



Marketing Strategy: The Marketing Budget

IEEE Entrepreneurs' Network (ENET)

Tuesday, March 6, 2007

Ralph E. Grabowski

marketingVP

57 Sunset Rock Road

Andover MA 01810-4828

978-470-3930

<http://marketingVP.com>

ralph@marketingVP.com

Ralph Grabowski will illustrate how much effort goes into the fact-gathering, analytical front-end process to identify needs, customers, and opportunities. He will quantify that investment with unique data.

Please join us

The evening begins with an optional meal at Bertucci's, 475 Winter Street, (exit 27B off Route 128) in Waltham, at 5:15 PM. Networking and presentations follow at the Bay Colony Office Park, 1100 Winter Street in Waltham, beginning at 7 PM. The meeting ends before 10 PM. Additional information, directions, and maps are available at <http://marketingvp.com/papers/strategy-budget>

About the speaker

In thirty-seven years of Front End Marketing, Ralph Grabowski has helped launch new products, new companies, and more than seven new fields; which have grown to become worth over ten Billion dollars and resulted in gainful employment for many thousands of his fellow engineers. He practices as a VP of Marketing for startups or Chief Marketing Officer (CMO), Marketing Consultant, and as a temporary executive. Ralph specializes in Front End Marketing leadership, the fact-gathering, analytical Marketing process to steer the enterprise. He has practiced in more than fifty technologies.

Ralph invented the Marketing/Engineering Investment Ratio™ as a new metric to guide the Marketing budget for technology-based enterprises. He writes about Marketing, teaches Marketing, and researches the impact of Marketing on success; delivering more than one hundred published papers, invited presentations, and courses taught for universities, institutions, and professional societies.

He co-founded the world's first IEEE Robotics Chapter, co-founded MIT's entrepreneurship program, co-founded Technology Capital Network (TCN) at MIT, co-founded the North Shore Technology Council (NSTC), and co-founded the MIT Sloan School of Management graduate course "Starting And Running A High Tech Company." He served the IEEE as Chapter Chairman of both the IEEE Robotics and Automation (RA) and Microwave Theory & Techniques (MTT) Chapters.

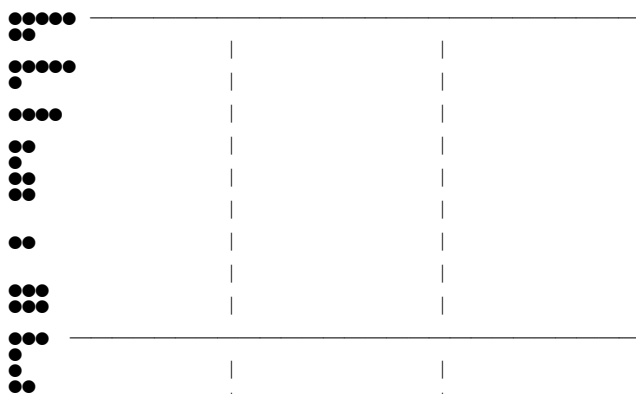
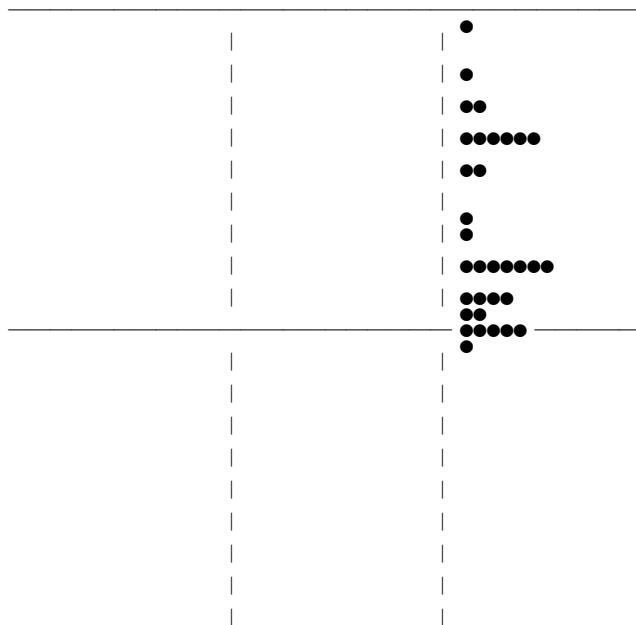
Mr. Grabowski taught or Mentored four teams who won MIT's \$100K Entrepreneurship Competition Grand Prize and, as a contestant, was the winner of the Fall \$1K Biotechnology category in the 2006-2007 MIT \$100K Competition. He has a BSEE from MIT, class of 1963, with thesis in image processing. Copyright 2007, Ralph E. Grabowski. All rights reserved.



IEEE ENET handout, Mar 6, 2007

Marketing*/Engineering Investment Ratio™

(*) excludes promoting and selling



Flaming
Failure

Neither

Super
Success

Infinity	Balico, balance aid medical device, Grand Prize Winner '05
Infinity	Helicos BioSciences, single-molecule DNA sequencing '03
Infinity	Angstrom Medica, synthetic bone, Grand Prize Winner '01
	MIT \$50K Entrepreneurship Competition
9	Litton Medical (ex-BD, ex-DataMedix), mid '80s
6.25	MolecularWare, bioinformatics MIT \$50K Grand Prize '99
5	ZippyCool, beverage cooler MIT \$50K Semi-finalist '99
5	Invent Resources, product development '93
4	Becton Dickinson, medical - arrhythmia recall '78-'80
4	Varian Associates, Component Leak Detector '93
4	DIVA (AVID), video editing software '90-'93
4	LiquidPiston, combustion engine MIT \$50K Runner-Up '04
4	ZippyCool, beverage cooler MIT \$50K Semi-finalist '99
4	Adaptive Optics, Div of United Technologies
3.2	two machine vision systems, 3.2 '94, 4 '95
3	AFC Cable, armored wiring systems '97
2.33	Exact Labs, colon cancer diagnostics '95-'96
>	MarketSoft, enterprise software '98-'02
>	1.5 Dell Computer, PCs '90s
1.53	thingworld.com, Internet media '98
1	2 Juno, free e-mail '96
1.5	Cytoc, PAP smear preparation '88-'89
1.5	Intuit, financial software '90-'93
1.5	Z2, injection molding flow device MIT \$50K Finalist '99
1.5	PSI Environmental, boiler temperature gauge '93-'95
1.25	Phoenix Controls (Honeywell), VAV controls '83
1.25	Molten Metal (MMT), elemental recycling '91
1.2	Monster, employment via the Internet '98
1.2	Aurora Systems, CTI software '90-'94 and precursor
1.1	Brooks Automation, semi robots & cluster tools '89-'90
1.1	Evidian USA, enterprise software '97-'99
1.05	Reflective Technologies, reflective sportswear '94-'95
1	Amana (Raytheon), RadaRange microwave oven '66-'75
1	Acugen Software, semi test software '86-'00s
1	Lycos, global Internet hub and media '97
1	EMC, enterprise storage '90s
.9	Open Market, Internet commerce software '98

Financial and human impact:

> 1 Trillion dollars
> 400,000 jobs created or lost
> 150,000 engineering slots developed or gone

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marketingVP.com - results through June 17, 2010
●● multiple data at one M/E Ratio™

.1	Molten Metal '97
.1	Optra, electro-optic sensors - 88 SBIR '84-'95
.1	Keithley Metrabyte, data acquisition Taunton MA '93
.1	MRS Technology, FPD lithography '86-'97
.1	Hampshire Instruments, X-ray stepper '91-'92
< .1	Essential Research, vacuum system CAD '90-'93
.09	RVA Technology, software '82-'85
.07	StarGen, fabless semiconductors '99-'06
.07	Orchid BioSciences, genotyping '98
.07	Veeco, wafer particulate detector '85
.07	Keithley Instruments, Cleveland OH '93
.06	GCA '81, semiconductor stepper
.06	GCA '92
.05	Brooks Automation, semi robots '77-'85
.05	Hampshire Instruments, '84-'90
.05	ITRAN, machine vision '79-'93
< .05	Varian Associates, IMPATT microwave oscillators '69
< .04	Object Databases, software '92
< .04	Polaroid, instant photography '90s
.037	Machine Technology (MTI), semi track '93
.033	Raytheon, RadaRange microwave oven '44-'65
.033	Micronix, X-ray stepper '81-'87
.033	Evidian USA, enterprise software (2) '92-'96 & '00-'02
< .033	KSR, supercomputers '86-'95
.02	Cisco, Internet routers '00
< .02	Quarterdeck, operating system (OS) software '90s
.015	Luminus Devices, LED lighting '10
.014	Cetacean Networks, real-time Internet & VoIP '00-'04
.013	Fusion Lighting, lighting '91-'02
.013	Genuity, Internet '98-'00
.013	electronics & instrumentation, AMA, '53
.012	HyperDesk (FTP), Internet groupware '92-'95
.01	Becton Dickinson (BD), Telocate patient location '73-'77
.01	DataMedix (bought BD division), early '80s
.01	Physical Sciences (PSI), > 200 SBIR '84-'95
< .01	Xerox, copiers '94-'02
.008	Thinking Machines, supercomputers '90-'94
.007	Lotus, office software '90s
.007	Nortel, telecom '84-'02
.004	Digital Equipment (DEC), PCs & minicomputers '90s
.003	Applicon, Computer-Aided-Design (CAD) '72-'82
.002	Lucent, telecom '67-'03
.002	SAL, X-ray stepper '81-'00s
< .001	WANG Laboratories, PCs & minicomputers '84-'91
< .001	VNCL, network video '93-'99
Zero	Thinking Machines '83-'89

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Ralph E. Grabowski
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 57 Sunset Rock Road
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 ralph@marketingVP.com
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fact-gathering, analytical Marketing to steer the enterprise™

Hello. My name is Ralph Grabowski. In 37 years of Marketing, I have helped launch new products, new companies, and more than seven new fields; which have grown to become worth **over ten Billion dollars**.

