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ARCHITECTURAL TRADE-OFFS & TARGET COSTING FOR CO-DESIGN

In the beginning there was neither electronics nor software. There were only mechanical and electrical products. Some might call this *"the good old days."* Then, technical functions began mastering low voltage and power applications and most "mechanical-electrical" products migrated to become "electro-mechanical" in nature. Soon thereafter, products advanced technically to become fundamentally "electronic." More recently, most of these types of products have evolved further so that they can now be classified as "software-driven hardware."

This technological evolution has led to increased complexity in design planning. In today's world of design there are typically several design alternatives available for any given feature. Designers must make choices early in the project as to the best way to implement a given feature. How, then, do most designers choose? All too many choose the alternative that facilitates rapid design and/or choose the alternatives that fall most naturally into their own design competencies. From an individual viewpoint, choosing the alternative that most closely aligns with one's design competency is synonymous with rapid design. At the same time, from a management perspective, rapid time-to-market is not always the best solution.

Proprietary research, conducted by GGI, indicates that there are an equal number of companies that believe that achieving low product cost is more important than fast time-to-market. Also, within a given company, on a product-by-product basis, time-to-market might be important on one product and low product cost might be more important on another. Most decisions should not be left up to designers, to be made locally, in the heat of a project.

Preston Smith and Donald Reinertsen, authors of the best selling product development book of the 1990s *"Developing Products In Half The Time,"* addressed the issue of *Economic Trade-off Analysis* masterfully. They have comprehensively analyzed the issues and mechanics of Economic Trade-off Analysis.

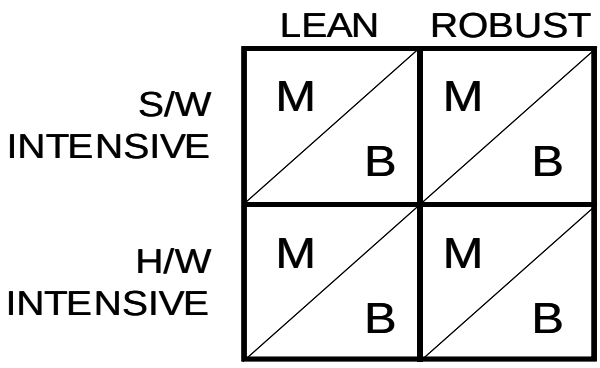

Figure 1: Target Costing For Co-Design Matrix

At the same time, many designers interact with projects, and the planning thereof, at a level of detail below the level at which management makes trade-offs. Yet, many design trade-off decisions left to lower levels of the organization significantly impact management-level Economic Trade-off Analysis. How does one improve the linkage between the impact of trade-offs made

at lower levels and the bottom-line, management-level, trade-off analysis?

GGI's clients have been using an analytical tool we developed in the mid-1990s to augment Smith and Reinertsen's trade-off analysis methodology. It has recently made its way to public visibility through client presentations at several conferences this year. If product cost is your company's number one design parameter on some or all of its products, GGI's tool, in conjunction with Economic Trade-off Analysis, may provide a scalable methodology. The "Target Costing For Co-Design Matrix" [TCCM] will add some work to the project up-front, during the Definition Phase, but like most other up-front analyses it is usually a worthwhile investment.

