National cranberry cooperative case

The major trends of the cranberry industry and the problems facing RP#1

There are several major trends that we can observe in the cranberry industry for the period of 1945-1979 (See Table 1 in the Appendix). First, there is a steady production increase in each of the five-year periods: from 615, 000 barrels in 1945-1949 to 1, 546, 120 barrels 30 years later. The production growth was caused by the increasing mechanisation of cranberry industry. For example, water harvesting could result in a yield up to 20% higher than that obtained via dry harvesting.

Hence, the average barrels per acre grew from 23. 7 in 1945-1949 to 73. 7 in 1975-1979. Second, the production growth led to the excess of cranberries produced over those utilized: from 0% of excess in 1945-1949 to 13% in 1965-1969. However, over the period 1969-1979 the overproduction has decreased due to the Agriculture Marketing Agreement Act followed by the Cranberry Marketing Order of 1978. That order limited the production of volume of each grower, thus, making a significant impact on both production excess and the industry's prices.

Before the Cranberry Marketing Order of 1978 the average price level per barrel was volatile and was not reflected in the country's inflation rate ($11. 06 per barrel in 1945-1949 vs $12. 00 per barrel in 1970-1974). Third, because the water harvesting methodology was more damaging than the dry one there was a decrease in the proportion of fresh sales from 76% in 1945-1949 to 22% in 1975-1979. Berries should not be damagedto be sold fresh. Receiving plant #1 (RP1) is facing operations management problems. First, overtime costs were out of control. Second, trucks spend too much time building up and waiting to be unloaded.

The flow rate (or capacity) of the system is limited by the bottleneck, the Dryers. The average number of barrels per day RP1 received in 1980 was 6041. 4 bbls. 58% of fruit delivered was wet. It is expected that in 1981 the percentage of water-harvested berries will increase to 70%. The Dryers have the highest utilisation rate (a bottle neck) in the process: udryers = (6, 041. 4/12)*70%/600 = 58. 7%

udestoning= (6, 041. 4/12)*30%/4, 500 = 3. 4% udry dechaffing= (6, 041. 4/12)*30%/1, 500 = 10. 1% uwet dechaffing= (6, 041. 4/12)*70%/3, 000 = 11. 7% useparators= (6, 041. 4/12)/1, 200 = 42% Dryers' capacity is 600 bbls/hr, determining the process capacity 600/0. 7 = 857. 1 bbls per hour. Processing and waiting time Assuming that on a peak day the plant receives 20, 000 bbls of berries, the processing would be completed in 20, 000 / 857. 1 = 23. 33 hours (23 hours and 20 minutes). Since the plant runs no more than 22 hours a day, there would be a stock of dry berries kept in the bins overnight.

Using the Little's Law formula the average time that the trucks wait to be unloaded is 3 hours. See Table 2 in the Appendix. Assuming that during a normal day the plant receives 10, 000 bbls of process berries there will be 833. 33 bbls supplied per hour. This supply rate is less than the system's flow rate 857. 1 bbls/h. Therefore, the total processing time is limited by the supply rate rather than the processing capacity and calculated 10, 000 / 833. 33 = 12 hours. In that case there wouldn't be any queues. See Table 3 in the Appendix. Investment options

During 20 busy days (from 20 Sep to 9 Oct) RP1 is expected to receive 16, 000 bbls daily (see Table 4 in the Appendix). Given that volume, the processing would be completed in 18. 67 hours (18 hours and 40 minutes). The average waiting time would be 0. 67 hours (40 minutes). With 20 seasonal workers employed for that period the performance indicators of the plant are compared for 3 different options. Option 1 – Convert 4 dry storage bins into wet bins ($7, 500*4) Benefits. Compared to the current process this option would only eliminate queues. See Table 5 in the Appendix. Costs. The additional cost of the current process is $30, 000 (investment to convert bins). It is difficult to calculate the financial benefits from the elimination of queues, though we must not forget that queues are an issue in the current process during peak days. Option 2 – Add 1 dryer ($40, 000)

