**Hot Bricks Inc. Costing Systems**

**Introduction**

Hot Bricks Inc. is a manufacturing company and global provider of high temperature bricks that are specially produced for use in high temperature and chemically corrosive environments. For years, Hot Bricks Inc. only produced and sold one product: the HB22, which is useful in settings up to 2200 degrees Fahrenheit. Through their research and development, they were able to formulate and produce two new brick products, the HB27, and HB29, using the same raw materials and the same infrastructure used for the HB22. The components that make up the bricks are as follows: high-purity refractory clay that serves as the primary binder; alumina, for the higher temperature applications; and organic pellets that eventually burn out but provide a uniform pore structure within the brick that is desirable to customer. Each brick product is fired in an oven at a temperature just above their suggested use temperature to give them the desired properties. Once fired and cooled, the bricks are ground to the desired size.

**Brick Making Process**

The manufacturing process begins with mixing, where the desired materials for the type of brick are added. The bricks are then formed using molds. One batch of the mixing process produces 500 bricks in molds which are then allowed to air dry to remove excess moisture that could cause the bricks to crack in the firing process. The bricks then undergo *firing* at high temperatures in furnaces called kilns. These kilns have a number of burners through which fuel, natural gas, enters the furnace. The firing process involves several steps. Preheating removes the water leftover from the drying process. The temperature increases to the desired level for a period to cause a chemical and physical change to the brick. In the final cooling stage, the temperature decrease must be slow and steady to prevent bricks from cracking. Bricks fired to higher temperatures require more fuel because additional gas is required to achieve the needed higher temperature and because these bricks have to pass through the kiln more slowly.

After being fired and cooled, the bricks all pass through an automatic grinding machine which uses specialized grinding wheels to grind them to the desired size. Production managers have suggested that the new brick products, require more time to grind and cause more wear on the grinding wheels. They believe it is because the higher temperature used to fire them makes them harder.

On occasion, customers require specially shaped bricks. In order to achieve the special shapes, these bricks undergo additional grinding by hand.

**Assigning Costs**

Hot Bricks Inc. developed their current costing system when they only produced the HB22. That cost system has two main cost categories for producing brick products; material costs and conversion costs. Both costs are allocated to each brick produced. The current material cost for a single brick of products HB 22, HB 27 & HB 29 are $4.00, $5.00 & $6.00 respectively. This cost is a function of the material composition and volume required for the molds. In the past, Hot Bricks Inc. has allocated all other manufacturing costs (labor and overhead) using a traditional (simple) cost system based on production volume. Several years ago, when HBI only made the HB22 bricks and did not provide special shapes, they determined that the indirect cost a brick was about $4.75. A recent analysis shows that that the average indirect cost for the bricks produced is about $5.50 per brick. Management originally attributed the cost increase to incremental increases in their indirect cost items although they could not put their finger on specific possible increases. To address the additional costs, management raised prices on all of their brick products. After the price change, HBI management was excited to see that they were gaining market share for the HB27 and HB29 products more quickly than expected. This was certainly view as welcome surprise as demand for their flagship product, HB22, was unexpectedly decreasing despite a fantastic reputation in the market as a high quality product. On an additional note, the company has also seen an increase in the number of special shapes ordered.

HBI’s longstanding senior accountant has requested an “emergency” meeting with upper management. Although normally calm, Tom has seems more anxious since HBI began selling their new products. His early P & L analysis shows that the company is not making the profit that they expected given the popularity of their new brick offerings. After some initial investigation, Tom no longer believes that costing system is providing accurate costs and he is asking for resources to evaluate two potential alternate costing systems. Specifically, Tom has identified two activities (firing and grinding) whose costs may be misallocated. Tom want to compare two new costing options to their current method and evaluate how cost allocation using these three methods would differ for their December production.

For the month of December, Hot Bricks Inc. made brick sales to four different customers. Each customer bought a different mix of the three firebrick products. One of these customers purchased bricks that also required special hand grinding. Exhibit 1 shows a breakdown of each customer’s order.

The following are the two methods that Hot Bricks Inc. is considering.

