

# “ILLUMIN8ING” THE WORLD’S KNOWLEDGE TO ACCELERATE INNOVATION

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Research and development professionals have ever-shortening timetables for completing their projects, but are faced with increasingly complex tasks and expanding information needs at each stage. A researcher’s primary strengths might be in experimentation or calculation, in turning theory into practice, and certainly in creation of new knowledge and insights, but they must also be skilled in searching and analyzing textual information. In particular, it is critical to access what other people already know; however, it is difficult to find the *useful* information without being overwhelmed by the immense and exponentially growing amount of information that can now be found. This paper addresses some new tools for uncovering relevant information and their use in creating insights, including a framework, discussion of tools, and some examples.

## THREE PHASES OF DEVELOPMENT

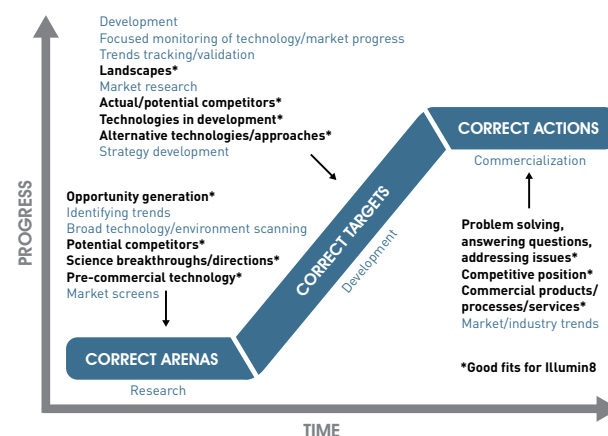
Many technologists think about development of a product, process, or business proceeding along an S-shaped curve: there is an initial period of slow progress, followed by a fast progress phase, and then a final period of leveling off. From a technology development perspective, you might envision the phases as **research**, **development**, and **commercialization**. The questions (and answers!) we pursue are clearly different in these three phases. As we advance new opportunities, our focus in these phases will be finding the **correct arenas** for technical and market research, the **correct targets** to develop within those arenas, and the **correct actions** to take to achieve those targets. Technology intelligence helps us answer these questions, find solutions, and, ultimately, accelerate innovation.

**Correct arenas** are our regimes. This is where we might want to find new platforms, new markets in which we want to participate, or new technology fields. Some typical questions would be: Where should the company participate? What trends might create opportunities? What new technology has come about that will allow us to gain advantage in satisfying customer needs?

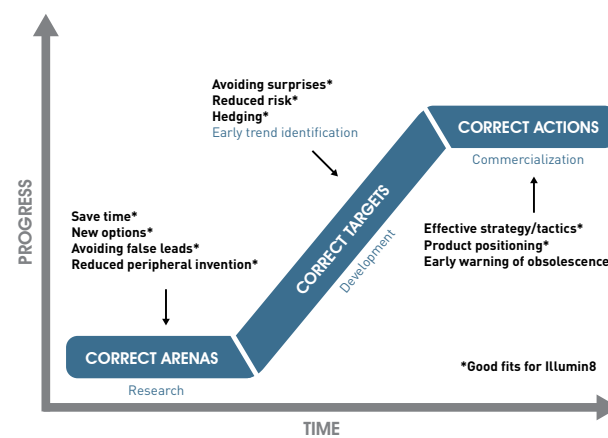
**Correct targets** are where we find a workable scope to pursue, for example, determining the best market segments of a platform, the right business model, the few alternative technologies that really have a chance, or the highest-value offerings. We cannot afford to pursue all of the options; in this phase, we narrow our focus to the best alternatives.

**Correct actions** are how we are going to address our target, for example, determining our strategy, converting our business model to a business plan, understanding how our offerings will displace current solutions, and solving the detailed implementation issues.

## TECHNOLOGY INTELLIGENCE FOCUS



## TECHNOLOGY INTELLIGENCE BENEFITS



**Technology intelligence** gives us the insights to answer these questions. Information is uncovered, but intelligence is created when you gain the insights from the information, e.g., why something happened or how something works. For our purposes in this paper, we will use a broadened definition of technology intelligence that includes some aspects of business intelligence. Since we do not want to develop technology in a vacuum, we need to know enough about platforms and market segments so that our R&D will result in solutions that are relevant and better than existing offerings. In addition, our view of technology intelligence goes beyond the traditional competitive focus into the world of opportunities. Although there is almost always something that competes with any offering, we can also be proactive, focusing on the new rather than the existing, seeking open space and disruptive innovations. This opportunity intelligence is offensive rather than defensive; we are looking to grow, to find and create new (and less-occupied) playing fields, to take advantage of technology in new ways. We want to find new markets for our offerings, new opportunities created by trends, developments, or actions in the marketplace, new offerings to help our organization meet a customer need.

