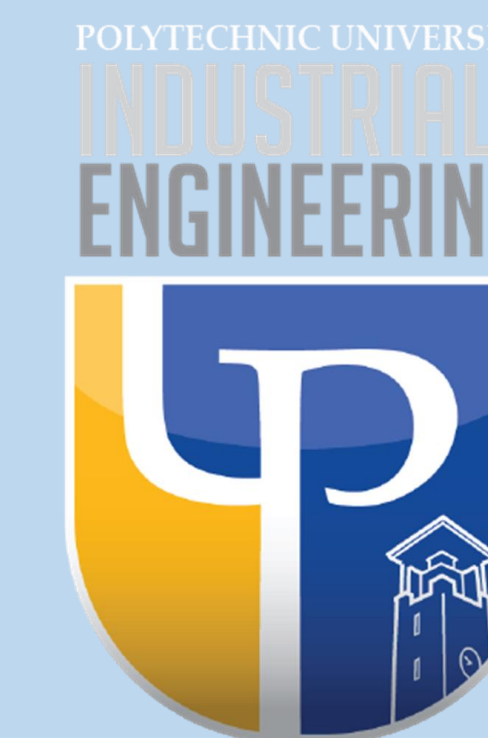




Waste Reduction on Filler #4 in Vaqueria Tres Monjitas

Christian Molina, Felwiam Balado y Frances Otero

IE 4995-39: Capstone I and II | Prof. Carlos Gonzales | SP - 24



Vaqueria Tres Monjitas is a company established in Puerto Rico, which is 100% Puerto Rican, that produces fresh milk. It is a private company that was established in the 1800s. Since its beginning, its goal has been to establish and improve milk quality standards. Always considering innovations to satisfy its customers. This industry is important as it is integral to the country's main agricultural industry.

DEFINE

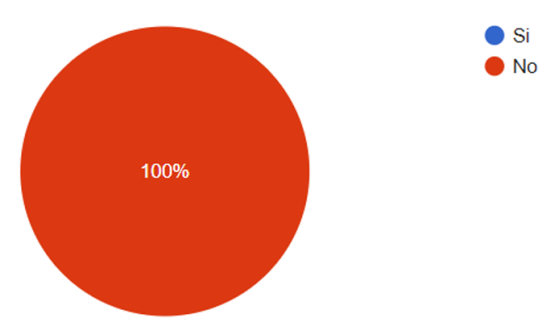
PROBLEM

The problem we chose after speaking with the "Stakeholder" at Tres Monjitas was to investigate the loss on the production line of Filler #4. We chose this problem since they do not have a way to measure the milk loss they have in production, so they told us to look for a way to measure the loss in filler #4. The reason they gave us this filler is because it is the most stable and the most filling product.

6) Is shrink loss being measured?

