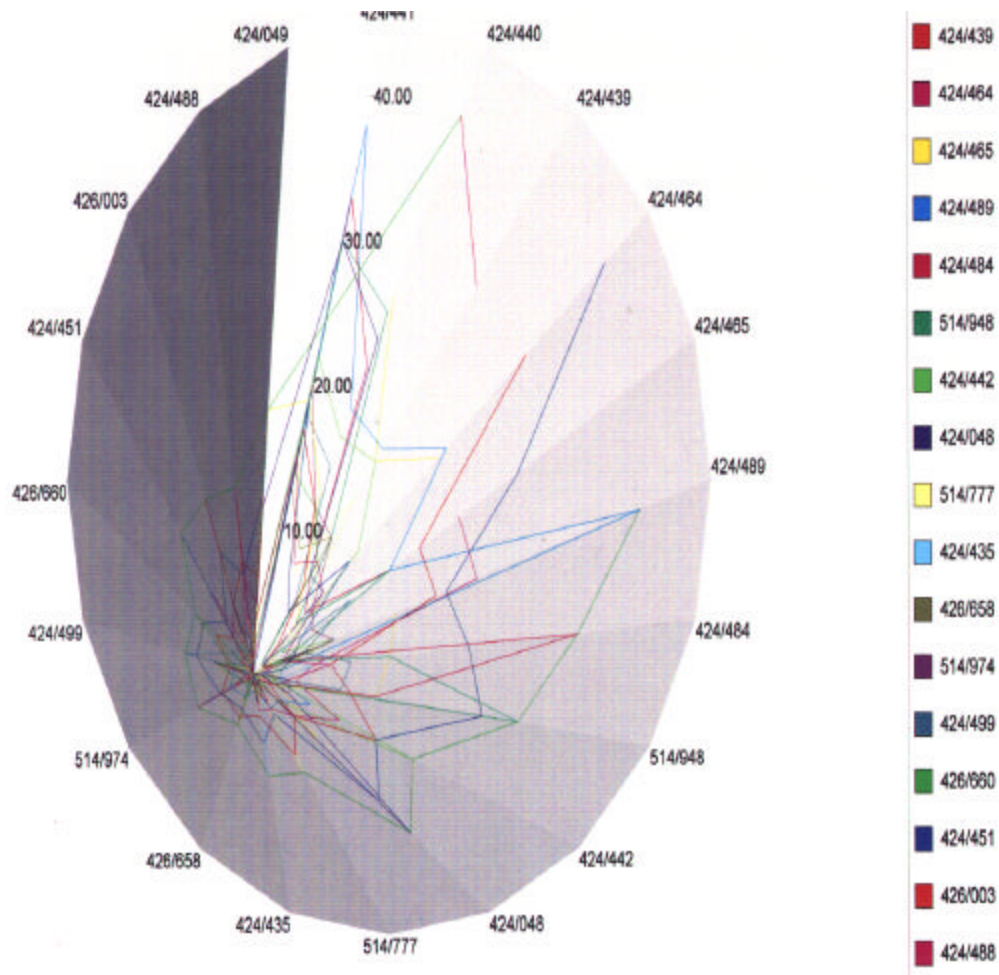


# Patent Landscaping Studies : Their Use in Strategic Research Planning



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## I. INTRODUCTION

Successful pharmaceutical research is becoming more and more expensive. More expensive still is research which is successful, but which cannot be commercialized due to unforeseen problems with third party patents.

To ease the commercialization of new research breakthroughs, more research-driven companies are planning future research with patent landscaping studies. A patent landscaping study shows, for a given general field of technology, what areas are potentially rife with third-party patent problems, and, by contrast, what areas remain relatively free of third-party patents - and possibly are available for appropriation.

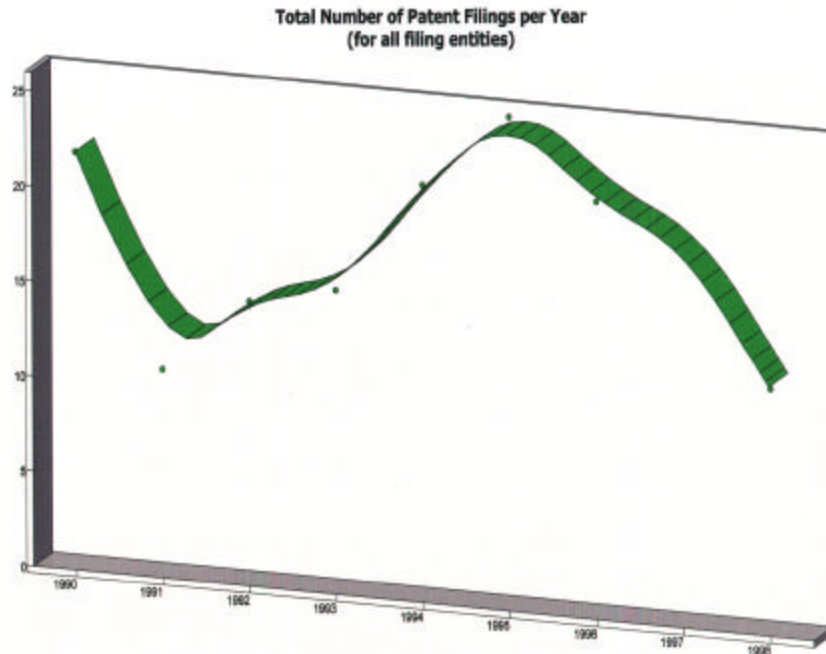
Patent landscaping is suitable for planning research in virtually any area of technology. We can best understand the kind of insight a patent landscaping study can provide, however, by reviewing a specific example of patent landscaping analysis. Here, we will take as our example the field of time release drug delivery technology in the 1990s. For this example, we collected data on all issued United States patents in the field of time release drug delivery technology from the early 1980s through the end of the 1990s, a data set of 271 issued patents. While not included here, patent landscapes can also include data on published United States and foreign patent applications, as well as issued patents. Data extracted from the patent provides insight into many areas, including:

