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ARCADIAN MICROARRAY TECHNOLOGIES, INC.

In August 2005, negotiations neared conclusion for a private equity investment by Sierra Capital Partners in Arcadian Microarray Technologies, Inc. The owners of Arcadian, who were also its senior managers, proposed to sell a 60% equity interest to Sierra Capital for $40 million. The proceeds of the equity sale would be used to finance the firm's growth. Sierra Capital's due diligence study of Arcadian had revealed a highly promising high-risk investment opportunity. It remained for Rodney Chu, a managing director with Sierra Capital, to negotiate the specific price and terms of investment. Chu aimed to base his negotiating strategy on an assessment of Arcadian's economic value and to structure the interests of Sierra Capital and the managers of Arcadian to create the best incentives for value creation.

Chu's analysis so far had focused on financial forecasting of equity cash flows. The final steps would be to estimate a terminal value for the company (also called "continuing value") and to discount the cash flows and terminal value to the present. He also sought an assessment of forecast assumptions. In that regard, he requested help from Paige Simon, a new associate with Sierra Capital.

Sierra Capital Partners

Sierra Capital, located in Albuquerque, New Mexico, had been organized in 1974 as a hedge fund, though over the years it had a successful record of private equity investments and had gradually shifted its activities to this area. The firm had $2 billion under management, and its portfolio consisted of 64 investments, about evenly split between venture capital investments and participations in leveraged buyouts. Sierra Capital focused almost entirely on the life sciences sector. Like other investors, however, the firm had been burned by several flameouts following the boom in biotechnology stocks in 2000, when many rising young firms' blockbuster discoveries failed to materialize. Sierra Capital's mantra now when evaluating investments was, "NRDO: no research, development only."

Arcadian Microarray Technologies, Inc.

Following the completion of the Human Genome Project[1] in 2003, which sought to map the entire human DNA sequence[2], several companies had developed technologies for researchers to exploit that mountain of data. Specifically, those new products helped scientists find the links between the variations in a person's genetic code and their predisposition to disease. It was hoped that ultimately this would usher in an era when disease diagnosis, treatment, and prevention could be tailored to an individual's unique genetic identity.

Arcadian Microarray Technologies, Inc.,[3] headquartered in Arcadia, California, was founded in 2003 by seven research scientists, two of whom had been major contributors to the Human Genome Project itself. The team had developed a unique DNA scanning device in the form of a waferlike glass chip that could allow scientists to analyze thousands of human genes or gene fragments at one time, rather than individually. The gene chips, also called DNA microarrays, made it possible to identify specific sequence variations in an individual's genes, some of which could be associated with disease. Arcadian's business consisted of two segments:

- *DNA microarrays.* Arcadian's DNA microarrays were created using semiconductor-manufacturing technology. The chips were only a few centimeters in size, and had short, single-stranded DNA segments spread across their surface. Arcadian's chips were unique because they could hold up to one billion DNA types—more than any other microarray currently available. That was ground-breaking technology that would afford low-cost and virtually error-free detection of a wide range of medical conditions. Development of the chip technologies was finished, and the products were moving rapidly through the Food and Drug Administration (FDA) approval process; because of their noninvasive and diagnostic nature, they might be available for sale within 12 months.
- *Human therapeutics.* The search for vaccines and antibiotics with which to fight incurable diseases was potentially the most economically attractive segment, and Arcadian leveraged its leading-edge DNA-testing platform to conduct proprietary research in this area. Management's long-term strategy was to use external funding (through joint venture arrangements with well-capitalized pharmaceutical firms) to the fullest extent possible to carry the firm until its first major proprietary breakthrough. But despite external funding, Arcadian still faced significant capital requirements stemming from investment in infrastructure, staffing, and its own proprietary research program.

[1] The Human Genome Project (HGP), completed in April 2003, was an international research program to map and understand all human genes. The HGP revealed that there are probably between 30,000 and 40,000 human genes, and the research provided detailed information about their structure, organization, and function.

[2] Sequencing is a means of determining the exact order of the chemical units within a segment of DNA.

[3] Genomics is the study of an organism's genome and its use of genes. A genome is an organism's complete set of deoxyribonucleic acid (DNA), a chemical compound that contains the genetic instructions needed to develop and direct the activities of every organism. Each of the estimated 30,000 genes in the human genome carries information for making all the proteins required by an organism, a process called *gene expression*.

Arcadian's management believed that applications for its DNA microarray technology would pay off dramatically and quickly: by the year 2013 they believed the firm's revenues (namely, sales of proprietary products, underwritten research, and royalties) would top $1 billion. Rodney Chu was less optimistic, believing that the FDA approval process would slow down the commercialization of Arcadian's new products. The cash flow forecasts of management and of Chu are given in **Exhibits 1** and **2**. Chu assumed the firm would not finance itself with debt; thus, the forecasted free cash flows were identical with equity cash flows.

In assessing Arcadian, Chu looked toward two publicly held companies in the general field of molecular diagnostics.