Benefits. Comparing to the current process this option would: * Improve the flow rate of the system by 33% (from 857. 1 to 1, 142. 9 bbls/hr) * reduce the total processing time by 25% (from 18. 67 to 14 hours) * reduce overtime labour costs by (18. 67 – 14)*4. 5*20*20 = $8, 406 per 20 days * reduce overtime hours by 4. 67*20*20 = 1, 868 worker-hours * eliminate queues

Another benefit is that the fewer overtime hours RP1 has, the easier it will be to find enough seasonal workers. However, the dryers’ stage is still the bottleneck in the process with a utilisation rate (16, 000/12)*0. 7/800 = 116. 7%. See Table 6 in the Appendix. Costs. The additional cost to the current process is (40, 000 – 8, 406) = $31, 594. That means that during those 20 days the benefits mentioned above would directly offset $8, 406 of $40, 000 investments. Assuming the same level of supply (16, 000 bbls/day), the total investment would be returned in (40, 000/8, 406)*20= 95 days. It is difficult to calculate the financial benefits from the elimination of queues and the lower dependence on seasonal workers, though we must not forget that those are issues in the current process during peak days. Option 3 – Add 2 dryers ($40, 000*2)

This option is only slightly more beneficial than ‘ option 2’ because the new process would be limited by the new bottleneck in the Separators’ stage (u= 111%). Benefits. Comparing to the current process this option would: * Improve the flow rate of the system by 40% (from 857. 1 to 1, 142. 9 bbls/hr) * Reduce the total processing time by 29% (from 18. 67 to 13. 33 hours) * Reduce overtime labour cost by (18. 67 – 13. 33)*4. 5*20*20 = $9, 666 per 20 days * Reduce overtime hours by 5. 34*20*20 = 2, 136 worker-hours * Eliminate queues

Again the fewer overtime hours RP1 has, the easier to find enough seasonal workers. See Table 7 in the Appendix. Costs. The additional cost of the current process is (80, 000 – 9, 666) = $70, 334. That means that during those 20 days the benefits mentioned above would directly offset only $9, 666 of $80, 000 investments. Assuming the same level of supply (16, 000 bbls/day), the total investment would be returned in (80, 000/9, 666)*20= 166 days.

It is difficult to calculate the financial benefits from the elimination of queues and the lower dependence on seasonal workers, though we must not forget that those are issues in the current process during peak days. Among all the mentioned options the most balanced one is Option 2. It gives more benefits compared to the current process and Option 1, and has a faster return than that of Option 3. For the additional cost $31, 594, there is a reduction of the overtime labour costs and elimination of queues. See Table 8 in the Appendix. Recommendations for improvement

In the short-run we have already eliminated the issue with queues and reduced overtime labour cost by adding one additional dryer. In the long-run the steady growth of supply will eventually result in the same issue of limited system's capacity. Besides the recommended installation of 1 new dryer, there are several more suggestions for RP1's process improvement. 1. To plan capital investments ahead and consider buying one more additional dryer and one separators line. This will increase system's output rate to (1, 000 / 0, 7) = 1, 429 bbls/h (determined by dryers' output rate 1, 000 bbls/h). This will help the RP1 be ready to the growth of supply level in future years. 2. The second recommendation is to convert the bins for dry berries into universal bins.

That will provide the RP1 with additional flexibility in receiving of wet berries; thus, reduce average waiting time during peak days. 3. The more radical option the RP1 might implement is to stop processing of dry berries. This is because of the extremely low utilisation rates of the dry berries processes (Destoning and Dechaffing) and declining share of dry berries supply. The benefits from that option: * Focus on maximisation of wet berries processing efficiency (70% of all supply) * Cash from selling of Destoning and Dechaffing units of dry berries process * Investments to wet berries processes improvement. First of all, increasing Dryers and Separators' capacities up to the level of Dechaffing's capacity.