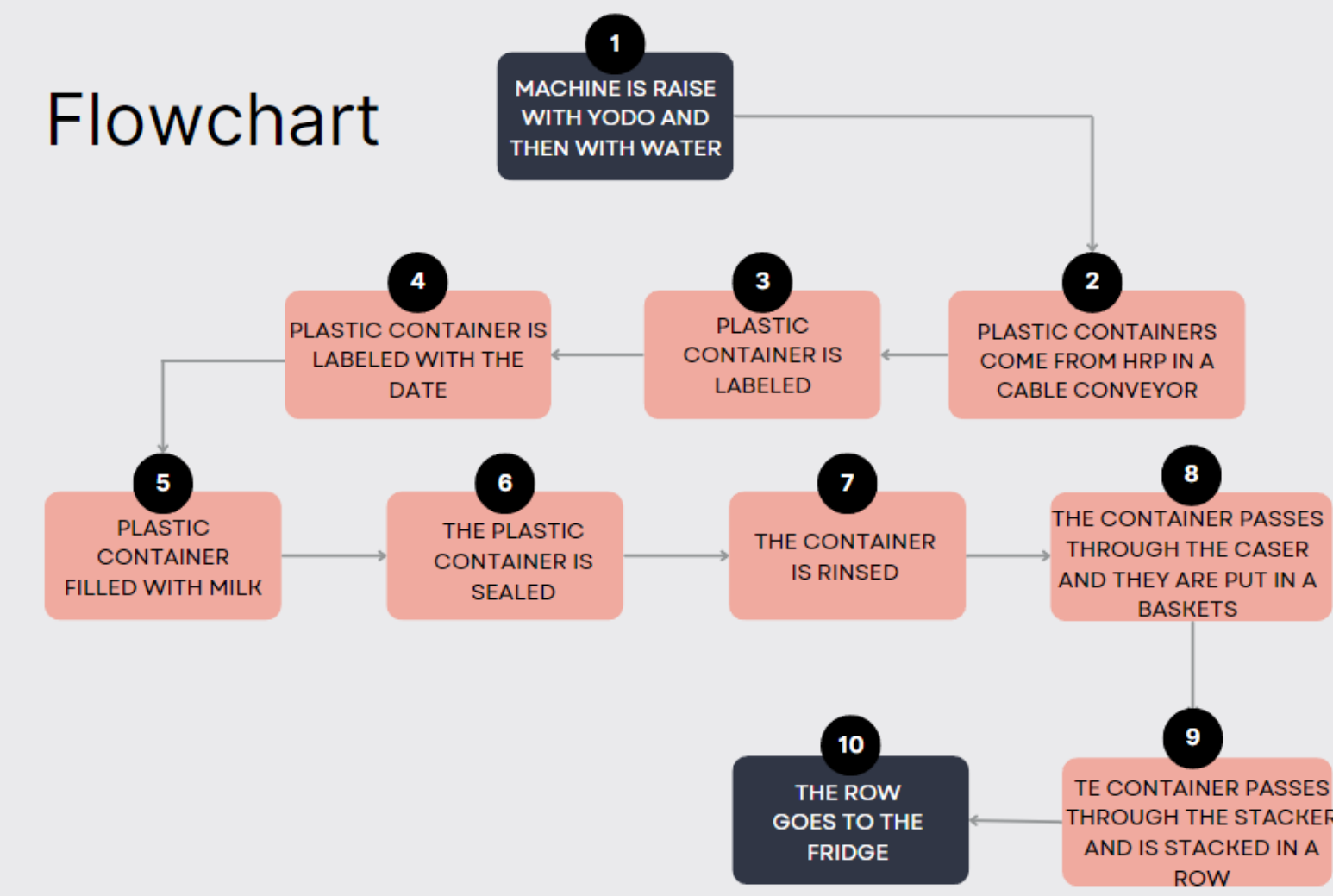
- Yes
- No

VI. Figure 1.6: Result of the sixth question of the survey



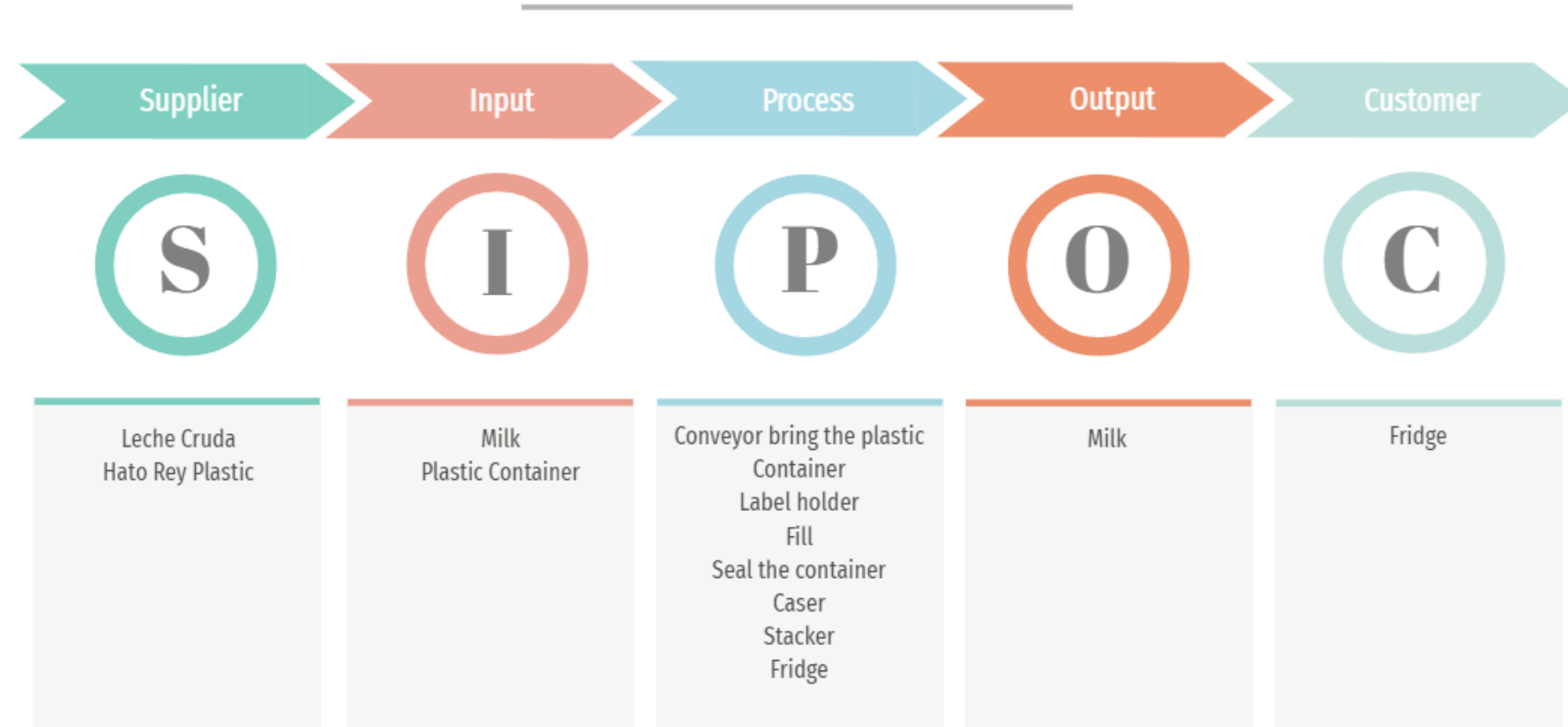
After carrying out the survey and seeing the results, we were able to see that at this moment in Tres Monjitas the loss of product is not being measured and because of this, the employees do not know the amount of loss they have during production. In addition, we were also able to observe that the machine has some problems in its daily production, which also causes delays in time and sometimes loss of milk. But despite the setbacks, they are satisfied with the use of the machine and the quality of their product.

