

PRODUCT DEVELOPMENT BEST PRACTICES REPORT

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TO REUSE OR NOT TO REUSE?

Reuse is one of the hottest topics to hit the product development community in years. Industry is gradually catching on to the astronomical cost of designing and/or purchasing new parts when existing parts will do the job. The costs include longer time-to-market, bigger development costs, and less reliable products.

On one side of the fence are the die-hard inventors. To this group, everything can be improved upon and should be improved upon—each and every time. On the other side, time-to-market managers look for any and all techniques to shorten time-to-market. There are cases where it is in the best interests of a company to create an entirely new product. Mostly, the non-reuse alternative is best deployed on the few next-generation products that a company may create. But on most derivative, incremental, and/or evolutionary development efforts, it is usually smart to reuse.

There are a number of compelling reasons to formalize reuse practices. Marv Patterson, former Corporate VP of Engineering for Hewlett Packard, perhaps said it best in his book, *Accelerating Innovation*, [Van Nostrand Reinhold, 1993]. Writes Patterson, "Translating a market opportunity into a new product requires perhaps 15% invention, the remaining 85% of the work involves previously learned processes that are often undocumented and undisciplined."

If you agree that it is only 15% or 20% of a product development effort that is really differentiable, then it makes eminent sense to reuse as much intellectual property as possible for the remaining 80% or 85%. Reuse will clearly shorten time-to-market for a given development cycle: there is less to design and develop. If time-to-market is reduced, development cost will be less. With a small leap, it is easy to see that a product with reused components will be more reliable than a product with 100% new components. Reuse also typically pushes the purchased or production volumes up for the reused components; if volume goes up, price goes down usually. New products, through reuse, can lower product costs for the new product itself, and lower product costs for existing products whose components now benefit from higher volume.

In summary, reuse:

- Shortens time-to-market
- Reduces development cost
- Reduces product cost
- Improves product quality and reliability

The major dangers of reuse are few. Too much reuse, over a long period of time, may result in products undifferentiated from prior generations. Reuse may also result, on a product-by-product basis, in needing to modify specifications for noncritical components.

One of the major challenges is getting started. What is the reuse entitlement at my company? To answer this question it is usually necessary to analyze a series of recently completed projects. Select a representative sample of the company's whole product portfolio. Meet with the program managers and lead designers in charge of these projects and ask, "If the company had the tools and systems in place to formally enable reuse when the project was started, how much of the final product design could have been achieved through reuse of existing components and/or intellectual property?"

The answers may surprise you. Before you ask, define the areas of intellectual property in your

INTEGRATED CIRCUIT MANUFACTURER							
REUSE RETROSPECTIVE							
	#1	#2	#3	#4	#5	#6	AVG
Specifications	80	25	80	70	20	0	46%
Schematics	75	30	80	30	40	20	46%
Layout	50	0	30	10	0	0	15%
Packaging	100	100	100	100	100	NA	100%
Test Programs	75	50	50	30	20	25	42%
Test Fixtures	0	50	0	0	10	0	10%
Fab Process	100	100	100	100	90	100	98%
AVERAGE	56	31	48	28	18	9	

ELECTRONIC SENSOR MANUFACTURER							
REUSE RETROSPECTIVE							
	#1	#2	#3	#4	#5	#6	AVG
Specifications	35	50	20	95	50	50	50%
Electrical	50	NA	10	66	90	30	49%
Mechanical	80	20	0	98	50	2	42%
Software	0	NA	10	NA	NA	NA	5%
Packaging	70	0	0	90	2	2	44%
Purchased Part	50	15	30	90	20	20	49%
Test Programs	10	100	0	90	30	30	55%
Test Fixtures	20	100	0	90	20	20	55%
Mfg Process	70	10	40	80	35	35	56%
AVERAGE	43	42	12	94	79	24	

company that could be reused. Here's a widely applicable list:

- Specifications
 - Mechanical
 - Electrical
 - Electronic
 - Software
- Subsystems and/or component designs
- Standard purchasable components
- Test software and/or jigs and fixtures
- Manufacturing process

Case studies from two companies illustrate the point. Each company selected six recently completed projects believed to be representative of the product portfolio mix as a whole. Program managers, shortly after the project completed, were asked about their reuse entitlement. As one would expect, the answers varied greatly by project/product and by type of intellectual property. But across the six projects some clear averages and ranges resulted. On average, the sensor company project leaders could conceive of reusing 40%-50% of designs across all categories of intellectual property. In the semiconductor company, reuse entitlement was more in the range of 40%-60%. Several project leaders from both companies also commented that if the product architecture of company products were more modular, that the reuse percentage could increase another 10%-30%.

Of other economic benefits of reuse not covered here, one can not go unmentioned: *carrying cost*. Every time a new part is added to a company's active parts a cost is incurred—the carrying cost. A new component must be propagated throughout the company's item master files. Purchasing and supplier management must qualify both the supplier and the component/part at some level. Characterization data regarding the part performance in a product is maintained in quality and reliability records. Often the part must be stocked in spare-parts warehouses, often globally distributed. There are other carrying costs as well.

These costs can really add up for a single part. One aerospace company estimated life cycle carrying cost at \$15,000/part. A European auto manufacturer estimated life cycle carrying cost at \$58,000/part. A high-volume cellular phone manufacturer estimated \$500,000/part. Colorado-based Cadis, a manufacturer of parts management software, estimates average costs ranges from \$5 to \$50,000/part. These

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costs take some effort to derive as they are hidden in small pieces in many budgets throughout the company. When developers decide to design-in a new part they usually do so without any understanding of the costs to which they just obligated their company. Few designers could justify using a new, slightly different component, if they were also asked to justify the cost of the decision.

Reuse, if properly managed, can yield tremendous economic benefits. The reuse body of knowledge is still new and evolving. Make sure your company is out in front on this subject. P₁



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