



## **Explanation of PatentCafe® Patent Factor Index™ Reports (PFI)**

### **The Practical Application of Statistical Quality Scoring to Effective Patent Management**

**White Paper**

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## Abstract

Determining patent value is one of the most pursued endeavors by portfolio managers, technology investors, M&A teams, litigators, R&D executives, and CFOs. The complexities surrounding methods of calculating patent value must consider time dependant metrics such as remaining patent life, market size, general health of the economy, and patent quality. The sheer number of variables therefore, frustrates the reliability of any repeatable, objective mechanism to compute patent value.

However, there have been many scientific and academic studies that focus on qualitative metrics, statistical indicators that have been positively correlated to patent value. This paper examines not only the application of metrics proven in various empirical studies, but extends the analysis to include new metrics that rely on comparative analysis of key quality indicators between the patent being investigated, and that patent's "Technology Sphere", the closest 100 semantically related patents that vie for the particular market space to which the inventions are targeted.

Finally, this paper then combines various indices, similar to subject matter experts' multi-dimensional analysis of many interrelated indices, but based on an objective, repeatable machine analysis that begins to shape a "real world" perspective on understanding patent quality, and hence, its potential value.

## Introduction

At any given time, a patent portfolio will contain a large number of patents of nominal quality, and on one end, a smaller number of exceedingly high quality patents, and on the other end, a smaller number of exceedingly low quality patents.

In any given infringement litigation or licensing proceeding, the patent of interest will be either low quality, high quality patent, or of a nominal quality.

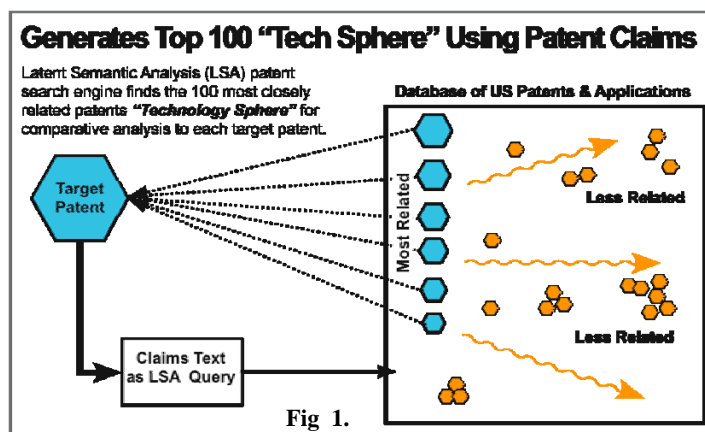
In the above instances, management or court decisions will directly correlate to a financial loss or gain. Understanding the business, technology or legal quality of a patent prior to the decision to involve a particular patent in a proceeding or business process can profoundly affect the outcome, and its financial impacts.

## Patent Factor Index (PFI) Report

Patent quality is the basis for almost all substantive decisions based on patent value, whether to assess the commercial or enforcement qualities of a single patent in a licensing negotiation, or analyzing large scale patent collections to maximize portfolio asset value.

PatentCafe's Patent Factor Index Reports (PFI) use our advanced linguistics, Latent Semantic Analysis search engine, and a statistical process to qualitatively analyze granted US patents.

PFI Reports compute 20 critical indices that contribute to the overall quality of a patent. Unlike other statistical patent scoring systems that rely on a static data set to compare against a particular patent (patent classifications, for instance), PFI reports compute the quality scores of each target patent as it compares to the technology sphere surrounding that patent.



Using PatentCafe's Latent Semantic Analysis search technology and international patent datacenter, the PFI Report automatically creates a patent search query using the claims text of the target patent. It finds the 100 patents most closely related to the target patent, the "technology sphere". (Fig. 1)

Technology spheres are dynamic. As more patents are granted in any given technology area, the scope of each patent necessarily becomes narrower. Over time, the incremental value of each additional patent becomes increasingly small, however, the pioneering patents that created the technology sphere can become increasingly valuable.

Patent quality indicators are also time dependent. As just one example, a patent with no forward citations today may evolve as the pioneering patent as it becomes a "most cited patent" in the future. On the other hand, a patent that remains un-cited for years within a highly competitive technology sphere may prove to be very low quality, and not warrant the continued investment of patent maintenance fees.

Real time qualitative analysis of each target patent, or of an entire patent portfolio, provides the decision-support information intellectual property managers need to make sensible business, legal or technology decisions.

PFI Reports finally employ large-scale statistical patent modeling, most of it from proven regression, econometric, patent citation, and bibliometric models developed by notable economists, anthropologists, and intellectual property professionals. (Download the White Paper "Application of Multiple Known Determinants to Evaluate Legal, Commercial and Technical Value of a Patent" from [www.PatentCafe.com](http://www.PatentCafe.com))

20 Separate Scores: A single score patent rating system is incapable of providing the transparency of the many components of a patent that contribute to qualitative value. Without fully understanding specific attributes of a patent, no reasonable licensing, investment, business or litigation decision could be rendered.

PFI Reports compute 20 data fields specific to (a) legal quality; (b) commercial quality; and (c) technology quality.

By providing this high-resolution analysis of multiple patent indices, PFI Reports deliver the most reliable real-time, real-world characterization of each target patent when compared to any other objective computer modeling system currently available.

## Patent Quality Impact Following KSR v. Teleflex

The Supreme Court Decision in **KSR v. Teleflex** (“KSR”) changed the long-standing definition of “obviousness”. After KSR, the courts read the “broadest interpretation of the claims” to assess “prior art” that could lead to validity.

The obvious implication of KSR is that the quality, and correspondingly at some level, the value of a patent estate changed. Following the Supreme Court decision, KSR has been cited in a growing number of cases before the Court of Appeals for the Federal Circuit (CAFC). In response to KSR, the US Patent and Trademark Office (USPTO) implemented new *Examination Guidelines for Determining Obviousness*.<sup>1</sup>

“Because patents granted under the old standard are now vulnerable to challenge, companies with large intellectual-property portfolios will have to reassess the value of their patents. Under the Sarbanes-Oxley law any substantial decline in value must be reported. Companies could be held liable under Sarbanes-Oxley if they fail to look at the record of each patent to determine its vulnerability.”<sup>2</sup>

Other intellectual property industry thought leaders, litigation strategists, and patent owners subjectively argue the implications of KSR on patent drafting, prosecution, and enforcement strategy, and recent CAFC decisions in standing cases may influence what new cases should be brought before the CAFC in light of KSR.

