

INNOVATION IN INDUSTRY

all talk and no action...

Introduction

Having worked for 15 years in industry, I have heard a lot of talk about innovation. That's the buzzword everyone throws around. It seems every company knows they need it, but hardly any of them are able to deliver it, and some do not even appreciate what innovation is. Therefore, I decided to write an article describing what I have seen over the years, trying to identify some of the problems and putting forward some steps to improve the lot of innovation and innovators.

Your first question might be "who is this guy and why does he think he's qualified to write about innovation?" In your shoes, I would certainly ask that question. Unlike many of the people who write books on innovation, (some of them very good books) I am not a professor or other neutral party from a business school writing dispassionately about the topic. Instead, I am an innovator. That's what I am known for and have been ever since my undergraduate days. I am someone who has worked in well-known companies for many years. I have been startled at how important innovation is to those companies and yet how rare it is that they can deliver it. Company after company, project after project, one sees patterns emerge and begins to see how some changes could dramatically improve the success rate. My biography, listing where I have worked, articles, patents etc. can be found in the appendix for those who wish to look.

The article will be divided into three sections. The first one briefly defines what innovation is and why we need it. That should be familiar ground to many, as most companies these days stress the importance of innovation. The second section describes the modes in which innovation stumbles, together with some thoughts, with specific recommendations, on how the problems could be ameliorated or overcome. The last section consists of a summary and conclusions.

Innovation – What is it and why do we need it?

The market does not stand still. Peoples' needs and desires are in a state of flux. In consequence, there is no sustainable, winning formula for being profitable. Even if you have great products today and you make money, that formula will no longer be successful a few years down the road. Either the demands will change or your competitors will overtake you in being able to deliver the product effectively. In fact it has been shown that whenever a company has been hailed a model for others to look up to, those same companies were performing very poorly just 5 years later [1].

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We need to create new products to meet those new needs and creation implies the need for creativity. Often ideas are mistaken for innovation. To quote Levitt:

“ideation and innovation are not synonyms. The former deals with the generation of ideas; the latter, with their implementation.”

So, innovation is the implementation of ideas and we need it to make new or improved products, so that our company can continue to grow and thrive.

Innovation – Why it fails and how to make it succeed

Innovation is like a relay race where every runner has to complete their leg of the race and pass along the baton without dropping it. Instead of runners, there are functions within the company and instead of a baton, there is the project. The project idea may have come from Marketing. R&D will propose solutions, test feasibility and scale up for hand-off to Product Development who will iron out problems for hand-off to Production and then once more Marketing will be given the new product so they can position it for Sales to present it to the customers. Like any chain of events, the whole process is vulnerable at every stage and only as strong as the weakest link. So, one can begin to understand intuitively why innovation is not easy.

For our conceptual innovation relay race, the runners distrust each other, the race lasts several years and it's unlikely that the team will reach the end and win. If the team does win, any medal will be handed only to the anchorman (Marketing).

Having established that the process is delicate, we can move on to find the most common places for the system to fail, why it fails and suggest how to prevent those problems. We will look at each of our “runners” in turn, in chronological order. Anyone experienced in solving problems will know that it is critical to understand and clearly identify the problem(s). Some possible remedies are presented in blue.

Marketing

In the well-known market-pull scenario, Marketing proposes some product or modification that would be welcomed by the market. In my experience this can work, but there are problems. Firstly, in many cases, the Marketing people are too far removed from the customer. It is the Sales people that interact with the customer regularly and best know their needs. Secondly, the project process takes so long that by the time the product is ready, either the market doesn't want it, or the Marketing people who requested it are no longer in their position, so there is no one to receive the fruits of the process.

Problem

1. Marketing is out of touch with the customers
2. Marketing lack Champions to drive the projects through

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3. High turnover means there is no-one to take ownership of the final result

Solution

1. Ensure marketing people have contact to the customers, Dow Corning calls this “line-of-sight to the customer”
2. Assign Product Champions in senior positions with clear targets and enough authority
3. Keep projects shorter and discourage reorganization and unneeded reassignment

R&D

A large proportion of scientists are not interested in making new products and solving practical problems for the consumer. In fact, many scientists look down on any kind of applied research. The Nobel Prizes for science are typically awarded for important work that has no readily apparent benefit to anyone.

