

Project Brief

Code Clan Data Analysis Course

Manufacturing project

Background

Your client is one of the largest manufacturer of leather in the United Kingdom.

The company group comprises of four leather manufacturing subsidiaries and a technology company, all located in the UK.

Their specialist leathers are produced for a wide range of industries including automotive, aviation, bus & coach, rail, marine and contract furniture.

Tannery Process

Of the group companies 2 are both tanneries, and in simple terms use a chrome tanning process to tan OX hides.

The tanneries purchase between 600,000 and a 1,000,000 hide a year, and processes them through the two companies. The main customer for the tanneries is the rest of the group with 90% of output going to the two group finishing companies.

As volumes flex up and down, decisions are made which supplier to buy more or less from, suppliers vary in cost and quality. Each supplier has a finite capacity, some suppliers we buy all of its production, some a proportion.

It is believed that there is seasonal variation in quality, as animals are moved in and out of winter store, this can be seen at a macro level, however each supplier may have a different date grouping due to geography.

Problem Statement

The questions which the business struggles with are

- Who are our best/Worst suppliers ?
- How do suppliers rank vs each other ?
- Who should we buy more or less from (subject to capacity) ?
- If we want a specific outcome today, whos hides should we input ? (Predictive Model)
- If we input this mix what do we expect to get out ? (Predictive Model)

Of course the challenge is the fact that as the hides get processed they get mixed, so maintaining integrity of what hides at the end came from what supplier is the issue, that's where the maths comes in.

Leather manufacturing stages

You will want to become familiar with the stages of manufacturing of leather. Below are some resources to get you started but you may find some other videos/websites:

<https://www.keleenleathers.com/the-tanning-process/>

<http://www.all-about-leather.co.uk/what-is-leather/how-is-leather-made.htm>

The tanning process takes a hide of an

Process	Comments	Data
<u>Purchase</u> Hides from abattoirs are purchased, the hide is a waste product from the beef (red meat) supply chain	This year the tanneries purchase approx. 52,000 hides a month, from 22 different suppliers.	<i>Deliveries</i> - List of individual deliveries by supplier code and date and price.
<u>Sorting</u> On receipt the hides are sorted into Small Medium Large		We know what size they were delivered as.
<u>Liming process</u> I think of a large washing machine drum, taking 3500kg of hides, approx. 180 hides. Chemical process for 24 hrs to dehair the hides	Hides from more than 1 supplier may be processed together, cannot trace individual hides, they are tracked as a batch	<i>RawtoLime</i> - transfer table that shows what qty of deliveries were put into each Lime Pack <i>LimePack</i> - Shows Date of Liming for each pack
<u>Fleshing & Splitting</u> Each Drum is dropped and each hide is processed individually through fleshing (takes fat off the hide), and Splitting (where the collagen has cut off)		
<u>Tanning Process</u> Same large washing machine drum, Hides are then loaded into tan drum, 3500kg of hides, typically 250 hides (as they are now lighter per piece). Chemical Process for 24 hrs to tan the hides	Typically 6 Lime drums go into 5 tan drums. This mixes the batches even further.	<i>LimetoTan</i> - transfer table that shows what qty of each Lime pack were put into each Tan Pack <i>TanPack</i> - Shows Date of Tan for each pack
<u>Measure Process</u> Each tan drum is dropped, and each hide is individually dewatered (squeezed through a mangle), the area measured, and individually graded. Grading is done manually and typically look for scars, disease, cuts that effect how and where the hide can be used and/or sold.	There are 8 differing quality grades, and there are 4 size categories	<i>Measure</i> - A table at individual hides showing size and grade of each and the tan pack they came from
<u>Ranking grid - Index</u> Each hide can be given a nominal index value to score its size and quality relatively to each other	Hides can be too big as well as too small	<i>RankinggridIndex</i> - A two dimensional table to gives a relative quality score
<u>Ranking grid - Index</u> Each hide can be given a nominal index value to score its size and quality relatively to each other	Hides can be too big as well as too small	<i>Rankinggrid£</i> - A two dimensional table to gives a relative quality score

Graphical Summary of the process

Box on Left - Hides from Different Suppliers

Box on Right - Measure Data,



Data Examples

Deliveries

This example is 6 separate deliveries for 3 different suppliers

orderdate	packno	Supplier	Del ref	purchased	Average of perhide	Average of tran_cost	wf22s	w22_25	w26_30	w31_35	w36kg_up	light_cow	others
15/07/2019	30579	SLA01	SL1537	105	£33.23	£0.79	0	0	0	105	0	0	0
16/07/2019	30584	LIN01	NCT253	9	£25.00	£0.84	0	0	0	9	0	0	0
16/07/2019	30585	LIN01	NCT253	12	£27.26	£0.91	0	0	12	0	0	0	0
16/07/2019	30588	PRI01	NCT254	17	£29.82	£0.95	0	0	0	17	0	0	0
16/07/2019	30589	PRI01	NCT254	1	£23.12	£0.88	0	0	1	0	0	0	0
16/07/2019	30592	SLA01	SL1538	105	£33.23	£0.78	0	0	0	105	0	0	0

RawtoLime

In this example there is a lime pack ID 39606, 189 hides, from 6 deliveries

limeid	rawid	LimPack Hides	RawtoLime Hides
39605	30589	189	1
39605	30584	189	9
39605	30585	189	12
39605	30588	189	17
39605	30579	189	45
39605	30592	189	105

LimePack

limeid	datetime	LimePack hides
39605	16/07/19	189

LimetoTan

As you can see the Lime pack 39605 was split into two different Tan drum 70 of the 189 into tanpack 2457, 119 of the 189 into tanpack 2456.