- field-wide trends affecting the entire field of technology as a whole;
- the identity and activity of the various competitors active in the field;
- within the broad field of technology, trends affecting specific technological sub-specialties; and
- geographic information pertaining to where the research activity is happening.

We discuss each of these aspects in turn.

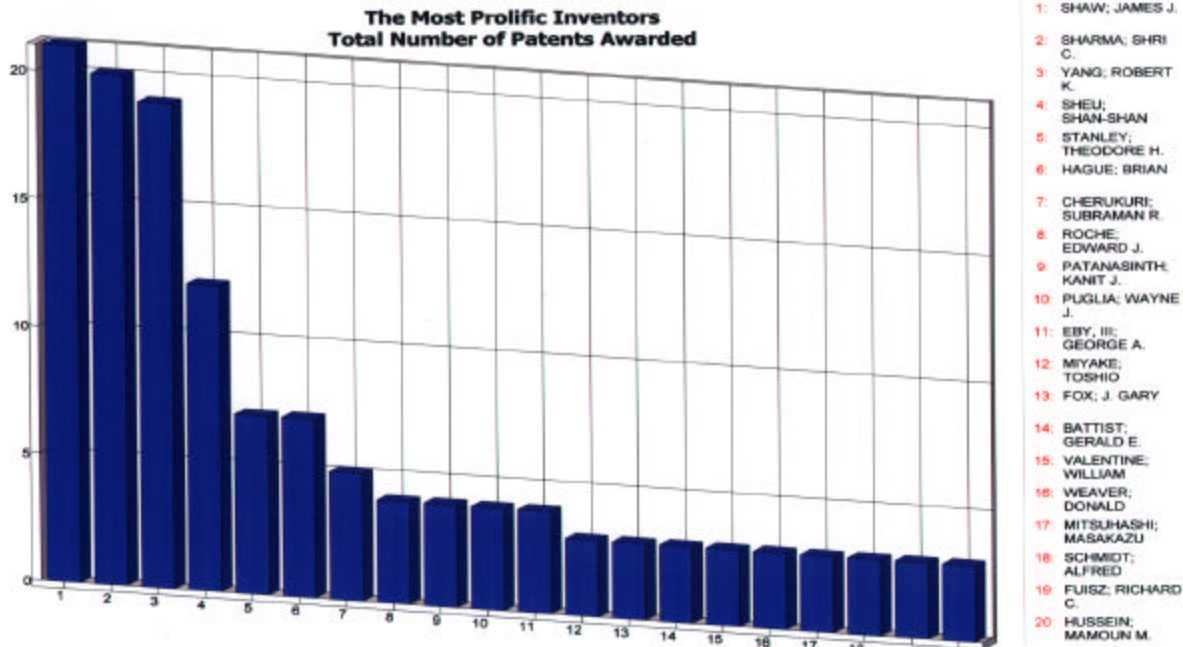
## II. FIELD-WIDE TRENDS

As with most areas of technology, the field has shown its ups and downs in total research activity. General information on the level of research activity in this area over time can be seen by examining the number of patent filings per year. We see a sharp increase in research activity and patent filings in the late 1980's, during a period of rapid economic growth. This is followed by a decline in the early 1990s, when general economic conditions were slow. Since then, filing activity has recovered, then tapered off. This is seen readily in the figure, with a curve smoothed to show trending activity more clearly.



Within this broad trend, various sub-specialties showed widely varying activity over the same period, with certain technological approaches falling out of favor, while others have emerged as the extremely active areas of research interest. We will compare the rate of research activity among the various sub-technologies in the field in some detail, later in this report.