I would like to share with you some observations and data from those experiences. There is a reason for the special graphic in the lower right, for it is the key to success.

I am an electrical engineer, BSEE MIT, class of 1963.

I earn my living as a VP of Marketing for startups, as a Marketing Consultant to established companies, and as a temporary executive for turnarounds and restarts. I support the institutions of technology-based business and entrepreneurship, write about Marketing, teach Marketing, and research how Marketing steers successful technology-based enterprises.

People ask me, "How did you get into Marketing?" Some Engineers in the audience even slur it derisively, "How did you get into Marrrrrrrrrketting?" as if I abandoned my roots.

---- next slide ---- In 1969, I was a Solid-State Microwave Circuit Design Engineer pioneering new technology and a new field at Varian Associates. We developed microwave Impatt oscillators, the solid-state replacement for the Klystron microwave oscillator, a vacuum tube. I engineered the world's first high power (1 Watt), solid-state microwave oscillators.

This radical technology was as significant and potentially disruptive a development for the radar and telecommunication fields as the transistor was for general electronics; with solid state devices replacing bulky, hot, unreliable vacuum tubes.

We had the know-how and designs to produce microwave sources from the low-power milliwatt level to the high power one-Watt level over the entire useful range of frequencies and could manufacture hundreds of units a day. Varian's Silicon Impatt diode oscillators enjoyed a **four-year technological lead** on the competition, Gallium Arsenide (GaAs) GUNN diode oscillators.



An Impatt - Back bias a silicon diode into avalanche with a DC current source. Incrementally, higher current results in less voltage meaning AC negative resistance. Conventional, large-junction diodes have high capacitance, swamping out the negative resistance. Impatt diodes are silicon microwave diodes with small junctions and small capacitance which are bonded junction down onto copper heat sinks. An Impatt in a resonant cavity will oscillate. Varian made Impatt oscillators from 3-15 GHz; from S-band through C-band, X-band, and Ku-band.

It was neat technology, but our so-called Marketing department did not perform Marketing. They could not figure out, "Who is going to buy the darn thing?" So Varian Associates threw our technology in the wastebasket and laid us all off.

I went home to my wife and told her I was laid off. My boss, our group leader, went home to his wife and daughters and **COMMITTED SUICIDE**.
(long pause) This talk is dedicated to the memory of Frank Sterner.

Varian was a "Flaming Failure" – like the flyer going down in flames, crashing, and burning.

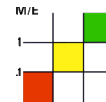
For I have suffered the **AGONY OF DEFEAT**, the personal and emotional grief, the stress, and the professional and financial setbacks from working for failures and being laid off.

I figured out that the quality of my life depended more on the **quality of Front End Marketing** that was performed – or not performed – and **did not depend on technology**, for almost nobody understands Marketing. Even fewer understand technology, can appreciate and articulate the value of technology, and know how to do Front End Marketing.

Over the weekend, I went from Solid-State Microwave Circuit Design Engineer to Applicon's first marketing and sales manager where I helped launch the Computer-Aided Design (CAD) and Electronic Design Automation (EDA) fields – both – and never looked back. These two new fields, alone, gainfully employ many thousands of my fellow engineers.

Outline

- Gather data about Marketing investment
- Conclusions based on facts
- Unique formula to budget and staff



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For I have tasted the **THRILL OF VICTORY**, the personal and emotional joy, the excitement, and the professional and financial rewards from being in successful companies and from helping my fellow engineers thrive.

Paul M. Kelley's companion talk, "Business Plans...Back to Basics," lists mandatory ingredients:
<http://www.ballos.com/enet/pdfs/MarMtg07/March07Kelley.pdf>

Supported market estimates
 Primary Market Research
 Competitive Intelligence (CI)
 Focused user benefits: economic vs. non-economic
 Knowledge of the customer
 Clear market picture
 Market / customers
 Do your homework, be customer-centric

How much investment is required to surface that Marketing and customer information?
 Well, we are engineers, trained to and familiar with gathering data and acting upon the facts.
Let's gather data about Marketing investment.

We will also learn a unique formula to budget and staff Front End Marketing.

Surprising, counterintuitive data reveals the significant investment required to surface that Marketing and customer information– and to achieve business success.

We won't address "Why," although that will fall out of the data.

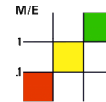
We won't talk about "How To."

We will focus on "How Much?"

Marketing budget and staffing

Why is "How Much" important?

- Too much = waste
- Too little = business failure
- How do you size the Marketing budget?



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How much Budget and staffing?

How much investment to surface that Marketing and customer information?

Too much investment means a waste of money – we could invest that in engineering.

Too little investment portends business failure – either making products which customers don't need or having the wrong strategy.

So how much do we Budget for Marketing?

The old budgeting models use the Sum of Marketing + Promoting + Selling as a percentage of sales. For example, the American Electronic Association (AEA) surveys and publishes this sum every year for a number of separate segments of the electronics industry. Electronic systems companies tend spend 25 to 30 percent of sales in Marketing, Promoting, and Selling. Similar surveys are available for other industries.

I have five problems with the model:

- 1 - It does not separate out the Marketing investment.
- 2 - Time is not in the guideline. It does not say **WHEN** we make the Marketing investment
- 3 - Startups have no sales. Therefore, you would budget nothing for Marketing.
- 4 - It is called Expense instead of **INVESTMENT**.
- 5 - Industry average is mediocrity. I am not interested in mediocrity.

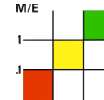
Marketing is not selling

Investment model – in time

Product is ready ↓

	Investment ratio	Developing the product	Ramping up sales
Front End (M)arketing	M/E™	✓	
(E)ngineering	1	✓	
Promoting			✓
Selling			

time →



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Marketing is a process of ascertaining needs which customers are willing spend money to satisfy, thus guiding engineering to design the right products. How much shall we invest in marketing to enable commercial success, and when?

At the request of the MIT Enterprise Forum, a world-wide support organization for enterprise, I developed a new metric to guide companies, the Marketing/Engineering Investment Ratio™ (M/E Ratio™). This model separates Marketing from the functions of promotion and selling. Formulating a ratio of Marketing to engineering installs Marketing concurrently with engineering, and sizes the Marketing budget with a readily identified number (engineering investment).

1 - Step one is to separate out Marketing from promoting and selling

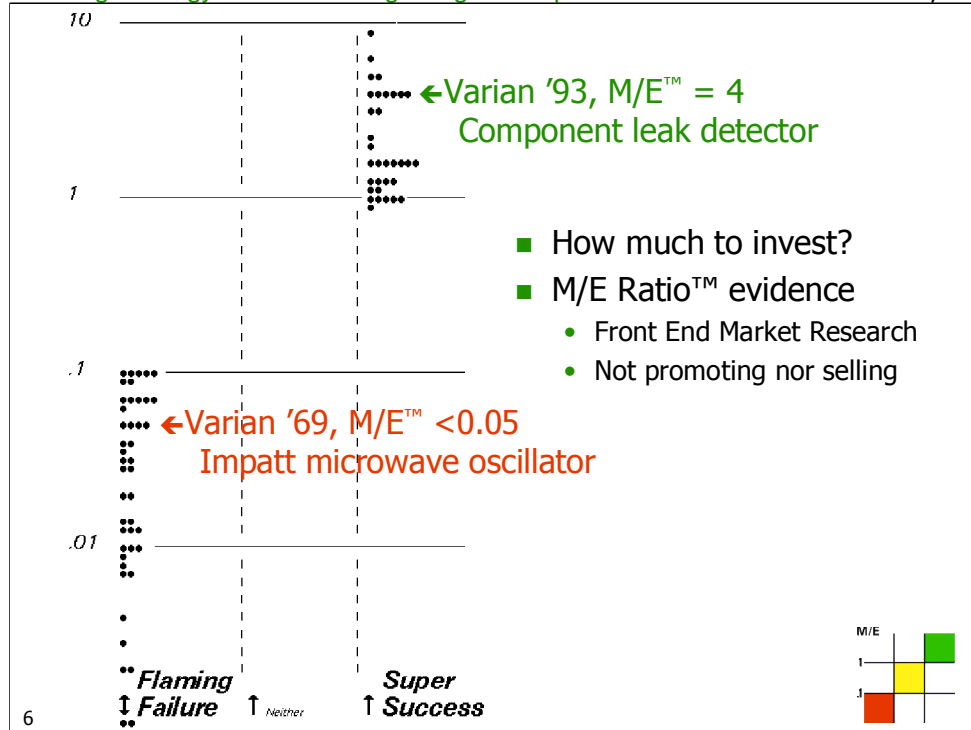
2 - Step two is to add Time to the guideline. The white boxes on the right represent time slots. To the right of the "Product is ready" arrow is the time after you have completed the development the product: when you are ramping up sales. Promoting and Selling occur during this time slot.

