



Grupo Nogueira Case Team 36

Akshita Anand, Jeremy Johnson, Eric Liu, Aijia Ma, Chao Zhou

Case background



Modeling

- Object: Maximizing Profit
- By Change: Londrina and Franca plant sugarcane intake amount from each supplier
- Constraints:
 - Plants operate between 50%-100% plant capacity
 - Meet molasses quantity required by each of the partner distilleries
 - Total molasses output from plants equal to partner distilleries intake
 - Londrina sugar has a maximum of 2000 metric tons per month; Sugar at Franca is limited to 4000 metric tons per month
 - Plants take full supply from all the suppliers

Current Month Recommendation

- The final optimized maximum profit is R\$183.135

Supplier	Londrina (t)	Franca (t)
Maringá	160.18	839.82
Paranavaí	1583.00	0.00
Frutal	0.00	2140.00
Rancharia	1370.00	0.00
Apucarana	2000.00	0.00
Bastos	0.00	1850.00
Sacramento	0.00	1260.00
Iturama	0.00	1700.00

Current Month Recommendation

- The final optimized maximum profit is R\$183.135

Supplier	Londrina (t)	Franca (t)
Jaú	480.00	0.00
Bariri	0.00	850.00
Cosmópolis	133.10	506.90
Itapira	651.10	0.00
Pirassununga	0.00	970.00
São Carlos	107.00	0.00
Diadema	80.00	0.00
Santa Bárbara d'Oeste	310.00	0.00
Araraquara	0.00	0.00

Profit=
183,135

Improve profit

- Sensitivity Report
 - Shadow price for Sugar price in Londrina is positive
 - Shadow price of Molasses is negative
- Unique solution
- Increasing the capacity of sugar for Londrina can increase our profit

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
\$H\$20	after transportation Londrina	4975.124378	0	8030	1E+30	3054.875622
\$H\$20	after transportation Londrina	4975.124378	0	4015	960.1243781	1E+30
\$H\$22	sugar Londrina	2000	59.78518635	2000	328.492138	62.653862
\$H\$39	total quantity of Molasses (t/month)	1761.19403	0	0	2.1795E-13	1E+30
\$I\$20	after transportation Franca	7579.494622	0	8780	1E+30	1200.505378
\$I\$20	after transportation Franca	7579.494622	0	4390	3189.494622	1E+30
\$I\$22	sugar Franca	3456.249548	0	4000	1E+30	543.7504524
\$I\$39	total Franca	2326.904849	9.3	0	133.0951511	2.1795E-13
\$J\$10	Frutal total	2140	32.5367151	2140	319.8580369	254.7575375
\$J\$11	Rancharia total	1370	33.4367151	1370	160.1802447	254.7575375
\$J\$12	Apucarana total	2000	33.2367151	2000	160.1802447	254.7575375
\$J\$13	Bastos total	1850	33.0367151	1850	414.7859343	254.7575375
\$J\$14	Sacramento total	1260	39.2367151	1260	414.7859343	254.7575375
\$J\$15	Iturama total	1700	33.7367151	1700	414.7859343	254.7575375
\$J\$21	Molasses total cost	4088.098879	16.2	0	76.09887877	2.1795E-13
\$J\$30	Jaú total	480	0	900	1E+30	420
\$J\$30	Jaú total	480	-9.8	480	76.09887877	123.9011212
\$J\$31	Bariri total	850	0	1150	1E+30	300
\$J\$31	Bariri total	850	-24.8	850	76.09887877	123.9011212
\$J\$32	Cosmópolis total	640	0	800	1E+30	160
\$J\$32	Cosmópolis total	640	-0.4	640	76.09887877	123.9011212
\$J\$33	Itapira total	651.0988788	0	775	1E+30	123.9011212
\$J\$33	Itapira total	651.0988788	0	575	76.09887877	1E+30
\$J\$34	Pirassununga total	970	0	970	1E+30	1.17384E-14
\$J\$34	Pirassununga total	970	-6.3	970	1.17384E-14	123.9011212
\$J\$35	São Carlos total	107	0	200	1E+30	93
\$J\$35	São Carlos total	107	-10.1	107	76.09887877	107
\$J\$36	Diadema total	80	0	400	1E+30	320
\$J\$36	Diadema total	80	-5.1	80	76.09887877	80
\$J\$37	Santa Bárbara d'Oeste total	310	0.9	310	76.09887877	123.9011212
\$J\$37	Santa Bárbara d'Oeste total	310	0	0	310	1E+30
\$J\$38	Araraquara total	2.31605E-16	0	470	1E+30	470
\$J\$38	Araraquara total	2.31605E-16	-7.8	0	76.09887877	2.31605E-16
\$J\$8	Maringá total	1000	32.4367151	1000	319.8580369	254.7575375
\$J\$9	Paranavaí total	1583	32.4367151	1583	160.1802447	254.7575375

