

New Frontiers in the Strategic Use of Patent Information

Delivered by PatAnalyse Ltd

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The advent of free access to on-line patent databases at the turn of this century was the first big change in the IP system for many decades but this was only the first step in the ‘democratisation’ of the data.

The benefits of free access to these vast amounts of data have been more than offset by the massive growth in the sheer volume of patent information over the last 10 years. The information needs of technology businesses now transcend the capabilities of any single end-user. Some 20 million patents have been granted with about one and a half million new patents issued each year globally. About £3 billion is spent by the industry every year on patent information, but much of this expenditure is wasted through inefficiency and duplication of effort.

Introduction

We transform the patent search process from 'black magic' into a logical and fully traceable self-learning iteration process.

The importance of IP protection has substantially increased in Europe and the US during the past decade mainly due to the shift towards an 'innovation economy' which resulted from outsourcing of manufacture to cheaper destinations. Nowadays this is reflected in at least a threefold increase in the size of the patent portfolio of many large firms and in the substantial growth of patent litigation.

As the volume of patent documents grows, so does the opaqueness of the patent data—making it more complicated to obtain insight or actionable information. For many companies unfiltered and unclassified patent data looks like a total chaos which reduces their chance to find relevant documents.

To cope with the increased volume of patent data PatAnalyse Ltd has developed revolutionary techniques for patent searching. It is not unusual for us to find up to four times more patents in the clients' areas of interest compared to the results provided by our competitors. Our clients are usually shocked when they learn the limitations of the conventional patent search strategies used by their advisors or internal teams.

Our tools allow the search to evolve into a self-learning iteration process, improving the completeness of the final results. Our algorithms are unique in providing capabilities beyond iterative assistance with finding and using all relevant patent codes and keywords – albeit critically important. The methodology is based on a pattern recognition algorithm and can find an additional 30% of patents which are misclassified in the European or US patent offices. These extra patents might well contain the documents that prove critical to the patent strategies of our clients.

In order to deliver comprehensive Patent Landscape studies PatAnalyse has developed innovative methods using modern 'Software as a Service' technologies. Within our tools the power of artificial intelligence algorithms is closely integrated with the judgement of subject area experts. Special emphasis is also given to the efficiency of task distribution, organising collaboration between the experts, and in assisting our clients with mining patent data in the post-project phase.

On the current market, the consultancy offering from PatAnalyse delivers the highest accuracy of result with the most efficiency.

PatAnalyse is mainly focused on providing premium services which are critically dependent on the completeness of the patent searching results:

- Tailored 'Patent Landscape' studies for detailed reviews of international R&D trends, technology scouting, or for achieving strategic portfolio alignment.
- Litigation support to provide key evidence to help to nullify claims of patents advanced by 'patent trolls' in potentially disastrous legal actions against our clients
- Comprehensive Freedom to Operate (FTO) analysis for achieving relatively accurate risk assessments; a special focus is provided to help avoid wilful infringement claims and subsequent treble damages
- Due-diligence studies before in-licensing or acquisition

Search management tools

It is not unusual for us to find up to four times more patents in the clients' areas of interest compared to the results provided by our competitors. The table below shows typically what proportion of relevant patents is found by the various search channels.

[Table 1] Search statistics

Search channels	IPC, international classification system	Useful patents found, %	31%
	ECLA, European classification system		16%
	US patent classification system		14%
	IPC + ECLA		42%
	IPC + ECLA + US		48%
	Keywords		53%
	IPC + Keywords		64%
	IPC + ECLA + US + Keywords		69%
	using PatAnalyse artificial intelligence		99% to 100%

The typical search strategy of a professional patent searcher relies on using a set of selected IPC codes and keyword expressions. Patent searchers based in the US will frequently also add some US patent codes. As is obvious from the data in Table 1, in both cases the results of the search will be limited to about 60% to 70% of the actual patent portfolio. In practice professional service companies rarely use iterative self-learning search strategies and thus are unable to create an exhaustive list of useful patent codes and keyword expressions.

As an example, one of our clients has been using the 'patent watch' services of one of the largest and most reputable patent attorney firms based in London, UK. The client was shocked when it learned the limitations of the patent search strategies used by its advisors. Our investigation revealed that the preferred patent attorney had missed all 46 patent codes specific to the area of interest of our client and available in the US and IPC patent classification systems. The search strategy used by PatAnalyse revealed almost 4 times more relevant patents compared to the search performed by the professional adviser. Naturally our client realised that any clearance search, freedom to operate project, or a strategic advice provided by their preferred patent attorney firm was doomed to be imperfect because of the inadequacy of the firm's

ability to find relevant patent data. The client now uses PatAnalyse as its preferred supplier of trusted IP intelligence due to our ability to provide much better quality inclusive patent searches.

We are so confident in our ability to find more relevant prior art documents than any other professionals, that we are frequently carrying out the litigation support projects on a success fee basis – charging only a nominal sum at the start of the project to establish a formal relationship and getting paid depending on the number of prior art documents identified by us that are actually used by our clients in the process of invalidating the asserted patents.

Our algorithms are unique in providing capabilities beyond iterative assistance with finding and using all relevant patent codes and keywords – albeit critically important. The methodology is based on a pattern recognition algorithm and can find an additional 30% of patents misclassified in the European or US patent offices. Such significant numbers of patents which are missed by the conventional patent search approach - even if perfectly implemented - cannot be ignored. The extra portion of the active patent portfolio that we can find might well contain the patent documents that prove critical to the patent strategies of our clients.

Sample Patent Map

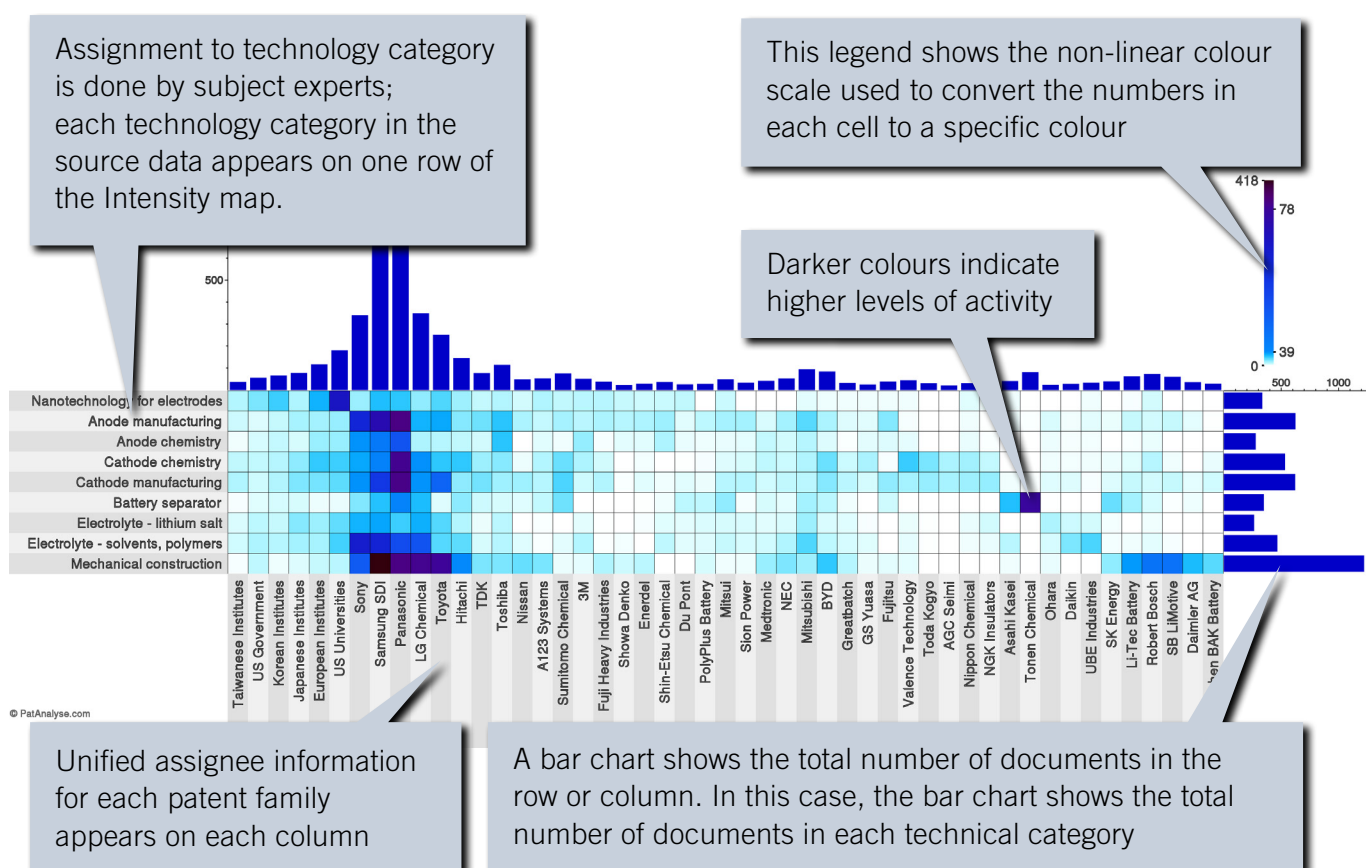
The on-line patent maps are interactive: clicking on the area of the patent map takes a user to the details of the patents

In a typical patent mapping project we work with the client team to transform a thorough understanding of the client's marketing and technical plans into a set of bespoke categories (multiple taxonomies) for classifying patents.

The patent map shown below shows the top assignees on the X-axis vs technical categories on the Y-axis for generic lithium-ion batteries technologies. The bar charts on the top and on the right represent a conventional aggregation of data with the bar chart numbers equal to the number of patents assigned to each individual assignee or

technical category. The two-dimensional 'intensity map' shows the numbers in each cell of the table according to the colour code shown in the legend.

The on-line patent maps are interactive - clicking either on an individual square of the intensity map or the bar chart itself takes the user to the list of patents, representing simple patent families. Clicking on the individual patent record shows bibliographic details of the individual patent family including the claims of all patents in the family, the legal status of patent documents, priority information, and a front-page picture.



“

Patents have been an underused intelligence resource for businesses of all sizes for some time. If properly analysed, the data they contain is a gold mine for corporate strategists. But patent landscaping, as the process of extracting the data is called, is notoriously difficult to do and especially to automate.

PatAnalyse is at the forefront in developing a disruptive technology which transforms patent landscaping into a reliable and affordable business tool. We are proud to collaborate with PatAnalyse to be part of the emerging cluster of small specialist companies in Cambridge UK which are breaking new ground in this exciting new field of business strategy.

Mick McLean,
*Managing Director of Cambridge-based
technology strategy company
Technologia Ltd
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About PatAnalyse

Completeness of search results and thorough generation of Patent Landscapes is followed with insightful interpretation; the workflow is supported with the best in class on-line portal patent knowledge management system

PatAnalyse is an integrated technology consultancy specialising in high quality exhaustive patent searching and comprehensive analysis of the trends presented in the patent portfolio.

The PatAnalyse's core team of software developers, technology and business consultants is based in Cambridge, UK. The main members of the team have been working together for over a decade on a wide variety of patent landscape assignments.

We have developed innovative on-line tools for organising the workflow of patent projects to support dispersed collaborative teams and to provide close integration between the artificial intelligence and the real judgement of subject area experts. The software is focused on improving the efficiency and quality of patent searching, and in assisting our clients with mining patent data in the post-project phase.

Using our advanced tools, and breadth of technical expertise, the PatAnalyse team works together with clients on patent studies which map the competitive IP landscape to deliver unique insights

into competitive intelligence. Patent Mapping tools provided by PatAnalyse ensure the accuracy and completeness of the results, but it's our business consultants who make the real difference. Our experience in technology consultancy allows us not just to map the Patent Landscape, but also to provide an interpretation closely aligned to the client's business strategy.

By identifying the strongest and most appropriate patent set from the client's patent portfolio, such projects can also assist in cost reduction and revenue generation through the abandonment or sale of non-core IP.

In addition to working for single clients, PatAnalyse also publishes multi-client Patent Mapping studies in specific areas of quickly growing markets and technologies. Such studies are aimed at smaller companies which are less likely to be able to afford the cost - ranging anywhere from €60k to €180k - of a dedicated single client IP study. In our experience many companies can leverage benefit from these multi-client studies by commissioning bespoke but very cost-effective analyses of the accumulated patent data.