3 - Step three is to relate Marketing to Engineering, NOT to sales. Engineering is defined as the investment in developing the product, the sum of R&D plus development – either by product or by company. To the left of the "Product is ready" arrow is the time when you are development the product. Engineering occurs during this time slot. Marketing also occurs during this time slot.

4 - Step four is to call it an Investment instead of an Expense

If we normalize engineering to 1, then all we have to do is to find out what the ratio is, the **Marketing/Engineering Investment Ratio™ (M/E Ratio™)**.

5 - Step five is to relate the budget to successes, NOT to mediocrity.



Let's gather data. Let's do Market Research on Market Research.

A vector is determined by the end points. I sought the extremes, starting with bankruptcies and business basket cases – **the spectacular financial and strategic failures** in the left column. At the other end of the vector, we gather data from **spectacular financial and strategic successes** in the right column.

This is different than the many books and articles written only about what successes do, with no thought if what they do is cause or effect, or if what successes do is also done by failures.

The axis on the left is the ratio of Market Research investment to engineering investment, called the Marketing-to-Engineering Investment RatioTM (M/E RatioTM), on a logarithmic scale.

Varian' Microwave Division suffered from an M/E RatioTM of less than 0.05.

Nearly a quarter century later, Varian's Vacuum Division created a new product category, the component leak detector, investing in **nine months of Front End Marketing before beginning engineering**. Varian surfaced the "Voice of the Customer" to develop explicit lists of what engineering should design, and of what engineering should not design. Armed with definitive guidance from marketing, engineering designed the new product in nineteen days.

It became a **"money rocket."** Varian Vacuum's M/E RatioTM was 4!

Varian Vacuum's success flowed from one-hundred times higher Marketing investment than the other Varian Division's failure.

Microwave oven story WWII radar

Before

Britain's
"Chain Home"
ground radar

20 MHz

Antenna
360' by 600'

Transmitter
building

After the resonant cavity magnetron

USA P-61
"Black Widow"
night fighter

x 150 to 3 GHz

% 150 to fit in
airplane nose

Palm-of-
your-hand



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It was before the STIR Program, before the SBIR Program, and before the space program. It was the largest government-funded R&D program in the history of the planet. World War II ultimately created enormous opportunities for the **commercialization of technology**.

As we all know, radar won the war. MIT's Radiation Labs employed 4,000, designed half of the radars deployed during World War II, and spawned incredible post-war commercial growth around Route 128, "America's Electronics Highway," including such microwave companies as:

- Varian Microwave Division in Beverly, now CPI Beverly Microwave Division
- Microwave Associates in Burlington, now M/A-COM in Lowell
- Alpha Industries in Woburn, now SkyWorks

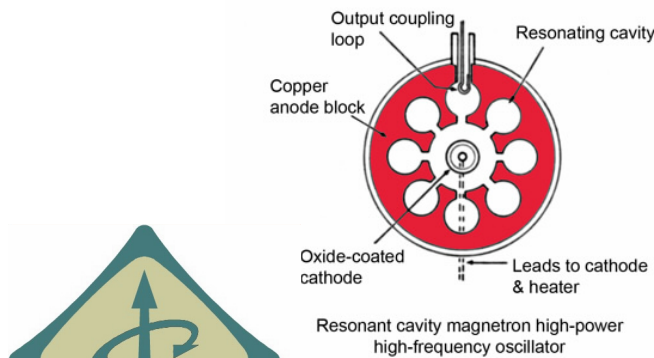
At the outbreak of WWII, Britain's "Chain Home" (CH) radar, the first to be used in wartime, allowed the RAF to defeat the much larger German forces during the Battle of Britain. The CH antenna was hundreds of feet on a side since no country could produce useful power at short wavelengths (high frequencies). Moreover, the Allies needed radar on ships and airplanes.

The magnetron was invented in the USA in 1921. The British followed by inventing the strapped, resonant cavity magnetron in 1940-41 which delivered 10 times the power of CH at 150 times shorter wavelength. This meant that the antenna could be 150 times smaller and also detect smaller objects. The combination of the palm-size magnetron, small antennas, and high resolution enabled small, high quality radars on ships, on airplanes, and even in PT boats:

- airborne radar as in the P-61 night fighter nose, above (Portending my microwave and radar career, I built a model of the P-61 as a ten-year-old fifth grader. When sixteen in high school, I used a war-surplus magnetron magnet to build Magnetic Resonance systems.)
- detecting German U-boat submarine periscopes previously undetectable from the air
- contour mapping radars for accurate Allied strategic bombing
- accurate gun laying radars making Allied battleships more deadly

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Microwave oven story Resonant cavity magnetron



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"Few in a position to judge would hesitate to name the cavity magnetron as having had a more decisive effect on the outcome of the war than any other single scientific device evolved during the war. **It was of far more importance than the atomic bomb.**"

AP Rowe, Superintendent of Britain's Bawdsey Research Station.

The availability of useful power at wavelengths of 10 cm and below (3 GHz and above) spawned a whole new technology and a new field – **"microwaves."**

The resonant cavity magnetron is a vacuum tube with an axial magnetic field (imagine magnetic field lines coming out of the slide). Electrons spiral out from the cathode to the copper anode block. Remember the "right hand rule" as embodied in our IEEE logo and in our IEEE ENET logo. Spiraling electrons excite resonant cavities which generate high power microwave energy.

The 100 Watt, building-sized, CH transmitter was only 0.5% efficient. Amazing stuff for 1941; the cavity magnetron delivered kilowatts of power at 70% efficiency in a 4 inch package!

But there was a **big problem**. The heart of the radar, the transmitter tube, required a complex hole machined into a solid block of copper. A skilled machinist labored two weeks to make one.

This is also the story of some local entrepreneurs who founded American Appliance Company in 1922 to make high-tech electronics for the home which, in the '20s, meant the advent of radio.

The US Government gave contracts to two major industrial powerhouses, Western Electric and Westinghouse, as well as to little American Appliance, which had changed its name to **Raytheon**. The action took place right here in Waltham, just 4 miles from our meeting tonight.

Commercialize the technology Microwave oven

■ Engineering directs Raytheon to failure

- \$50,000 (2006 \$)
- ~6 feet tall
- 800 pounds
- special 220V wiring
- water-cooled



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Between them, Western Electric and Westinghouse could make only 10 magnetrons a day.

Raytheon's Chief Technology Officer, Percy Spencer, realized that the magnetron had a constant cross-section. He used a stamping press, stacked up the pieces, ran them through a belt furnace, brazed them together, and made 2,700 magnetrons per day. **We won the war.**

As the war wound down, Raytheon was desperate to commercialize their technology. One day, Spencer came back from lunch with a Hershey bar in his back pocket and happened to stand in front of a magnetron. Shortly, he felt a **warm, squishy, brown mess in his pants.**

He had invented the microwave oven.

Raytheon's engineers directed the commercialization of the microwave oven.
From 1944 to 1965, Raytheon's RadaRange was engineering directed:

- It sold for \$50,000 (2006 \$)
- used special 220 Volt wiring (needing an electrician)
- and was water-cooled (requiring special plumbing)

Like the proverbial 800-pound Gorilla, it was nearly 6 feet tall and weighed almost 800 pounds.

Raytheon's RadaRange suffered from an M/E Ratio™ of 0.033.
The microwave oven began life as **Raytheon's largest commercial failure.**

Photo courtesy of the Spencer Family Archives and Rod Spencer, grandson of Percy Spencer, inventor of the microwave oven.



After twenty years of failure, Raytheon finally recognized that they needed to **dramatically increase the Marketing investment**, acquiring Amana Refrigerator in 1966 for their Marketing expertise. **Amana raised the M/E Ratio™ to 1.** Amana's Marketing directed their engineering effort and the RadaRange microwave oven to success:

- to make a microwave oven which customers would buy
- it must sell for <\$500
- be portable to the countertop (can be lifted by a woman)
- uses standard 110 Volt wiring (no electrician needed)
- and air cooled (no special plumbing)

Furthermore, it came with a home economist. Literally, when you purchased an Amana RadaRange, a professional home economist, hired by Amana, came into your home and taught you to become a successful microwave oven user.

The picture was scanned from the cookbook brought into my home in 1972 by Amana's home economist when I bought my first microwave oven.

