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# Improving Business Results through Value Engineering

Capital equipment manufacturers are faced with the constant challenge to drive down product costs for a variety of reasons such as lower cost targets aligned with emerging markets, competitive need to improve product margins, or a desire to extend the life of legacy products that are experiencing parts obsolescence. In parallel is the constant need to improve product quality and performance. The opportunity to meet both of these goals lies in the fact that pressure to deliver the first product nearly always leads to short-cuts and trade-offs during the development effort that, due to constraints in engineering resources, never are resolved after first shipment. However, both of these goals can be addressed by well-run Value Engineering (VE) projects with a proper focus on upfront assessment and Return on Investment (ROI) analysis aligned with business goals.

VE is a common methodology for assessing product costs, quality, and performance requirements, and establishing programs for improvement. We believe that there are three key aspects for a successful VE project:

- Clearly defined business goals and use of a phased approach
- Be guided by a thorough ROI analysis
- Assignment of a cross-functional team

The need to accomplish this along with ongoing R&D needs and constrained engineering budgets sometimes leads companies to decide to work with an outsource partner to provide these services. It is imperative to select a company with established experience both in the area of VE and deep domain understanding to ensure that the resulting outcome will meet all business and technical needs. In this article, we will examine these aspects and explain why, in combination, they are likely to yield VE success.

## Clearly Defined Business Goals and a Phased Approach

The first task of any VE program is to clearly capture the goals of the project, be it cost reduction, feature adjustment for new products or markets, or quality improvements. Once the overall goals of a VE project are clearly defined, using a phased approach provides the best results while avoiding program risk. A stage gate should exist at the end of each phase that allows a management decision to be made regarding whether the return on investment (ROI) is sufficient to proceed to the next phase.

**Phase I: Analysis and Idea Generation/Selection**

This phase involves detailing specific project goals, current cost structures, and functionality. This is followed by the generation of possible approaches to design challenges in line with the goals. As stated above, the goals for a product change may be solely cost reduction or may include functionality and/or quality improvements. There may also be a desire to adjust the cost and functionality of an existing product to fit a new market. Whatever the goals, they must be clearly stated and understood by the project team.

While companies tend to know their product's overall cost, often the data is not in a form that can readily be used at a detailed level. If there is high labor cost associated with assembly or test that needs to be addressed; a breakdown of these costs is also needed.

The important thing is that the team has a Pareto of all costs involved. Absent this base-line information, effort can be expended reducing costs that bear little benefit to the bottom line. Once the goals and costs are understood, brainstorming by the cross-functional team on potential solutions should generate a wealth of ideas, some of which have "been known" and some of

which are new. Then assessing the ideas will provide estimates of the costs and ROI, as well as assessments of technical and market acceptance risk. After a short review and selection process, a list of projects that the team feels has sufficient ROI is the final deliverable of this phase and is presented to management for approval.

**Phase II: Detailed Design**

No different than the initial development, detailed design must be done to complete the approved product changes. It is important to realize that the engineering effort involved is often no less complex than the initial development effort, and strong design and verification experience is required. The advantage is the ability to extract information from the initial design to ease the development effort. In efforts in which there is associated software, it is imperative that the software compatibility of the new and old components be clearly understood.

For critical parts, it is crucial that the supply chain organization facilitates interaction with suppliers to validate cost analyses which have been performed. Deliverables for this phase include engineering analyses, detailed design models, production documents, and an update to the cost and ROI predictions from Phase I. These data should be presented to management as a stage gate review, with management approval required for moving to the next stage.

An outsource engineering firm can be a valuable partner during this phase by taking most of the engineering load. The internal engineering team can act as consultants and reviewers as the detailed design is performed, ensuring that the product and domain knowledge built up over years is thoroughly integrated into the new effort without requiring it to perform all of the detailed work involved, hence being free to also contribute to the company's leading-edge product development initiatives.

**Phase III: Implementation**

The implementation phase should follow the usual product development process. Much of the development engineering content (technical interaction with suppliers, correcting design defects, developing assembly and test fixtures, helping solve production problems) can be borne by the engineering services partner, again preventing dilution of key internal R&D efforts. It is important to remember that any outsource partner should stay engaged through alpha and beta testing and pilot production, and in some cases through the first few installations and first rounds of customer feedback.

## Be Guided by Return on Investment (ROI)

Throughout the project, it is important to closely monitor the project goals and continually assess the expected ROI generated in Phase I and refined in Phase II. This includes directly balancing production cost reduction against R&D costs and risks for all proposed changes. But other business functions must also be included in the process.

For example, software control may need to be altered to support new hardware and functionality. The service organization may have to develop new service tools or may need to implement new training courses. Production implementation will have some cost implications. Impact to production and spare parts inventories should be considered. For VE projects that change functionality, any market size impact estimates should be revisited periodically for validation and updates.