“Basic research is like shooting an arrow in the air and, where it lands, painting a target.”

Homer Adkins (Nature, 1984)

Let’s face it. You do not need much skill to hit the ground with an arrow. Hitting a worthwhile target is much more difficult and rewarding. The same applies to research. Applied research is done with constraints on time, practicality, money and safety.

Large companies are havens for scientists to investigate their pet subjects. More and more resources are put into R&D but tangible output is lacking. An ideal company scientist needs a sense of urgency, a pragmatic attitude and the tenacity to drive projects through. These qualities are rarely found within the same person. The three problems I see are:

Problem

1. R&D departments are too large and not focused
2. There is no meaningful way to measure the effectiveness of R&D
3. R&D gets no credit when innovations do come to fruition

Solution

1. Maintain a small, focused R&D that is stable and not downsized whenever the economy falters
2. Identify and agree upon ways to quantify the effectiveness of R&D, for example by benchmarking against competitors or last years’ performance
3. Foster a team approach with recognition and rewards for the successful teams

Product Development

Product development is sandwiched between R&D and Production. The role tends to involve shorter term activities including so-called fire-fighting topics where Product Development helps solve urgent problems arising in Production. Hand-off from R&D to Product Development is a weak link for various reasons. One reason is that the Product Development people are smart technical people who do not take kindly to R&D folks giving them work to do. There is a “not invented here” attitude. Usually, the Product Development people were not involved and consulted with from the outset. They are disinterested or too busy to properly take over the project.

Problem

1. Not involved early on
2. Too busy to take ownership
3. View R&D as competitors

Solution

1. Product development will feel respected and feel ownership if they are actively involved from the outset
2. By feeling ownership, time will be freed for work on the project
3. The company culture has to see innovation as a team exercise

Production

Production people have the task of producing product around the clock without down-time or mishaps. This type of work demands dependable people who can be relied upon not to tinker with the processes they are controlling. The ideal Production person does not want change, as any change involves the likelihood of downtime and generation of scrap. Therefore, it is not easy to get trial runs done on factory equipment. The running production takes precedence because that's what generates profits and what the workers get evaluated on.

Problem

1. Not involved early on
2. People who are intrinsically disinclined to welcome change
3. No motivation to do trials or introduce new processes

Solution

1. Production people will feel respected and feel ownership if they are actively involved from the outset
2. Find those Production people who are willing to try new technology; there often is one
3. Once again, make innovation a team activity with rewards for the whole team

Company and business factors

Having looked at the problems in the process, we now turn to the overall topic of how companies approach innovation. Finding the problem is an essential precursor to proposing solutions. Thinking back over the years I have spent working in R&D and marketing in large companies, I can only think of one example of a truly new product making it to market and that one example is not a success story, but an embarrassing example of how innovation processes utterly fail to work in reality. Given that huge amounts of money are being spent for little to no output, I would like to discuss some factors that stifle innovation.

Priorities and goals

Companies state that innovation is extremely important and yet there is often no sign of that in the way the reward system is set up. For example, I have seen a system whereby top managers (Business Unit Head and above) have their bonuses tied to the number of accidents but not to innovation or new products. Have one minor accident and the head people all lose their bonus and remember, for people on that level, their bonus can be more than their fixed salary. R&D is therefore run in such a way that nothing can get done for fear of creating an accident. This is a huge barrier to innovation. I am not advocating an unsafe working environment. The places I am talking about were already so safe that the accident rate was vanishingly small, they were fighting the law of diminishing returns whereby no matter how much more time and money they spent on “safety”, the benefit would be almost nil. When companies set up their reward systems, they have to do it very carefully because the people will act in a way that maximizes their own remuneration, not in a way that necessarily helps the company. If you need innovation, then there must be bonuses, recognition and rewards for innovation that counterbalance those for safety so that an appropriate equilibrium can be reached.

