The use of Knowledge Based Tools for Managing Product Cost at Harley-Davidson – A case study

Abstract

Managing product cost through the process of development is an industry-wide challenge. Harley-Davidson has recently modified its process for new product development cost management to better focus on managing product cost through all development. This process links the cost of new products to corporate financial objectives and provides for an iterative process of cost understanding with development objectives. A critical element of the process requires early and accurate cost understanding. This paper presents a case study depicting how Harley-Davidson is using Knowledge based tools in the understanding of product cost during early development to assist in striking a balance between Quality, Cost, Timing, and Function to deliver consistent corporate financial performance.

Introduction

Over the past 15 years, Harley-Davidson has seen the demand for its products grow over 5 fold and now commands roughly 50% of the US Market. The company's stock value has grown steadily over this period from a 1986 prices of $37/share to a 2000 equivalent of nearly $200/share. This financial performance has become a record that investors and corporate leadership have come to expect. As new product introductions continue to play a significant role in Harley-Davidson's future revenue and profit, a significant contributor to maintaining financial growth into the future has been identified as New Product Cost Management. At Harley-Davidson, Product Cost Management is the mechanism that supports the development community in delivery of products that meet corporate targets.

Harley-Davidson Product Cost Management Overview

The intent of Product Cost Management at Harley-Davidson is precisely that; Cost Management not Cost Control. The Goal of Cost Management is to assist in striking a balance in the elements of Quality, Cost, Timing, and Function during product development through early and accurate understanding of product cost. Harley-Davidson has developed and implemented a Company-wide process to link corporate objectives directly to new product development initiatives. The Harley-Davidson Product Cost Management process encompasses two elements, *Target Based Performance* and *Business Planning*.

Business Planning is the element of the Cost Management Process that links the corporate objectives for the business to the new product development process. Business Planning considers the elements of Quality, Cost, Timing, and Function and determines thresholds and priorities for a project. For this purpose, Quality, Cost, Timing and function are defined as follows:

Quality: Conformance to requirements.

Cost: Internal – Cost structure (What it takes to make the product).
External – Price (What it costs to purchase the product).

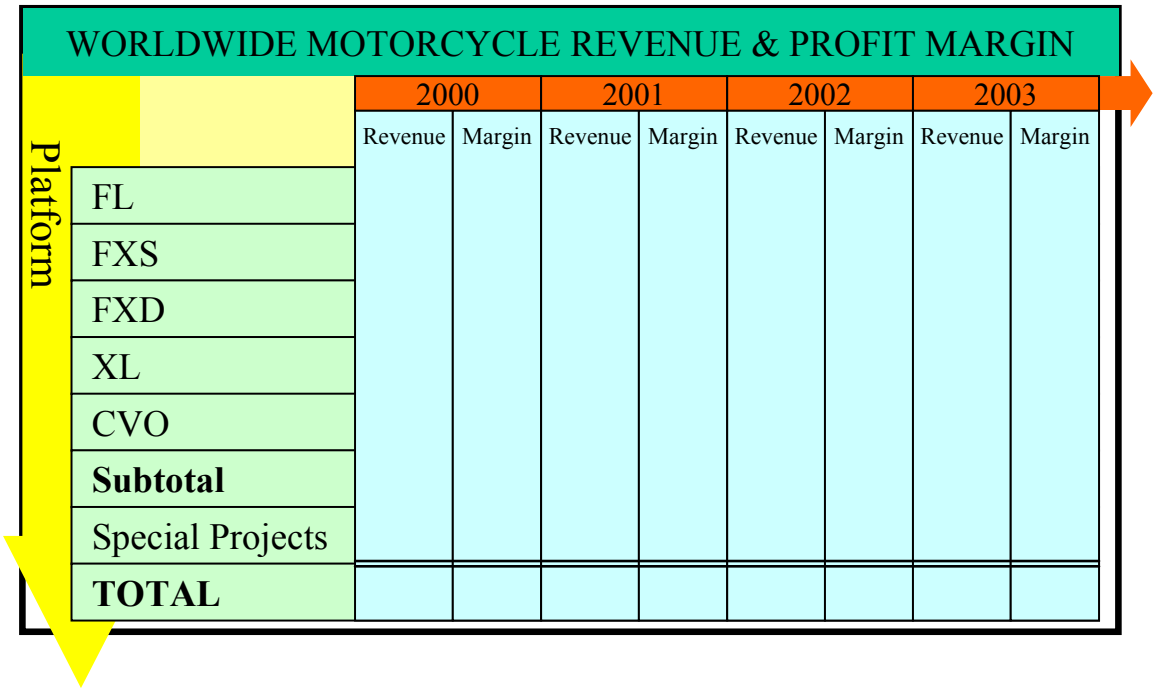
Timing: Internal – How Long the product takes to develop.
Externally – When it is available to the public.