## APPLYING TECHNOLOGY INTELLIGENCE TO FIND THE CORRECT ARENAS

One of the most fascinating arena questions is to find the “white space”; in other words, search for where there is nothing—a great challenge, but an exciting question with potentially rewarding solutions. The classic, and likely the most valuable approach for uncovering white space, is scenario analysis. This open-ended technique, starting with drivers that are uncertain, causal, and important, and seeing where they lead, is extremely well-suited to uncovering white-space arenas. Searching databases and the Internet can help identify the drivers and human sources that will add to them and validate them. The analysis is best performed in facilitated sessions by a diverse team of knowledgeable people with different perspectives.

An early-warning system is also critical for finding arenas; if you are looking for something you do not already know, then you should be

looking in lots of places. This kind of proactive monitoring is a whole topic in itself; for our purposes here, we should certainly do broad environmental and technology scanning, and we should have a mix of published literature, gray literature, and human sources, e.g., attending a broad array of conferences and utilizing a human network. However, getting breadth

## ‘TREND IDENTIFICATION AND, MORE IMPORTANTLY, VALIDATION PLAY ESSENTIAL ROLES IN IDENTIFYING WHITE SPACE.’

without getting overwhelmed is difficult; post-search tools that perform text-mining, clustering, and visualization, allowing us to explore the search results through the text analysis rather than by reading the search, are enormously helpful.

However, the Internet is a completely different story; only simple keyword searches, e.g., in Yahoo® or Google™, can generally be used, and these are limited by requiring you to know what you want. In addition, such a search will often return many thousands of “hits”, ranked by popularity instead of relevance to your question. There is clearly a need for advanced, automated searching of new items on the internet. Fortunately, you can at least efficiently check hundreds of websites in a semi-automated way with tools, such as WebSite-Watcher or Copernic Agent™, that highlight changes since the last time you visited. If you know likely places for interesting developments, e.g., university and government technology transfer pages, this is a very productive way to find unexpected things.

Trend identification and, more importantly, validation play essential roles in identifying white space. New text-mining and statistical tools are helpful for spotting trends before they become known to everyone. A very effective approach for understanding technology trends is to analyze the literature for academic vs. industrial authors, scientific vs. trade journals, patents vs. papers, and type of work being reported, e.g., synthesis, characterization, process development, or applications development. Thought leaders and alliances can be determined and confirmed. Combining business information and Internet sources into this analysis can bring additional dimensions, especially for determining reality vs. hype. Of course, trends should be verified. The importance of the trend and the insights that can create implications for your organization can be evaluated through intelligence analyses, such as signals or force field.

The ability to access technical and business content, literature and patents, the internet, and internal information together brings tremendous advantages. We want to search all of these sources and then analyze, rather than analyzing each separately and trying to integrate the conclusions, which can be very different from each limited source. In most cases, it is not possible to conduct such a consolidated search and integrated analysis. Recently, Elsevier and NetBase Solutions partnered to produce a tool called illumin8™, which combines Internet and premium content in a single search. In addition, it permits enhanced concept searching and categorizes the output so that you can navigate to the most relevant information and more quickly gain insights.



illumin8 is focused on solutions, easy to use, and aimed at R&D professionals. It has robust content since it accesses the Internet, Elsevier's extensive databases of scientific and technical literature, non-Elsevier scientific content, and patents. A meaning-based search is used, and linguistics programming automatically provides the alternate search terms. illumin8 indexes its extensive content in such a way that you can extract problems, solutions, or benefits, enabling researchers to retrieve specific products, approaches, authors/inventors, companies, and other organizations with solutions. You can also filter the results by literature, patents, and the Internet.

'... A GREAT WAY TO JUMP-START, OR EVEN ELIMINATE, A DEVELOPMENT EFFORT.'

illumin8 categorizes the search results so that it is easy to navigate through the output to the most appropriate content. Future enhancements will permit searching by technology type (e.g., product, product category, compound, device) and specifically finding technology benefits, problems, applications, causes, effects, and more. The overall capability provides a great way to jump-start, or even eliminate, a development effort. In addition, by uncovering alternative approaches, we can apply traditional intelligence analyses, like attribute analyses or competitive assessment, to determine the best approaches for each segment or offering.

illumin8 is particularly good for quickly understanding the relevant technology landscape. Using broad search terms (since we are likely at an early stage of our knowledge), we can easily find the participants in an area who are inventing, funding, manufacturing, and using the technology. You can determine the market segments and application areas, find competing alternatives and enabling technologies, and more. In other words, you can efficiently and effectively get up to speed in a new area.

For example, if we were interested in potentially participating in the arena of optical adhesives, a search on illumin8 quickly provides places where optical adhesives are used, key players in the field, some of the products, and some of the attributes those in the field consider important for success. We can look at those to see if we might serve some of those needs. We can look at



the journal and patent sets to see which companies might be research leaders. We can contrast the topics covered on the Web with those in journals to assess the state of commercialization.

As another example, we might investigate the world of anti-microbial packaging; the search quickly turns up leading products, companies, research organizations, and alternative approaches. All of these are nicely clustered so that you can navigate in a very effective manner through what might have been an overwhelming search.