A typical projects aims to:

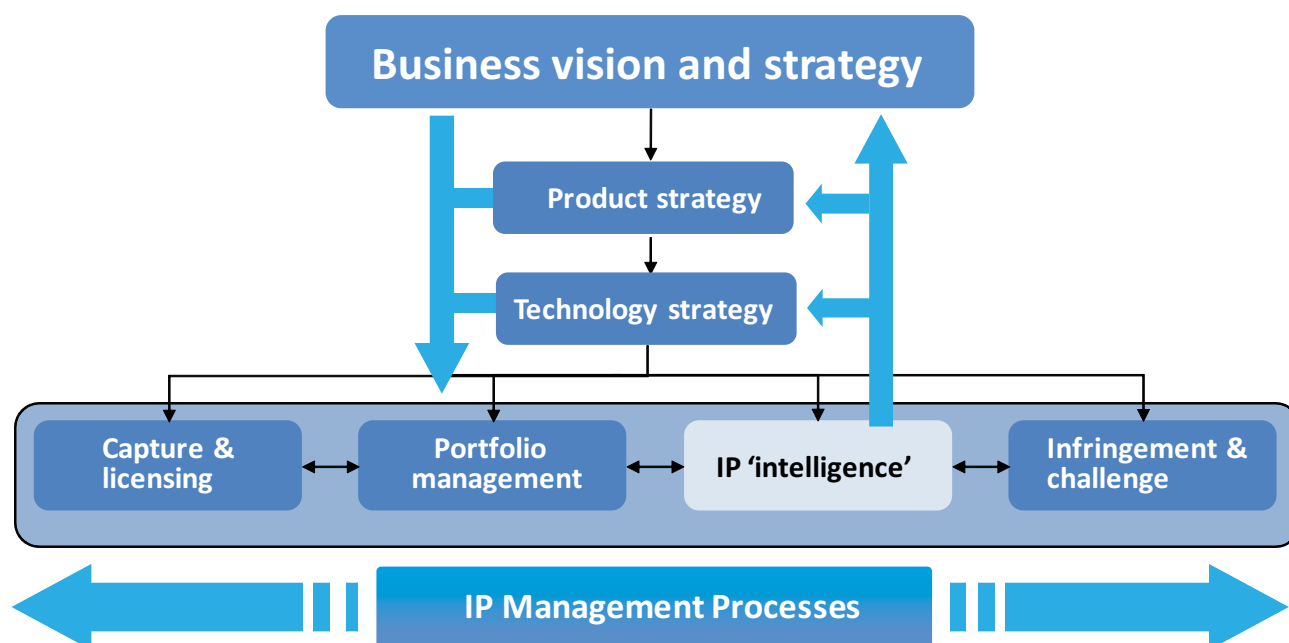
- Inform the strategic decision makers in the client organisation
- Align research budgets according to the gained intelligence
- Help to focus patent filing efforts in areas more likely to produce broad patents
- Benchmark the clients' existing patent portfolio against competitors
- Clearly understand the strengths and weaknesses of the patent portfolio of major competitors
- Improve efficiency of internal portfolio management
- Facilitate smart decisions by including a relatively accurate risk assessment in FTO analysis
- Assist with technology scouting
- Identify and evaluate the most appropriate acquisition targets
- Determine if any potential blocking patents will affect the right for the in-licensing technology
- Support required defensive activities with key evidence.

The role of 'IP intelligence'

Our flagship 'Patent Landscape' offering helps to close a feedback loop between Business Strategy and IP Managements

Our clients have access to an unparalleled skill set: our teams of diverse subject experts and seasoned business consultants work together to provide collective 'IP Intelligence'. This mode of support enables our clients to trust us with their most technically and commercially challenging IP projects.

'IP Intelligence' in combination with the understanding of the business issues facing the client organisation adds value to all IP management processes.



Case Study for Patent Search and Portfolio Build

Multi-client study "Advanced Energy Storage technologies: Patent Trends"

The iterative search was build up using a combination of

- » 110 assignees
- » 1,200 inventors
- » 2,600 patent codes (including IPC, ECLA, ICO, US, and Derwent)
- » 1,250 keywords

All forward and backward citations were added to the portfolio

The de-duplication algorithm aggregated about 12,000 simple patent families from about 40,000 national patents

- » INPADOC frequently aggregates different inventions into the same patent family
- » our algorithm separates out individual inventions into simple families

Only 3% of patent families were left unassigned

- » assignee information is taken from INPADOC legal file and if necessary is further expanded to all patents from the large INPADOC family

The Utility of Patent Mapping

Unlike marketing reports which analyse information accessible via an intelligent use of Google, a Patent Mapping study is a deep dive into the Invisible Web – to the reliable information derived from paid subscription patent databases

Firms disclose their secrets – ‘patent’ them in exchange for a limited monopoly. Yet the complexity of the patenting system – especially the sheer number of patents - severely diminishes the value of disclosure. A Patent Mapping study aims to restore the original intention by allowing clearer dissemination of knowledge. Thus it serves an urgent need for companies - both large corporations and SMEs - to gain access to the rich vein of technical and commercial intelligence contained in patent databases.

Patents are an exclusive and valuable source of information on recent developments in highly commercially sensitive technology areas. Patents can be considered as a topical indicator of levels of R&D effort - being one of the principal outputs of such activities - and patent data are available with at most an 18 month delay. A good overview of the activities of major players is essential for the cross-fertilisation of R&D efforts at an international level.

Business intelligence derived from such knowledge frequently helps strategic decision making. Improving access to the information buried within patent databases creates huge opportunities for businesses, especially for new entrants that have yet to build up significant internal technology know-how. Patent landscapes can be used to visualise patterns of technology competition on a global scale. Patent landscaping, as the process

is called, is the tool increasingly used by large corporations to inform product development and technology strategies.

By analysing vast amounts of data in patents databases, users can gain a significant competitive advantage. For example, patent mapping can give firms comprehensive insights into innovation trends and the position of rivals, can show gaps and opportunities, the parts of the world where specific new technologies are being developed, and so on. But current methods are notoriously difficult to automate and so they are skill and labour intensive. While Patent Mapping is historical in its perspective, its primary value is in allowing a corporation to inform the Business strategy to define a successful path forward. Once the business become aware where its competitors are and which way they are heading, the managers receive the vital information they need to shape the strategic and tactical responses for the Product and Technology strategy.

Patent Mapping is essential for modern corporations because its relatively modest investment can both minimise potential risks and identify significant opportunities. A Patent Mapping study is a vital part of any IP ‘intelligence’ exercise and must be considered by each company in the context of its own business strategy, product/service planning and technology strategy.

Cambridge is home to an international technology consultancy cluster that applies leading scientific and technological know-how to commercial needs

PatAnalyse has close personal relationships with many technology consultancy companies in the Cambridge technology consultancy cluster and several former ‘sister’ technology consultancies based in US and Germany. We frequently team with our partners to deliver the right level of business intelligence to address the most demanding IP intelligence studies.

Preventing wilful infringement exposure

PatAnalyse is taking quite seriously the desire of some US companies to stay away from the minefield of the wilfulness infringement claims

There is also a special advantage of Patent Mapping for companies that are exposed to the risk of a patent infringement lawsuit in the US. These risks are considerable because damage awards can be the highest encountered in private litigation. US courts can increase damages threefold if so-called 'wilful infringement' can be proved by the patent owner. So if a company encounters a patent that has a high risk of being relevant to its business the firm has a duty to obtain an expensive opinion from external counsel in order to avoid the accusation of wilful infringement.

One of the factors taken into account is a defendant's 'actual notice' of the particular patent which has been infringed. The concept of 'actual notice' is poorly defined by case law. This vagueness has led many US companies to encourage employees not to read other companies' patents and not to store the electronic records of such patents in internal databases. On February 2006 the USPTO conducted a public meeting with

the open-source software community to discuss issues of patent quality and prior art. One of the main concerns discussed at the meeting was related to "wilful infringement danger," where developers would be reluctant to look at any patent data whatsoever for fear of becoming liable for wilful infringement.

To resolve possible concerns our clients can opt to receive the final report without any specific references at the level of individual patents; in such cases we also withdraw from providing clients with both the back-up of the patent portfolio and access to our on-line portal system.

In addition, by default the PatAnalyse multi-client Patent Mapping reports analyse technology trends without reference to any single patent document. Thus subscribers are able to study the competitive landscape while avoiding a subsequent commitment to follow such a report with a set of bespoke Freedom to Operate studies.

The market for 'IP intelligence' services provided by technically diligent consultants is expanding

During the last decade patent searching was a forbidden subject in many corporations and legal firms in US and worldwide. The case law has been radically changing in US since 'In re Seagate'. The new Bill, the "America Invents Act", approved by the Senate and The House of Representative is moving further:

“ The failure of an infringer to obtain the advice of counsel with respect to any allegedly infringed patent or the failure of the infringer to present such advice to the court or jury may not be used to prove that the accused infringer willfully infringed the patent or that the infringer intended to induce infringement of the patent. ”

Further details of patent studies

It is vital to understand properly the business issues facing the client organisation in order to align the analysis of the patent landscape with the needs of a particular type of study.

PatAnalyse's business is to deliver 'IP intelligence' to its clients:

- We take responsibility for finding the patent information required by our clients and then structure and make sense of it;
- To deliver a project we use a proprietary, comprehensive search management system to capture expert judgements and combine these with artificial intelligence analysis to produce a pre-analysed universe of data tailored exactly to each client's needs;
- Our experience in technology consultancy allows us to provide an interpretation of the competitive intelligence 'landscape'; our analysis is closely aligned to the requirements of the client's business strategy;
- Our client, as the user, first influences how the universe of patent data is gathered and structured and then can exploit it using the on-line patent information management system provided by PatAnalyse.

Patent Mapping is used by PatAnalyse as a universal tool for the visualisation of the patent portfolio created during the course of a particular study. At the very early stages of each project, PatAnalyse works closely with the client's team, in order to understand the set of questions which should be addressed in the study. The experience of PatAnalyse with Patent Mapping studies is rooted in many consultancy projects for big corporations undertaking strategic reviews before diversifying into new business areas or executing technical due-diligence studies before major acquisitions.

Litigation support

We provide key evidence to help to nullify claims of patents advanced by 'patent trolls' in potentially disastrous legal actions against our clients.

Comprehensive Freedom to Operate study

A well executed FTO analysis provides a relatively accurate risk assessment and can facilitate smart business decisions by the client organisation.

Due-diligence study for in-licensing activities

Our approach to due-diligence in-license assignments is similar to that of Freedom to Operate studies as it includes an assessment of any potential blocking patents.

International R&D trends and technology scouting

In such studies the 'big picture' revealed by the Patent Maps is complemented with a detailed analysis of each top company and each technology cluster.

Strategic portfolio alignment

Separating key patents from low value assets and understanding the role of different patent bundles can help to organise the portfolio and maximise its value.

Litigation support

We have carried out successful invalidity patent searches to nullify the claims of patents asserted by 'patent trolls' in potentially disastrous legal actions against our clients.

Often our clients become aware of the existence of a blocking patent only after the owner of the patent in question has made an approach with a perfunctory infringement complaint.

A non-infringement opinion of counsel will not be sufficient in some cases and new key evidence must be produced in order to challenge the blocking patent itself. In such circumstances it is usually necessary to find prior art that invalidates the patentability of the blocking patent. Alternatively our client might have spotted a potentially blocking patent at the prosecution stage and is willing to file an opposition against an overly broad patent scope with the European Office or to file a request for re-examination in the United States.

The very success of such Validity search assignments critically depends on the ability to find all possible patent and non-patent literature evidence - sometimes a single document is enough to help invalidate the blocking patent. The invalidation strategy is quite difficult to master as most companies (including patent attorney firms)

are not experienced in all-inclusive high quality patent searching. PatAnalyse uses its revolutionary technique for searching for patent information with a fully documented self-learning iterative approach and can warranty the best possible completeness of the search results. PatAnalyse has been able to find dozens of close prior art documents in several instances when its clients were unable to find even a single relevant item of prior art. In addition, we are able to provide extra evidence by searching the Web of Science and InSpec on-line databases of scientific literature for non-patent prior art documents.

The results of such studies are represented as a Patent Map of most relevant published patents and non-patent documents followed by a PowerPoint presentation discussing individual documents which might form basic key evidence for the opinion of counsel as to the invalidity of the blocking patent in question. The report is aimed at assisting the patent attorney by eliminating the need for additional background investigative work.