The total set of patents studied include four hundred and sixty two (462) inventors of record. Of these, some inventors are more prolific than others. While mere number of patents



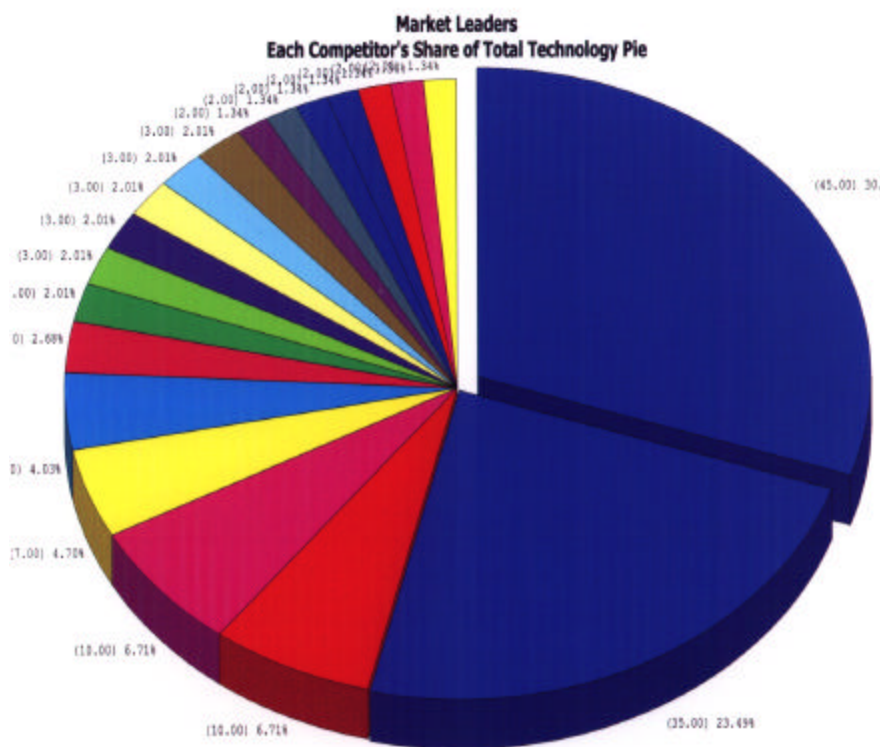
gives little indication of the commercial value or breadth of each patent, patents are not inexpensive, so the sheer number of patents can indicate the willingness of the employer to invest in protecting technology in this area of technology, and thus indicate the importance the employer places on protecting such technology for future activity. Of the four hundred and sixty two inventors active in this area of technology, the inventors with the greatest number of issued patents are shown in the graph. We see that a relatively small number of researchers (e.g., James J. Shaw, Shri C. Sharma, Robert K. Yang, Shan-Shan Sheu, Theodore H. Stanley, Brian Hague) account for significantly more inventive activity than the average inventor in the field.

The most prolific inventors generally do not work in solitude. We can see what institutions host the most prolific laboratories, by identifying for the most prolific inventors, their respective employers. The major inventors ranked by the most prolific five assignees is shown in the table. As the table shows, James J. Shaw is the most prolific inventor in the field, and has generated patents both for Warner-Lambert Company and patents which remained unassigned at the time of issue. This could indicate he has left Warner-Lambert to go “free agent” (and thus may be available for consultation) or visa versa. A look at his patent filings over time would give insight into this.

	Assignee	Inventor
1	UNASSIGNED	SHAW; JAMES J.
2	WARNER-LAMBERT	SHAW; JAMES J.
3	MCNEIL-PPC, INC.	ROCHE; EDWARD J.
4	PROCTER & GAMBLE	DAMANI; NALINKANT C.
5	UNIVERSITY OF UTAH	STANLEY; THEODORE H.

### III. COMPETITORS IN THE FIELD

The "Assignee" is the company or legal entity of record which is recorded as the owner of the patent. For example, patents issuing to researchers and inventors working at a certain chemical company, will typically cite that company as the assignee of record. There are a total of one hundred and thirty-seven assignees of record in this area of technology. Some of these competitors show only a passing interest in the field, filing very few patents, while others have filed numerous applications and accumulated significant patent estates. The most active of these competitors have patent estates of varying sizes, and established in various technical sub-specializations within the broader field of technology. A total of one hundred and thirty seven patent assignees of record have applied for patent protection during the sample period.



Of the total patents in this field, the largest single slice of the pie - representing fully 45% of the patent landscape - were unassigned as of the patent issue date. These patents may be licensed, rather than assigned. More likely, however, is that the inventions were invented by "independent" inventors unaffiliated with any larger institution. Typically, a high percentage of such independent inventions never are commercialized. Each color denotes a specific competitive entity. The key for these colors, and the entities they designate, is provided at the end of this report, along with the key designating the international patent classification definitions.

Assignee	Occurrence(%)
UNASSIGNED	45(15.96%)
WARNER-LAMBERT	35(12.41%)
MCNEIL-PPC, INC.	10(3.55%)
PROCTER & GAMBLE	10(3.55%)
UNIVERSITY OF UTAH	7(2.48%)
132Company(s)	175(62.06%)

The most prolific five Assignees (out of the total of 137 assignees), are shown in the table. Note that the field shows significant decentralization or lack of concentration; sixteen percent of total activity is by inventors working independent of any assignee institution, and more than half of the total field (62%) is scattered among a diverse group of one hundred and thirty two different assignee companies, each with relatively miniscule slices of the total technology pie.