### APPLYING TECHNOLOGY INTELLIGENCE TO FIND THE CORRECT TARGETS

Suppose your analyses have determined that energy, or even energy efficiency, would be a great arena—that sounds nice, but it is not really actionable; we need to focus on some specific market segments and technologies. And by the way, what are we going to sell and how are we going to sell it? This is an area where new tools that access external research and match needs and solutions, deliver great leverage. Continuing our example, as we learn about energy efficiency, we will uncover many market segments. To understand those, we will likely produce market screens of each segment, including size, growth, key competitors, customers, offerings, and trends and unmet needs. Now comes the lucrative piece—how can we link what people need with what we know how to do or, in true open innovation fashion, with what we can acquire that other people know how to do?

As we explore the illumin8 results for energy efficiency, we see some approaches for which we have skills, e.g., combustion. We can then go to those records to find specifics. In other words, we can read a rather large search through concept linkages.

Let's say that the segment that interests us is building energy efficiency. A fast search on illumin8 shows some of the key areas for savings: perhaps we can bring offerings in insulation or in lighting. By reading the search through the interesting connections, we can save time in our exploration of this very broad overall category.

'THE SEARCH COMES BACK WITH KEY PRODUCTS, KEY PLAYERS, AND A WIDE RANGE OF ALTERNATE APPROACHES.'

Suppose we wanted to investigate applications of rheology modifiers in textile processing. Maybe our interest is additional uses of rheology modifiers or maybe we want to expand our offerings to textile processing; it does not really matter which we consider to be the arena and which the target within the arena. The search comes back with

key products, key players, and a wide range of alternate approaches. We can explore this target through these linkages to see if there are any fits for our skills.

Once we have a segment with a need that we know we want to serve, we can use illumin8 to find all of the solutions, understand their strengths and weaknesses, and put together a superior offering. The tool can identify alternative products, organizations participating, and approaches being developed. Because of its access to both Internet and premium scientific sources, we can understand what is on the market and what might be coming. We can then organize the information into a landscape for comparison and insights. The content, search tool, and analyses combine to allow us to access the world and rapidly develop an irresistible offering.

### APPLYING TECHNOLOGY INTELLIGENCE TO FIND THE CORRECT ACTIONS

As we get closer to commercialization, we need to refine our target offering and to solve a myriad of detailed problems, including such issues as manufacturing, packaging, and distribution. The new tools and intelligence techniques help in this regime as well.

'AS WE GET CLOSER TO COMMERCIALIZATION, WE NEED TO REFINE OUR TARGET OFFERING AND TO SOLVE A MYRIAD OF DETAILED PROBLEMS...'

we do not add much value by inventing a package that is already on the market or a new machine to process the active ingredient.

Let's say that we are manufacturing a large piece of equipment to do a chemical separation. The customer is in a remote location and we want to spend as little as possible on getting the machine to them. How have other organizations, such as the military or refinery constructors, moved large equipment to remote locations? Are there ways that we could manufacture it differently, perhaps partially in the local region? What design changes might simplify the construction in such a circumstance? These are questions that can now be answered; we can put our needs into illumin8 and search for solutions that others have already learned.

As we approach commercialization, we may need to find complementary and peripheral technologies, for example, for packaging or manufacturing. We may have invented the active ingredient, but

In some cases, we can take action directly from the information. In others, we will want to combine what we know about our own organization's efforts with what we have learned about competitive alternatives, competing organizations, and trends. With this robust knowledge, we can help with strategic and tactical planning, using such intelligence techniques as SWOT analyses, scenarios, and war games to determine the best courses of action. These will be grounded in the information and insights we have learned throughout the cycle of finding arenas, targets, and actions.

### PUTTING IT ALL TOGETHER

Technology intelligence is about skillfully uncovering information and illuminating insights for actions. R&D professionals play critical roles in using technology intelligence to develop and drive future opportunities. We can help determine the arenas in which we should be participating, the best targets to pursue within those arenas, and the best actions to bring successful offerings to those targets.

We can no longer just find a critical piece of information; there is too much information and we have to find ways to make sense of all of it. New search tools, such as illumin8, help us in this by bringing more effective search strategies, broader content, and by filtering and clustering, to lead us more quickly to the best content. We then bring human insights to the content, adding tacit knowledge, integrating perspectives, structuring the information to reveal the insights, allowing us to go beyond finding information to creating intelligence. This is what leads to well-informed, insightful, and wise decisions that drive actions to create sustainable competitive advantage.

**Merrill Brenner** is an independent consultant with over 20 years' experience in business and technology intelligence, decision processes, and strategic planning. Prior to that, he performed and led new process and product development for ten years. He most recently was Manager of Business and Technology Intelligence at Air Products and Chemicals, Inc., before retiring after 31 years in the chemicals industry. Merrill has been published in peer-reviewed journals concerning technology planning, technology scouting, R&D partnerships, and intelligence, and his efforts in these areas have been benchmarked frequently by a wide variety of organizations.



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