Chicago patent attorney Lee Eulgen said that “Making it easier to challenge patents will diminish the value of many existing patents, and that may require corporations to notify shareholders of reduced assets in their intellectual-property holdings.”<sup>3</sup> Moreover, the potential implication of KSR on portfolio value and corporate reporting under Sarbanes Oxley is still being analyzed. “...decisions [following KSR] are a clear victory for promoting patent quality and more equitable damages standards, and will go a long way in enhancing future innovation and productivity”<sup>4</sup>.

Regardless of the profound implications of KSR and other recent CAFC cases that change the scope of what constitutes patent quality, without the proper tools, IP managers continue their traditional ways.

Latent Semantic Analysis (“LSA”) search technology is used in generating all PFI Reports. By identifying the technology sphere for each patent, LSA provides the underpinning for advanced statistical patent data mining and information management.

Specifically, KSR changed the definition of what may constitute prior art – and what prior art that previously would not challenge patent validity, now does.

35 U.S.C. 102 Conditions for patentability; novelty and loss of right to patent.

A person shall be entitled to a patent unless -

*(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or*

*(e) the invention was described in - (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, ...*

35 U.S.C. 103; Conditions for patentability; non-obvious subject matter.

*(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.*

LSA identifies the 100 patents that define each technology sphere for each patent being analyzed, overcoming the limitations of trying to perform statistical comparisons on a statistical patent data set.

Patent classifications are limiting, and prevent the analysis from looking into non-obvious technology areas (US patent classifications) that may contain highly relevant art which could be used to challenge validity of the target patent.

<sup>1</sup> <http://www.uspto.gov/web/offices/com/sol/notices/72fr57526.pdf> Examination Guidelines for. Determining Obviousness Under 35. U.S.C. 103 in View of the Supreme. Court Decision in KSR International. Co. v. Teleflex Inc.

<sup>2</sup> Alan Thiele, San Antonio IP attorney, Court douses patent wildfire, May 1, 2007, Jon Van, Chicago Tribune

<sup>3</sup> Lee Eulgen, Chicago IP attorney, Court douses patent wildfire, May 1, 2007, Jon Van, Chicago Tribune

<sup>4</sup> BSA Statement Applauding Supreme Court Rulings on Patent-related Cases, April 30, 2007, Business Software Alliance (BSA) President and CEO Robert Holleyman

Keyword searching, once again, is incapable of identifying non-obvious art that resides in different industries, or defined by different jargon. In fact, keyword patent searching carries the inherent danger of not finding all of the relevant art even within a specific technology segment, since crafty patent writers use lexicon that frustrates the most diligent patent searcher.

In order to assess how much KSR changed the patent quality landscape, PatentCafe conducted a qualitative analysis of patents judged in CAFC cases before and after KSR. The following chart illustrates how statistical scoring of patent quality indices is used to identify how KSR changed the anticipated:

Decided for the defendant		Prior Art Validity	Concurrent Art Validity
2006	Average Defendant Scores	810	870
Post-KSR	Average Defendant Scores	796	917
	Percent Change	-2%	5%

Decided for the Plaintiff

2006	Average Plaintiff Scores	690	828
Post-KSR	Average Plaintiff Scores	841	955
	Percent Change	18%	13%

By the numbers, the chart clearly shows that the Validity Confidence scores rose sharply for patents decided for the plaintiff. In other words, patents that did not show an appreciable rise in validity confidence scores were decided for the defendant.

Of course, statistical quality analysis may never serve as a reliable predictive model for CAFC decisions. However, the application of statistical modeling at a granular level, as opposed to a "total patent score", can be a highly valuable solution for objective management of patent assets and management decision support.

## Transparency of Process; Reliability of Ratings Scores

In order for any statistical patent evaluation process to be trustworthy, the process must be completely transparent, repeatable, and objective.

Arguments by providers of other patent scoring and rating systems say that their algorithms are “proprietary”, and therefore cannot be disclosed, or claim of objectivity by subject matter experts using “proprietary but in-house tools” disregard the critical requirement of transparency, repeatability and objectivity.

In this paper, PatentCafe endeavors to not only provide the transparency of process that has resulted in the PFI Report becoming the most trusted statistical patent rating system in the industry, but taken a step further, it also provides meaningful and actionable explanation of each index score as it pertains to the patent management decision process within an organization.

Further, no single-score patent rating system is capable of providing the level of information, granularity of information, needed to support the myriad decisions that are made regarding acquisition, divestiture, enforcement, or abandonment of a patent, or a portfolio of patents. PFI Reports provide clear explanation of each of the 20 critical quality indicators that correspond to patent value. Alone, or in combination with other indices, the PFI scores help attorneys and IP managers make conservative, informed decisions regarding patent asset management.

In confidential studies performed by reputed universities, intellectual property consultants and analysts, and commercial patent owners, PFI Reports have therefore been shown to **consistently correlate positively** to patent quality evaluations performed by human subject matter experts – however, more consistently objective and repeatable than humans.

In an ongoing effort to improve the transparency and reliability of PFI Reports, continued analysis by third party commercial organizations, financial and academic institutions is underway. Once completed, the results of any ongoing analysis of the veracity of the PFI Reports and processes will be published in the appropriate peer-reviewed journals and articles.<sup>5</sup>