- *Affymetrix, Inc.,* based in Santa Clara, California, was the pioneer in the development of DNA microarrays and was at that time the world's leading provider of gene expression technology. Its patented GeneChip® product was widely used for molecular biology research and had been cited in more than 3,000 peer-reviewed publications. On December 27, 2004, Affymetrix's GeneChip was the first microarray approved by the FDA for in-vitro use, which represented a major step toward the use of DNA microarrays in a clinical setting. The firm's beta was 1.30; its price/expected earnings ratio was 50.09; its price/book ratio was 8.56; price/sales was 7.49; and price/free cash flow was 97.50. The firm had $120 million in debt outstanding. The firm's sales had grown from $290 million in 2002, to $301 million in 2003, to $346 million in 2004, and to an expected $380 million in 2005. The company paid no dividend.
- *Illumina, Inc.* of San Diego, California, developed a microarray design that attached hundreds of thousands of biological sensors to submicroscopic glass beads that could seek out and latch onto specific sequences of DNA. The company's proprietary BeadArray technology used fiber optics to achieve this miniaturization of arrays that enabled a new scale of experimentation. With negative historical and expected earnings, the firm's price/earnings ratio was meaningless; however, the firm traded at 8.46 times book value, and 8.82 times sales. Illumina's revenues were $10 million in 2002, $28 million in 2003, and $51 million in 2004, and were expected to be about $73 million in 2005.

Having been burned by the biotech bust, securities analysts were now cautious about the fledgling gene diagnostics industry. "The human genome period ushered in a new wealth of information about our genes and at the time there was a lot of hoopla about the ability to cure disease," said one analyst. "In reality, human biology and genetics are complicated."[4] DNA-based medical testing, made possible by gene expression diagnostic technology, was at the edge of the legal envelope, and the field was quickly being flooded with entrepreneurial research scientists. The FDA approval process was at best uncertain in this area, and established firms experienced internal clashes over direction.

[4]Aaron Geist, analyst with Robert W. Baird & Co., quoted in "Success Is All in the Genes," *Investor's Business Daily,* 18 July 2005, A12.

The Idea of Terminal Value

To assist him in the final stages of preparing for the negotiations, Rodney Chu called in Paige Simon, who had just joined the firm after completing an undergraduate degree. To lay the groundwork for the assignment, Chu began by describing the concept of terminal value:

Chu: Terminal value is the lump-sum of cash flow at the *end* of a stream of cash flows—that's why we call it "terminal." The lump sum represents either (a) the proceeds to us from exiting the investment, or (b) the present value (at that future date) of all cash flows beyond the forecast horizon.

Simon: Because they are way off in the future, terminal values really can't be worth worrying about, can they? I don't believe most investors even think about them.

Chu: Terminal values are worth worrying about for two reasons. First, they are present in the valuation of just about every asset. For instance, in valuing a U.S. Treasury bond, the terminal value is the return of your principal at the maturity of the bond.

Simon: Some investors might hold to maturity, but the traders who really set the prices in the bond markets almost never hold to maturity.

Chu: For traders, terminal value equals the proceeds from selling the bonds when you exit from each position. You can say the same thing about stocks, currencies, and all sorts of hard assets. Now, the second main reason we worry about terminal value is that in the valuation of stocks and whole companies, terminal value is *usually a very big value driver.*

Simon: I don't believe it. Terminal value is a distant future value. The only thing traders care about is dividends.

Chu: I'll bet you that if you took a random sample of stocks—I'll let you throw darts at the financial pages to choose them—and looked at the percentage of today's share price *not* explained by the present value of dividends for the next five years, you would find that the unexplained part would dominate today's value. I believe that the unexplained part is largely due to terminal value.[5]

> Simon's first task: Present and explain the data in **Exhibit 3**.

Simon: I'll throw the darts, but I still don't believe it—I'll show you what I find.

[5] The unexplained part could also be due to option values that are not readily captured in a discounted cash flow valuation.

Varieties of Terminal Values

Chu: We can't really foresee terminal value, we can only *estimate* it. For that reason, I like to draw on a wide range of estimators as a way of trying to home in on a best guess of terminal value. The estimators include (a) accounting book value, (b) liquidation value, (c) multiples of income, and (d) constant growth perpetuity value. Each of those has advantages and disadvantages, as my chart here shows (**Exhibit 4**). I like the constant growth model best and the book value least, but they all give information, so I look at them all.

Simon: Do they all agree?

Chu: They rarely agree. Remember that they are imperfect estimates. It's like picking the point of central tendency out of a scatter diagram or triangulating the height of a tree, using many different points of observation from the ground. It takes a lot of careful judgment because some of the varieties of terminal value are inherently more trustworthy than others. From one situation to the next the different estimators have varying degrees of appropriateness. In fact, even though I usually disregard book value, there are a few situations in which it might be a fair estimate of terminal value.

Simon: Like what?

