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He is Director of SRIC-BI's Explorer service which helps companies and governments evaluate commercial opportunities arising from technology developments across a broad spectrum of technology and application areas.

The management of any forward-looking organization is well aware of the importance of emerging technologies for its future. New and developing technologies provide opportunities and threats that no company can afford to ignore – in particular those that have the potential to be disruptive to the organization's well-being, whether that be for good or for bad.

Organizations need as much lead time as possible in order to be prepared for what could be a major shift in their future business focus or health. But although consideration of technology already plays a vital role in most business strategies, substantial difficulties face any company or government trying to assess the effect that advanced technologies may have on its current and future interests.

In this interview, Nick Evans talks about why companies need to monitor new technologies and how the emergence of new (or evolution of existing) technologies can turn an industry upside down.



Guru Interview: Nick Evans

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Interview by James Nelson



Q: What should be the first step companies take in setting up a technology evaluation programme?

Nick Evans:

The first step is for the company to know why it is doing it. It has to play an integral role in a company's strategic plans. Only then should the company begin its process to identify and assess all technologies that may affect current and future business plans. Companies most often need to expand their perspectives on technologies that should or could be of interest to them, and then set up appropriate filters for selection of those technologies to prioritize for evaluation.

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Therefore, the technology evaluations will necessarily cover a wide range of technology areas and not just a company's core technologies. Of course, this process equally applies to businesses that use technology in their operations – not just those that produce technological products directly. The speed at which technologies emerge and develop is now so fast that the selection and assessment phase has to be continuous and not just a one-time review. This gives the next phase of the technology strategy – the decision and action phases – inbuilt flexibility, allowing management to respond quickly to further technology advances, commercial opportunities or threats.

Q: What pitfalls do companies face if their monitoring operation is not correctly conceived?

Nick Evans:

From the smallest single-product company to the largest multinational corporation, firms fundamentally have the same technology problems. For continued success it is no longer sufficient to have the most advanced material or design, the best processing capabilities, or a currently successful product with huge market share. Waiting around the corner is a new material, process, or product using an entirely new technology that can destroy a company's successful market or future business plans within 12 months.

Many examples illustrate why companies need to monitor new technologies. All of them demonstrate that the emergence of an alternative technology has the potential to turn an industry upside down. Some technology advances are so monumental that they change the world as we know it. For example, semiconductors replaced valves, jet

propulsion replaced propellers, and wireless technologies are fast replacing wired communications. The jury is still out over the cost and environmental advantages and disadvantages of biofuels and other bio-based chemicals. The technology of synthetic biology is advancing at such a fast pace that the rest of the world seems to be standing still while Craig Venter moves toward creating the first synthetic life form. Other technologies just advance or expand an industry. Sony's Blu-ray format recently championed over Toshiba's HD DVD format as the next-generation of DVD media, beating Toshiba through some smart loss-making marketing (by incorporating a Blu-ray player into its PlayStation 3 consoles) very much the same way that its Betamax video format lost out to VHS in the 1980s: Having the best technology is not necessarily the route to commercial success. Next step? Practical and affordable holographic storage?

Technology breakthroughs are rare. The Human Genome Project (HGP) was only achievable in the remarkable time frame that it was completed because of the huge steps made in the development of a variety of DNA-sequence analysis equipment. When breakthroughs do occur, as with the HGP, companies and research institutes with expertise in the area respond with a rapid switch of resources to confirm or improve the initial experimental results, and move forward with a broad range of innovative scientific and commercial projects. Fast response is essential – not only on scientific grounds, but also to stay ahead and obtain the all-important patents needed to provide payback on the high investment needed for this early R&D. Companies involved at this level have already made an initial assessment of the potential commercial rewards and are prepared for a long-term investment. They will continue to assess the potential applications of the technology, and adjust their research investment accordingly.

Q: How should other companies react?

Nick Evans:

Even when technologies directly affect existing essential core technologies, most companies will either not be able or not want to be involved with the initial R&D. In many cases emerging technologies will be a long way from a company's core technologies. Nevertheless, the advances should still be monitored and assessed – at a level appropriate for the individual company to make sound commercial decisions. The company will need to know what will be available, and when.

For example, the practicality of many types of renewable energy sources is still being evaluated – and indeed some have already been dismissed in some quarters. However, many governments and major organizations have committed (and will continue to commit) considerable resources to research the potential of renewable energy technologies (RET) and bring them to commercialization, because the availability of cheap, clean, and renewable fuel and power from non-fossil sources would be a sea-change from the current reliance on fossil fuels.