Option 1: Use a refined costing system, like activity based costing. Exhibit 2 shows a breakdown of the total conversion costs, with separate columns provided for key production activities of firing, grinding, and hand grinding according to what is required by each type of brick produced in December. Management feels that the hand-grinding costs should only be assigned to bricks that are hand-ground. Management can track the quantity of BTUs used for each product type and wants to use that information to assign all firing costs. Management is still deciding how to best assign grinding costs, but they feel that the remaining conversion costs are still driven by volume regardless of the product type.

Option 2: As a more simplistic method, management is considering assigning all conversion cost to bricks based on the material cost of the bricks. In this method, the bricks with the highest material cost would also have the highest conversion cost assigned. Management believes that using material costs is a better allocation base than volume because the products with higher material costs also require more gas to be fired and cause greater wear on the grinding wheel. Recent analyses of December cost information shows conversion costs would be 1.20 times the material costs.

As a cost accountant working in the Hot Bricks Inc. office, you are being asked to evaluate the cost system options by answering the following questions based on you study of ABC and using information provided in the case and the exhibits. Make sure to show your calculations.

**Questions**

1. In general, what factors affect whether a company should consider refining their costing system? What steps can companies take to refine their cost system?
2. What is product costing cross-subsidization? Why is Hot Bricks Inc. at risk of product costing cross-subsidization? What general problems might a company experiencing product costing cross-subsidization face?
3. Based on information provided in the exhibits, what is the average overhead cost allocated per brick for Hot Bricks Inc. in December? What is total cost of each type brick under this cost assignment method?
4. Briefly describe the four cost hierarchy categories in ABC and why it is useful to assign cost to these categories. Would you agree or disagree with the statement that costs of firing, grinding and hand-grinding activities are all unit-output costs. Briefly explain your answer.
5. Under option 1, firing costs are to be allocated to brick products based on the total BTUs used. Use the information in Exhibit 2 to determine a) how many BTUS are used by each brick product category b) what percentage of BTUs are used by each product category, c) how much firing cost should be assigned to each product category and d) what is the firing cost per brick within each category.
6. For option 1, how much “Other” conversion cost will be assigned to each brick using a per-brick volume-based approach?
7. For option 1 and with given the information available, how would you choose to assign standard grinding cost? What would be the standard grinding cost per unit for each type of brick? Is there other information about grinding you want to know to better assign grinding costs?
8. How would you assign the hand-grinding cost to each brick? What would be the hand-grinding cost for each brick?
9. Consider your answers to questions 5, 6, 7 & 8. Under option 1, how much conversion cost and total cost would you allocated to products HB 22, HB 27, and HB 29 and hand ground HB 27.
10. Under option 2, Hot Bricks Inc. estimated that conversion costs would be a percentage of material costs. Using information from December, demonstrate that the conversion cost would be 1.2 times the material costs. What would be the total cost of each brick type. Create a table to compare the different cost of HB 22, HB 27, HB 29 and HB 27 hand ground across three methods: the original volume-based method, the activity-based costing method (option 1) and the material-based method – option 2.
11. Discuss the cost differences between the methods; discuss the benefits and drawbacks of using option 1 or option 2 to replace the traditional costing method. What cost system recommendation would you make? Supplemental option: Create a table to show how the cost of customer orders differ across the costing systems and comment.
12. Do you think that the company would benefit separating out the cost of the batch mixing process and assigning those costs to products with another cost driver? Why or why not?
13. Consider the market response to the new products and the cost data of HB 22 as the only product, write a brief summary of what you think really happened as a result of adding the two additional products and the option to offer special shapes. What do you suggest HBI do?