Chu: Give it some thought; you can probably figure it out. Give me some examples of where the various estimators would be appropriate or inappropriate. But remember that no single estimator will give us a "true" value. Wherever possible, we want to use a variety of approaches.

> Simon's second task: Consider the approaches described in **Exhibit 4**.

Taxes

Simon: What about taxes in terminal values? Shouldn't I impose a tax on the gain inherent in any terminal value?

Chu: Sure, if you are a taxpaying investor and if it is actually your intent to exit the investment at the forecast horizon. But lots of big investors in the capital markets (such as pension funds and university endowments) do not pay taxes. And other investors really do not have much tax exposure because of careful tax planning. Finally, in mergers and acquisitions analysis and most kinds of capital budgeting analysis, the most reasonable assumption is to *buy and hold*, in perpetuity. Overall, the usual assumption is *not* to tax terminal values. But we all need to ask the basic question at the start of our analysis, is the investor likely to pay taxes?

Liquidation versus Going Concern Values

Simon: Now I'm starting to get confused. I thought "terminal" meant the end—and now you're talking about value in perpetuity. If terminal value is really the ending value, shouldn't we be talking about a *liquidation value*? Liquidation values are easy to estimate: we simply take the face value of net working capital, add the proceeds of selling any fixed assets, and subtract the long-term debt of the company.

Chu: *Easy* isn't the point. We have to do what's economically sensible. For instance, you wouldn't want to assume that you would liquidate Microsoft in three years just because that's as far into the future as you can forecast. Microsoft's key assets are software, people, and ideas. The value of those will never get captured in a liquidator's auction. The real value of Microsoft is in a stream of future cash flows. When we come to a case such as Microsoft, we see the subtlety of "terminal value"—in the case of *most* companies, it means "continuing value" derived from the going concern of the business. Indeed, many assets live well beyond the forecast horizon. Terminal value is just a summary (or present value) of the cash flows beyond the horizon.

Simon: So when would you use liquidation value?

Chu: I've seen it a lot in corporate capital budgeting, cases like machines, plants, natural resources projects, etc. The assets in those cases have definite lives. But companies and *businesses* are potentially very long-lived and should be valued on a going concern basis. But I still look at liquidation value because I might find some interesting situations where liquidation value is higher than going concern value. Examples would be companies subject to oppressive regulation or taxation and firms experiencing weird market conditions—in the late 1970s and early 1980s, most oil companies had a market value *less* than the value of their oil reserves. You don't see those situations very often, but still it's worth a look.

Market Multiples and Constant Growth Valuation

Simon: Aren't multiples the best terminal value estimators? They are certainly the easiest approach.

Chu: I use them, but they've got disadvantages, as my chart (**Exhibit 4**) shows. They're easy to use, but too abstract for my analytical work. I want to get really close to the assumptions about value, and for that reason, I use this version of the constant growth valuation model to value a firm's assets:

$$TV_{Firm} = \frac{FCF \times (1 + g_{FCF}^{\infty})}{WACC - g_{FCF}^{\infty}}$$

"FCF" is free cash flow. "WACC" is weighted average cost of capital. And "g^{∞}" is the constant growth rate of free cash flows to infinity. This model was derived from an infinitely long DCF valuation formula.

$$PV_{Firm} = \frac{FCF_0 \times (1+g_{FCF}^{\infty})}{(1+WACC)} + \frac{FCF_0 \times (1+g_{FCF}^{\infty})^2}{(1+WACC)^2} + \frac{FCF_0 \times (1+g_{FCF}^{\infty})^3}{(1+WACC)^3} + \cdots + \frac{FCF_0 \times (1+g_{FCF}^{\infty})^{\infty}}{(1+WACC)^{\infty}}$$

If the growth rate is constant over time, this infinitely long model can be condensed into the easy-to-use constant growth model.

When I'm valuing equity instead of assets, I use the constant-growth valuation formula, but with equity-oriented inputs:

$$TV_{Equity} = \frac{Residual\,cash\ flow \times (1+g_{RCF}^{\infty})}{Cost\ of\ equity - g_{RCF}^{\infty}}$$

Residual Cash Flow (RCF) is the cash flow which equity-holders can look forward to receiving—a common name for RCF is dividends. A key point here is that the growth rate used in this model should be the growth rate appropriate for the type of cash flow being valued; and the capital cost should be appropriate for that cash flow as well

You may have seen the simplest version of the constant growth model—the one that assumes zero growth—which reduces to dividing the annual cash flow by a discount rate.

Simon: Sure, I have used a model like that to price perpetual preferred stocks. In the numerator, I inserted the annual dividend; in the denominator I inserted whatever we thought the going required rate of return will be for that stream.

Chu: If you insert some positive growth rate into the model, the resulting value gets bigger. In a growing economy, the assumption of growing free cash flows is quite reasonable. Sellers of companies always want to persuade you of their great growth prospects. If you buy the optimistic growth assumptions, you'll have to pay a higher price for the company. But the assumption of growth can get unreasonable if pushed too far. Many of the abuses of this model have to do with the little infinity symbol, ∞: the model assumes *constant growth at the rate, g, to infinity*.