Risk versus reward

Another manifestation of the reward system being misaligned is apparent when one considers that innovation by its very nature, entails risk. If something is new, then there can be no absolute guarantee that it will work. What is the incentive for a worker to accept the risk of failure associated with innovation? I always say, “in big companies you get punished for mistakes, in small companies you get rewarded for success”. The reason is that big companies have built something that they now have to protect; revenues, market share and so on. Small companies are more nimble, without much to lose so that, if they take a gamble and win, it can affect the bottom line. The message for innovators is clear, if you want to really see your work make a difference and to get recognized for it, then work in a smaller company. The message for large companies is that innovation will not come from within if a normal big company mentality is applied to the innovation efforts. The only hope for innovation is to create small autonomous units in the company or better yet have it

done externally. This advice is in-line with that of Christensen and Raynor in the books *The Innovator's Dilemma* [2] and *The Innovator's Solution* [3].

“In any great organization it is far, far safer to be wrong with the majority than to be right alone.”

John Kenneth Galbraith

Measuring innovation

Many companies have specific targets such as “5 years from now, 20% of our revenue must come from new products”. Of course, what happens is that companies and individuals cheat to meet those goals for example by claiming that changing the color of a product creates a new product. There is no accurate way to measure innovation or its benefits and that has serious consequences. There is no way for R&D to prove its worth, so it is often the first thing to be downsized when times are tough. The result is that when the economic upturn arrives, the company has no new products and is poorly placed to take advantage of the boom.

Project Management Procedures

Project management is often organized using a system with milestones, phase-gates or checkpoints. The nomenclature changes from company to company, but the system remains virtually identical. These systems offer a way for management to feel that they have an overview and that there is order to the innovation process. In reality, these systems offer little to no advantage. Instead of channeling energies into innovating, the resources are devoted to filling out paperwork and learning new software. I am sure that had Michelangelo lived today, he would have been required to spend weeks in safety training and preparation of Gantt charts before being allowed anywhere near the Sistine Chapel ceiling.

“So much of what we call management consists in making it difficult for people to work.”

Peter Drucker

As I have never seen such project management work, I would suggest it not be used. It may well be invaluable for some types of predictable project but is unsuited to innovative activities. Some effective ways to reduce the burden of gate processes are given in the book *Developing Products in Half the Time* [4].

Generating ideas

Some people naturally have more ideas than others. Some accept the world as it is and others are always looking for a better way to do things. However, there are tools to eek ideas from all types of people. I have seen them in action and they do work. Brainstorming is one very well-known method but there are many others as described in books such as *Thinkertoys* [5]. Even those who don't consider

themselves creative will not only be able to have ideas, but they can even have fun doing it. With such tools, everyone can contribute somewhat to the idea pool and feel involved. Even so, I do not believe such tools can create a star innovator. The true Innovator who delivers world-class ideas is very rare and cannot be created through training. Ideas are created by questioning the status quo, therefore these idea people are non-conformists and need to be managed differently. Due to their rarity they need to be sought out and rewarded properly.

“The opportunities of man are limited only by his imagination. But so few have imagination that there are ten thousand fiddlers to one composer.”

Charles F. Kettering

Filtering

“The best way to have a good idea is to have a lot of ideas.”

Linus Pauling

Now that we have plenty of ideas, we are ready for the next step. Filtering the ideas is crucial. This part can make or break the process. An experienced person is needed. That person needs to know what the state of the art is so they can judge what is new and what is not. They also need a feeling for what the probability of success is and the time / resources needed to realize the idea. It is not so hard to find a person who is a dynamo for idea generation. However, a person who can down-select the feasible ones is rare and valuable.

Financial aspects

“There is no greater barrier to innovation than a paid-off plant.”