- Ability to find all possible evidence is critical
- Revolutionary technique for patent searching

- Self-learning iterative approach
- Capability for searching scientific literature

Case Study: Saving our client from disastrous lawsuit

Challenge:

- » Company X received a notice of infringement letter
- » Initial attempts to obtain an invalidity or non-infringement opinion failed
- » The launch of new products in the quickly growing market became a threat

Approach:

- » PatAnalyse approached the search as an iterative self-learning process
- » The export of the final search request (written using Boolean logic) took up 20 pages in the standard text editor program
- » All references to/from the broadly relevant patent documents were added

- » Overall 8,000 patent were screened, and 80 most relevant patents identified
- » 32 patents were carefully selected and provided for further review by company X

Benefit:

- » Our study provided company X with the required key evidence to file an opposition against an overly broad patent with the European Office and a request for re-examination in the United States
- » Company X saved several hundreds of thousands of Euros which would have had to be spent on a complete product redesign

Comprehensive Freedom to Operate study

A well executed FTO analysis provides an accurate and comprehensive risk assessment and can help the client make the right business decisions.

It is of crucial importance to carry out any Freedom to Operate (FTO) analysis well, thoroughly, and on time. In the worst case a poorly done study can, at a later date, result in high costs in connection with license fees, product redesign, production stoppage, damage compensation, or even the payment of treble damages for wilful infringement. However, contrary to common belief that even a brief patent search and review can give the client 'an 80% answer', in most cases the coverage of a brief review is well below 20%. Using revolutionary patent searching technologies, PatAnalyse is able to find many more patents than other service providers and to deliver an intelligent analysis of the details of those individual patents most relevant to the subject area of the FTO study.

The extent of the risk from potentially offensive patents cannot be known at the beginning of the study, so to overcome this inherent uncertainty PatAnalyse uses a structured multi-phase approach. The first phase of the study is aimed at identifying the main set of possible offensive patents and begins by building a thorough understanding of the client's marketing and technical plans. Working together with PatAnalyse, the client's team highlights what technologies, features, and benefits new products should have. After that, PatAnalyse documents the agreed boundaries of the FTO study and develops the initial search strategy.

We continuously iterate the self-learning patent search strategy and add newly identified patents to the project repository. By agreement with the client team, we keep in the patent repository only patent families which contain actively maintained granted patents or patent applications with specific patent offices - for instance PCT, DE, EP, or US patent offices. Any abandoned, revoked or withdrawn patents are identified using the information available from the INPADOC Legal Database. PatAnalyse continually runs the artificial intelligence relevance score algorithm in order to segregate the most relevant patent families from the patent repository for preferential review by the project

team. Typically our relevance score algorithm is capable of identifying more than 99% of all relevant patents without adding more than 50% of irrelevant entries to the patent screening process. This allows us to keep the project budget under control even in when broadly inclusive patent search strategies bring in a substantial number of irrelevant patents.

The list of emerging patent documents which are likely to be of interest is regularly shared with the client. Any emerging risks and our recommendations about how to deal with them are first discussed with the client team in conference calls. Written records are created only after discussion with a client. The main deliverable of the first phase of the FTO study is a list of classified patents for a further review by the client's in-house patent attorney team.

If the existence of potentially blocking patents is confirmed by the patent attorney, we carry out the next phase of the FTO study in order to find the best way forward. During consecutive separate project phases we carefully determine if potentially blocking patents are valid. We aim to find the prior art documents which have the potential to challenge the novelty of the claims of potentially blocking patents. The invalidity search is carried out using patents filed at various national patent offices including the Japanese, Korean, UK, French, Canadian, Chinese, Brazilian, etc. Using the keyword strategy developed for the first phase of the project we carry out searches in the scientific publication databases - the Web of Science and InSpec.

If the invalidity challenge proves to be difficult, we provide initial suggestions for a work-around. Using the deep technical insight into tried and failed approaches we have gained from screening patents during the previous phases of the FTO study we aim to find breakthrough solutions which engineer around the claims of any potentially blocking patents. As a deliverable, we document all proposed ideas and supplement this list with an initial feasibility study for the most promising one.

Due-diligence study for in-licensing activities

The complex nature of the valuation of patents provides a clear and strong justification for the rigorous due-diligence studies which PatAnalyse is well placed to undertake.

Each in-licensing deal has its own unique issues of patent valuation. The estimated value of the licensed technology is usually based on the projected cash flow for the products underpinned by the licensed technology including the level of remaining investment required for bringing such new products to the market. However the level of achievable profit margins for such new products is strongly dependent on the monopoly rights provided by the patented technology. Usually two key judgments – evaluating the offensive strength of the patents considered for in-licensing and evaluating the remaining implicit threats from the third party patent thicket surrounding the technologies required for manufacturing the new products – cause the main difficulties for business executives.

Many companies use the external services of brokers with deep technical and market knowledge in the field to assist with such value assessments. Simultaneously the firms often seek further strategic advice from such knowledgeable brokers. Such advice may concern their acquisition strategy for establishing market position, protecting their business activities and bolstering their licensing negotiations. The complex nature of the valuation of intellectual property provides a clear and strong justification for the rigorous due-diligence studies which PatAnalyse is well placed to undertake. Indeed in-licensing due-diligence studies have many similarities to the invalidity search, freedom-to-operate analysis, and patent landscape studies which PatAnalyse provides as stand-alone services. The appropriate extent of the due diligence for in-licensing deals should be determined mainly by the initial perceived value of the transaction.

Patent protection is not a right to use, but rather a right to exclude. As a result it requires a careful investigation of Prior Art:

- Following comprehensive iterative patent searching we seek to understand the competitive patent landscape;
- Using interactive Patent Maps and comprehensive searching capabilities of our proprietary on-line portal system, we investigate individual patents in order to determine if any third-party intellectual property rights may affect the in-licensing portfolio;
- We determine if there are any other problems in the in-licensing IP portfolio including possible potential design around options;
- While broad claims increase patent scope, they can also make patents vulnerable to prior art challenges; PatAnalyse aims to evaluate whether or not the in-licensing portfolio is likely to withstand such an attack;
- As the final step we determine who actually owns the relevant intellectual property.

Such a due-diligence study helps to address key questions:

- Does the client need a license?
- If he takes the license will he be able to use the anticipated commercial technology?
- If everything necessary to practice the licensed technology is going to be transferred?
- What is the license worth?

In some instances, the due-diligence study will reveal information that will result in adjustment of the terms of the agreement, including the royalty. In other situations, the due-diligence may reveal

information that precludes the deal altogether. Using our technical and business insight we aim to propose creative solutions for most of the problems identified in a due-diligence study.

International R&D trends and technology scouting

In such studies the 'big picture' revealed by the Patent Maps is complemented with a detailed analysis of each top company and each technology cluster

Because of the increasing levels of litigation many companies are finding it harder to ignore the benefits provided by IP intelligence. In addition, business managers are increasingly recognising the need to protect their own competitive advantage in the face of increased 'offshoring' of manufacturing. Many R&D managers also appreciate that competitors' patents are a valuable source of technical information which might help to improve the efficiency of their own innovation processes. Patent mapping is emerging as the one of the essential tools to assist with the proper technology scouting and the strategic review of R&D landscapes.

Most companies have limited capabilities to carry out patent searching themselves, instead they typically rely on the incomplete 'patent watch' services provided by patent attorneys or other service companies. In our experience most advisors involved in this kind of work are not very expert at patent searching. In the main such third party service providers justify their high fees by developing conclusions and recommendations on the basis of a rather incomplete initial patent dataset. PatAnalyse has a clear competitive advantage for providing patent landscape studies due to our revolutionary technique for managing the process of patent searching. The PatAnalyse search management system allows firms to obtain a much more complete picture of competitive IP activities and is specifically adapted for 'self-learning' iterations of the patent search strategy and to receive regular updates to the active patent portfolio.

To add to these problems, the competitors' patents known to the clients are usually analysed internally in the client's organisation using an archaic spreadsheet approach. As the volume of patent documents grows, so does the opaqueness of the patent data - making it more complicated to obtain insight or useful information.

PatAnalyse can provide to such companies its proprietary on-line patent management tools to improve their processes. In order to assist

companies further to make good use of patent data, PatAnalyse's on-line tools address the need for increasing the efficiency of task distribution and organising collaboration between users. Our tools are specifically developed to assist with the exploitation of the insights gained from the patent knowledge base. These on-line tools provide an intuitive and efficient system for technical analysis of un-met needs and the shortcomings of the available solutions. Putting together a proper understanding of un-met needs with insights into why technical solutions adopted in the past have failed can often stimulate disruptive innovation – usually the ultimate goal of R&D managers.

A Patent Mapping study provided by PatAnalyse is a 'deep dive' into the Invisible web - to the information derived from patent databases. In our analysis we are starting with the following:

- benchmark the clients' existing patent portfolio against competitors;
- detailed analysis of each top company and each technology cluster;
- identified novel solutions, white spaces and potential partners;
- systematic approach to Open Innovation technology scouting.

Patent statistics are supplemented with publicly available marketing intelligence regarding the current product portfolio of major competitors. Our findings contribute to technology forecasting and management. The results of the study inform the strategic decision makers in the client organisation and help to align research budgets according to the gained intelligence.

Detailed studies of the patent portfolio are achieved with support from the on-line patent portal system. Among other options, the on-line portal provides access to an interactive electronic version of the Patent Maps. This allows, with one click, the user to zoom in to the list of patents behind a particular spot on the Patent Map and then down further to the details of the individual patents.

Strategic portfolio alignment

Separating key patents from low value assets and understanding the role of different patent bundles can help to organise the portfolio and maximise its value.

In a typical high-technology market, the product/technology life cycle is shortening as a result of increasing competition and more rapid innovation. In consequence the active life of a technology has become ever shorter – and much less than the 20 years of protection provided by patents. However little has changed in the way that companies actively reviewing patents in their active patent portfolios.

It is common knowledge that less than 20% of patents represent more than 80% of the total value

Typical issues are:

- Continued maintenance of patents whose utility has run out;
- Neglecting to trade off non-strategic patent assets;
- Continued patent filings in areas with more than sufficient existing protection;
- Reliance on “old” patents without renewing strong competitive position with fresh IP.

A macro level understanding of how the individual patents in the client’s portfolio are distributed across various scoring metrics often requires thorough investigative work involving current marketing intelligence and benchmarking of the patent portfolios of close competitors. As a benefit of the newly gained understanding of the dynamics and interdependencies in the patent portfolio, the company improves its patent prosecution, acquisition and divestiture strategies.

For better understanding of small and medium size patent portfolios (with less than 2,000 patent families) PatAnalyse can introduce detailed scoring and rating in order to take into account a combination of criteria:

- The breadth of geographical coverage (calculated automatically);
- The role of the patent (strategic, defensive, non-core, dormant, redundant);
- End-user benefits;
- Technology status (base, key, pacing, emerging, & speculative);
- Claims coverage (conceptual, broad, constrained) reflecting the difficulty of circumvention of claims;
- The level of inventiveness.

According to the TRIZ (Theory of Inventive Problem Solving) there are several levels of inventiveness as explained below:

A simple improvement– about 32%

Obvious solutions without substantial change to the system; narrow extensions of existing solutions rather than actual inventions

Radical change – 19%

Resolution of some contradictions in the existing solutions; usually based on a single engineering or scientific discipline

Slight modification – about 45%

Usually combines knowledge from different areas within an industry; still does not resolve major technical compromises

New system – 4%

Replacement of the old technology with a new one; usually based on interdisciplinary solution

Technology status can also be classified:

- Base technology – is ageing technology which is available or known to all industry participants; it cannot provide competitive advantage because of its widespread use;
- Key technology – a proprietary product or process technology already well embodied in the processes and products on the market; is critical to the basis of competition – it is used by its owners to differentiate products and services from those of their competitors;
- Pacing technology – those emerging technologies which already demonstrated their ability to change the basis of competition and as a result are now moved to the development stage at many companies; these will probably become a key technology in the near future;
- Emerging technology – forward looking technologies sometimes under development in substantially different industries; at an early research stage with unknown potential, but promising.

A small number of emerging technologies of today will be the pacing technologies of tomorrow; some, but not all, pacing technologies of today will be tomorrow's key technologies; and some key technologies become base technologies and will serve as a new foundation for an industry.