Another Supplier Dracena

- Based on our model, add one more Supplier Dracena
- The maximum to pay for Dracena is R\$30.38/t

Supplier	Londrina (t)	Franca (t)
Maringá	1000.00	0.00
Paranavaí	1583.00	0.00
Frutal	0.00	2140.00
Rancharia	530.18	839.82
Apucarana	2000.00	0.00
Bastos	0.00	1850.00
Sacramento	0.00	1260.00
Iturama	0.00	1700.00
Dracena	0.00	1225.52

Current Month Recommendation

- The maximum to pay for Dracena is R\$30.38/t

Supplier	Londrina (t)	Franca (t)
Jaú	480.00	0.00
Bariri	0.00	850.00
Cosmópolis	0.00	800.00
Itapira	775.00	0.00
Pirassununga	0.00	970.00
São Carlos	107.00	0.00
Diadema	89.19	0.00
Santa Bárbara d'Oeste	310.00	0.00
Araraquara	0.00	72.98

Profit=
220,369

Price Strategy

- When solving for Maximum profit with D, we assume the price is R\$0
- The maximum GN should be willing to pay for Dracena is R\$30.38/t
- Break-even point calculation:
(Maximum profit with D(220,369) - Maximum profit without D(183,135)) / Amount of sugarcane from D(1225.52)



Renegotiation



Renegotiation strategy – with Dracena

- Jau, Bariri, and Sao Carlos have negative shadow prices, indicating that reducing the guaranteed quantity for these locations will increase profit.
- Jau, Sao Carlos, Araraquara, and Diadema have capacity for buying more molasses.
- Considering the shipping fees and capacities, 397.1 tons of molasses will be reallocated from Bariri(31.7\$) in Franca to Araraquara(14.7\$).
- Additionally, 200 tons of molasses will be transferred from Bariri(31.7\$) to Sao Carlos(28\$).
- The remaining 252.9 tons from Bariri(31.7) will be redirected to Jau(30.1).
- Because the shipping fee difference between Sao Carlos(26.3\$) and Diadema(21.3\$) is greater than the difference between Jau(26\$) and Diadema(21.3\$)for Londrina, the initial 107 tons from Sao Carlos will be moved to Diadema.
- Consequently, there is no need to sign or maintain contracts with Bariri, as the molasses supply will be reallocated to other distilleries with more favorable conditions and existing capacity.

Renegotiation strategy – without Dracena

- Pirassununga and Santa Barbara d'Oeste have reached their maximum capacity
- Due to the significant shipping fee difference between Bariri and Cosmopolis in Franca (24.4\$), the 133.1 tons of molasses currently in Londrina will be redirected to a distillery other than Cosmopolis.
- 293t of molasses will be transferred from Bariri to Cosmopolis, as Bariri has available capacity.
- 133.1t of molasses initially intended for Cosmopolis will be diverted from Londrina to a different distillery.
- In Franca, 470t of molasses should be redirected from Cosmopolis to Araraquara
- The remaining 87t of molasses in Franca will be switched from Bariri to Itapira
- Smaller quantities will be reallocated from Londrina: 36.9t from Cosmopolis to Itapira and 96.2t from Cosmopolis to Diadema.
- Finally, 107t of molasses in Londrina will be moved from Sao Carlos to Diadema.
- There is no necessity to sign or maintain contracts with Bariri, as the adjustments cater to the existing capacities and fee differences.