

Lehigh steel case study essay sample



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Introduction:

Lehigh Steel is a steel and alloy production company with a huge range of products. It was able to reach a record profit in 1988, but went down to a record loss by 1991. Lehigh is owned by a parent company, The Palmer Company who's a global manufacturer of alloy and steel and were interested in Lehigh's specialised equipment to allow them to gain a competitive advantage.

Palmer had acquired Lehigh in 1975 not for synergies with its own speciality steels businesses, but for the Continuous Rolling Mill (CRM). CRM is specialized equipment that can convert steel intermediate shapes to wire for Palmer's Bearing rollers. There are only 6 mills in the US.

The specialty steel industry composes 10% of the US steel industry. The quality of steel products is determined by the product application and the grade of the steel. Since the steel market is in a very competitive sector, firms must maintain a high standard of quality and keep its costs to its minimum. For non-profitable products to exit the market, the manufacturers can do this silently by raising their price above the competitive price so there'll be no customers remaining and allow the manufacturer to stop making these products.

Lehigh Steel has a huge range of products but 3 of these products comprise 70% of Lehigh's total sales, these three products are: Alloy, Die Steel and High Speed. In order to analyses each of these products, we will need to do some costs analysis to find out whether these products are profitable or whether these products are the causes for the loss in Lehigh Steel. To do

this, we will focus mainly on ABC and TOC analysis to analyse the cost and therefore different profits due to the different methods of cost allocation, for each product using the two different methods, then compare the results arising from the two analyses, and finally draw a conclusion.

The main aim of this report is to identify the true resource consumption of resources from each product using the two main techniques of costing ABC and TOC, in an attempt to highlight the best product value mix for Lehigh to help the company to maintain market share in the steel industry.

ABC:

Theoretical background:

ABC was first introduced by Cooper and Kaplan in late 1980s. Its purpose is to identify cost pools or activity centres and allocate the costs to the products based on the amount of resources used to create a certain product. It implicitly assumes that all overheads allocated are variable some time in the future. It is a good tool for planning and control as it identifies each products cost, based on the activity used to make the product. The costs allocated to each product is a realistic figure as it allocates the costs according to the amount of time spent or the amount of resources used in each of the activities, but to acquire these data, it requires a lot of research and monitoring to give a reasonable estimate of the time or resources spent.

Traditional systems often allocate service costs to production centres. ABC however tends to establish separate cost driver rates for support centres and assigns the cost of support activities directly to the cost objects without any allocation to production centres. With the more accurate results for each

product, companies can make lots of decisions, for instance, dropping unprofitable products, raising prices for low-volume orders. Also information from ABC can encourage companies to redesign products and process technologies to be more efficient and cost less. This was why Bob Hall was called upon at Lehigh - to introduce the case for ABC and thus help Lehigh to highlight the best value product mix.

In an ABC analysis, we will firstly need to identify the different activities that are required to make each product rather than costs incurred in different departments. In Lehigh, the different activities identified are: Melting, Refining, Molding, Rolling, Finishing. There are also administrative activities such as General, Material Handling, Order processing, production planning and technical support. In order to allocate these costs, we need to define a cost driver for each of the activities to allocate the cost to each product. These drivers are the machine times for the activities, pound of production for General Admin, SKU's for production planning and no. of order for the remaining processes.

Figure 1 below summarises the above ABC technique that Lehigh adopted:

Figure 1: Summary of the Activity Based Costing at Lehigh.

TOC:

During the 1980's Goldratt and Cox (1984) advocated a new approach to production management called optimised production technology (OPT). OPT is based on a principle that profits are expanded by increasing the throughput of the plant. The OPT approach determines what prevents

throughput being higher by distinguishing between bottleneck and non-bottleneck resources. A bottleneck may be a machine whose capacity limits the throughput of the whole production process.

The aim is to identify bottlenecks and remove them, or if not possible, ensure that they are fully utilized at all times. Non-bottleneck resources should be scheduled and operated based on constraints within the system and should not be used to produce more than the bottlenecks can absorb.

Thus the OPT theory suggests that spare capacity and idle time are not considered to be detrimental to the overall efficiency of the company. TOC focuses on one of the constraints of the company, which restrains the company's overall performance. It assumes costs other than materials are fixed at least in short term. This makes TOC very applicable to Lehigh because it is an accurate reflection of the business, where operating costs are fixed in the short run.