The classification by technology status is useful in evaluating how a company's technology compares to its internal needs and targets and to those of its competitors, and in providing direction for its R&D efforts. Also it can assist in cost reduction through the abandonment of redundant and dormant patents or sale of non-core IP. For instance, it might be useful to present Patent Maps with the patent information regarding the 'technology status' plotted against the 'level of inventiveness' or 'role of the patents' taxonomies. Although it might be reasonable to hold on to 'slight modification' patents for 'key' technologies, it is quite questionable to actively maintain 'simple improvement' patents for 'base' technologies. Indeed, mastering 'base' technologies is essential to be in business and so a set of broad 'modification' patents with the 'base' technology status can serve an important defence purpose. Nevertheless an excessively strong position in 'base' technologies might indicate

a waste of resources; while a lack of 'strategic' patents in 'pacing' technologies might be an alarm signal for the future of the company.

Working closely with the client's team, the 'rating' taxonomies can be substantially modified. To guide analysis of the patent portfolio it is possible to create several Patent Maps filtered by different categories of the 'rating' taxonomies; or to create a single Patent Map but to apply different weights to different parts of these taxonomies. The Patent Map builder fully supports the scoring mechanism and allows the creation of Patent Maps with weighted data for each patent family.

The 'Software as a Service' Web 2.0 user environment of the on-line patent portal system fully supports multi-user collaboration and provides the client company with an option for contributing to the process of assignment of various 'rating' taxonomies to individual patents. A frequent root cause of ineffective IP utilisation is the fragmentation of the necessary knowledge across the corporation. The collaborative nature of our on-line tools allows to properly maximise the value of a company's IP by empowering the previously hidden internal knowledge.

- Separating key patents from low value assets;
- Understanding the role of different patent bundles;
- Help to organise the portfolio;
- Help to maximise portfolio value.

“

In 2009 I was contracted under NDA by PatAnalyse staff to provide advice for the strategic portfolio alignment for one of the major European Telecommunication conglomerates. I reviewed portfolio of cryptographic technologies. Some patents in this portfolio were clearly an emerging technology at the date of filing. However technologies and industry standards have substantially moved on since then. As a result many patents have changed their technology status from emerging technology to redundant. A careful study of each individual patent involved a comparison to the prior art and to current marketing wisdom. This was a very interesting assignment and I would definitely participate in such studies again

Sergey Nenashev PhD,
*leading expert on information security at
Inforion Co. Ltd.*

”

Our own competitive position

As a technology consultancy with highly comprehensive proprietary software tools, PatAnalyse is uniquely positioned to help clients with the Competitive Intelligence studies.

To track competitors' patents, businesses traditionally rely on resource intensive searches of international patent databases. Screening and classifying patents found in the search process is widely regarded as an even more time consuming and costly process. A decade ago an Aurigin's Aureka patent mapping tool was introduced as a 'magic button' solution to streamline the process of classifying patent portfolios. This semantically driven tool had been initially adopted by many commercial clients and had catalysed the appearance of the Patent Landscape offering from many technology consultancies. However the limitations of the semantic artificial intelligence tool have gradually become evident to most companies. A substantial number of users have since abandoned using this product.

An alternative gradual development of software tools has been initiated outside of the circle of major patent search providers. Most large corporations use specialised patent knowledge management tools for organising work flow within their internal IP portfolios. In certain cases, patent management tools might become semi-aligned to carry out Competitive Intelligence studies. The tools from providers like Software for Intellectual Property (Invention Navigator) are combined directly with global patent searching capabilities. Several companies produce stand-alone versions which can take an input from a variety of external search systems. Examples of such providers include Gridlogics Technology (Patent iNSIGHT Pro) and UBM Techinsight (PatentVista).

These patent management tools are still rather limited in their utility to assist in the efficiency of patent screening and classification tasks. The

software tool developers do not actively use their own tool sets for delivering ambitious Patent Landscape studies. In addition, instead of cleaning bibliographic records, some providers cut out important available fields. The analytical resources in such systems rarely exceed the visualisation capabilities of Excel. To the best of our knowledge, such patent management tools are rarely adopted by technology consultants specialising in Patent Mapping studies. Instead in most cases the Patent Landscape projects carried out by external consultants are still delivered in a rather old fashioned manner using Excel spreadsheets as the main tool. This reduces the accuracy of such Patent Mapping studies, increases delivery time, and inflates the required budgets.

PatAnalyse has captured in its software tools the first-hand experience gained over a decade of active delivery of Patent Landscape studies. Novel software tools represent the next generation attempt (after Aurigin's Aureka) to bring affordable and accurate Patent Landscape studies to the market using 21st century technologies. The power of artificial intelligence algorithms is introduced closely integrated to the judgement of subject area experts. The PatAnalyse tools allow the search to evolve into a self-learning iteration process, improving the completeness of final results. Screening and classification have been modified into a highly collaborative process with the automatic distribution of work amongst a dispersed team of experts. The tools have been further extended to provide the results of the patent study in a user-friendly patent knowledge management system, thus greatly improving the efficiency of re-use of the results of the study within the client's company.

“

Many of the answers to key questions of technology and business strategy can be found in the patent databases if you know how to find them; PatAnalyse has the powerful tools and expertise to do this and to present the answers using clear, easy to communicate, views of patent landscapes.

Alan MacDougall.
*European Patent Attorney, partner at
Mathys&Squire*

”

The PatAnalyse Methodology

Our approach has been tested by more than a dozen large Patent Landscaping studies delivered to corporate clients.

The generic IP landscaping method consists of three major steps:

1 Mobilisation phase:

Activities:

- » Build a thorough understanding of client marketing and technical plans;
- » Together with the client team translate this understanding into a set of bespoke categories (multiple taxonomies) for the classification scheme;
- » Identify the initial search strategy and the boundaries of the project study;
- » Test the classification scheme by applying it to a set of more than 100 patents from the initial search;
- » Review required changes to the classification system with the client;
- » Instruct the project team and provide example patents from the initial set;
- » Call for all project team experts to classify substantial number of test patents from the initial set;
- » Organise ongoing support to ensure a thorough understanding of instructions.

Output:

- » Initial classification scheme;
- » Detailed set of instructions for the rest of the team.

2 Portfolio building & classification phase:

Activities:

- » Continuously iterate the self-learning patent search strategy and add new patent families to the project portfolio;
- » Classify the most relevant patents ;
- » Improve the classification scheme at the very early stages of classification using feedback from the project team;
- » Continuously add substantial fraction of test & example patents to the patent review list in order to ensure a full understanding of classification instructions;

- » Further screen and classify the less relevant patents;
 - remove items which are found to be outside of the project scope;
- » Using the self-learning error correction algorithm, identify records with the most probable inconsistencies in the judgement of the subject area experts;
 - Re-classify such patents.

Output:

- » Final classification scheme;
- » Set of differentiated patent documents (the portfolio) with applied classification scheme.

3 Patent Mapping & documentation phase:

Activities:

- » Control a semi-automatic process of cleaning bibliographic records;
- » Prepare a set of Patent Maps showing different views of the Patent Landscape;
- » Identify documents likely to create interest within the clients' team;
- » Analyse trends and supplement patent data with marketing intelligence ;
 - Identify the most striking discrepancy between patent activities and market intelligence;
- » Summarise strategic recommendations based on analysis of Patent Maps and individual patents;
- » Provide technical support to the client team for using the on-line portal with the results of the study.

Output:

- » Graphical presentation of the patent landscape;
- » A client meeting with a presentation of the PowerPoint report ;
- » Access to the on-line portal containing the portfolio of documents classified;
- » Patent database back-up.

Benefits of working with PatAnalyse

The best possible quality of deliverables is combined with a quick turnaround of about ten weeks for large patent landscape studies and about six weeks for a Freedom to Operate analysis

1 Full confidence in the completeness of results from the patent search

- A fully traceable search is undertaken by experienced PatAnalyse staff using several self-learning iterations under the assistance and control of dedicated software algorithms;
- A bespoke project stemming database is used to expand both internal and external patent searching;
 - » helps to combine synonyms used for technical terminology including chemical names and chemical formulas which are frequently used with randomly positioned erroneous blanks and inconsistent subscript indexes.

2 Improved quality of data through 'clean' patent bibliographic records:

- A proprietary algorithm for patent record de-duplication;
 - » no more patent families with up to 100 patents;
- Withdrawn, revoked or abandoned patents can be removed from Patent Maps;
- A carefully designed algorithm finds Assignee information for unassigned documents;
 - » less than 5% of unassigned patents in the most recent records;
- Unified Assignee names;
 - » cleaning of misspellings and variations in the Assignee records are achieved using a bespoke database;
 - » Assignee information is updated using INPADOC Legal Status database;
 - » hierarchical company structures are used to combine records to top level Assignees;
- We provide extra bibliographic records unavailable from DocDB and INPADOC databases;
 - » claims for Japanese, Koreans and Chinese patents;
 - » legal status for Japanese & Korean patents

3 Top level classification of the patent portfolio using a technical taxonomy developed with the client

- Public classification patent systems, such as US, IPC, and ECLA classification codes, are very conservative to respond quickly to emerging and disruptive technologies; also they do not provide enough granularity needed for effective analysis of a patent portfolio.

4 Highest possible quality is assured via the extensive involvement of subject area experts under NDA

- Example and test patents are added as a substantial part of review patents; this helps to control and improve understanding of the classification system by individual experts;
- Experts are assigned to specific subject areas of the patent portfolio; software algorithms are used to separate the most relevant raw patents from less relevant entries and to feed patents to different experts according to their preference in subject areas;
 - » the enhanced homogeneity of the data reviewed by the experts automatically improves the quality of their judgement;
- Expert judgement is controlled with self-learning human error correction algorithms.

5 A carefully prepared set of clustered Patent Maps representing different views of the portfolio

- Comparison of activities of various companies against a set of multiple taxonomies;
- Time line of activities presented for a variety of companies or for various taxonomies;
- Most prolific inventors of various Assignees are shown as a measure of aggressive policies;
- Aggregated visualisation of patent citation links between various Assignees;
- Revealing strategies of various corporations for filing patents in different National Patent offices;
- Licensing activities as specified in the INPADOC Legal Status database;
- Presenting information for patents aggregated by country of invention;
- Patent Maps for a set of individual companies with possible use of 'rating' taxonomies.

6 Analysis of information by Business consultants with a good grasp of technology issues

7 A client presentation with strategic recommendations based on analysis of the Patent Maps and individual patents

8 Patent database back-up in CSV (Excel), XML, MySQL, or PostgreSQL database format

9 Ability to deliver patent projects covering such diverse technical areas as medical devices, life sciences, material science and chemistry, mechanical and electrical engineering, electronics, opto-electronics, sensors and analytical measurements, software and business methods.

Asian Patents Coverage

This year China became the second biggest economy and took the top place in the volume of national patent filings per year.

The patent growth is achieved due to the range of questionable incentives for local companies

Chinese patents taken to at least one additional national destination like Europe, US, Japan or Korea are more likely to represent an actual invention

PatAnalyse provides the following coverage for China, Japan, and Korea:

- » Manual translation of Title, Abstract, Claims
- » Automatic machine translation of the full Text
- » Legal status for Japanese and Korean patents
 - such legal data are missed in the INPADOC file

Benefits of re-using PatAnalyse tools by clients

The best available on-line patent knowledge management tools help to facilitate the re-use of project results across the client organisation

The information contained in patents can stimulate fresh ideas and accelerate the innovation process:

- » The on-line patent management system provided by PatAnalyse can be used to guide the customer team to key individual patents;
- » Clients might need to look at competitors' patents to check the strength of their own IP in order to avoid unnecessary legal and R&D costs;
- » But these patents also provide a comprehensive source of technical analysis – which frequently highlight the shortcomings of the available solutions;
- » Putting together a proper understanding of un-met needs with insights into tried and failed technical solutions can often stimulate disruptive innovation – solutions which transcend existing IP landscapes and venture into 'white space'.

