



*Innovation Strategy from Technology Mapping  
Answers from Technology Analytics*

Technology Mapping  
for  
Investors  
Executives  
and  
Managers

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**Predictive** We can accurately predict how a technology will evolve and which new product development pathways will emerge by measuring and interpreting technical trends from both a business and an R&D perspective.

**Specialty** Strategic technology assessments. Clarifying the fuzzy front-end of innovation and new product R&D is our specialty.

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# Chapter 1

## WHY INVESTORS, EXECUTIVES AND MANAGERS SHOULD MAP TECHNOLOGY

Investment decisions in innovation or new technology areas are among the most difficult decisions investors and managers must make because they often reach well into the future where solid information is scarce and “informed opinions” are frequently in conflict. To mitigate risk, investors and innovation program managers can use time-tested predictive practices such as technology mapping to answer key strategic questions before costly investments are made, sometimes even before R&D programs actually begin.

- How has a technology area developed to date?
  - Where are the technology roadblocks?
  - What has already been done? Who has done it?
- What are the trends?
  - Where are the white spots in which I can run useful new R&D projects?
  - Which R&D program has the best chance of success?
    - Where should I invest?
    - Which should I fund?
- What is the competition doing and how far along are they?
  - Are they an immediate threat?
  - How are they organized?
  - Should we buy or build?
- Mergers, Acquisitions and Partnering
  - With whom can I partner?
  - Can I license a technology? What will it cover?
  - What can I acquire and how will it fit into our portfolio?
- What is our roadmap?
  - Which products should we introduce first?
  - Where are there adjacent markets? Are they large enough to be interesting?

With technology mapping, investors and managers can visualize the options, more accurately predict the competitive landscape and reach organizational consensus. The result is an accurate picture of leaders and laggards. From a better overall picture of technology developments in an area, investors and managers can make more optimized strategic technology decisions.

Optimal strategic decisions will be even more important in the future. The 2008 IBM Global CEO Survey [1] reported that “organizations were bombarded by change and are struggling to keep up.” The 2008 survey suggested that organizations need to become “innovative beyond customer imagination” and “disruptive by nature”. IBM’s 2010 Global CEO Study [2] suggested that complexity will only get worse in the future and that companies will need “creative leaders” who will take more calculated risks, find new ideas, and keep innovating in their organizations. Continuous change and complexity make selecting new technologies for new products in new markets more difficult for both investors and company managers.

Fortunately, a foundation for the future has been laid by Christensen [3], Chesbrough [4], Davenport [5], Kim [6], Liefer [7], O’Connor [8] and others. One technique, the technology roadmap, has become so “common” that it even has a Wikipedia page [9]. Roadmapping is a good starting point, but it is highly dependent on the quality of the team building the map. More insights are available if we combine advanced analytics and visualizations to form technology maps.

We define technology mapping as a business or opportunity analysis process which typically supports strategic technology assessment decisions including investment decisions, R&D program selection or business development decisions, innovation decisions, competitor analysis, merger, acquisition, partnering or licensing decisions. Technology maps include patent maps, maps of science and trade literature, regulatory literature maps, product introduction maps and the like. The result of the process is a comprehensive analysis that leads to more accurate and more confident decisions.

## Chapter 2

### WHAT ARE THE BENEFITS AND CHALLENGES OF TECHNOLOGY MAPPING?

Technology mapping provides a variety of benefits to organizations that use the process well.

- Investors can see why an idea makes business sense and why it is strategically useful.
- Management can see why a project or program is not a leap of faith.
- Business Development can negotiate from a stronger position, knowing more than the other side.
- Program leaders can prove that their ideas are fundamentally sound before proposing a project.
- Project teams can judge new ideas and new information in an agreed upon context.

The benefits are substantial, but there one really large challenge: organizational acceptance. For strategic technology mapping to play a role in key decisions, investors and managers must **choose** to use analytical models. Davenport [5] specifically highlights this barrier. Investors and company managers are accustomed to financial modeling, but modeling and mapping technology is often a new idea.

Even though technology mapping has been in use for decades (by a few), it has remained a secret mostly because it is a powerful strategic advantage to those who do it well. As a result, a barrier to the benefits remains for many investors and managers. To help cross the barrier, Emerging Tech Insights has developed technology maps that provide information in a format that technical and non-technical managers can accurately interpret quickly.

Technology Mapping is **still** one of the **best kept secrets** on the planet.

# Chapter 3

## WHY DOES TECHNOLOGY MAPPING WORK?

Technology mapping allows a trained observer to make strategically usefully accurate predictions for several reasons.

1. Most often technologies advance by combining known processes or materials in a unique format. Technology mapping can reveal the strategies that are in play for each organization and in some cases, how the group is organized to pursue their strategy.
2. Information about technology development plans is widely available if you know where to look. The forces for disclosure of technology development plans are stronger than most imagine and are often are only partly under management's control.
  - Businesses talk about their technology development programs in press releases, trade publications, annual reports and other publications.
  - Larger businesses must convince shareholders that they are still leaders.
  - Small businesses talk publicly to raise money.
  - Scientists and engineers are often "evaluated" on their publication, presentation or patenting frequency. As a result, businesses "speak" at scientific meetings, trade shows and other venues.

An exception could occur if a technology or product could be developed in full secrecy, but this scenario is very rare.

3. The scientific, patent and regulatory literature is structured and lends itself to analysis.
  - In both patents and papers, an abstract details key ideas.
  - Conclusions and claims detail the results of the work.
  - Publication and filing dates time-stamp inventions and discoveries.
  - Inventors, authors and organization names document who is involved.

In addition, different literature sources document the progression from concept to idea to product. Grant proposals document early stage concepts. Scientific papers document new ideas. Patents document inventions etc. By mining multiple literature sources, the stage of development of an idea can be efficiently assessed.

