8. Location

8.1. Attended countries

Tecnofil has plenty of clients all around the world. The branch of principal clients is centered on Continental America. These are Canada, USA and Mexico in the north and Venezuela, Ecuador, Colombia, Peru, Chile and Argentina. There is also an important deal of clients in Costa Rica. In the European continent the principal clients are located in The Netherlands, Spain, France and Italy. In Asia the most important clients are located in Singapore and Taiwan.

The sales in Peru represent the 24% of the total, meanwhile the exports sum up 76%. Because of the American-Chinese trade war the revenue from copper exports was lower that expected on the last period.

> *"While some markets such as Peru and North America are experiencing slowdowns, shipments to Europe will remain strong this year, and in the case of Asia they will grow by new customers and new lines." (Louis Rens, Gestión 2019)*

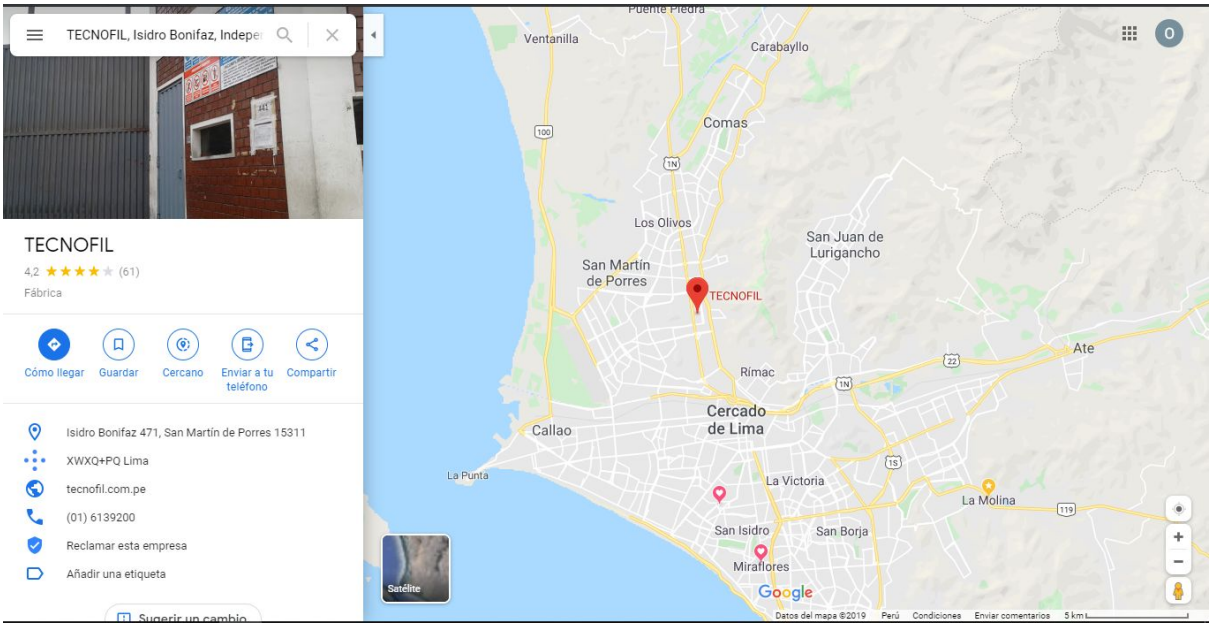
Tecnofil exports its products to the before mentioned countries, but also it is developing an aggressive penetration of the Asian market.

> *"We are already exporting to Japan and are advancing negotiations to grow with shipments to Taiwan and India." (Louis Rens, Gestión 2019)*

Despite the fact that the Asian market represents the lower percentage of sales and the US and Canada the highest, Tecnofil is focusing all of its efforts on conquer of the new economic asian giants with special focus on China, India and Japan.

8.2. Physical location:

Tecnofil attends its current demand on the only plant they have. The plant is located in Calle Isidro Bonifaz 471 in the District of Independencia in Lima. The Independencia plant has 20,0000 m2 and is valuated in 25,000,000 USD.