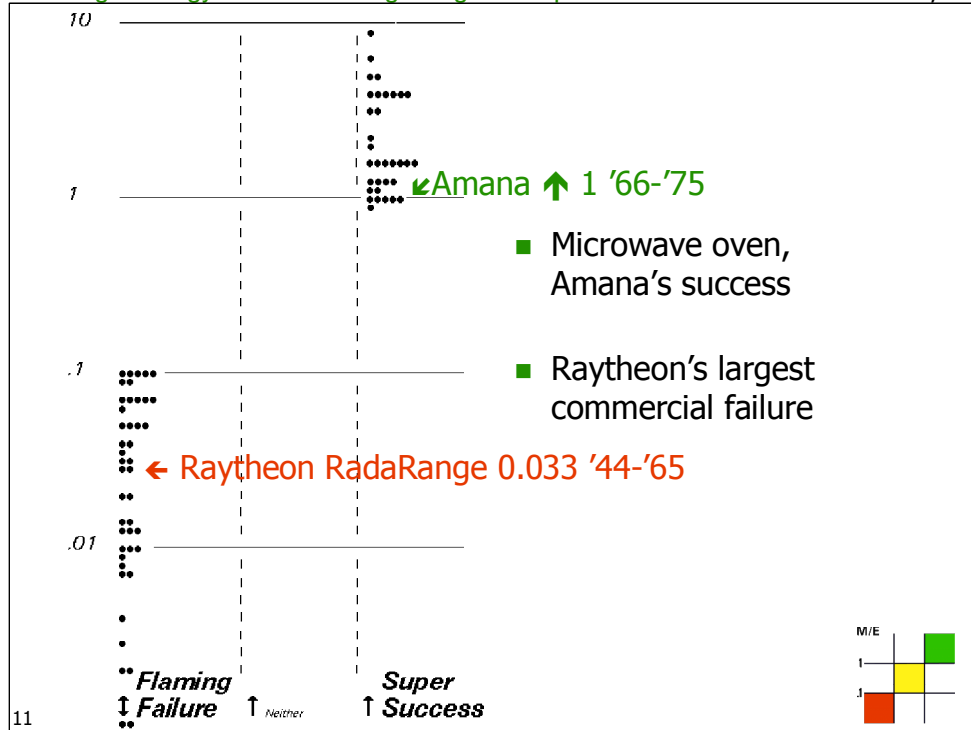
----- dig deeper -----

"Why good products fail"

<http://marketingvp.com/guests/globe/>

"Neat Technology, But Who Will Buy It?" <http://marketingvp.com/papers/neat/>
A play in 3 acts with Percy Spencer, inventor of the microwave oven – portrayed by his grandson, Rod Spencer

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How much did Raytheon and Amana invest in Market Research to understand the customer, to speak their language, and to articulate their needs? How much did they invest to drive engineering, promoting, and selling? How much did this market research cost?

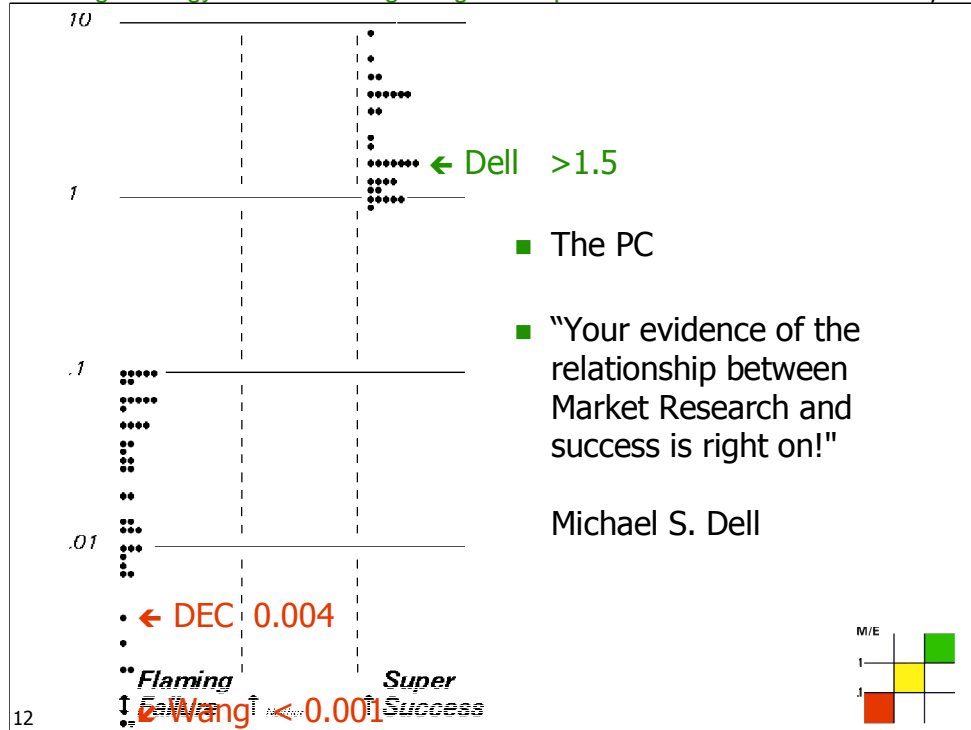
- Raytheon RadaRange, 0.033 M/E Ratio™, Raytheon's largest commercial failure.
- Amana raised the M/E Ratio™ from 0.033 to 1 and became a success.

Today, the microwave oven is the world's largest selling home appliance; more than stoves, more than refrigerators, more than dishwashers, and more than washers and dryers.

The difference between failure and success was Marketing, not technology.

Clearly, Raytheon had incredible, war-winning technology "of far more importance than the atomic bomb." Raytheon's technology, without Marketing, was a failure. There was no difference in the technology between Raytheon's RadaRange and Amana's RadaRange.

The only difference was the level of Marketing investment: that Amana invested as much in Marketing as in engineering and that Amana's Marketing steered the company to success.



Two local entrepreneurs, An Wang (Wang Computer) and Ken Olsen (DEC), both launched PCs in 1982. In fact, DEC launched two lines of PCs in 1982.

In 1984, a Texas entrepreneur named Michael started selling keyboards from his dorm room as PC's Limited. DEC launched their second generation of PCs in 1985, the same year that Michael Dell changed the company name to Dell Computer and entered the PC business.

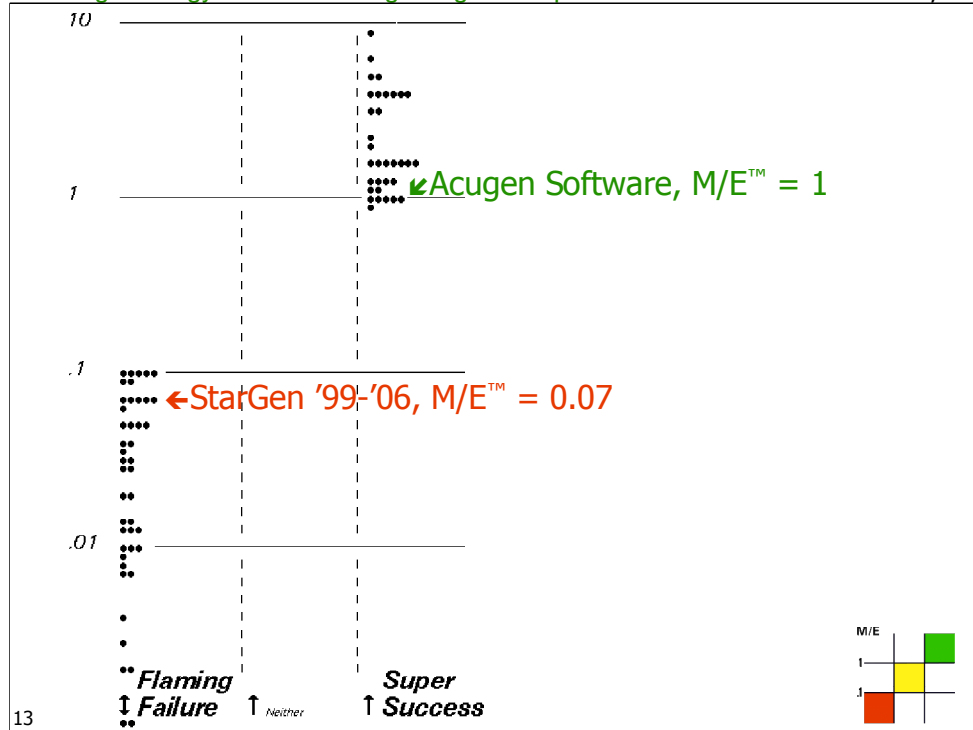
DEC and Wang are gone, shedding 177,000 jobs and 56,000 engineering slots between them. If each employee had a spouse and two children, that would represent more than 10% of the entire population of Massachusetts – gone. If all the technical folks were IEEE Members, they would represent more than 15% of the entire world-wide IEEE membership losing their jobs.

By contrast, Dell has grown to

- more than \$60 billion in revenue,
- more than \$100 billion in market capitalization,
- and more than 60,000 employees.

Michael S. Dell, Founder, Chairman, & CEO delivered a Spotlight presentation at the MIT Enterprise Forum (in 1998), speaking for an hour on how his company is absolutely driven by customer data. So I raised my hand to ask, "How much does Dell invest in market research to collect customer data?"

Michael Dell immediately replied, "**Dell's M/E Ratio™ is North of 1.5!**" Here's the data.



---- StarGen, a fabless semiconductor startup, squandered \$56 million in Venture Capital. After seven years, they barely rose to \$5 Million revenue and needed \$20 million more to burn for the next two years until they **maybe** broke even.

StarGen suffered from an M/E Ratio™ of 0.07.

In August 2006, the VCs gave up and began shutting the doors.

My son-in-law was one of their engineers.

He had to go home to my grandson and to my daughter to tell her that he had lost his job!

(long pause)

---- Acugen Software was launched for \$60K, about one-thousandth of StarGen's capitalization, to create semiconductor test software. The entrepreneur maintained an **M/E Ratio™ of ONE**, enabling a depth of customer understanding.

This not only steered his engineering to make a product that was superior in the dimensions that mattered to the customer, but also defined the key levers in the selling process.

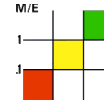
in 18 months

Startup to world market dominance

- Entrenched competitor 50 direct sales (withdrew)
- Acugen Software
 - Price twice the competition
 - Market share world dominance in 18 months
 - Sales \$ multi-million
 - Equity capital none
- Marketing engineers the product AND engineers the selling motion

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ACUGEN Software, Inc.