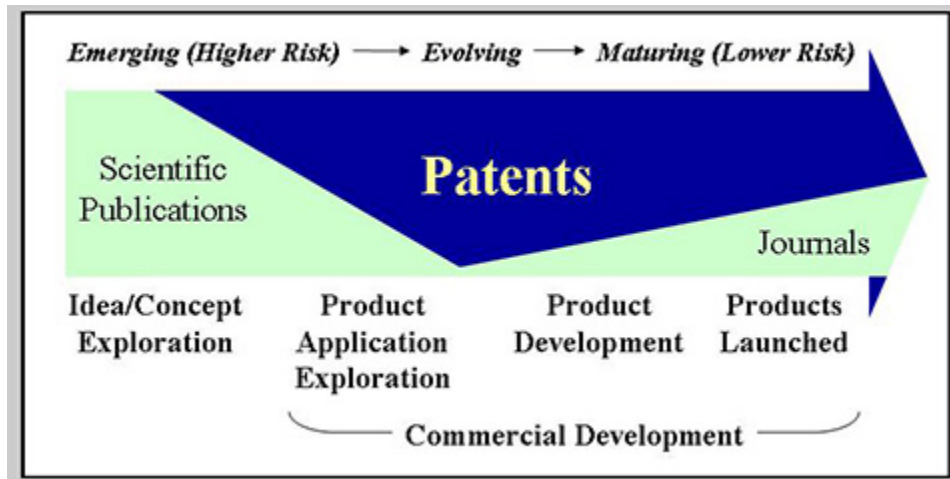


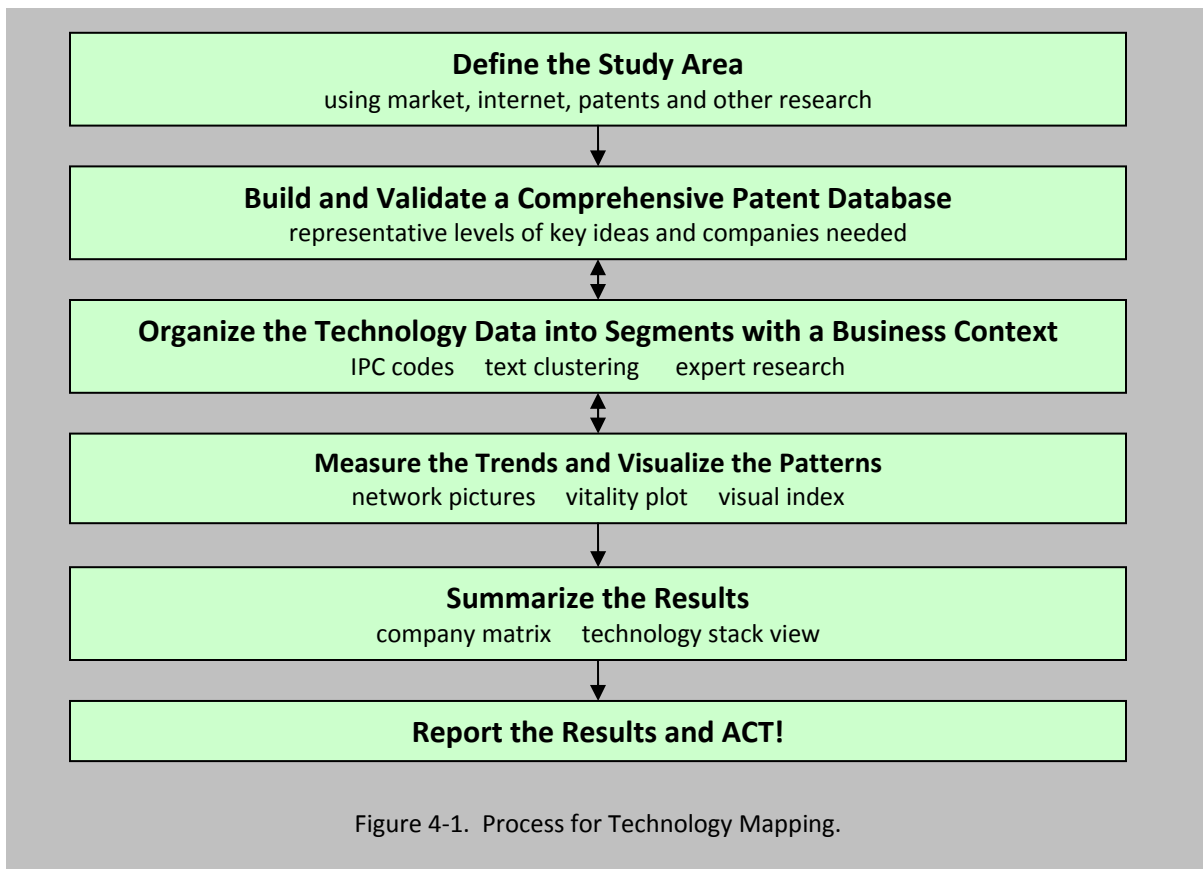
Figure 3-1. Information sources. Where information is published can help analysts to understand the readiness of a technology for commercialization.

4. The development cycle in many companies is often longer than the publication cycle. Even if it takes 12-18 months for a paper or patent application to appear, patents and papers still appear soon enough to provide an early warning of potential new products or at least interest in an area.

# Chapter 4

## THE TECHNOLOGY MAPPING PROCESS

We will briefly review key features of each step of the strategic technology map construction process illustrated in Fig. 4-1.



### Define the Study Area

Defining the study area is not always as easy as it sounds, but it is essential to determine the boundaries of interest. The final audience, traditional marketing research and other internet research can be helpful.

### **Build and Validate a Comprehensive Database**

Once an area of interest is chosen, search strategies are designed and run in appropriate databases. To build a comprehensive database, it is often necessary to use multiple, overlapping search strategies. Keywords for the search strategies can be drawn from process flow diagrams, ingredients, materials, production processes, product features and even marketing research. Broadly configuring the search strategies can draw surprise lessons from other industries into the study.

Upon completion, an independent assessment of the utility of the comprehensive database is needed. Validity can be assessed using readily available information from several sources.

- Expert opinions
- Marketing research reports
- Internet searches
- Trade publications
- Scientific meeting agendas
- Preliminary patent searches
- Business development databases

If the “comprehensive database” contains all known key organizations and ideas, it is sufficiently complete to provide answers to strategic questions. Otherwise, additional search strategies need to be added.

### **Organize the Technology Data into Segments with a Business Context**

The amount of data retrieved from a comprehensive search is usually large, often ranging between 1,000 and 50,000 documents. The next step is to organize the data into meaningful groups for analysis. Several common methods for organizing data and extracting concepts are listed in Table 4-1.

Table 4-1. Key Features of Each Method for Organizing Data

Technology	Measurement	Automation Friendly?	Advantages Disadvantages
Co-Citation Analysis	Pairs of references cited together	Yes	Concept extraction can be very fast  Concepts extracted depend on input data
Co-word Analysis	Pairs of words with chosen spacing	Yes	
Citation Analysis	Citations – one at a time	Yes	
Text Clustering	Computer chosen word groups	Yes	
Expert Opinion	Experience, Education	No	More targeted concepts possible Labor Intensive Expert bias concern

References 10, 11, 12, 13, 14.

**Data-focused Taxonomy.** Co-citation analysis, co-word analysis, citation analysis and text clustering lend themselves to automated extraction of meaningful groups from a comprehensive search database. While automated methods of concept extraction can be very fast, they also suffer the disadvantage that the segments extracted may or may not be meaningful to the business questions being asked. In addition, with automated methods, the segments extracted depend on input data. Changes to the input data can change the technology map. An unstable map can cause confusion for managers when they need to compare versions of the same map.

**Market-focused Taxonomy.** Sound strategic technology decisions require technology developments and business interests to be considered together. By creating the technology-business linkage explicitly, the technology map which results can have an immediate impact on management decisions. The process of organizing technology data into markets, categories and segments can be thought of as forming an outline.