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| **Exhibit 1** |  |  |  |  |  |  |
| **Firebrick Products** | |  |  |  |  |  |
| **Product** | **Temperature (F)** | **Average BTUs required per Hour** | **Hours in the oven** | **Material Cost per Brick** | **Total Material Costs** | **Selling Price per Brick** |
| HB 22 | 2200 | 2,100,000 | 7 | $4 | $28,000 | $14.40 |
| HB 27 | 2700 | 2,500,000 | 4.8 | $5 | $20,000 | $18.00 |
| HB 29 | 2900 | 3,000,000 | 3 | $6 | $12,000 | $21.60 |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **Exhibit 2** |  |  |  |  |  |  |
| **Conversion Costs for December** | |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total** | **Firing** | **Grinding** | **Hand Grinding** | **Other** |  |
| Depreciation | $20,000 | $5,000 | $3,000 | $600 | $11,400 |  |
| Labor | 10,000 | 1,000 | 0 | 200 | 8,800 |  |
| Energy (gas) | 30,000 | 15,000 | 1000 | 200 | 13,800 |  |
| Other | 12,000 | 1,000 | 0 | 0 | 11,000 |  |
| **Total** | **$72,000** | **$22,000** | **$4,000** | **$1,000** | **$45,000** |  |
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|  |  |  |  |  |  |  |
| **Exhibit 3** |  |  |  |  |  |  |
| **December Customers** | |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **Customer** | HB 22 | HB 27 | HB 29 | **Total Bricks produced and Sold** | **Bricks Needing Hand-grinding** |  |
| Automotive | 1000 | 1000 | 1000 | 3000 | 0 |  |
| Bio-technical | 1000 | 0 | 0 | 1000 | 0 |  |
| Chemical | 5000 | 1000 | 0 | 6000 | 500 HB 27 |  |
| Diesel | 0 | 2000 | 1000 | 3000 | 0 |  |
| Totals | 7000 | 4000 | 2000 | 13000 |  |  |

**Solution and discussion**

* 1. In general, what factors affect whether a company should consider refining their costing system?
     1. High-level of product diversity or recent increase in product diversity. That is the degrees to which the products use productions resources differently.
     2. High-level of indirect costs or recent increase in indirect cost
     3. A level of competition that requires accurate cost information to ensure effective production and pricing decisions.
  2. What steps can companies take to refine their cost system?
     1. Direct cost tracing – Where possible trace cost directly to the products.
     2. Assign indirect cost into homogenous cost pool.
     3. Assign cost to products with using an allocation base that has a cause and effect relationship ( i.e. a cost driver)
  3. What is product costing cross-subsidization?
     1. Product costing cross-subsidization describes a scenario when costs that should be assigned to one product are assigned to other products as a result of trying to uniformly assign costs across diverse products. Whenever one product is assigned to much cost, at least one other product is assigned too-little cost.
  4. Why is Hot Bricks Inc. at risk of product costing cross-subsidization?
     1. Three areas where Hot Bricks Inc. currently faces cross-subsidization is in firing, grinding and hand-grinding. By assigning firing cost per brick, the extra cost required by HB29 is being assigned to HB 27 and HB 22 which use less fuel. Similarly, the extra grinding cost required by HB29 is being assigned to HB 27 and HB 22. Lastly, the cost of hand-grinding is being subsidized by all of the other products. Because only certain customers require bricks that need to be grinded by hand, a better method of assigning costs would be to assign the hand grinding cost to only the customers that require it.
  5. In general, what problem(s) might companies face due to product costing cross-subsidization?
     1. When a traditional costing system over-costs a product relative to its ABC cost …
        1. The product price might be set too high which could result in sales to competitors with lower prices.
        2. Managers may waste effort to lower costs.
        3. Manager may discontinue a profitable product
     2. When a traditional costing system under-costs a product relative to its ABC cost
        1. The product price might be too low result in loss of profitability.
        2. Managers will not be motivated to lower costs.
        3. Managers may retain a product that is unprofitable.

1. $72,000/13,000 = $5.54 of Overhead cost per brick.
   1. HB 22 cost would be 5.54 + 4.00 =9.54
   2. HB 27 cost would be 5.54 + 5.00 =10.54
   3. HB 22 cost would be 5.54 + 6.00 =11.54
2. Cost hierarchies -
   1. Output Unit – level: These costs are for activities that are performed on every unit of product.
   2. Batch – level – The are cost required for a batch process that impacts a varied number of products.
   3. Product -sustaining level – these are ongoing cost that are required to sustain products regardless of the number of units produced or batches made.
   4. Facility – sustaining – cost that support the organization as a whole

It is not always easy to identify appropriate cost driver for activities. After classifying costs into a cost hierarchy category, it may be easier choose the appropriate cost driver. We agree that arguments could be made for these cost to be placed in several cost categories. We typically view and present unit-based costs as appropriate when units, regardless of product, get the same treatment and therefore the same cost. We typically view batch activities as having the same one time activity cost while recognizing that a different number of units may benefit from that cost. That leads me to conclude that product-sustaining is the best fit.

