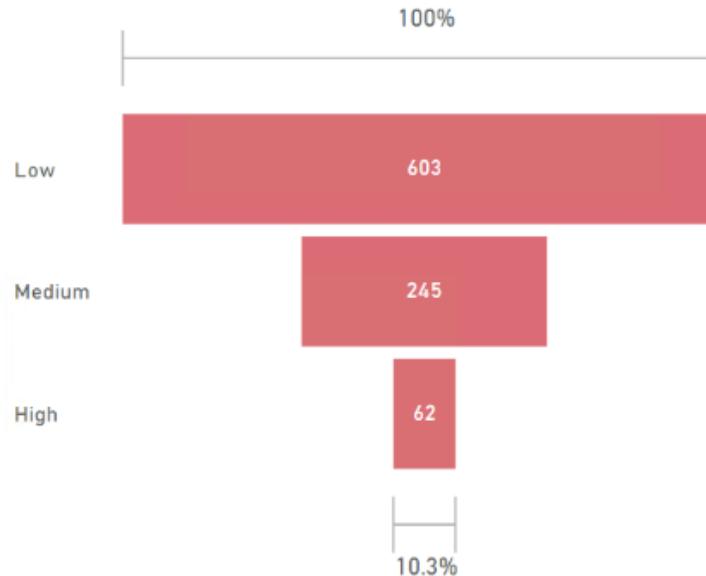


Sector Rank

● SR8 ● SR5 ● SR3 ● SR1 ● SR2 ● SR6 ● SR9 ● SR7 ● SR4



Retention Risk

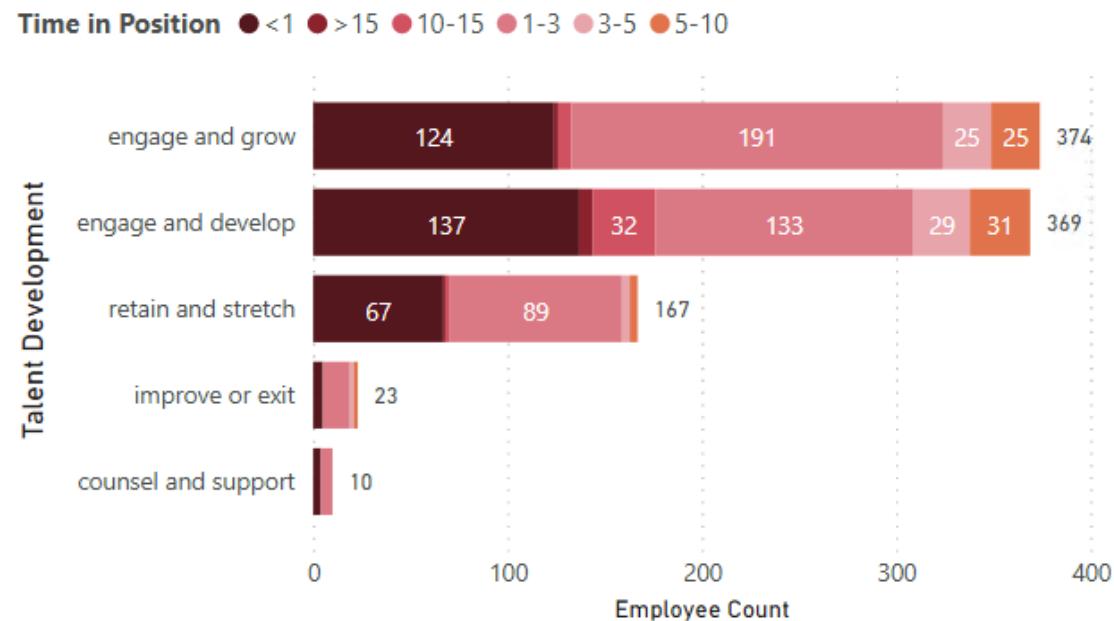


Employee Details

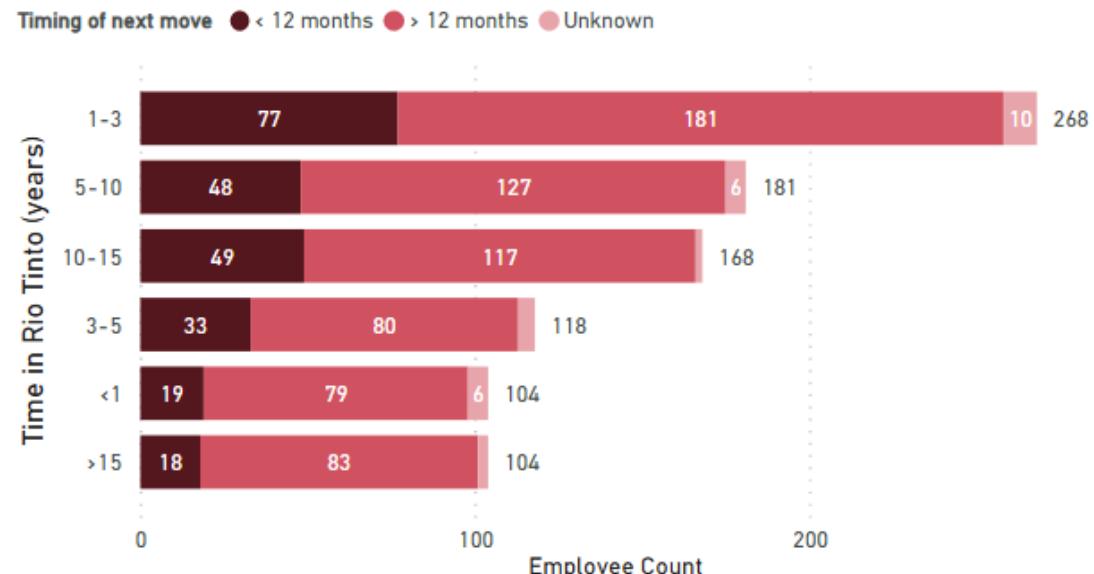
id	Operating Responsibility	Location
1	Aluminium Sales & Marketing	Unknown
2	Aluminium Sales & Marketing	Unknown
3	Aluminium Sales & Marketing	Unknown
4	Aluminium Sales & Marketing	Unknown
5	Aluminium Sales & Marketing	Montreal, QC
6	Aluminium Sales & Marketing	Montreal, QC
7	Aluminium Sales & Marketing	Montreal, QC
8	Aluminium Sales & Marketing	Montreal, QC
9	Aluminium Sales & Marketing	Montreal, QC
10	Aluminium Sales & Marketing	Montreal, QC
11	Aluminium Sales & Marketing	Montreal, QC
12	Aluminium Sales & Marketing	Unknown
13	Aluminium Sales & Marketing	Montreal, QC
14	Aluminium Sales & Marketing	Montreal, QC
15	Aluminium Sales & Marketing	Montreal, QC
16	Aluminium Sales & Marketing	Montreal, QC
17	Aluminium Sales & Marketing	Montreal, QC
18	Aluminium Sales & Marketing	Montreal, QC
19	Aluminium Sales & Marketing	Montreal, QC

Talent Development Overview

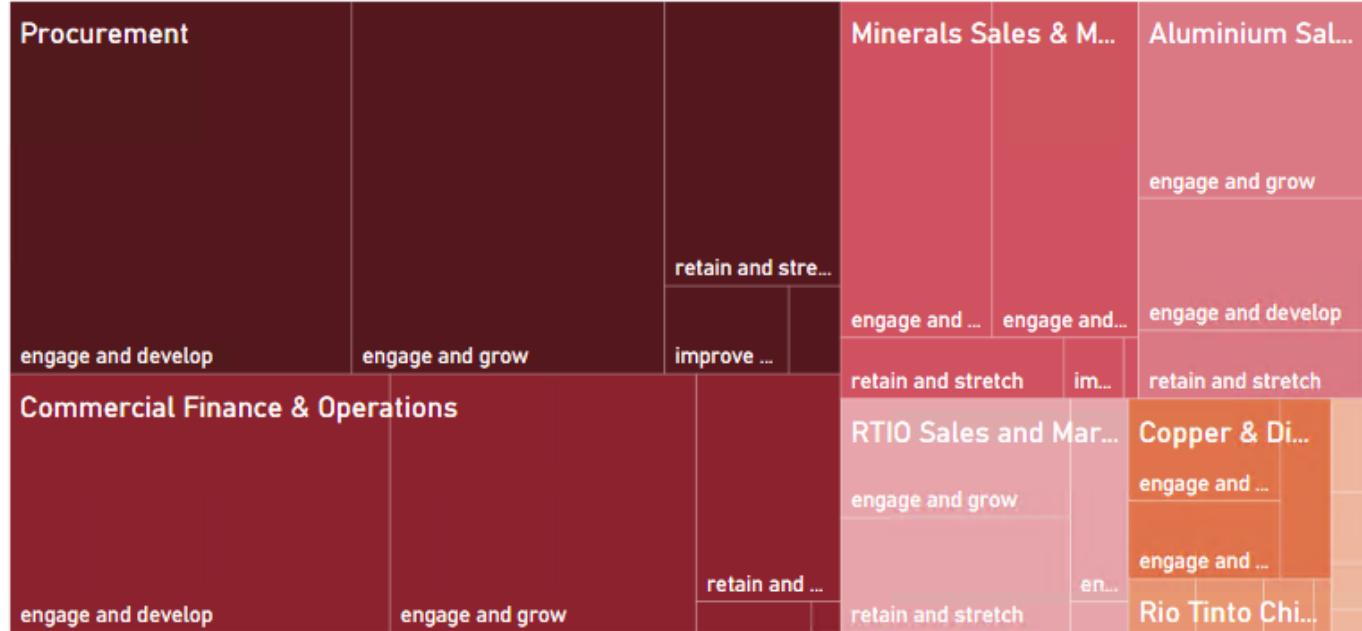
Talent Development Strategy compared to years experience in position