In order to implement TOC, the company must firstly identify the bottleneck (constraint), secondly decide on a method to exploit the bottleneck by increasing its utilisation, thirdly subordinate everything to the bottleneck, fourthly is to elevate the bottleneck by increasing the capacity and finally repeat the whole process if the bottleneck changes after these steps.

Together with its offshoot 'throughput accounting', it allows companies not only to remove the constraints of the overall profitability, therefore enhance the profit, but also evaluate the company and products using a new concept, throughput, further products can be ranked using throughput per bottleneck to show the profitability. Therefore it'll enable companies to drop the

unprofitable products and possible increase the favourable ones, also to make more accurate price decisions.

The above TOC technique is summarized in figure 2:

Figure 2: Summary of the TOC applied to Lehigh.

Edwards implemented TOC at Lehigh as it was a good candidate for the technique. For example there were aims to increase “ The rate at which raw materials were turned into sales”, and by using throughput accounting and TOC, emphasis is placed upon getting products through the manufacturing process and sold in the least time possible. This will then lead to a reduction in the build up on inventory that Edwards was observing with the piles of WIP.

TOC also assumes costs other than materials are fixed at least in short term; at Lehigh where operating costs are fixed in the short run thus making TOC an accurate reflection of reality at Lehigh. Finally simple cost or selling price focus is not enough. The steel industry is a price taker industry, customers are “ sophisticated about the value of the product”, TOC can help Lehigh to rationalize the product mix - thus help to price accordingly in this price taker industry.

The next page shows the calculations and results from standard costing, ABC and TOC.

ABC and TOC Calculations from Excel

ABC Results:

We carried out the ABC technique that was summarised in Figure 1 and got the results as shown on the previous page. From the ABC analysis, we can see that the only profitable product is Die Steel High Speed - the only product that makes an actual gain in profit of \$0. 15. Ranked in order of profitability after Die Steel High Speed comes Die Steel Round Bar - which breaks even, with zero profit or loss, followed by Alloy, Conversion Roller Wire, then the least profitable being Die Steel Chipper Knife (with these last three making a loss.)

We can see that the most profitable product; Die Steel High Speed, uses in production using only a total of 0. 34 min/lb. One of the least profitable products - Conversion Roller Wire uses the least total time of only 0. 17 min/lb, however makes a great loss of (\$0. 14) per unit.

It can be seen that all the products make a contribution, and thus this has to be considered when rationalizing the product mix and deciding on the best value product mix for Lehigh. Under ABC consideration alone, it could be suggested that the products should be made in the following order of profitability:

- i. High Speed Machine Coil
- ii. Die Steel Round Bar
- iii. Alloy
- iv. Conversion Roller Wire
- v. Die Steel Chipper Knife

TOC Results:

To apply TOC to Lehigh, operations staff agreed to use the time used on CRM

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as the bottleneck. Then subtracted the price and materials per unit to calculate the throughput, and then calculated the throughput per bottleneck using information in Exhibit 4 and 5. The rankings of throughput per bottleneck from TOC are given as follows:

- i. High Speed Machine Coil
- ii. Alloy
- iii. Die Steel Round Bar
- iv. Conversion Roller Wire
- v. Die Steel Chipper Knife

From the results, the machines that spent the longest time on the constraint were ranked last as the analysis focuses mainly on the constraint rather than the costs itself.

Standard Costing Results:

Our results also summarises the overall operating profit that each of the five products makes, which highlights an important figure. Below ranks the products in order of profitability under standard total absorption costing:

- i. \$0. 60 Alloy
- ii. \$0. 00Conversion Roller Wire
- iii. (\$0. 15)High Speed Machine Coil
- iv. (\$0. 25)Die Steel Chipper Knife
- v. (\$0. 26)Die Steel Round Bar

Overall Analysis:

It can be seen clearly from the above ABC and TOC rankings, that the order of production and the best value product mix are fairly similar under ABC or TOC. The only difference is that ii. (alloys) and iii. (Die Steel Round Bar) have been swapped round in order of best value product mix. The fact that the two techniques provide us with relatively the same results can help Lehigh to come to a conclusion on the best product mix.

Both ABC and TOC show that Die Steel chipper Knife and Conversion Roller Wire are making the biggest loss out of all the products along with the smallest throughput rate per scarce resource per minute thus one could consider rationalizing these products in order to create a new product mix with higher value. However this begins to raise various issues.

