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New Product Development—A Financial Model

Application Note AN-8 **by Christopher Moore**

Introduction

Companies face many challenges in new product development, not the least of which is choosing the best projects. Many factors must be considered, but I'll focus on projecting the financial performance of a project.

While there are a number of single measures intended to capture a product's financial goodness, my view is that several measures should be used. I will discuss three of them--NPV, IRR, and total development cost--in this article.

Net present value (NPV)

In each time period, a certain net number of real dollars flow in or out. We could just add all these cash flows and get a single number, but that would overlook the hidden cost of missing alternative investment opportunities and their financial rewards. For example, if we didn't pay out $130,000 in development costs in Year 1, we could invest it in stocks or money market funds. So we seek an analysis that takes into account a rate of return for a comparable investment.

Another factor we would overlook if we just added up the cash flows is the time element. $40,000 net cash flow earned in Year 2 is less valuable than it would be if earned in Year 1 because if it were earned earlier we could invest it and earn income at the rate of return during the year. Conversely, an expense paid out in the future is less costly than one paid now because we could invest the money and earn return until it was time to pay the expense.

Net present value analysis presents the various predicted cash flows of the project as a single number, called the NPV. All the projected expenditures and income, all the projected sales quantities, cost of units sold, etc. are wrapped up and distilled into one number. NPV is calculated by this formula:

$$NPV = \sum_{i=1}^{n} \frac{value_i}{(1+r)^i},$$

where *i* is the number of time periods from the start, *r* is the expected rate of return, and *value* is the cash flow for time period i.

Internal rate of return (IRR)

IRR is a close cousin of NPV. In fact, the definitions are such that the NPV of a series of cash flows, evaluated with an r equal to the IRR of the same series of cash flows, is zero. The IRR of a series of cash flows gives the rate of return that would result in an NPV of zero, hence it is the rate of return of the project itself, with no comparison to any other investment's rate of return.

Spreadsheet entries

The spreadsheet shows the project running against a time line. Choose a time interval, probably quarters or months, perhaps years.

The example here shows only summary lines: you will almost certainly want to work from a more detailed estimate of each line item. It's convenient to place the detail for each line on its own sheet in a spreadsheet workbook.

Product design costs include staff costs (burdened), outside consultants and service bureaus, project materials, small tools, equipment, etc.

Marketing and sales expenses would include staff costs, advertising, product introduction activities, literature and documentation, travel, etc.

Production startup costs would include production fixtures, test software development, etc.

Understanding the results

The results are summarized by three numbers.

The first is the project NPV, $91,812. This tells us that, compared to some other investment opportunity with a rate of return of 10%, this project will return $91,812 over and above the 10% return. We get a feeling for the *magnitude* of the financial return from NPV.

The IRR, 16%, shows us the rate of return of this project, a rate that we can compare to other investment opportunities. We choose to look at IRR as well as NPV to get a feeling for the *profitability* of the project in relative terms.

We also show a development cost, $835,000. This gives us an appreciation for the *total amount we will have to put at risk* to develop the product and prepare it for the factory and the marketplace.

Finally, the distribution of development cost and cash flow viewed over the project time periods shows us *how long we must wait* before the spending winds down and the earning begins.

Several other items could be added to the spreadsheet. Additional rows (and perhaps graphs) could show the accumulating development cost and cash flow against time.

Comparing projects and alternative investments

Comparison is at the heart of this kind of financial analysis. Even when modeling one project, we are comparing it to an