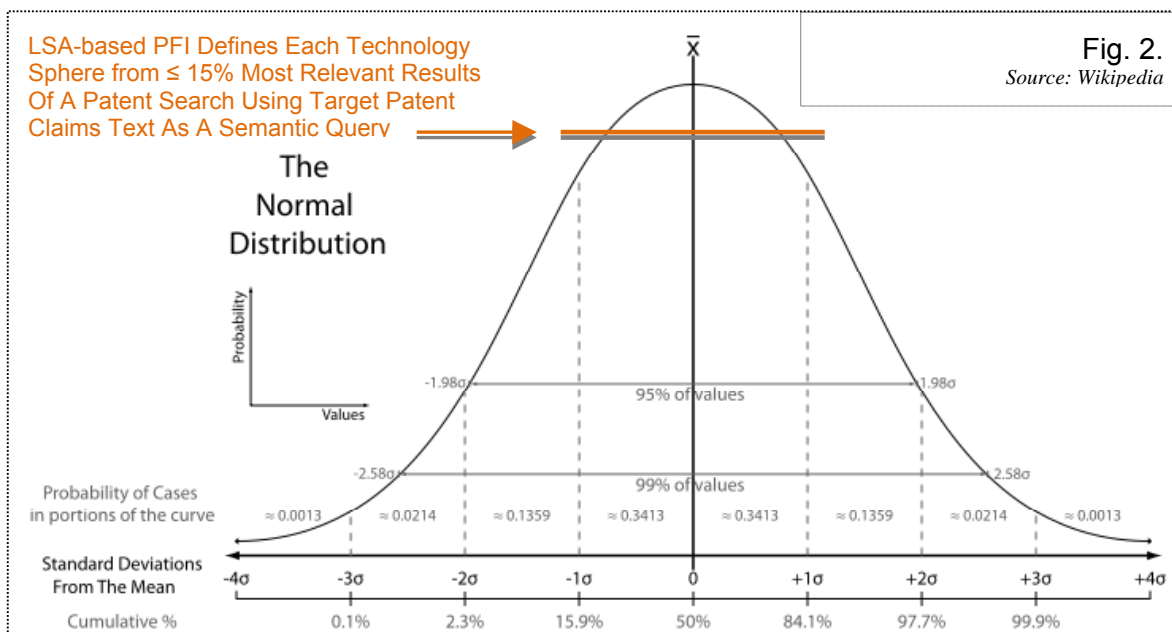
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<sup>5</sup> “Gibbs, Andy; “KSR defines new baseline for statistical patent quality”; IAM Magazine, Issue #29, March/April 2008.

## Statistical Process

PatentCafe uses various statistical processes in computing the scores for each of the PFI indices. The objective of the PFI statistical process is to identify causality, and in particular, to draw a conclusion of the effects of the independent quality indices of a patent document on dependent variables.

In other words, the conclusions of many statistical studies<sup>6</sup> correlating patent quality indices are incorporated into the PFI computations, and are applied to a group of related patents (technology sphere) as an indicator of how the target patent of interest would score against the group for that particular index.



Next, the generation of the important technology spheres relies on the use of Latent Semantic Analysis search technology. LSA<sup>7</sup> uses a document-term matrix, and weights linguistic patterns and frequency occurrences within a concept space.

LSA finds the most relevant 15% or fewer closely related patents before applying the analyses of the individual quality indices (Fig. 2.).

Many PFI scores used in support of a particular management decision may be used alone, without consideration or any other scores of any other indices.

In some cases, the statistical probability is 100%, for instance, as in the Enforceability index. If the patent has maintenance fees paid up, and has a period of time remaining prior to the expiration of its grant term, it is enforceable. If maintenance fees have not been paid (abandoned patent), or if the grant term has expired, the patent is not enforceable.

However, statistical analysis of the patent data set may reveal that two variable properties of the patent within the technology sphere under consideration tend to vary together, as if they are connected. For example, a high number of inventors on the target patent (when compared to the 100 patents within its technology sphere) suggest a higher level of technical sophistication - in this case, a positive correlation to *Technical Sophistication*.

<sup>6</sup> See **References** at the end of this paper

<sup>7</sup> Latent Semantic Analysis: [http://en.wikipedia.org/wiki/Latent\\_semantic\\_analysis](http://en.wikipedia.org/wiki/Latent_semantic_analysis)

Conversely, the same higher number of inventors may also reduce the probability of surviving an opposition challenge - in this case, a negative correlation to *Sustainability in Opposition*.

Each PFI score is computed using a different, and most appropriate calculation. The computed scores are repeatable and objective.

## Computed PFI Indices.

A description of the 20 indices scored in the PFI Reports follows. The possible scores referred to, and found in the PDF version of the PFI Report, are:



The PFI scores provide more of a relative qualitative value, rather than an absolute value. When the scores are computed, they are rounded up, or down, to the nearest quality quartile. "No Quality" patents fall off the left end of the rating bar.

### 1. Enforceability

Index description: *A US patent has three maintenance fee payment dates between issuance and expiration. Failure to pay maintenance fees, or expiration results in an unenforceable patent. If a patent is in review, the enforceability rating is reduced since there is a chance the patent will be invalidated.*<sup>8</sup>

**A Low Score Means:** "Zero" indicates that the Patent is not legally enforceable – either because of failure to pay maintenance fees when due, because the patent has expired, or the patent has been officially withdrawn.

Mid-score 500 indicated that the patent is under review by the USPTO

**A High Score Means:** The patent has not yet reached its date of natural termination, and all currently due maintenance fees have been paid.

**Other Considerations:** The PFI computes the estimated date of expiration of a patent using the 17 year term after grant, or 20 year term after filing based on the filing date. A patent term adjustment by the USPTO may apply to any given patent. Patent term adjustments are not computed in the Report.

### 2. Total Relevancy Strength

Index description: *Relevancy ranking of this patent compared to the 100 most relevant US patents returned from a Latent Semantic Analysis search using the full text claims of this patent.*

One would assume that if we use the claims text of a target patent as the search query, the target patent will naturally be returned as the #1 most relevant search result. Depending on the technology domain, this is NOT necessarily the case in nearly half of the instances. Patents that teach the art better than the target patent from which the claims were used represent **invalidity / infringement risks or enforcement / licensing opportunities**, depending on whether the search results patents were earlier filed, or later filed, when compared to the target patent filing date.

**A Low Score Means:** When the claims text of the target patent is used as a Semantic search query, it returned search results wherein the target patent ranks lower than many other patents within its technology sphere.

**A High Score Means:** The target patent is returned in the #1 position (or very high) in the search results list that was generated using the claims text of the target patent as the Semantic search query.

<sup>8</sup> 35 U.S.C. § 365 Right of priority; benefit of the filing date of a prior application

*Other Considerations:* A low score should be a warning indicator to the patent owner considering the enforcement of the patent. On the other hand, an alleged infringer would consider a low score as a positive indicator to its litigation defense strategy.

This index correlates positively to indices 5 and 6 (Validity Confidence), and to index 13 (Enforcement Licensing Potential).