Acugen became a money rocket!

Acugen catapulted to world market dominance and a multi-million dollar revenue stream in 18 months, at twice the price, with NO additional capital, no sales force and no distributors!

Acugen drove their competitor, with a 50-person direct sales force, to withdraw.

---- dig deeper ---- Acugen Software ----

Acugen Software vignette

"The Importance of the Selling Process"

<http://marketingvp.com/payback/acugen/>

<http://marketingvp.com/guests/sellproc/>

Launch a new field – ThinPrep® Pap test

- Startup to \$3.65 Billion
- 65% more disease detection for women
- "The biggest advance in 50 years"
 - Mark Schiffman, National Cancer Institute

 C Y T Y C
c o r p o r a t i o n



I have been asked,
 "How can you spend so much money on Marketing? What do you do, take trips to Hawaii?"

How do you do Market Research when the market does not exist? How do you start a new field? Cytoc will illustrate the unique tools, methods, and processes for the beginning of a new field, and the **enormous, detailed, fact-gathering, analytical investment.**

The fundamental tools of the Market Macrocosm™ (M²) method are:

- 1- A broad overview of the market landscape
- 2- Market segmentation
- 3- Market sizing, from the bottom-up
- 4- Customer payback analysis
- 5- Disciplined, rigorous, Primary Market Research
- 6- Investing more in Market Research than in engineering

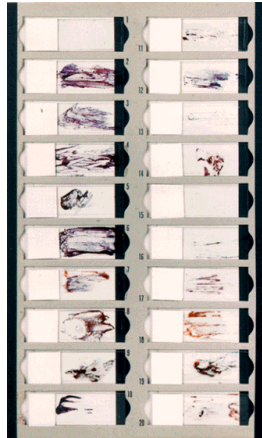
In the 50 years since the Pap smear became widely used, cervical cancer deaths have declined 70%. It is the only cancer screening test in the world that has decreased the incidence and mortality (numbers and deaths) of a cancer.

Nevertheless, the conventional Pap smear suffered from a terrible error rate.

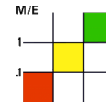
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Pap smear screening – microscope slides

Before, variable



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The conventional Pap smear is made by hand; the physician "smears" the sampling device across a microscope slide to spread a layer of cells. Each physician may do it differently, leading to some slides with thick lumps and clumps, and some slides with clear areas of no cells. The conventional Pap smear has False Negative rates ranging from 10-55% and up to **90% of those False Negatives are due to limitations of sampling or slide preparation.**

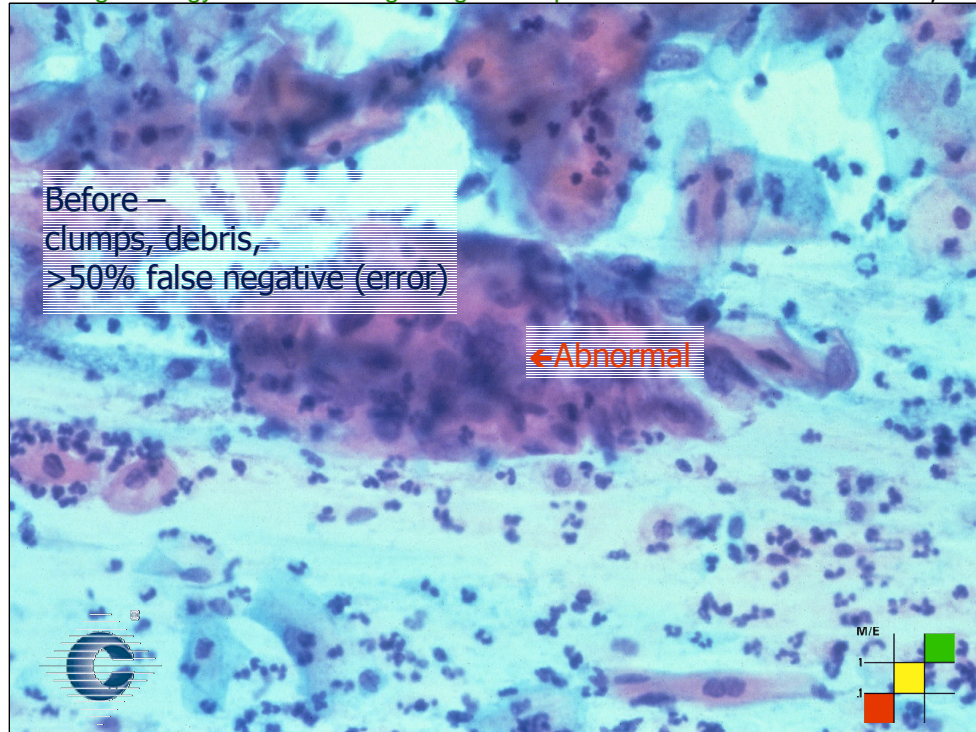
In order to address these problems, Cytyc Corporation has developed the ThinPrep® Pap Test®. In May 1996, the Food and Drug Administration (FDA) approved the ThinPrep® Pap Test® as a replacement for the conventional Pap smear. On November 6, 1996, the FDA approved labeling allowing Cytyc to claim that:

- The ThinPrep® 2000 System is **significantly more effective than the conventional Pap smear**, improving detection of Low Grade Squamous Intraepithelial (LSIL) and more severe lesions by 65% in screening populations and by 6% in hospital (high risk) populations.

- Specimen quality** with the ThinPrep® 2000 System is **significantly improved over that of conventional Pap smear** preparation in a variety of patient populations.

By reducing the number of sub-optimal or "satisfactory but limited by" (SBLB) slides by as much as 50%, the number of return visits and repeat Pap smears is diminished. The significant improvement in specimen quality will substantially reduce costs and patient anxiety associated with re-screening and unnecessary follow-up testing.

Cytyc established the new standard of care. Cytyc has 17 issued patents and 11 pending patent applications in the United States (Cytyc 2001 Annual Report).



In the center of the microscope field is a mass of cells with abnormal, misshapen nuclei. This is exactly the **indicator of a precursor of cervical cancer that the Pap screening is supposed to find.**

The conventional Pap smear has False Negative (FN) rates ranging from 10-55%. A human Pap reader must view about two thousand separate fields under a microscope, examining perhaps 250,000 cells to attempt to find a few cells (as little as five or six) that have slightly misshapen nuclei.

About one-third of the 15,000 women diagnosed with cervical cancer annually still die because the cancer was detected too late.

With the conventional Pap smear method, cells can be obscured by blood, mucus, and inflammation. Furthermore, the three-dimensional (3D) character of overlapping cells in lumps and clumps makes the examination a daunting challenge.

Accurate interpretation of up to 40% of conventional Pap smears are compromised by the presence of blood, mucous, obscuring inflammation, scant cellular material, and air-drying artifact.

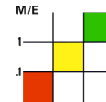
The National Cancer Institute (NCI) estimates that about 3.5 million Pap smears are found to be inconclusive each year in the US which often lead to unnecessary colposcopy (internal exam), biopsy, and office visits. The average cost of the standard management of such cases is about \$1,200 per case. The NCI estimates the cost to the US health care system at about \$3.6 billion each year.

Who is going to buy the darn thing?™

Woman



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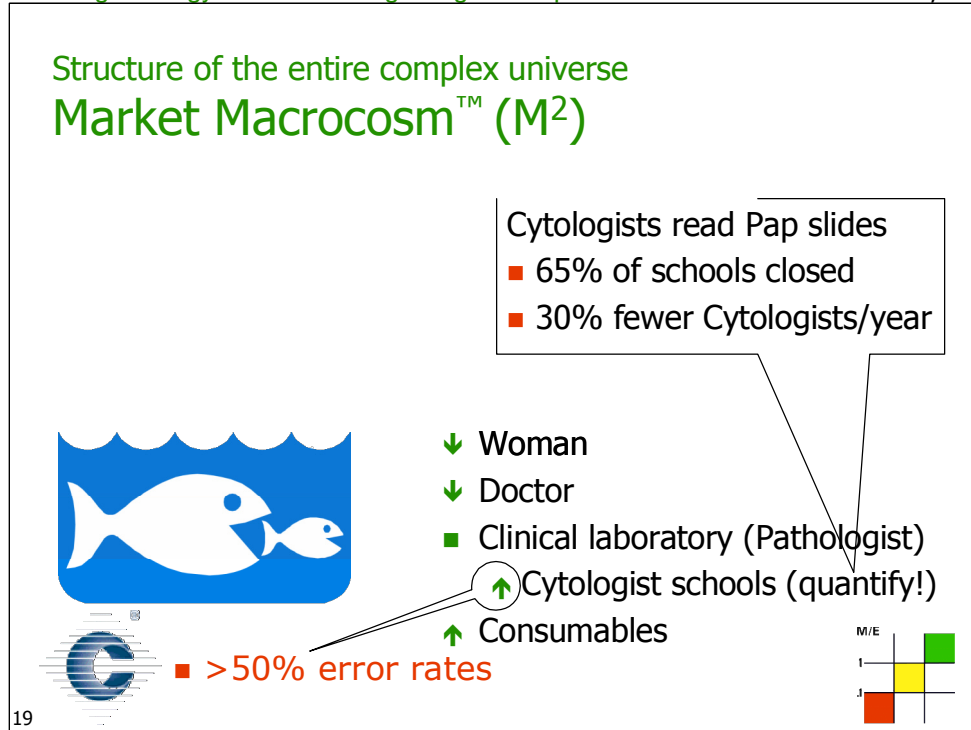
The first market research, while the entrepreneur was still in the basement, was about the food chain; the players and the concatenation of people, suppliers, and companies that make a market. Let's start by talking about the market segmentation, market sizing, and market access. This is the **business landscape**.