Time in Rio Tinto compared to Timing of next move

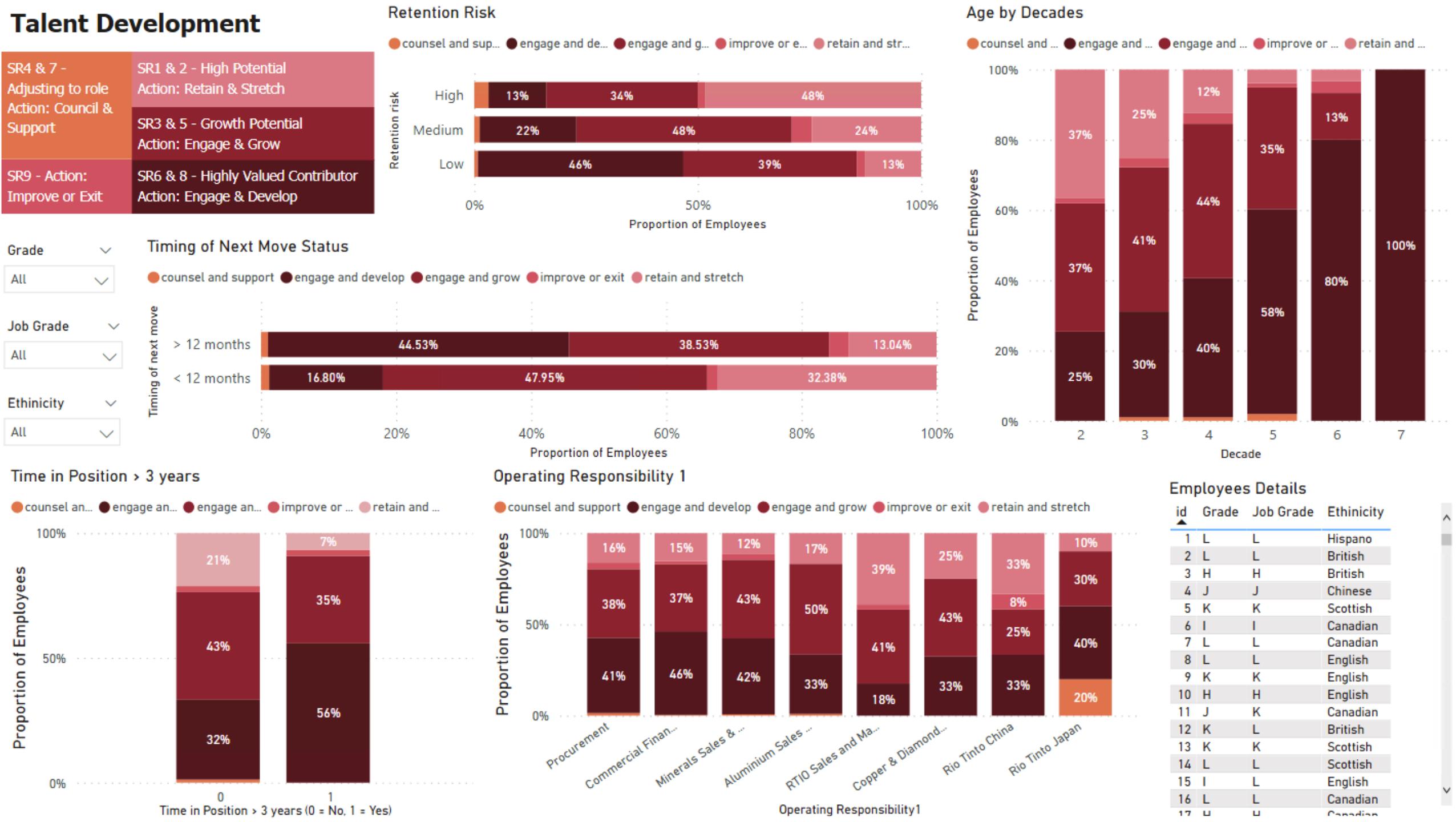


Operating Responsibility 1 compared to Talent Development Strategy



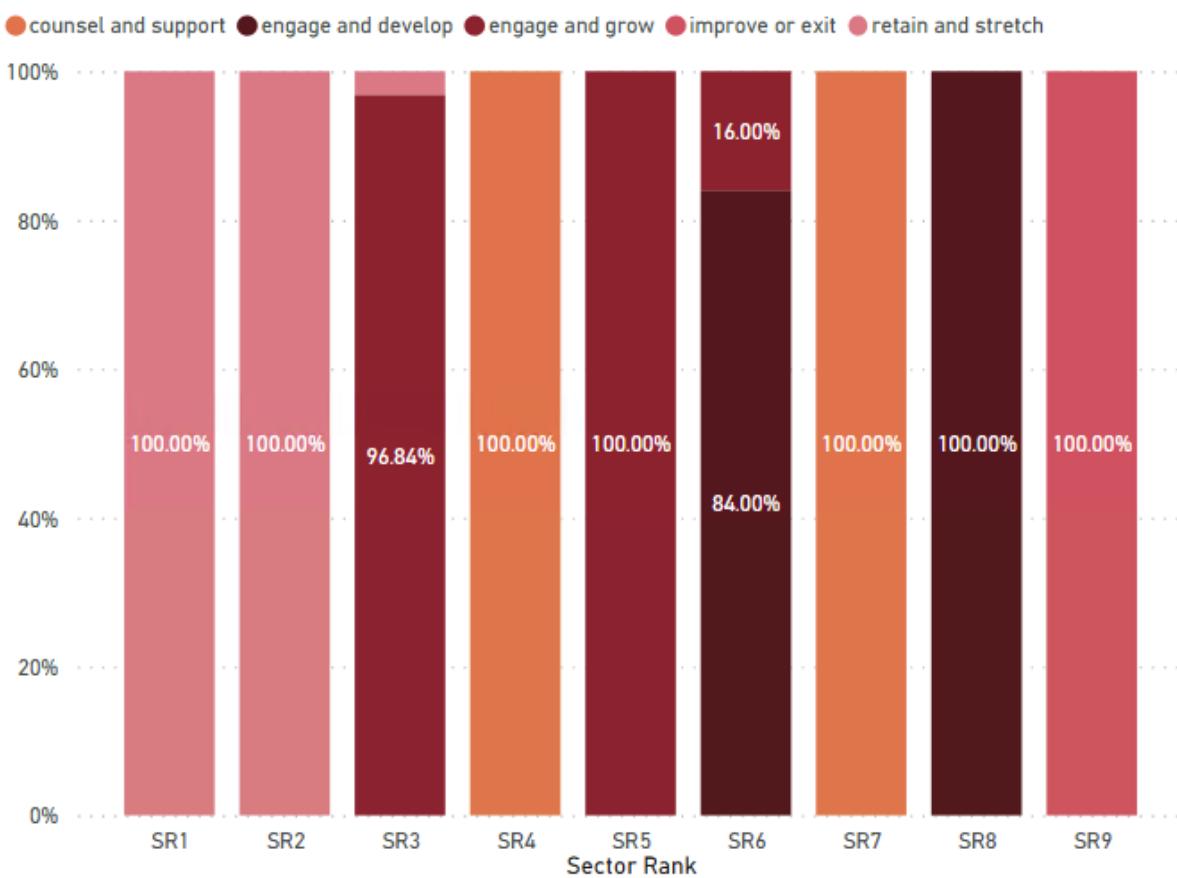
Employee Details

ID	Decade	Grade	Job Grade	Retention risk	Career stream (primary)	Ethnicity	User Gender	Location
1	5	L	L	Low	Functional	Hispano	Female	Unknown
2	4	L	L	Low	Commercial	British	Female	Unknown
3	6	H	H	Low	Technical	British	Male	Unknown
4	4	J	J	Low	Commercial	Chinese	Female	Unknown
5	5	K	K	Low	Commercial	Scottish	Female	Montreal, QC
6	3	I	I	Medium	Commercial	Canadian	Male	Montreal, QC
7	2	L	L	Medium	Commercial	Canadian	Female	Montreal, QC
8	2	L	L	Medium	Commercial	English	Female	Montreal, QC
9	5	K	K	Low	Commercial	English	Female	Montreal, QC
10	5	H	H	Low	Functional	English	Female	Montreal, QC
11	4	J	K	Unknown	Unknown	Canadian	Female	Montreal, QC
12	2	K	L	High	Technical	British	Male	Unknown
13	5	K	K	Low	Commercial	Scottish	Female	Montreal, QC
14	2	L	L	Unknown	Unknown	Scottish	Male	Montreal, QC
15	3	I	L	Unknown	Unknown	English	Male	Montreal, QC
16	5	L	L	Unknown	Unknown	Canadian	Female	Montreal, QC
17	4	H	H	Low	Commercial	Canadian	Male	Montreal, QC
18	5	J	J	Low	Commercial	Canadian	Male	Montreal, QC

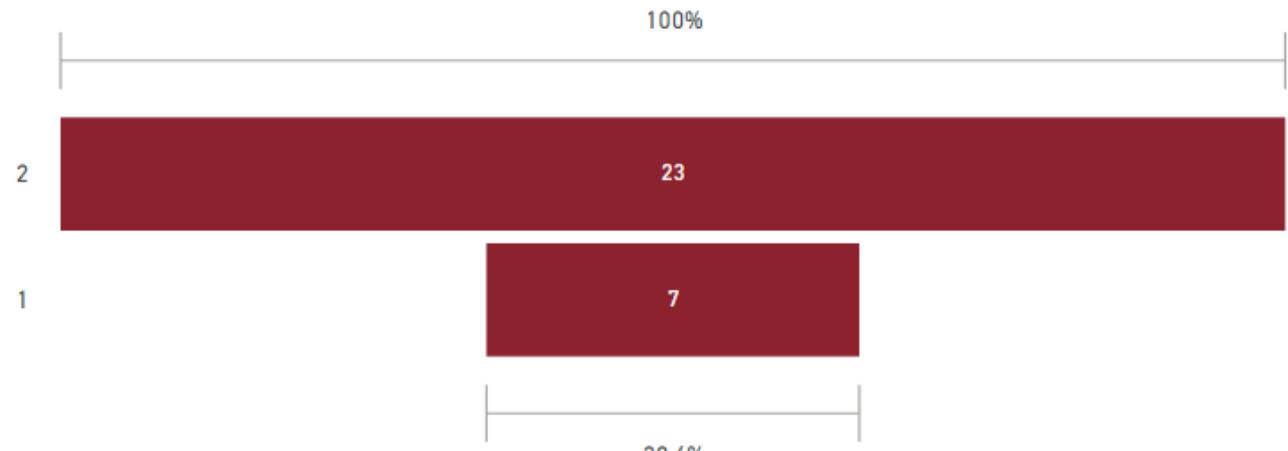


Talent Development Effectiveness

Proportion of talents to be developed based on Sector Rank last year



Employees' Sector Rank compared to Previous Year (Positive = Drop in SR)



Is our talent development program effective?

- 1) Bar chart shows the comparison of classification for people development strategy last year against the Sector Rank this year. Focus on the difference in colour in SR3 and SR6. The difference shows change in Sector Rank for individuals, thus requiring a different development strategy this year.
- 2) Funnel chart act as a filter to find individuals who have a change in Sector Rank from last year to this year. By clicking on the funnel bar, user can filter and find out what strategy the individuals had last year and compare to their current Sector Rank.
- 3) The table of employees output the filtered employees and their Operating Responsibility area, along with a comparison of their Sector Rank last year and this year.
- 4) We found that there are 23 employees who drop Sector Rank by 2 grades and 7 employees who drop Sector Rank by 1 grade.

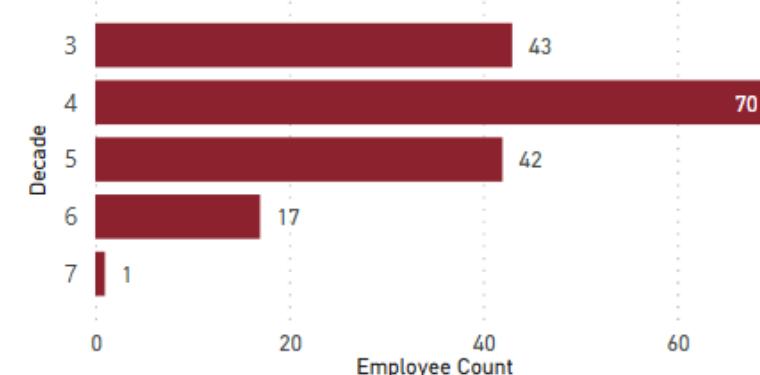
Employee Details

id	Job Title	Operating Responsibility1	Sector Rank Raw last year	Sector Rank Raw	Decade	Time in Position	Time in Rio Tinto
1	Administrative Assistant	Aluminium Sales & Marketing	SR8	SR8	5	10-15	>15
2	Administrative Assistant	Aluminium Sales & Marketing	SR5	SR5	4	10-15	>15
3	Manager	Aluminium Sales & Marketing	SR8	SR8	6	10-15	10-15
4	Adviser	Aluminium Sales & Marketing	SR3	SR3	4	1-3	1-3
5	Analyst	Aluminium Sales & Marketing	SR3	SR3	5	1-3	>15
6	Adviser	Aluminium Sales & Marketing	SR3	SR3	3	<1	3-5
7	Analyst	Aluminium Sales & Marketing	SR3	SR3	2	<1	3-5
8	Analyst	Aluminium Sales & Marketing	SR5	SR5	2	1-3	1-3

Career Mobility - Individuals in position for more than 3 years

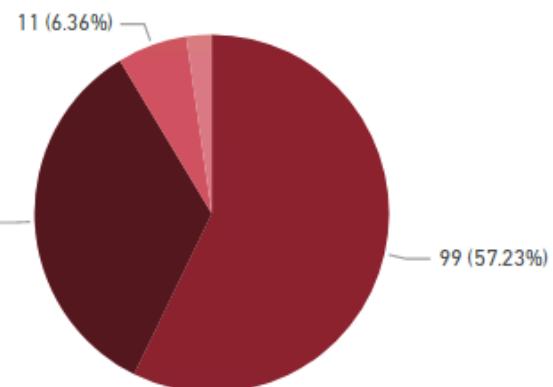
Diversity

Age by Decade



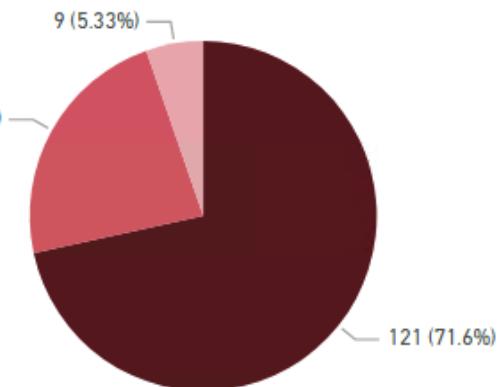
Talent Development

● engage and develop
● engage and develop
● retain and develop
● improve or develop



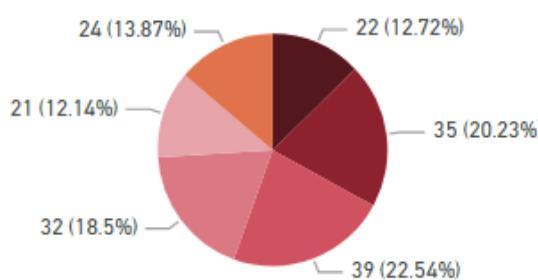
Talent Retention

● Low
● Medium
● High

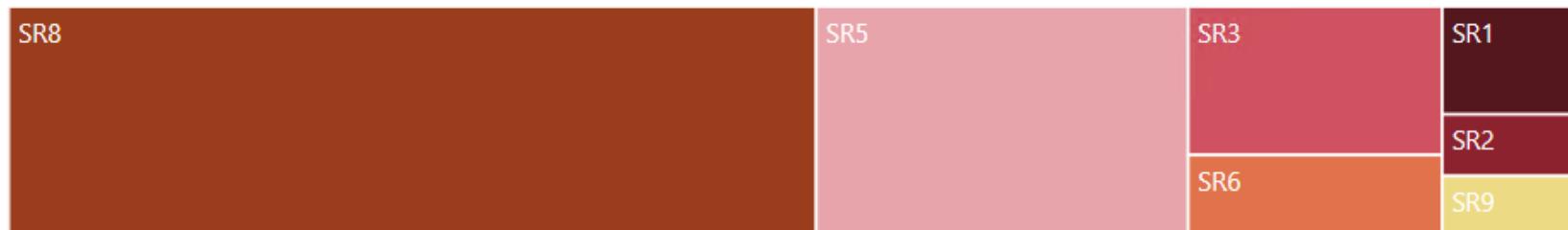


Grade

● G ● H ● I ● J ● K ● L



Sector Rank



Employee Details

id	Ethnicity	Job Title	Operating Responsibility	1	Sector Rank	Raw last year
1	Hispano	Administrative Assistant	Aluminium Sales & Marketing	SR8		
2	British	Administrative Assistant	Aluminium Sales & Marketing	SR5		
3	British	Manager	Aluminium Sales & Marketing	SR8		
27	Scottish	Principal Adviser	Aluminium Sales & Marketing	SR5		
29	Chinese	Principal Adviser	Aluminium Sales & Marketing	SR6		
30	Chinese	Analyst	Aluminium Sales & Marketing	SR8		
34	Italian	Analyst	Aluminium Sales & Marketing	SR3		
35	Indian	Analyst	Aluminium Sales & Marketing	SR5		
36	Chinese	Analyst	Aluminium Sales & Marketing	SR6		
45	Chinese	Adviser	Aluminium Sales & Marketing	SR5		

Observations

For employees who has been in the position for more than 3 years:

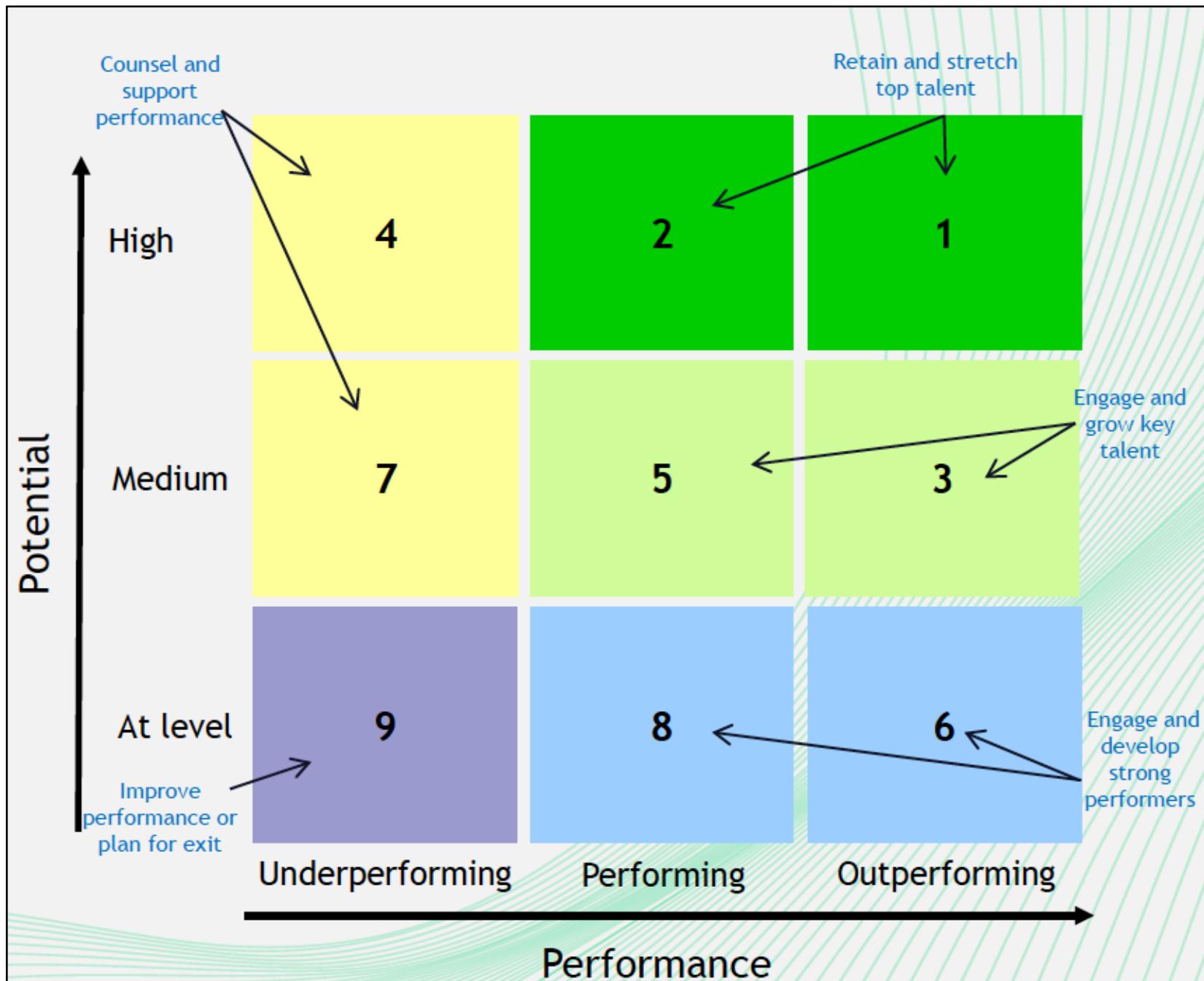
- 1) The largest age group of employees are the forties age group.
- 2) 57.23% of employees in position more than 3 years are classified in highly valued contributor category, to be engaged and developed. 51.45% of such employees are classified under Sector Rank 8.
- 3) Only 5.33% of employees in position more than 3 years are noted to have high retention risk.

Insights:

Among employees who are in same position for more than 3 years, half of them are average performance with low potential (SR8). 68% of them are specialist and supervisors and more than 70% have a low retention risk. This large group of 89 employees will require attention in engagement and development to pick strong performer or arrange for lateral move.

1.1 PBI Supporting Charts (Q&A)

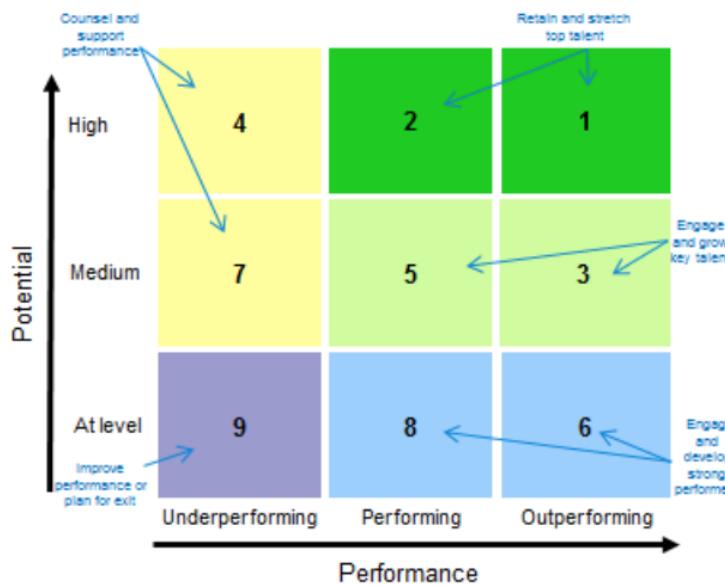
SR Matrix



SR Matrix and Talent Development Strategies

Characteristics of Sector Ranks

“What traits do employees in each Sector rank typically exhibit?”



Note: if you have a new starter or early career professional in your team, trust your experience as a leader and assess individual potential based on your observations to date. Make your best judgement call

SR 4 & 7 - Adjusting to role

Action: Coach & Support performance

- Employee has the aspiration and capability to perform more complex roles; however is currently underperforming.
- Focussed leader support and action is required to improve performance.
- It is expected to see this employee in a different sector rank or moved from role within 6 months.

SR 9 - Needs Improvement

Action: Improve or Exit

- Employee is underperforming.
- Focussed leader support and action is required to improve performance.
- It is expected to see this employee in a different sector rank or moved from role within 6 months.

SR 1 & 2 - High potential

Action: Retain & Stretch

Demonstrates the characteristics of a high performer and the:

- aspiration to take on more complex or higher level role;
- ability and commitment to grow at a rapid rate compared to peers;
- capabilities and behaviours required for a more complex or challenging role, and;
- propensity to lead, inspire and bring out the best in people.

SR 3 & 5 - Growth potential

Action: Engage & Grow

- Displays strong performance
- Demonstrate career aspirations and ability to develop and grow into a more complex role and;
- Leads by example and demonstrates Rio Tinto values and behaviours.

SR 6 & 8 - Highly Valued Contributor

Action: Engage & Develop

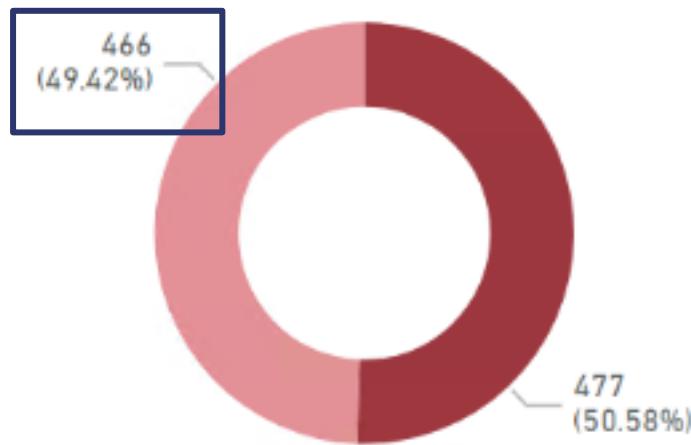
Demonstrates:

- the skills, knowledge and experience that make a positive impact on the business, e.g. considered an expert or specialist in their field, and;
- the aspiration and/or ability to grow and develop in their current role level for the foreseeable future, e.g. may include development opportunities or a lateral move to foster breadth of experience.

Female Representation

In Rio Tinto

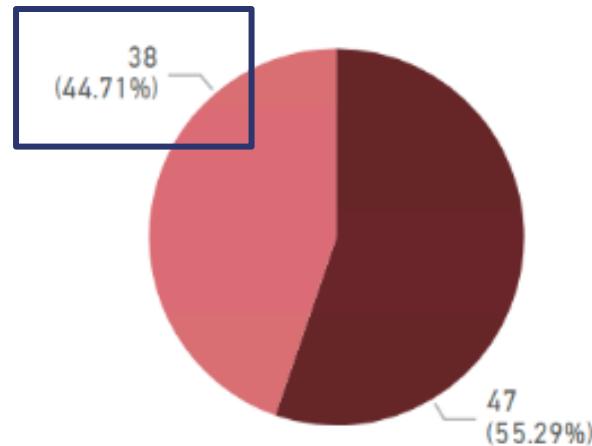
● Male ● Female



(PBI "Overview")

In SR1

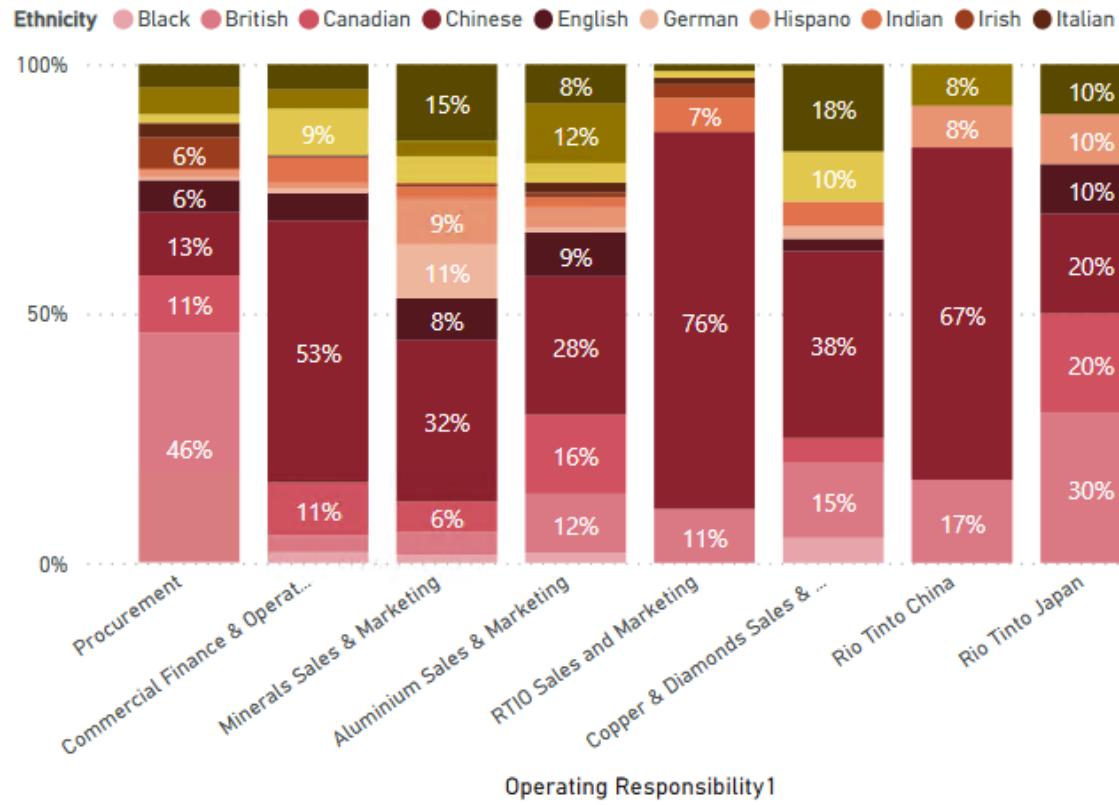
● Male ● Female



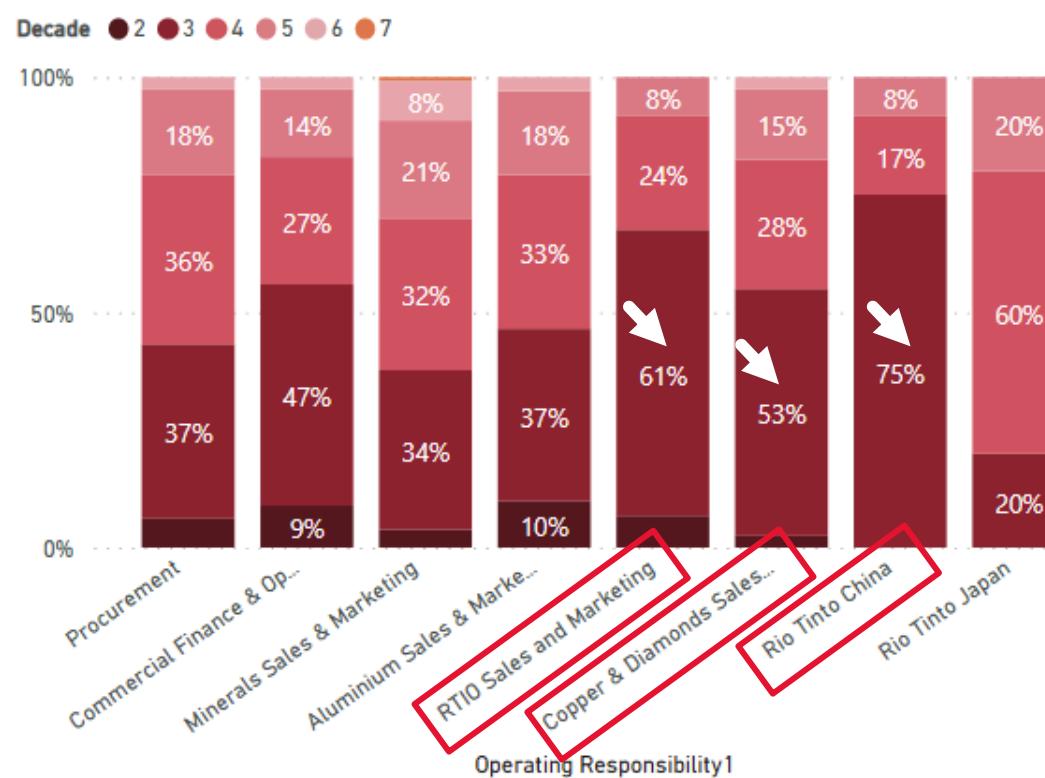
(PBI "Diversity: across SR1")