Flowchart



In the flowchart properly details the specific process of the machine being analyzed, Federal 4, from the moment empty containers start running through the machine, labeled, filled with milk, sealed, rinsed, sealed and stored in packaging to be dispatched to the freezer for future customer delivery

Process of Filler #4



The SIPOC of the process of the filler #4, is the machine we are working on. It starts with the suppliers that are Leche Cruda and Hato Rey Plastic, the input is the milk and the plastic container, then comes the process of filler #4, the output is the milk and the customer in this case is the fridge.

MEASURE

DATA RECOLLECTION

Information	Date	Gallons	Filler #1	Filler #2	Filler #4	Filler #5	Pouch	MST	Total
2-Jan	46611	0	6881	0	13653.5	29602.1875	187.5	0	45824
3-Jan	40620	0	4066.5	0	5011.5	14838.25	93.75	0	25615
4-Jan	67807	8071.5	0	2551.5	18938.5	19821.5625	5967.15625	0	54652
5-Jan	45482	9409.5	0	254.5	13611	20200.3125	0	0	45305
8-Jan	37106	5564.5	0	3162.75	8066	20757.1875	575.625	0	38106
9-Jan	29055	6550	0	0	8023.5	13671.875	0	0	12920
10-Jan	41802	10754	0	0	10278	20236.25	0	0	41308
11-Jan	52370	4330.5	0	3275.5	15614	27925.3125	0	5275.429688	56421
13-Jan	55775	8170.5	0	251	18237	29071.875	0	0	55730
15-Jan	42740	8235.5	0	3283.75	12046.5	18845.625	0	0	42411
16-Jan	32327	4083.5	0	0	10619.5	17199.375	0	0	31852
17-Jan	46799	9387.5	0	0	12823	24156.5625	0	0	46387
18-Jan	47869	5340	0	2287.5	11209.5	23647.5	0	0	42485
20-Jan	58551	9284	0	470.5	12784	13035.875	3966	5825.789063	87861
22-Jan	39837	9103	0	2509.5	9708	10063.125	3080.625	0	34454
23-Jan	31374	6048.5	0	0	8253.5	16974.375	0	1851.125	33128
24-Jan	42809	7944.5	0	0	11083	23189.0625	281.25	0	42498
25-Jan	53517	5410	0	2822	18616.5	22215.625	2314	4331.429688	58910
27-Jan	52561	9866.5	0	2831.25	14175	27897.1875	0	0	54730
29-Jan	41285	10004.5	0	2525.75	9354.5	18768.75	5409.75	0	46083
30-Jan	31230	3050	0	0	9952.5	17981.25	0	0	30984
31-Jan	21419	2586.5	0	0	12795	23467.5	0	0	43181
1-Feb	51390	6179	0	2769.25	12096.5	24227.8125	46.875	2329.117188	46649
2-Feb	49400	9312.5	0	275.5	14592	24833.125	3768	0	52801
5-Feb	42186	0	0	2462.5	15009	20265.9375	3822	0	45586
6-Feb	32305	0	0	9201.5	0	18027.875	0	2542.53125	29951
7-Feb	50405	7262	0	0	21005	28892.8125	140.625	0	57300
8-Feb	53530	1962	0	2990.5	13687.5	27717.1875	0	4373.375	50731
10-Feb	28511	6561.5	0	252	23073.5	24657.5	3804	0	53142
12-Feb	46704	9139.5	0	2755.5	10531	23381.25	3974.625	2113.398438	51825
13-Feb	29369	9942	0	0	5083	14033.4375	0	0	28998
14-Feb	44115	1434	0	0	5675.5	22601.25	0	0	29711
15-Feb	48362	10514.5	0	3260.5	5736.5	24617.8125	140.625	0	44230
17-Feb	59312	16326	0	312.25	11074	31006.875	1938	4680.117188	65287
19-Feb	39623	6879.5	0	1303.75	10867.5	20691.5625	0	0	39242
Total	1,534,258	232,780	10,387,501	42,637,251	422,443	769,945	35,645,251	38,639,471	1,532,377