That is a quotation from a conference presenter from a large chemical company. It generated a good laugh from the audience because we could all identify with it. Just a few decades ago, all things technical were new. Every experiment generated a new result. Some of those new inventions were commercialized and now huge, world-scale, plants exist to produce hundreds of thousands of tons of product per plant. This has some seriously negative consequences for innovation today. Any new idea is competing against processes that have been honed for decades. Furthermore, in order to be competitive, you would need to install a world-scale plant to get the same economies of scale already enjoyed by the incumbent product or process. In the real world, no-one would take the risk of making such an investment because of the expense and the risks. So, even if you invented something slightly better or cheaper, it would not be implemented.

Geographical influences

My career has been in Europe and the USA. In those countries, there is a strong reluctance to trying anything new. The companies will not try a new idea in their factory, even if you are trying to get the trial done in the very company you work for. They want you to first prove it elsewhere before they will test it. Of course this means these companies end up being followers, not leaders. One way around this paradox is to go to countries where the people are more open to new ideas and the processes are less established. For example, it is possible to get trial runs done in dynamic countries such as India, China, Mexico and South America. Then, once the concept is proven, it can be validated and implemented in conservative locations such USA and Europe.

Effect of economic climate

The economy swings back and forth between boom and bust. Although we tend to think of it as a bad thing, in fact, it is natural and probably inevitable. If a plant were to produce flowers all year, there would be no time for it to recoup its energy and the plant would die. In much the same way, an economy cannot grow at full speed indefinitely. Instead, it fluctuates. For example, the Dow Jones Industrial Index (adjusted for inflation) has cycled up for 17.5 years and then down for the same amount of time since its inception in 1920. According to that pattern, we cannot expect the economic recovery to begin until late 2017. Although that may be bad news for stock market investors, it is not necessarily bad from a holistic point of view. During boom times, innovation is hard to accomplish because all efforts are focused on production. If you need resources they may not be there. R&D staff are sidetracked into "fire fighting" activities. When scaling up, you need to run trials at the factory. That means shutting down production and losing profit just to try out your new product or process. Such trials are very hard to schedule when times are good. Who wants to lose money when you could be making it instead? The slow economic times allow companies to hunt for new technologies and opportunities. These are the buds that can then flower once the upturn arrives. The companies that prepared most diligently will be those that emerge fastest and strongest on the next cycle.

Unfortunately, companies (like stock market investors) tend to act in just the wrong way. They hire too many R&D staff when times are good and then fire too many when the downturn comes. A small, stable R&D is far more effective than one that experiences large swings and reorganizations. One cannot fight the natural cycles of the market. Instead we need to base our plans and strategies around them. Instead of cutting R&D as soon as the bad times arrive, we should keep a smaller R&D of a size that is sustainable through good time and bad.

Time and timing

Neither technology, nor the market, stand still. The goal is to track (or predict) what the market wants and what is technically possible and match the two. An idea could

be too early or too late. Too early to be technically realizable (e.g. a time machine) or too late to satisfy a market need (an idea for a new horse-drawn carriage). So, the idea needs to hit that opportunity window and the project has to deliver the product before the window closes. Projects are often run too slowly to hit the window. It has been shown that projects can be run much faster [4]. Relatively simple steps such as starting a new project immediately, rather than waiting for the new budget year, can dramatically reduce time to market. Other measures included running activities in parallel, allocating more resources and identifying risks at the outset.

Employees

The section on employees is last for a reason, namely, that it is the topic left until last in the business world. Although companies like to use the cliché “people are our most valuable resource”, I have yet to see that properly reflected in the way the employees are selected or in the way in which they are treated.

Many personnel departments see it as their job to fill positions quickly and at the lowest cost to the company. The people are viewed as Lego® pieces. If one is lost, it can easily be replaced by another, essentially identical unit. In some companies, the average employee may only stay a year and in others several decades is common. In either case, employing the right people is vital and yet overlooked. We can all understand intuitively that having talented people is a good idea. Yet, who takes the trouble to define what we mean by talented? How do we identify these people so that we can both *attain* and *maintain* an edge? Firstly, let us define talent as it applies to the employees' ability to contribute to the company.

