The Positive Impact of Supply Chain Visibility on Design-to-Cost

"Treating cost as a required design parameter is important"[1]

Designers have the greatest impact on product life cycle cost

Problem:

Deep in a design problem, an engineer may not notice cost blowouts in the Bill of Materials (BOM) until they click "Report -> Bill of Materials". Coarse views of the BOM seldom reveal this issue until it's too late.

Electronic design teams face a daunting challenge in rapidly fluctuating global markets. Challenged with ever-shorter time-to-market requirements, design teams need to understand and mitigate against supply chain risks during the design process. This is particularly crucial since choices made during the design phase impact 70% of the life cycle cost of a new product (See Fig. 1)[2]. Another source estimates this impact as being even higher, in the range of 70-80%[3]. Another expert, Kenneth Crow, states that the cost structure in a company is locked in place because it is based on design decisions about the company's products.[4]

Product design teams often overlook supply chain risks. Even if they do focus on costs, someone on the team typically must enter data into an Excel spreadsheet for each component. This approach causes data entry errors which will inevitably occur. The spreadsheet may also not include lead times, volume pricing, volume capacity, or logistics information.

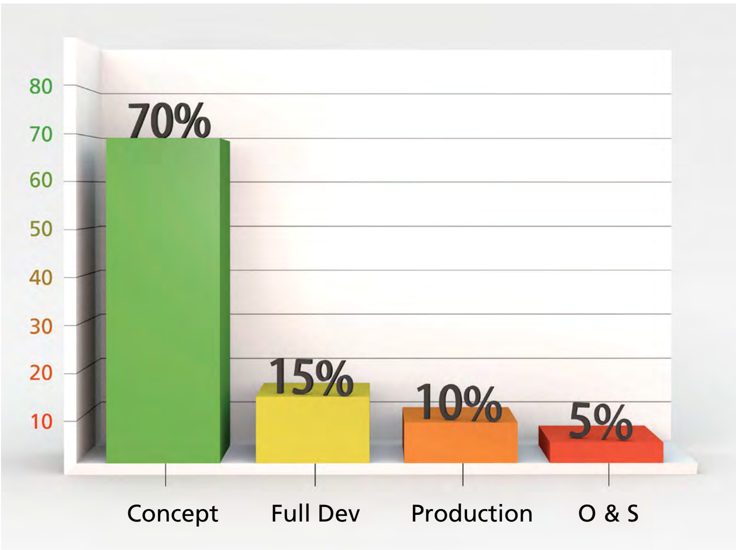


Figure 1: Leveraged Effect of Design Phase on Life Cycle Costs
Source: Military Electronics/Countermeasures, August 1990.

To gain and maintain competitive advantage, the design team needs access to real-time supply chain data to assess design choices with cost objectives in mind. This well-developed process is called "Design-to-Cost."

Just what is Design-to-Cost (DTC)?

- DTC is a management technique
- DTC is part of the development and production process
- DTC requires early establishment of realistic goals
- DTC is a continuous process[5]
- All of the above

According to Bill Williamson in his insightful 1994 Design-to-Cost paper, and even more relevant today, "All of the above," is the correct answer. At the time Williamson presented this paper, design teams lacked real-time access to supply chain data. Costs were developed based on printed catalogs, vendor quotations, or in-house spreadsheets. Today, procurement officers access the Internet daily to obtain real-time pricing, volume, availability, and logistics information. Unfortunately in many companies, such supply chain data remains "siloed" in business units other than engineering.

Design teams risk compromising their company's competitive position if they fail to design-to-cost. Even if a product is novel, competitors will inevitably arise. Further, customers' financial requirements, such as ROI or other pricing parameters, may play a prominent role in their buying motivations.

As a management tool, DTC requires commitment to the process, which means that cost be addressed at all design reviews.[6] When originally developed, organizations committed to DTC did not have access to real-time data on each of the components in a design. Today, with good collaboration between supply chain members, electronic design teams can have direct access to component costs and availability.

RISKS

The risks of not including real-time costs and supply chain data in the design process include:

- Inability to identify and understand a product's cost drivers
- Unexpected actual component cost(s)
- Failure to balance requirements and affordability
- Creeping elegance filters into the design, increasing costs that exceed targets
- Limiting creative exploration of design alternatives to achieve lower cost approaches
- Vendor shortages or inadequate volume from component vendors[7]
- Evaluate new product concepts solely on the basis of high performance at the expense and detriment of rigorous cost analysis resulting in a failed design in the marketplace

Designers must creatively explore cost-savings

As the multiple-choice question noted above, DTC is part of the product development process, as versus a discrete step. A commitment to DTC by the design team focuses increased attention on costs early in the design process. This emphasis naturally drives down the overall product cost. In turn, this positively impacts the company's cost structure, competitive position, and overall profitability.