### 3. Novelty

Index description: *This index is based on backward patent citations. A higher number of backward citations generally indicates a reduction of invention novelty. This indicator shows the placement in number of backward citations compared to the 100 most relevant patents.*<sup>9</sup>

Practically speaking, a patent with very little comparative prior art citations will more often characterize a breakthrough technology. Conversely, a patent with a very large list of prior art references must find a thin path of novelty through a large body of earlier developed technology.

In practice, PFI Reports have shown that patents granted to academic institutions generally have lower novelty scores reflecting the exhaustive research typically required by graduate students who are highly focused on research to find small, incremental advances.

*A Low Score Means:* The novelty of the target patent is presumed to sufficiently satisfy the novelty conditions for patentability under 35 U.S.C. 102, but reflect very little practical novelty advantages over most of the other patents within its technology sphere.

*A High Score Means:* The target patent teaches a highly novel invention that, when compared to other patents within its technology sphere, reflect a significant quality advantage. This often correlated positively to a higher commercial value of the patent.

*Other Considerations:* A low novelty score alone does not necessarily suggest a low value patent. In cases where the patent owner owns other patents closely related to the target patent (“patent bundle”), even a low novelty score could add appreciable synergistic value to the target patent if considered an incremental addition to the patent bundle.

This index correlates positively to Index 21 (Technology Advancement).

### 4. Claim Scope Breadth

Index description: *Patents containing a higher number of backward patent and non-patent citations have been shown to have a narrower scope of claims (more limitations) than related patents with fewer citations.*<sup>10</sup>

*A Low Score Means:* A disproportionately high number of backward citations of the target patent, when compared to patents in its technology sphere, suggest that a “fine needle” has been threaded through voluminous prior art in order to scratch out one or more allowable claims, albeit, of exceedingly narrow scope.

*A High Score Means:* A small amount of prior art suggests that the present invention, when compared to other patents in its technology sphere, represents a significant claim on the technological advancement(s) taught in the target patent.

<sup>9</sup> Market value and patent citations (Hall, Jaffe & Trajtenberg) JEL Classification: O31, O38 – 2004.

<sup>10</sup> An analysis of the source of EPO citations: applicant vs patent examiner citations; Applied Econometrics Association, by Criscuolo, Geuna & Verspagen, 2004

*Other Considerations:*

A countervailing condition to the computation of this index, and one which would reverse the score, is when a large number of backward citations reflect the application of various implementations of the prior art throughout a large number of market segments. If the target patent has a correspondingly high number of claims that correlate to each of the market segments established by the prior art citations, the overall claim scope score would be HIGH, even though it contains a higher number of backward citations than other patents within its technology sphere.

However, in light of KSR, the correlation of the claim scope scores could be positive, or negative. The following chart illustrates the correlation of claim scope scores to CAFC decisions before, and after KSR. The data should not be considered a reliable predictor of future CAFC decisions, however, care must be taken when relying on PFI Claim Scope scores in support of enforcement decisions.

Data extracted from a study comparing Claim Scope Scores in CAFC Decisions before and after KSR v. Teleflex		Average Claim Scope Scores
Decided for the Defendant		
2006	Defendant's Claim Scope Score	495
Post-KSR	Defendant's Claim Scope Score	417
	Percent Change	-19%
Decided for the Plaintiff		
2006	Plaintiff's Claim Scope Score	397
Post-KSR	Plaintiff's Claim Scope Score	500
	Percent Change	21%

**5. Validity Confidence (Un-Cited Earlier Filed Art)**

Index description: *A lower number of highly relevant but un-cited patents with earlier filing dates, disregarding earlier prior art issue dates, increases the confidence of surviving an invalidity challenge.* <sup>11</sup>

Patent Validity may be the ultimate indicator of patent quality. Ultimately, an invalid patent is worthless, while a patent that survives a validity challenge is increasingly stronger. The PFI Report determines where in the search results (technology sphere) the target patent is listed. A subsequent analysis then looks at any patents that are ranked higher in the search results list (more relevant to the claims of the target patent than the target patent itself), and identifies those that are earlier-filed.

*A Low Score Means:*

A large number of earlier-filed patents ranked higher on the search results list than the target patent. These earlier-filed patents, which were not cited by the target patent should be reviewed to determine whether they teach art later claimed by the target patent.

*A High Score Means:*

The target patent ranked at the top, or very close to the top of the search results list, indicating that few, if any, earlier-filed patents taught the art claimed by the target patent.

*Other Considerations:*

This index correlates positively to index 2 (Relevancy Strength).

Patents that should be reviewed as potential un-cited prior art are listed in the PDF version of the PFI Report on the page following Legal Indices.

<sup>11</sup> Internet Business Method Patents, John R. Allison, Emerson H. Tiller; McCombs School of Business, University of Texas at Austin

## 6. Validity Confidence (Un-Cited Concurrent Art)

Index description: *Discovery of fewer highly relevant but un-cited Concurrent art patents (co-pending during prosecution) increase the confidence of surviving an invalidity or infringement challenge.*

Index 6 is similar to index 5, with the exception that this index looks specifically at patents that neither cite the target patent, nor are cited by the target patent, since the group of patents was being prosecuted by the USPTO at the same time. In these cases, the examiners did not have the luxury of being able to review patent applications that other examiners were reviewing, henceforth, not having the benefit to identify which applications may teach prior art relative to another application being prosecuted.

The theory of parallel invention, or the experience that “technology happens in bubbles” has application to this index, since it looks at the large number of patent applications on very similar technologies or inventions filed within the short technology bubble period.

*A Low Score Means:* A large number of earlier-filed patents ranked higher on the search results list than the target patent. These earlier-filed patents, which were not cited by the target patent should be reviewed to determine whether they teach art later claimed by the target patent.

*A High Score Means:* The target patent ranked at the top, or very close to the top of the search results list, indicating that few, if any, earlier-filed patents taught the art claimed by the target patent.

*Other Considerations:* This index correlates positively to index 2 (Relevancy Strength).

Patents that should be reviewed as potential un-cited prior art are listed in the PDF version of the PFI Report on the page following Legal Indices.

## 7. Sustainability In Opposition

Index description: *The number of inventors on a patent significantly correlates to opposition survivability; the fewer inventors, the more likely a patent is to survive opposition.*<sup>12</sup>

Opposition proceedings are typically mounted by competitors or other third parties against a target patent as a cost-effective alternative to litigation. Opposition is usually brought against a patent prior to, or shortly after it is granted. The Patent Office considers many arguments in order to determine whether to disallow, or invalidate a patent grant, including whether new prior art, or procedural inconsistencies should lead to a decision unfavorable to the patent owner.