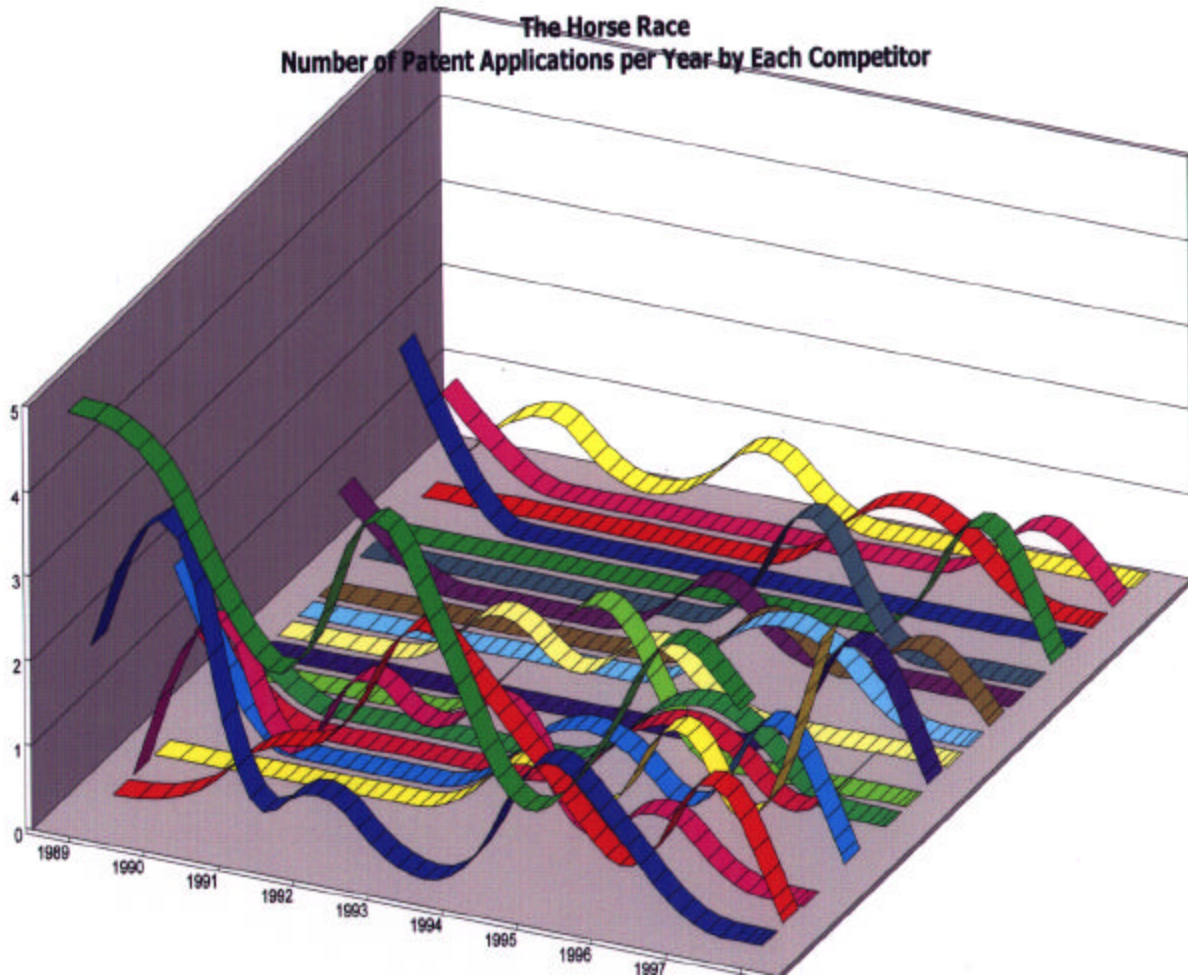
Within the broad field of technology are seventy-five sub-classes of technology. Certain of these sub-classes or sub-technologies are more active than others, in hosting research activity. The comparative activity of these various areas can be seen by contrasting the activity in the various patent sub-classifications. The most frequently cited International Patent Classification sub-classes for time release drug delivery technology are A61K-009/20 (pills, lozenges or tablets), A61K-009/68 (chewing gum drug delivery), A61K-009/28 (dragees, coated pills or tablets), A61K-009/16 (agglomerates, granulates, microbeadlets) and A61K-007/16 (medicinal preparations characterized by the non-active ingredients used). The number of issued patents ranked by the most prolific original International Patent Classification (out of a total of seventy-five (75) original international patent classifications) are shown in the Table.

	Original International Patent Classification	Occurrence(%)
1	A61K-009/20	48(17.71%)
2	A61K-009/68	23(8.49%)
3	A61K-009/28	16(5.90%)
4	A61K-009/16	14(5.17%)
5	A61K-007/16	13(4.80%)
Etc.	70 Kind(s)	157(57.93%)
Sum.	75 Kind(s)	271

There are a total of four hundred and sixty two inventors of record active in this field of technology patents. Some of these inventors are, of course, more prolific than are others. More prolific inventors generate more patents, and these greater numbers of patents show up in the data discussed above, relating to the number of issued patents per competitor. What of competitors who generate fewer patents, yet employ relatively large head-counts of research staff. These competitors, despite their lag in the total number of issued patents, remain important to identify, as these are the institutions with the largest research staffs - and who ostensibly retain the largest competitive research capability. The assignees of record with the greatest number of inventors employed by or otherwise associated with them, are ranked in the table.