The plant was first opened in 1975 and has been operating ever since. In the past the district of Independencia would authorize the selling of I-4 type industrial land for the construction of plants. Nowadays, the maximum allowed in the area is I-3.

TIPO	AREA MINIMA DE LOTE	FRENTE MINIMO	TIPO DE INDUSTRIA
1	300 M2.	10 ML.	ELEMENTAL Y COMPLEMENTARIA
2	1,000 M2.	20 ML.	LIVIANA
3	2,500 M2.	30 ML.	GRAN INDUSTRIA
4	(*)	(*)	INDUSTRIA PESADA BASICA

8.3. Factor rating method:

Following Tecnofil's strategy of penetrating the Asian Market it requires the construction of a new plant to increase its production in order to be able to fulfil the new asian demand.

A lot of factors have to be taken into account to decide the location for the new plant. We have elaborated a model to optimize the decision of choosing a location to build the new plant. The optimization formula is the following:

$$MAX\{Score_i\}$$

$$Score_i = \left(\sum W_j \, x_j\right) \varphi_j$$

$$\varphi = \{0,1\}$$

Where i represents the different location choices and j is the different criterias used to establish the score. Phi is a dummy binary variable based on the industrial land permission required on the zone.

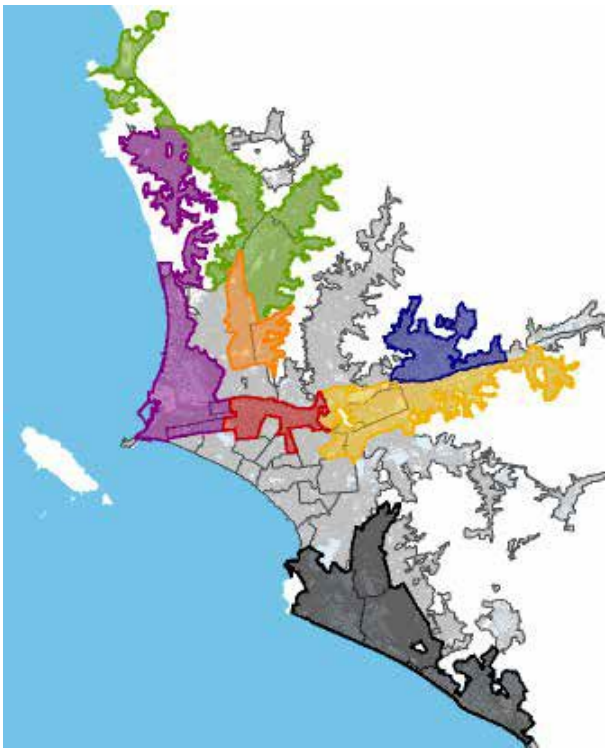
Provided that many times the scoring of a criteria could be entirely subjective we developed a quantitative analysis of the features of each sector in order to determine the optimal.
The criteria for zone are scored on the average of 17 projects divided by zone. Furthermore, there is a financial analysis behind some criteria and logistic estimations and clustering for the rest.

$$\alpha_2 = \frac{\alpha}{MAX\{\alpha\}}, where$$

$$for\ \alpha_2\ in\ [0{,}100]\ ;\ x = \ [1{,}10] \in IN\text{: } on\ a\ 10\ to\ 1\ scale$$

$$x_j = AVG(x)\text{: } per\ zone$$

As stated by the municipality of Lima and Colliers International, in Lima there are 8 big zones that concentrate the industrial activity. These are the following:



1. Center. Conformed by el district of Cercado de Lima.
2. North 1. Conformed by los districts of Los Olivos e Independencia.
3. North 2. Conformed by los districts of Puente Piedra, Carabayllo and Comas.
4. East 1. Conformed by los districts of Santa Anita, Ate and San Luis.
5. East 2. Conformed by districts of Lurigancho – Chosica and San Juan de Lurigancho.
6. West. Conformed by the Provincia Constitucional del Callao, the districts of Cercado del Callao and Ventanilla.
7. South 1. Conformed by the districts of Chorrillos, Villa El Salvador and Lurín.
8. South 2. Conformed by the district of Chilca.