Access to an on-line portal for secure sharing and collaborative re-use of the results of the patent study

- » A hosted web based application does not require any input from internal IT teams;
- » Extensive patent mining interface;
- » Highlighting of various keywords in the text presented to the user is achieved using a table of the keywords with colour schemes selected separately for each keyword expression;
- » Capability for zooming down to individual patents via an interactive Patent Maps interface;
 - Patent Maps are updated each time when shown to users;
- » Each user has the capability of setting-up their own interactive Patent Maps which can be shared between restricted groups of users across the client organisation;
 - a set of on-line Patent Maps can be exported in jpg format for inclusion in reports and PowerPoint presentations;
- » Possibility to expand taxonomy and to review and modify results of the study;
 - contradicting opinions from different users are resolved using a weighted voting algorithm;
 - all entries in the system are date and user stamped ;
- » Multi-user work flow support is further enhanced with the system of flexible distribution of the required patent information to individual users across the client organisation;
- » Security and role based permissions at different levels for various groups of users with soft firewalls between different departments of the client organisation;
- » Work flow support for large collaborative teams at the client organisation is provided with assistance from the centrally controlled flexible task and role assignment interface;
- » The whole project can be isolated on a server dedicated to the single client;
 - the access to such servers is allowed only from the fixed list of IP addresses defined by the client.

The flexibility to convert the one-off study into a subscription to regular updates including patent searches and classification

- » A Legal Status Alert can be set for certain patent families from the project portfolio to control their abandonment or the change of the ownership;
- » Interactive Patent Maps are always up-to-date reflecting the latest state of the patent portfolio.

Technical details of our approach

The white paper “Innovative Tools for Comprehensive Patent Studies” provides new insights into best practise in patent searching & in techniques for overcoming the pitfalls of reliance on raw bibliographic data.

In a separate white paper “Innovative Tools for Comprehensive Patent Studies” available under a mutual non-disclosure agreement (NDA) we present further details of our patent pending technology for patent search & for arranging on-line project workflow.

To obtain a copy of “Innovative Tools for Comprehensive Patent Studies” white paper please send your initial request to info@patanalyse.com

The ten pages of the separate methodology white paper discuss the aspects described below.

Introduction to the PatAnalyse innovative toolset

The core of our approach is related to organising efficient web-based interaction between experts under the control of artificial intelligence algorithms

Patent Search

The ‘quantum leap’ provided by our algorithms to the effectiveness of patent searching is comparable to the improvements in web searching introduced by Google 12 years ago

Error correction algorithm

PatAnalyse puts substantial effort in tutoring team members by providing them with a number of example and test patents; in addition we use a self-learning algorithm to reveal the most likely errors in the expert’s judgement

Refining bibliographic data

Patents can be grouped in families with more than 100 records; the bulk of new patent applications are left unassigned; there are many versions of spellings of the same assignee names. We have fully resolved these issues

Building Patent Maps

The novel visualisation technologies developed by PatAnalyse allow the provision of clear, easy to communicate, views of patent landscapes, and have successfully been used in a range of tailored patent assignments in the public and private sectors

Accessing the on-line patent portal

The on-line portal allows users to access updates to the study and to receive the most recent versions of the Patent Maps containing patent documents which have been unavailable at the time of preparation of the original report

A separate technical white paper is of main interest to active practitioners in the IP department of client’s organisation and to our respected competitors.

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While head of strategy for what is now the National Measurement Office, I became aware of the value of the strategic information contained in worldwide patent databases. A pioneering patent mapping study carried out by PatAnalyse staff was extremely helpful in the formulation of the Measurement for Emerging Technologies research programme in 2004. We faced the problem that emerging technologies inherently involve newly forming sectors, with limited sector leadership/representation (as compared to well established technologies), so we did not know whom we should consult in the formulation of this programme. Patent data is inherently forward-looking and thus ideally suited for thinking about the long term future. The patterns of activity revealed by the mapping confirmed real industrial & academic interest in the research themes selected and identified key players in the UK and overseas. Many of these players became partners in the programme leading to an unprecedented level of industrial and academic co-funding in the research programme. Subsequently patent mapping became a routine part of the formulation process for all NMO research.

”

Petar Stojic*Formerly Head of Measurement
Science Strategy;**Department of Business Innovation and Skills, UK*

Multi-client studies

PatAnalyse has launched a new product line: in depth patent studies available to all players, large and small, for a fixed price. This novel source of evidence-based competitive intelligence can validate and complement conventional market analyses

Cace Study: “Advanced Energy Storage technologies”

There are big surprises. The car maker increasing its patent filings fastest from an already high level is one. Some apparently powerful players that seem to be dismantling R&D are another

In order to deliver a series of multi-client Patent Mapping studies, PatAnalyse teamed with IDTechEx - a global analysis, strategic advice, and market intelligence company covering printed electronics, electric vehicles and allied technologies.

The first report “Advanced Energy Storage technologies: Patent Trends and Company Positioning” in this series provides an analysis of the rapidly developing technologies for the Lithium batteries, supercapacitors, and traction batteries used in electric vehicles.

The current boom in electric vehicles is related to the impressive improvements in Lithium-Ion battery technologies, which are starting to replace the older and lower energy density Lead Acid and Nickel Metal Hydride (NiMH) batteries. The new high energy Lithium-Ion cells, however, are more vulnerable to abuse and need the support of electronic battery management systems to provide protection and ensure a long life cycle. The battery itself, and on-board battery management system has become the important product differentiator, just like the engine in contemporary cars.

PatAnalyse has carefully developed the patent search strategy via several rounds of iteration. A combination of about 110 Assignees + 1,200 inventors + 2,600 patent codes (including IPC,

ECLA, US patent codes) and about 1,250 keywords were used to carry out the patent search. As a rule of thumb, it takes at least five years from invention to the first product on the market. In order to focus on the ‘hidden’ R&D efforts which have not yet materialised as new products on the market, the initial study was restricted to patents with a priority date from 2005. However because of a significant increase in the rate of patenting in this area, this initial patent portfolio contains over half of all patents with a priority from 1990 in this area.

About 2,800 original Assignee names from the original bibliographic records were combined into 200 Top Assignees. The proprietary de-duplication algorithm aggregated about 12,000 simple patent families from about 40,000 national patents.

Only 3% of the patent families have been left unassigned and it was further found that about 12% of the patent portfolio is assigned to small players with fewer than one invention per year. The remaining 85% of the patent portfolio is assigned to about 250 companies with about 66% of the patent portfolio assigned to the top 50 companies in terms of patenting.

Almost a hundred Patent Maps were provided in the report to facilitate the detailed analysis of various aspects of the patent landscape.

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The report is organised in eight chapters:

- » General overview of combined portfolio;
- » Generic Lithium Batteries technologies;
- » Further details of Anode chemistry;
- » Further details of Cathode chemistry;
- » Lithium Traction Batteries;
- » Traction batteries in general, their mounting and mechanical arrangement for cooling and heating;
- » On-board Electric Vehicles Battery Management System and external charging equipment;
- » Generic Supercapacitors technologies.

Building on the marketing intelligence of our partner IDTechEx, the report pulls together a facts based analysis of patent filings over the years, customer relationships, and investments made by traction battery makers.

- Which chemistries, construction techniques etc. are prioritised by whom?
- Which firms are spending heavily on new factories and gaining major sale successes but throttling back R&D so fewer patents are filed every year?
- What are the aspects prioritised by different regions, countries, companies and academia?
- Which individuals are the most prolific inventors?
- Which aspects receive more attention nowadays and which are increasingly ignored?

The report goes beyond the small and large scale Lithium-ion battery technology and looks at allied technologies such as on-board Electric Vehicle Battery Management Systems, EV battery charging stations, and supercapacitors (ultracapacitors). It shows the origin of work, profiles end-users of traction batteries in the automotive industry and highlights technology trends of patent filings. We used a comprehensive set of technical categories for analysing relevant patents as listed below:

Generic Lithium batteries technologies

- Cathode chemistry
- Cathode manufacturing
- Nanotechnology for cathodes
- Nanotechnology for anodes
- Anode chemistry
- Anode manufacturing
- Electrolyte - lithium salt
- Electrolyte - solvents, polymers
- Battery separator
- Mechanical construction

Details of anode chemistry

- Lithium non-metal compounds
- Germanium
- Polymers
- Carbon
- Nano-form carbon
- Graphite
- Silicon
- Silicon compounds
- Silicon oxide
- Other metal compounds
- Tin compounds
- Tin oxide
- Vanadium oxide
- Titanium oxide
- Titanium compounds

Details of cathode chemistry

- Lithium iron phosphates
- Other lithium metal phosphates
- Lithium cobalt oxide
- Lithium cobalt nickel oxide
- Lithium cobalt nickel manganese oxides
- Other lithium cobalt complex oxides

- Lithium manganese oxides
- Lithium nickel oxides
- Lithium nickel manganese oxides
- Lithium-vanadium complex oxide
- Lithium-titanium complex oxide
- Other metal lithium oxides
- Lithium-sulphur
- Other lithium compounds
- Carbon
- Conductive polymers

Traction and large scale batteries in general

- Li-based traction battery
- non-Li traction batteries
- Battery mounting in EV
- Arrangement for cooling/heating
- Supercapacitors for EV

Generic supercapacitors technologies

- Asymmetric supercapacitors
- Lithium ion capacitor
- Electrode manufacturing
- Nanotechnology for electrodes
- Supercap electrolyte chemistry
- Separator for supercaps
- Supercap construction

On-board electric vehicle battery management system and external charging equipment

- Battery temperature control
- General monitoring of voltage and current
- Battery recharging
- Battery depth of discharge control
- Battery or supercap balancing/redistribution
- Battery related regenerative braking
- Battery safety system
- Battery life prediction and modelling
- Other commercial aspects of using battery in EV
- External equipment related to battery recharging

Sample analysis of Patent Maps

Even a quick analysis of several Patent Maps can give a good insight in to the company positioning in the global R&D competition

The ten Patent Maps discussed below represent a small extract from the results of the “Advanced Energy Storage technologies: Patent Trends” study. Seven out of the ten Patent Maps represent patent analysis at the top level of the project without going into the level of detail provided by the bespoke technology taxonomy. Nevertheless even such a top down view of the patent portfolio can provide quite useful insights.

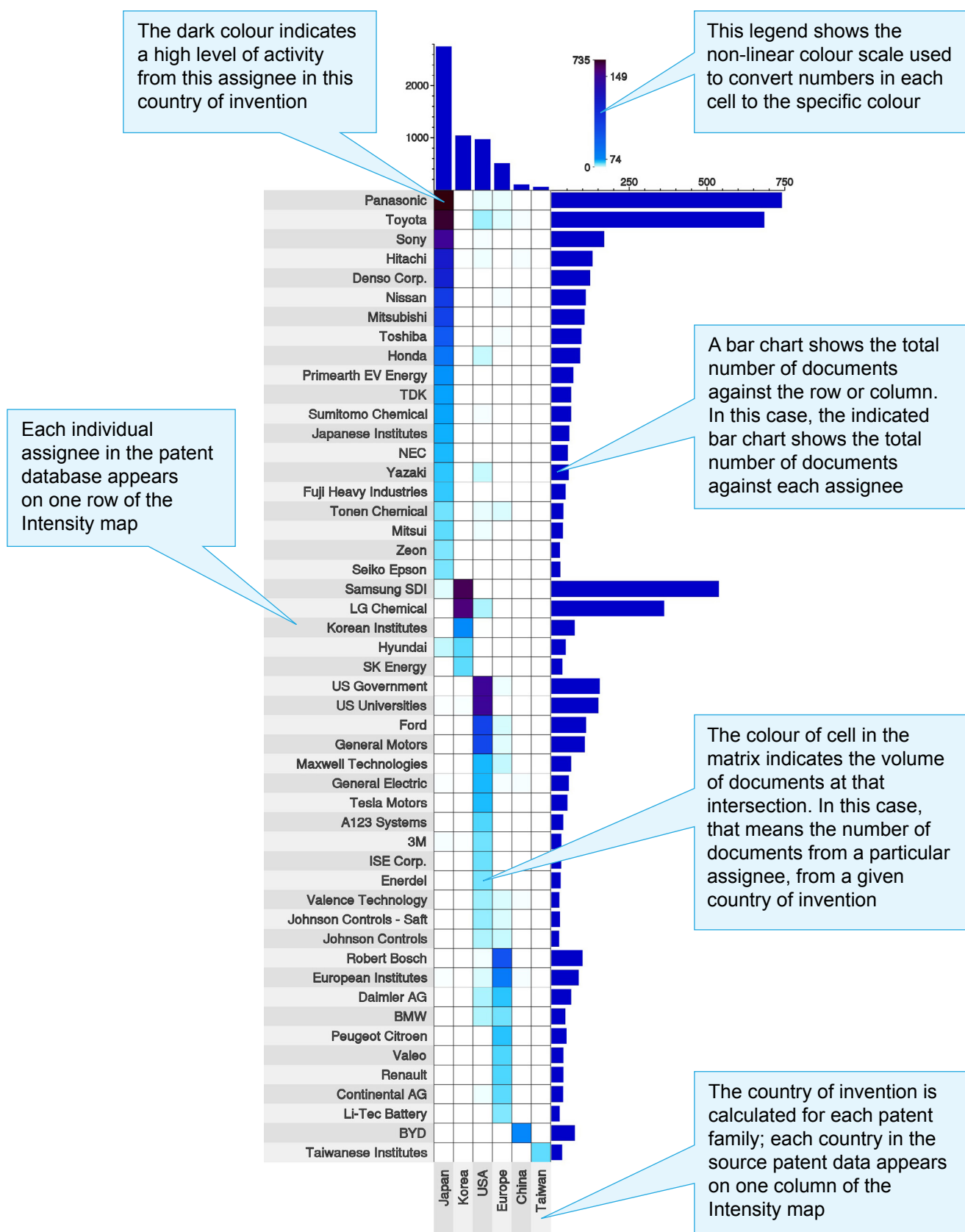
[Figure 1] Top 50 Assignees vs Country of invention