Unfortunately, creeping elegance, if not contained, can result in costly wrong turns. As "elegance" creeps into the design, the engineer might unwittingly specify a challenging part. It might be difficult to source, have a high logistics cost, or may not be available in sufficient supply. Discovering these issues early in the design cycle will save considerable engineering time and cost on the project.

In turn, DTC empowers the design team to establish and execute against an accurate development timeline. With accurate and current cost information, the design team can initiate preventive action that avoids costly supply chain surprises downstream. They will also be able to quickly identify other potential supply chain issues involving availability or logistics in real-time. In addition, DTC motivates and empowers designers to creatively explore cost-saving alternatives that still fulfill design requirements.

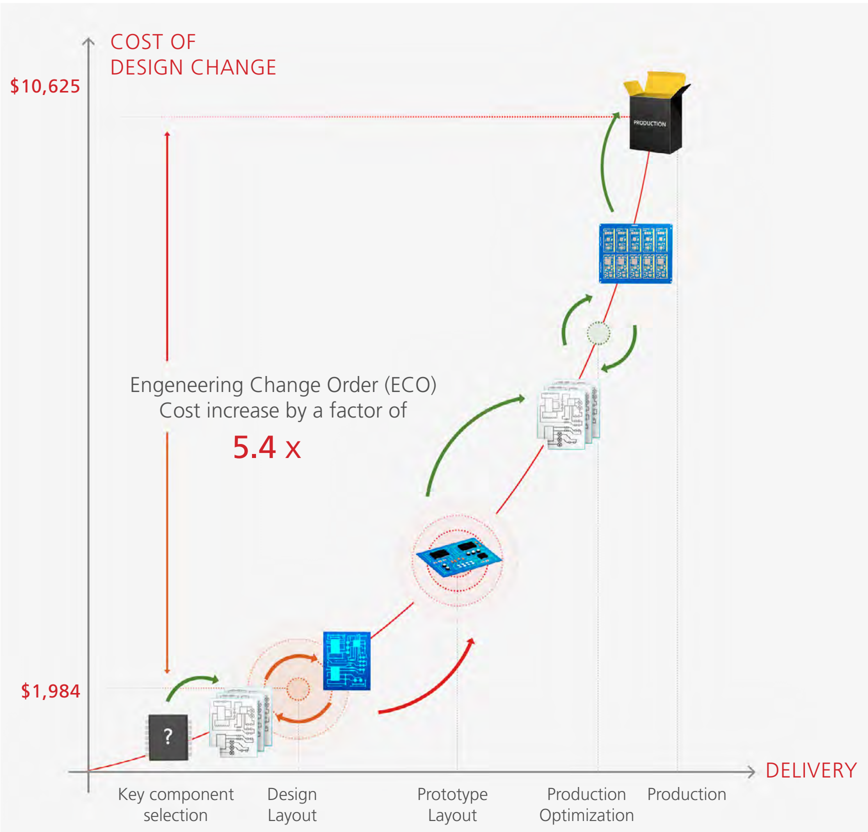
Definitions of Life Cycle Costs

These cost definitions lay the groundwork for defining life cycle Costs

- Recurring production cost = production labor + direct materials + process costs + overhead + outside processing. [Note: Bill of Materials (BOM) cost is part of direct materials cost]
- Non-recurring costs = development costs + tooling
- Product costs = Recurring production costs + tooling
- Product price or acquisition costs = Product costs + selling, general, and administrative + warranty costs + profit

Life cycle costs = Acquisition costs + other related capital costs + training costs + operating costs + disposal costs[8]

Viewed from the standpoint of life cycle costs, each design decision impacts multiple areas at later stages of the product's life. For example, a particular component may require one or more of the following costs not mentioned previously; Special processing, increased warranty costs, additional training, and possibly other costs.



SKYROCKETING COST OF CHANGE

In addition, design teams may well encounter impacts from global or local general economic conditions or industry trends. During the Great Recession in the global economy, a number of component vendors have disappeared from the landscape.[9] For teams designing a later generation release of a key product may find that the originally specified vendor has gone out of business. Further, as is typical in economic downturns, the number of suppliers in virtually every segment of industry tends to narrow, limiting sourcing options and possibly raising prices.