"Peter Pan" Growth: WACC < g

Simon: Right! If you assume a growth rate greater than WACC, you'll get a *negative* terminal value.

Chu: That's one instance in which you cannot use the constant growth model. But think about it: WACC less than g *can't* happen; a company cannot grow to infinity at a rate greater than its cost of capital. To illustrate why, let's rearrange the constant growth formula to solve for WACC:

$$WACC = \frac{FCF_{Next\ period}}{Value of\ \ firm_{Current\ period}} + g_{FCF}^{\infty}$$

If WACC is less than *g*, then the ratio of FCF divided by the value of the firm would have to be *negative*. Since the value of the healthy firm to the investors cannot be less than zero,[6] the source of negativity must be FCF—that means the firm is absorbing rather than throwing off cash. Recall that in the familiar constant growth terminal value formula, FCF is the flow that compounds to infinity at the rate *g*. Thus, if FCF is negative, then the entire stream of FCFs must be negative—the company is like Peter Pan: *it never grows up*; it never matures to the point where it throws off positive cash flow. That is a crazy implication because investors would not buy securities in a firm that never paid a cash return. In short, you cannot use the constant growth model where WACC is less than *g*, nor would you want to because of the unbelievable implications of that assumption.

Using Historical Growth Rates; Setting Forecast Horizons

Chu: A more common form of abuse of this model is to assume a very high growth rate, simply by extrapolating the past rate of growth of the company.

Simon: Why isn't the past growth rate a good one?

Chu: Companies typically go through life cycles. A period of explosive growth is usually followed by a period of maturity and/or decline. Take a look at the three deals in this chart (**Exhibit 5**): a startup of an animation movie studio in Burbank, California; a bottling plant in Mexico City, and a high-speed private toll road in Los Angeles.

- **Movie studio.** The studio has a television production unit with small but steadily growing revenues and a full feature-length film production unit with big but uncertain cash flows. The studio does not reach stability until the 27th year. The stability is largely due to the firm's film library, which should be sizable by then. After year 27, exploiting the library through videos and re-releases will act as a shock absorber,

[6] This is a sensible assumption for healthy firms, under the axiom of the limited liability of investors: investors cannot be held liable for claims against the firm, beyond the amount of their investment in the firm. However, in the cases of punitive government regulations or an active torts system, investors may be compelled to "invest" further in a losing business. Examples would include liabilities for cleanup of toxic waste, remediation of defective breast implants, and assumption of medical costs of nicotine addiction. In those instances, the value of the firm to investors could be negative.

dampening swings in cash flow due to the production side of the business. Also, at about that time, we can assume that the studio reaches production capacity.

- **Bottling plant.** The bottler must establish a plant and an American soda brand in Mexico, which accounts for the initial negative cash flows and slow growth. Then, as the brand takes hold, the cash flows increase steeply. Finally, in year 12, the plant reaches capacity. After that, cash flows grow mainly at the rate of inflation.
- **Toll road.** The road will take 18 months to build, and will operate at capacity almost immediately. The toll rates are government-regulated, but the company will be allowed to raise prices at the rate of inflation. The cash flows reach stability in year 3.

A key point of judgment in valuation analysis is to *set the forecast horizon at that point in the future where stability or stable growth begins.* You can't use past rates of growth of cash flows in each of these three projects because the explosive growth of the past will not be repeated. Frankly, over long periods of time, it is difficult to sustain cash flow growth much in excess of the economy. If you did, you would wind up owning everything!

Simon: So at what year in the future would you set the horizon and estimate a terminal value for those three projects? And what growth rate would you use in your constant growth formula for them? Uh-oh. I know: "Figure it out for yourself."

Simon's third task: Assess the forecast horizons for the three projects. See **Exhibit 5.**

Growth Rate Assumption

Chu: There are two classic approaches for estimating the growth rate to use in the constant-growth formula. The first is to use the self-sustainable growth rate formula,

$$g^{\infty} = ROE \times (1 - DPO)$$

That equation assumes that the firm can only grow as fast as it adds to its equity capital base (through the return on equity, or "ROE," less any dividends paid out, indicated through the dividend payout ratio, or "DPO"). I'm not a big fan of that approach because most naive analysts simply extrapolate *past* ROE and DPO without really thinking about the future. Also it relies on accounting ROE and can give some pretty crazy results.[7]

The second approach assumes that nominal growth of a business is the sum of *real growth* and *inflation*. In more proper mathematical notation the formula is

$$g^{\infty}_{Nominal} = [(1 + g^{\infty}_{Units}) \times (1 + g^{\infty}_{Inflation})] - 1$$

[7] For a full discussion of the self-sustainable growth rate model, see "A Critical Look at the Self-Sustainable Growth Rate Concept" (UVA-F-0951).