1. Markets are typically defined by marketing research. For our purposes, markets are a collection of related categories.

- a. Categories represent the technology stack. A technology stack includes ingredients, materials, processes, methods and products or product features arranged in a manufacturing sequence.
  - i. Segments are sets of specific solutions that belong to a category. A segment is defined by a set of keywords or key phrases. As a result, a segment contains companies, organizations and individuals who are pursuing specific solutions for the problem of the segment.

In our experience, a combination of expert opinion and automated grouping ensures creation of robust, meaningful segments. We typically employ Internet research and marketing research reports to start a project. Expert opinions expand the outline. Finally, we use co-word analysis and text clustering to help discover surprises.

### Measure the Trends and Visualize the Patterns

If a picture is worth a thousand words, visualizing the trends within segments is worth millions. A good visualization conveys complex information quickly and helps to facilitate decisions. Visualizations come in all forms including simple bar charts, radar graphs, network pictures or topographical maps, temporal graphs and top-level visualizations of the strategic landscape.

*Network Picture (Fig. 4-2A).* A network analysis is a common method of showing relationships among a collection of “nodes” which may be text clusters, segments, inventors and sometimes companies. In Fig. 4-2A, a circle is a node that represents a segment in a study of pizza crust in patents. The lines in Fig 4-2A trace the most important relationships among the nodes (segments). The physical proximity of one node (segment) to another suggests that the segments are related. In Fig. 4-2A, the colors indicate “groups” chosen by the computer.

## Segment Measurements & Visualizations

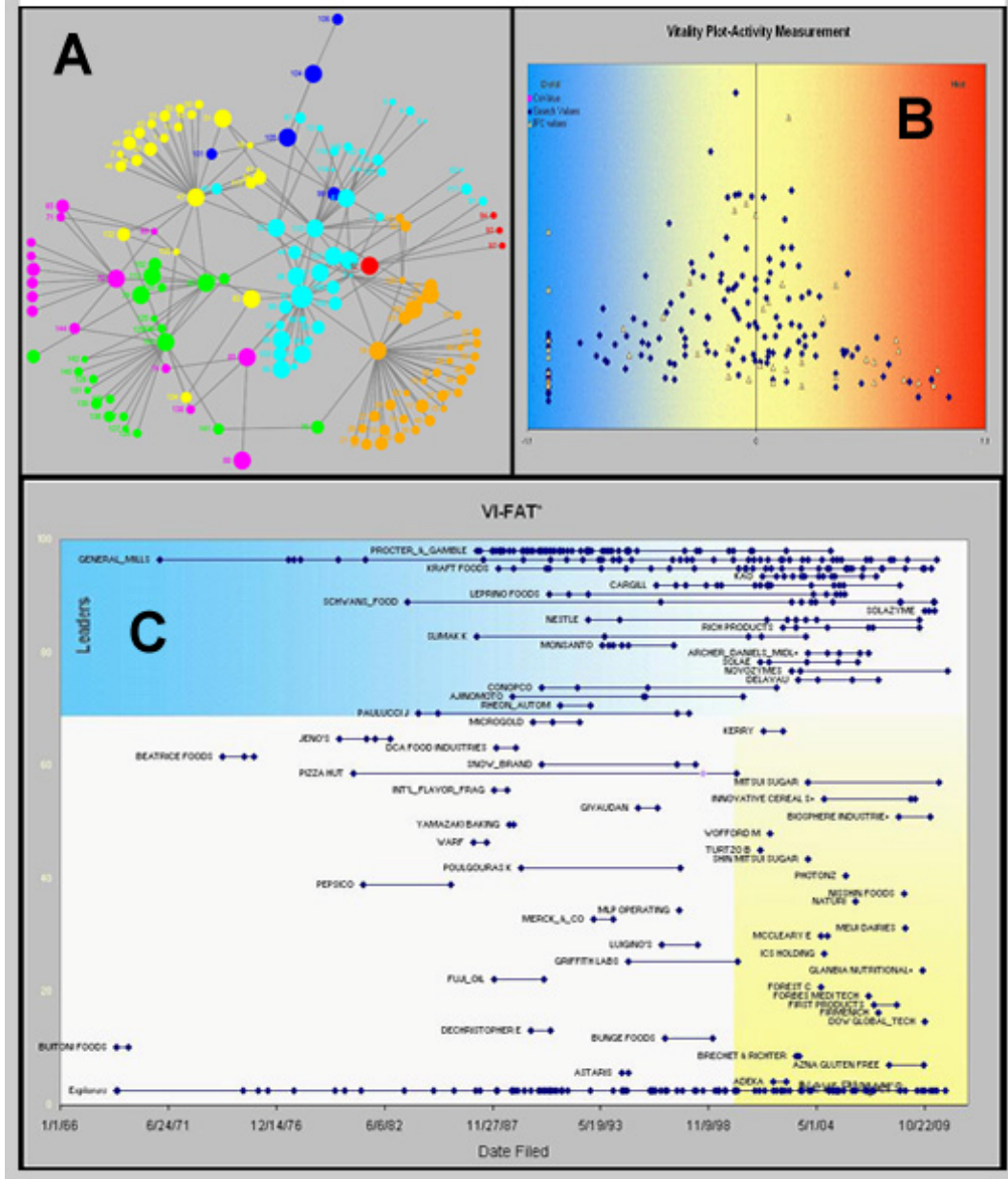


Figure 4-2. Measurements and Visualizations for segments.  
 (A) Network. (B) Vitality Plot™ (C) Visual Index™

A disadvantage of network analysis is that the shape of the network is dependent on the data fed into the study and changes if new data is added or if data is removed. Another disadvantage of a network is that it sometimes takes an expert to interpret the meaning of

the picture. Despite the volatility of the picture in a network analysis and interpretation issues, the technique is widely used to understand developments in science and in patents.

*Measurement of Acceleration or Growth (Vitality Plot™, Fig 4-2B).* In most technology areas of interest, patenting activity trends upward, but not all areas are equally active. The Vitality Plot MEASURES the growth rate of a segment or text cluster, IPC code or company portfolio relative to the database as a whole. On a Vitality Plot, the y-axis measures the size of the segment (larger segments near the top). The x-axis measures the acceleration of a segment on a scale of +1 (growing fast) to -1 (slowing dramatically). The colors in the background of the chart also indicate growth rates.

- Those segments, clusters, codes or companies that are growing (accelerating) faster than the norm for the database appear on the right and in the red. Segments in the red region are “hot” and “new” and deserve special attention as they are growing fast! Delays in participation could prove fatal.
- Those segments, clusters, codes or companies that are growing at the same rate as the whole database appear in the yellow zone.
- Those segments, clusters, codes or companies that appear on the left in the blue zone are slowing dramatically relative to the database. If a company is actively working in a segment that appears in the blue region, there should be a good reason as most others will have abandoned the area.