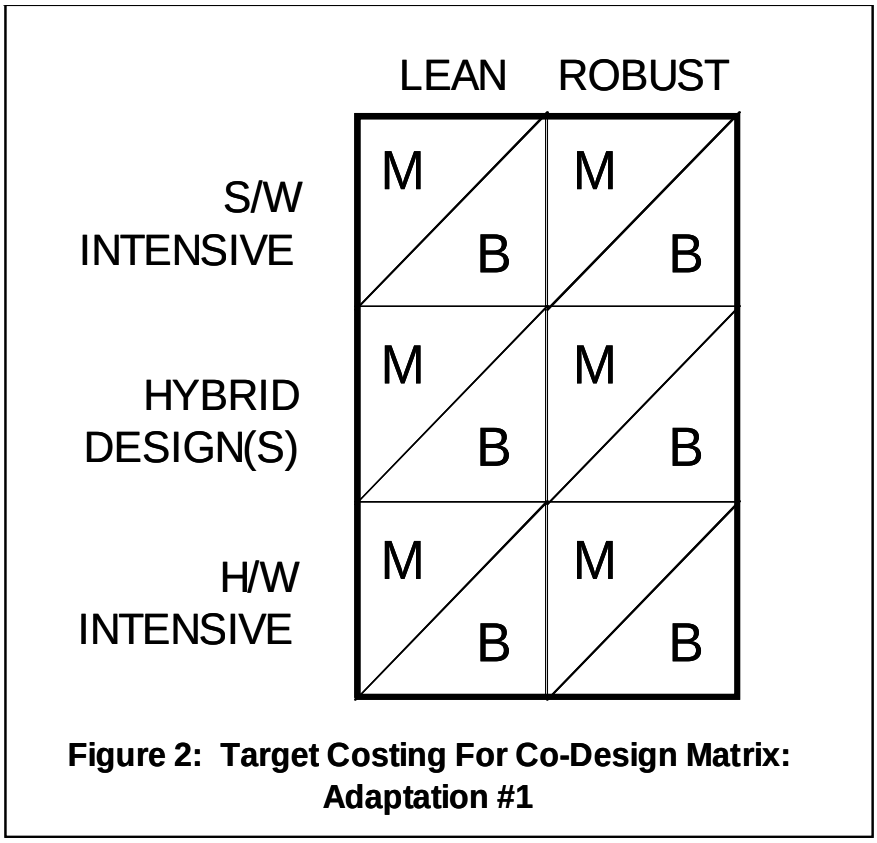

Figure 2: Target Costing For Co-Design Matrix: Adaptation #1

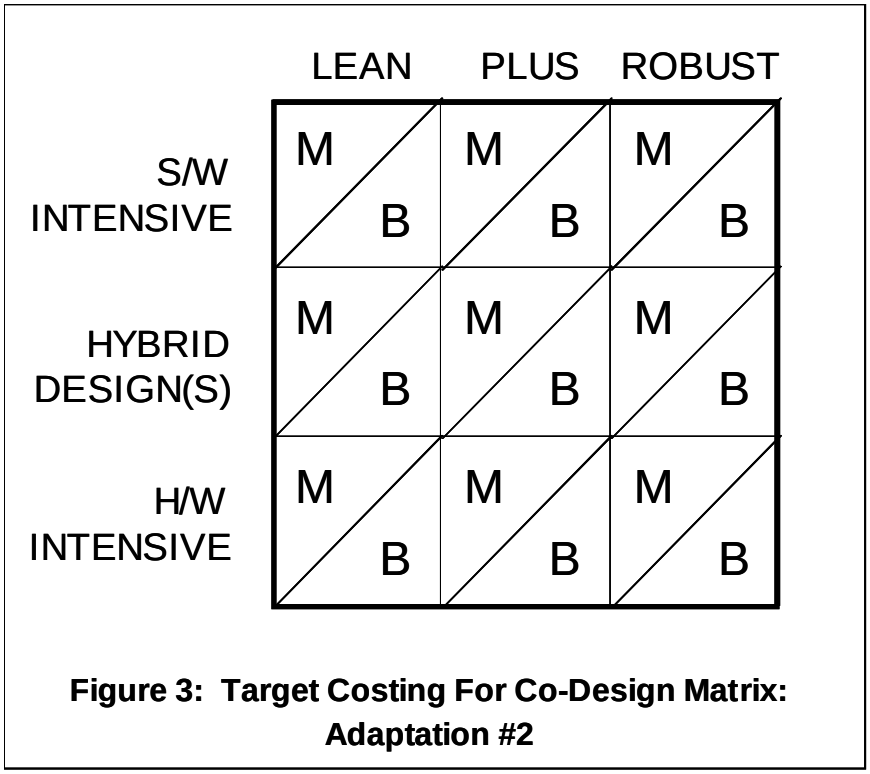

Figure 3: Target Costing For Co-Design Matrix: Adaptation #2

The Target Costing For Co-Design Matrix is necessarily a cross-functional tool. It causes project team members from different competencies and areas of expertise to think through trade-off decisions together and reduces the number of design decisions that are made individually.

Specifically, in a software-driven hardware environment, trade-offs revolve around whether to implement features in hardware or in software. In the TCCM, this is captured in the rows of the matrix. One design alternative is software-intensive and the other is hardware intensive. In complex products, one may need to apply TCCM several times at different levels of design.

The columns of TCCM address a second key variable of design – *lean design* or a *robust design*. We have all heard of "creeping elegance" or "creeping specifications." A design that exceeds marketplace requirements usually leaves profit on the table for the seller. *Additional features* or the *over implementation of needed features* tend to extend time to-market and increase both development cost and product cost. This issue needs to be thought through and understood up-front. Once design begins it is difficult to scale back an architecture.

This problem is often compounded when one designs a platform. Subsequent derivatives and extensions will reflect the values and costs of the original architecture. While most managers and designers intuitively know this, in the absence of a process and/or tool to structure analysis and communications, it too often gets bypassed – and local designers end up making the trade-off decisions.

Finally, it is equally important to consider "Make [M]" versus "Buy [B]" when performing trade-off analyses. This is especially important in smaller companies or over-loaded larger companies. Most designers have a natural bias to *"do it themselves."* Call it *"Not Invented Here Syndrome,"* or more simply *"if you want it done right do it yourself."* In small and/or over-loaded shops, time-to-market can often be saved through outsourcing without negatively affecting product cost. At the very least, a robust analytical method will always examine Make vs. Buy at the point that alternatives are being analyzed.

There are two self-explanatory adaptations or extensions of TCCM that are useful in demonstrating the flexibility of the method. Each adaptation builds upon the predecessor matrix [Figures 2 and 3, on page 11].

Most companies need to undertake cost reduction programs to realize the original target cost goal and they do not achieve the original goal until several years after the product is launched. A large percentage of these overly costly products could have been prevented if better up-front analysis had been performed. The TCCM is an intuitive and simple method for structuring the process of early architecture-cost analysis. It will improve the quality of the data entering, and the decisions resulting from management-level Economic Trade-Off Analysis. **PD**

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