One empirically proven statistical indicator of a patent’s ability to survive an opposition is the relative number of inventors of the target patent compared to the number of inventors of patents within the technology sphere.

*A Low Score Means:* This patent has a higher probability of **not surviving** an opposition proceeding, when compared on average to other patents within the technology sphere.

*A High Score Means:* This patent has a higher probability of **surviving** an opposition proceeding, when compared on average to other patents within the technology sphere.

*Other Considerations:* This index correlates negatively to index 24 (Technology Cogency).

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<sup>12</sup> What Do Patent Indicators Really Measure? Testing Current Theory on Value Drivers of Innovations Within a Structural Two-Stage Discrete Choice Simultaneous Equation Model, Markus Reitzig, January 2003

## 8. Litigation Avoidance

Index description: *When compared to closely related patents, if this patent has fewer forward citations within 3 years of issuance, it will substantially increase likelihood of avoiding future litigation.*<sup>13</sup>

Described using a scenario: highly competitive technology areas that have a correspondingly high volume of patent filings (e.g., semiconductors) reflect the high commercial value of a given market. A patent for a beanie-copter baseball cap is not likely to be granted in a highly competitive technology area with a high volume of patent filings. As such, this patent owner would not likely enforce this patent against a number of infringing competitors attempting to capitalize on a lucrative market. In other words, this commercially low value patent would have a higher likelihood of avoiding litigation than a semiconductor patent in a fiercely competitive market space.

*A Low Score Means:* This patent has a high probability of being litigated because it exhibits the characteristics of being a patent filed early in the emergence of what may now be a market filled with potentially infringing competitors.

*A High Score Means:* The patent is likely to be of little commercial value, and will therefore enjoy little visibility by competitors. The commercial market protected by a patent likely to avoid litigation will not likely support the costs of litigation.

*Other Considerations:* For enforcement or licensing purposes, a patent scoring low on this index may have a very high commercial value. Therefore, a patent that has a high probability of finding itself in litigation may be considered a high value intangible asset.

The owner of a low scoring patent may want to examine enforcement opportunities. A company that manufactures products claimed by patents scoring low in this index may want to examine invalidity or opposition opportunities prior to litigation brought by the patent owner.

This index correlates positively, but somewhat loosely, to index 11 (Forward Citation Value Contribution), and index 22 (Technical Sophistication).

(Index 9 and 10 reserved for future use)

## 11. Forward Citation Value Contribution

Index description: *A larger number of forward citations when compared to the 100 most closely related patents disproportionately increases the value of this patent.*<sup>14</sup>

Compared to relevant patents within the target patent's technology sphere, each extra citation per patent has been statistically shown to increase market value by 3%. Patents with two to three times the median number of forward citations carry a 35% value premium, and those with 20 citations and more have been shown to correlate to a 54% market value premium.

*A Low Score Means:* The target patent has not been cited, or has been cited very few times when compared to patents in the technology sphere. This indicates that the market value of this patent is substantially lower than other, more valuable patents to which it was compared.

*A High Score Means:* The target patent has been "peer reviewed" and deemed to be a highly pivotal disclosure of technology which preceded a high volume of subsequent patent application filings. Typically, pioneering patents, or seminal patents achieve a very high score in this index.

<sup>13</sup> Characteristics of Patent Litigation: A Window on Competition, Jean O. Lanjouw and Mark Schankerman, Revised March 2000

<sup>14</sup> Market Value and Patent Citations: A First Look, Jaffe, A., and Trajtenberg, M.; Working Paper No. 7741, NBER, 2000

*Other Considerations:*

**Forward citations are time-dependent. For this reason, patent managers that rely heavily on forward citation data should regenerate PFI Reports periodically – depending on the patent grant velocity within the technology spheres.**

Although forward citations have long been used as a proxy for patent value, dangers of over-reliance on forward citations as a value indicator have also been shown. Before attributing a high value to a high scoring patent, consider whether the target patent was the first of a long series of continuations or divisional patents filed by the same applicant (but not equally cited by third parties). This may indicate a false positive score.

Another consideration is that examiners in various art units frequently cite the same patent they think qualifies as the best prior art, even though a thorough search may uncover more relevant art. This practice of examiners citing patents they know from experience, their “pet patents”, can be discovered by conducting an additional search by examiner name, and determining whether there is a high frequency of citations of the same prior art from the same examiner. This practice creates a false positive score. If this practice is discovered, a high index score should be adjusted downward using common sense.

This index correlates positively, but somewhat loosely, to index 8 (Litigation Avoidance), and index 22 (Technical Sophistication).

## ***12. Backward Citation Value Contribution***

Index description: *The larger number of backward patent citations tend to suggest a larger market size. Backward citations are a less reliable contributor to patent value than Forward Cites.*<sup>15</sup>

As described in index 3 (Novelty), a large number of backward citations may also indicate a highly developed technology area. This corresponds positively to a “larger market size” since large markets evolve over time, and during that time, many improvements emerge.

*A Low Score Means:*

There are very few backward citations, possibly indicating that there is little, or no commercial market opportunity (i.e.; the previously mentioned beanie-copter hat may have very little prior art).

*A High Score Means:*

The target patent has a long list of backward citations, indicating that the patent has found a commercially valuable improvement that warrants the investment in a patent.

*Other Considerations:*

There are a number of factors to consider before determining the value contribution of this index:

a) large number of non-patent references may only reflect an active technology research area, and not a commercially valuable market.

b) target patent with very few backward citations may become a seminal patent since it may disclose “revolutionary” technology. Consider the low number of citations in US 2,524,035 granted on the transistor.

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<sup>15</sup> Backward citations to the patent literature are an indicator of market size (+Harhoff and Reitzig 2002)

### 13. Enforcement Licensing Potential

Index description: *Fewer applicants dominating a particular field present a more favorable environment to pursue more costly opportunities to generate the highest revenue per licensee.*<sup>16</sup>

There is a core assumption underlying this index. That is, a patent enforcement campaign would be more profitable if the investment in infringement litigation could be directed at but a few alleged infringers that have “deep pockets”, rather than at many small companies that may lack the relative means to mount an affirmative defense, or more importantly, may have little market share, thereby representing little licensing royalty potential.