I am often told by entrepreneurs, "We have this neat (Pap smear testing) technology. EVERYBODY can use it!" What's wrong with that statement? Well, guys cannot use a Pap test! That's half of the World's population. OK, you say, "There are 5 Billion people in the World, about half of which are women; 2.5 Billion women times \$40 per Pap test means a \$100 Billion market. All we need is 1% market share and we will be a \$1 Billion per year company overnight!" The first thing that is wrong with that statement, if it played out that way, is that a \$100 Billion market will attract serious competition and the company which dominated the other 99% of the market will dominate you.

However, that is not the market segmentation – that is not the market sizing. Here is that market segmentation and sizing:

- A woman,
- who is sexually active (eliminating women under the age of 12, or about 1/3 of all women),
- who spends money on health care (that eliminates all of the World except the developed countries – and even there eliminates the first several rungs of the socioeconomic ladder where they can't spend money on health care)
- goes to the doctor (not any doctor – not the cardiologist, psychologist, podiatrist, or proctologist – but the her gynecologist or family practice physician or nurse-midwife) who takes a Pap smear

This is a channel of collection, not a channel of distribution. The Doctor, reimbursed by a 3rd party payer, sends the Pap slide to a commercial clinical lab. At the lab are cytologists; the people with specialized degrees from cytology schools who read the Pap smear slides.



There were rumors that clinical labs were having trouble finding cytologists. Market research converts anecdotes into quantified evidence! The **fundamental driving forces were quantified** and conveyed to potential investors to compel investment.

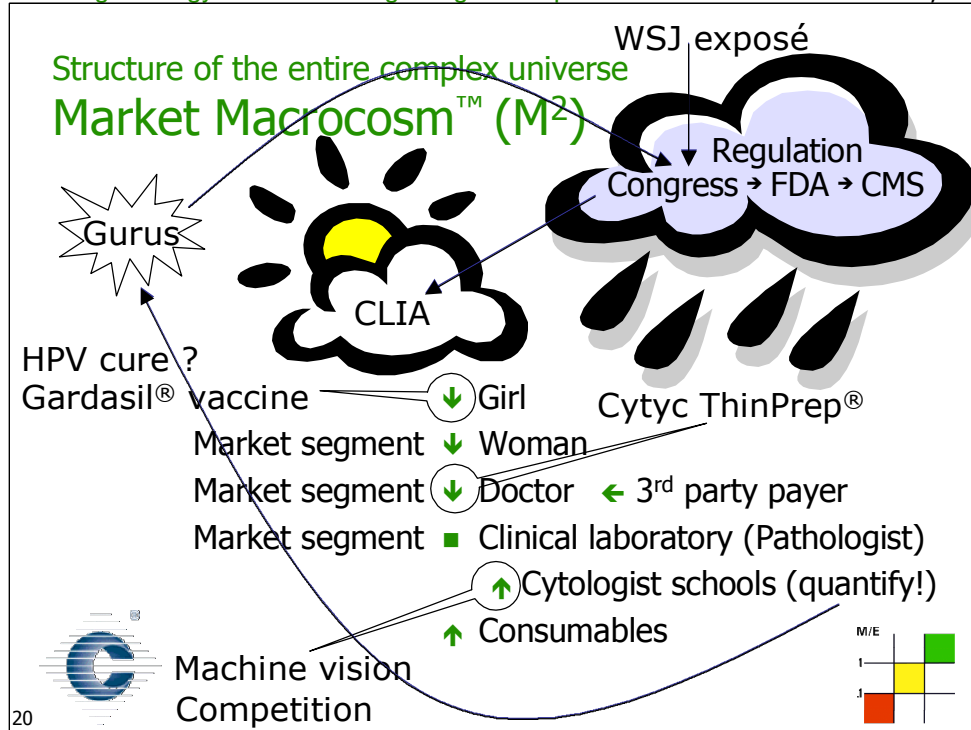
Cytec market research, while the entrepreneur was still in the basement, revealed that 30% fewer cytologists were being certified per year in the prior 5 years. By mid-1987, only 41 cytology schools were still active, down from 117 in the 1960s, with 76 having closed or stopped training.

Why is this important?

- Because the job is difficult, tiring, and tedious, fewer entered the field.
- Because with too few cytologists to do the work, there was pressure to review (examine) more slides per day just to get the work done, and this led to missed warnings (False Negative).

Overall is regulation. Some of the institutions include:

- FDA – Food and Drug Administration
- HCFA – Health Care Finance Agency, now called The Centers for Medicare & Medicaid Services (CMS), a Federal agency within the U.S. Department of Health and Human Services. Programs for which CMS is responsible include Medicare, Medicaid, State Children's Health Insurance Program (CHIP), HIPAA, and CLIA.
- CPT codes – "Physicians' CURRENT PROCEDURAL TERMINOLOGY", for the payment code



Strategy

A regulatory strategy and legal strategy should be an integral part of the business strategy. **Market research is the fundamental intellectual discipline of strategy.**

Cytoc began working to understand customer demographics, market trends, and the industry drivers; which precipitated an exposé of "Pap mills." The outcry led to Congressional Hearings in Washington, DC, under Massachusetts' Senator Edward Kennedy. By that time, their market research was available to be used in testimony before Congress, helping to result in new legislation focusing on quality and increased disease detection (that will speed market demand for their products).

New legislation resulted, limiting the number of smears a cytotechnologist may read in a day. This ultimately sped market demand for Cytoc's products.

Because of poorly run labs (Pap mills), particularly after several deaths from misdiagnosis due to inaccurate lab results, Congress wanted to guarantee public safety and the best possible patient care.

Competitive intelligence (CI)

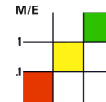
While the entrepreneur was still in his basement, Cytoc carried out Competitive intelligence (CI) on an emerging competitor while that competitor was still in their garage. That competitor is still struggling.

Front End Market Research Leads to profound product changes

- Identified the real customer problem
 - "... quality of the smear ..."
 - Slide preparation, not slide reading!
- Engineering designed the right product
- **65% more disease detection**



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Technology-based startups present two types of technical risk. First, there is the risk that the startup cannot make the technology work. The second risk, as happened at Cytyc, is that the startup does make the technology work, but that they are **developing the wrong technology**. Up-front marketing can **guide engineering to the right technology**.

Cytyc's up-front marketing investment identified profound changes from the initial product concept, which used machine vision. An entirely new product idea arose from the primary market research; a patented slide prep system, ThinPrep™, which creates a cell monolayer and simplifies the PAP reading process.

---- dig deeper ---- Cytyc ----

Cytyc vignette

"What Do Customers Want?"

"Cytyc's Impact on Women's Health"

"How To Raise \$100 Million"

"Marketing, the Bridge for Growing
from Engineer to Entrepreneur"

<http://marketingvp.com/payback/cytyc/>

<http://marketingvp.com/papers/buhitech/>

<http://marketingvp.com/papers/mdg/>

<http://marketingvp.com/papers/100mil/>

<http://marketingvp.com/guests/bridge/>



The initial product idea was machine vision; a TV camera through the microscope lens, coupled to a special computer, which would examine 250,000 cells in two minutes and subject each cell to perhaps forty separate medical criterion in software. The machine vision would pre-screen every slide (without humans) to select the few "worst" cells from each slide for presentation to a human cytologist who would perform a medical determination. The intent was to replace the (tedious, error-prone) data processing of human eyeballs with (tireless, consistent) machine data processing.

This technology was fully developed and worked. It met its specifications. Cytac made a production run of ten units and started clinical trials.

Nevertheless, **Cytac continued Primary market research.**



Early market research, in advance of engineering, identified profound changes from the initial product concept. **Upstream market research identified the real customer problem;** data gathering and data preparation of the Pap smear slide, before any human data processing. A patented slide prep system emerged, the ThinPrep® System, which adds to product differentiation and simplifies Pap screening. The ThinPrep® Pap Test® makes Pap smears by an automated slide preparation unit, the ThinPrep® slide processor, that produces uniform thin-layer slides, virtually free of obscuring artifacts such as blood, mucous, and inflammation.

With marketing guidance, engineering designed the right product, and captured the business opportunity. Cytec developed the technology to fit the customer need.

Here is how it works. As before, specimens are first collected by the clinician with a cervical sampling device. Then, instead of smearing the cells on a slide, the device is rinsed into a ThinPrep® vial containing PreservCyt® transport medium. The vial is then labeled and sent to the lab for processing.

At the laboratory, the vial is placed into the ThinPrep® slide processor. First, a gentle dispersion step breaks up blood, mucous, and non-diagnostic debris; and then thoroughly mixes the sample. A negative pressure pulse is generated which draws fluid through a TransCyt® Filter that collects a thin, even layer of diagnostic cellular material. The ThinPrep® Processor constantly monitors the rate of flow through the TransCyt® Filter during the collection process to prevent the cellular presentation from being too scant or too dense.

