Comparative Financial Analysis Report:

The Engineering Software Industry and Its Evolving Business Models

By

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I. Abstract:

This report compares the most recent two year performance of three leading engineering software companies. Such companies, also called EDA (Engineering Design Automation) companies, develop products and deliver services that support the design and verification of today's highly complex electronic chips. We take a managerial role in this report, and seek a business model for such EDA companies that would be best suited for the ever changing and challenging world of electronics. These EDA companies are experimenting with various models. Based on the profitability of such models, we recommend that the companies, instead of licensing their software at high prices to a few customers, spur innovation by reducing their software prices and partaking in the mass markets of commodity electronics. The commodity electronics develops generic, general purpose products that could then be targeted for use in various specific industries, ranging from automotive to consumer to aerospace electronics.

II. The Industry and Its Major Players:

Need for Engineering Software: The electronics industry has been governed by the Moore's law, named after the Intel Chairman G. Moore, who predicted decades ago that the electronic chips will double in complexity and performance, for the same size, every 18 months. The empirical prediction continues to drive the industry to new heights of innovation. A computer chip running at 1000 MHz will be commercially available next year, and will be packaged with a 1000 Mbyte memory chip (Semiconductor Industry Association, 1997). These numbers will double and quadruple, respectively, in 3 years hence. On a different dimension, electronics for human interface and wireless communication will be integrated into the same chip. Further, technologies that would integrate medical diagnostics, security, and safety are around the corner. Each represents integration of a new field of engineering, new challenges, and at a very small size– an active electronic chip element is two to three orders of magnitude narrower than a human

hair. The enormous complexity of such designs, and the large databases, drive the need for engineering software to model, design, simulate, manufacture, and test such chips.

Customer Base: Electronic chips are found in all types of products and systems of industries such as automobile, aerospace, computer, consumer, and medical industries. The customers for such engineering software (or EDA) companies, thus, are the major electronic design companies which design, manufacture, and sell such chips to other industries. The customer base comprises of only large corporations in various industries. The total number of customers is only a few hundred such accounts, since such major companies tend to standardize on one EDA vendor for compatibility across their various divisions. Such electronic design companies face many challenges: Continued drive towards miniaturization of electronics; Increased system capability; Decreased Time to Market; and Improved Performance. The EDA company products and services have to support this design and verification process. In addition to these customer domain challenges, they face other challenges: Few customers; Management of huge interlinked databases; Design tools internal to the customer and their compatibility with these external tools; and Many small competitors with niche capabilities.

Competition: There are only four major EDA companies. We cover three of them here, specifically Cadence Design Systems, Mentor Graphics, and Synopsys, all established during 1980s. The fourth company, Avant! is more recent and aggressive. It is also mired in many infringement suits at present. EDA companies perceive the competition to come from each other, the many small competitors with a specific tool, and the customers' own internal tools. The EDA companies invest considerable funds in research and development, and pass on such costs to their customers. Thus, a small innovative company with a better niche product can easily undercut and put the business model of these bigger EDA companies in disarray. As such, the major EDA companies seem to be always on a binge of mergers and acquisitions.

Array of Products and Services: These EDA vendors have had the traditional role of developing engineering software, licensing to their customers, and providing consulting and training to the customers' engineers. Two years ago, Cadence aggressively sought to move into the design service sector as well, in direct competition with their customers. On the other hand, Synopsys raised the barrier to entry by developing very sophisticated high level tools that make the designers very productive and lead to high performance systems, albeit at a slight increase in chip size. Mentor Graphics developed a strategy of providing reusable design components, in collaboration with Synopsys, that the customers can license and use right away. This reduces the design effort by engineers.

Future Trends and Their Impact: The EDA industry has to address trends of the electronics industry and the consumer software industry, without the potential lucrative markets of either. The electronics hardware industry is moving to integrate more functionality on a smaller chip, and with diverse engineering subsystems (Audrey, 1999). The consumer software industry, on the other hand, is moving towards a web-model of licensing and distribution (McWilliams, 1999) of unbundled software. This trend will reduce the cost of use of software. Large customers of the EDA companies will put

pressure on the EDA companies to respond in a similar manner. While this trend is good for the consumers, the EDA software suppliers may not be able to recover their high software R&D (Research and Development) cost from the customers.

III. Comparison of the Companies Based on the Financial Ratios:

Table 1 below summarizes the results obtained from the annual 1998 SEC filings of the three companies. We used the 10-K filings made at the end of their fiscal year in 1998. The table categorizes the measures based on their impact. Synopsys stock price has high valuation, the result of discounted future growth. This is based on its high entry barrier software synthesis and verification tools. Cadence kept up a high pace of growth, by changing the mix of products and services (see above). However, we do not think that their business model will survive in the longer run (see section IV below) – many of their products are on the low-barrier entry side of the business. Mentor Graphics initiated a strategic makeover, which actually caused them to lose money and show significantly less growth compared to the other two. Synopsys showed better Earnings Per Share (EPS). Cadence was the only company with 10% of all outstanding stocks in stock options, attesting to their high level of incentive programs and the acquisition pace. This diluted their EPS significantly.