The Vitality Plot™ allows us to quickly identify the hot new areas that could disrupt the technology norm of today. The Vitality Plot measurement also allows us to compare company R&D activity investments and see whether the bulk of the investment is in newer areas or not, allowing us to spot leaders and laggards with ease.

*Temporal Patterns (Visual Index™, Fig. 4-2C)* A temporal visualization (Fig. 4-2C) of patenting or publication activity for a segment provides a detailed picture of the trends for companies, organization and individuals within a segment. On a Visual Index, each

diamond represents a patent and is plotted vs. the filing date, a measure of the invention date. The lines highlight patents belonging to one parent company. The company at the top is the company with the most patents in the segment. The group at the bottom, the Explorers, is a collection of all the organizations and individuals that were present only once in the segment. The yellow highlight is intended to draw your eye to the newest organizations or individuals, those you might not expect to see in the segment. The blue highlight is intended to draw your eye to the older, established players in the segment. By organizing the patent information in a segment in this format, patterns of activity emerge.

The **pattern of activity** in a temporal picture shows whether a segment is new and emerging or large, complex and mature. The overall pattern of activity in a Visual Index leads directly to decisions about how to participate in such an area, the type of resources that may be needed and who to acquire or with whom to partner. Investors can better understand whether they believe an organization of interest has invested wisely in the area – or not.

**Summarize the Results**

**Summarize the Results.** A set of Visual Indexes or network pictures are ideal visualizations to allow analysts, line project managers and technical experts to see the details of technology developments. However, very few decision makers have the time to digest that much detail. Most investors and senior managers need the technical details summarized into strategic views that convey technology options and risks in a clear, simple format.

One strategic view is the Company Matrix (Fig. 4-3A) which shows where one company’s R&D portfolio is strongest or weakest by color coding (Table 4-2).

Table 4-2. Color coding in the Company Matrix (Fig 4-3A)  
(number of patent in the segment for one company)

0	1	4-5	6-10	11-15	16-25	25+
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With the Company Matrix and the color coding, you can see at a glance whether one company's portfolio enhances (or not) another's. The collection of data in the Company Matrix facilitates construction of partnering or acquisition selection models in a process we call "Active Screening".

Another strategic summary view is the Technology Stack View (Fig. 4-3B). The Technology Stack View uses a business action/risk model to form a meaningful strategic view designed specifically for investors and senior managers. The model is based on the well known business S-curve and is intended to facilitate discussions of technical risks, project status and project team structure.

To construct a business action/risk model, we use an observed correlation between the stages of development in the business S-curve and the activity patterns in a Visual Index. The model employs an exponential function with the following factors for each segment:

- the total number of documents,
- the time-span of publishing or patenting and
- a measure of the "dominance" of the most active company.

The model rates patenting or publishing activity on a 0 – 1 scale. A rating near zero corresponds to a small, simple area that a good R&D team should be able to dominate by invention. A rating near 1 corresponds to a mature, complex area where a solution probably already exists, but it would take a good business development team to discover the best path. While the model is simple, an independent test showed that it succeeded in capturing the business risk correctly most of the time.

Note that the color of each segment on a Technology Stack corresponds to the Vitality Plot measurement of acceleration for the segment (red = accelerating fast, blue= decelerating quickly).

**Report the Results and ACT!**

When competition is driven by technology developments, technology mapping and strategic technology analysis can reveal the direction of key trends and can identify leaders and laggards with precision, an advantage for investors and managers who make competitive technology investment decisions.

# Summaries of Segments & Categories

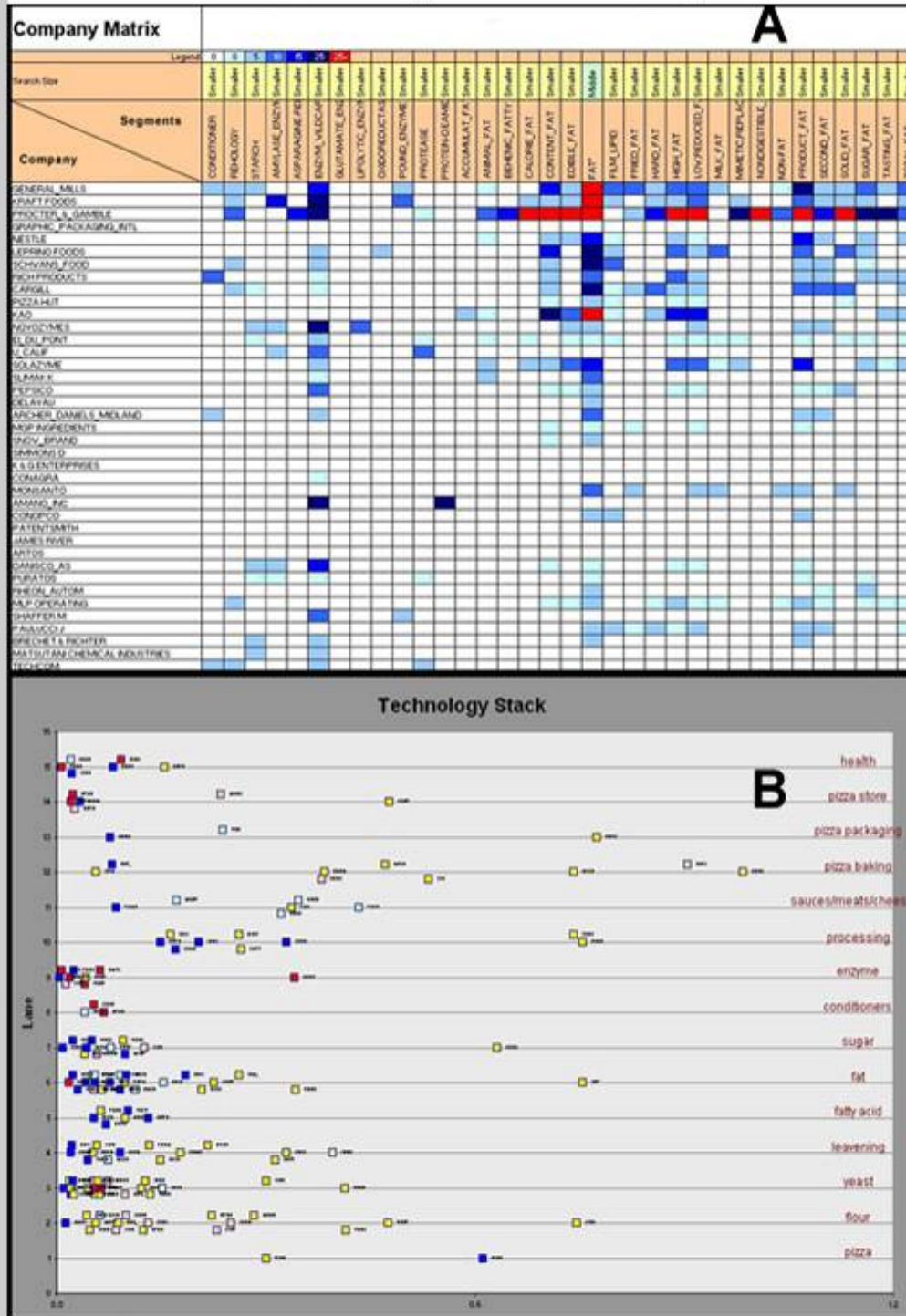


Figure 4-3. Summarizes Segments and Categories. (A) Company Matrix summarizes company participation in segments and allows comparisons between or among companies. (B) The Technology Stack view uses a business risk model to display segment size and acceleration. The view facilitates discussion of product strategy, team structure and the competition.