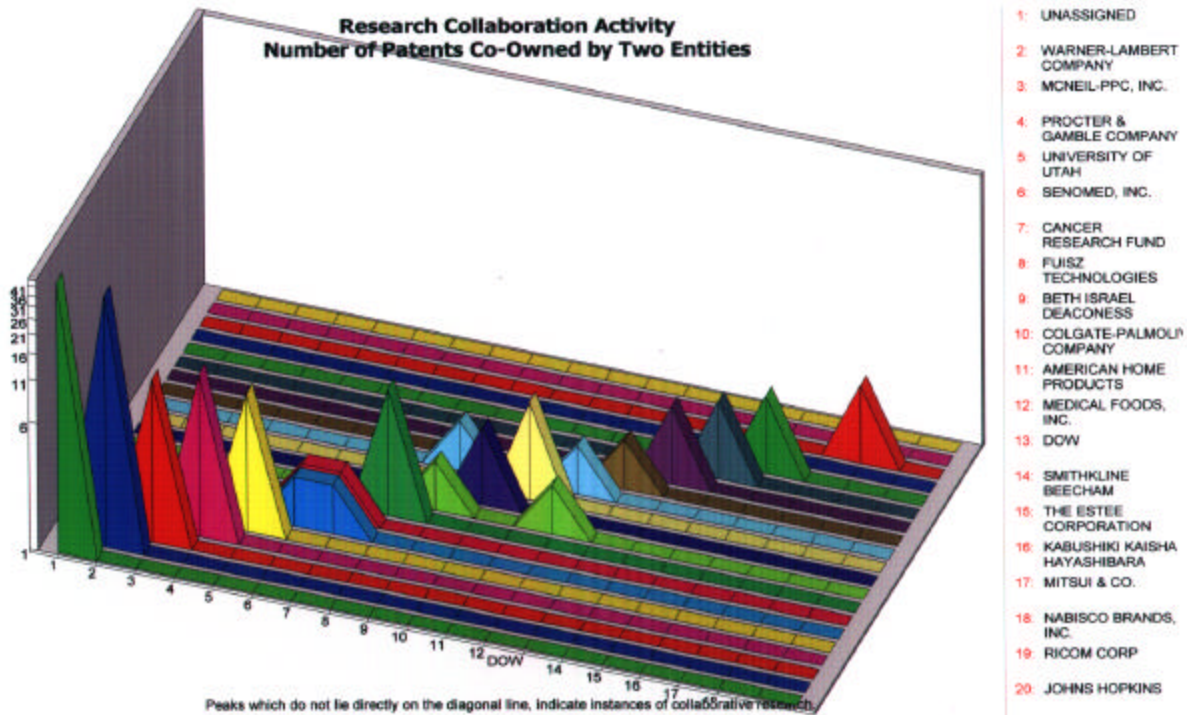
Assignee	Inventors
UNASSIGNED	56
WARNER-LAMBERT	42
MCNEIL-PPC, INC.	14
PROCTER & GAMBLE	18
UNIVERSITY OF UTAH	2

Inventive activity does not remain constant over time. We have already seen that the total number of patent applications filed per year has varied significantly over time, due to general economic activity and other factors. While total patent filings varies each year, the number of filings made by each specific competitor varies over time, as well. We can review this data to get an idea of which competitors are becoming more active in this area, and which



competitors may have significantly curtailed - or even altogether stopped - competitive research in this area. Each competitor is shown as a band of a certain color.

No man is an island. Increasingly, no company is an island, either. Collaboration in research and development is more significant now than ever before. We can gain insight into



research collaborations in the field, by measuring the number of patents assigned of record to more than one competitor. One way to do this is to identify patents assigned to more than one assignee. Patents assigned to only one entity form a series of peaks, which articulate a ridge running from left corner to right corner of the chart. Peaks which do not fall directly on this ridge, but rather lay off to one side of it, indicate the existence of patents assigned to more than one assignee - a tell-tale sign of research collaboration. The height of such peaks shows the number of patents jointly owned - a sign of the intensity of the collaborative effort. Note that this type of comparison will not reveal every instance of research collaboration activity. For example, a research collaboration which uses a special-purpose holding company to hold title to jointly-developed intellectual property, and collaborations which assign all intellectual property to only one of the two partners, while cross-licensing those rights to the other partner, will not show up on this screen.

In addition to the topics already discussed, a patent landscape can convey even more information regarding competitors, their employees and their levels of activity. At the risk of sacrificing thoroughness for conciseness, however, we will now review examples of how a landscaping study can provide insights into specific technical sub-specialties.