In this table, we can see first, the number of units in oz that were produced was searched on the sheet written by the filler operators. After that was done, it was placed on a table and divided by machine. Since we decided to work in gallons we converted from oz to gallons. For the conversion, what we did was multiply the units by the oz. Federal #1 produces 64oz, Federal #2 produces 64oz, Federal #3 produces 62oz, Federal #4 produces 64oz, Federal #5 produces 120oz, pouches produce 12oz and MST produces 59oz. After multiplying the units by the corresponding oz, we divide them by 128 gallons, because 1 oz is equivalent to 128 gallons. The numbers that appear in the table are the results of those calculations. Then in the last column add the number of daily gallons produced. In the end we were able to see that in the month that we collected data, the number of gallons that were produced is greater than what came in with a difference of 18,119 gallons more. This indicated we must review the product accounting form.

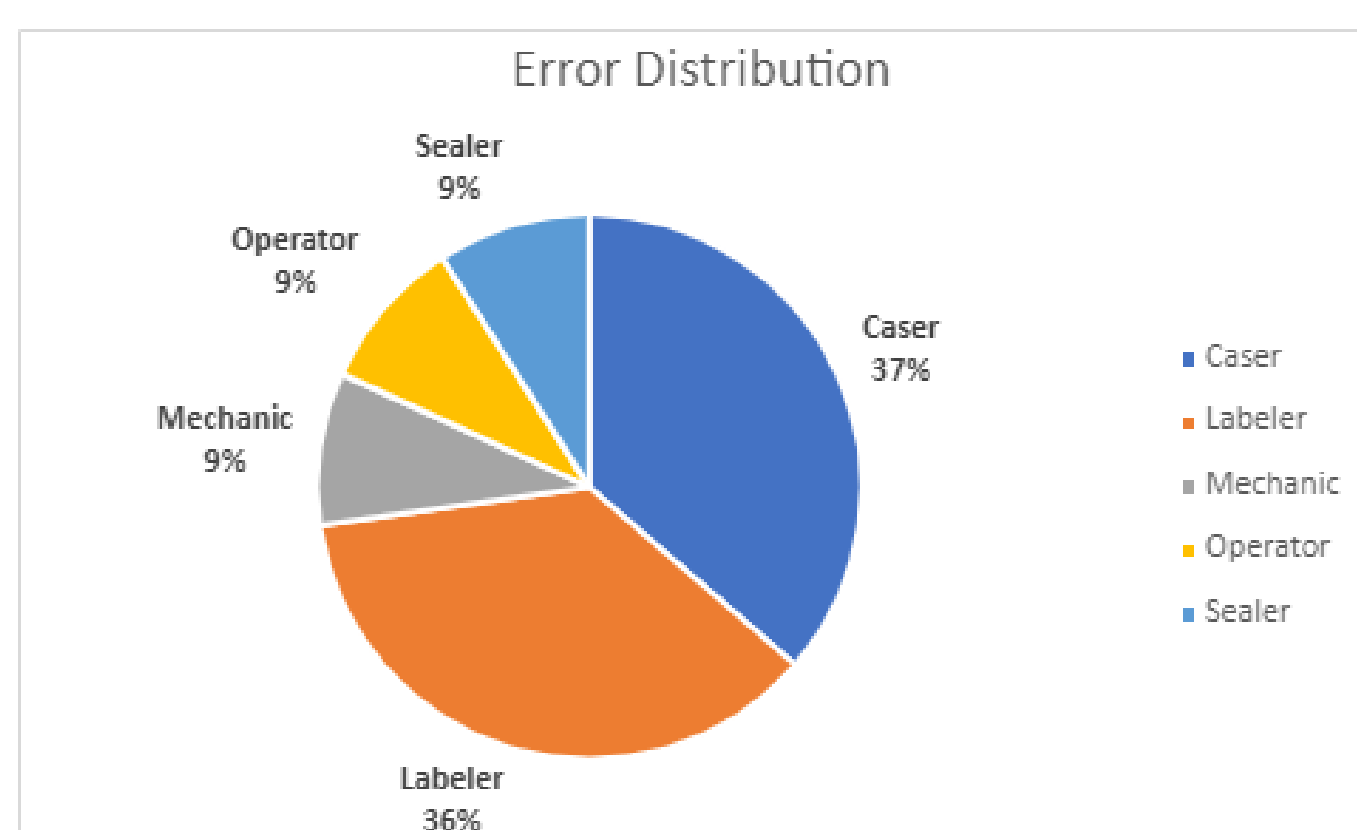
Federal #4				
Date	Gallons	Quantity per Unit	Unit * Oz	Oz/128 gal
2-Jan	46611	27307	1747648	13653.5
3-Jan	40620	10083	645312	5041.5
4-Jan	67807	33877	2188128	16938.5
5-Jan	45482	27222	1742208	13611
8-Jan	37106	16132	1032448	8066
9-Jan	29055	16025	1025600	8012.5
10-Jan	41802	20256	1315584	10278
11-Jan	52370	31228	1998592	15614
13-Jan	55775	36474	2334336	18237
15-Jan	42740	22093	1413952	11046.5
16-Jan	32327	21239	1359296	10619.5
17-Jan	46799	25646	1641344	12823
18-Jan	47869	22419	1434816	11209.5
20-Jan	58551	34568	2212352	17284
22-Jan	39837	19416	1242624	9708
23-Jan	31374	16507	1056448	8253.5
24-Jan	42809	22166	1418624	11083
25-Jan	53617	33233	2126912	16616.5
27-Jan	52561	28350	1814400	14175
29-Jan	41285	18709	1197376	9354.5
30-Jan	31230	19905	1273920	9952.5
31-Jan	21419	25586	1637504	12793
1-Feb	51390	22193	1420352	11096.5
2-Feb	49400	29184	1867776	14592
5-Feb	42186	38018	2433152	19009
6-Feb	32305	18403	1177792	9201.5
7-Feb	50405	42010	2688640	21005
8-Feb	53530	27375	1752000	13687.5
10-Feb	28511	42147	2697408	21073.5
12-Feb	46704	21062	1347968	10531
13-Feb	29369	10046	642944	5023
14-Feb	44115	11351	726464	5675.5
15-Feb	48362	11473	734272	5736.5
17-Feb	59312	22148	1417472	11074
19-Feb	39623	20735	1327040	10367.5
Total				422443

In this table, what we did was specify the data collected from federal #4. The data we specified was the unit quantity produced, multiplying the unit by oz and then dividing by 128 gallons to convert them to gallons. To be able to calculate the milk that enters and the milk that goes out in units.

