

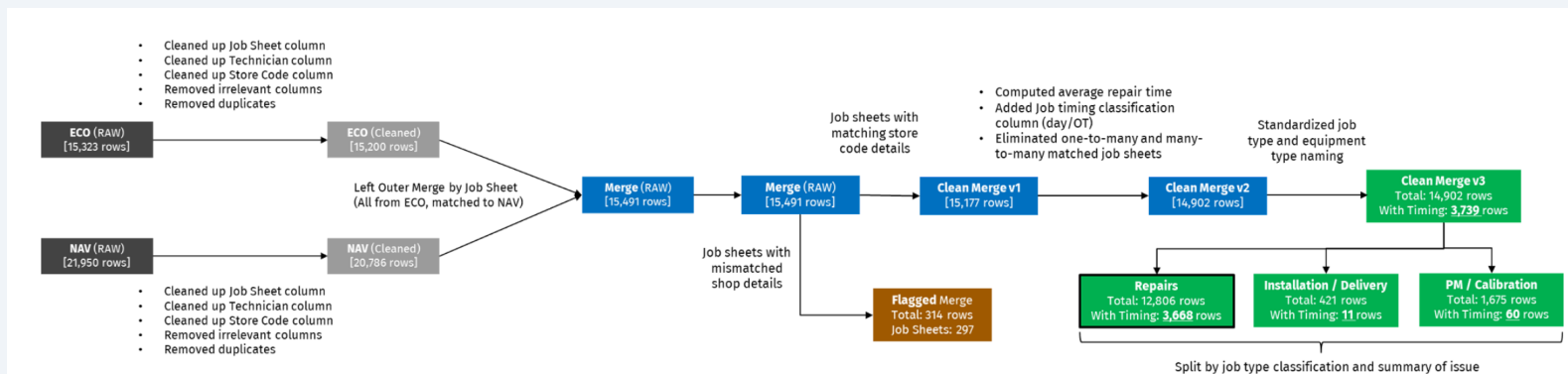
## PROJECT STATEMENT

The existing remuneration model – fixed base salary with variable overtime remuneration – disincentivises work efficiency and promotes an unhealthy work-life balance for Simplex's technicians.

## KEY OBJECTIVE

The key objective of the project was to replace the existing remuneration model with a pay-per-job model with minimal deviation from their existing salary.

### 1. DATA PREPROCESSING



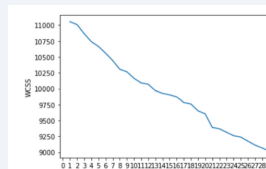
## Unsupervised Machine Learning – Clustering

### Textual Data Preprocessing

The textual data was first standardised and cleaned for noise reduction. Subsequently, we utilised NLTK in python for tokenisation, lemmatisation and removal of stop words. Finally, we utilised Python's Sklearn for vectorisation.

We then performed both hierarchical and k-means clustering to categorise similar repair jobs into clusters based on the text descriptions.

The k-means results were more comprehensive, which was used for further analysis based on equipment categories. After deriving the median repair time, we assigned the corresponding job category for each sub-cluster.



Cluster	Top 10 common words															
0	board	relay	control	display	fryer	quote	suspect	heater	valve	burn						
1	belt	shaver	motor	conveyor	broken	align	rod	side	blender	tight						
2	water	inlet	valve	level	pump	hose	clean	leak	probe	hot						
3	door	hinge	spring	broken	chiller	rod	close	break	gasket	right						
4	condenser	clean	dirty	fan	chiller	temperature	evaporator	condensor	adjust	monitor						
5	transformer	burn	magnetron	capacitor	fuse	diode	light	side	left	burnt						
6	ice	thickness	probe	adjust	harvest	clean	blade	blade	bowl	build						
7	socket	drive	blender	plug	power	wear	kit	swap	kit	bearing						
8	valve	solenoid	brew	leak	lms	caramel	mocha	line	water	swap						
9	heater	tank	pcs	wash	short	side	beef	bottom	terminal	wire						
10	fuse	amp	relay	blow	oven	blown	microwave	open	system	fan						
11	gasket	door	chiller	torn	temperature	manager	pcs	condenser	old	clean						
12	gas	low	topup	top	pressure	temperature	ice	monitor	leak	valve						
13	motor	fan	shaver	blender	condenser	condensor	blower	gear	evaporator	noisy						
14	switch	door	float	interlock	oven	adjust	temporary	broken	monitor	secure						
16	faucet	assy	hot	water	leak	condition	functional	spring	wear	seat						
17	power	incoming	cable	plug	supply	reset	trip	switch	wire	heat						
18	drain	pipe	pan	clean	chock	heater	hose	water	evaporator	choke						
19	contactor	fryer	relay	board	heater	gray	burn	monitor	color	kfc						
20	controller	display	chiller	temperature	fastron	monitor	temp	temperatures	compressor	suspect						
21	pump	hose	filter	oil	rinse	box	control	leak	wash	clip						
22	scale	beam	calibration	weight	calibrate	container	update	quote	recalibrate	settings						
25	blade	shaver	rusty	shaft	assy	blender	assembly	side	blower							
28	compressor	trip	cool	temperature	condenser	refrigeration	hot	quote	noisy	monitor						