As part of the stage gate decisions at the end of Phases I and II, it is critical that a detailed ROI be assessed and considered when making decisions of whether to proceed to subsequent phases. Figure 1 is an example of a simple ROI analysis report of a component without software impact that shows some of the issues that must be used in guiding the outcomes.

Figure 1

ROI Analysis

| Sl. No. | Part # | Description | Existing BOM Cost | Proposed Change Forecast | Opportunity | Tooling Cost | NRE Cost (Phase-1) | NRE Cost (Phase-2) | | Total NRE+ Tooling Cost+Material Cost | Approx. Units - Breakeven | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Design | Prototype and Testing | | | |
| 1 | ZZZZZ-01 | Board & Module + Accessories | $1,093 | $918 | $175 | $3,067 | $12,000 | $36,720 | $19,040 | $77,327 | 107 | |
| 2 | ZZZZZ-02 | Pulse Assy. | $768 | $493 | $275 | | | | | | | |
| 3 | ZZZZZ-03 | Panel Assy. | $735 | $660 | $75 | | | | | | | |
| 4 | ZZZZZ-04 | Front Panel Assy. | $60 | - | - | | | | | | | |
| 5 | Applicable to all | - | - | - | $150 | | | | | | | |
| 6 | - | Mechanical Enclosure Assy. | $690 | $619 | $75 | $0 | | $2,720 | - | $2,720 | | Without PCBA and Related Items |
| | | Sub-Total | $3,345 | $2,690 | | | | | | | | |
| | | Total Estimated Savings/Unit | | | $750 | | | | | | | |
| | With the above listed Costs, % Cost Savings/Unit | | | | 22% | | | | | | | |

## Assign a Cross-functional Team

Companies often assign a team from design engineering to carry out VE projects. Certainly a strong team of design engineers can achieve results. However, synergy across multi-disciplinary teams nearly always produces superior results because poor assumptions are avoided by clear communication across engineering disciplines and various functions of the company. Without this collaborative approach, VE results can do more harm than good by missing dependencies that can result in poor performance or quality problems. At a minimum, a cross-functional VE team usually has representation from:

- **R&D Design Engineering** – Brings in expertise and experience in the product technical domain. Often contributes the most cost-reduction ideas.
- **Production Engineering** – Understands issues that production is facing and often has insight into quality problems, as problems customers find are related to difficult production steps. Also brings insight into production cost and lead times.
- **Field Service** – Knows the difficulties encountered in installation and/or service of the product. Often acutely aware of the most important customer satisfaction issues.
- **Supply Chain** – Understands current material costs and lead times. Also needed to acquire cost information for existing and proposed designs.
- **Marketing/Product Management** – Provides voice-of- the-customer insight for any proposed functional or appearance changes.

## Engaging an Outside Company with VE and Systems Engineering Experience

Engaging the right engineering services partner can greatly enhance the value and lower the costs and risks associated with VE projects in the following ways:

- An experienced partner will bring lessons learned from performing many VE projects across a wide range of products and technologies
- A partner with a pedigree that includes systems engineering can add an extra dimension when it comes to generating and evaluating options
- The fresh eyes of "outsiders" can question long-held internal beliefs which can result in innovative ideas
- Eliminates the risk of lost productivity – your team stays focused on building pipeline products while outside experts focus on VE
- Alleviates the burden of assuming long-term fixed costs:
  - You don't have to add permanent staff to handle this process
- The company has an "exit option" at the end of each stage:
  - If sufficient ROI at low technical risk is not demonstrated
  - If the market or budgetary environment has changed

## Three Keys to VE Success

In today's highly competitive marketplace, it is imperative that VE be a weapon in the business arsenal of all capital equipment companies. With a solid approach to VE, a company can attack cost and quality improvements, or even adjust a product for entering new markets.

Remember the three keys to VE success:

1. Clear definition of business goals and use of a phased approach:
   - Clearly define and measure the specific goals of the project
   - Limit exposure and utilize the power of stage gates
2. Be guided by a thorough return on investment analysis:
   - This tool should always be your guide – the entire team should embrace ROI
3. Assign a cross-functional team:
   - A range of stakeholders will contain risk and make for the best team

Engaging an outside company with VE and systems engineering experience can have a very positive impact on these types of programs. The range of experience and variable staffing structure can allow for a broader variety of VE projects, resulting in more and faster cost savings, with lower risk. A strong partnership with such a firm can also bring a fresh look at the source of your product cost, apply past experience running VE projects, and allow you to focus key resources on valuable next-generation products.

**Have questions about Value Engineering?**

CONTACT ALTRAN

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Established in 1986, Altran North America is an engineering consulting partner to businesses in Aerospace and Defense, Automotive, Digital markets, Energy, Industry and Electronics, and Medical and Life Sciences. We offer solutions that combine disruptive technologies, complex software development expertise, and innovative processes to solve the business and technical challenges inherent in conceiving, developing, and supporting the complex, connected systems demanded by markets driven by rapidly evolving technology.
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