ANALYZE

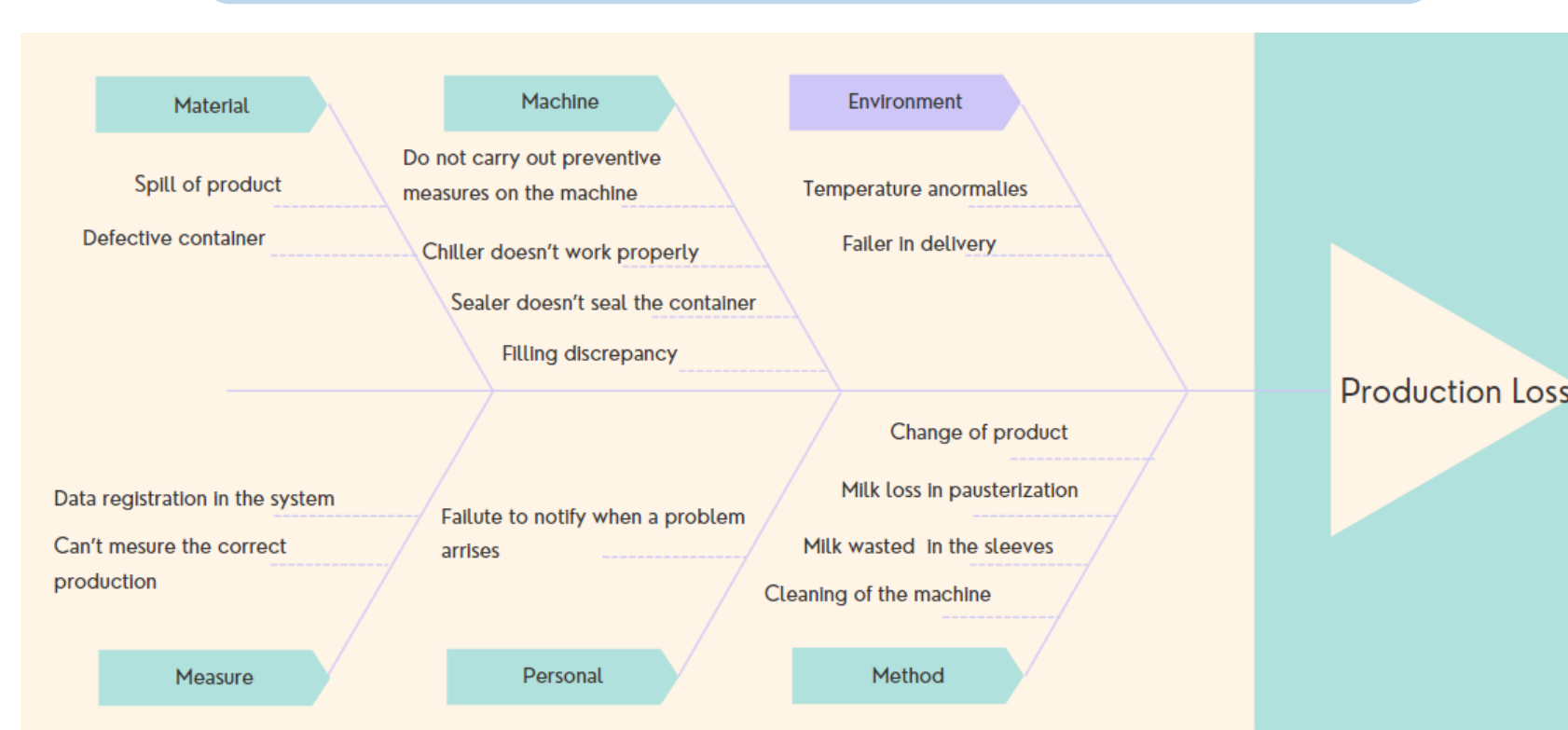
ERROR ANALYSIS

Machine	Error	Downtime (Mins)	Occurrence (Daily)	Total Downtime (Mins)	Occurrence (Annual)
Caser	Arm gets stuck	27.5	1	27.5	252
Labeler	Does not label	10	1	10	252
Labeler	No Date	5	1	5	252
Mechanic	Calibration Error	15	1	15	252
Caser	Sensor Malfunction	10	1.5	15	378
Caser	No Basket available	5	2	10	504
Labeler	Labels incorrectly	10	2	20	504
Scaler	Does not seal	20	2	40	504
Labeler	Incorrect Date	5	3	15	756
Caser	Knocks bottles Down	15	6	90	1512
Operator	Human Error	1	7	7	1764
Total		123.5	27.5	254.5	6930