Talent = initiative x drive x ability x focus

but

**Productivity = initiative x drive x ability x focus
selfishness**

The words used are fairly self-explanatory, nevertheless it is worth defining them. Initiative defines the ability and willingness of a person to identify a task that needs to be done and set about doing the task. A worker can still be effective without this quality because a manager can provide the initiative / direction for them. However, drive, ability and focus are all required for a worker to be effective. A lack of even one of those, renders the person unable to attain results. Drive is the overall energy level of the worker. Ability is their intelligence, knowledge in their area and problem solving capability. Focus is their propensity to remain on task without becoming distracted. Lastly comes selfishness. Selfishness in this context relates to the motivation of the worker. Are they working to further the goals of the company or are they only interested in furthering their own goals? Human nature dictates that most people will have some tendency to look after themselves and that must be

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tolerated to a reasonable extent. However, a proportion of people would sabotage any project or goal for personal advancement. This selfish behavior is doubly harmful because it destroys both the work of the whole team and the morale of the workers.

So, now that we know what qualities we value and those we wish to avoid, how then does one ensure that the employees are selected from the desirables? After all, if we were able to recruit an above average staff then we could expect superior results. Simple statistics dictate that any corporation of reasonable size will end up with a distribution of talent that approximates the mean. Some big corporations like to believe that their workers are above average. Unfortunately for them, both the theory and the practice show that to be a fallacy.

The answer is surprisingly simple and I have seen it work. There are simple, twenty minute personality tests available for use in the interview process that allow the qualities of a person to be identified. I have been tested in the past and the results were remarkably accurate. What is amazing is that corporations are prepared to invest in a person for 5, 10 or 20 years but not prepared to spend 20 minutes to make sure that they are making the right choice, or at the very least, improving their chances of making a good choice. Simply put, it is outright negligence. By applying due diligence in the hiring process, high quality team players can be found and bad apples can be avoided.

We must abandon some of the traditional ways to select employees. For example, good grades alone are poor indicators because they do not show ability to work with others or to work under pressure. In some places, a candidate with successful parents is preferred. In others, handwriting is analyzed and used as a selection tool. These are also examples of ineffective selection criteria.

Innovators

My advice for truly innovative people is to get wide experience for example at an institute where you get exposure to the problems of many companies and where you can build contacts. Also get experience of the corporate world and mindset. Concentrate on identifying the true problem then use your wide experience and contact network to solve it. Know your own abilities. Do not even start projects that are impossible or overly difficult. Do not stay in a large company unless you have a very good boss and are recognized for your work. It is far better to work in a small company or start your own company / consultancy firm, possibly in partnership with someone who has business skills.

Corporations

Companies view the R&D unit as a necessary evil. They need to spend money on it to make it appear to the stock holders that they are innovating and a bright future lies ahead. Then, because there is no effective way to prove what the R&D is bringing to the bottom line, it is the first thing cut in a downswing. To make R&D

work, you need top level buy-in. Look at Apple for an example of what a difference that can make. A modest R&D staff is needed and it should be kept at a sustained level in good and bad times because the key people cannot be replaced once lost.

Future Trends

Virtual Marketing

It is self evident that in order to develop and sell products that the market wants, you need to have information and preferable hard data on the market status and demands. In real life, that is easier said than done. In all my years, I have seldom seen any hard market data presented to back-up the decision making process. Even the Marketing department often acts on gut feeling with no factual basis for the direction taken. If there is any data it is probably from an expensive, outdated market report, which may, or may not, be accurate. Most likely, it will be a best guess as to the market make-up and growth rate. In most situations accurate data is impossible to get.

Access to real, up-to-date market information is now possible through internet / virtual marketing. A shining example is SpecialChem / Omnexus. Through their web site they draw in hundreds of thousands of members from the plastics, additives, adhesives and cosmetics industries. They know the profiles of these members and can target them with relevant information. When the customer interacts by browsing pages, completing questionnaires, downloading documents or viewing webinars, that data is used to gauge the level of interest and areas of interest of the members. This information can be accessed through SpecialChem and provides hard data on the needs and of the market. This new way of working is set to replace the antiquated printed report system and open the path to better, directed, product development and marketing.