1. BTUs/hr # hrs BTUs Used

HB 22 2,100,000 x 7 = 14,700,000

HB 27 2,500,000 x 4.8 = 12,000,000

HB 29 3,000,000 x 3 = 9,000,000

Total = 35,700,000

HB 22 14,700,000 /35,700,000= 41.14% of total BTUs x $13,800 = $5,677

$5677/7000 = .811 per brick for BTUs

HB 27 12,000,000/35,700,000= 33.63% of total BTUs x $13,800 = $4,641

$4,641/4000 =1.16 per brick for BTUs

HB 29 9,000,000/35,700,000= 25.23% of total BTUs x $13,800 = $3,482

$3,482 / 2000 = $1.741 per brick for BTUs

1. Volume based conversion costs, excluding firing, grinding, and hand grinding costs are $45,000. Assigned per 13,000 bricks = 45,000/13,000= $3.46 per brick.
2. Standard grinding costs for all bricks produced were $4,000 but not all units are the same, so volume-based assignment is not a likely option. However, knowing the volume-based average cost of .308 per brick may help accountants evaluate other methods.
   1. Based on BTU costs
      1. HB 22 = 41.14% of $4000 1645.6/7,000 brick = .235 per brick
      2. HB 27 = 33.63% of $4000 1345.2/4,000 brick = .3363 per brick
      3. HB 29 = 25.23% of $4000 1009.2/2,000 brick = .5046 per brick
   2. Based on material costs
      1. $4,000/$60,000 = .067 cents per dollar of material
         1. HB 22 would get .267 dollars per brick
         2. HB 27 would get .333 dollars per brick
         3. HB 29 would get .40 dollars per brick
   3. It should be noted up front that the standard grinding cost pool is fairly small. Therefore misallocation would have relatively little impact. This could be a factor in deciding how much additional work will be required to assign grinding costs. There is no right answer based on the information available. An advantage of using the BTU approach is that the grinding costs can be added to the firing costs for relatively easy assignment. It could be possible to assess whether management believes that each HB 29 brick uses twice as much grinding resources as each HB 22. Assigning grinding cost base on material cost would require additional calculations and record keeping. Other information that could be used would be using grinding time or the use of grinding supplies such as grinding wheels.
3. Hand grinding cost

$1000/500 brick = $2 per brick

1. Activity-based costing

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Brick product | Firing | other | Standard Grinding | Hand grinding | Total overhead | Material cost |  |
| HB 22 | .811 | 3.46 | .235 |  | 4.51 | 4 | 8.51 |
| HB 27 | 1.16 | 3.46 | .3363 |  | 4.96 | 5 | 9.96 |
| HB 27 hand ground | 1.16 | 3.46 | .3363 | 2.00 | 6.96 | 5 | 11.96 |
| HB 29 | 1.741 | 3.46 | .5046 |  | 5.71 | 6 | 11.71 |

1. First determine the total cost of material from December

HB 22 = ($4 \* 1000\* 7) = 28,000

HB 27= ($5 \* 1000\* 4) = 20,000

HB 29 = ($6 \* 1000\*2) = 12,000

Total material costs 60,000

* 1. Determine the actual conversion rate
     1. $72,000/$60,000 =$1.20 of conversion per dollar of material
  2. Cost of each brick
     1. HB 22 cost would be 4.00 + 4.80 (4.00\*1.20) =8.80
     2. HB 27 cost would be 5.00 + 6.00 (5.00\*1.20) =11.00
     3. HB 29 cost would be 6.00 + 7.20 (6.00\*1.20) =13.20

|  |  |  |  |
| --- | --- | --- | --- |
|  | Traditional | ABC | Material based |
| HB 22 | 9.54 | 8.51 | 8.80 |
| HB 27 | 10.54 | 9.96 | 11.00 |
| HB 27 hand ground | 10.54 | 11.96 | 11.00 |
| HB 29 | 11.54 | 11.71 | 13.20 |

Of the three options, the ABC method is the best. The fact that the ABC method is the only method to address the hand grinding cost makes it the best choice. With small amounts of hand grinding this is not an issue. However, if hand-grinding became more common it would present a significant problem. Also, while material cost currently mimics the increase in resources, there is nothing to suggest that it will always do so. As a result, changes in prices of materials would cause a change in cost allocation even though units use of resource is not altered. A review of how much customer costs change across the methods also suggest the company should use the method that best reflect the use of resources despite the additional record keeping required.