- » The patent portfolio is dominated by two Japanese players - Panasonic and Toyota, and two Korean players - Samsung SDI and LG Chemical
- » Japanese companies heavily dominate the patent landscape, but even Koreans companies are ahead of US; this is a rare exception in patent studies
- » The list of the second tier companies is more international. Japanese companies like Sony, Hitachi, Denso, Nissan, Mitsubishi, Toshiba, and Honda are joined by Ford, General Motors, Robert Bosch, and not surprisingly by Chinese BYD
- » US activity is dominated by the governmental grant support which is reflected in the strong position of US government and US Universities on the Patent Maps

[Figure 2] Top 50 Assignees & their strategy for applying to National Patent offices

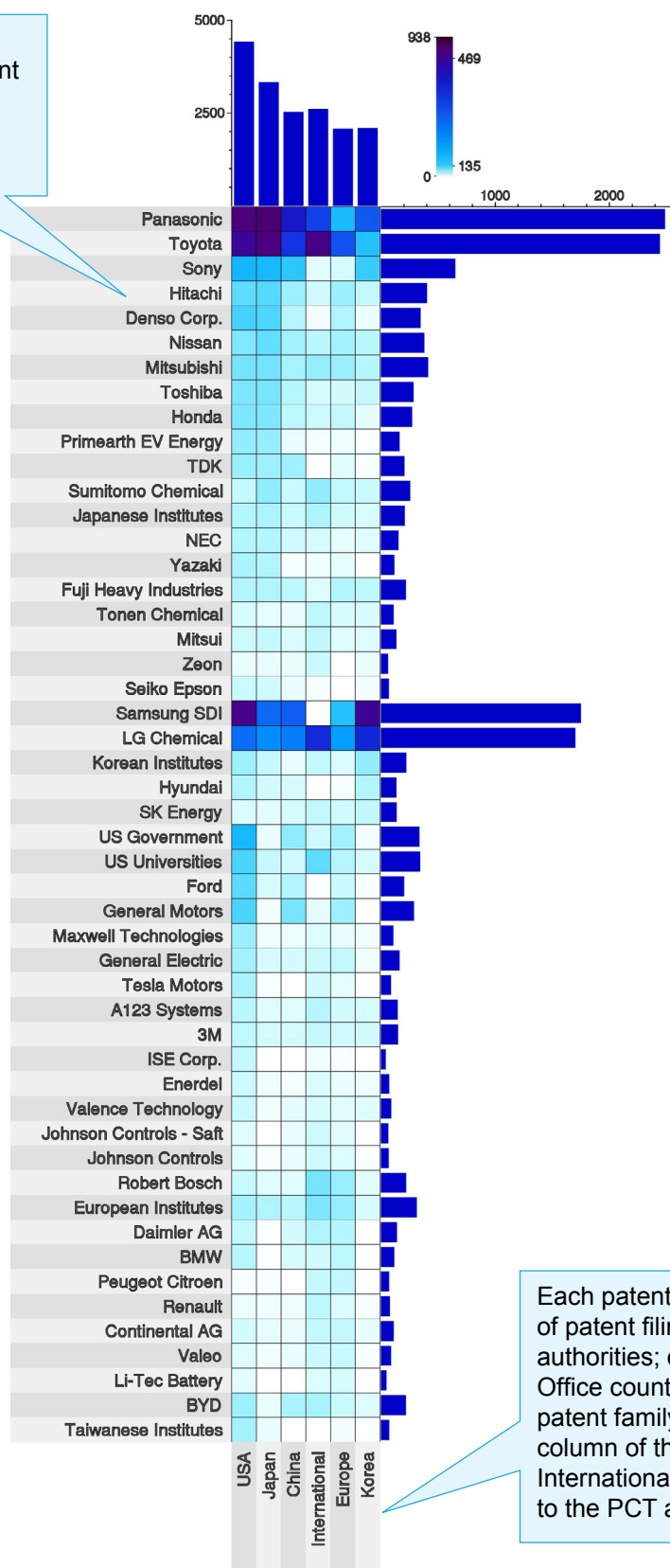
- » In spite of the geography of the main players the most popular destination for patenting the inventions follow the markets – foreign patent applications are taken predominately to US, China and Europe. Patent applications in Japan and Korea are heavily dominated by the domestic companies with some added overspill from Korea to Japan and vice versa
- » Samsung SDI, and to a lesser degree Panasonic, are ignoring the International Patent office WIPO in their patent filings

[Figure 1] Top 50 Assignees vs Country of invention



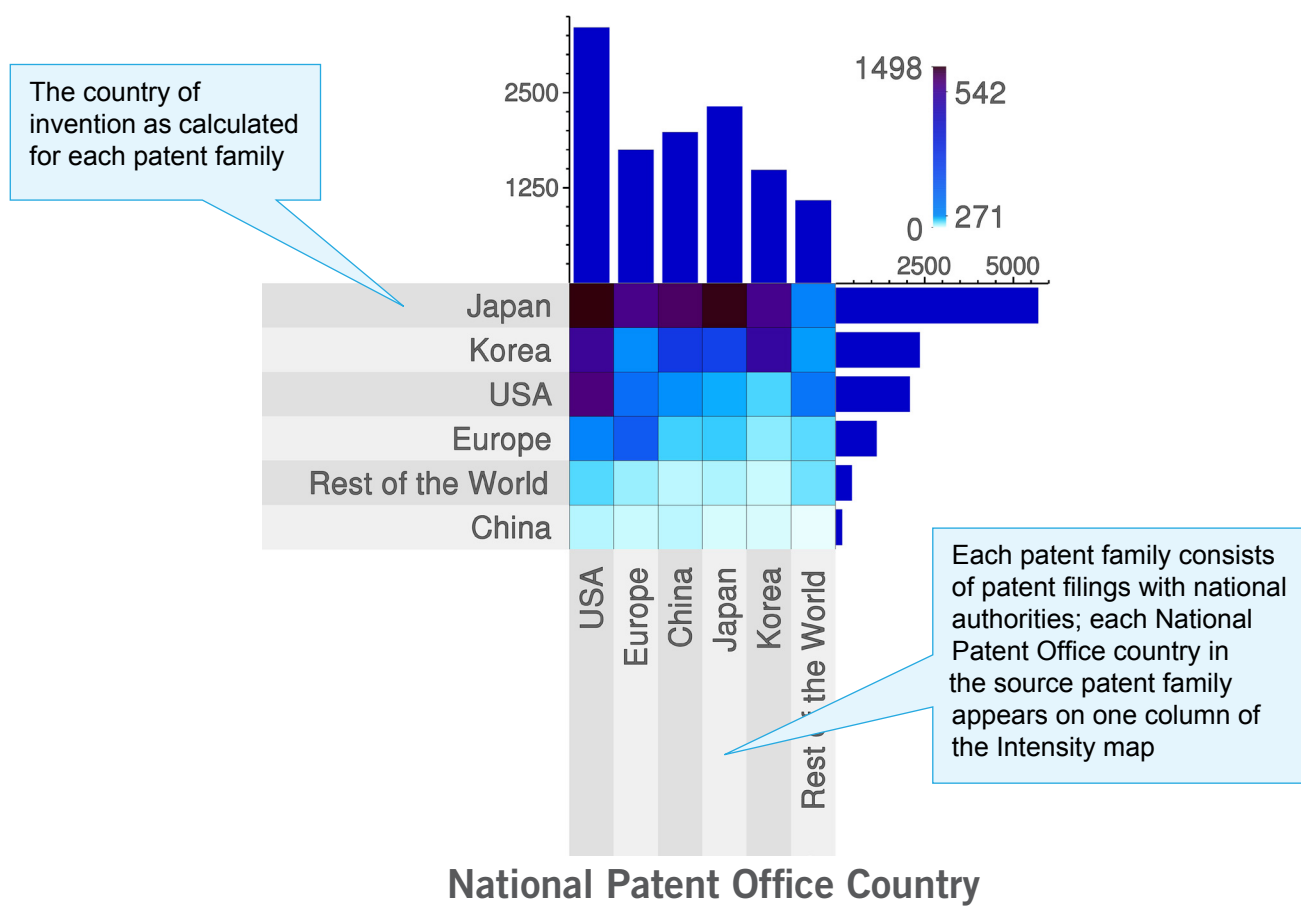
[Figure 2] Top 50 Assignees and their strategy for applying to National Patent offices

Each individual assignee in the patent database appears on one row of the Intensity map

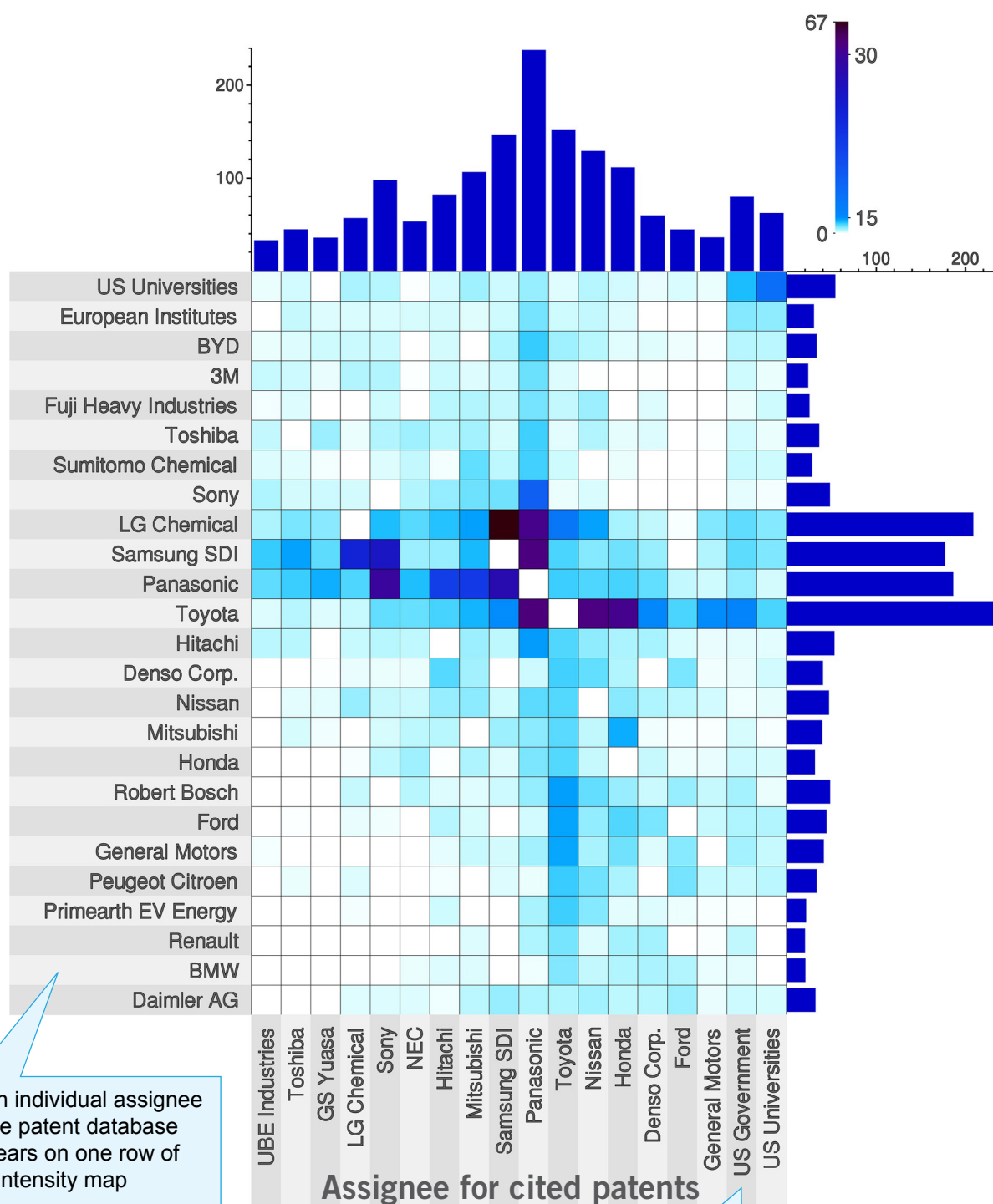


Each patent family consists of patent filings with national authorities; each National Patent Office country in the source patent family appears on one column of the Intensity map; International field corresponds to the PCT application