The collected data of the this zones is collected on the following table and it was provided by Colliers International.

Zones		Center	North 1		North 2		East 1		East 2			West			South 1			South 2
Districts		Cercado de Lima	· Los Olivos		· Puente Piedra		· Santa Anita		· Lurigancho-Chosica			· Callao			· Chorrillos			Chilca
			· Independencia		· Carabayllo		· Ate		· San Juan de Lurigancho			· Carmen de la Legua			· Villa El Salvador			
					· Comas		· San Luis					· Ventanilla			· Lurin			
Corridor		Colonial	Naranjal	Independencia	Puente Piedra	Trapiche	Santa Rosa	Ayllon	Huachipa	Cajamarquilla	Campoy	Ventanilla	Argentina	Gambetta	Chorrillos	Villa El Salvador	Lurin	Chilca
Most Important Industries		Industrial	Metal derivatives	Machinery and motor	Food products	Metal derivatives	Common metals	Textile products	Food products			Metal derivatives	Logistics	Logistics	Industrial Park			Industrial Park
				Metal derivatives			Rubber and plastic products	Common metals	Metal derivatives									
		Commercial	Pharmaceutical products		Drinks							Pharmaceutical products	Metal derivatives	Storage				
				Textile products			Wood and cork products	Pharmaceutical products	Textile products									
AVG time to strategic points of logistic routes	Airport	17	40	45	75	70	60	75	65			65	30	40	100	110	120	160
	APM Terminal	26	70	65	85	85	75	90	80			75	45	40	110	120	140	170
	Panamericana Sur	60	120	130	170	160	40	80	75			180	90	120	30		16	
	Carretera Central	23	65	60	100	90	16	100	25			100	35	75				
	Peaje evitamiento														55	50	65	100
USD/M2	Rent	$6.85	$5.45		$3.82	$1.50	$6.76	$6.05	$3.68	$3.00	$4.08		$5.90	$5.65	$5.98	$3.34	$4.26	
	Buy	$1,043.00	$900.00	$900.00	$633.00	$633.00	$1,251.00	$1,157.00	$580.00	$430.00	$720.00	$590.00	$1,170.00	$477.00	$561.00	$561.00	$561.00	
	Land	$1,000.00	$1,081.00	$1,000.00	$262.00	$323.00	$800.00	$900.00	$420.00	$420.00	$420.00	$350.00	$830.00	$240.00	$377.00	$377.00	$182.00	$113.00
INDUSTRIAL LAND HABILITATION		I1	I1		I1		I1		I1			I1			I1			I1
		I2	I2		I2		I2		I2			I2			I2			I2
		I3					I3		I3						I3			I3
		I4	I3		I3		I4		I4			I3			I4			I4

The scoring system is based on 5 criteria that combined with the weight of each returns a value. Also, there is the dummy binary criteria that is either 1 or 0.The criteria are the following:

1.Financial estimation of the Project:

The idea behind this criteria is understanding the value over time of the project. We use the IRR of each mutually exclusive projects to better understand which gives a better return.
For this estimation we are assuming that the length of the project will be 30 years apart from the fact that the lifetime of the plant would be longer. We took the value of the actual plant and expected a x1.6 extra value on the plant. Moreover, we estimated based on Tecnofil financial statements an Annual growing rate on sales of 6.3% based on the last 10 years increment. Also we estimate that the available profit would finance the plant on the short term during the construction period and that is a 2% available margin. By the time the plant is already functioning we estimate that the plant would produce on the before mentioned rate and at the end we Net all the cash flows during the project length. We assume a stable exchange rate of USD at 3.6. Assuming that the capital investment would be released on the year 0 by any means of debt, bond release or equity opening. And the estimated annuity would be over 15 million USD yearly on the length of the project under a discount rate of 15% taken by the appropriate literature.