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| --- | --- | --- | --- | --- | --- | --- |
| Traditional | Automotive | 9540 | 10540 | 0 | 11540 | $ 31,620.00 |
|  | Bio-technical | 9540 | 0 | 0 | 0 | $ 9,540.00 |
|  | Chemical | 47700 | 5270 | 5270 | 0 | $ 58,240.00 |
|  | Diesel | 0 | 21080 | 0 | 11540 | $ 32,620.00 |
|  |  |  |  |  |  |  |
| ABC | Automotive | 8510 | 9960 | 0 | 11710 | $ 30,180.00 |
|  | Bio-technical | 8510 | 0 | 0 | 0 | $ 8,510.00 |
|  | Chemical | 42550 | 4980 | 5980 | 0 | $ 53,510.00 |
|  | Diesel | 0 | 19920 | 0 | 11710 | $ 31,630.00 |
|  |  |  |  |  |  |  |
| Material based | Automotive | 8800 | 11000 | 0 | 13200 | $ 33,000.00 |
|  | Bio-technical | 8800 | 0 | 0 | 0 | $ 8,800.00 |
|  | Chemical | 44000 | 5500 | 5500 | 0 | $ 55,000.00 |
|  | Diesel | 0 | 22000 | 0 | 13200 | $ 35,200.00 |

1. Although there is a batch process for mixing, the fact that all batches produce the same number of units and that the batching cost is the same regardless of the product effectively make this a volume-based unit output activity that would not benefit from being treated as a separate activity.
2. There is nothing present in the case to really explain why the cost of the original product HB22 should increase because two additional products were added. Additional review into the cases suggest that the extra cost of the HB22 is coming from being assigned incrementally higher firing and grinding costs that required by HB27 and HB29. The increase in demand of HB27, HB29, and the specialty shapes suggest that customer see those prices as good deals. However, not achieving expect profit levels is the result of incurring additional cost to make those products and failing to recoup those costs with low prices. The lower demand for the HB22 is likely from customers viewing the new price as too high. As demand for the newer products increase, the monthly costs will likely increase at a higher rate. With more accurate cost information, HBI can now adjust their prices to maximize profits by balancing demand and unit profitability.

Teaching notes:

This case is based on one of the author’s experiences as sales engineer at a brick manufacturing plant. This cases was designed to demonstrate the costing problems that can occur when adding new products, even in the simplest setting. The case provides some basic background of the manufacturing process and market conditions, thus providing sufficient context to help students understand where ABC is beneficial and how it can be applied. The cases requires students to making cost calculations, make choices about possible cost drivers that could be used for an activity, and discuss comparison of cost difference among the cost systems considered. Students must conclude with a discussion of how there finding match with the company’s current marketing conditions.

Learning opportunities:

* Application of ABC costing
* Reconciling inaccurate costs with market conditions
* Reconcile tradeoffs between the benefits and costs of an ABC system

Implementation guidelines – I give this case as an in-class assignment. I found an existing ABC case, Forest Hills paper company, that had a similar framework to my design of this case. I typically, provide my students with the forest Hills case and solutions as a study guide for this case. Students

Evidence of efficacy- I have used a similar version to this case in each of the last two years in an in-class setting that gives Master’s students 2 hours to complete the case. Students have consistently accomplished the more routine questions, and have often provided extraordinary answers to questions . When presenting the solutions in a case review, students were quickly able to understand what they m

