Expanding Capacity to Address Persistent Demand-Supply Imbalance

Since 1996, Scharffen Berger has been committed to our reputation as the maker of "*America's Finest Dark Chocolate*". This has been the cornerstone of our success, evident in the sales growth we have seen from $0.6 Million in 1998 to $10.0 Million in 2004. Demand for our chocolate has consistently outstripped our production capacity, especially in the last 18 months. It is anticipated that demand will further increase by 30% by the end of the year, and triple in the years ahead. Without efforts to expand our capacity, we may miss a significant growth opportunity.

Purchase of Custom Ball-Mill

Purchasing a custom ball mill could boost our production capacity while maintaining the quality and taste of our products. In our current operational system, the bottleneck is the conching step, which takes 48 to 72 hours to process each batch of 1,400 kg on average. Assuming operations run 24 hours a day and 31 days a month, this translates to a maximum system capacity of 54 kg per hour to produce a maximum monthly output of about 40,000kg. The refining step done in the conche could instead be managed by the ball-mill, which would reduce the total time spent for conching *and* milling to 15 hours. By reducing the time required for refining, the purchase of this ball mill would help to alleviate the current bottleneck in our production process.

By the Theory of Constraints, the new bottleneck will now be at the step with the lowest system capacity, which is at the melangeur, with a maximum capacity of 92 kg per hour (or 115 kg every 75 minutes). This translates to a new monthly capacity of 68,448kg, which is an increase of 28,448kg in monthly output from our current output of 40,000 kg (~71%). Assuming no changes to our pricing strategy from 2005 when expected revenue is $15 Mil, we can expect a ~71% increase in revenue, to $26 Mil. Further assuming a variable profit margin of 75%, we could see a Return on Invested Capital (ROIC) of a payback period of 13.3days for the $300,000 investment to purchase the ball mill (i.e. $300,000 divided by 75% of $11 Mil per year or $23,000 per day). As such, we recognize the implementation of the ball-mill to be a positive investment, and recommend pursuing this.

Implementation of Ball Mill

To ensure the smooth implementation of the ball-mill, we propose to subordinate the other steps in the production cycle to the production levels of the newly identified bottleneck at the melangeur. This could be achieved by calibrating the shift hours (as detailed in annex), such that each step of the process produces only up to 92 kg per hour, while maintaining regular shifts of 8 hours a day per worker to provide workers a fixed shift. There is also a need to reorganise the factory to cater space for changes in the inventory build-up. Where previously most of the inventory built up was after melangeuring (as conching was the bottleneck), most of the inventory build-up

with the new process will likely be after winnowing (as melangeuring is the new bottleneck). There will also be new inventory space requirements after milling, which will be faster than tempering.

Medium Term Increase of Production Capacity

Purchasing the ball mill will allow us to meet the 30% increase in demand by the end of the year, but will not allow us to meet the 200% increase in demand in the years ahead. As such, we propose to also aim to increase the current capacity by 150% as a medium term target. This would imply raising our current capacity to 100,000 kg per month, up from the 40,000 kg per month today. This translates to a production rate of 134 kg per hour, assuming 24/7 operations throughout the month. To achieve this, we will need a corresponding output of 134 kg per hour for winnowing, melangeuring, conching, milling, tempering, moulding and packaging. However, given the yield loss in cleaning and winnowing, we would need an output of 190 kg per hour for cleaning as well as 182 kg per hour for roasting and cooling.

The current capacity of cleaning, winnowing, conching, milling, tempering, moulding and packaging meets the output requirements. However, this is not the case for roasting and cooling and melangeuring, which have a capacity of 167 kg per hour and 92 kg per hour respectively, below the requirement of 182 kg per hour and 134 kg per hour for each step. To raise the capacity for roasting and cooling as well as melangeuring, we could purchase an additional roasting and cooling as well as melangeuring machine. This would double the capacity for roasting and cooling as well as melangeuring to 334 kg per hour and 184 kg per hour, which meets the outputs required.

We have found a used melangeur that could be purchased and refurbished for $50,000. For the roasting and cooling machine, we estimate that it would cost no more than the custom ball mill's cost of $300,000, given that it is a less specialised and complex machine. Again assuming no changes to our pricing strategy from 2005 when expected revenue is $15 Mil, we can expect a 150% increase in revenue, to $38 Mil. Again assuming a variable profit margin of 75%, we could see a ROIC of a payback period of 7.4 days for the $350,000 investment to purchase the two machines (i.e. $350,000 divided by 75% of $23 Mil per year or $47,000 per day). As such, we recognize this to be a positive investment, and recommend pursuing this.

For implementation, we propose to adjust the workers' shifts according to the output requirements for each step as detailed above. This could be achieved by calibrating the shift hours (as detailed in annex), such that each step of the process produces only up to the target outputs required, while maintaining regular shifts of 8 hours a day per worker to provide workers a fixed shift. There is also a need to reorganise the factory to cater space for changes in the inventory build-up. With the purchase of an additional roasting and cooling machine, there could be a small inventory build-up after roasting and cooling, which has a slightly higher capacity than winnowing.

Potential Concerns and Mitigation Measures

With the purchase of an additional roasting and cooling as well as melangeuring machine, our total system capacity will be at 104,160 kg per month, with the bottleneck at moulding, which has a capacity of 140 kg per hour. As such, there remains scope to further increase the capacity. However, we advise a cautious approach, for three reasons.

First, increasing workers' shifts could result in quality control issues. The current production method relies on sensory perception for quality control, meaning that workers have to be extra attentive. Given this, extending or adding extra shifts could lead to fatigue, reducing their ability to perform consistently and perceive flavour nuances. This could affect product quality, and should be avoided, as maintaining high quality is essential to uphold our brand reputation. Second, increasing the demands on the machines could also accelerate wear and breakdowns. This is exacerbated by the fact that many of our machines are over 50 years old, and spare parts as well as repair and maintenance expertise may not be commonly available. This is particularly concerning as we only have a single machine in some steps. Third, the shift in inventory due to the changes in shifts and the positioning of new machines could prove challenging for implementation in the immediate term.

To prevent fatigue resulting in quality issues, we could employ more workers to increase employee rotation so as to maintain the number of hours each worker works per week. This would be justified given the expected growth in profits with an expanded capacity. We should also expand our training process to grow training capacity for roasting and cooling and melangeuring, as these will constitute most of the new hires. To minimise the risks of machine breakdowns, we could adopt predictive analytics through artificial intelligence tools and dashboards to monitor system performance parameters like temperature and wear. This will allow us to conduct preventive maintenance in a timely manner to reduce the risks of machine breakdowns. In addition, we could grow our onsite technician teams to allow this preventive maintenance to be completed as quickly as possible. To mitigate the challenges of implementation in the changes in the inventory buildup, we could also purchase an enterprise resource planning software to enable us to more closely monitor finished goods and raw material inventory. With varied recipes and packaging, a comprehensive inventory view would ensure that workers have the necessary materials and resources available, streamlining their workflow and reducing potential delays.

Conclusion

In conclusion, we recommend purchasing the ball mill, roasting and cooling as well as melangeuring machines. This would allow us to grow our production capacity to capitalise on demand growth. In the longer term, we should also explore purchasing an additional moulding machine to attain the 300% increase in production capacity to meet the demand forecasted.