Rio Tinto is ethnically diverse but not age diverse across OR1

Ethnic Diversity in Operating Responsibility 1

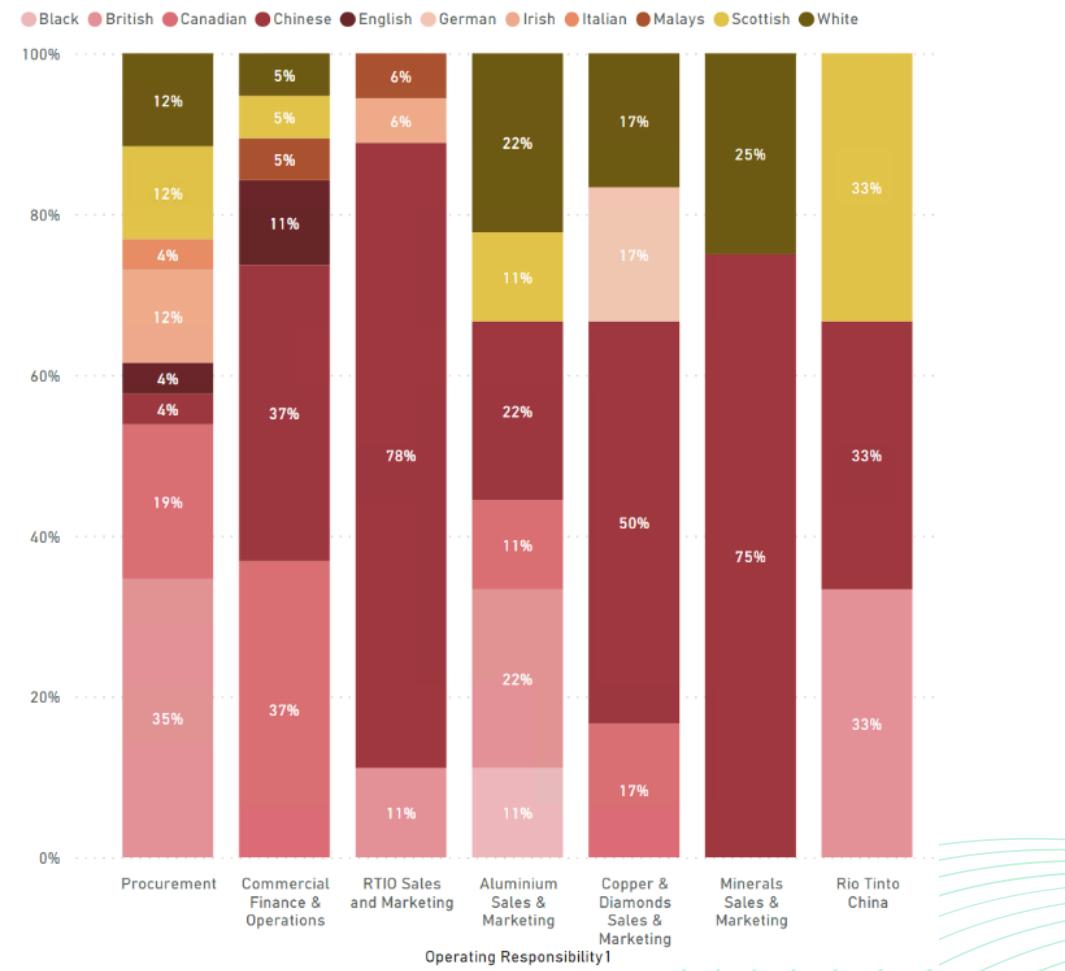


Age Diversity in Operating Responsibility 1



Inconsistent Ethnic Diversity

Proportion of Ethnicities in Operating Responsibility 1

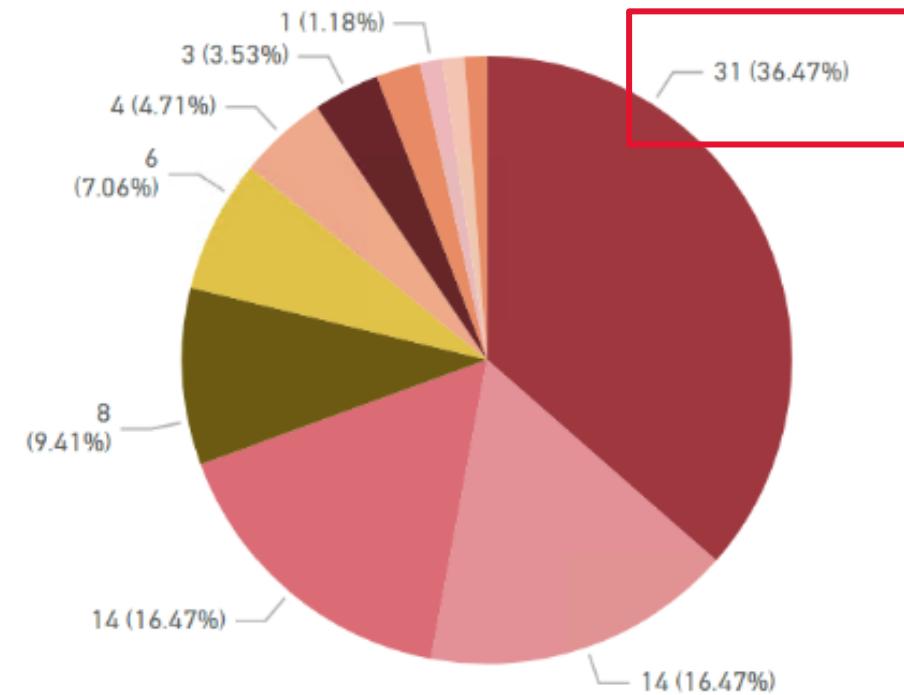


(PBI "Diversity: across SR1")

36% in SR1 are Chinese

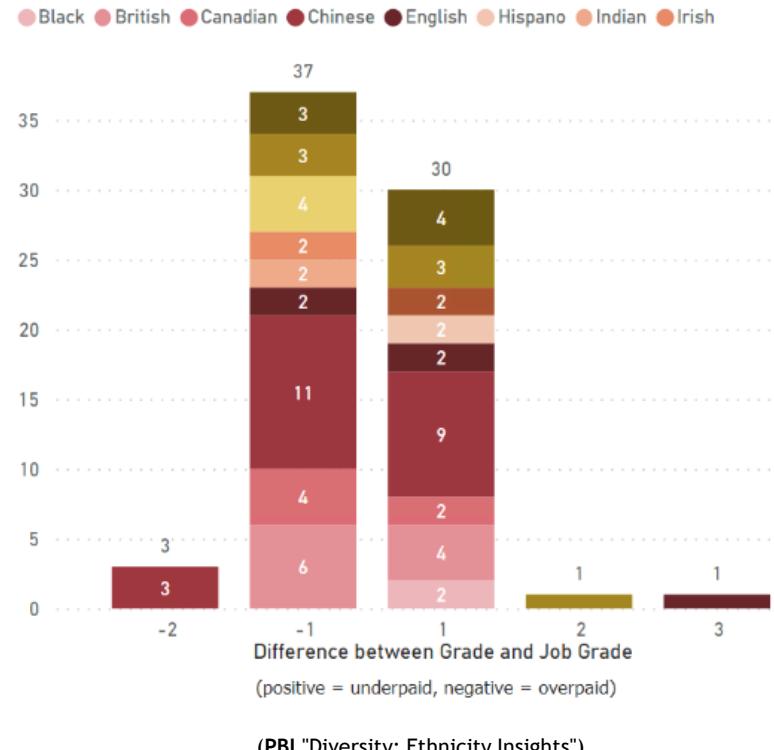
Proportion of Ethnicities w.r.t Sector Rank

● Chinese ● British ● Canadian ● White ● Scottish ● Irish ● English

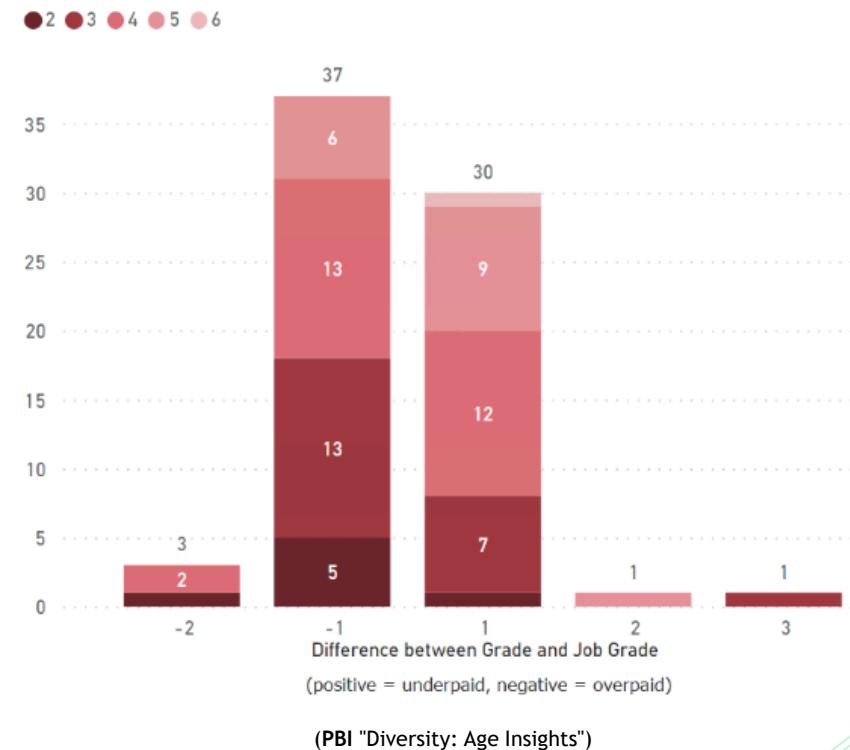


No specific discrimination for pay mismatch

Ethnicities with Grades and Job Grades Mismatch

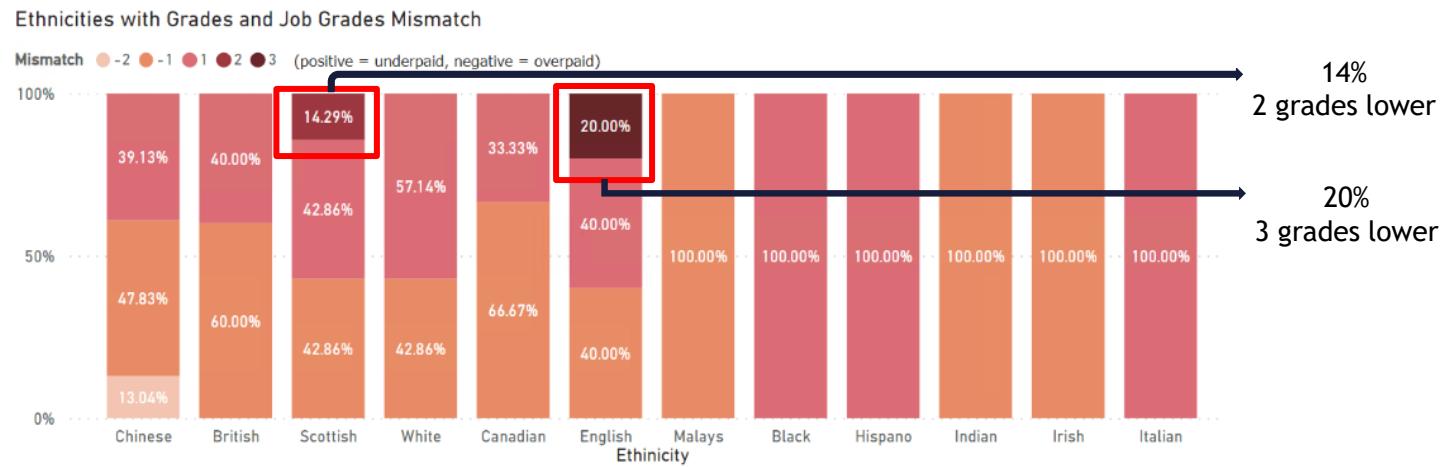


Age by Decades with Grades and Job Grades Mismatch



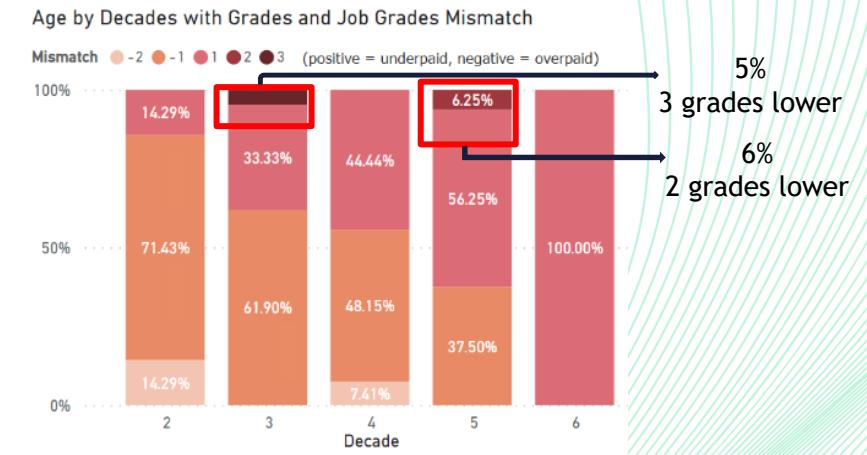
Employees underpaid by 2-3 grades

Across Ethnicities



(PBI "Pay Mismatch Insights")

Across Decades



26 employees are flagged as underperformers who should be moved to another role within 6 months but are not planned so

Talent Development

SR4 & 7 - Adjusting to role Action: Council & Support	SR1 & 2 - High Potential Action: Retain & Stretch
SR3 & 5 - Growth Potential Action: Engage & Grow	SR6 & 8 - Highly Valued Contributor Action: Engage & Develop
SR9 - Action: Improve or Exit	

Retention Risk

Age Group

With relevance to Question 1.2 & 2.3: This tab explores the employees who need focus (SR4&7 & SR9)

Timing of Next Move Status

Time in Position > 3 years

Operating Responsibility 1

Table:

id	Grade	Job Grade	Ethnicity
101	G	G	Chinese
147	K	K	Chinese
158	H	H	Malays
166	H	H	Chinese
214	H	H	White
219	L	L	White
253	L	K	White
333	K	K	Indian
351	L	L	Chinese
382	I	I	Chinese
404	K	K	Chinese
413	J	J	Canadian
521	H	H	English
522	I	I	Malays

With relevance to Question 1.2 & 2.3: This tab explores the employees who needs focus (SR4&7 & SR9)