Summary of DTC Process

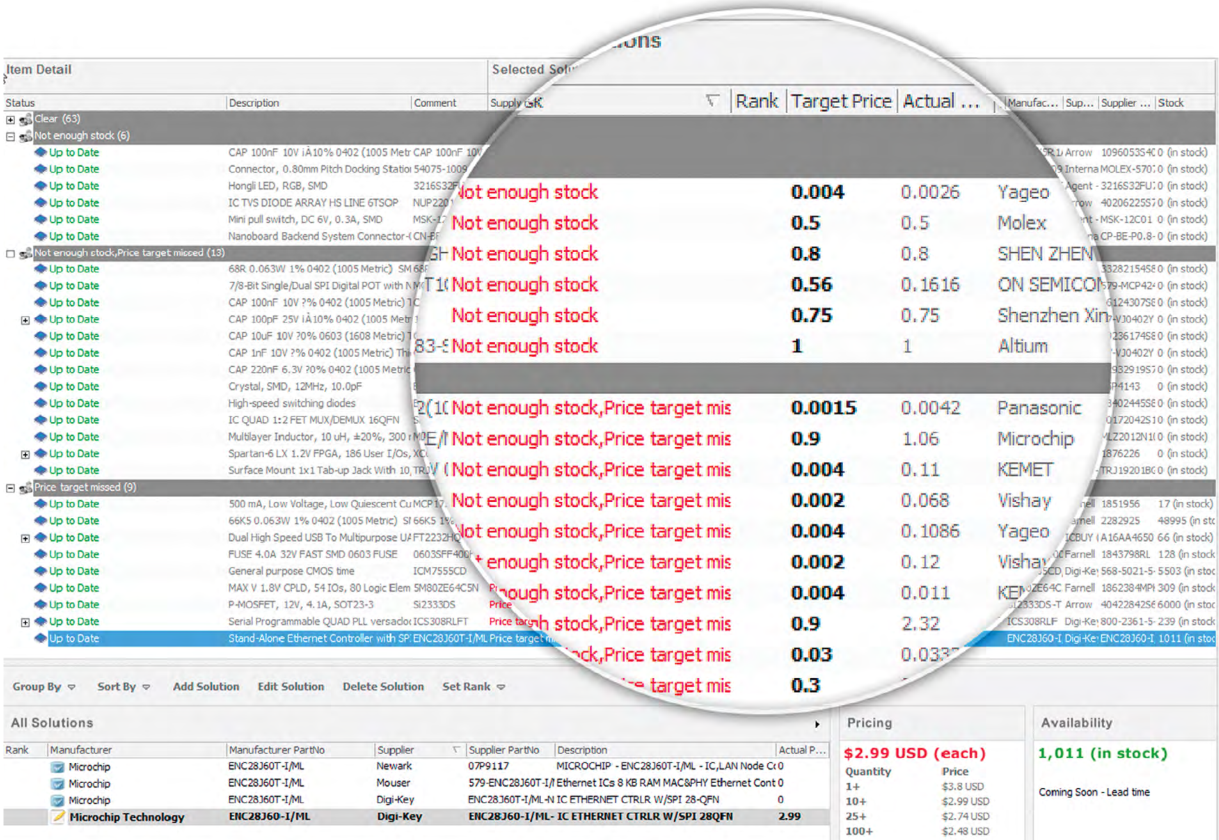
- Ongoing management technique
- Establishes cost as a constraint from the outset of the design process
- Collaborative effort between management, supply chain executives, and design team
- All team members commit to cost targets, development budgets, and design timelines.
- Goals need to be sensible and achievable to the design team
    - Impossibly high goals will be ignored[10]
    - Goals that are obviously too low do not generate team commitment to achieve them
- Once established, DTC needs to be continued to the end of the product's life since additional cost-saving opportunities will arise during later production, operations, and support phases.[11]
- Without DTC, the functional elements of the corporation will execute according to their perceived best interests. Examples:
    - Cutting design engineering budgets may result in a less than ideal product for manufacturing, driving up material and labor costs.
    - Slashing test engineering budgets may well result in a lower level of automation and higher recurring test costs during production.[12]
- Cost cutting on components by procurement managers may result in increased downstream warranty issues, more rework, and lower customer perceptions of the end-product.