*A Low Score Means:* There are many small companies sharing the market space defined by the technology sphere. This would represent an undesirable ratio of high litigation investment to revenue opportunity.

*A High Score Means:* There are a few large, “rich” companies sharing a commercially valuable market space (as indicated by the investment these few companies have made in multiple patents identified within the technology sphere). This represents a desirable revenue opportunity to litigation cost ratio.

*Other Considerations:* A market defined by very many small companies may nevertheless represent a lucrative enforcement licensing opportunity, even though the target patent has a low score on this index. Such a case would be when the enforcement strategy is to file suit against 50, 100, or more alleged infringers, yet provide a compulsory licensing “fee” priced such that taking a license would be economically preferred to more costly litigation defense.

This index correlates negatively to index 15 (Crowdedness)

### 14. Partnering Licensing Potential (Cross-Classification)

Index description: *Licensing potential into non-obvious or unrelated patent classes is based on invention activity in closely-related markets protected by different US classifications.*<sup>17</sup>

Following KSR, obviousness can now extend into technology areas previously analogous, or “non-obvious”. Very often multiple inventors in different industries employ currently available materials, manufacturing processes, designs, or apparatuses to solve an equivalent problem. Since the inventions occur in different industry segments, and perhaps not as the primary invention, but as a means to enable the claimed invention, the art is often classified in patent classifications not obvious to the respective inventors.

Case in point: various fire extinguisher nozzle designs were found to read on a Hewlett Packard patent claiming a unique nozzle design on an ink jet printer head. The Hewlett Packard ink jet print head was classified in Class 347: INCREMENTAL PRINTING OF SYMBOLIC INFORMATION, while the fire extinguisher nozzle was classified in US Patent Class 169: FIRE EXTINGUISHERS. The inventors and applicants of the later filed fire extinguisher patents never considered ink jet printer heads as potentially troublesome prior art. Nevertheless, this discovery of non-obvious classifications represents significant licensing opportunities from non-competitive companies.

**The PFI Report is the only patent quality analysis method currently available that uses semantic search technology to identify non-obvious licensing opportunities.**

*A Low Score Means:* Most of the licensing opportunities appear to originate from within the target patent owner’s own industry or markets.

<sup>16</sup> Characteristics of Patent Litigation: A Window on Competition (Jean O. Lanjouw and Mark Schankerman, Revised March 2000)

<sup>17</sup> San Diego State University generation II controller Robert Leach, Frank Beale and James Eriksen Dept. of Astronomy, MS 1221, San Diego State University

*A High Score Means:* There appears to be very many licensing opportunities that lie in non-obvious patent classifications (non-obvious industry or market segments).

*Other Considerations:* This index correlates positively to index 23 (Combinatorial Accession)

### ***15. Crowdedness (Potential Licensees)***

Index description: *Crowdedness (more assignees practicing highly related patents that are within the top 100 most relevant) suggests more activity in the market, and more licensing opportunities.*

*A Low Score Means:* Very few companies dominate the market, thereby reducing the potential for many licenses. If the dominant market players aggressively litigate infringement allegations, the effort to earn licensing royalties may outweigh the revenue potential.

*A High Score Means:* There are many licensing targets that could be approached, and possibly converted to profitable royalty streams. This is especially true if many companies reside in non-obvious and non-competitive industry or market segments.

*Other Considerations:* This index correlates negatively to index 13 (Enforcement Licensing Potential), and positively to index 14 (Partnering Licensing Potential).

### ***16. Divestiture Licensing Premium (Patent Group)***

Index description: *Broader market protection corresponds to the increased number of patents, and value of each patent this applicant owns (Patent Group) within the 100 most relevant.*

Often, the ownership of the 100 patents defining the technology sphere is divided into groups based on the number of those 100 patents each company owns. For example, patent ownership may graduate downward from the top company owning 20 of the top 100, to many companies owning just one.

A target patent that is the only patent owned by a company does not leverage the benefit of having other closely related patents to group together for a more formidable enforcement strategy. On the other hand, a target patent that is but one of many within the technology sphere owned by the same company will enjoy a premium on its potential commercial value – a synergistic effect realized when the target patent is bundled, or grouped with its closely related same-owned patents.

From an enforcement perspective, a “bundle of patents” represent a more serious threat, and therefore commands a premium on the ultimately negotiated licensing terms.

*A Low Score Means:* The target patent is one of a smaller group or patents (or is a single, non-grouped patent) in a technology sphere dominated by companies owning significantly larger groups of closely related patents. The target patent will realize little, or no premium value.

*A High Score Means:* The target patent, if licensed, could realize a value premium since the target patent could be grouped with other closely related patents, creating a more formidable offering.

*Other Considerations:* This index correlates positively to index 17 (Patent Group competitive Position).

### ***17. Patent Group Competitive Position***

Index description: *The competitive position of this applicant's Patent Group relative to the size of other applicants' Patent Groups identified*

within the 100 most relevant patents.<sup>18</sup>

This index is similar to the previous Divestiture Licensing Premium, except it more generally defines how competitively the owner of the target patent is positioned against other multi-patent owners within the same technology sphere.

The importance of this index relates back to the target patent owner's research and development budgets and strategy, and may significantly influence the company's long term patent filing and portfolio-building strategy.

If a company appears to already control the dominant share of a target market, additional investment within this technology domain may not be warranted, freeing up budget dollars, and technical and legal human resources to establish a stronger position in a different market.

On the other hand, a company with an inferior market position, yet committed to long-term market share capture, can clearly identify the scope of market share ownership by its major competitors through patent group analysis.

*A Low Score Means:* The owner of the target patent occupies a very small, and highly vulnerable position in a market dominated by superior technology investors.

*A High Score Means:* The owner of the target patent has already committed significant resources to dominate this technology area. Unless there is a compelling reason to continue aggressive investment in this area (i.e.: the patent filing trajectory of its competitors is continuing to rise), it may be better served to repurpose its investment to new emerging markets.

*Other Considerations:* This index correlates positively to index 16 (Divestiture Licensing Premium).

