Benefit Model Input List
TMAG Economics Committee
Version 1.2
17 December 2009

Development Factors

- Development cycle time devoted to test and quality of best analog of product under consideration.
- Estimate of cycle time required without test improvement under consideration.
- Estimate of reduction in critical path time given test improvement adoption.
- TTM risk factors based on historical data. For instance, if management says that improving test will not impact TTM, but the last three products have been delayed to market due to bugs discovered late, the risk factor may be high. Industry analogs can be used also. This should be used to make the possibly optimistic estimates by management more realistic.
- Test writing costs, including time and staffing levels
- Bring-up costs, including equipment requirements, time, and staffing levels
- Benefit of faster bug discovery through test audits

Manufacturing Factors

- ATE Costs: capital and rate per minute, including power and floorspace
- Test times for baseline product
- Test process flows
- Current quality levels, for baseline
- Cost of rework
- Inventory costs during manufacturing, to compute increased turns due to better throughput
- Current failure rates at each process step
- Manufacturing process improvement flows. We need this to compute potential benefits in manufacturing processes through information discovered during root cause analysis of in-line failures.
- BOM costs.
- Historical incoming quality levels per component
- Historical escape rates out of manufacturing. This can be used to estimate test coverage.
- Reduction of fail rates of purchased components if DFT and improved testability requirements are pushed back to vendors

Field Cost/Benefit Factors

- Estimate of failure rate reduction through fewer field escapes after introduction of DFT enhancement. Should be based on reduction from current rates. This should be time-based.
- Incremental field failure cost per visit.
- Estimate of field service sunk costs. For instance, the cost of a field service office in a geographical area, including minimum costs independent of failure rates.
- Repair depot costs per incident.
- Cost of inventory for spares.
    - Cost of transport of spares (dependent upon product geographical dispersion)

    - Increase in transport space due to reduction in spares transportation
    - Improved mission effectiveness through ATE/Spares savings allowing more 'on station' support materials.

Time to diagnose – critical depending upon location/function…

- Warranty terms. Revenue from service contracts. Estimate of revenue reduction through reduction in service contract renewals given improved quality.
- Field service and return process, with costs associated with each stage.
- Expected level of degradation – that is, the expected failure rate over time.
- Expected product lifetime in field. This is time to market obsolescence, since DFT to extend life beyond this might not be beneficial.
- ATE costs at service/repair depots
- Training costs for field service personnel, which might be reduced with better diagnosability.
- Possible reduction in numbers of field service personnel through improved (easier/quicker) diagnosibility
- Possible reduction in numbers of required ATE.
- Improvements in morale due to improved reliability and 'trust' in equipment.
- Possible reduction in equipment purchases because of improved up-time.
- Improvements in reliability because of "if it ain't broke, don't fix it", i.e. reduced disturbance of equipment and subsequent reliability degradation through improved/correct diagnosis.

Customer Factors

- Total cost of ownership, from a customer perspective.
- Logistics footprint – customer support costs
- Length of use by customer

Sales/Marketing Factors

- Estimate of increased sales/profitability for a given speedup in time to market, and an estimate of lost sales/profitability from a delay. This should come from Marketing.
- Data showing how sales track with quality levels. This should be used as the input to a statistical analysis to determine if there is a correlation.
- Input from marketing on sales elasticity with quality for similar products from the company and similar products in the industry.

Other Factors

An additional requirement

We should resist the urge to give a single number for all of these inputs. Some may be best represented as a range of values, especially predictions should as quality levels and product sales. We might want a mean estimate and 90% confidence interval estimates. Our model will have to be able to handle these ranges and compute best case and worst case estimates, and possibly use Monte Carlo techniques to compute the most likely benefit levels. To be useful, the model will not be a simple arithmetic

calculation.

In addition, some of the inputs will be time-based, values increasing or decreasing over time, possibly with discontinuities (for instance on warranty expiration.) The Monte Carlo simulation may have to be done with this dimension also.