[Figure 3] Country of Invention vs National Patent Office Country



[Figure 4] Citation links between Top Assignees



[Figure 3] Country of Invention vs National Patent Office Country

- » This Patent Map aggregates both large and small players from the same country to provide an overall view of the trends
- » Already a major manufacturer of lithium ion batteries, in future China will become an even more important patent destination for foreigners due to the Chinese government financial support for promoting electric vehicles. However, domestic Chinese R&D in energy storage technologies is not yet resulting in major patent activities
- » A substantial amount of patents taken to China from Japanese and Korean companies is supported to a lesser extent by US and European companies. However both US and Europe are gradually starting to take part in the trend

[Figure 4] Citation links between Top Assignees

On this Map the citation links from patents are used as a measure of the international visibility of R&D efforts of different companies. In order to correct the otherwise biased citation pattern, the self-citations (citations from one patent to another patent of the same Assignee) are ignored. Some apparent white spots in the busy areas on the Patent Map can be related to such removed self-citations.

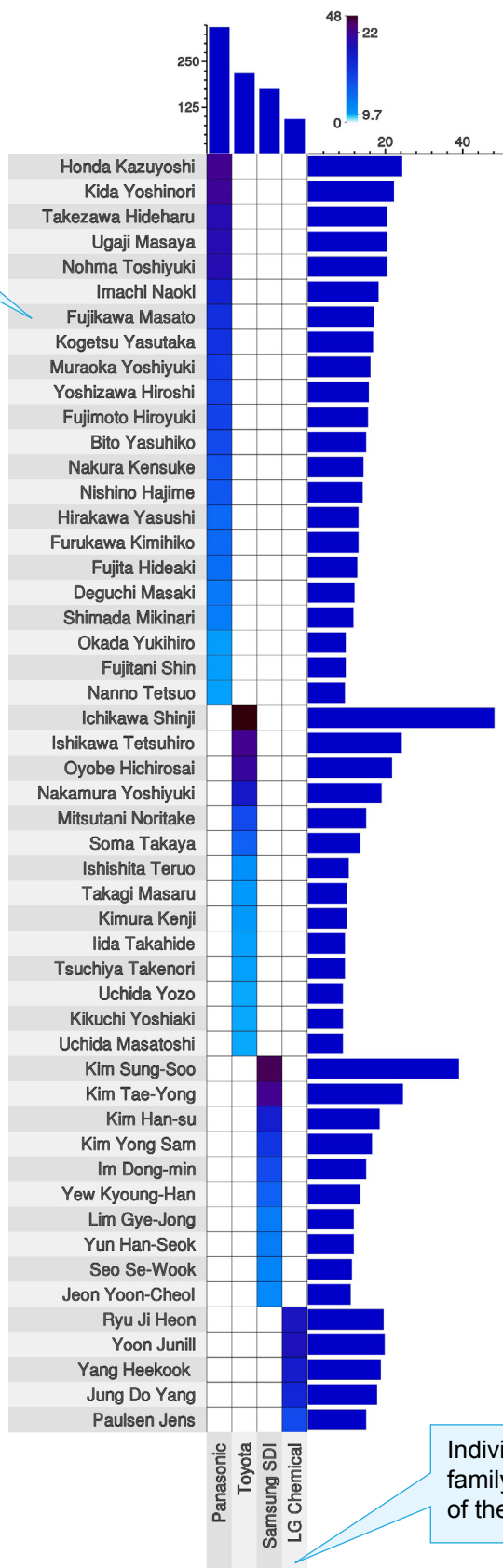
- » The citation network analysis shows the reduced dominance of the main four players. As a result LG Chemical has even dropped out from the list of the first tier players
- » The refreshed list contains names like Sony, Hitachi, Samsung SDI, Panasonic, Toyota, Nissan, and Honda
- » Not surprisingly the citation link analysis shows that Toyota is related more to the electric vehicle makers and Panasonic – to battery makers. Nevertheless both companies do overlap in the lithium traction battery development space
 - Both Toyota and Panasonic are cited by almost everyone else in their respective groups. So they represent impressively integrated R&D activities

[Figure 5] Most prolific Inventors as a measure of aggressive patent strategies

The major four players have a relatively similar number of patents in the project portfolio. From the analysis of the most prolific inventors from these four companies it is obvious that Panasonic has the most aggressive patent strategies and LG Chemical is least aggressive.

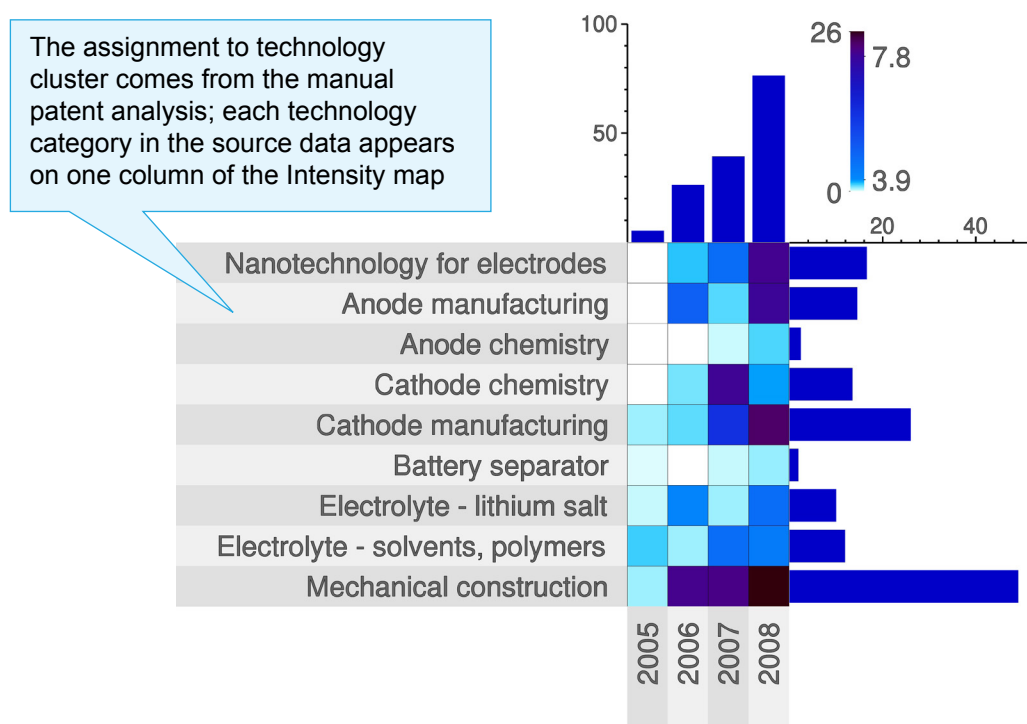
[Figure 5] Most prolific Inventors as a measure of aggressive patent strategies

Each individual inventor in the patent database appears on one row of the Intensity map

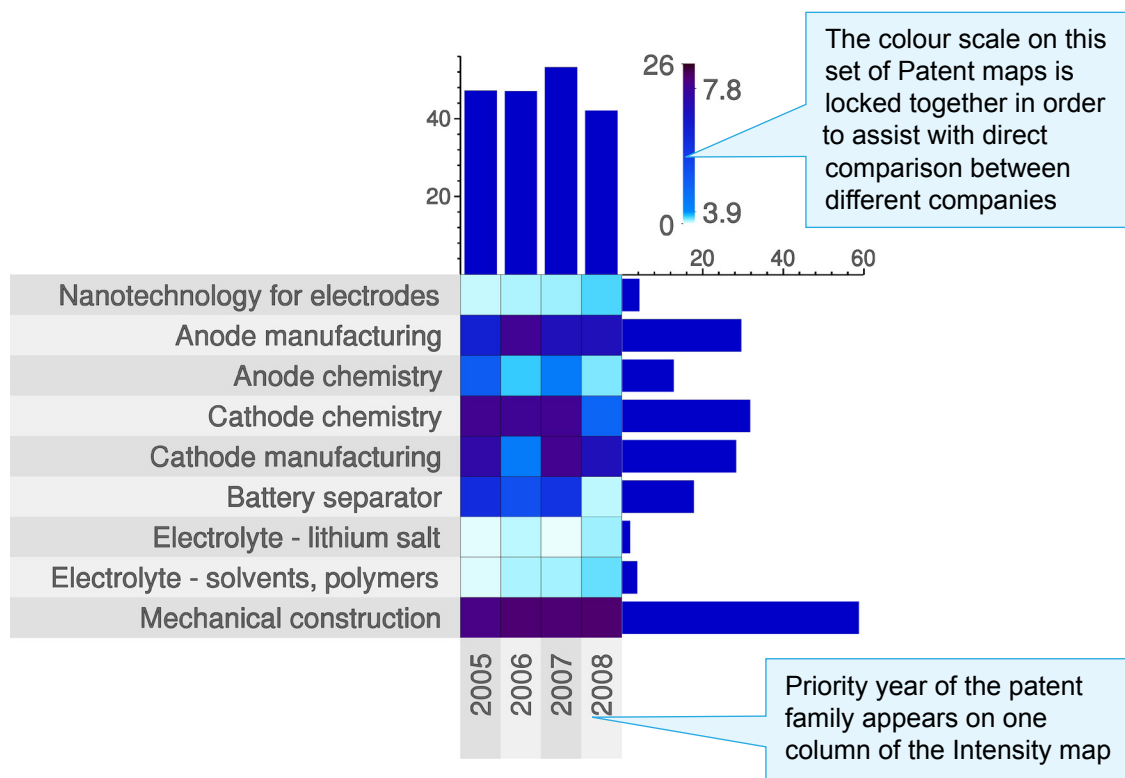


Individual assignee of the patent family appears on one column of the Intensity map

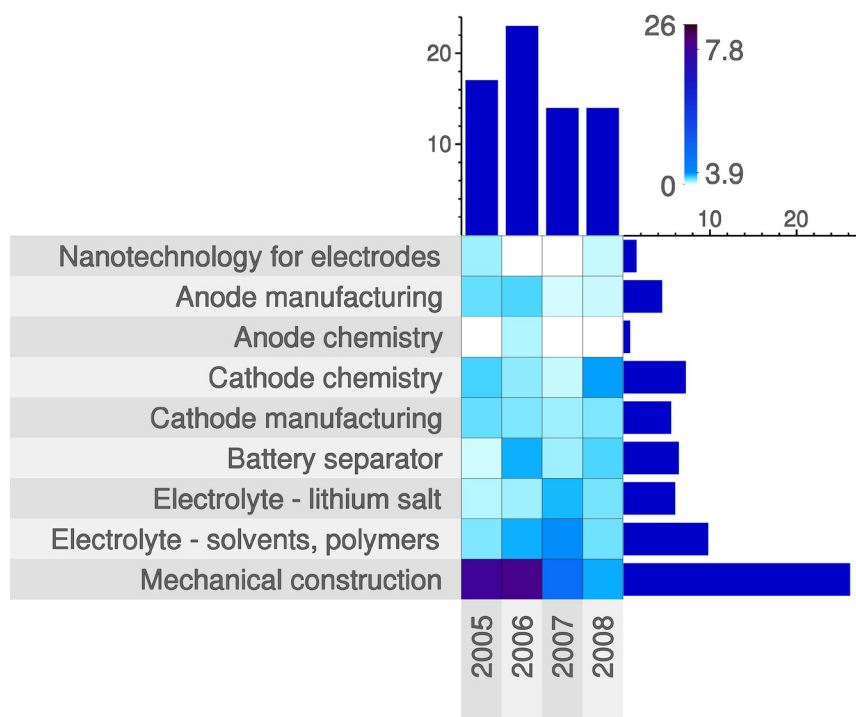
[Figure 6a] Comparison of Profiles for top companies in Lithium Traction batteries **Toyota**



