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Radical Technology Innovation in Your Organization Or Grow Your Own

Abstract

In the competitive arena of low cost offshore producers, manufacturers need to rely upon radical innovation technology to preserve their margins. Unique, differentiated product is critical to real profitability. Manufacturers often struggle with the challenge of developing and implementing innovation in their technology base. Disruptive technologies can be developed with the application of simple managerial strategies. The strategies are explored, including:

- External development of technology
- Internal development, and
- Integration of an external resource

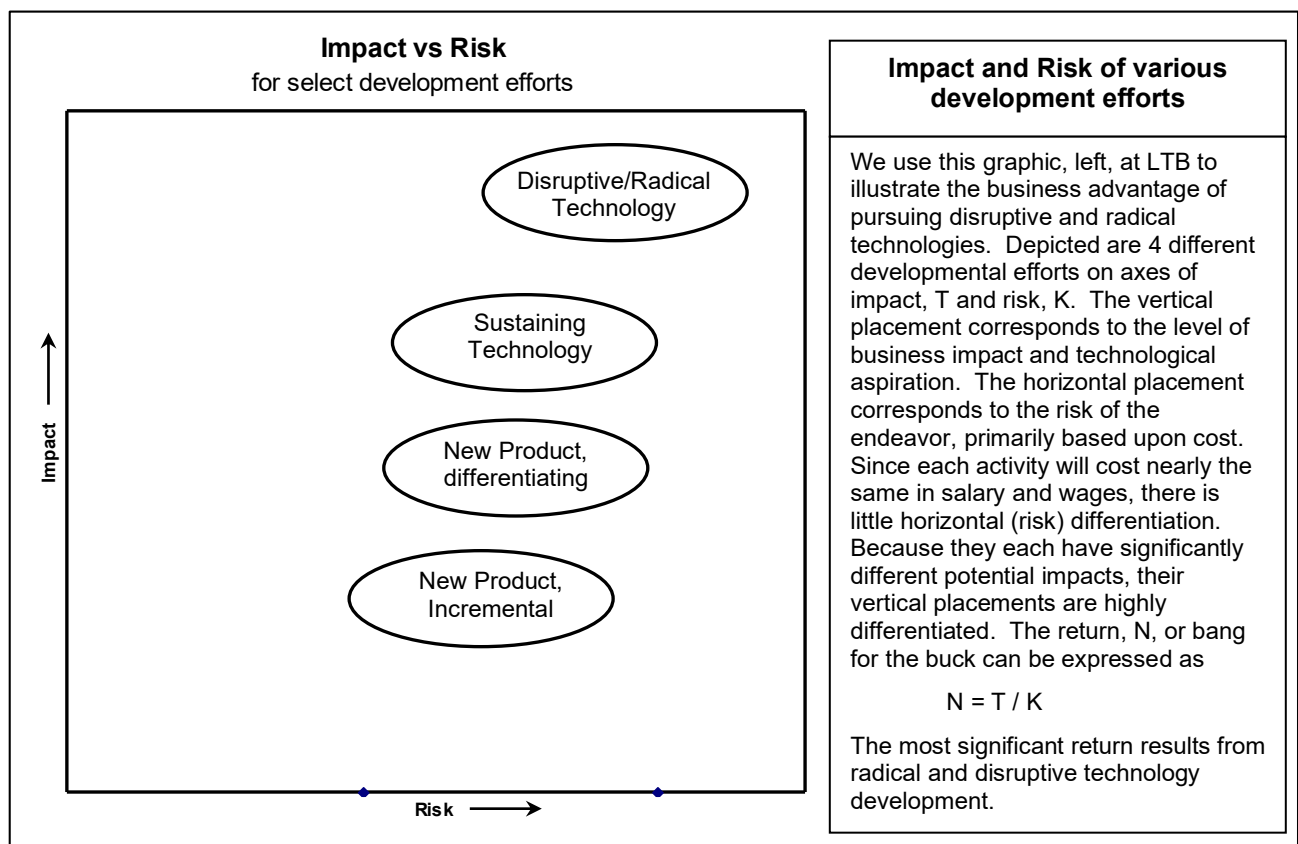
The issues of why disruptive technologies are the best venue and how to manage, deploy and exploit them are explored.

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Greg Lyon has over forty years in technology development, having worked in research & development and new products development at General Electric, Leviton Manufacturing, Thomson Industries and American Standards Testing Bureau. He is the named inventor on 38+ US patents. He is the principal at LTB Engineering, a firm specializing in enabling American manufacturers to develop and leverage their technology base.

Technologically swinging for the fences is the road to superior cash generation and growth. For manufacturers in high-cost regions, it is the only guaranteed defense against low-cost offshore market intrusion. Properly exploited, proprietary, unique, disruptive technology is the single-most critical element in product success and business development. Of all possible technical endeavors, radical & disruptive technology development provides the best 'bang for the buck'.