That formula uses the Fisher Formula, which holds that the nominal rate of growth is the product of the rate of inflation and the "real" rate of growth[8]. We commonly think of real growth as a percentage increase in units shipped. But in rare instances, real growth could come from price increases due, for instance, to a monopolist's power over the market. For simplicity, I just use a short version of the model (less precise, though the difference in precision is not material):

$$g^{\infty}_{Nominal} = g^{\infty}_{Units} + g^{\infty}_{Inflation}$$

Now, this formula focuses you on two really interesting issues: the real growth rate in the business, and the ability of the business to pass along the effects of inflation. The consensus inflation outlook in the United States today calls for about a 2% inflation rate indefinitely. We probably have not got the political consensus in the United States to drive inflation to zero, and the Federal Reserve has shown strong resistance to letting inflation rise much higher. Well, if inflation is given, then the analyst can really focus her thinking on the more interesting issue of the real growth rate of the business.

The real growth rate is bound to vary by industry. Growth in unit demand of consumer staple products (such as adhesive bandages) is probably determined by the growth rate of the population—less than 1% in the United States. Growth in demand for luxury goods is probably driven by growth of real disposable income—maybe 3% today. Growth in demand for industrial commodities like steel is probably about equal to the real rate of growth of GNP—about 3% on average through time. In any event, all of those are small numbers.

When you add those real growth rates to the expected inflation rate today, you get a small number—that is intuitively appealing since over the very long run, the increasing maturity of a company will tend to drive its growth rate downward.

Terminal Value for Arcadian Microarray Technologies

Chu: We're negotiating to structure an equity investment in Arcadian. We and management disagree on the size of the cash flows to be realized over the next 10 years (see **Exhibits 1** and **2**). I'm willing to invest cash on the basis of *my* expectations, but I'm also willing to agree to give Arcadian's management a contingent payment if they achieve *their* forecast. To begin the structuring process, I needed valuations of Arcadian under their and our forecasts. We have the cash flow forecasts, and we both agree that the weighted average cost of capital (WACC) should be 20%—that's low for a typical venture capital investment, but given that Arcadian's research and development (R&D) partners are bearing so much of the technical risk in this venture, I think it's justified. All I needed to finish the valuation was a sensible terminal value assumption—I've already run a

[8] Economist Irving Fisher derived this model of economic growth.

sensitivity analysis using growth rates to infinity ranging from 2% to 7% (see **Exhibit 6**). The rate at which the firm grows will place different demands on the need for physical capital and net working capital—the higher the growth rate, the greater the capital requirements. So, in computing the terminal value using the constant growth model, I adjusted the free cash flow for these different capital requirements. Here are the scenarios I ran (in millions of U.S. dollars):

Simon's fourth task: Interpret **Exhibit 6**.

Nominal Growth Rate to Infinity	Capital Expenditures in Terminal Year, Net of Depreciation	Net Working Capital Investment in Terminal Year
2%	$0 million	$0 million
3%	($5)	($3)
4%	($12)	($5)
5%	($15)	($7)
6%	($20)	($8)
7%	($28)	($9)

Arcadian's management believes that they can grow at 7% to infinity, assuming a strong patent position on breakthrough therapeutics. I believe that a lower growth rate is justified, though I would like to have your recommendation on what that rate should be. Should we be looking at the population growth rate in the United States (about 1% per year), or the real growth rate in the economy (about 3% per year), or the historical real growth rate in pharmaceutical industry revenues (5% per year)? Are there other growth rates we should be considering?

Simon's fifth task: What drives g^{∞}?

We ought to test the reasonableness of the DCF valuations against estimates afforded by other approaches. Estimates of book and liquidation values of the company are not very helpful in this case, but multiples estimates would help. Price/earnings (P/E) multiples for Arcadian are expected to be 15 to 20 times at the forecast horizon—that is considerably below the P/Es for comparable companies today, but around the P/Es for established pharmaceutical companies. Price/book ratios for comparable companies today are around 8.5 times; Arcadian's book value of equity is $3.5 million. Please draw on any other multiples you might know about. We do not foresee Arcadian paying a dividend for a long time.

Simon's sixth task: Estimate terminal values using multiples and prepare present-value estimates using them.

Simon: That makes me skeptical about the whole concept. Terminal value for a high-tech company will be an awfully mushy estimate. How do you estimate growth? How sensitive is terminal value to variations in assumed growth rates? And with several terminal value estimates, how do you pick a "best guess" figure necessary to complete the DCF analysis? And once you've done all that, how far apart are the two valuations?

Chu: You need to help me find intelligent answers to those questions. Please let me have your recommendations about terminal values, their assumptions, and ultimately, about what you believe is a sensible value range today for Arcadian, from our standpoint and management's. By "value range," I mean high and low estimates of value for the equity of Arcadian that represent the bounds within which we will start negotiating (the low value), and above which we will abandon the negotiations.

Simon's seventh task: Triangulate value ranges and recommend a deal structure.