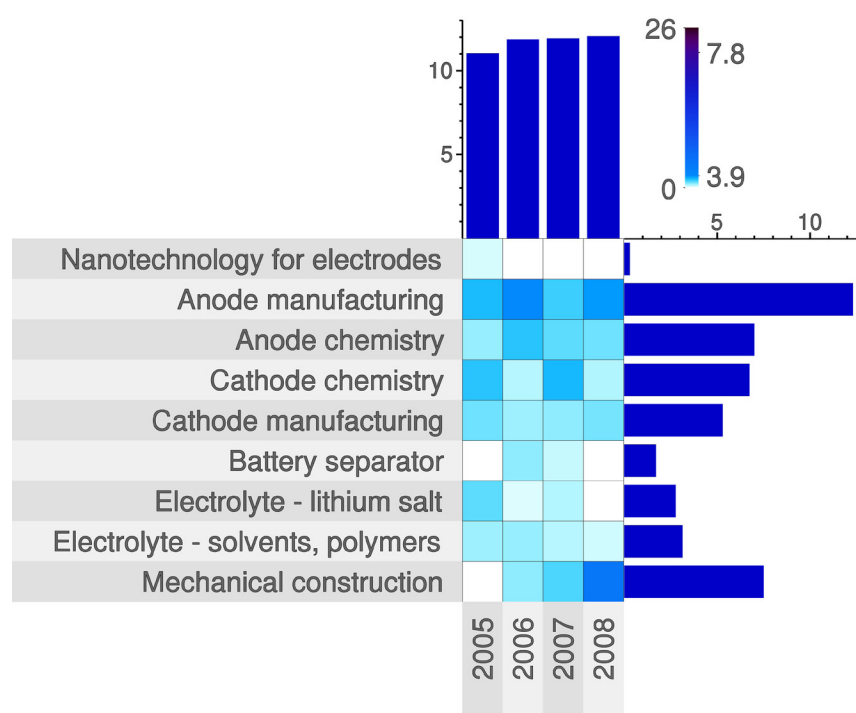
[Figure 6b] Comparison of Profiles for top companies in Lithium Traction batteries **Panasonic**



[Figure 6c] Comparison of Profiles for top companies in Lithium Traction batteries **LG Chemical**



[Figure 6d] Comparison of Profiles for top companies in Lithium Traction batteries **Toshiba**



[Figure 6] Comparison of Profiles for top companies in Lithium Traction batteries

Three Patent Maps with a fixed colour scale for Panasonic, Toyota, LG Chemical and Toshiba are presented for the patents relating to Lithium Traction Batteries. Samsung SDI is not shown along other players as this company is not involved in this specific technology development. It is easy to see that:

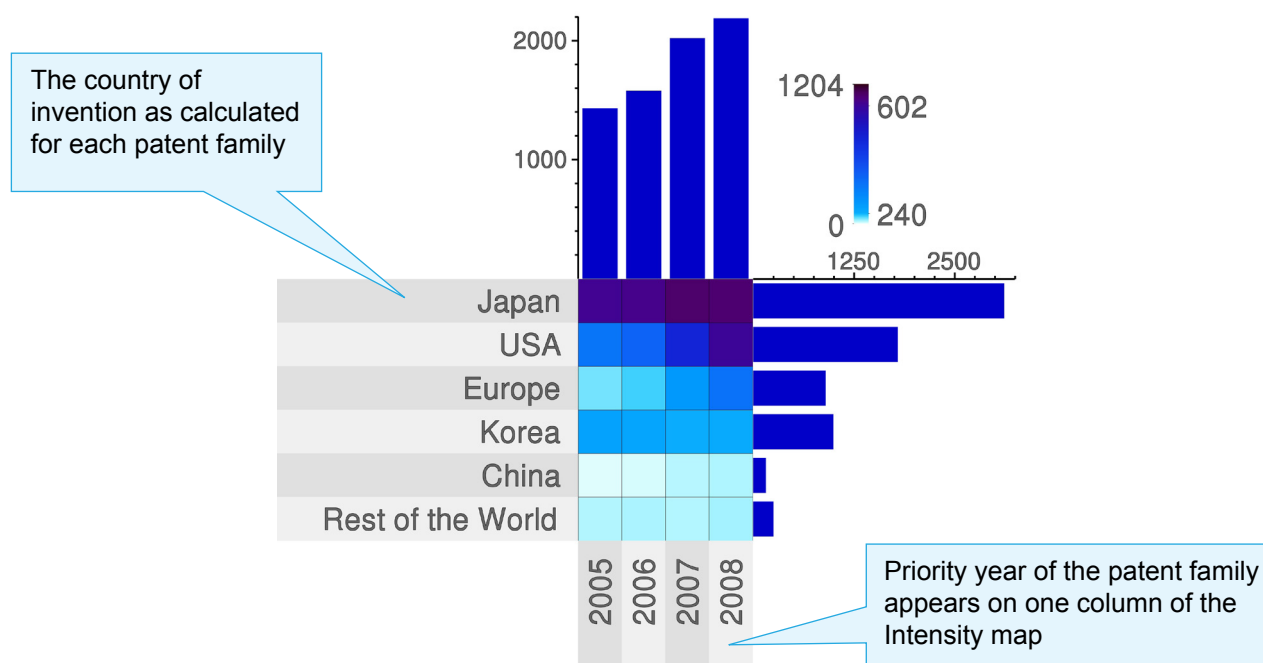
- » LG Chemical is showing a declining level of patent activities and most probably a reduced R&D spend for the development of the new generation of lithium traction batteries
- » It seems that LG Chemical is shifting its financial resources from R&D to manufacturing which should pay off in a short term but might become quite a risky strategy in the long run
- » Panasonic has demonstrated a steady activity
- » Toyota has shown an aggressive growth by being the new but bold entrant to the area
- » Toyota is backing the use of nanotechnology for reducing the charging time of lithium electrodes and improving their lifetime
- » Panasonic has no apparent interest in nanotechnology; instead it is focusing more efforts on technologies related to separators and cathode chemistry

[Figure 7] Comparison of Profiles for top companies in Lithium Traction batteries

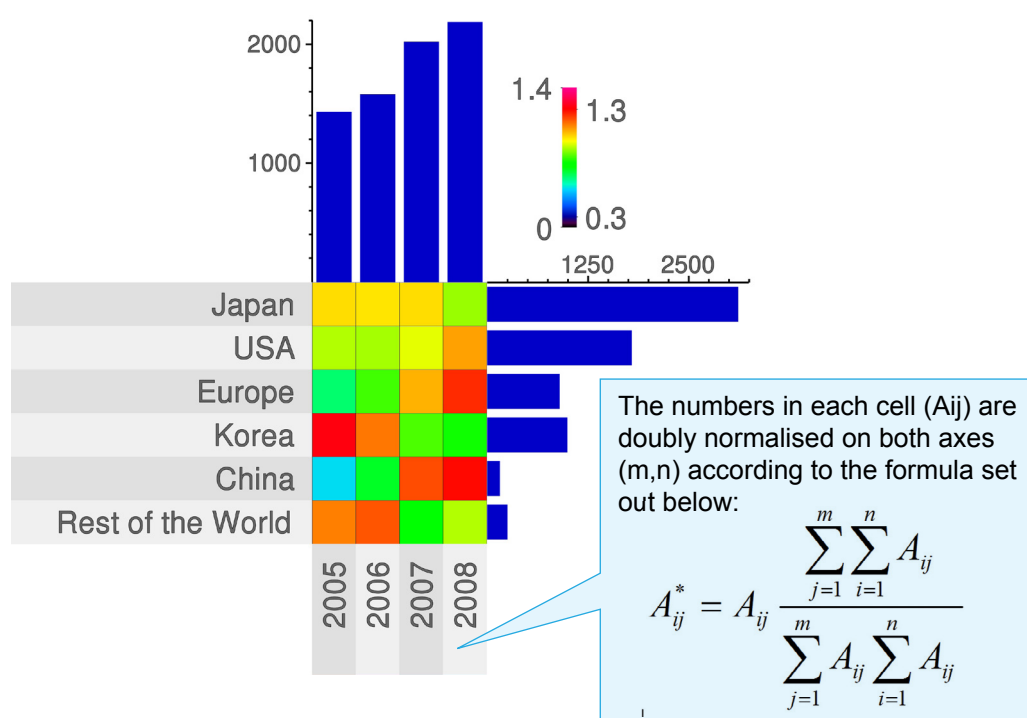
- » The evident growth rate in patent activities in Advanced Energy Storage is caused partially by European and US players waking up to the challenge
- » Koreans are substantially reducing their contribution to global R&D activities with Europeans and China substantially increasing their input.
- » It is useful to point out that the US companies substantially outnumber Koreans once all small players are taken into account
- » The finding regarding reduced R&D efforts of Korean companies is mainly related to the behaviour of LG Chemical but is also related to some degree to the similar trend from Samsung SDI
- » Figure 7b presents a Patent Map plotted in the normalised form. It is used to show the deviation of activities of each country from the common trend. The country which follows the trend will look predominantly yellow (this colour represents the value equal to one)

The report “Advanced Energy Storage technologies: Patent Trends and Company Positioning” contains much more detailed Patent Maps including ones using technology taxonomies. The report is provided with further insight into the conflicting picture between marketing and IP intelligence. To purchase a copy of the report please contact IDTechEx at <http://www.idtechex.com/patent>

[Figure 7a] Timeline for different Countries



[Figure 7b] Timeline for different Countries



About the Author

Dr. Victor Zhitomirsky is the founding director of PatAnalyse Ltd

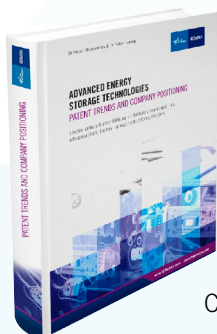


Victor is a keen innovator with a creative approach for problem solving. He authored more than a dozen patent applications. His broad technical skills in engineering, electronics, and material science are grounded in a solid fundamental education in physics. As a student, Victor won second and third prizes in the several Soviet Union Physics Olympiads. He graduated with a 1st class degree from the Moscow Institute for Physics and Technology - the Soviet equivalent of MIT (Massachusetts Institute of Technology). Victor obtained his PhD in Experimental Physics from the Institute of Solid State Physics, Russia. He graduated from the same department as the 2010 Nobel Prize winner Professor Andre Geim and gained his PhD from the same academic Institute.

After defending his PhD Victor received a Max-Planck fellowship and for the next 5 years worked at the Institute für Festkörperforschung, Stuttgart in the laboratory of the Nobel Prize winner Professor Klaus von Klitzing. After that he moved to the Clarendon Laboratory of Oxford University where for another three years he carried out scientific research and teaching.

At the beginning of 2001 Victor moved to Cambridge, UK, to start his career in the local technology consultancy cluster. As a senior technology consultant he has been involved in due diligence assignments on many early stage European high-tech start-up companies; has invented, developed and successfully licensed several new sensor technologies; contributed to product development and technology scouting projects; developed new approaches to analysis, clustering and graphical presentation of knowledge-based databases; and delivered numerous patent studies to both public and private sector clients.

Victor is a member of the Advisory Committee for the 'Metrology Innovation R&D' Programme of the Department for Business, Innovation and Skills, UK. In 2004-2007 he also served as a member of the Advisory Committee for the 'Measurement for Emerging Technologies' (MET) Programme.



Case Study

“Advanced Energy Storage Technologies: Patent Trends and Company Positioning”
www.patanalyse.com/AES_report



Power-Point Presentation

A brief review of PatAnalyse services
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Technical white paper

To obtain a copy of white paper “Innovative Tools for Comprehensive Patent Studies” please send your initial request to info@patanalyse.com

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