#### IV. TECHNOLOGICAL SPECIALIZATION

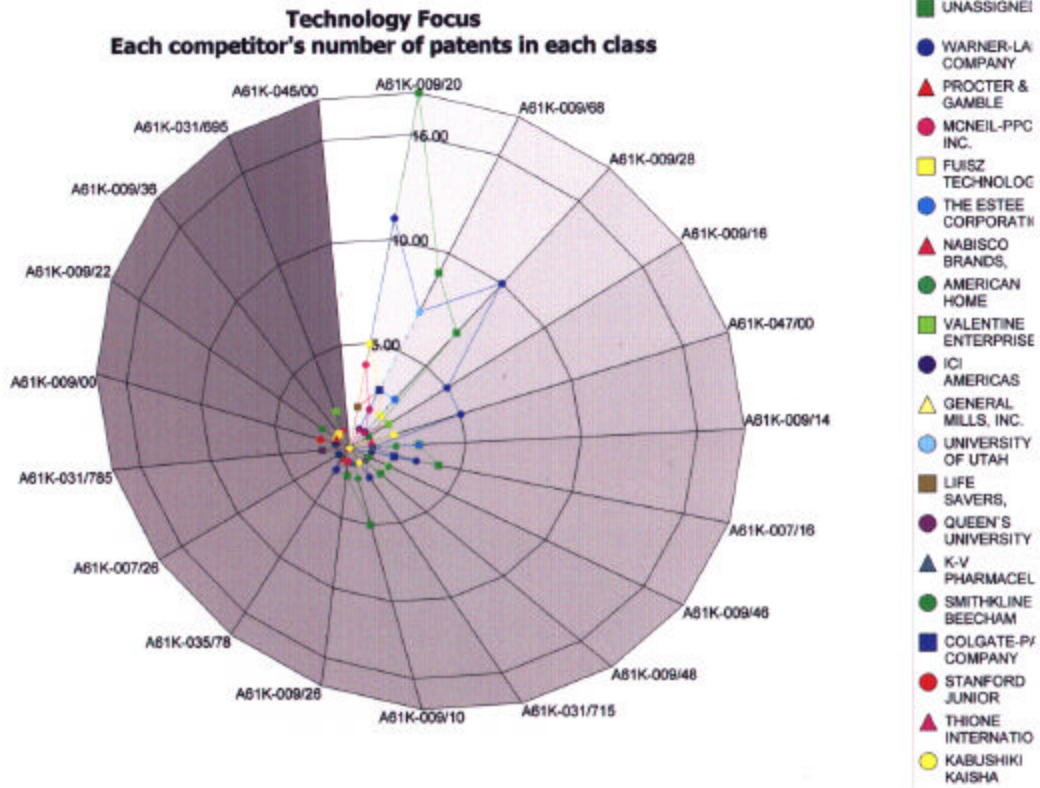
We have already reviewed examples of trends affecting the technological field as a whole. While the field as a whole may show certain trends, the field as a whole is composed of numerous specific, more focused technologies. Discovering trends in these specific, more focused fields, can give a more reliable interpretation of what is going on behind a competitor's laboratory doors.

This broad area of technology can be subdivided into numerous sub-classifications. Each of these sub-classifications may be dominated by one or more competitors, who need not necessarily hold any significant position over the entire field of technology as a whole. The most active entities are, to some extent, clustered in either of two discreet patent sub-classifications - 009/20 (pills, lozenges and tablets) and 009/68 (chewing gum type). The dominant patent sub-class by Assignee (Dominant patent class means the patent class to which the greatest number of patents owned by an assignee belong), are as follows:

	UNASSIGNED	WARNER-LAMBERT	MCNEIL-PPC	PROCTER & GAMBLE	UNIVERSITY OF UTAH
International Patent Classification	A61K-009/20	A61K-009/20	A61K-009/20	A61K-009/68	A61K-009/68

This shows that Warner-Lambert and McNeil both have the largest parts of their patent estates concentrated in subclass 009/20 (pills, lozenges and tablets), while Procter & Gamble and the University of Utah both have the largest part of their patent estates concentrated in subclass 009/68 (chewing gum).

We can get a more clear idea of each competitor's activity level in each specific kind of technology, by comparing each competitor's number of patents in each of the major sub-classes of technology. Most competitors have few patents (shown as data points lying close to the



center, or apex, of the cone). Certain competitors have built more numerous patent estates, stretching farther from the center of the cone. We see, however, that even the largest of these estates is relatively sharply focused in only one or two patent sub-classes. Warner-Lambert, for example, shows a relatively large concentration in subclass 009/20, 009/28 and 009/16, with little remarkable activity elsewhere.

Just as each assignee shows an activity level which varies each year, so too the industry as a whole also shows a varying level of activity in and commitment to each of the many specific technological approaches available. The industry's varying level of interest in or commitment to the various technical sub-classes over time, shows what areas of technology are perceived as *au courant*, and what areas are possibly perceived as obsolete or otherwise less than fruitful. As the