Conclusion

Later, Rodney Chu reflected on the investment opportunity in Arcadian. It looked as if management's asking price was highly optimistic; $40 million would barely cover the cash deficit Sierra had projected for 2005. That implied that further rounds of financing would be needed for 2006 and beyond. But buying into Arcadian now was like buying an option on future opportunities to invest—the price of that option was high, but the potential payoff could be immense if the examples of Affymetrix and Illumina were accurate reflections of the potential value creation in this field. Indeed, it was reasonable to assume that Arcadian could go public in an initial public offering (IPO) shortly after a major breakthrough pharmaceutical was announced. An IPO would accelerate the exit from this investment. If an IPO occurred, Sierra Capital would not sell its shares in Arcadian, but instead would distribute the Arcadian shares tax-free to clients for whom Sierra Capital was managing investments. Chu wondered how large the exit value might be, and what impact an early exit would have on the investment decision.

Chu's task: Assess early exit values and their impact on the decision.

Exhibit 1

ARCADIAN MICROARRAY TECHNOLOGIES, INC.

Arcadian Microarray Technologies Cash Flow Forecast, by Arcadian Management
(values in millions of U.S. dollars)

INCOME STATEMENT	Actual 2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Sales											
Clinical microarrays	$0	$1	$15	$56	$107	$181	$249	$274	$282	$285	$289
Research microarrays	2	12	28	45	75	110	135	165	190	210	225
Royalties and other revenue	0	0	2	13	52	106	146	166	174	186	189
Human therapeutics	0	0	0	0	8	57	171	250	330	352	362
Total sales	**2**	**13**	**45**	**114**	**242**	**454**	**701**	**855**	**976**	**1,033**	**1,065**
Cost of sales	7	10	21	41	84	159	246	322	335	350	361
Gross profits	**(5)**	**3**	**24**	**73**	**158**	**295**	**455**	**533**	**641**	**683**	**704**
Contract revenue	16	21	23	15	12	4	3	3	3	3	3
Operating expenses											
Research & development	14	20	24	18	21	21	32	43	51	52	50
Selling, general & admin.	12	15	24	45	93	176	259	323	369	372	349
Total expenses	**26**	**35**	**48**	**63**	**114**	**197**	**291**	**366**	**420**	**424**	**399**
Other income	3	2	2	0	(3)	(10)	(25)	(38)	(43)	(37)	(20)
Income before taxes	**(12)**	**(9)**	**1**	**25**	**53**	**92**	**142**	**132**	**181**	**225**	**288**
Taxes	0	0	5	9	19	32	57	76	89	90	85
Net income	**($12)**	**($9)**	**($4)**	**$16**	**$35**	**$60**	**$85**	**$56**	**$92**	**$135**	**$203**
FREE CASH FLOW											
Net income	($12)	($9)	($4)	$16	$35	$60	$85	$56	$92	$135	$203
Noncash items	0	1	2	2	6	10	18	19	15	8	(1)
Working capital	(4)	(8)	(12)	(22)	(63)	(101)	(118)	(100)	(61)	1	39
Capital expenditures	(15)	(6)	(5)	(23)	(53)	(93)	(111)	(98)	(66)	(10)	(10)
Free cash flow	**($31)**	**($22)**	**($19)**	**($27)**	**($76)**	**($124)**	**($126)**	**($123)**	**($20)**	**$134**	**$231**

Source: Case writer’s analysis.

Exhibit 2

ARCADIAN MICROARRAY TECHNOLOGIES, INC.

Arcadian Microarray Technologies Cash Flow Forecast, by Sierra Capital Analysts
(values in millions of U.S. dollars)

INCOME STATEMENT	**Actual 2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Sales												
Clinical microarrays	$0	$0	$2	$11	$22	$36	$56	$71	$85	$95	$106	$114
Research microarrays	2	4	11	22	40	59	89	135	145	160	185	199
Royalties and other revenue	0	1	4	7	12	15	25	50	60	75	91	105
Human therapeutics	0	0	0	0	0	0	0	14	56	80	110	140
Total sales	**2**	**5**	**17**	**40**	**74**	**110**	**170**	**270**	**346**	**410**	**492**	**558**
Cost of sales	7	17	20	25	39	54	72	96	124	142	154	160
Gross profits	**(5)**	**(12)**	**(3)**	**15**	**35**	**56**	**98**	**174**	**222**	**268**	**338**	**398**
Contract revenue	16	22	22	15	12	4	4	4	4	4	4	4
Operating expenses												
Research & development	14	23	25	27	29	33	37	44	52	53	54	58
Selling, general & admin.	12	21	25	32	44	64	87	104	127	138	136	136
Total expenses	**26**	**44**	**50**	**59**	**73**	**96**	**124**	**147**	**179**	**191**	**191**	**194**
Other income	3	0	0	1	(1)	(2)	(2)	(3)	(2)	0	0	3
Income before taxes	**(12)**	**(34)**	**(31)**	**(29)**	**(27)**	**(38)**	**(24)**	**28**	**45**	**80**	**152**	**210**
Taxes	0	0	(0)	1	4	(13)	4	11	15	27	39	48
Net income	**($12)**	**($34)**	**($31)**	**($30)**	**($31)**	**($25)**	**($28)**	**$17**	**$30**	**$53**	**$112**	**$162**
FREE CASH FLOW												
Net income	($12)	($34)	($31)	($30)	($31)	($25)	($28)	$17	$30	$53	$112	$162
Noncash items	2	3	3	3	4	6	8	10	14	18	20	23
Working capital	(6)	(6)	(6)	(7)	(14)	(17)	(19)	(20)	(28)	(16)	(6)	(6)
Capital expenditures	(15)	(9)	(9)	(9)	(10)	(11)	(15)	(18)	(24)	(27)	(28)	(30)
Free cash flow	**($31)**	**($46)**	**($43)**	**($43)**	**($51)**	**($47)**	**($54)**	**($11)**	**($8)**	**$28**	**$98**	**$149**