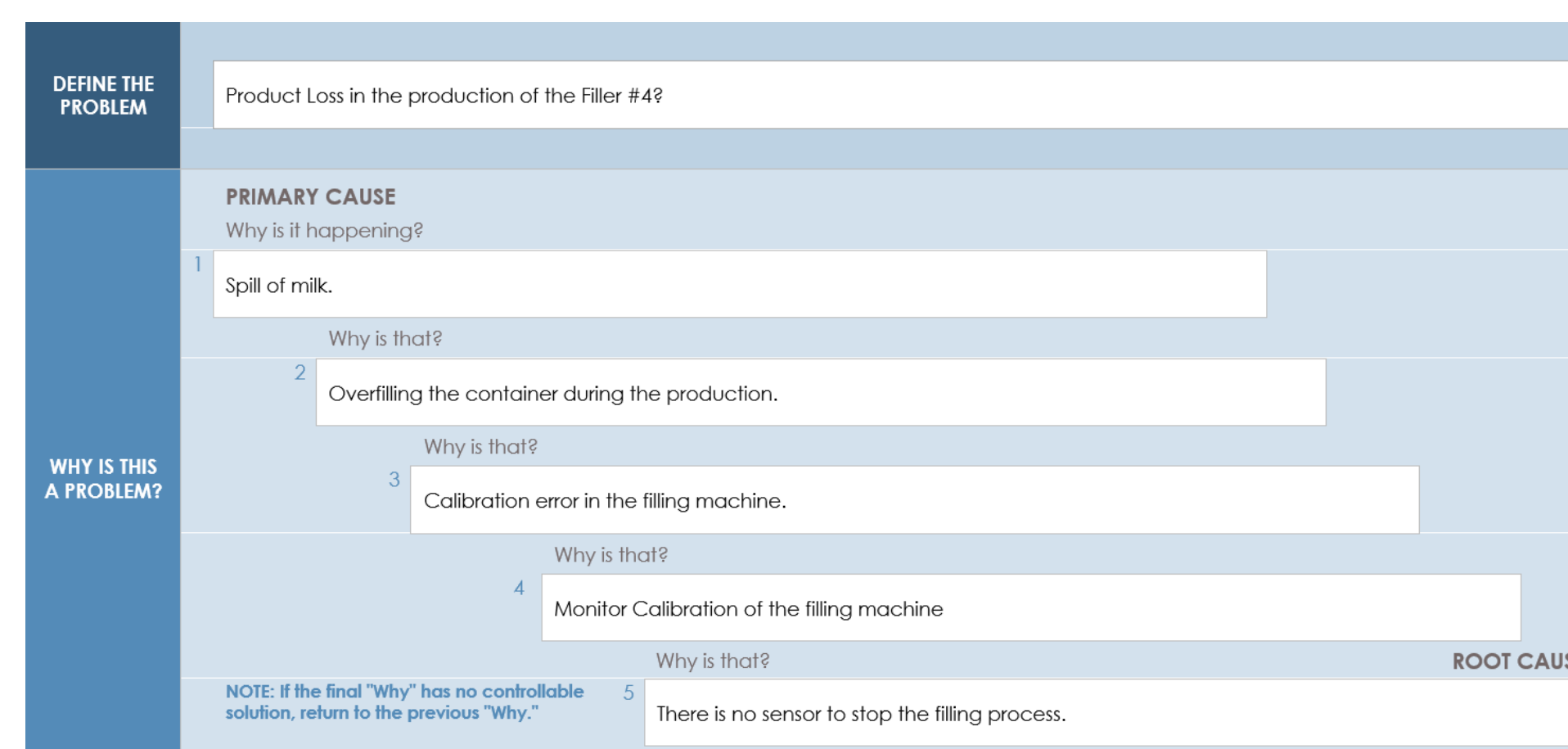
In this pie chart, we focus on the distribution of the errors in the process and which part sports the most errors. As can be seen from the chart the most different type of error occurs in the caser which is the part of the process when the bottles are packed and stacked before being sent to the fridge. Following the caser the labeler is the next step where most errors occur with 36% of the mistakes coming directly from the step where the product is labeled and stamped with the appropriate expiration date.

FISHBONE



In the fishbone, we are explaining different causes that cause milk loss to occur, which is the effect. The causes of milk loss are material, machine, environment, measurement, personnel, and method. After identifying the causes, we dig deeper into what specifically causes them.

5 WHY'S



In the 5 Why we are looking for the root cause of the problem that we defined, the problem is the loss of product in filler #4. After realizing the reason for the problem, we identified that the root cause of the problem in production was the lack of a sensor at the time of filling. This is because the way of filling is by weight. The corrective action we take after identifying it is to recommend purchasing a sensor with which they can measure, the amount of milk that is filled in the container and avoid spilling it.