Internal Rate of Return	IRR	Percentage	Score	AVG score
IRR1	10.29%	72%	7	7.00
IRR2	10.03%	70%	7	
IRR3	10.29%	72%	7	7.00
IRR4	13.42%	94%	9	
IRR5	13.09%	91%	9	9.00
IRR6	10.99%	77%	7	7.00
IRR7	10.63%	74%	7	
IRR8	12.60%	88%	8	
IRR9	12.60%	88%	8	8.00
IRR10	12.60%	88%	8	
IRR11	12.95%	90%	9	
IRR12	10.88%	76%	7	8.33
IRR13	13.54%	95%	9	
IRR14	12.81%	90%	9	
IRR15	12.81%	90%	9	9.00
IRR16	13.88%	97%	9	
IRR17	14.31%	100%	10	10.00

There are 17 projects available, the capital investment cost is the sum of the price of the land plus the estimated value for the plant. The land requirement is of 80,000 m2.
Given all the IRR, we take the highest and then take the percentage of each project on that scale. The score goes from 0-10. Then we take the average per zone and return the zone score.

2. Land Investment:

Assuming that the value of the plant construction is a fixed cost under the previous analysis, we have that the Land price with the land requirement would return different project initial investments.
The derivative of the variable cost function provides the growing rate on the long run. Provided 17 different land price on USD per square meter we have available the total land investment. We take the highest and then take the percentage of each project on that scale. The score goes from 0-10. Then we take the average per zone and return the zone score.

Zone	USD/M2	Required Land	Land Investment	Percentage	SCORE	AVG score
Center	$1,000.00	80000	$80,000,000.00	0.93	1	1
North 1	$1,081.00	80000	$86,480,000.00	1.00	1	
	$1,000.00	80000	$80,000,000.00	0.93	1	1
North 2	$262.00	80000	$20,960,000.00	0.24	8	
	$323.00	80000	$25,840,000.00	0.30	7	7.5
East 1	$800.00	80000	$64,000,000.00	0.74	3	2.5
	$900.00	80000	$72,000,000.00	0.83	2	
East 2	$420.00	80000	$33,600,000.00	0.39	7	
	$420.00	80000	$33,600,000.00	0.39	7	7
	$420.00	80000	$33,600,000.00	0.39	7	
West	$350.00	80000	$28,000,000.00	0.32	7	
	$830.00	80000	$66,400,000.00	0.77	3	6
	$240.00	80000	$19,200,000.00	0.22	8	
South 1	$377.00	80000	$30,160,000.00	0.35	7	
	$377.00	80000	$30,160,000.00	0.35	7	7.67
	$182.00	80000	$14,560,000.00	0.17	9	
South 2	$113.00	80000	$9,040,000.00	0.10	9	9

3. Proximity to markets:

We established the importance of being able to deliver the product to the international markets. For this purpose Tecnofil transports the goods the APM terminals in Callao. We took the average time from the location on the zone to the docks. Times are estimated considering that they are taking traffic 5 p.m. vehicle from the starting points indicated in each corridor. It is important to mention that there is a security cost involved on the transportation to the docks since copper is valuable item and there's the risk of cargo assault. We take the highest and then take the percentage of each project on that scale. The score goes from 0-10. Then we take the average per zone and return the zone score.

Zones	Avg min	Percentage	SCORE	AVG score
Center	26	0.15	9	9.00
North 1	70	0.41	6	
	65	0.38	7	6.50
North 2	85	0.50	5	
	85	0.50	5	5.00
East 1	75	0.44	4	4.50
	90	0.53	5	
East 2	80	0.47	6	
	80	0.47	6	6.00
	80	0.47	6	
West	75	0.44	6	
	45	0.26	8	7.33
	40	0.24	8	
South 1	110	0.65	4	
	120	0.71	3	3.00
	140	0.82	2	
South 2	170	1.00	1	1.00

4. Proximity to suppliers:

Like on the previous one is important to mention the critical need that the plant has on receiving the materials to be processed. One of the biggests suppliers is the Southern Copper corporation. The plant receives the material by truck and it comes down from the Panamericana Sur. Security is provided by the supplier, still there is relevance on the fact that the supplies need to go across Lima.We take the highest and then take the percentage of each project on that scale. The score goes from 0-10. Then we take the average per zone and return the zone score.