Source: Case writer's analysis.

Exhibit 3

ARCADIAN MICROARRAY TECHNOLOGIES, INC.

Paige Simon's Dart-Selected Sample of Firms with Analysis of Five-Year Dividends as a Percentage of Stock Price

	Recent Price	Annual Dividend	Projected Five-Year Dividend Growth (%)	Beta	Equity Cost	Present Value of Five Years' Dividends	Percent of Market Price Not Attributable to Dividends
BNSF	$53	$0.64	13.0%	0.95	11.2%	3.36	94%
Caterpillar	49	0.80	10.0%	1.20	12.6%	3.74	92%
Cooper Industries	67	1.40	0.0%	1.20	12.6%	4.98	93%
Cummins, Inc.	82	1.20	1.0%	1.35	13.4%	4.30	95%
Deluxe Corporation	33	1.48	1.5%	0.80	10.4%	5.79	82%
RR Donnelley	34	1.04	3.5%	0.95	11.2%	4.21	88%
Dun & Bradstreet	64	0.00	0.0%	0.80	10.4%	0.00	100%
Eaton Corp.	63	1.08	13.5%	1.10	12.0%	5.62	91%
Emerson Electric Co.	70	1.60	7.5%	1.10	12.0%	7.08	90%
Equifax	33	0.11	3.5%	1.10	12.0%	0.44	99%
FedEx Corporation	81	0.29	13.0%	1.10	12.0%	0.00	100%
Fluor Corporation	63	0.64	4.0%	1.20	12.6%	2.54	96%
Honeywell Int'l. Inc.	34	0.75	3.0%	1.35	13.4%	2.84	92%
Illinois Tool Works, Inc.	82	1.00	8.5%	1.05	11.7%	4.58	94%
Kelly Services	29	0.40	11.0%	0.95	11.2%	1.99	93%
ServiceMaster	14	0.43	2.5%	0.80	10.4%	1.73	87%
Sherwin-Williams Co.	46	0.68	11.0%	1.00	11.5%	3.36	93%
Smurfit-Stone Cont. Co.	10	0.00	0.0%	1.30	13.1%	0.00	100%
Tenneco	17	0.00	0.0%	1.75	15.5%	0.00	100%
Weyerhauser Co.	68	1.60	7.5%	1.15	12.3%	7.03	90%
						Average	**93%**

Note: To illustrate the estimate of 94% for Burlington Northern, the annual dividend of $0.64 was projected to grow at 13.0% per year to $0.72 in 2006, $0.82 in 2007, $0.92 in 2008, $1.04 in 2009, and $1.18 in 2010. The present value of those dividends discounted at 11.2% was $3.36. That equaled about 6% of Burlington Northern's stock price, $53.00. The complement, 94%, is the portion of market price not attributable to dividends.
Source of data: *Value Line Investment Survey* for prices, dividends, growth rates, and betas. Other items calculated by case writer.

Exhibit 4

ARCADIAN MICROARRAY TECHNOLOGIES, INC.