# Chapter 5 – Case Study

## ASSESSING COMPETITIVE ADVANTAGE

In collaboration with an equity research firm, we conducted research into future technology developments for stents in 2003. Our interest was primarily heart stents, a promising (at that point) method to avoid more invasive methods such as angioplasty. In 2003, Johnson and Johnson was the only company with a heart stent on the market, but it was rumored that J&J's monopoly would soon be broken. We used a strategic technology analysis to determine whether Boston Scientific was capable of becoming a powerful competitor and to determine the potential future positions of Guidant, Medtronic and other legacy players.

The team that conducted the study was broadly skilled. Three members were financial analysts with decades of experience following healthcare companies. One member was a Ph.D. technologist. The group held regular meetings to assess results and determine the implications of the findings.

We built a comprehensive database and found 7730 US patents or applications that mentioned “stent” anywhere in the patent. In 2003, we could search in full text patents, but we could only download bibliographic information. As a result we had only titles and abstracts for the study, enough to understand the intent of the patent. We cleaned the data carefully, associating subsidiaries to parent companies using published information and the expert knowledge of the group. Finally, the team divided the problem into enough categories and segments to isolate materials, manufacturing and applications issues for stents

Fig. 5-1 is an early strategic technology evolution view that the team built manually from many temporal visualizations and a knowledge of existing stent products. The view is a historical view that it emphasizes the flow of ideas leading from one technology

development step to another. Because the team knew which products were already on the market, it could also recognize segments that were aimed at future products.

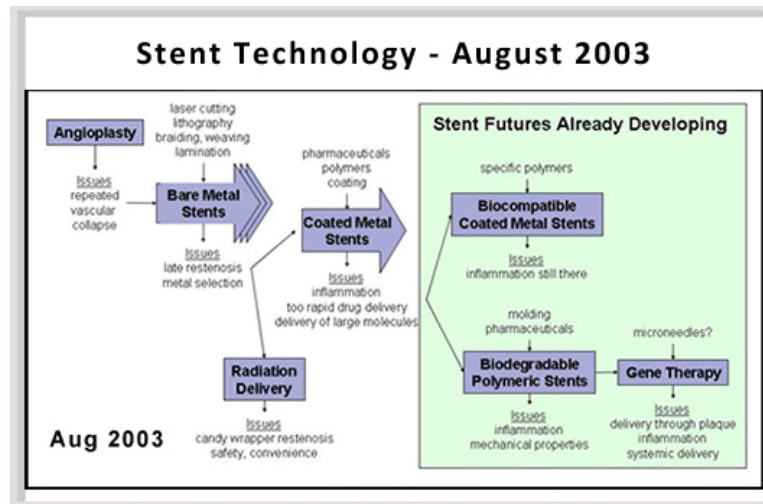


Figure 5-1. A strategic view of stent developments based on known product introductions and analysis of patent trends.

Fig 5-2 is a segment (a Visual Index™) containing 110 patents and was formed from a word/phrase search for drug delivery and stents. The visualization reveals a number of points relevant to the key question about J&J dominating the stent market space.

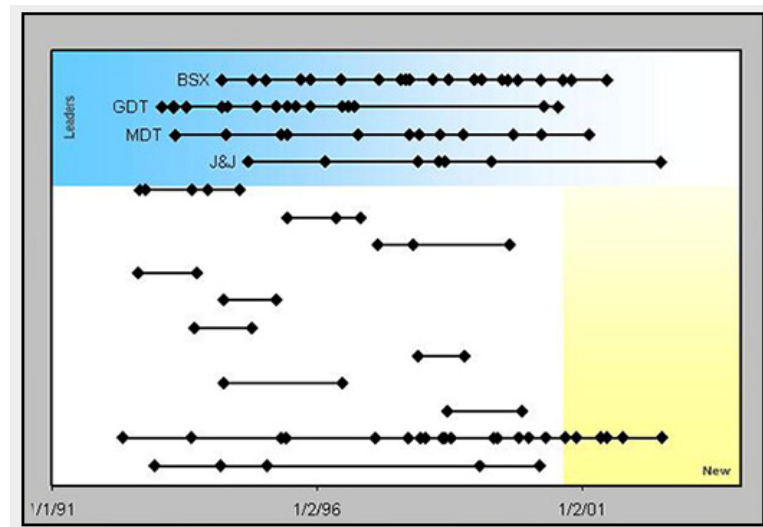


Figure 5-2. Visual Index™ (temporal view) of drug delivery in stents in 2003. Each diamond is a patent plotted vs. filing date. Each line is a parent company. The company at the top has the most patents in the segment. Yellow is the area where new players are found. Blue is the area where leaders are found.

- Notice that the top four in this category are Boston Scientific, Guidant, Medtronic and J&J and that Boston Scientific had more patents than J&J.
- Notice that Guidant’s activity occurred early and then tapered off.
- Medtronic’s activity was slow and steady.
- J&J, the field leader and alleged (in 2003) “owner” of the area, was number four.

Exploration of other temporal views (Visual Indexes) revealed the same general pattern. An annual report from Boston Scientific showed a picture of a stent manufacturing setting that allowed the group to determine which of the several paths that had been explored in Boston Scientific’s extensive patent base was actually being used. From the technology development patterns, the group became sure that Boston Scientific would shortly emerge as a major competitor and that it was set for success.

In August 2003, an equity research report detailing the landscape for heart stents was published. The research team recommended Boston Scientific as a stock to buy. Those who followed their advice profited handsomely since the price of the stock did nothing but rise for almost a full year after the recommendation.



Figure 5-3. BSX performance around the publication time period.

In the process of forming categories and segments, the group found several surprises that foretold product that might emerge in the future.

- One surprise was the connection to genetics and the idea of using a stent as a means to deliver genetic material for gene therapy. The group felt that the idea was a patent placeholder and might emerge much later.
- A second surprise was to find significant amount of work on biodegradable and biocompatible stents. In 2003, there was almost no “buzz” about biodegradability or biocompatibility. Almost all attention was focused on coated metal stents. In fact,

what the group had found was an early warning signal for stent products that would emerge in late 2007 and 2008.