Zones	AVG time	Percentage	Score	AVG score
Center	60	0.33	7	7.00
North 1	120	0.67	4	
	130	0.72	3	3.50
North 2	170	0.94	1	
	160	0.89	2	1.50
East 1	40	0.22	8	7.00
	80	0.44	6	
East 2	75	0.42	6	
	75	0.42	6	6.00
	75	0.42	6	
West	180	1.00	1	
	90	0.50	5	3.33
	120	0.67	4	
South 1	30	0.17	9	
	0	0.00	10	9.33
	16	0.09	9	
South 2	0	0.00	10	10.00

5. Business clustering:

Based on the business clustering concept we extrapolated the most important ideas to quantify the factors. Ideally a cluster would concentrate businesses, suppliers and institutions of the same sector. Moreover, Clusters are considered to increase the productivity with which companies can compete, nationally and globally. Given the conditions on the current industrial sector of Lima, we took the most important industries and sector and counted wheter or not it had metal work, non ferrpus metal or metal derivates plants. Also, we accounted the most important metal work companies on the country and quantified if they were on a sector at least on a 30% concentration.We take the highest and then take the percentage of each project on that scale. The score goes from 0-10. Then we take the average per zone and return the zone score.

Zone	Major industries			Individual score	Big corp	30% Accumulation	Score	Total Score
Center	Industrial		Commercial	2	2	0.14	2	4.00
North 1	Metal derivatives		Pharmaceutical products	2	1	0.07	1	3.00
	Machinery and motor vehicles	Metal derivatives	Textile products					
North 2	Food products		Drinks	2	0	0.00	0	2.00
	Metal derivatives							
East 1	Common metals	Rubber and plastic products	Wood and cork products	3	1	0.07	1	4.00
	Textile products	Common metals	Pharmaceutical products					
East 2	Food products	Metal derivatives	Textile products	2	1	0.07	1	3.00
West	Metal derivatives		Pharmaceutical products	2	3	0.21	3	5.00
	Logistics		Metal derivatives					
	Logistics		Storage					
South 1	Industrial Park			2	2	0.14	2	4.00
South 2	Industrial Park			2	0	0.00	0	2.00

Corporation	District	Zone
Corporacion Aceros Arequipa	-	-
SIDERPERU	-	-
Moly Cop ADESUR	-	-
Procesadora Sudamericana	Ate	East 1
Industrias ElectroQuimicas	Callao	West
Productos Acero Cassado	Callao	West
Comercial del Acero	Cercado de Lima	Center
Zinc Industrias	Callao	West
Tecnofil	Independencia	North 1
Sandvik	Lurigancho	East 2
Metalurgia Peruana	Cercado de Lima	Center
Soldex	Lurin	South 1
Tecnicas Metalicas Ingenieros	Villa el salvador	South 1

The final result of all this quantification is the aggregate matrix of criterias. There we can see the established weights for each one and the score for every zone. As mentioned before the dummy variable of legislation has a value of 1 or 0, therefore if the zone doesn't count with the appropriate land permission for heavy industry the total score is reduced to 0.

	Weight	Center	North 1	Noth 2	East 1	East 2	West	South 1	South 2
Financial estimate of Project	35	7	7	7	9	8	8.33	9	10
Land investment	30	1	1	7.5	2.5	7	6	7.67	9
Proximity to markets	15	9	6.5	5	4.5	6	7.33	3	1
Proximity to suppliers	10	7	3.5	1.5	7	6	3.33	9.33	10
Business Clustering	10	4	3	2	4	3	5	4	2
Total Weight	100	520	437.5	580	567.5	670	664.8	723.3	755
Industrial License	ϕ	1	0	0	1	1	0	1	1
Net Total		520	0	0	567.5	670	0	723.3	755