Open Innovation

A growing and exciting trend is outsourced idea and solution generation as provided by companies such as Innocentive and NineSigma. This allows a company to access ideas from hundreds of thousands of individuals all around the globe. Industrial problems are posted with the identity of the poster kept confidential. The open innovation company acts as intermediary, helping the poster to frame the problem and with transfer of intellectual property between the winning solver and problem poster. Only the winning solver, if there is one, gets rewarded, typically the rewards are in the range \$10 000 to \$100 000. This method of problem solving has several significant advantages over maintaining a large R&D department. For one, it is preferable to make a one-time payment for a solution that has been judged valid than to pay continually for R&D personnel who may or may not provide an answer. Secondly, there is access to a much larger pool of people, from many countries, backgrounds and disciplines. The large number of solvers and their diversity are plusses. This new way of working compliments the company R&D rather than replacing it. After all, the company still needs experts there to judge and validate the proposed solutions from competing solvers.

Another underused resource is the use of consultants. Much of the World's top talent is retired and their services can be purchased for very reasonable expenditure. In many industries, the same topics cycle through over and over again. Having access to someone who knows the history of the technology can be invaluable to give clues and to prevent companies from repeating their mistakes. As staff turnover has accelerated over the decades, the corporate memory has almost ceased to exist, so using people with experience is more vital than ever.

Conclusions

As we have seen, innovation is both crucial and illusive. Corporations know that they need innovation to bring them new products and to maintain growth. Individuals try to deliver the innovation their companies ask of them and yet no matter how hard they try, they see no new products actually making it to market. We have identified some prevalent problems and put forward some remedies.

The lack of fruitful innovation stems from the fact that companies fail in nearly every aspect of the process. Namely, identification of market needs, proposing technical solutions and running the projects are all mishandled.

Firstly the companies are out of touch with the market and its demands for new products. This can be ameliorated using near real-time internet marketing tools to get up-to-date, targeted information.

Proposing technical solutions to meet the market needs is the role of internal R&D staff whereas it is much more effective to access the global pool of ideas available through Open Innovation. Why have the huge fixed cost of a large internal R&D function when you can have more and better ideas with variable cost?

The project process is run like a relay race where the project is handed off between corporate functions. There is no real ownership of the project and the "baton" is usually dropped. A better approach is to use highly placed champions to spearhead innovative activities and maintain continuity throughout the process. Using proven, modern methods, to accelerate product development, one can get the products to market in time to meet the market needs and opportunity window.

The bad news is that your company probably is not delivering to its potential for the reasons described. The good news is that the competition are no better, so that implementing some or all of the measures proposed will lead to a huge competitive advantage and at reduced cost.

Biography

Dr. Chris DeArmitt
FRSC CChem



As President of **Phantom Plastics™**, Chris provides consultancy and training services to the plastics industry. With years of experience from leading companies such as BASF (Germany) and Electrolux (Sweden & Italy), as well as a small start-up company, Hybrid Plastics (USA), Chris has a wealth of technical knowledge and international experience.

A recognized expert on plastics, composites, materials and additives, Chris has given innumerable invited lectures, workshops and web seminars, chaired conferences and has over 40 patents, papers and book chapters to his name. Most recently, he was commissioned to write two chapters for the Plastics Engineering Encyclopedia.

In addition to technical expertise, Chris is a renowned innovator. He solved a major technical production problem that had confounded BASF for over 30 years. This was followed by the invention of a new class of smart materials, namely plastics that change opacity reversibly with temperature. In 2007, 2009 and 2010 he won substantial cash prizes for solving Innocentive open innovation industrial challenges. As well as his more established seminars and workshops in the plastics field, Chris now lectures to share his insights on innovating in an industrial setting and how to overcome obstacles to success.

Chris obtained his BSc, MPhil and PhD from the University of Sussex, UK. He is a Fellow of the Royal Society of Chemistry, a Chartered Chemist and a member of the SPE.

For more information visit: www.phantomplastics.com

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