### 3. MODELLING & SOLVER

Using Excel's Solver function, we optimised the preliminary pay-per-job rates for each job category under the new model. With jobs completed as constraints, and total wages as goals, solver ensures that costs for Simplex does not increase substantially under the new model, and ease the transition for technicians in terms of take-home pay.

	Constraints					% Deviation		Weights		
Technician	Actual amount	Under Achieve	Over Achieve	Goal	Target	Under	Over	Under	Over	Base salary
Tech C	\$ 14,253.25	\$ 1,115.93	\$ -	\$ 15,369.18	\$ 15,369.19	7.26%	0.00%	1	1	\$ 2,500.00
Tech A	\$ 14,097.53	\$ -	\$ -	\$ 14,097.53	\$ 14,097.53	0.00%	0.00%	1	1	\$ 1,440.00
Tech B	\$ 26,391.27	\$ 0.00	\$ -	\$ 26,391.27	\$ 26,391.27	0.00%	0.00%	1	1	\$ 1,890.00
Objective	0.072608141									
Per-Job Remuneration Per Technician										
	A	B	C	D	PM	Del/Ins				
Tech C	\$7.63	\$13.74	\$20.61	\$51.53	\$7.63	\$7.63				
Tech A	\$4.40	\$7.92	\$11.87	\$29.68	\$4.40	\$4.40				
Tech B	\$5.77	\$10.39	\$15.58	\$38.96	\$5.77	\$5.77				
Per-Job Remuneration Allocation (%)										
	A	B	C	D	PM	Del/Ins				
Percentage	0.31%	0.55%	0.82%	2.06%	0.31%	0.31%				

## 1. Remuneration Calculator

Basic information		Certification level and Job distribution		Additional multipliers	
Base Salary	\$1,800.00	Certification level	1 (Yes) or 0 (No)	1 (Yes) or 0 (No)	
No. of working days per month	22	BIC/BIM	1	Multiplier A	0
Base working hours per day	10	CHILLER/FREEZER	0	Multiplier B	0
Night jobs hours a month	10	ICE MAKER	0	Multiplier C	0
Weekend hours a month	10	COFFEE	0	Multiplier D	0
		FRYER	0	Multiplier E	0
		SPEED OVEN	0	Multiplier F	0
		TOASTER	0	Multiplier G	0
		QUEING OVEN	0	Multiplier H	0
		ICE CREAM	0	Multiplier I	0
		CARPIGIANI	0	Multiplier J	0
		MICROWAVE	0		
		DISHWASHER	0		
		BROILER	0		
		COMBI OVEN	0		
		BLENDER	0		
		OTHER	0		
		WARMER	0		
		GRILL	0		
		EGG	0		
		OIL FILTER	0		
		OVEN	0		

We incorporated the rates per category derived from Excel Solver and all other additional considerations into our final pay-per-job remuneration model. This model was then integrated into our remuneration calculator. Using a calculator eliminates calculations and potential human error from users. Additionally, our calculator is much easier to understand than our model, allowing Simplex and its employees to easily pick it up with little explanation or training.

## 2. Google Forms & Sheets

Using Google Forms & Sheets, we proposed an alternative data collection system, comprising of our recommendations, that Simplex can immediately adopt or integrate into their system.

Our proposed system reduces time and effort spent on form filling for technicians, by only requiring required inputs, and maximizing the uses of drop-down and data validation.

Simplex Technician Form	
Proposed new way of data collection - Technician name, store, equipment, model should be automatically populated, same as before.	
*Required	
Technician Name *	Choose
Order ID Number *	e.g. M02000001
Job Sheet Number *	e.g. J12345
Job Type *	Repair PM Delivery / Installation
Equipment Type *	Choose
Start Time *	Time
Next	