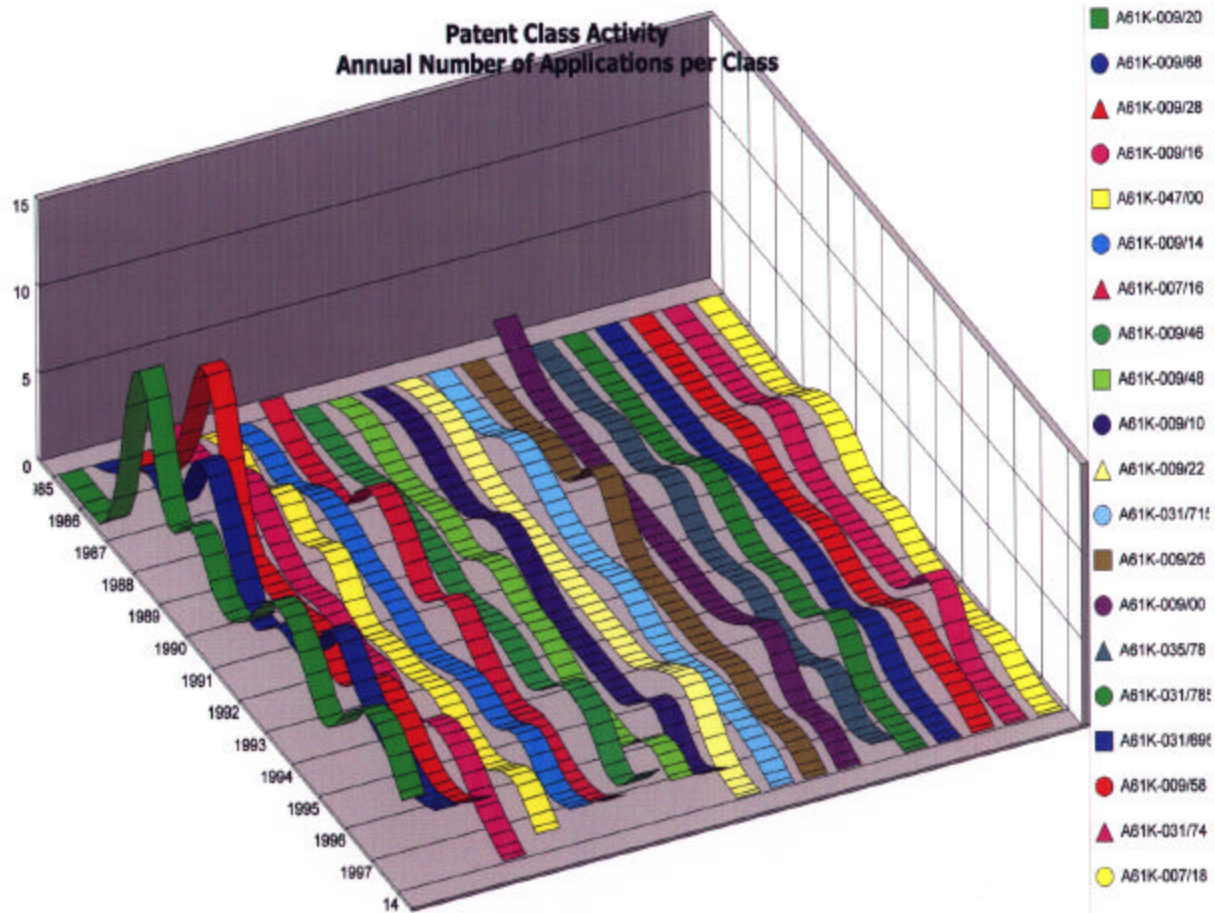
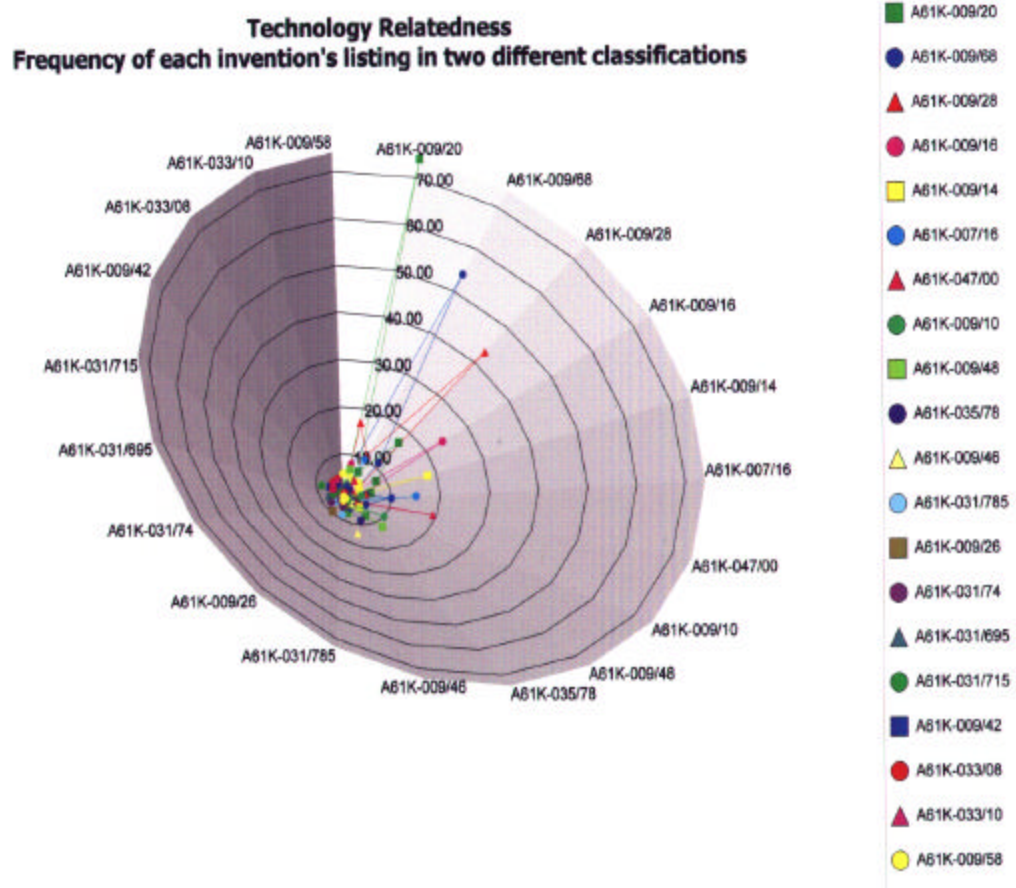