Figure 1: Technical endeavors as functions of impact and risk



The focus of this paper is on disruptive and radical technology innovation. While each of the endeavors is based on innovation, it is by disruptive technology development that new rules can be written to optimize cash generation. A new product should be the developmental vehicle; while it may not be the end deployment platform, it will allow the technology to be seamlessly implemented into other new product lines.

The radical/disruptive technology affords its owner the right to exploit and profit from it. Its uniqueness sets it apart from sustaining and incremental technology and product development. Low-cost overseas producers have become very effective at incremental technology development; it is very difficult to compete at that pace. It is by swinging for

the fences and hitting the technological home run that the American manufacturer can change the playing field to its advantage.

There are alternatives to development:

1. Farm out technology development
2. Develop internal technology development capabilities
3. Introduce resources to leverage your existing technology base

Farming out technology development has its own set of pros and cons. This can sometimes be accomplished through working with academia or with so-called think tanks. While the caliber of the developers may be quite high a significant degree of control and ownership is usually sacrificed. Further, there can be a lack of a sense of urgency, making for frustratingly long delivery times.

Internal technology development is the historical norm, typically performed by an R&D team or the like. When functional and motivated, this is the most exciting place in the whole of the company. The rewards of internally developed technology include ownership and control. Technology development is not, however, without its challenges, including risk and cost.

The challenges are sufficient that many manufacturers have abandoned their internal pursuit of technology innovation. The process and management of technology development are unique in business and requires a special set of tools.

Maintaining a self-sufficient internal R&D function can be expensive. Salaries for talented developers tend towards the top end of any specific discipline. A further component of cost is the infrastructure, consisting of labs, prototyping facilities, etc. Other deterrents to internal development include elements of risk; return on investment is not guaranteed.

Manufacturers, squeezed by a number of commercial pressures have in cases responded by decreasing resources directed towards technology development. This starts a vicious circle; because there are no new streams of revenue from new technology offerings, the company retreats even further to the perceived safe venue of tried and true (aging) technology. This is an extremely dangerous situation as the company is now faced with toe-to-toe competition with overseas manufacturers who have proven to be very effective incrementalists, and are starting at a lower cost structure.

The injection of external resources to help leverage your existing technology base can be highly efficacious, both technically and economically. This approach is especially advantageous when the remaining technology base is well versed in the present technology. The resource, though exceptionally knowledgeable in the underlying sciences, should ideally not have the same experience set as the incumbent technology base; it's this difference of background that produces new ideas. The resource introduces a number of challenging new approaches that contrast against the conventional technology. The conflict that ensues is almost sure to produce unanticipated solutions. This process is usually hugely rewarding and results in a re-invigorated team always on the hunt for new ways.

Outside resource 101

A manufacturer of bellows and expansion joints was trying to break into a new manufacturing process, especially to pursue small volume quick runs. One challenge was the 'state of the art' tooling which had some impediments. First, it was patented, and the assignee expected significant licensing fees. Second, the tools were both expensive and a single sizing adjustment could require up to one day. Working collectively with the process engineers and toolmakers we developed substantially simpler and less expensive tool designs that do not rely upon the aforementioned patent. In trials, the tools demonstrated a sizing adjustment of less than thirty seconds. This new, proprietary tooling design is the subject of a US patent application, the first for this manufacturer.

Varied backgrounds are helpful to increase the number of sources of ideas; another advantage of an external resource. The staff developers will tend to be young; they are less inhibited and haven't yet learned 'the way' to design something. They will tend to be independent, usually preferring to work as an individual than in a consensus building team. Obviously, the successful developer tends to be of extraordinary intelligence, comfortable with the underlying science in a number of disciplines and be capable of producing quantities of solution ideas to given sets of problems. They will have a tendency to 're-ask' the question to look for loop-holes and to change the rules. This intelligence, creativity and independence sometimes make the developer a difficult employee to manage.

The manager of the development group has a strenuous but tremendously rewarding challenge ahead of him or her. From an employee management standpoint, the manager will usually need to be a successful developer in order to earn the respect and trust of the staff. Ideally, the manager should work as a resource for each developer for the developer's project. From the project management standpoint, the manager needs to be able to persevere past the inevitable development pitfalls and keep a clear, communicable vision of the likely outcomes. Development projects tend to be fluid, so flexible project management skills are a must.

Outside resource 102

The new management at a producer of gas transducers wanted to explore new ways of accomplishing proportional electronic control of pressure in a range of environmental stresses. The engineering department, though a fraction of its on-time max, was extremely well-versed in the technology. LTB, integrating itself into the engineering function, proved to be a catalyst. Present technology development is directed towards order-of-magnitude cost reduction, and elementally new approaches. One patent is pending (the first in ten years), and (at least) three other endeavors are patentable.