Firstly we have to remember that the parent company - Palmer only purchased Lehigh in order to take advantage of it's CRM - specialized equipment that can convert steel easily and Palmer uses the CRM to convert billet to coil. The fact that this process occurs purely for the parent company means that transfer pricing must be taking place for the Conversion Roller Wire. It can be seen from the calculations that the operating profit for the Conversion Roller Wire is \$0. 00, thus indicating that the transfer price is based upon the standard full cost, which in turn generates zero profit or loss.

Thus we can summarise this finding in the sense that we cannot drop the product Conversion Roller Wire from Lehigh's product mix. However we can argue that the transfer price is not high enough. ABC shows that the standard cost is wrong and that it is too low, thus generating a loss for the product, thus the actual cost is higher indicating the transfer prices needs to

be higher. Lehigh is a cost centre and thus in order for it to make a profit, it must drive costs down and one way in which this can be achieved is increasing the transfer price of the Conversion Roller wire to Palmer to decrease costs. If this is achieved, then the overall group and parent company's profit will be unchanged, but could be very beneficial to Lehigh if successful.

We can further analyse the ABC results that we have produced. Within some costs, depreciation is included which raise some issues. Depreciation is an activity that drives overheads which then contributes to product costs, however the total cost allocated to each product has been allocated via cost drivers such as melt machine hours, refine machine hours, finish machine hours etc. This allocation of depreciation into the costs may lead to the incorrect highlighting of true resource consumption by the products.

In further analysis of the ABC calculations, we can see that activity - Technical support has been allocated the cost driver of stock keeping units - SKUs. However, from exhibit 2, Lehigh's product summary, we can see that each product has a different number of grades and a different number of products. We also know that technical support includes the metallurgists who are qualified scientists that spend 80% of their time on the niche product lines. Thus by using a cost driver SKUs we are evenly spreading the cost of technical support across the products. Pricing therefore would be out of line.

After looking at ABC, we can also look into TOC. The idea of throughput accounting is that there is a scarce resource, in this case it is the CRM, and we want to get maximum profit from the bottleneck. Lehigh has a major

difference in this bottleneck compared to normal bottleneck situations however. At Lehigh it is not simple to elevate the bottleneck by purely purchasing additional CRM equipment. There exists only 6 such mills in the US, if to be invested in would cost \$50 million and such an investment in a CRM could not be duplicated in less than five years. This bottleneck therefore is hard to add additional capacity to. Thus in the short term, investing in a new CRM is not an option due to the timescale and large outlay.

TOC theory suggests that spare capacity and idle time are not considered to be detrimental to the overall efficiency of the company, thus in order to increase throughput management at Lehigh should focus attention exclusively upon the constraint - the CRM. This is because the CRM acts as the drum that sets the pace for the entire operation. To increase throughput through the CRM throughput has to be increased throughout the entire system

The results and calculations highlight the fact that the key to profitability is to send the most profitable products through the CRM in the order as ranked earlier on in the report.

Conclusion:

Lehigh is facing a falling market share in the steel industry and must maintain this or increase it if it is to stay as competitive and successful in the steel industry and continue producing highly specialized products to niche markets and general markets. In a recession less premium work is available and thus there are smaller order sizes - i. e there are more customers buying less per order, thus the buyers have a large bargaining power, choice and

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therefore also face long lead times in the CRM constraint. The increased number of smaller orders lead to high costs in terms of order processing costs and thus this needs to be addressed.

The steel industry is comprised of buyers that have great knowledge in what they purchase and thus is a price takers industry, however to improve the situation of losses and decreasing market share, Lehigh needs to make changes in it's pricing and product mix. Lehigh could manipulate the market with pricing.

For example, Lehigh could carry out price increases on speciality or niche markets and thus get the best benefits out of the resources they have. The niche markets for example artificial limbs, or aero-engineering often require stringent requirements to be met and Lehigh has the great ability to do this, with it's metallurgy and engineering technical support who has the best ratio of metallurgist per ton than anyone in the world, Lehigh can begin to take advantage of the niche demand and thus price at a higher level based on it's high levels of quality and thus make a higher profit.

With this strategy however, Lehigh must ensure that its niche markets are not entered by competitors, and must ensure that it's quality and expertise in the market segments remain superior in order to maintain a competitive advantage.