Function: What the customer gets.

Target Based Performance is a three-step proactive process for 1) setting and validating Quality, Cost, Timing, and Function targets; 2) measuring project progress to these targets; and 3) managing cost gaps proactively.

Case Study of Product Cost Management at Harley Davidson

In the introduction of new products, the first element generally encompasses a request from the marketing department or a proposal from the Product Planning Committee describing a new vehicle and how it fits within the product portfolio. The product proposal is slotted into the vehicle line-up and the corporate business plan through an iterative process as the business case is developed. The visibility to corporate financial objectives is critical and is monitored in the format shown below.



In this case, a business proposal was developed for a new motorcycle. Quality, Cost, Timing, and Function objectives were identified, and the project was placed within the business matrix as identified above. In the course of developing and setting objectives, an iterative process is used comparing desired objectives to projected values until a balance is achieved between the needs of the marketplace and the capabilities of Harley-Davidson and our supply base. In order to deliver a successful product that meets all objectives it is critical that accurate understanding of the future cost be developed early in the development process. In assistance to the Quality – Cost – Timing – Function balancing process, a cost analysis is conducted on the proposed design changes. For this new motorcycle we undertook the task of validating cost targets by determining the future cost of the major systems that were changing using the Boothroyd-Dewhurst concurrent cost software. This paper describes one of those systems: the frame.

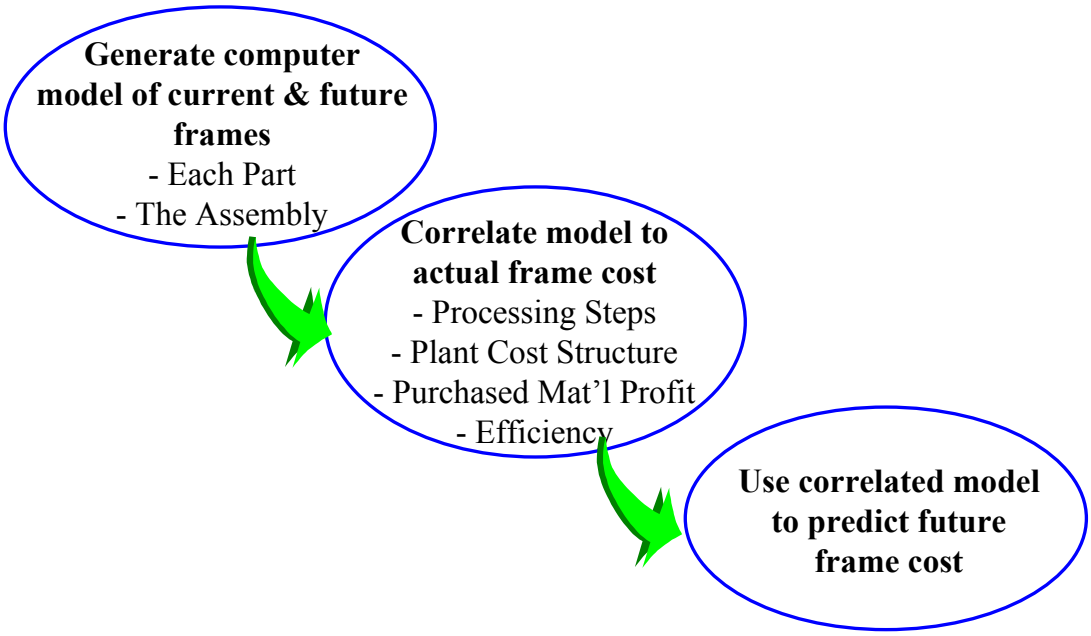
The Boothroyd-Dewhurst tool is being used within Harley-Davidson in two related, but distinct ways. Early in the design stage the tool can be utilized to help Design Engineering rapidly determine the relative cost difference between design alternatives. Once a design direction has been set and cost targets are required it becomes important to understand the absolute cost of the future design. It is during this stage where it becomes necessary to correlate the software model to the cost structure of the producing plant whether in-house or supplier. This allows realistic, achievable cost targets to be established. The frame cost estimating and target validating example will describe the second use of the software, i.e., understanding absolute cost