1. In general, what factors affect whether a company should consider refining their costing system? What steps can companies take to refine their cost system?
   1. This was designed to draw student attention to some of the more explicit concepts in ABC as a way to help them frame the types of decisions that they will consider in the case.
2. What is product costing cross-subsidization? Why is Hot Bricks Inc. at risk of product costing cross-subsidization? What general problems might a company experiencing product costing cross-subsidization face?
   1. This question also draws students attention to a key ABC concept , while asking them to consider the implication of the concept to the company in the case.
3. Based on information provided in the exhibits, what is the average overhead cost allocated per brick for Hot Bricks Inc. in December? What is total cost of each type brick under this cost assignment method?
   1. This question just asks student to make a volume-based calculation. In part, it reinforces the simplicity of assigning cost in this manner. However, several students have shown propensity to over-complicate this question assuming that it was too easy.
4. Briefly describe the four cost hierarchy categories in ABC and why it is useful to assign cost to these categories. Would you agree or disagree with the statement that costs of firing, grinding and hand-grinding activities are all unit-output costs. Briefly explain your answer.
   1. The purpose of this question is to make student think hard about these classifications.
5. Under option 1, firing costs are to be allocated to brick products based on the total BTUs used. Use the information in Exhibit 2 to determine a) how many BTUS are used by each brick product category b) what percentage of BTUs are used by each product category, c) how much firing cost should be assigned to each product category and d) what is the firing cost per brick within each category.
   1. This question attempts to guide student towards the a cost allocation method based on BTUS.
6. For option 1, how much “Other” conversion cost will be assigned to each brick using a per-brick volume-based approach?
   1. This question asks student to make a volume-based calculation on a portion of the costs. It reinforces the facts that some of the cost are still volume-based.
7. For option 1 and with given the information available, how would you choose to assign standard grinding cost? What would be the standard grinding cost per unit for each type of brick? Is there other information about grinding you want to know to better assign grinding costs?
   1. This question is designed to make students choose between a few obvious options ( material-cost based costing, temperature-based costing, or volume based, but further makes them explain why that option is appropriate. As the instructor, I am pretty lenient in my grading on this question. I consider the best answer to be temperature-based because it is already being used for firing costs and can be lumped in together. I acknowledge that material-cost base does assign more cost to units that are harder to grind and that material cost is also already being measured, so it is acceptable. I typically take off points if the students propose volume base cost unless they point out volume is already being used and that the cost size of the cost pool is relatively small.
8. How would you assign the hand-grinding cost to each brick? What would be the hand-grinding cost for each brick?
   1. This question was designed to introduce the idea of a cost that can be traced to a specific set of brick or to a customer as a whole, when a single customer buys all of the hand-ground brick.
9. Consider your answers to questions 5, 6, 7 & 8. Under option 1, how much conversion cost and total cost would you allocated to products HB 22, HB 27, and HB 29 and hand ground HB 27.
   1. This questions just asks students to put together the pieces from previous questions and gives them an opportunity to assess whether their answers as consistent with other information.
10. Under option 2, Hot Bricks Inc. estimated that conversion costs would be a percentage of material costs. Using information from December, demonstrate that the conversion cost would be 1.2 times the material costs. What would be the total cost of each brick type. Create a table to compare the different cost of HB 22, HB 27, HB 29 and HB 27 hand ground across three methods: the original volume-based method, the activity-based costing method (option 1) and the material-based method – option 2.
    1. This questions requires students to back into the given rate and them makes them compare all of the costs methods considered.
11. Discuss the cost differences between the methods; discuss the benefits and drawbacks of using option 1 or option 2 to replace the traditional costing method. What cost system recommendation would you make? Supplemental option: Create a table to show how the cost of customer orders differ across the costing systems and comment.
    1. This is where students get to explain why the costs are different and what the implication of those differences are. The supplemental question asks students to assign the costs to customers and provide insight into how the customers might respond to prices that are consistent with the different costs
12. Do you think that the company would benefit separating out the cost of the batch mixing process and assigning those costs to products with another cost driver? Why or why not?
    1. This is a bit of a trick question to make student thinks about the cost categories and leave them with the take away that just because the word batch is used, the activity is now also a volume based activity.
13. Consider the market response to the new products and the cost data of HB 22 as the only product, write a brief summary of what you think really happened as a result of adding the two additional products and the option to offer special shapes.
    1. The case concludes asking student to reconcile the cost findings with the market conditions.