## ***18. In-License Opportunity***

Index description: *For portfolio expansion through in-licensing: this index rates the relative number of high interest but unassigned enforceable patents within the 100 most relevant.*

Oftentimes, new markets are created by small companies, or "garage inventors", such as Hewlett and Packard, Jobs and Wozniak, Henry Ford, and others. In the early stages of innovation by these independent thought leaders, patents are granted but remain under the ownership of the inventor (they are not assigned to a company, especially if a company has not yet been formed).

Other unassigned patents are granted to inventors who may have retired from industry, or are part time academics / inventors, or highly skilled tinkers.

In most cases, when these patents are identified within the PFI Report technology sphere, they are of a rather high quality, and could represent very high value in-licensing or acquisition opportunities.

*A Low Score Means:* Very few independent inventor patents are unassigned in this technology sphere. This may indicate that the technology domain either requires significant investment just to experiment (i.e.: nuclear reactors), or that the technology evolution is built on old-world legacy technology of companies that dominate the market segment.

*A High Score Means:* There are many in-licensing or acquisition opportunities that could represent very cost-effective portfolio-building opportunities.

*Other Considerations:* High quality scoring patents that represent high value in-licensing or acquisition opportunities are

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<sup>18</sup> Valuation and Pricing of Technology Based Intellectual Property, Richard Razgaitis, 2003, John Wiley & Sons Inc.

listed at the end of each PFI Report.

(Index 19 and 20 Not Used)

## 21. Technology Advancement

Index description: *This patent factor bar indicates whether this patent is a small incremental step, or a significant leap over the technology disclosed in the 100 most closely related patents.*<sup>19</sup>

A large number of backward citations indicates that the technology taught in the target patent is very closely tied to earlier generations of the same technology.

On the other hand, a small number of backward citations indicates that the target patent has little earlier generation art upon which to rely, and is therefore more “revolutionary” than “evolutionary”.

*A Low Score Means:* The target patent represents a very small, incremental advancement over the prior art.

*A High Score Means:* The target patent represents a technological leap over the prior art, and may therefore be considered to have higher commercial value.

*Other Considerations:* It's important to look at the specifics of a high scoring patent, since not all “revolutionary” technology will ultimately develop into highly valuable commercial markets (for example, consider the beanie-copter baseball cap that may have very few backward citations).

This index correlates positively to index 3 (Novelty)

## 22. Technical Sophistication

Index description: *A higher number of forward citations to this patent, when compared to the 100 most relevant patents, indicates a higher level of technical sophistication.*<sup>20</sup>

Technical sophistication is operationalized by forward citations. In other words, the most important technologies are built upon in the future, as refinements to the technology are developed to address specific product features or market trends.

The number of forward citations a patent receives correlates positively with its technological importance, as measured by expert opinions, social value, and industry awards, as well as to an increased economic value of the invention.

*A Low Score Means:* The target patent simply builds on the core technology taught in other patents, resulting in an improvement that may prove to be quite small, and commercially insignificant.

*A High Score Means:* The target patent is emerging as the pioneer, or seminal patent upon which an industry or important technology is being built. A high score may indicate a target patent that has a clearly superior technology and market position.

*Other Considerations:* Before taking this index score at face value, re-consider whether the forward citations of this patent signal a false positive score as described in “Other Considerations” in the description for index 11

<sup>19</sup> An analysis of the source of EPO citations: applicant vs patent examiner citations; Applied Econometrics Association, by Criscuolo, Geuna & Verspagen, 2004

<sup>20</sup> *Science As A Map In Technological Search* Lee Fleming And Olav Sorenson, *Strategic Management Journal Strat. Mgmt. J.*, 25: 909–928 (2004)

(Forward Citation Value Contribution).

This index correlates positively to index 8 (Litigation Avoidance), and index 11 (Forward Citation Value Contribution)

### **23. Combinatorial Accession**

Index description: *The higher the number of primary classifications within the top 100 most relevant that differ from the present invention, the more diffused the core technology is.*<sup>21 22</sup>

Following the KSR decision relating to obviousness, looking into inventions in otherwise non-obvious patent classifications may uncover new revenue opportunities (non-obvious application of the technology to non-competitive solutions).

Described another way, a core technology that is ultimately diffused across a broad range of technologies and industries enjoys a high/higher opportunity for commercialization, and for generating windfall licensing revenue.

*A Low Score Means:* The technology of the target patent appears to be licked within its core technology area. The target patent technology is not considered commercially valuable outside of its primary industry or market segment.

*A High Score Means:* The technology of the target patent had diffused through many unrelated, and perhaps originally unintended industries and market segments. Not only does this signal an important new core technology, but it's predictive of potentially larger than anticipated opportunities for licensing revenue.

*Other Considerations:* This index correlates positively to index 14 (Partner Licensing Potential).

### **24. Technology Cogency**

Index description: *More inventors listed on the present patent, when compared to the 100 most relevant patents, argue in favor of a stronger, more substantial and persistent technology (cogency).*<sup>23</sup> Simply stated: more heads are better than one.

The average number of inventors listed on patents varies wildly between industry segments. The PFI Report analyzes technology strength within each technology domain by comparing the average number of inventors listed on patents within each specific technology sphere. In other words, a solo inventor may earn a patent, but the quality of the technology of that patent may not favorably compare to a patent in which a company invested salaries of multiple engineers or inventors.

*A Low Score Means:* The core technology of the target patent was developed by a solo-inventor, or by a very small group of inventors, within a competitive landscape, reflecting statistically lower technology strength.

*A High Score Means:* The owner of the target patent has earned a stronger technology position as a result of investing more time and resources (inventors) into the development of the new technology.

*Other Considerations:* This index correlates negatively to index 7 (Sustainability in Opposition).

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<sup>21</sup> "Combinatorial innovation" IBM Symposium on the Coevolution of Technology-Business Innovations Innovation, Components and Complements, Hal R. Varian, University of California, Berkeley October 5, 2003

<sup>22</sup> Trends of Engineering System Evolution, INNOVAZIONE, (2003) Sergei Ikovenko, Chief Specialist of Invention Machine Corporation

<sup>23</sup> *Science As A Map In Technological Search* Lee Fleming And Olav Sorenson, *Strategic Management Journal Strat. Mgmt. J.*, 25: 909–928 (2004)

## Application Of PFI Scores To Portfolio Management

Once the IP manager has a solid command of the various PFI Report scores for individual patents, s/he can begin to develop the rationale to support the statistical evaluation of very large portfolio collections.