We believe that when attempting to determine an absolute cost it is important to correlate by modeling an existing product. As this was the first major application of the Boothroyd-Dewhurst software at Harley-Davidson there was considerable skepticism as to the accuracy of tool.

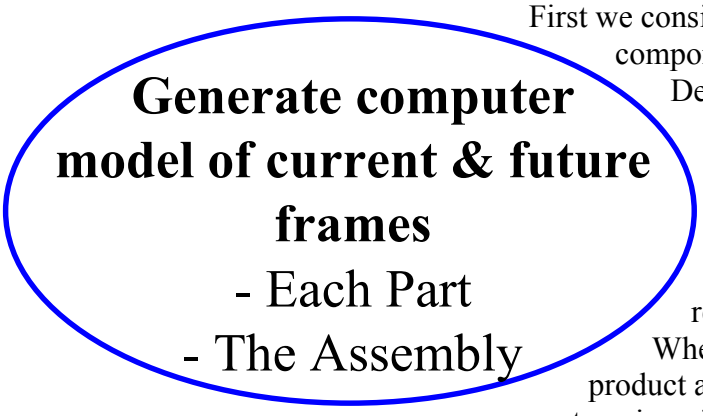
The new automated frame line was expected to deliver a $70 cost savings over the existing frame. It was commonly believed that reduction in labor due to automation would more than offset the increase in material cost being driven by more complex purchased components. This $70 was going to be spent on other functional improvements to the vehicle so it was important to verify the validity of this target.

A three-step process is followed to arrive at absolute cost for a current and future design.

Steps to Estimate Current and Future Frame Costs:



Step 1:

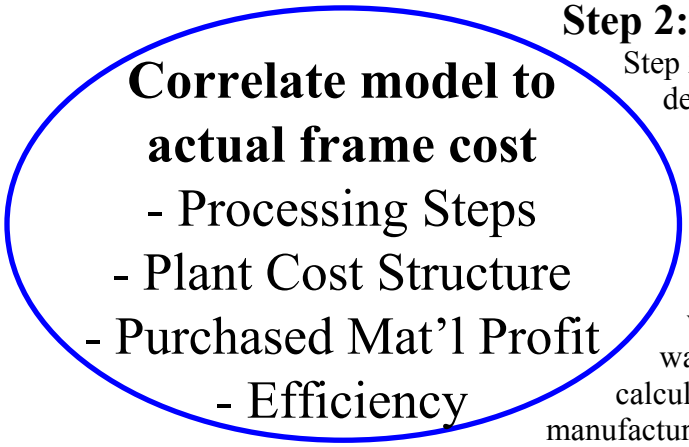


First we considered a Parametric Cost Estimate of each component of the existing frame using Boothroyd-Dewhurst software.

Each component and each assembly element was analyzed to determine the total cost of the frame. Because the method of production determines the cost building the model required the process steps to make the part. When generating a cost for a new part, process and product are designed simultaneously resulting in true concurrent engineering.