The study illustrates how technology mapping can lead to a successful prediction of the near-term competitive situation. The study also successfully anticipated the next step in stents, the development of the biodegradable, biocompatible stent 4-5 years before the product was introduced.

# Chapter 6 – Case Study

## PREDICTING DISRUPTIVE TECHNOLOGY

Late in 2003, I went to the Detroit area to speak to a group of competitive intelligence experts. Since I was going to car country, I thought I should tailor my presentation a bit. So, I decided to look quickly at catalytic converters.

It turned out that the clean air regulations had stimulated patenting activity in catalytic converter patenting.

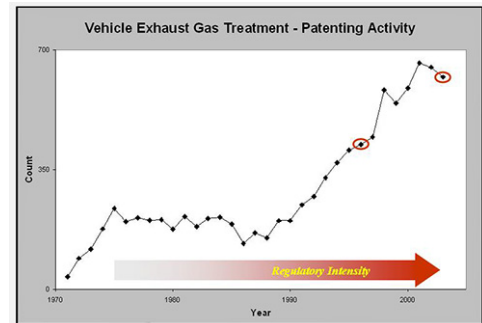


Figure 6-1. Patenting activity in catalytic converters.

The question we wanted to ask was what had changed from 1996 to 2003 (red circles in Fig. 6-1).

Since time was short, I decided to use 4-digit IPC codes

to define segments in this study. IPC codes are the "knowledge management" system the

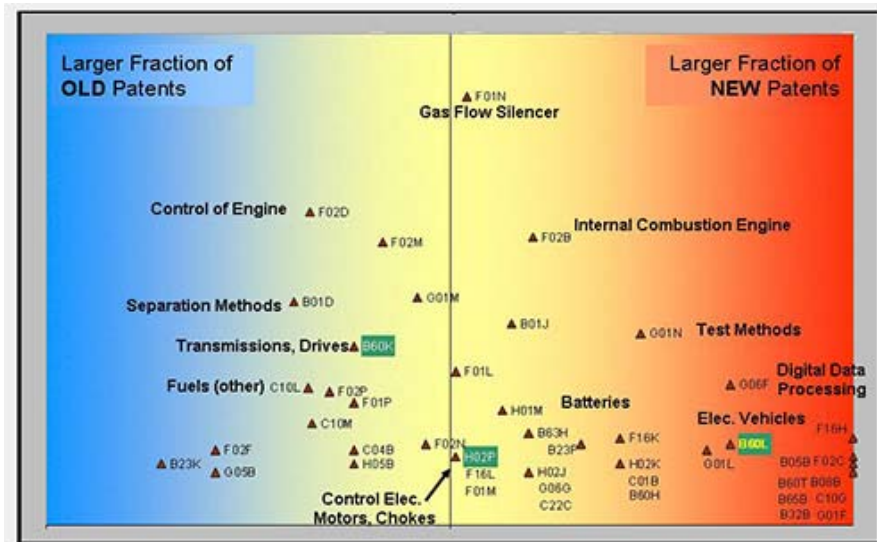


Figure 6-2. Vitality Plot for catalytic converters using IPC codes. Segments (IPC codes) that were accelerating are on the right and in the red (+1). Segments that were decelerating are on the left and in the blue (-1). Segments that were not too different from the "norm" were in the center, yellow (0). On a Vitality Plot, the larger segments are near the top and the smaller are near the bottom. The scale is non-linear.

patent offices use to classify inventions. Then, we MEASURED changes in the IPC codes using the Vitality Plot measurement and created a picture (Fig. 6-2).

When you think about it AND when you remember that it was back in 2003-2004 when this was done, the things you see are about what you'd expect. Then, notice the small B60L code in the red region (green highlight). When we look into the code and view the titles, we see that the code is talking about hybrid vehicles. Remember 2003-2004? Hybrid vehicles were barely on anybody's mind. Yet the signal for a hybrid vehicle is clear and unmistakable. It was not just one patent.

At this point in the meeting, I postulated that hybrid vehicles were a coming attraction in the auto industry. After a very little discussion, one person from one of the Big 3 (in 2003-2004) stood up and said —and this is nearly a quote.

**"You are totally wrong. We tested those electric cars.  
They don't work. We have them all back."**

After the meeting, I checked my database and discovered the following companies in codes B60L and B60K in my database. Do you see any big players that are missing?

Bowling Green State University	Denso Corp.
Ford	H. R. Ross Industries.
Honda	Nissan Motor
Northrop Grumman	Paice Corp.
Volvo	

Would it help if I told you the missing company needed a bailout later?

The heart of this story is that with **MEASUREMENTS** of technology trends, you can see well into the future — 3-4 years in this story. Isn't a warning of 3-4 years enough time for you or your company to see a disruptive signal and make plans for the change that is coming?

# Chapter 7 – Case Study

## ASSESSING IDEAS – KNOWING WHEN TO QUIT!

In 2005, a group of entrepreneurs and an investment banker presented an idea for a stock inventory system based on handheld readers and RFID (radio frequency identification) technology. The group wanted to determine whether their idea could be the basis for a new company, a key question for an investor!

Since the company was to be formed in the US, we decided that evaluation of US patents would provide sufficient information to start. A comprehensive search for RFID technology in the US found 6810 patents. Using their knowledge of the RFID space, the group segmented the 6810 patents into 7 categories and 48 segments, enough to answer the question and formed a technology stack view (Fig. 7-1). It came as no surprise that patents for RFID technology were appearing for every conceivable application. The fact that we found so many applications in the database lent credibility to the search and validated the process.

Next, the entrepreneurs segmented the database using their expert knowledge of the area and the process flow diagram for their product idea. When the strategic view of the area was completed, we highlighted the key technology components of their product idea (open squares in Fig. 7-1) and the focuses of two companies that the group considered to be likely competitors (indicated by diamonds and circles on Fig. 7-1). Notice the confluence of highlights. The key result of the analysis was that the product idea was not unique and several well financed companies were already working on the very similar ideas. To our knowledge, the group kept their day jobs while they reconsidered their ideas.

We consider this study to have been a success! Before significant investor, R&D or personal dollars had been committed, the group knew whether there was a chance for their idea to

succeed. In our opinion, all R&D projects should be vetted with the same process before they are funded.