Thereafter, IP managers can begin to select specific patent indices to identify patents for which management is considering various dispositions.

PatentCafe has incorporated PFI Report scores into **Portfolio-Xpert™**, a web-based software solution that allows IP professionals to manage multiple portfolios, or very large patent portfolios based on 30 statistical indices (20 PFI report indices above, plus additional bibliographic fields).<sup>24</sup>

For example a portfolio manager tasked with identifying low quality patents for which continued payment of maintenance fees would be a waste of company resources, can select certain indices they feel correlate to patents not worthy of continued financial investment. These indices may be:

- **Validity Confidence:** if the manager has no confidence in the validity of the patents, they will likely never be asserted against an alleged infringer. Therefore, by sorting the entire portfolio in ascending order for indices 5 and 6 (Validity Confidence), the manager can instantly identify the patents with the poorest validity scores, and strip them off for independent assessment, and ultimately for sale or abandonment.
- **Patent Group Competitive Position:** if the company has a number of “orphan” patents which do not collectively correspond to the company’s core business, it can quickly identify those patents by sorting the portfolio based on ascending order for index 17 (Patent Group Competitive Position).
- **Combination Sort:** by sorting first on Validity Confidence, then immediately resorting the patents with the lowest validity confidence by ascending Patent Group Competitive Position, the IP manager can now quickly identify the most likely 10, 50 or 100 patents out of a portfolio of 10,000 or more, and take affirmative action on divesting or abandoning patents to cut recurring patent legal costs.


Following are examples of the application of PFI Scores to the overall management of large patent portfolios.

In the following real world scenarios, the actual portfolio of an automotive industry giant was used. However, PatentCafe created viable intellectual property management objectives in each case to illustrate how multiple quality indices are used to data mine very large portfolios.

The screen shots below show the user interface for selecting the indices to be computed for the portfolio patents.

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<sup>24</sup> Portfolio-Xpert™ Web-based Enterprise Portfolio Management Solution: [http://www.patentcafe.com/products/patent\\_portfolio.asp](http://www.patentcafe.com/products/patent_portfolio.asp)



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**INSTRUCTIONS**

**PORTFOLIO SELECTION**

Select patent collection / portfolio to analyze:

Number of results per page:

Select Patent Factor Index Report data fields to display:  Save Checked As My Indices Preference

LEGAL INDICES	COMMERCIAL INDICES	TECHNOLOGY INDICES
<input type="checkbox"/> 1: Enforceability	<input type="checkbox"/> 11: Forward Citation Value	<input type="checkbox"/> 21: Technology Advancement
<input type="checkbox"/> 2: Relevancy Strength	<input type="checkbox"/> 12: Backward Citation Value	<input type="checkbox"/> 22: Technical Sophistication
<input type="checkbox"/> 3: Novelty	<input type="checkbox"/> 13: Enforcement Potential	<input type="checkbox"/> 23: Combinatorial Accession
<input type="checkbox"/> 4: Claim Scope Breadth	<input type="checkbox"/> 14: Partnering Potential	<input type="checkbox"/> 24: Technology Cogency
<input type="checkbox"/> 5: Prior Art Validity	<input type="checkbox"/> 15: Crowdedness	<input type="checkbox"/> Forward Cites Classes Count
<input type="checkbox"/> 6: Concurrent Art Validity	<input type="checkbox"/> 16: Divestiture Licensing Premium	<input type="checkbox"/> Inventors Count
<input type="checkbox"/> 7: Sustain Opposition	<input type="checkbox"/> 17: Competitive Position	<input type="checkbox"/> <b>Total Technology</b>
<input type="checkbox"/> 8: Litigation Avoidance	<input type="checkbox"/> 18: In-License Opportunity	<input type="checkbox"/> <b>Total Patent Score</b>
<input type="checkbox"/> Forward Citation Count	<input type="checkbox"/> Domestic Classes Count	Check All / Un-check All
<input type="checkbox"/> Backward Citation Count	<input type="checkbox"/> Potential Licensees Count	
<input type="checkbox"/> Uncited Patent Count	<input type="checkbox"/> Unassigned Patents Count	
<input type="checkbox"/> <b>Total Legal</b>	<input type="checkbox"/> Patents Owned Count	
	<input type="checkbox"/> <b>Total Commercial</b>	

Sort Priority:  then:  then:  then:

**Optional Filters:**

Filing Date: From  To       Pub Date: From  To

Minimum Number of Forward Citations:

Compute patents from Applicant(s):   
 Show applicant name in grid view

Generate Report
Reset Query Form
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## Conclusion

Intangible assets must be managed just as diligently as tangible assets. Without some tangible information however, effective management is nearly impossible, or at the very least, grossly inefficient.

With Patent Factor Index Reports, and within the framework of Portfolio-Xpert patent portfolio manager, IP managers can now effectively identify high and low quality assets, and with objective data, can begin to apply traditional management objectives and performance metrics to the intellectual property management process.

### *Related white papers:*

Gibbs, A; *Patent Portfolio Quality Management; Practical Application of Portfolio-Xpert™ Software for Qualitative Analysis of Patent Portfolios for Intellectual Property Management Decision Support*, 2008

Gibbs, A; *Comparison of Statistical Quality Indicators of Patents in CAFC Decisions Before and After KSR V. Teleflex*, 2008

## About PatentCafe: [www.patentcafe.com](http://www.patentcafe.com)

PatentCafe is a global provider of advanced intellectual property software, offering a comprehensive suite of intellectual property solutions for international patent data search, strategic portfolio management, and qualitative patent analytics.

The company's enterprise-level solutions incorporate the intellectual property industry's most advanced linguistics search technology that helps customers realize improved patent quality, superior patent-based business intelligence, licensing revenue optimization, and corporate governance compliance.

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For more information on PatentCafe's patent research and portfolio management solutions, or to request a presentation of its enterprise solutions, contact the company at <http://www.patentcafe.com/buy/contact.asp> or call +1 916 239 2500

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PFI Reports incorporate the conclusions drawn from a number of statistical studies performed on large patent data collections. These references are provided for those interested in further study.

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Patent Factor Index Report:

[http://www.patentcafe.com/products/patent\\_analysis.asp](http://www.patentcafe.com/products/patent_analysis.asp)

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