chart shows, the number of patent filings per year in each of a dozen color-coded technical specialty areas, varies greatly over time. Many of the specific technologies have shown little activity at all for several years, indicating they have perhaps become perceived as less than productive areas. In contrast, other types of technology (*e.g.*, 008/20) show consistent activity over the long-term. Certain types of technology (*e.g.*, 008/46; 009/10) seem to be experiencing a spate of recent growth, indicating the possibility of emerging as tomorrow's technology leaders

It is fine to compare the activity among discreet technical specialties and approaches. Many technical specialties, however, overlap to a certain extent with other areas. To gain insight into how various technical sub-specialties may overlap, it is informative to examine the



“relatedness” of the various technical sub-specialties. The relatedness of technology, or the degree to which research overlaps more than one patent sub-classification, can be seen in the frequency of "cross-over" patents which are classified in more than one sub-class. The spokes which display more than one data point, are those patent sub-classes which contain patents classified in a second sub-class. We can see that, in general, technology falls into only one main sub-classification - thus producing only one data point on most of the radial "spokes" of the conical graph.

## V. GEOGRAPHIC INSIGHTS

Just as various corporate competitors are more active than others, and specialize in various specific technologies, so too individual countries are more active or prolific than others, and can be seen to host research specialized in certain specific areas of technology. The geographic location of the most active hotbeds of research can be identified by reviewing the location of the priority patent filing. The country of the priority filing is usually assumed to be either the location of the inventor personally, or the location of the headquarters of the corporate assignee. The number of issued patents by the most prolific five countries out of a total of thirteen priority countries, is shown

Priority Country	Occurrence(%)
The United States of America	217(80.07%)
Great Britain	13(4.80%)
The Republic of Japan	10(3.69%)
The Federal Republic of Germany	7(2.58%)
The Republic of France	6(2.21%)
Etc. - 8 Countries	18(6.64%)
Summary - 13Countries	271

in the accompanying table. The United States generates the overwhelming majority of the new patent filings in this field. Note that the data sample includes only issued United States patents, not international patent applications; including published international applications in the data set could conceivably increase the relative proportion of non-United States priority filings, and give greater information on non-United States based research.

As various corporate competitors specialize in specific sub-classes of technology within the broader field, so too research located in different countries tends to show specific specialization in specific sub-classes of technology. We can see how this specialization both in the original classification of the initial patent application filing, and in the final patent classification assigned to the patent upon issue. Certain types of technology (*e.g.*, 009/20; 009/28) are so fundamental to the field that they are researched in a significant level in all major geographic research locations. Other types of technology, however (*e.g.*, 009/16; 025/34), seem of interest only to competitors located in more limited geographic areas.

	Original IPC	IPC
United States of America	1. A61K-009/20 (17.71%) 2. A61K-009/68 (8.49%) 3. A61K-009/28 (5.90%)	1. A61K-009/20 (12.65%) 2. A61K-009/68 (9.23%) 3. A61K-009/28 (7.35%)
Great Britain	1. A61K-009/20 (23.08%) 2. A61K-009/28 (15.38%) 3. A61K-009/16 (7.69%)	1. A61K-009/20 (17.39%) 2. A61K-009/28 (8.70%) 3. A61K-009/16 (8.70%)
Japan	1. A61K-047/00 (20.00%) 2. A61K-007/18 (20.00%) 3. A61K-007/26 (20.00%)	1. A61K-009/68 (9.52%) 2. A61K-047/00 (9.52%) 3. A61K-007/18 (9.52%)
Germany	1. A61K-009/20 (28.57%) 2. A61K-009/28 (14.29%) 3. A61K-047/00 (14.29%)	1. A61K-009/20 (33.33%) 2. A61K-009/68 (11.11%) 3. A61K-009/28 (11.11%)
France	1. A61K-009/20 (33.33%) 2. A61K-009/00 (16.67%) 3. A01N-025/34 (16.67%)	1. A61K-009/20 (25.00%) 2. A61K-007/18 (12.50%) 3. A61K-009/00 (12.50%)
Total	1. A61K-009/20 (18.15%) 2. A61K-009/68 (8.00%) 3. A61K-009/28 (6.46%)	1. A61K-009/20 (12.90%) 2. A61K-009/68 (9.09%) 3. A61K-009/28 (7.33%)

## **VI. SUMMARY**

The specific examples discussed here merely scratch the surface of the information and insight available from a patent landscaping study. More tailored analysis can be done to address the specific concerns appurtenant to a given specific research initiative. However used, patent landscaping provides a tool to avoid expensive and embarrassing problems before they start. Patent landscaping can also indicate the most efficient way to achieve research goals. Because it is so informative, patent landscaping is a powerful tool for strategic research planning.