The correct regional balance of fuel and power technology



alternatives could revolutionize the economics of transport, processes, and products. The average company will not need to take immediate action today, but certainly they should have already made an initial assessment of how its long-term plans could be affected by the availability of cheap fuel and power. It should also have established an *appropriate-for-that-organization* monitoring system to keep abreast of developments. The alternative is the *head-in-the-sand* acceptance that the current continuous rise in the cost of fuel and power will spiral without any hope of relief. And that gloomy forecast does not even take into consideration the effect of continued fossil fuel use on the global environment. Of course, current fuel and power generation producers are already well-established in their strategic developments of RET, and assiduously monitor and evaluate all developments, whether they be from technical, commercial, consumers, or regulatory origins.

We find that when companies are evaluating the effect of emerging and disruptive technologies on their business strategies, the most common questions they ask are the most basic. A company needs to know which technologies to assess, and why. In addition, it needs to know how to monitor technology changes effectively, and how to assess the commercial significance of any developments.

Q: Which again brings up the question of identifying which technologies to monitor?

Nick Evans:

Identifying the right technologies to monitor is critical for an efficient technology strategy, but doing so is also very difficult. Every organization is unique and needs to develop an efficient set of filters that will enable it to select and prioritize technologies that could be disruptive to its business. Certain candidates should obviously be monitored. These include all technologies that the company already plans to introduce. This monitoring should take place regardless of whether the company is involved with actual R&D of the technology. Monitoring these technologies is important, because a company needs ample warning of any advances in technology that it may need to consider introducing to improve a product or process in order to remain competitive. Just as important, it must know how vulnerable its business is to a technology switch.

A stage comes in the development of any technology that no amount of R&D can improve upon by any cost-effective means. The limits of the technology have been reached, and if enhancements in ability or efficiency are needed by a company for improved competition, an alternative technology must be sought. It should surprise no business to hear that advance warning of a potential technology switch is vital to both the technology/product supplier and the user. And assessing the timing of a technology development is usually as important as identifying the technology itself.

Q: What about tracking the core technologies of customers and suppliers?

Nick Evans:

Yes, the core technologies of customers and suppliers are just as important to monitor as those of your own. Will a company's current customers remain customers in the future, or will a technological development leave a company with no one to buy its products? For example, the development of smart materials will radically change the materials requirements of many industries. So will the emergence of nanoelectronics, which has the potential to revolutionize such markets as portable devices, sensors, and ubiquitous computing. A manufacturer may perceive opportunities in using a new material or electronic component in its product to gain competitive advantage. It will be in the manufacturer's interests to persuade and support its supplier with the ability to develop the appropriate technology for the manufacturer's sole use, before competitors have the same idea.

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Q: What are the critical success factors which will ensure the monitoring programme is properly organized?

Nick Evans:

The key to a company having confidence in its advanced technology awareness and evaluation is to have continuous and efficient full commercial evaluations of the right technologies through a well-structured process. This calls for:

- A broad-enough set of technologies, with ability to add and remove technologies from the list.
- A network to gather and filter recent technology and commercial developments from a wide range of sources, including the Internet; internal and external databases; newspapers; scientific, industrial and business journals; press releases; patent searching; personal contacts in government bodies, companies, universities and research bodies; and conferences.
- A research and evaluation team composed of members with expertise in the technical development of the basic technologies and their applications, and commercial experience of the markets, applications and industries



in which the technology will be used. This team will focus on filtering, focusing and assessing the commercial significance of any recent developments using established criteria – specific to the organization.

- Access to a second, often overlapping, network of industry and academic experts that the monitoring team can contact to confirm or elaborate on their evaluations.
- An efficient clear means of communication, customized to the exact needs of the end-user, who may, for example, be strategic planners, R&D planners and technologists, product managers, or marketing managers.

Each part of this monitoring and evaluation organization should include internal and external staff and resources. In this way the widest views can be incorporated into an evaluation, which is, as far as possible, unbiased from any company preconceptions of the commercial strategy or value of the technologies monitored.

Q: What advice can you give on the timelines for the evaluation process?