There were no industry standards for us to compare against. Such engineering software companies cannot be grouped with consumer software companies such as Microsoft and Oracle. Thus, we compared the major players against each other. The EDA companies are at present experimenting with different strategies and the short term effects of these strategies are obvious in the financial ratios.

Table 1: Financial Ratios for the three companies

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Type of Mesure	Ratio	Units	Cadence		Mentor Graphics		Synopsys	
			1997	1998	1997	1998	1997	1998
Performance	Price/Erngs Ratio	-	16	18.1	Nmf	18.1	26	23
Performance	Return on Assets1	%	27	26	-4.3	7.5	16.4	18.7
Performance	Ret. on Sh. Equity1	%	38.1	43.1	-6.1	11.9	25.1	26.8
Growth / year	Revenue	%	19	31	1.6	7.7	23	11
Growth / year	Income	%	39	33	Nmf	Nmf	34	41
Profitability	Profit Margin1	%	29.9	30.3	-3.7	7.1	19.5	24.7
Profitability	Earnings / Share1	$	1.3	1.6	-0.3	0.5	1.9	2.6
Inv. Utilization	Asset Turnover	Times	0.9	0.9	1.1	1.1	0.8	0.8
Inv. Utilization	Equity Turnover	Times	1.3	1.4	1.6	1.7	1.3	1.1

Inv. Utilization	**Collection Period**	days	81	83	85	94	68	64
Coverage	**Debt to Asset**	%	29	39	31	36	35	30
Coverage	**Book Value / Share**	$	3.3	3.7	4.3	4.5	7.7	9.7
Coverage	**Cash Flow / Share2**	$	1.0	0.6	-0.1	0.4	1.9	2.0
Liquidity	**Current Ratio**	-	2.3	1.8	2.2	1.8	2.3	2.9

Notes:
1. Income used in these expressions excludes one-time gains and charges.
2. Cash Flow measure = Net Income for the year + Depreciation + Amortization
3. Nmf = Not meaningful. Mentor Graphics had a net loss in 1997.
4. Stock prices were obtained as the average for the four quarters.
5. Ratios based on inventories were not calculated: Inventories were low.

IV. Comparison of the Companies Based on their Portfolio of Products and Services:

Certain common traits exist:

- International Sales, mostly to Japan and Europe, amounted to 45 to 50%, with the higher numbers reported by Cadence.

- All the companies acquired smaller companies with innovative complimentary engineering software tools. However, Cadence continued its rapid pace of acquisition, far outpacing others. Cadence also established a $50 M venture capital fund to fund start ups with needed software. Mentor Graphics, on the other hand, helped smaller companies develop reusable design components which it will license out to major design houses.

- While the portfolio differed, the sale of engineering software continued to be the major revenue resource for all the companies, with the customer support the next major category. However, the growth was higher for certain “high level” tools that Synopsys has expertise in.

- The companies used both “pooling of interests” and “outright purchase” methods to acquire smaller companies.

The companies chose different mix of portfolios to position themselves for the coming years. See Table 2 below. Cadence branched off to add ‘Design Service’ which increased from $115 M in 1996 to $265 M, a 100% plus increase. This, however, incurred a ‘Cost of Revenue’ at 72% because of the high salaries of experienced professionals needed in design services. This should be compared with ‘Costs of Revenue’ for software manufacturing and customer support at 9% and 14% respectively. These mature, low

barrier sectors saw 50% and 20% growth in 2 years. Synopsys focused on the "designer productivity gap," a measure that designers could appreciate much better since it impacted their day-to-day work more, as compared to the "silicon performance gap," that Cadence focused on. The latter could give better chip performance, but we have reached an era of diminishing returns, and no suite of tools is better at this end. Mentor Graphics focused on helping many small specialized companies develop reusable design components that others can license out. Mentor would collect revenues when such components are licensed out. Thus Mentor stands to benefit more as more commodity type of electronic systems are manufactured, on a large scale. They will collect a percentage of the retail price. Synopsys, by collaborating with Mentor on the 'design reuse' methodology, has positioned itself to benefit also, but not to the same extent as Mentor, since Synopsys can only supply the engineering software for use by a much smaller group, of engineers and designers.

Table 2: Products and Services

Portfolio Item	In Companies:	Profit Margin	Growth Rate	Succeed with:
Software	All	Very Good	Low	Get Technology
Customer Support	Synopsys	Good	Low	Lock in Customer
Design Service	Cadence	Poor	Good	Skilled Engineers
Design Licensing	Mentor	Good	Good	Good Collection

V. Conclusions:

We believe that the Mentor Graphics model of helping small companies develop reusable design components has much higher chance of succeeding in the longer run. In addition, the web is changing the way all software companies would perform in the future. Unbundling of the software and pay-as-you-go strategy, for the use of the software based on the frequency of usage, will change rapidly the way the EDA companies do business. We expect many small design houses, perhaps even situated in universities, to come into existence, both to supply reusable design components, and to use them in commodity electronics. This is all the more certain, given the trend that the consumers no longer wish to get all the features of today's sophisticated systems. Designer Electronics is on its way and Engineering Software companies have a pivotal role to play in this.

VI. References:

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