Thus after analysing the standard costing, ABC and TOC we can begin to analyse some options that are open to Lehigh in terms of improving it's product mix. There are many options that are available to Lehigh. The first option that arises after analysing the calculations is that because High Speed

Machine Coil is the most profitable product under ABC and also it has the highest throughput rate per scarce resource that Lehigh could concentrate solely on this product and scrap the rest. This would mean that the highest profits would be made, and at the same time in terms of TOC - the constraint of the CRM would be elevated because the fact that we are increasing the overall throughput in the system.

There is a major side of caution however that needs to be taken with this option however. Consumer taste and demand may change, and if Lehigh did undertake this option to only produce High Speed Machine Coil - then the fall in demand at Lehigh would have catastrophic effects and major losses would be experienced with the fall in demand. Also one must also consider the situation if Lehigh chose only to produce only this product that of a competitor was to come into the industry and sell an identical product at a lower price, then a price war could start - making Lehigh lose profits and having a detrimental effect.

Another alternative option to altering the product mix to make it more profitable is to stop producing Die Steel Chipper Knife altogether. Under standard costing, ABC and TOC, this product is unprofitable and has the least throughput rate per scarce resource and thus it could be more profitable to Lehigh if they undertook another product, or if they scrapped it totally. However one must remember the fact that despite it being an unprofitable product that it is still making a contribution to fixed costs.

The possibility of abandoning the second to least profitable product; Conversion Roller Wire as shown under ABC and TOC has already been

discussed. It is not profitable and does not have a good throughput rate per scarce resource and thus if it wasn't demanded from the parent company could be abandoned in the product mix. However, abandonment is not an option, thus under ABC we showed that the standard cost was too low upon which the transfer prices was based, and thus negotiations could be carried out to increase the transfer price of the product, thus helping Lehigh, yet keeping overall parent profits constant.

A final option that is available to Lehigh is related to TOC. One method of elevating the constraint is to purchase additional capacity, i. e here one option for Lehigh is to obtain another CRM. The implications of initial outlay and time to start up has been discussed already with a cost of \$50 million and a timescale of at least five years, thus in the short term this is not a viable option. However one must consider the possibility of purchasing another firm that already has a CRM - as Palmer did originally with Lehigh.

This would mean that the steel group would own two out of the six CRM in the US. Thus would dramatically reduce any competitive threats that the group faced, as well as elevating the constraint of the CRM and Lehigh could then product the products with the most throughput without any constraints and thus be able to maximise profits.

In suggesting a take over of another company with a CRM and the option of dropping certain products, we also have to think about the consequences upon the workforce. In terms of abandoning High Speed Machine Coil and Die Steel Chipper Knife, this could result in loosing some key workers who

only specialise in these product lines, this in turn would then have major effects upon morale across Lehigh.

These morale issues could then be teamed with productivity, efficiency and absenteeism issues. The niche markets where standards need to be high and maintained, productivity and efficiency are vital, as flaws in products cannot be made due to the application of the products e. g planes etc.

Thus constant communication with the workforce regarding possible takeovers, changes in production and pricing strategies need to be communicated to the staff to ensure effective change. Thus overall Lehigh should negotiate a new transfer price with Palmer - making it higher, thus decreasing losses experienced under Conversion Roller Wire, and should also consider abandoning Die Steel Chipper Knife. Deep consideration into a take over to obtain another CRM has great competitive advantages and production benefits, thus also needs deep consideration into improving Lehigh's product mix, production operations and overall stake in the market with it's market share.

ABC systems can more accurately measure the resource consumed by cost objects. Thus helping to choose the correct product mix for Lehigh Steel.

Assign the cost of activities to products according to the product's demand for activities. (The final calculations can be seen in table 1.)

Determine the cost driver for each major activity (Machine hours, lbs of production, No of SKU's, No of orders.)

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Assign costs to cost pools/cost centres for each activity (From exhibit 4)

Identify major activities that take place in a firm (From Exhibit 6) - Melting, refining, moulding, rolling, and finishing.)

The four step method for ABC:

A case for ABC

Decisions regarding the optimum mix of products to be produced by the bottleneck must be made - this is the case at Lehigh; that TOC will help find the optimum value product mix.

If, in the previous steps, a bottleneck has been broken - go back to step 1.

Elevate the system's bottlenecks

Subordinate everything else to the decision in step 2

Decide how to exploit the bottlenecks

Identify the system's bottleneck (At Lehigh: CRM)

A case for TOC (5 step method)