This tab explores the age diversity in SR ranking

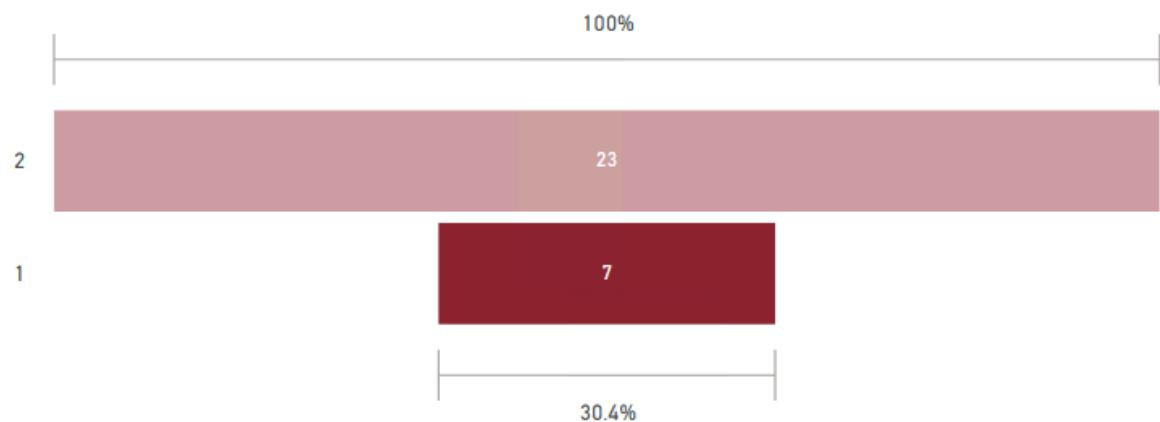
Talent development program can be improved

Proportion of talents to be developed based on Sector Rank Raw last year

● counsel and support ● engage and develop ● engage and grow ● improve or exit ● retain and stretch



Employees' Sector Rank compared to Previous Year



- 30 employees decreased in Sector Rank score from last year to this year.
- Of which, 7 employees required change in talent development strategies.
- Of note, the 7 employees shown with a drop in 1 SR Rank meant a drop in potential but an increase in performance.
 - All are employees with at least 10 years' experience in position
 - May require change in position for higher potential

Employee Details

id	Job Title	Operating Responsibility1	Sector Rank Raw last year	Sector Rank Raw	Decade	Time in Position	Time in Rio Tinto
35	Analyst	Aluminium Sales & Marketing	SR5	SR6	4	10-15	10-15
127	Manager	Copper & Diamonds Sales & Marketing	SR2	SR3	4	10-15	10-15
174	Analyst	Minerals Sales & Marketing	SR5	SR6	5	10-15	10-15
181	Analyst	Minerals Sales & Marketing	SR5	SR6	6	>15	>15
182	Analyst	Minerals Sales & Marketing	SR2	SR3	3	10-15	10-15
198	Manager	Minerals Sales & Marketing	SR5	SR6	5	10-15	10-15
832	Adviser	Procurement	SR2	SR3	4	10-15	10-15

2.0 Machine Learning

Classifier model with Performance (SR_Flag) as target

#	List of Features
1	User Country
2	Time in Rio Tinto
3	Time_Position_gt_3
4	Retention risk
5	Decade
6	Grade num
7	Job grade num
8	Diff_Grade_Job_Grade
9	Seniority
10	Job Title
11	Operating Responsibility1
12	PromotionReadiness
13	Change of Responsibilities



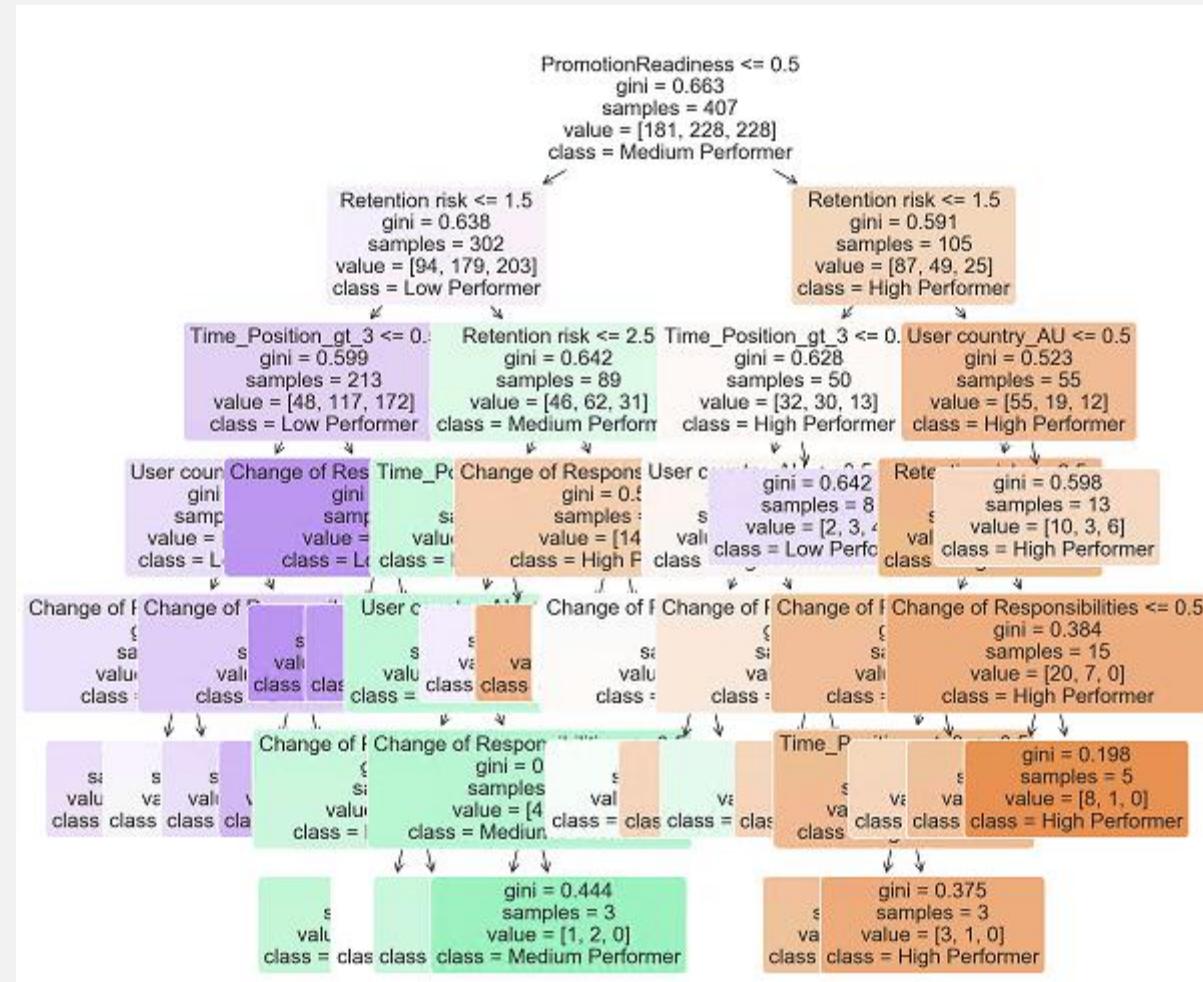
**Predicted
SR_Flag**



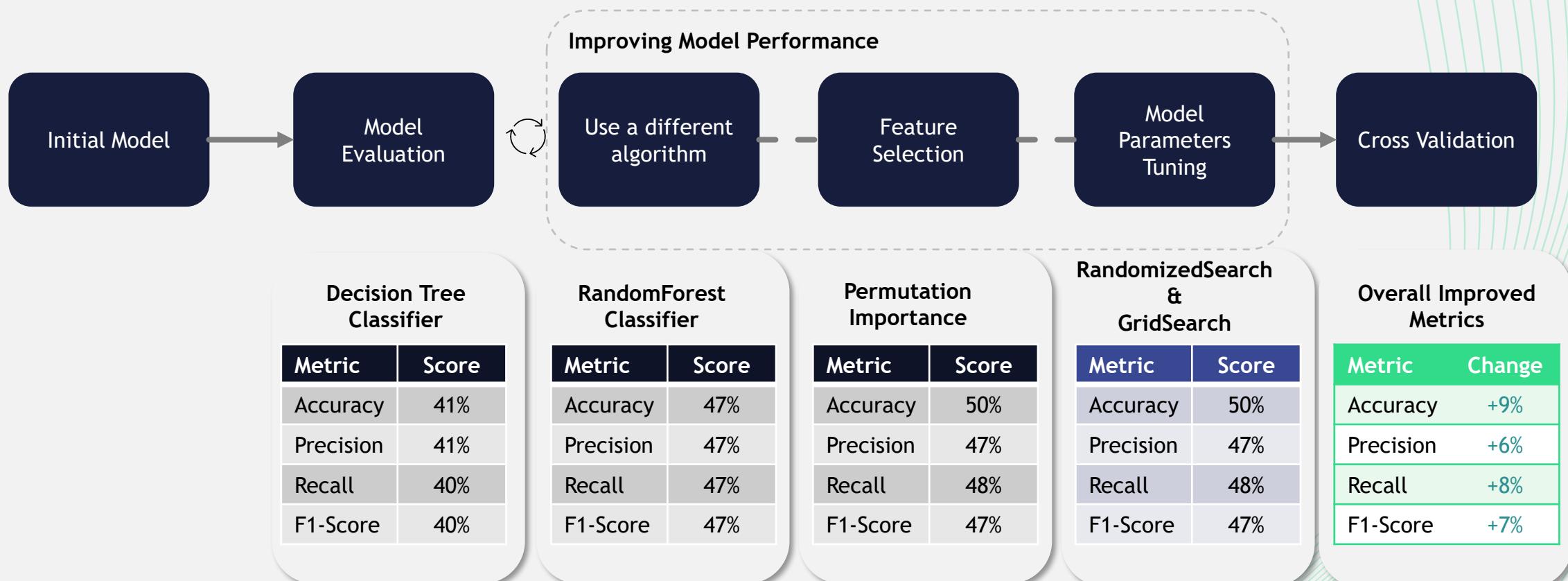
Model Evaluation:

Metric	Score
Accuracy	50%
Precision	47%
Recall	48%
F1-Score	47%

Decision Tree from SR_Flag RandomForest Classifier



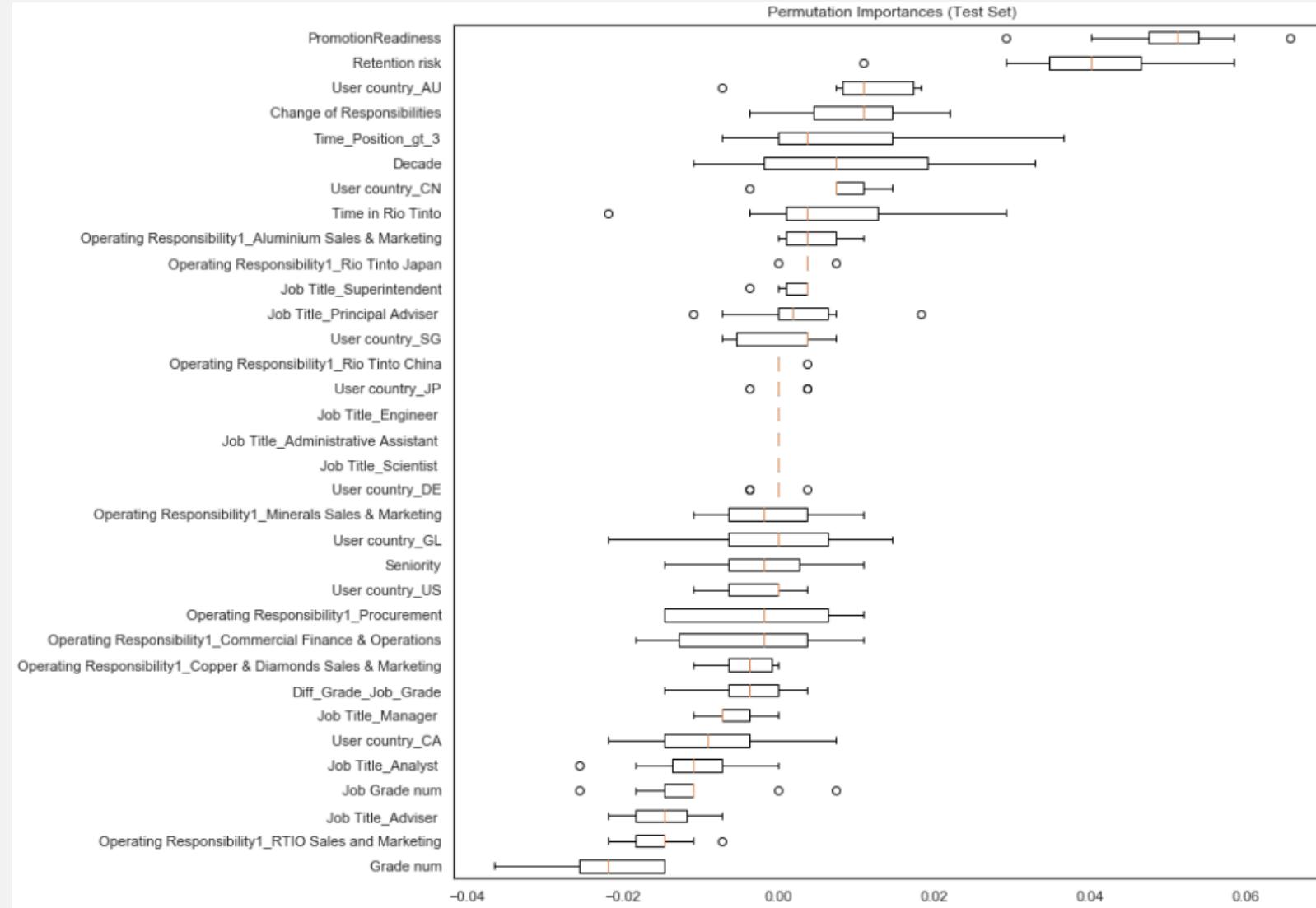
Detailed workflow for Classifier for SR_Flag



Trimmed to 5
from 34 Features

- n_estimators: number of Decision Trees in RandomForest
- max_depth: max # of levels in trees
- max_features: # of features to consider at every split
- min_samples_split: min # of samples required to split a node
- min_samples_leaf: min # of samples required at each leaf node
- bootstrap: method of selecting samples for training each tree

Permutation Importances results for SR_Flag



Parameters:

- Ran on Test-set
- Scoring: “Accuracy”
- n_repeats = 10

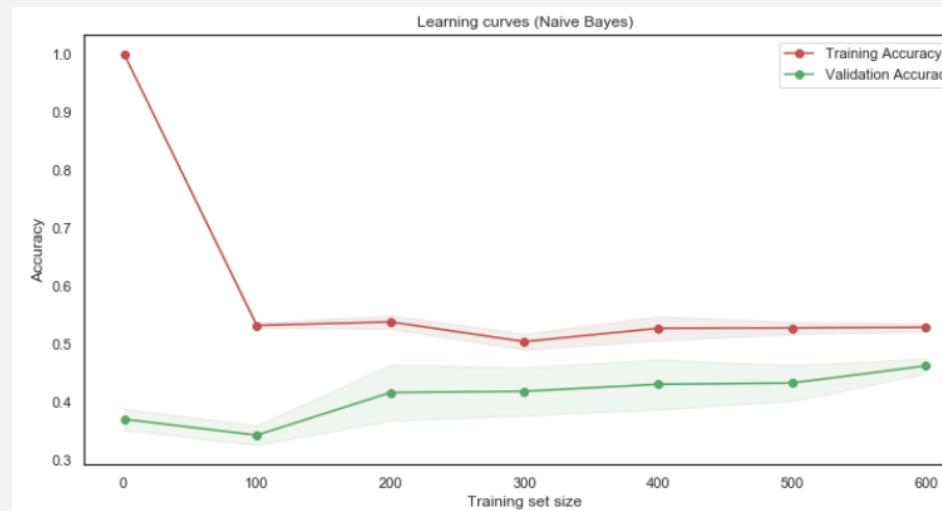
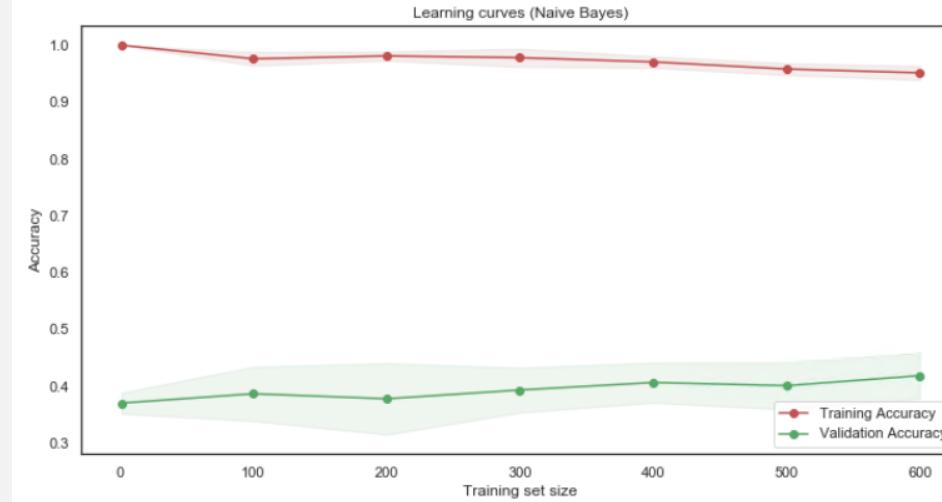
What is “Permutation Importance”?
It randomly shuffles a single column of Features and measures the impact to the accuracy of the model. With this, we can determine what are the most important predictors of our target variable.

Height at age 20 (cm)	Height at age 10 (cm)
182	155
175	147
...	...
156	142
153	130

Source:

<https://www.kaggle.com/dansbecker/permutation-importance>

Bias-Variance tradeoff with Learning Curves (SR_Flag)



Baseline (“Out-of-bag”) RandomForest:

- n_estimators: 100
- # of Features: 34

“Best” RandomForest:

- n_estimators: 1200
- max_depth: 30
- max_features: 3
- min_samples_leaf: 3
- min_samples_split: 4
- bootstrap: True

• # of Features: 5

Correlation Matrix of Features vs. Performance

-1.0 +1.0: Intra-feature correlation
 -1.0 +1.0: Target vs. Feature correlation

Feature Importance	Feature	PromotionReadiness	Retention Risk	User Country_AU	Change of Responsibilities	Time_Position_gt_3
1	PromotionReadiness					
2	Retention Risk	0.271 (Higher PR, Higher Risk)				
3	User Country_AU	0.021 (Higher PR, Works in AU)	-0.069 (Higher RR, Does not work in AU)			
4	Change of Responsibilities	0.057 (Higher PR, Has CoR)	0.025 (Higher RR, Has CoR)	0.189 (Works in AU, Has CoR)		
5	Time_Position_gt_3	-0.040 (Higher PR, Not >3 years in Position)	-0.053 (Higher RR, Not >3 years in Position)	-0.195 (Works in AU, Not >3 years in Position)	-0.033 (Has CoR, Not >3 years in Position)	
Target Variable	SR_Flag	-0.310 (Higher PR, Higher Performance)	-0.269 (Higher RR, Higher Performance)	0.055 (Works in AU, Lower Performance)	-0.075 (Has CoR, Higher Performance)	0.155 (>3 years in Position, Lower Performance)

- PromotionReadiness: {"No": 0, "Yes": 1}
- Retention Risk: {"Low": 1, "Medium": 2, "High": 3}
- User Country_AU: {"No": 0, "Yes": 1}
- Change of Responsibilities: {"No": 0, "Yes": 1}
- Time_Position_gt_3: {"No": 0, "Yes": 1}
- SR_Flag: {"High-Performer": 1, "Mid-Performer": 2, "Low-Performer": 3}

Classifier model with Retention risk as target

#	List of Features
1	User Country
2	Time in Rio Tinto
3	Time_Position_gt_5
4	SR_Flag
5	SRChange
6	Decade
7	Ethnicity
8	Grade num
9	Job Grade num
10	Diff_Grade_Job_Grade
11	Seniority
12	Operating Responsibility1
13	PromotionReadiness



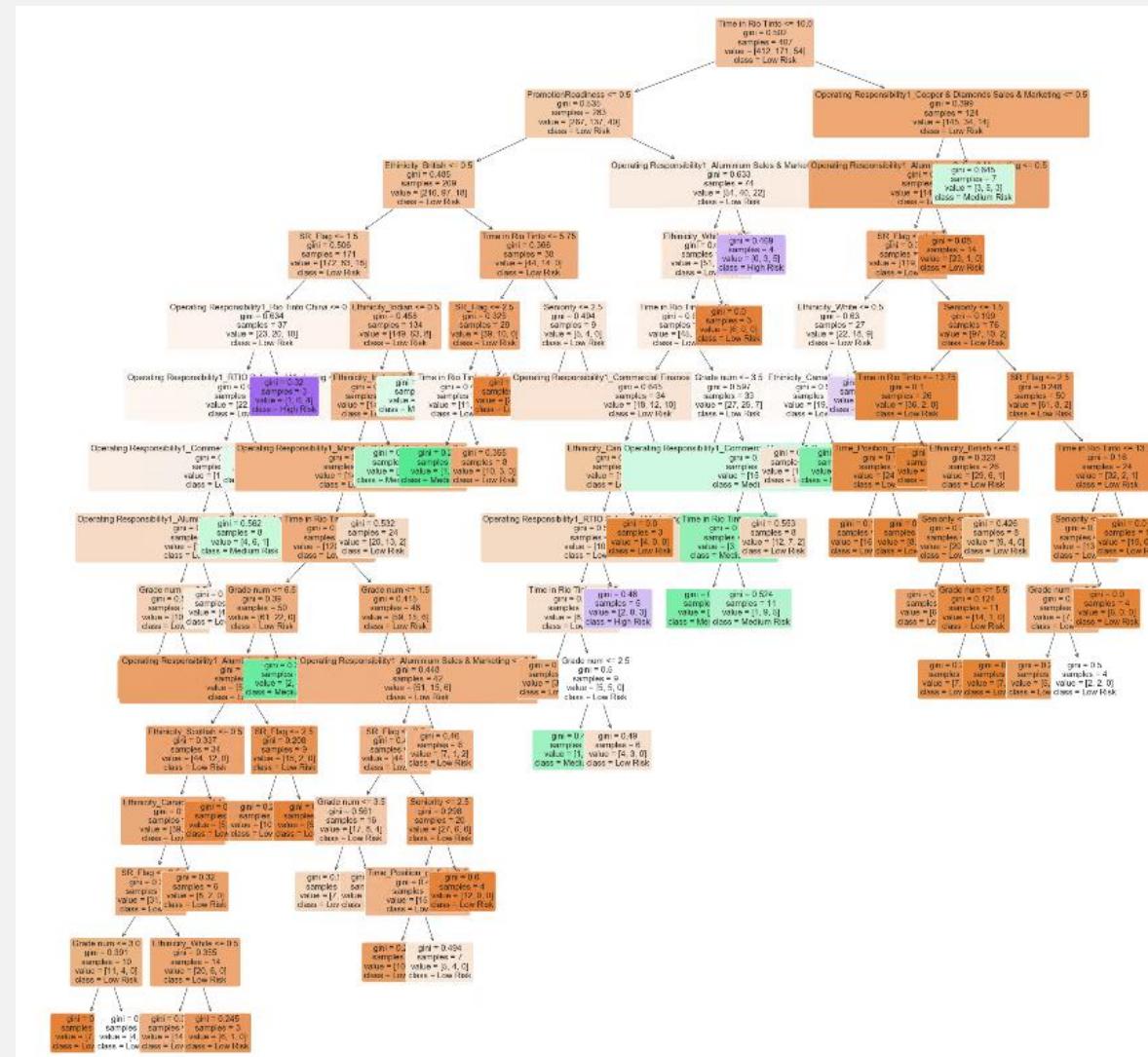
**Predicted
Retention risk**



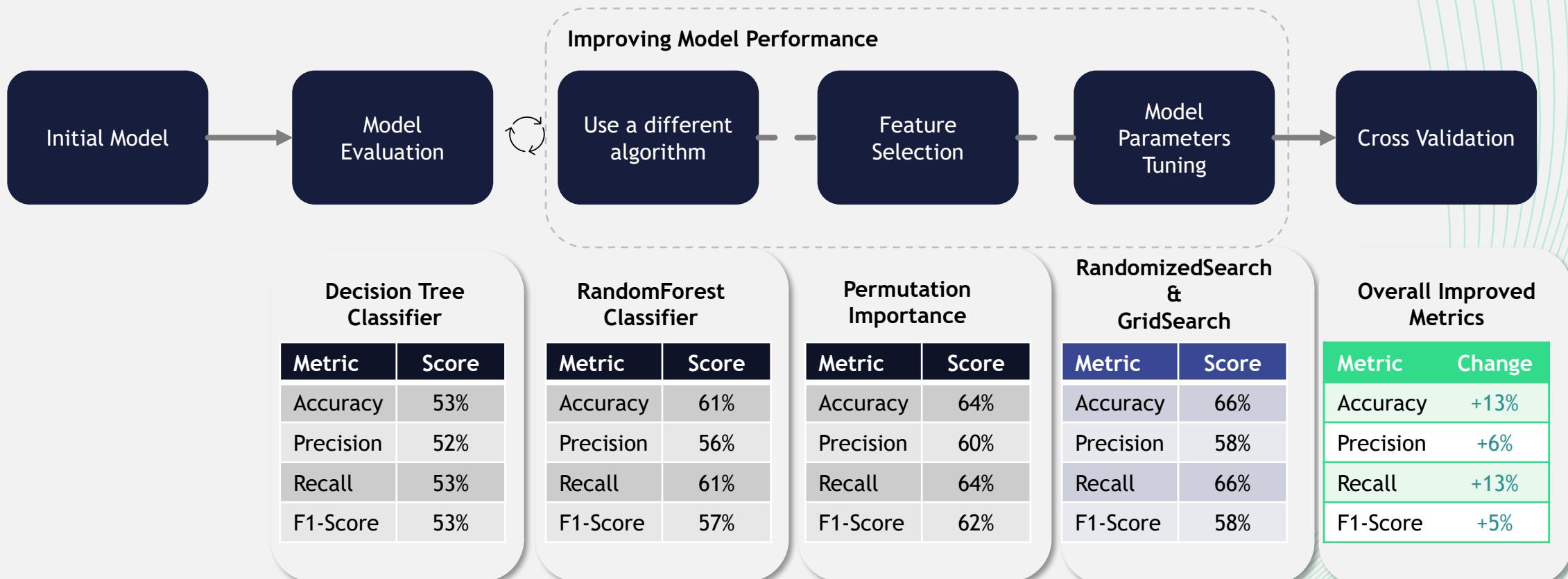
Model Evaluation:

Metric	Score
Accuracy	66%
Precision	58%
Recall	66%
F1-Score	58%

Decision Tree from Retention risk RandomForest Classifier



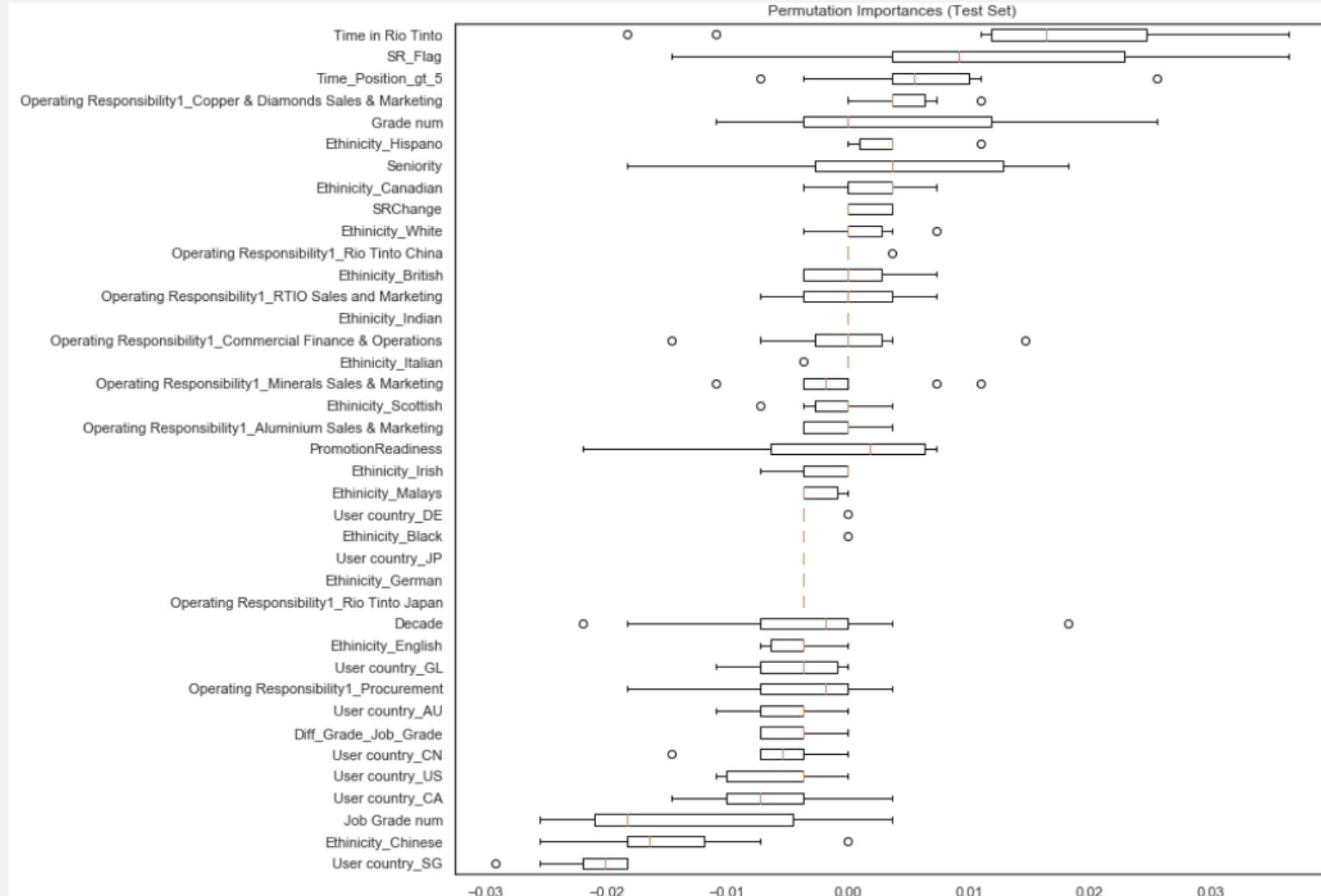
Detailed workflow for Classifier for Retention risk



Trimmed to 23
from 39 Features

- n_estimators: number of Decision Trees in RandomForest
- max_depth: max # of levels in trees
- max_features: # of features to consider at every split
- min_samples_split: min # of samples required to split a node
- min_samples_leaf: min # of samples required at each leaf node
- bootstrap: method of selecting samples for training each tree

Permutation Importances results for Retention risk



Source: <https://www.kaggle.com/dansbecker/permutation-importance>

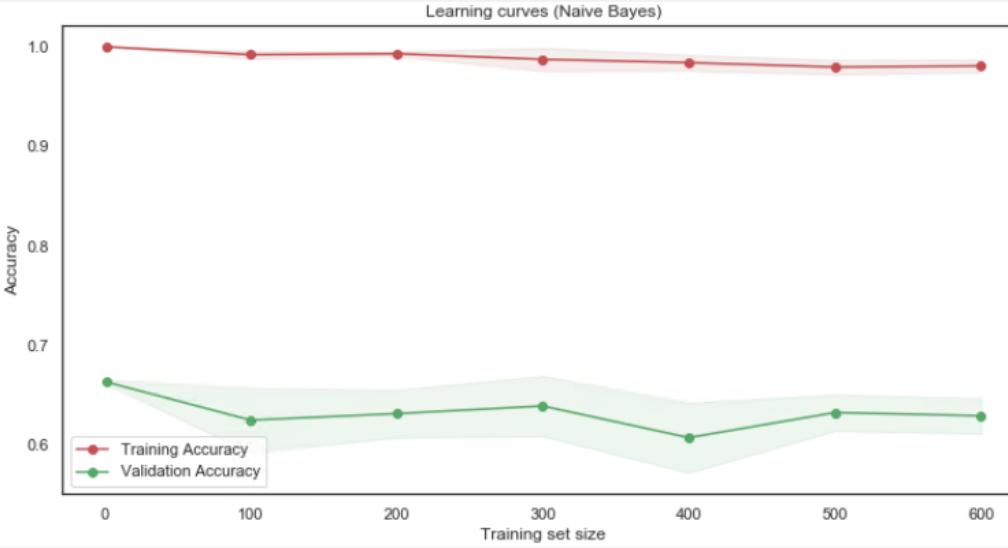
Parameters:

- Ran on Test-set
- Scoring: “Accuracy”
- n_repeats = 10

What is “Permutation Importance”?
It randomly shuffles a single column of Features and measures the impact to the accuracy of the model. With this, we can determine what are the most important predictors of our target variable.

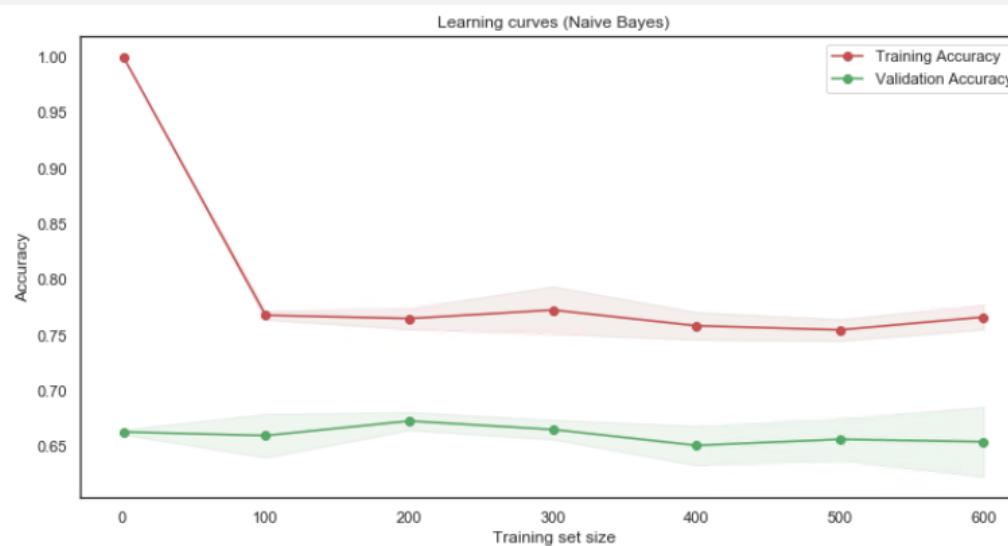
Height at age 20 (cm)	Height at age 10 (cm)
182	155
175	147
...	...
156	142
153	130

Bias-Variance tradeoff - Learning Curves (Retention Risk)



Baseline (“Out-of-bag”) RandomForest:

- n_estimators: 100
- # of Features: 39



“Best” RandomForest:

- n_estimators: 1200
- max_depth: 20
- max_features: 6
- min_samples_leaf: 3
- min_samples_split: 9
- bootstrap: True
- # of Features: 23

Correlation Matrix of Features vs. Retention Risk

-1.0 +1.0: Intra-feature correlation
 -1.0 +1.0: Target vs. Feature correlation

Feature Importance	Feature	Years in Rio Tinto	Performance	Years in Position >5	Copper & Diamonds Sales & Marketing (CD S&M)	Job Grade
1	Years in Rio Tinto	0.057 (Lower Performance, Higher Years)				
2	Performance					
3	Years in Position >5		0.422 (Higher Years, >5 Years in Position)	0.148 (Lower Performance, >5 Years in Position)		
4	Copper & Diamonds Sales & Marketing (CD S&M)		0.083 (Higher Years, Works in CD S&M)	-0.011 (Higher Performance, Does Not Work in CD S&M)	0.100 (>5 Years in Position, Works In CD S&M)	
5	Job Grade		0.132 (Higher Years, Higher Job Grade)	-0.129 (Higher Performance, Higher Job Grade)	-0.001 (>5 Years in Position, Lower Job Grade)	0.029 (Works in CD S&M, Higher Job Grade)
Target Variable	Retention Risk	-0.107 (Higher Years, Lower Risk)	-0.269 (Lower Performance, Higher Risk)	-0.109 (>5 Years in Position, Lower Risk)	0.042 (Works in CD S&M, Higher Risk)	0.112 (Higher Job Grade, Higher Risk)

1. Years in Rio Tinto: {1 - 15}
2. SR_Flag: {"High-Performer": 1, "Mid-Performer": 2, "Low-Performer": 3}
3. Years in Position >5 {"No": 0, "Yes": 1}
4. Copper & Diamonds Sales & Marketing {"No": 0, "Yes": 1}
5. Job Grade {1 (Lowest) - 6 (Highest)}
6. Retention Risk: {"Low": 1, "Medium": 2, "High": 3}

List of Hypothesis

1	location	Working in a foreign country leads to lower SR	Working in a foreign country has an impact on retention risk
2	duration	Time in Position and/ or Time in Rio Tinto has an impact on SR;	Time in Position and/or Time in Rio Tinto has an impact on Retention Risk
3	Retention Risk	Retention Risk has an impact on SR	
4	Employee Profile / Diversity	Diversity indicators has an impact on SR	Diversity indicators has an impact on retention risk.
5	Business Unit	Operating Responsibility2 has an impact on SR Career stream (primary) has an impact on SR	Operating Responsibility2 has an impact on Retention Risk Career stream (primary) has an impact on Retention Risk
6	Career Trajectory	Timing of next move has an impact on SR Having a 'Suggested next job' preference has an impact on SR Change of Responsibilities have an impact on SR	Timing of next move has an impact on Retention Risk. Having a 'Suggested next job' preference has an impact on Retention Risk Change of Responsibilities have an impact on Retention Risk
7	Sector Rank		Sector rank has an impact on Retention Risk
8	Sector Rank (Performance)		<u>Change in SR</u> has an impact on Retention Risk

Deep Dive into Clusters

		Decade	Job Grade num	Time in Rio Tinto	Time in Position	Sector Rank Raw num	Retention risk	PromotionReadiness	Cluster
Cluster									
0	count	223.000000	223.000000	223.000000	223.000000	223.000000	223.000000	223.000000	223.0
	mean	4.542601	3.547085	12.652466	5.800448	6.623318	1.130045	0.103139	0.0
	std	0.803554	1.595681	2.764655	4.523647	1.959452	0.386883	0.304825	0.0
	min	3.000000	1.000000	2.000000	1.000000	1.000000	1.000000	0.000000	0.0
	25%	4.000000	2.000000	12.500000	2.000000	5.000000	1.000000	0.000000	0.0
	50%	4.000000	4.000000	12.500000	4.000000	8.000000	1.000000	0.000000	0.0
	75%	5.000000	5.000000	15.000000	7.500000	8.000000	1.000000	0.000000	0.0
	max	7.000000	6.000000	15.000000	15.000000	9.000000	3.000000	1.000000	0.0
1	count	466.000000	466.000000	466.000000	466.000000	466.000000	466.000000	466.000000	466.0
	mean	3.403433	3.611588	4.054721	1.663090	5.435622	1.379828	0.000000	1.0
	std	0.767841	1.435867	3.295763	0.829049	2.376665	0.563725	0.000000	0.0
	min	2.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.000000	1.0
	25%	3.000000	3.000000	2.000000	1.000000	5.000000	1.000000	0.000000	1.0
	50%	3.000000	4.000000	2.000000	2.000000	5.000000	1.000000	0.000000	1.0
	75%	4.000000	5.000000	7.500000	2.000000	8.000000	2.000000	0.000000	1.0
	max	6.000000	7.000000	15.000000	7.500000	9.000000	3.000000	0.000000	1.0
2	count	222.000000	222.000000	222.000000	222.000000	222.000000	222.000000	222.000000	222.0
	mean	3.423423	3.554054	5.664414	1.995495	3.810811	1.734234	0.995495	2.0
	std	0.897957	1.499399	4.366288	1.407793	2.368777	0.740917	0.067116	0.0
	min	2.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.000000	2.0
	25%	3.000000	2.000000	2.000000	1.000000	2.000000	1.000000	1.000000	2.0
	50%	3.000000	4.000000	4.000000	2.000000	3.000000	2.000000	1.000000	2.0
	75%	4.000000	5.000000	7.500000	2.000000	5.000000	2.000000	1.000000	2.0
	max	6.000000	7.000000	15.000000	12.500000	9.000000	3.000000	1.000000	2.0

Clustering detailed view: Group by (Part 1/2)

Cluster 0:			Cluster 1:			Cluster 2:		
Decade			Decade			Decade		
2	28	13%	2	0	0%	2	32	7%
3	102	46%	3	16	7%	3	262	56%
4	66	30%	4	98	44%	4	124	27%
5	22	10%	5	84	38%	5	46	10%
6	4	2%	6	25	11%	6	1	0%
7	0	0%	7	1	0%	7	0	0%
222			224			465		
Pay Grade			Pay Grade			Pay Grade		
1	27	12%	1	31	14%	1	44	9%
2	30	14%	2	32	14%	2	62	13%
3	45	20%	3	45	20%	3	106	23%
4	55	25%	4	43	19%	4	121	26%
5	44	20%	5	43	19%	5	86	18%
6	20	9%	6	30	13%	6	45	10%
7	1	0%	7	0	0%	7	1	0%
222			224			465		
Time in Rio Tinto			Time in Rio Tinto			Time in Rio Tinto		
1	19	9%	1	0	0%	1	79	17%
2	77	35%	2	1	0%	2	180	39%
4	33	15%	4	3	1%	4	77	17%
7.5	46	21%	7.5	32	14%	7.5	97	21%
12.5	39	18%	12.5	96	43%	12.5	31	7%
15	8	4%	15	92	41%	15	1	0%
222			224			465		
Time in Position			Time in Position			Time in Position		
1	72	32%	1	29	13%	1	216	46%
2	131	59%	2	71	32%	2	223	48%
4	11	5%	4	23	10%	4	24	5%
7.5	7	3%	7.5	51	23%	7.5	2	0%
12.5	1	0%	12.5	40	18%	12.5	0	0%
15	0	0%	15	10	4%	15	0	0%
222			224			465		
Sector Rank			Sector Rank			Sector Rank		
1	54	24%	1	2	1%	1	28	6%
2	24	11%	2	6	3%	2	52	11%
3	40	18%	3	21	9%	3	34	7%
4	0	0%	4	0	0%	4	1	0%
5	67	30%	5	47	21%	5	165	35%
6	4	2%	6	11	5%	6	10	2%
7	3	1%	7	0	0%	7	6	1%
8	26	12%	8	132	59%	8	155	33%
9	4	2%	9	5	2%	9	14	3%
222			224			465		
Retention Risk			Retention Risk			Retention Risk		
1	98	44%	1	199	89%	1	307	66%
2	85	38%	2	21	9%	2	139	30%
3	39	18%	3	4	2%	3	19	4%
222			224			465		
PromotionReadiness			PromotionReadiness			PromotionReadiness		
0	1	0%	0	201	90%	0	465	100%
1	221	100%	1	23	10%	1	0	0%
222			224			465		