	Year 1				Year 2				Year 3				Year 4	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Product design	-$130,000	-$130,000	-$130,000	-$130,000	-$105,000	-$35,000								
Tooling				-$10,000	-$10,000	-$5,000								
Production start up					-$25,000	-$20,000								
Marketing and sales					-$20,000	-$20,000	-$15,000	-$15,000	-$15,000	-$5,000	-$5,000	-$5,000	-$5,000	
Development cost total	-$130,000	-$130,000	-$130,000	-$140,000	-$160,000	-$80,000	-$15,000	-$15,000	-$15,000	-$5,000	-$5,000	-$5,000	-$5,000	$0
Unit cost						-$550	-$550	-$550	-$550	-$550	-$550	-$550	-$550	-$550
Sales volume (units)						50	100	100	150	250	300	300	400	400
Cost of units sold						-$27,500	-$55,000	-$55,000	-$82,500	-$137,500	-$165,000	-$165,000	-$220,000	-$220,000
Unit selling price						$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100
Sales revenue						$55,000	$110,000	$110,000	$165,000	$275,000	$330,000	$330,000	$440,000	$440,000
Outflows	-$130,000	-$130,000	-$130,000	-$140,000	-$160,000	-$107,500	-$70,000	-$70,000	-$97,500	-$142,500	-$170,000	-$170,000	-$225,000	-$220,000
Inflows	$0	$0	$0	$0	$0	$55,000	$110,000	$110,000	$165,000	$275,000	$330,000	$330,000	$440,000	$440,000
Cash flow	-$130,000	-$130,000	-$130,000	-$140,000	-$160,000	-$52,500	$40,000	$40,000	$67,500	$132,500	$160,000	$160,000	$215,000	$220,000
Annual rate of return for PV and NPV, r =	10%			Development cost =		-$835,000								
Project NPV =	$91,812			Project IRR =		16%								

alternative investment via the rate of return used in the NPV analysis, while the IRR gives us a rate of return which we compare to that of other opportunities.

While it is useful to look at each project individually, an analysis like this is most useful when we are trying to choose which of several proposed projects to develop. It is important to compare projects of similar risk and to use a rate of return that corresponds to the project risk. A variant or line extension project (perhaps tested against a 10 to 20% rate of return) usually has lower risk than a new platform project (which might be compared with a rate of return of 20 to 30%).

Predicting: perhaps the toughest part of analysis

Financial forecasts are notoriously tough, and no part is tougher than estimating sales volumes. The more time you can spend getting real market data and refining your estimates, the better. Don't forget to offset sales income to allow for new product cannibalization of sales of present products.

Also difficult to forecast are schedule time for development and, naturally, development cost. Finally, estimates of the cost of units sold can be seriously in error. Go into enough detail to become confident of your numbers, but remember that one day planning must end, choices must be made, and development must begin.

Explore various scenarios

The joy of spreadsheets (if there is any), lies in their ability to quickly run scenarios. I like to build a "realistic" scenario first, then edit it into pessimistic and optimistic versions. It's also useful to vary key parameters such as the cost of units sold, the sales volume, and the schedule duration to explore the sensitivity of the project to these parameters.

When the project simply must go on

Sometimes new projects are chosen despite poor projected NPV or IRR, as when it is simply imperative for a company to lead with new technology, play catch up with a competitor, or expand its line for synergistic effect with existing projects. In such cases, financial models are still important because they give the company a basis for planning borrowing and cash flow.

Handling projects with sunk costs

If you develop the financial model some time after a project has started, after money has already been spent, you might be tempted to roll the previous costs, the "sunk costs," into the model. While you might want to do that to get a sobering appreciation for the profitability of the project, you should not let sunk costs influence the here and now decision of whether or not to go forward. A go/no go decision should only depend upon the viability of the project compared with alternative projects, from now forward.

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Mission statement of Seven Woods Audio

I am an electrical engineering consultant specializing in the conception and design of products and circuits used in audio applications. My company, Seven Woods Audio, is committed to helping manufacturers quickly create digital or analog audio products that generate a good return on investment, work right the first time, sound excellent, and please the end user. Seven Woods Audio works with manufacturers of professional audio, consumer audio, broadcast, telecommunications, and computer equipment.

SEVEN WOODS AUDIO, Inc.

Concepts, Products, and Circuits for Audio • Analog/Digital

44 Oak Avenue Belmont, MA 02478-2715 USA

voice/fax 617 489 6292

SevenWoodsAudio@compuserve.com

http://www.world.std.com/~cmoore