IMPROVE

FINDINGS

After conducting our research at the Vaqueria Tres Monjitas we discovered different aspects of the filler during the time we were observing it. During our observations, we asked different questions about how the filler works in which we discovered that the way it works in the filling part is that the nozzle that is inserted into the bottle has a vacuum valve in which the hole sucks in the air and makes the milk through the edge. The way the filler performs the filling is that the bottle is placed on a scale and while the bottle is empty the scale is down and while the bottle is filling the scale goes up and when it reaches the indicated weight it goes up, but because there is no way to measure the milk, this causes spills to occur during the filling process, but because there is no way to measure the milk, this causes spills to occur during the filling process.

ROOT PROBLEM

Thanks to our discoveries we were able to discover that there is a loss of product during the filling process, the filler is operating in high pressure parameters and is not being measured and the flow is not being monitored. Also, we discovered that the fillers by gravity are not the most recommended for viscous products, gravity fillers are suitable for low-viscosity liquids. If the product is more viscous than expected, it could cause splashing when filled. A better one would be an overpressure filler with adjustment, we will put it as a recommendation because the company would see a reduction in milk spills.

RECOMMENDATION

- Long term recommendation:
- Over pressure filler regulated
- Short term recommendation:
- Weight sensor: measure the weight of the product (volume)
 - Pressure transmitter: a device that detects and responds to changes in pressure
 - Batch flow meter: measure the quantity of milk that passes through (flow)
 - Excessive filling speed: If the milk flow is too fast, it can cause turbulence and splashing. Solution: Reduce the filling speed to make the flow smoother.
 - Milk supply pressure: If the pressure in the milk supply system is high, it can cause splashing when exiting the nozzle. Solution: Adjust the supply system pressure to ensure a more uniform flow.
 - Machine adjustments: The synchronization and settings of the filling machine may not be correct. Solution: Review and calibrate the machine to ensure that the timing and movements are correctly synchronized.

FINANCE IMPACT ANALYSIS

Short term recommendation:		
Cost Analysis		
Current Loss		
Annual Merma Lost (unit)		59,559.05
Annual Lost (\$)		\$224,537.61
Reduce with implemetation		
Implementation	Cost	Estimated %
Flow Meter	\$5,000	6%
Weight Sensor	\$3,000	2%
Pressure Transmitter	\$2,500	12%
Monetary Saving		
Saving in Gallons		11,911.81
Saving		\$44,907.52

Long term recommendation:		
Cost Analysis		
Current Loss		
Annual Merma Lost(unit)		59,559.05
Annual Lost (\$)		\$224,537.61
Reduce with implementation		
Implementation	Cost	Estimated %
New Filler Machine	\$125,000	95%
Installation Fee	\$15,000	-
Total	\$140,000	95%
Monetary Saving		
Saving Gallons		56,581.10
Saving		\$213,310.73

CONTROL

PLAN

To address the issues with milk filling causing splashing, we will implement a structured plan. First, we will assess the current equipment condition and collect data using weight sensors and batch flow meters. Based on this data, we will adjust the filling speed to ensure a smoother flow, thereby reducing turbulence. We will also calibrate the supply pressure to maintain a uniform flow and prevent splashing. Next, we will review and calibrate the synchronization settings of the filling machine to ensure proper timing and movements. Additionally, we will establish a regular monitoring and preventive maintenance schedule to sustain optimal performance and train operators to make necessary adjustments. Finally, we will document all changes and create a feedback loop for continuous improvement, ensuring that the filling process remains efficient and splash-free.

CONCLUSION

In conclusion, this plan aims to enhance the milk-filling process by systematically addressing the root causes of splashing. We will achieve a smoother and more efficient operation by thoroughly assessing equipment conditions, collecting precise data, and making targeted adjustments to filling speed, supply pressure, and machine synchronization. Regular monitoring, preventive maintenance, and operator training will ensure optimal performance. Documenting changes and establishing a feedback loop will facilitate continuous improvement, leading to a more reliable and high-quality filling process.

GRATITUDE

Thanks to the help of the employees of Vaqueria Tres Monjitas, we were able to finish our Capstone, which had various challenges during its construction. We deeply appreciate the assistance of Eng. Carlos Santiago and Eng. Cristian Lugo during our visits to the plant to carry out the project. Additionally, we want to thank the team of mechanics, supervisors, operators, and employees who supported us throughout our journey. We also want to express our gratitude to Prof. Carlos Gonzales, who helped us during our course, as well as the other teachers who contributed to our growth.



TRES MONJITAS