Delivering Supply Chain Visibility

“Target Cost Information vs. Actual Cost is Front & Center”

Altium recognized that customers needed to establish common ground between their design and supply chain teams to implement the Design-to-Cost process. As a result, Altium Vault can contain access to centralized real-time, ready-to-use, qualified electronic data for every component in the design. This includes all data needed to fabricate, load, and assemble boards.

The live, real-time supply chain data is available in a single view. Called “ActiveBOM”, the screen displays the components in the schematic of the design plus any other off-board components. Side-by-side fields compare actual BOM cost to target BOM cost before and during the design process and also includes other relevant supply chain information.



ActiveBOM with side-by-side fields to compare actual vs. target BOM costs.

Altium ActiveBOM Empowers Design Teams

As cited above, immediate knowledge of cost, availability and lead times at early stages of the design process profoundly impacts design decisions. In turn, those decisions at the BOM level impact the overall life cycle costs of any product. This dynamic database incorporates real-time data from component vendors, eliminating data transfers from other departments, duplicated effort, and human error. The database provides design teams with with a direct link to access ERP/MRP-based supply chain data.

ActiveBOM dynamically maintains and updates the supply chain data for each component in the vault library. This establishes the ongoing cost parameters for the design. In addition, designers are often tasked with "BOM scrubbing", a cost-focused redesign in the event that one or more design components are in short supply or about to become obsolete. With ActiveBOM, the team can revisit the supply chain data in the vault-based design. The database solution will immediately provide clear choices for suitable alternatives, eliminating much of the pain associated with sourcing replacement components.

Conclusion

Design decisions have an accumulative impact on the life cycle cost of a product. Choices made during this phase can contribute as much as 70% to the overall cost. Employing a sound design-to-cost methodology, backed with a real-time and accurate view of cost implications, empowers design teams to make the best decisions upfront.

ActiveBOM makes design-to-cost a living process. By dramatically improving the cost visibility of the BOM, design team managers can immediately assess the cost of a design change. As a result, the dynamic supply chain database delivers invaluable fact-based management decision support, facilitating Go / No Go decisions.

When the design engineering team implements ActiveBOM, they also can eliminate unexpected costs associated with seemingly simple revisions. As another exercise, the design team can quickly and safely launch a cost-driven evaluation to reduce the BOM cost to the benefit of product margins. In turn, improved margins drive increased corporate profits.

Read More About Design-to-Cost

The following two papers provide excellent content on DTC for teams that either want to implement or deepen their implementation of DTC principles.

"Design to Cost Lessons Learned," by Bill Williamson, Design-to-Cost Champion, Defense Systems, Texas Instruments, originally presented at the 1994 International Conference of the Society of American Value Engineers (SAVE) in New Orleans, LA. The paper describes 15 essential lessons learned for a successful DTC program.
Available online at: http://www.value-eng.org/pdf_docs/conference_proceedings/1994/9434.pdf

"Achieving Target Cost / Design-to-Cost Objectives," by Kenneth Crow. The paper enriches understanding of just how to define cost including a detailed explanation of each different type of cost up to and including life cycle costs. It also contrasts "Traditional Approaches" in electronic design to Design-To-Cost. Available online at: http://www.npd-solutions.com/dtc.html

More details available online at: http://wiki.altium.com/display/ADOH/ActiveBOM

[1] "Design to Cost Lessons Learned," by Bill Williamson, Design to Cost Champion, Defense Systems, Texas Instruments, originally presented at the 1994 International Conference of the Society of American Value Engineers (SAVE) in New Orleans, LA. Available online at: http://www.value-eng.org/pdf_docs/conference_proceedings/1994/9434.pdf

[2] Williamson, Ibid.

[3] "Nonstationary Root Causes of Cobb's Paradox," by Lt. Col. Joseph W. Carl, USAF (Ret.) and Col. George Richard Freeman, USAFR (Ret.), published by The Defense Acquisition University, p. 347. Available online at: http://www.dau.mil/pubscats/PubsCats/AR%20Journal/arj55/Carl_55.pdf

[4] "Achieving Target Cost / Design-to-Cost Objectives," by Kenneth Crow, available online at: http://www.npd-solutions.com/dtc.html

[5] Williamson, Ibid.

[6] Williamson, Ibid.

[7] Crow, Ibid.

[8] Crow, Ibid.

[9] Infographic titled, "Acquisitions of the Electronics Industry" in 2012, available online at: http://www.siliconexpert.com/blog/Acquisitions_2012

[10] Williamson, Ibid.

[11] Williamson, Ibid.

[12] Crow, Ibid.