Nick Evans:

As a result of the continuous monitoring, at any one time the evaluation made by the monitoring team should give a snap shot of the current status of the technology. Continued monitoring after this point assures that the evaluation is modified according to any developments, allowing the end-user to reassess the status of the technology at any time. How often the end-user needs an updated assessment will depend on factors such as the priority of the technology (Disruptive? High priority? Watching brief?), the role of the end-users, and why they need the information. Also, is a decision being taken which relies on a current evaluation of the technology? When? How vital is the technology to a company's prosperity and are the filters in place still appropriate to today's needs? These factors will vary the time a company needs between new evaluations of fast-developing technologies from anything between one week and six months. Nevertheless, the basic monitoring should be continuous, so that major developments are not missed. And the process should include a clear set of milestones, signals, and signposts that indicate change and/or whether the route to commercialization is progressing along the lines of expectation or whether anything unexpected has happened.

Q: What criteria should the evaluation team use to have confidence in its analysis of key developments?

Nick Evans:

Any organization evaluating technologies for their commercial potential or likely level of disruption needs an initial knowledge base, followed by a continuous monitoring process, to catch any recent developments. Both phases select and evaluate the information using the same set of criteria.

Establishing the specific set of right criteria for individual organizations is the most critical part of the process. The criteria should not be underestimated in their importance or their need for examination in case circumstances merit change. Fundamentally, the whole process is about asking questions: The right questions and at the right time. These are:

- *The technology.* The assessment team needs a precise, but at the same time broad, basic understanding of the technology at the level of pure and applied research, so that any technical developments can be properly evaluated in terms of a technical advance. Take out the hype. Is an advance really as major as the developers claim? How does it advance the technology? What are the implications of the advance on the future potential and timing of other technical components? What other technologies might such an advance affect?
- *Commercial development parameters.* A clear understanding of all the commercial development parameters is essential for the team to make a proper assessment of the technology's potential. They need to know what factors will influence the timing of key developments of the technology. What technical or commercial constraints exist? Will they be overcome? If so, when? When will key products enter the market? Where is the demand? Are the demands technically or market driven? What influences are synergistic and competing technologies having on the commercial development? What are the required investment resources? Do regulatory factors need consideration?
- *Supportive areas to monitor.* Isolated monitoring of the technology alone will not provide the complete picture of a technology's development. Many other areas direct the development of a technology, and become key areas to monitor. These may be first identified by the team as commercial development parameters, such as specific technical hurdles that must be overcome, advances in synergistic and competing technologies, or a change in potential application areas and markets. But having been identified, they must then be monitored so that any changes can be incorporated into the evaluation equation. Numerating/prioritizing the importance of each area to monitor is important at this stage. How important is the solution or progression of a particular area to the commercialization of the technology. And how certain is the team about what the solution will be or its timing. In Explorer we map these areas to monitor on a chart showing Impact against Uncertainty.
- *Implications.* The team must consider the major effects of the successful development of the technology on the business environment. Where will the impacts be felt? Which industries, how and when? Where are the opportunities and threats? Build stories or scenarios that indicate different ways or environments in which the technology could contribute to a successful product portfolio or future for the company.
- *Market.* Knowledge of the potential market for an



emerging technology is certainly of interest in any commercial evaluation, but detailed market analysis is not needed for the initial assessment. An overview of the likely product markets five or ten years after the entry of the technology into the commercial market is sufficient to position the technology in terms of the potential commercial reward. A more detailed market analysis of specific areas will be necessary once target areas have been accurately identified.

- *Opportunities.* Opportunities only arise from successful application of a technology. Development of a technology will often be driven by interest in using the technology in certain application areas that must be identified early to provide niche markets for the inspired entrepreneur. Other application areas will use the technology as a simple alternative to existing technologies. All existing and potential application areas need evaluation in any assessment of a technology's commercial potential, addressing the full potential of the technology in those areas, the timing of new applications of the technology, and the extent to which it may already feature. And finally, of course, the fit with a company's business and technology/product strategy.
- *Participants.* Lastly, any technology evaluation programme needs to know the key players involved in the development of the technologies, and the roles that they play in the business value chain. The interest is twofold. First, the key players are a good source of information for non-proprietary information. The monitors need to know who to go to for information. Second, it is important to follow company announcements, mergers, and acquisitions that might indicate a new direction in the development of a technology that is not public information. Clearly, a company should be as aware as possible of the technology developments of an active or potential competitor. If they are involved in developing a technology, why are they? Finally, where do you want to be in the new value chain? Who will be your partners, who will be your competitors, and who will be your customers? ■

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