tanpack	limepack	TanPack hides	LimetoTan hides
2457	39605	225	70
2457	39606	225	135
2456	39604	225	106
2456	39605	225	119

TanPack

tanid	datetan	Count of hideid
2457	17/07/2019	225
2456	17/07/2019	225

Measure

There would be 225 records such as this.

hideid	Grade	Hide Area	TanID
4283766	3	4.23	2456
4283767	B	4.58	2456
4283768	C	4.94	2456
4283769	1/2	4.57	2456
4283770	TM	5.82	2456
4283771	AE	4.5	2456
4283772	Cow	4.94	2456
4283773	Reject	4.11	2456

RankingGridsIndex and RankingGrid£

These are the two dimensional tables that give a relative score or financial for each combination of are and grade

		Price Adjust for Quality	10	5	0	-5	-35	-75	-65	-115
		Base Value								
		100								
Price Adjust for Size	Hide Size [sqft]	Hide Size [m2]	1and2	TM	Agnes	3	B	C	Cow	Reject
-28		0	82	77	72	67	37	-3	28	-15
-26	40.86	3.8	84	79	74	69	39	-1	28.5	-15
-24	41.94	3.9	86	81	76	71	41	1	29	-15
-22	43.01	4	88	83	78	73	43	3	29.5	-15
-20	44.09	4.1	90	85	80	75	45	5	30	-15
-18	45.16	4.2	92	87	82	77	47	7	30.5	-15
-16	46.24	4.3	94	89	84	79	49	9	31	-15
-14	47.31	4.4	96	91	86	81	51	11	31.5	-15
-12	48.39	4.5	98	93	88	83	53	13	32	-15
-10	49.46	4.6	100	95	90	85	55	15	32.5	-15
-8	50.54	4.7	102	97	92	87	57	17	33	-15
-6	51.61	4.8	104	99	94	89	59	19	33.5	-15
-4	52.69	4.9	106	101	96	91	61	21	34	-15
-2	53.76	5	108	103	98	93	63	23	34.5	-15
0	54.84	5.1	110	105	100	95	65	25	35	-15
2	55.91	5.2	112	107	102	97	67	27	35.5	-15
4	56.99	5.3	114	109	104	99	69	29	36	-15
6	58.06	5.4	116	111	106	101	71	31	36.5	-15
8	59.14	5.5	118	113	108	103	73	33	37	-15
10	60.22	5.6	120	115	110	105	75	35	37.5	-15
12	61.29	5.7	118	113	108	103	73	33	37	-15
14	62.37	5.8	116	111	106	101	71	31	36.5	-15
16	63.44	5.9	114	109	104	99	69	29	36	-15
18	64.52	6	112	107	102	97	67	27	35.5	-15
20	65.59	6.1	110	105	100	95	65	25	35	-15
22	66.67	6.2	108	103	98	93	63	23	34.5	-15
24	67.74	6.3	106	101	96	91	61	21	34	-15
26	68.82	6.4	104	99	94	89	59	19	33.5	-15
28	69.89	6.5	102	97	92	87	57	17	33	-15

		Price Adjust for Quality	£0	£-5	£-10	£-15	£-20	£-25	£-30	£-65
		Base Value								
		£85								
Price Adjust for Size	Hide Size [sqft]	Hide Size [m2]	1and2	TM	Agnes	3	B	C	Cow	Reject
-28		0	£57	£52	£47	£42	£37	£32	£48	£20
-26	40.86	3.8	£63	£58	£53	£48	£43	£38	£50	£20
-24	41.94	3.9	£65	£60	£55	£50	£45	£40	£50	£20
-22	43.01	4	£67	£62	£57	£52	£47	£42	£51	£20
-20	44.09	4.1	£69	£64	£59	£54	£49	£44	£51	£20
-18	45.16	4.2	£71	£66	£61	£56	£51	£46	£52	£20
-16	46.24	4.3	£73	£68	£63	£58	£53	£48	£52	£20
-14	47.31	4.4	£75	£70	£65	£60	£55	£50	£53	£20
-12	48.39	4.5	£77	£72	£67	£62	£57	£52	£53	£20
-10	49.46	4.6	£79	£74	£69	£64	£59	£54	£54	£20
-8	50.54	4.7	£81	£76	£71	£66	£61	£56	£54	£20
-6	51.61	4.8	£83	£78	£73	£68	£63	£58	£55	£20
-4	52.69	4.9	£85	£80	£75	£70	£65	£60	£56	£20
-2	53.76	5	£87	£82	£77	£72	£67	£62	£56	£20
0	54.84	5.1	£89	£84	£79	£74	£69	£64	£56	£20
2	55.91	5.2	£91	£86	£81	£76	£71	£66	£57	£20
4	56.99	5.3	£93	£88	£83	£78	£73	£68	£57	£20
6	58.06	5.4	£95	£90	£85	£80	£75	£70	£58	£20
8	59.14	5.5	£97	£92	£87	£82	£77	£72	£58	£20
10	60.22	5.6	£99	£94	£89	£84	£79	£74	£58	£20
12	61.29	5.7	£97	£92	£87	£82	£77	£72	£58	£20
14	62.37	5.8	£95	£90	£85	£80	£75	£70	£58	£20
16	63.44	5.9	£93	£88	£83	£78	£73	£68	£57	£20
18	64.52	6	£91	£86	£81	£76	£71	£66	£57	£20
20	65.59	6.1	£89	£84	£79	£74	£69	£64	£56	£20
22	66.67	6.2	£87	£82	£77	£72	£67	£62	£56	£20
24	67.74	6.3	£85	£80	£75	£70	£65	£60	£55	£20
26	68.82	6.4	£83	£78	£73	£68	£63	£58	£55	£20
28	69.89	6.5	£81	£76	£71	£66	£61	£56	£54	£20