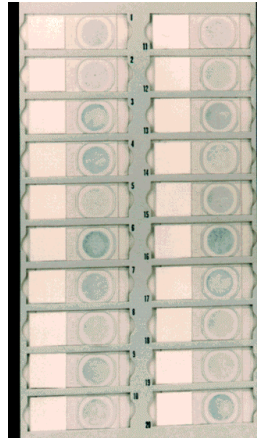
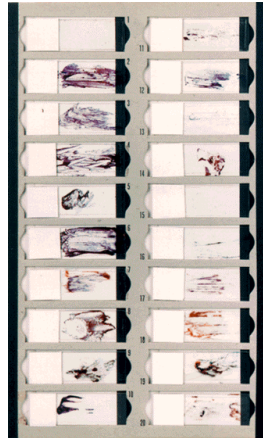
The cellular material is then transferred to a glass slide and fixed. ThinPrep® slides are stained and then evaluated by laboratory personnel using criteria similar to the conventional smear. What is different is the **marked improvement in clarity and specimen adequacy** achieved with the ThinPrep® System.

Profound product changes

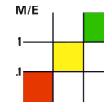
ThinPrep® mono-layer, no debris

Before, variable

ThinPrep®, uniform



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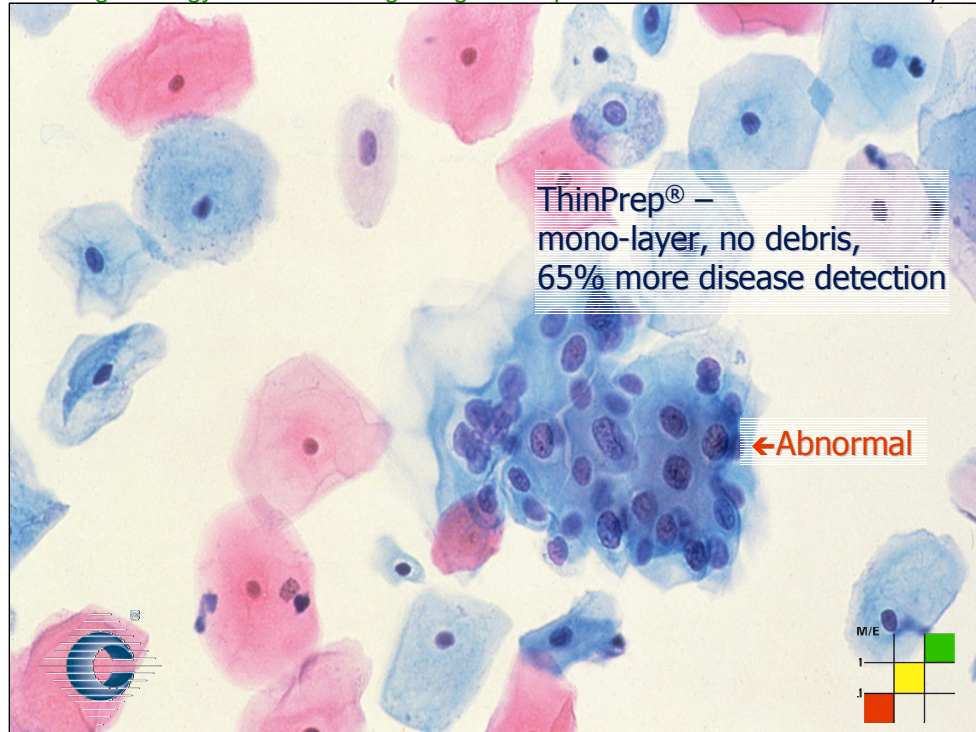
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Cytyc established the new standard of care. Cytyc has 17 issued patents and 11 pending patent applications in the United States (Cytyc 2001 Annual Report).



There is a mass of cells with abnormal, misshapen nuclei in the center of both this microscope view and the earlier slide. This is exactly the **indicator of a precursor of cervical cancer that the Pap screening is supposed to find.**

However, the warning cells are difficult to see in the first slide and more readily apparent here. The suspect cells in the first slide are obscured with medical debris and overlapping cells, and difficult to see because the layer is thick and hard to keep in focus under a microscope. The suspect cells in the ThinPrep® slide are more easily seen because they are free from medical debris and overlapping cells. The layer remains in focus since it is presented in a monolayer, one cell thick.

Clinical trials demonstrated that the **ThinPrep® Pap Test® increases disease detection 65%**, and reduced the error rate (False Negative) by a factor of four. Specifically, the clinical trials showed Cytyc's ThinPrep® System detected 65% more cancerous or precancerous samples when used in screening centers (where 95% of all Pap smears are processed) compared to the conventional Pap smear.

The ThinPrep® Pap Test® method preserves the cells and minimizes cell overlap, blood, mucus, and inflammation. It creates a mono-layer, a layer one cell thick, with no overlapping cells.

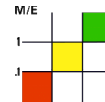
65% more disease detection!

Cytec's super success – \$\$\$

- Raised \$174.4 million
 - \$3.6 million first round
 - \$43.6 million Venture Capital
 - \$48 million IPO
 - \$85.8 million secondary offering
- Achieved a market cap of **\$3.65 Billion**



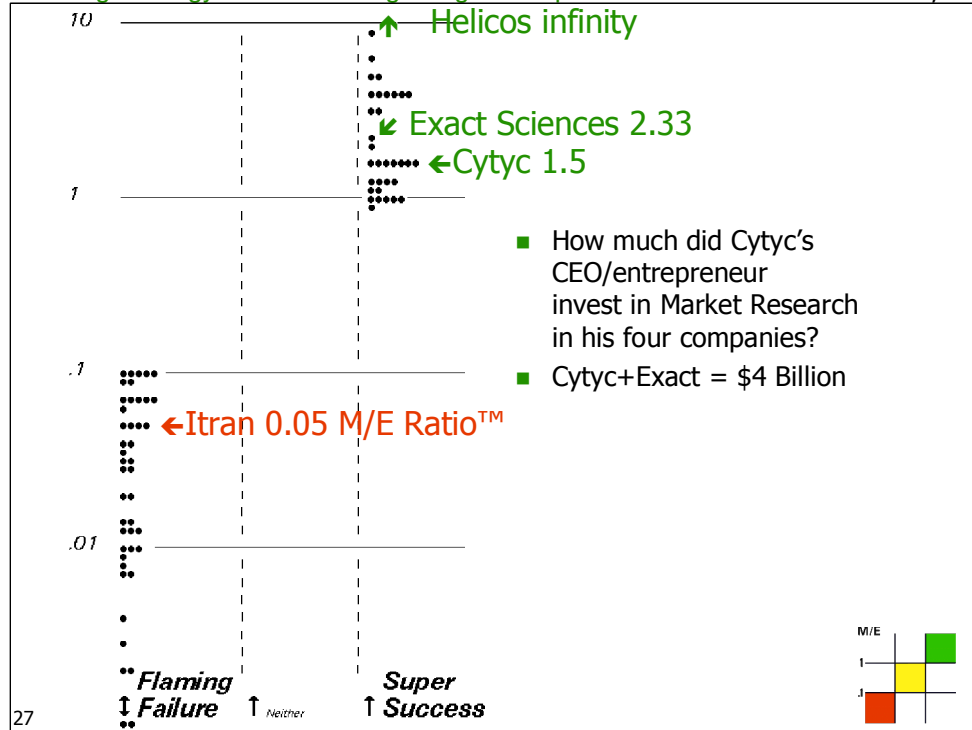
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Cytec's first round VC financing, \$3.6 million, was huge for the late 1980s.

Cytec achieved a **market capitalization of \$3.65 Billion**. [Peak market value on October 21, 2001 at the day's high stock price of \$30.22 times 120,776,000 (diluted) shares outstanding as of Dec 31, 2001.]

In 2004, annualized revenue passed \$320 Million, and Cytec made a \$311 million acquisition for cash.



Itran, M/E Ratio™ = 0.05. Before Cytoc, Stan Lapidus started Itran. With due respect to my friend Stan, **Itran was a failure.** Stan launched Itran and took it to #1 in the machine vision market; an entrepreneurial and strategic success. However, the \$15 million in VC investment only resulted in a company with \$10 million revenue. Thus Itran was a financial failure.

How much did Cytoc's entrepreneur, Stan Lapidus, invest in market research to understand the customer, to speak their language, and to articulate their needs? Stan performed serious, formal market research up front (in concert with the technology development). He validated the market and validated the customer payback BEFORE (while) the technology was developed. He went to every Pathology, Cytology, and Pap screening conference in the world for years, sat in the front row, raised his hand, and asked questions. How much did this market research cost?

Cytoc, 1.5 M/E Ratio™, while Stan was still in the basement. It wasn't enough.

In his next startup, **Exact Sciences**, Stan invested **2.33** times as much in market research as in engineering (1995-1996), while developing world-class molecular biology technology for colorectal cancer screening, arguably even more complex technology than Cytoc's.

It wasn't enough. In his next startup, Helicos BioSciences, Stan invested \$400K in real dollars and nearly a man-year in Market Research before commencing engineering. **Helicos M/E Ratio™ was infinity!** (end of 2003) Armed with market validation, the CEO raised \$27 million in six weeks, then another \$40 Million (early 2006). On March 3, 2007, Helicos announced a \$100 million IPO. With that IPO, Stan will have raised over \$330 million!

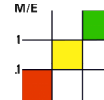
One CEO/Entrepreneur, four companies. The common thread to Stan's success was the significant front-end Marketing investment; a M/E Ratio™ greater than one. Just two companies, Cytoc and Exact Sciences, created \$4 Billion in market value.