The output of Step 1 was a preliminary process and cost for each part and the frame assembly.

Step 2:



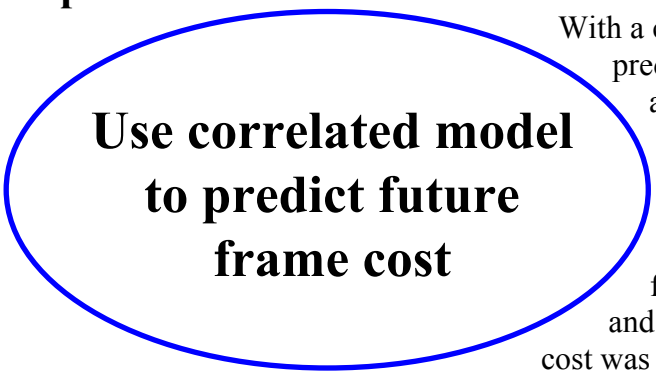
Step 2 was the critical step in not only determining absolute cost but in establishing credibility for the software.

With the involvement of the entire development team 1) the process flow was corrected, 2) the actual plant cost structure was considered, 3) purchased material profit was included, and 4) operating efficiency was calculated. This was accomplished at the manufacturing facility with Designers, Operators, Process Engineers, Cost Engineers, and Plant Finance working together to ensure the model was representative of current frame production.

An unexpected benefit of this close collaboration was the understanding by all parties of the cost they could, and could not influence. The designer could see that, while his design could impact material, direct labor, and supplies, he could not change the plant overhead allocated to his product.

How accurate was the model? By factoring in the purchased material profit, which is necessary because the software calculates cost, not price, the model predicted the material cost of the current frame within $0.50 (0.5%).

Step 3:



With a correlated model the team was now able to predict the cost of the future frame. As in Step 1 all parts and the assembly of the new frame were modeled. The designer and operators were intimately involved in determining the correct steps for the future automated process. With the output of the model and by factoring in plant overhead, planned spending, and the previously calculated efficiency factor a cost was developed for the new frame.

The outcome? With diligent review of the design and process it was discovered that, instead of saving $70 the new frame would be $7 more expensive than the current frame. And, more importantly, the frame would not provide savings to offset improved function.

How accurate was the model? At the time of the modeling exercise supplier quotes had not been received for many parts of the new frame. There was considerable skepticism to the conclusion that the new frame would cost more than the existing frame. Two weeks after completing the model, however, Materials Management had received all quotes and, although the final accuracy will not be known until the new frame is in production, the model predicted material cost within $2 (1%).

With this knowledge the product development team comprised of Engineering, Marketing, Materials, Manufacturing, and Cost Management was able to revisit the business case assumptions and strike a new balance between Quality, Cost, Timing, and Function that would still deliver marketplace and corporate requirements. In the past this knowledge would not have been available until the time of launch when it was too late to strike a new balance. Cost targets were seldom achieved. The knowledge that the new frame would not meet its initial cost target was made available to the team nearly two years before production.

The benefits of using a software tool that drives concurrent design of part and process are many. By acknowledging that process drives cost there is better collaboration between designers and manufacturing during the early stages of design. Also, the software provides the tool for capturing all the assumptions in material, process, and assembly that drove the cost estimate. As any of these assumptions change during development the model can be updated to determine a new estimate.

As a result of this exercise, we were able to determine that the objective of $70 cost savings was not reasonable. In the process we also determined that the analysis tools we are developing can 1) give very accurate information that correlate with known cost of existing product and that 2) we can project future cost.

As demonstrated in this frame example, the Product Cost Management Process results in

1. Concurrent design of Product and Process
2. Understanding of Cost structure.
    - The Design Group knows what cost they can influence
    - The Plant knows what cost they control
3. Cost reduction ideas and design modifications that can be modeled
4. Lead time to strike a balance in Quality, Cost, and Timing.

Early and accurate cost understanding allows the development team to proactively manage the numerous changes normal to the development of a complex product.