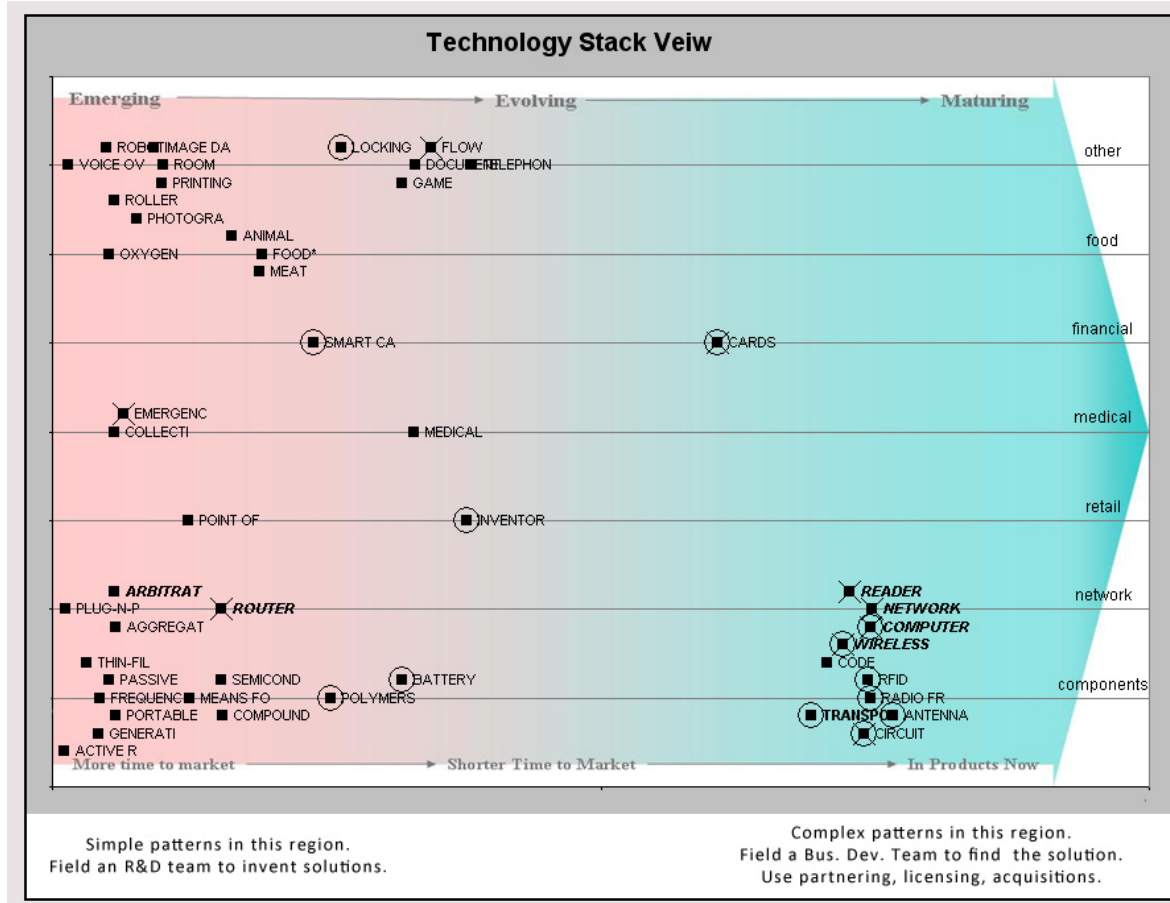


Figure 7-1. Knowing when to quit. A company that never formed and shouldn't have.

# Chapter 8 – Case Study

## X-RAY OF COMPANY R&D ACTIVITY

For an investor, business development manager or R&D manger, it can be useful to understand the organizational structure and finances of key R&D projects or programs of a competitor, a potential partner or an acquisition candidate. However, R&D program finances and structure is often a carefully guarded secret – unless you X-ray a company's R&D efforts using co-author analysis methods and visualize the result with a network picture.

In 2009, Emerging Tech Insights conducted an X-ray analysis of a major healthcare company's non-invasive glucose testing efforts, the holy-grail in self blood glucose testing and an area in which the author once managed an R&D effort. The study database was ultimately composed of 135 unique authors and 269 patents. We subjected the database to co-author analysis in which one counts the number of times a pair of authors appears together in a collection of patents. Then, the results were visualized using a force-directed graph (Fig 8-1).

In Fig. 8-1, the size of an author's circle depicts the number of patents authored. Authors that publish frequently together are placed near one another. Authors in red are those that I recall being a member of an internal venture. The yellow and blue circles represent leaders of the venture sub-groups. Authors in green were unknown to me.

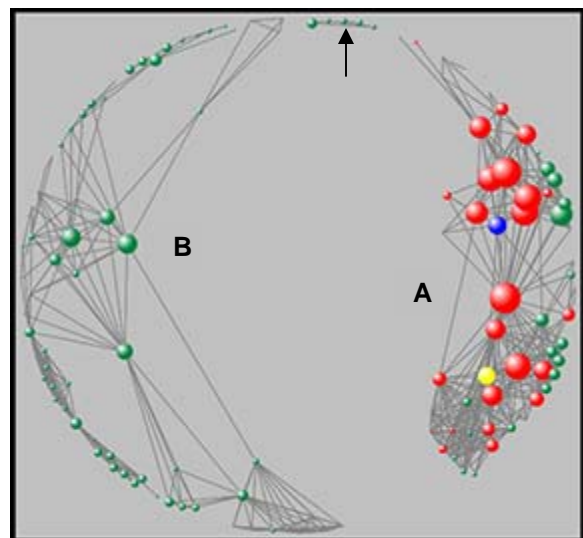


Figure 8-1. Co-author analysis of one company's non-invasive glucose R&D organization.

Fig. 8-1 shows that the company fielded one individual, unconnected effort (arrow) and two major groups (A and B) to work on non-invasive glucose. Group A LOOKS like it has two major cross-connected components (top and bottom), and it did. Already, the chart is showing more than was ever “made public.”

Fig. 8-2 shows patenting activity by years. Given the three lobes in the chart, we can conclude that three different groups, two larger groups and one smaller group were working probably independently at different points. Further analysis shows that the middle lobe corresponds to the group at the top of Fig. 8-1.

We can estimate the R&D budget for the effort with several fairly reasonable assumptions.

1. Salaries correspond to the professional salaries from the Bureau of Labor Statistics.
2. A patent represents one year’s effort for each author, an amount that fits with my personal experience.
3. Overhead is an additional 35% of salary and covers benefits, lab space and management and secretarial help.
4. Non-inventor help corresponds to an additional 35% of salary, another number drawn from personal experience.

The R&D project financial model suggests that project expenses corresponded to about \$32 million over the life of the project, information that is NEVER made public in most companies.

**CONCLUSION** When vetting a partner, acquisition or competitor's interest in an area, co-author analysis can provide cost-effective, risk-free information about organizational structure as it was when publication occurred. Limited or focused interviews to confirm

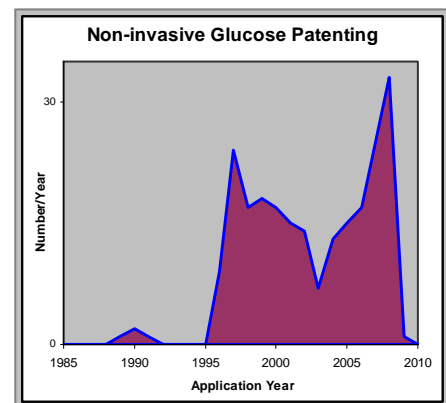


Fig. 8-2 Patenting activity reveals three major group efforts.

your understanding of an R&D program's structure are quite different and more effective than probing or unfocused market research questions.