They said it!

- "Earth shaking data!"
David English, Chairman,
Greater Nashua Software Entrepreneurs' Group (GNSEG)
- "I just hope that the technologists read this!"
Marilyn Joly, Computer Associates
- "Skimping on market research can prove a fatal flaw.
Engineering firms neglect marketing at their own peril."
Robert Weisman, Boston Globe



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They said it!

"We didn't plan it that way [for Cytyc to invest 1.5 times as much in Market Research as in engineering]. We just did what we had to do. In retrospect, it would have been helpful to have such a planning tool.

"Now, we have a budgeting tool in the M/E Ratio™!"

Stanley N. Lapidus, Founder, Chairman, and CEO
ITRAN, Cytyc, Exact Sciences, and Helicos BioSciences

Cytyc + Exact Sciences created more than \$4 Billion in market value.

---- dig deeper ----

"Why good products fail"
Rob Weisman, Boston Globe

<http://marketingvp.com/guests/globe/>

"Real Engineers Believe in Front End Marketing"
Thomas J. Vaughan Jr., P.E., Chairman, IEEE Boston Consultants Network

<http://marketingvp.com/guests/real/>

They said it!

- "Now, we have a budgeting tool in the M/E Ratio™!"

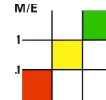
Stanley N. Lapidus, Founder, Chairman, and CEO
ITRAN, Cytyc, Exact Sciences, and Helicos BioSciences

- "I believe in the M/E Ratio™;
in putting significant resources into the Front End
Marketing process to validate real customer needs."

Thomas J. Vaughan Jr., P.E., Founder, GSC Engineering™ and
Chairman, IEEE Boston Consultants Network



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---- next slide ---- this text is with slide 30 ----

THIS IS THE FORMULA to budget and staff for Front End Marketing! A Marketing-to-Engineering Investment Ratio™ of a minimum of one and more likely over two-to-one.

This is the punch line. The magnitude of the upstream Marketing process requires decisive resources. **The enormity of the challenge simply requires it.**

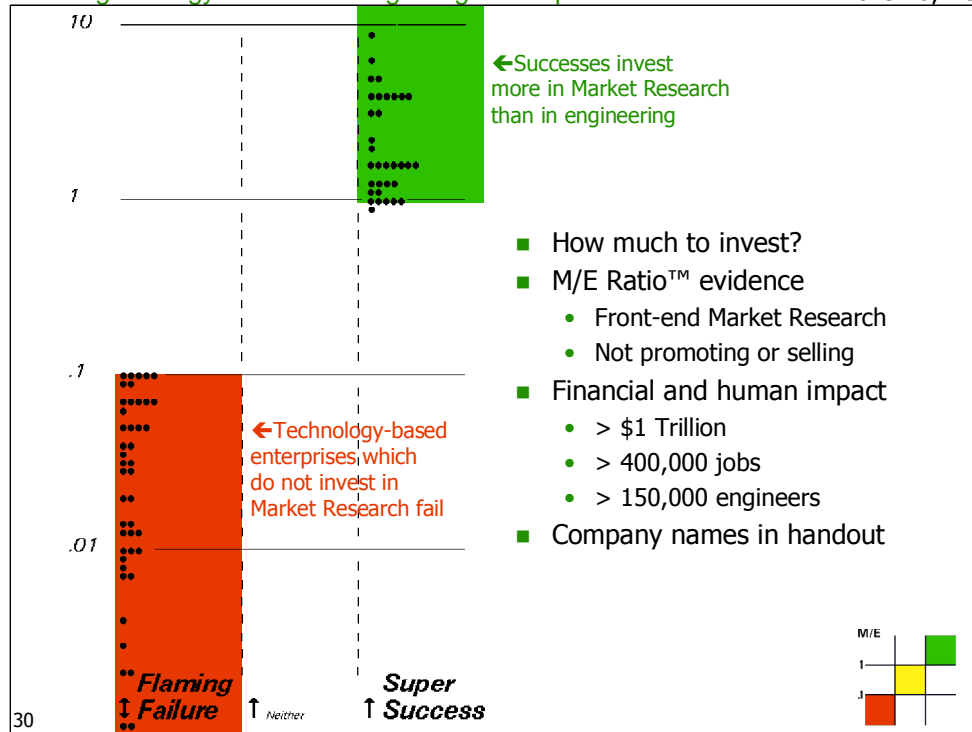
More than \$1 Trillion is represented either in value creation by the successes, or in capital squandering by the failures.

The data are consistent over seven different decades, from the 1940s to today, from startups to Fortune 500 firms, and across a broad range of technology-based enterprises; from molecular genomics biotech and semiconductor robots to kitchen appliances.

The human impact has been more than 400,000 jobs created by the winners, or lost by the basket cases; and more than 150,000 engineering slots fashioned or vanished, including my job in 1969 and my son-in-law's job four months ago.

All the failures had good technology.

All the companies that succeeded on technology alone are in the lower right (Super Success with no significant Marketing investment). There is no data there. While it is hard to prove a negative, the evidence shows that **technology alone does not result in success.**



Come to your own conclusion.

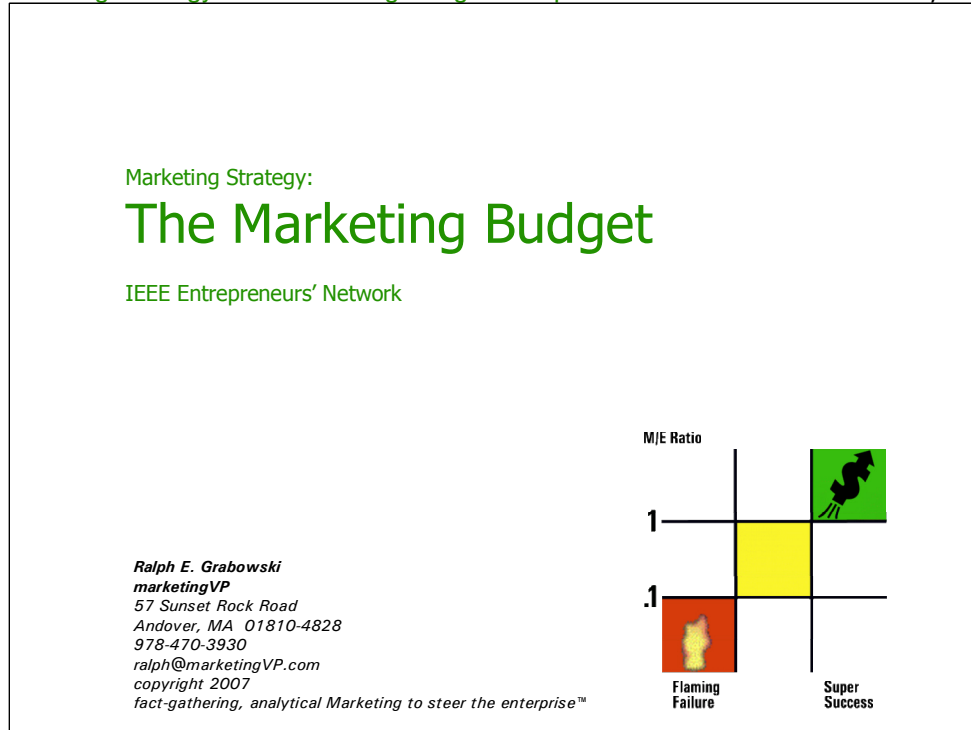
Perhaps the data shows that neither technology, nor radical technology, nor disruptive technology matters, although you must have technology. Neither innovation, nor radical innovation, nor disruptive innovation matters, although you must have innovation. The **ONLY** thing that matters is decisive investment in Front End Marketing.

Your core competency is **NEITHER your R&D, NOR your technology, NOR** your distribution model, **NOR** your significant capital investment in plant. The evidence shows that your **ONLY core competency is your significant investment in Front End Marketing;** which develops a depth of customer understanding.

Some have called me one-dimensional. I suggest that the evidence shows that **Front End Market Research is the one and only dimension that matters.** If there were any other dimensions that mattered, there would be scatter in the data. There is no scatter in the data.

There are **NO** low-cost methods that work. There is no data in the lower right, for the **ONLY** method that works is the higher investment in Front End Marketing

For the evidence shows that it is **ONLY A DECISIVE INVESTMENT** in Front End Marketing; the **SIGNIFICANT FUNDING AND STAFFING** of the Front End Marketing process.



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---- dig deeper ----

"Who Is Going To Buy The Darn Thing?"	http://marketingvp.com/download/whois.pdf
"Why good products fail"	http://marketingvp.com/guests/globe/
"Neat Technology, But Who Will Buy It?"	http://marketingvp.com/papers/neat/ 3-act play
"The Board of Directors; Vital Partner for a VoC Culture"	http://marketingvp.com/papers/boardvoc/
Investment evidence & research methods	http://marketingvp.com/invest/
Cytyc vignette	http://marketingvp.com/payback/cytyc/
Acugen Software vignette	http://marketingvp.com/payback/acugen/
"Real Engineers Believe in Front End Marketing"	http://marketingvp.com/guests/real/
"Cytyc's Impact on Women's Health"	http://marketingvp.com/papers/mdg/
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"The Importance of the Selling Process"	http://marketingvp.com/guests/sellproc/
"Business Plans...Back to Basics"	http://www.ballos.com/enet/pdfs/MarMtg07/March07Kelley.pdf

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