Cluster 0: High Performing employees with highest risk of Retention & High Promotion Readiness "High-Flyers"

Group Defined by

- Highest sector ranks (“Sector Rank Raw num”)
- Highest retention risk
- Highest promotion readiness (“Promotion Readiness”)
- Medium time in employment position (“Time in Position”)

Cluster 1: Longest serving employees with Lowest Sector Ranks & Low Promotion Readiness "Cruisers"

Group Defined by

- Longest employment time in Rio Tinto (“Time in Rio Tinto”)
- Longest time in employment position (“Time in Position”)
- Lowest positions in sector rank (“Sector Rank Raw num”)
- Lowest retention risk (“Retention risk”)
- Low Promotion Readiness (“Promotion Readiness”)

Cluster 2: Shortest serving, average performance employees with medium risk of Retention & no Promotion Readiness "Adjusting"

Group Defined by

- Lowest time in Rio Tinto (“Time in Rio Tinto”)
- Lowest time in employment position (“Time in Position”)
- Average to higher sector ranks (“Sector Rank Raw num”)
- Medium retention risk (“Retention risk”)
- Lowest promotion readiness (“Promotion Readiness”) - possibly due to short employment duration

Clustering detailed view: Group by (Part 2/2)

Cluster 0:			Cluster 1:			Cluster 2:		
Decade			Decade			Decade		
2	28	13%	2	0	0%	2	32	7%
3	102	46%	3	16	7%	3	262	56%
4	66	30%	4	98	44%	4	124	27%
5	22	10%	5	84	38%	5	46	10%
6	4	2%	6	25	11%	6	1	0%
7	0	0%	7	1	0%	7	0	0%
222			224			465		
Pay Grade			Pay Grade			Pay Grade		
1	27	12%	1	31	14%	1	44	9%
2	30	14%	2	32	14%	2	62	13%
3	45	20%	3	45	20%	3	106	23%
4	55	25%	4	43	19%	4	121	26%
5	44	20%	5	43	19%	5	86	18%
6	20	9%	6	30	13%	6	45	10%
7	1	0%	7	0	0%	7	1	0%
222			224			465		
Time in Rio Tinto			Time in Rio Tinto			Time in Rio Tinto		
1	19	9%	1	0	0%	1	79	17%
2	77	35%	2	1	0%	2	180	39%
4	33	15%	4	3	1%	4	77	17%
7.5	46	21%	7.5	32	14%	7.5	97	21%
12.5	39	18%	12.5	96	43%	12.5	31	7%
15	8	4%	15	92	41%	15	1	0%
222			224			465		
Time in Position			Time in Position			Time in Position		
1	72	32%	1	29	13%	1	216	46%
2	131	59%	2	71	32%	2	223	48%
4	11	5%	4	23	10%	4	24	5%
7.5	7	3%	7.5	51	23%	7.5	2	0%
12.5	1	0%	12.5	40	18%	12.5	0	0%
15	0	0%	15	10	4%	15	0	0%
222			224			465		
Sector Rank			Sector Rank			Sector Rank		
1	54	24%	1	2	1%	1	28	6%
2	24	11%	2	6	3%	2	52	11%
3	40	18%	3	21	9%	3	34	7%
4	0	0%	4	0	0%	4	1	0%
5	67	30%	5	47	21%	5	165	35%
6	4	2%	6	11	5%	6	10	2%
7	3	1%	7	0	0%	7	6	1%
8	26	12%	8	132	59%	8	155	33%
9	4	2%	9	5	2%	9	14	3%
222			224			465		
Retention Risk			Retention Risk			Retention Risk		
1	98	44%	1	199	89%	1	307	66%
2	85	38%	2	21	9%	2	139	30%
3	39	18%	3	4	2%	3	19	4%
222			224			465		
PromotionReadiness			PromotionReadiness			PromotionReadiness		
0	1	0%	0	201	90%	0	465	100%
1	221	100%	1	23	10%	1	0	0%
222			224			465		

Decade

- 0: Mostly 30-40s (76%)
- 1: Mostly 40-50s (82%)
- 2: Mostly 30-40s (83%)

Pay Grade

- 0: 3-5 (65%)
- 1: 3-5 (58%)
- 2: 3-5 (67%)

Time in Rio Tinto

- 0: 2 (35%), 7.5 (21%)
- 1: 12.5-15 (84%)
- 2: 1-2 (56%)

Time in Position

- 0: 1-2 (91%)
- 1: 1-2 (45%), 7.5 (23%)
- 2: 1-2 (94%)

Sector Rank

- 0: 1-3 (53%)
- 1: 8 (59%)
- 2: 5 (35%)

Retention Risk:

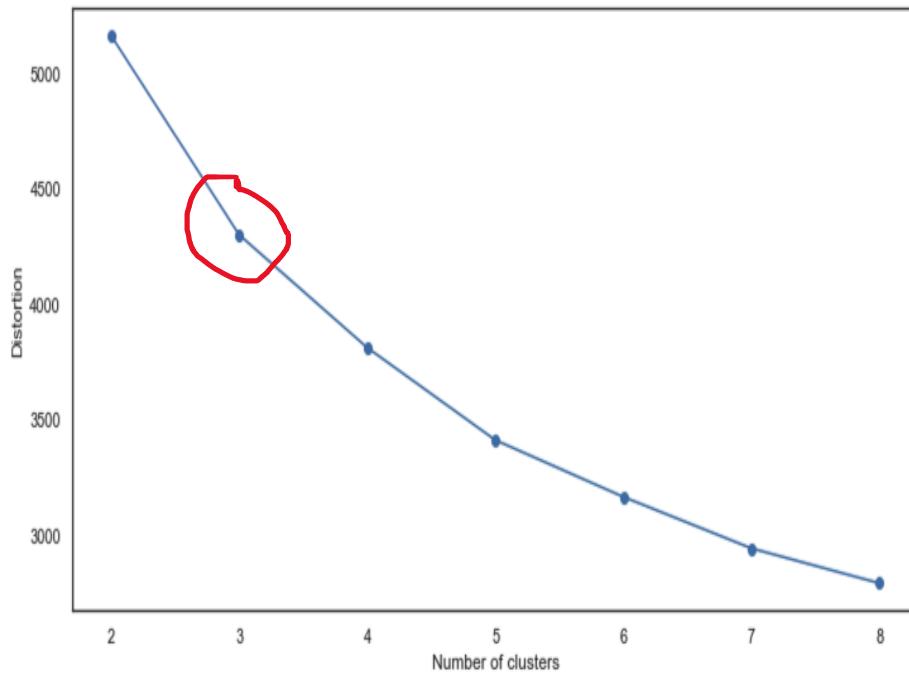
- 0: 1-2 (82%), 3 (18%)
- 1: 1 (89%)
- 2: 1-2 (96%)

PromotionReadiness:

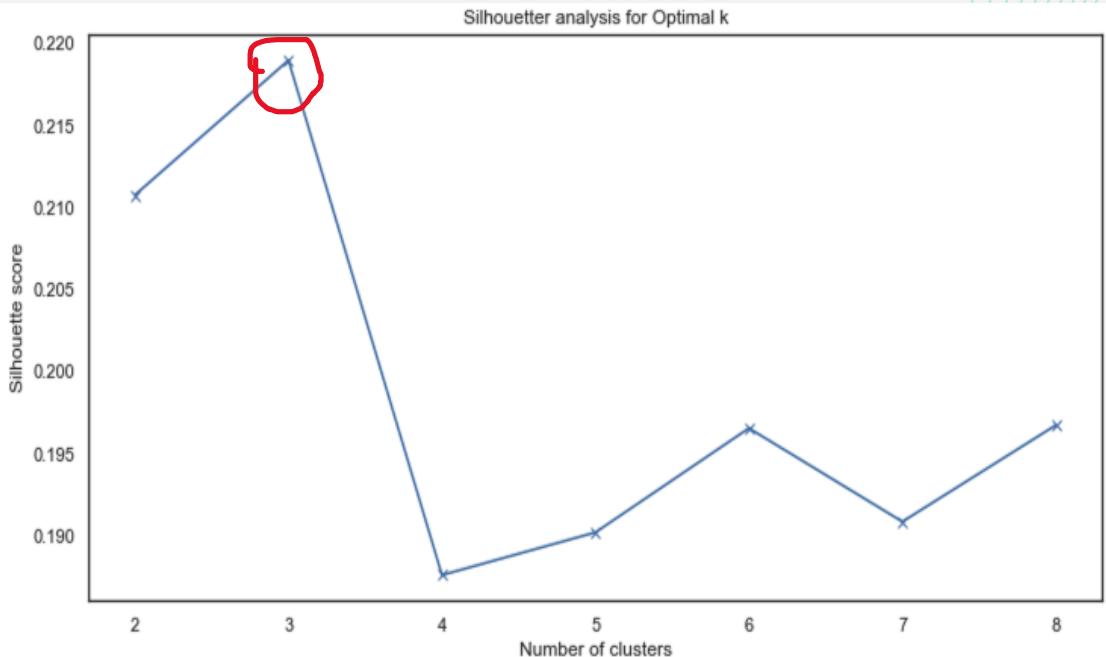
- 0: 1 (100%) Ready
- 1: 0 (90%) Not Ready
- 2: 0 (100%) Not Ready

How do we determine the optimal number of clusters for the Clustering model

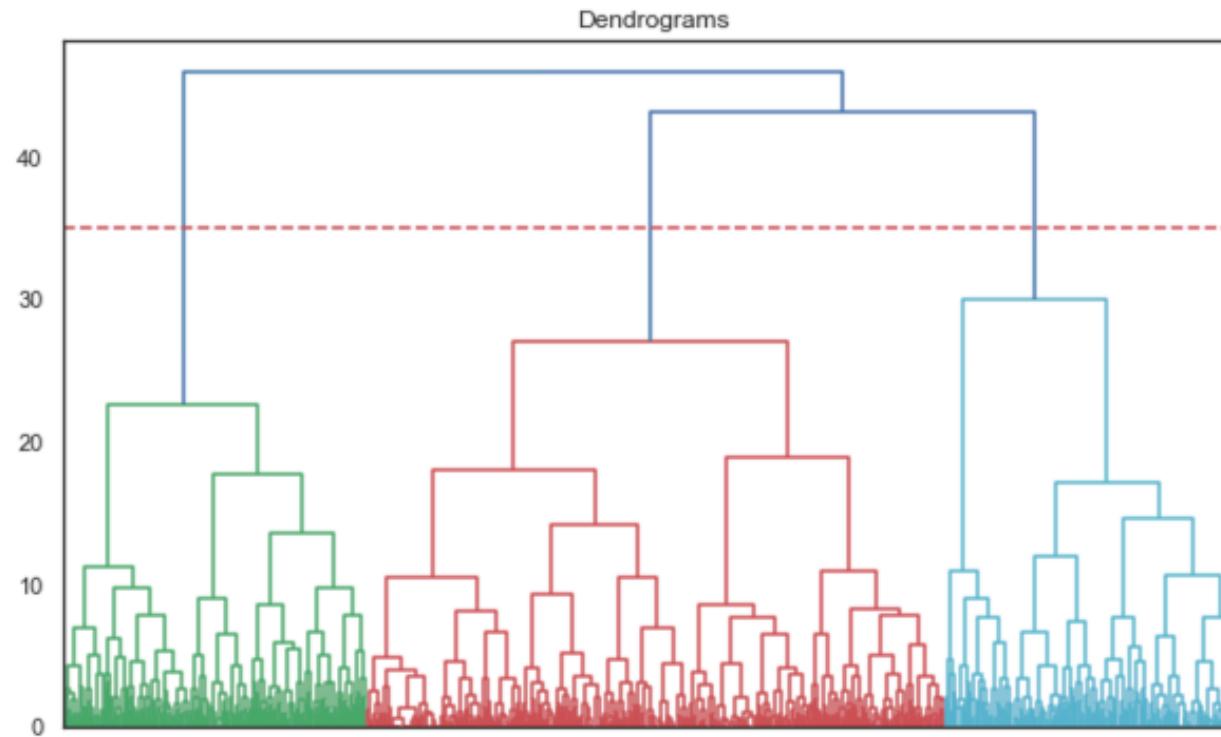
Finding optimal number of clusters with Elbow curve



Silhouette analysis for optimal number of clusters



Dendrogram: Measuring similarity across features



- Dendrogram generated to test hierarchical clustering
- Similar heights of the graph describes similarity in features
- Dissimilarity is measured by distance between features on the x axis

Data Dictionary (ML)

Description	Features	Examples
Country of Work	User Country	GL, CA, US, etc.
Years in Rio Tinto	Time in Rio Tinto	1 to 15
Years in Position > 3	Time_Position_gt_3	0 (No), 1 (Yes)
Retention Risk	Retention Risk	1 (low risk) to 3 (high risk)
Age by Decade	Decade	2 to 7
Job Grade	Grade num	1 (lowest) to 6 (highest)
Pay Grade	Job Grade num	1 (lowest) to 7 (highest)
Job Seniority	Seniority	Junior, Mid-level, Senior
Job Title	Job Title	Administrative Assistant, Manager, Adviser, etc.
Operating Responsibility	Operating Responsibility 1	Aluminium Sales & Marketing, Procurement
Ready for Promotion	PromotionReadiness	0 (No), 1 (Yes)
Change of Responsibilities	Change of Responsibilities	Yes, No
Years in Position > 5	Time_Position_gt_5	0 (No), 1 (Yes)
Performance	SR_Flag	1 (highest) - 3 (lowest)
Change in SR compared to previous year	SRChange	0 (stagnant) to 2 (improved)
Race/Ethnicity	Ethnicity	Hispano, British, Chinese, etc.