Key Terminal Value Estimators

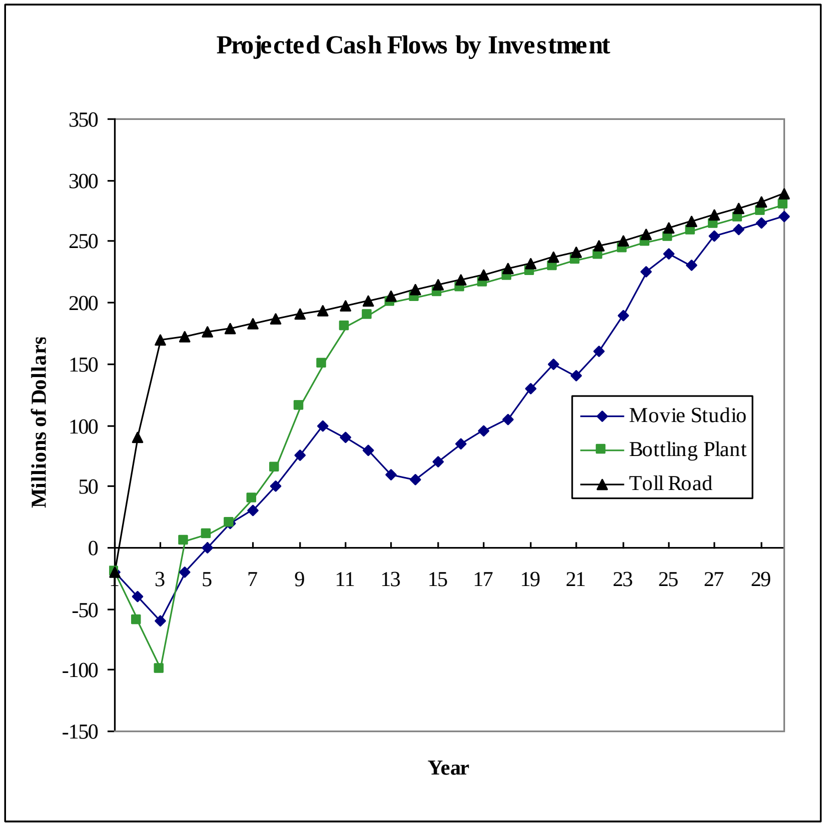
Approach	Advantages	Disadvantages
Book Value	—Simple —"Authoritative"	—Ignores some assets and liabilities —Historical costs: backward-looking —Subject to accounting manipulation
Liquidation Value	—Conservative	—Ignores "going concern" value —(Dis)orderly sale?
Replacement Value	—"Current"	—Replace *what?* —Subjective estimates
Multiples, **Earnings Capitalization** **—Price/Earnings** **—Value/EBIT** **—Price/Book**	—Simple —Widely used	-—"Earnings" subject to accounting manipulation —"Snapshot" estimate: may ignore cyclical, secular changes —Depends on comparable firms: ultimately just a measure of relative, not absolute value
Discounted Cash Flow	—Theoretically based —Rigorous —Affords many analytical insights —Cash focus —Multiperiod —Reflects time value of money	—Time-consuming —Risks "analysis paralysis" —Easy to abuse, misuse —Tough to explain to novices

Exhibit 5

ARCADIAN MICROARRAY TECHNOLOGIES, INC.

Cash Flows of Three Deals with Differing Rates of Development
(values in millions of U.S. dollars)

Year	Movie Studio	Bottling Plant	Toll Road
1	($20)	($20)	($20)
2	(40)	(60)	90
3	(60)	(100)	169
4	(20)	5	172
5	0	10	176
6	20	20	179
7	30	40	183
8	50	65	187
9	75	115	190
10	100	150	194
11	90	180	198
12	80	190	202
13	60	200	206
14	55	204	210
15	70	208	214
16	85	212	219
17	95	216	223
18	105	221	227
19	130	225	232
20	150	230	237
21	140	234	241
22	160	239	246
23	190	244	251
24	225	249	256
25	240	254	261
26	230	259	266
27	255	264	272
28	260	269	277
29	265	275	283
30	270	280	288
31+	Steady growth to infinity.		



Source: Case writer's analysis

Exhibit 6

ARCADIAN MICROARRAY TECHNOLOGIES, INC.

Sensitivity Analysis of Arcadian Terminal Value and Present Value
by Variations in Terminal Value Scenarios
(values in millions of U.S. dollars)

Arcadian's View						
Annual growth rate to infinity	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**
Weighted average cost of capital	20%	20%	20%	20%	20%	20%
Annual capex (net of depr'n.) 2015	$0	($5)	($12)	($15)	($20)	($28)
Annual addition to NWC 2015	-	(3)	(5)	(7)	(8)	(9)
Adjusted free cash flow 2015	202	194	185	180	174	165
Terminal value 2014	1,142	1,173	1,200	1,257	1,314	1,355
PV of terminal value 2014	185	189	194	203	212	219
PV free cash flows 2005-2014	($151)	($151)	($151)	($151)	($151)	($151)
Total Present Value	**$33**	**$38**	**$43**	**$52**	**$61**	**$68**
Sierra Capital's View						
Annual growth rate to infinity	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**
Weighted average cost of capital	20%	20%	20%	20%	20%	20%
Annual capex (net of depr'n.) 2016	$0	($5)	($12)	($15)	($20)	($28)
Annual addition to NWC 2016	-	(3)	(5)	(7)	(8)	(9)
Adjusted free cash flow 2016	185	177	168	163	157	148
Terminal value 2015	1,049	1,073	1,093	1,142	1,189	1,219
PV of terminal value 2015	141	144	147	154	160	164
PV free cash flows 2005-2015	($118)	($118)	($118)	($118)	($118)	($118)
Total Present Value	**$23**	**$26**	**$29**	**$35**	**$42**	**$46**

Source: Case writer's analysis.