The placement of the development team need also be carefully considered. In many manufacturing organizations, the R&D function is placed in the overall engineering function. This has some benefits, but great restraint must be applied lest the R&D function become support for the other engineering tasks. This is a very talented pool and the temptation is great to assign them to sustaining and incremental jobs. Other placements include the marketing function, but similar comments apply. Consider placing the development function at the top line of reports to a senior executive;

president, COO or CEO. While this places yet another report to an already burdened manager, it places this strategic function precisely where it needs to be guided. It also provides the senior executive with first hand knowledge when the time comes to supersede corporate protocols to allow a new technology to flourish. The external resource can be of significant assistance to the senior executive for perspective.

With the team in place the process of innovation is really straightforward. Again, an outside resource is very effective in getting the ideas to flow. Innovation can be taught and developed in each of us. With practice it becomes habit and a way of working. The key is the right motivation and impetus in the right culture and environment.

Motivating developers is easy! A challenge is an effective impetus to start the creative process. One example of such a challenge is to produce one new idea, documented in a lab notebook, per day. This should be a regular part of their duties, complementing their current projects. Make sure the manager and senior developers, including any external resources are always ready for impromptu brainstorming, which are always an opportunity to add excitement to the effort. Encourage approaching every aspect of the working environment with the attitude of 'how else can that be done?' It is in the ideas that new solutions will be imagined.

The ideas should not be limited to technologies applicable to new product design. They should include new processes, new analytic techniques, new distribution channels, new test methods, etc. The more varied the ideas sets, the more innovative the ideas.

The emphasis is on the quantity of ideas. Assume for a moment there is one best solution to any problem. Now try to envision that one solution; that's nearly impossible! Now imagine that you have thought of every possible solution; you have by definition envisioned the best. Now just find it! With the right motivations, it will become easier; invention becomes a way of life. Imagine a group of only 3 developers operating to this standard. If they achieve 50% of this goal and 10% of those are remarkable ideas, you will have 36 pearls to choose from every year.

The most effective method for motivating the generation of ideas is rewarding the inventor with sincere interest from his or her peers and superiors. This is so easy to achieve and so rarely executed. One approach is to have a weekly meeting where the developers can all sit down together and exchange ideas. The ideas should be explained in detail, to the point where one of the other developers can witness and date the idea, see sidebar on lab notebooks. This inevitably creates more ideas on the part of the other developers. The quantity of ideas produced in this feeding frenzy is astounding. Make these 'Ideas Sessions' a special event to build *Esprit de Corps*.

Food for Thought

The most successful Ideas Sessions were those that took place immediately after the inventors were provided lunch. The meal helped the participants to relax with each other, joke a bit, and become receptive to the new and wonderfully whacky ideas that ensued. Further, it supported the sense of team and belonging. These became events looked forward to for the whole week. My chili was a staple, as well as a local BBQ house the fellows found. Our Korean-American member once (only once) brought in Kimchi and Bulgogi. We chipped in and bought a grill and would have hot dogs, hamburgers, etc. Our IP attorney (refer to the sidebar on lab notebooks) treated us to gourmet grillables. The lesson? Invention is easy, it's a heck of a lot of fun, and it tastes good.

On Laboratory Notebooks and Patents

Under the U.S. patent system, an application for a patent must be filed in the name of the actual inventor(s). In the event multiple inventors independently come up with the same invention, only the first true inventor will be awarded the patent.

In most cases, a properly maintained inventor's laboratory notebook is the first evidence of conception. The notebook itself should have permanently bound, consecutively numbered pages and be used by a single person. In making entries in the notebook, it is extremely important to describe the facts supporting the invention(s) in clear and concise terms, including as much detail as possible. In addition, care should be taken to make legible entries in permanent ink and relatively close in time to the work being discussed, preferably the same day.

At the bottom of each page, the notebook owner must sign their full name and enter the date. No changes or additions can be made to the entry after signature. If changes or additions are deemed necessary, they should be made on a new page.

Finally, in order to properly and legally corroborate the entry, each page of the laboratory notebook must be witnessed by a co-worker who is competent to understand the entry and who is not a potential co-inventor in the entry. Witnessing should be done on a daily basis and certainly no less frequently than weekly.

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The disclosure and witnessing is also the first filter. Only the ideas that pass a very simple test should be allowed into a catalog. Keep this first filter very open indeed. On occasion, the idea may not make the catalog, but could be encouraged to go back for more consideration.

The catalog is a method of capturing and formalizing the worthy ideas. This is easily accomplished in a database program such as Access. Each entry should, at a minimum, include a scan of the idea, a short abstract, and some discussion as to how the idea could be applied, possible products, processes and business units to be impacted. This invaluable intellectual property management tool is critical to the success of the whole ideas generation endeavor. This tool should be the primary vehicle for communicating the ideas to the next filter, the managers whose businesses will be impacted. The database also serves to provide a wealth of design tools for the developers.

The radical/disruptive technology is the most robust path to growth and business development. It affords new products, markets and profits in discontinuous trajectories. It is simultaneously the best weapon to assure unique technology offerings in contrast to low-cost offshore product lines. Technology innovation development is easy – provided the right conditions are met and resources applied. This requires the implementation of a few special management skill sets. Once the innovation/growth machine is turned on, the results will be nothing short of startling.