None of the information derived from co-author analysis is typically public information. However, with just a little analysis, we can see inside a potential investment, competitor or acquisition candidate very clearly and very uniquely.

# Chapter 9 – Case Study

## PROFILE OF A POWER ACQUISITION

In 2006, Merck bought SIRNA, instantly strengthening an already strong patent portfolio in the newly emerging technology of RNA interference (RNAi). The industry saw the acquisition as a master stroke, but is it repeatable?

The problem with M&A, partnering or acquisitions for investors or managers is finding the best opportunity, a needle in the haystack problem. You can guess, use industry knowledge AND you can actively screen for the best candidate using the information in a technology map.

Emerging Tech Insights has been following developments in RNAi since 2003 and had a 2006 technology landscape available when the acquisition was announced. Our database

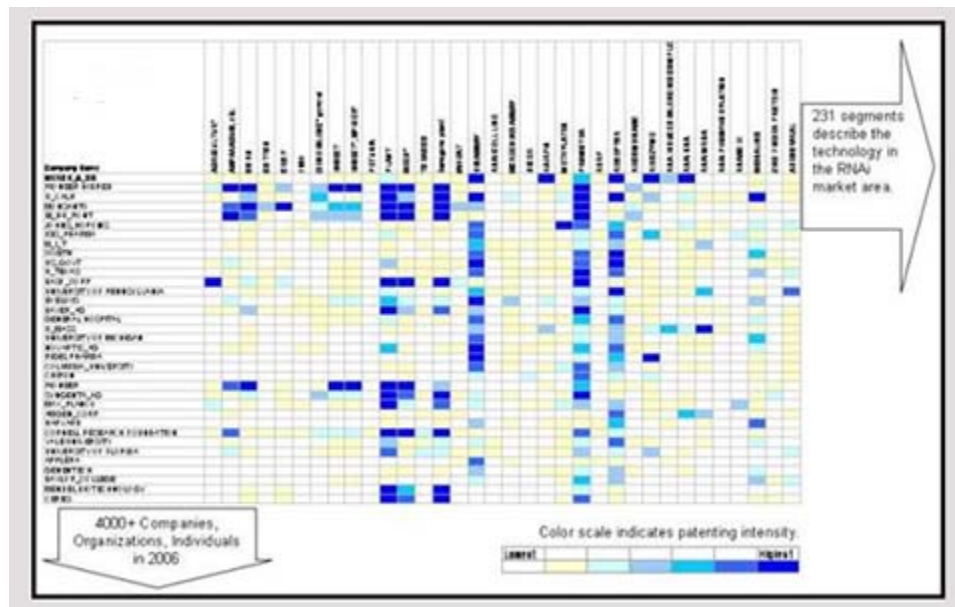


Figure 9-1. The Company Matrix is a summary of activity in each study segment for all the companies in the database. The Company Matrix is an ideal starting point for comparing company portfolios and identifying potential competitors or M&A options.

contained over 4000 organizations and individuals who were participating in RNAi development. We had segmented the database into 231 segments. In 2006 (after the acquisition was announced), we used our Active Screening process to sift all the possibilities. Our question was whether we felt that Merck had made the best possible choice.

The Company Matrix is a view which summarizes each organization's and individual's participation in each segment of the technology model. To find organizations that might enhance Merck's portfolio, we built a simple model which measured *how much* each company in our extensive database might strengthen Merck's portfolio in each segment. Then, we rated each increase on a 0-3 scale.

Table 9-1 Rating Scale

<i>Rating</i>	<i>Meaning of the rating</i>
3	indicates a dramatic enhancement
2	indicates some enhancement
1	indicates a very small enhancement
0	indicates no enhancement

One market in RNAi is related to agricultural applications. Since this study was about Merck, a pharmaceutical company, we eliminated the agricultural segments from the model. The process eliminated mismatched companies such as DuPont (Pioneer Hybrid) from the Merck acquisition candidate search.

Finally, we summed the scores for each segment in each company to form a rating, and sorted by the rating. A high rating indicates a company with a patent portfolio that would strengthen Merck's original portfolio. The table below indicates the top candidates based on the model.

Table 9-2 Acquisition Opportunities Table

<i>Rating</i>	<i>Acquisition Candidate List</i>	<i>Comment</i>
1	University of California	
2	SIRNA	FIRST CHOICE
3	Johns Hopkins	
4	Massachusetts Institute of Technology	
5	Wyeth	an Alternative
6	Chiron	an Alternative
7	University of Texas	
8	ISIS Pharmaceuticals	
9	US Government	
10	University of Massachusetts	
11	Columbia University	
12	Exelixis	an Alternative
	and many others ...	

CONCLUSIONS. Based on the model rankings SIRNA *WAS THE* obvious best fit for Merck to acquire. But, if an alternative to SIRNA were needed, the list presents some other potential opportunities too. While we chose to back test the idea of an acquisition, the process works equally well for other purposes.

- Identifying acquisition opportunities
- Identifying potential partners
- Identifying merger opportunities
- Identifying candidates for the sale of IP
- Others

Imagine how an active screening process could help investors and managers evaluate and rate potential acquisition candidates. If you knew what your second and third choices might be before you start, imagine how different the initial negotiations might be with the “best” choice.

# Chapter 10

## DISCUSSION/CONCLUSIONS

When new products, innovation, disruption or technological changes drive competition, technology mapping can help investors and managers better understand what is really coming and when. Technology mapping is a disciplined business process that yields information and insights that are independent of management statements or traditional market analyst opinions, allowing us to get beyond the hype efficiently.

With technology mapping, investors and managers can see when to make investment decisions, R&D program funding decisions, buy-build decisions or acquisition or licensing decisions. Competitor analysis with technology mapping can lead to a clear picture of where their investments are focused and when products might be ready to launch. Technology mapping provides uniquely clear over-the-horizon pictures of trends in technology and the breadth of the competition that traditional marketing research methods often miss.

Technology mapping is widely applicable. Our own experience shows that it can be applied in many industry areas including the medical industry, chemical industry, electronics, consumer products, environmental industry, equity research and selected service industries. The argument that technology mapping doesn't work in "my" industry or "my" area is now thoroughly discredited.

Technology mapping is also one of the best kept secrets on the planet for several reasons. First, it is strategically critical to those who do it well. As a result, they are often reluctant to tell others about a process they consider be a key competitive advantage and a secret. Second, technology mapping is rarely taught to marketing managers or scientists or engineers. Third, management must be prepared to use the output of technology mapping,

and stunningly few organizations are prepared to use predictive models for key strategic technology decisions.

Emerging Tech Insights believes that technology mapping is a necessary tool for the 21<sup>st</sup> century. Organizations which successfully implement technology mapping will join the small group that profits from future changes that are just trends today.

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