

Increasing Pace of Innovation: The Innovation Cube Model

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Abstract – Innovation is the essence of humanity’s progress. Well-known internal corporate R&D and innovation centers like AT&T Bell Labs and Xerox PARC have been quite prolific in generating new innovations in post-World War II era and even received a number of Nobel prizes.

Interestingly, it is often not possible to always count on internal innovations: big companies need to source new technologies and ideas from outside rather than trying to develop it all internally. GE’s inability to stay ahead of rapid changes got highlighted in 2018.

Internet exponentially enhanced the pace of global innovations. With lower entry barriers and relatively easier availability of financing, innovators are increasing in numbers. In fact, new out-of-the-box innovations are emanating from smaller entrepreneurial startup organizations.

‘Innovation Cube’ is offered as a visualization tool to help refine the annual and longer-term strategic vision for a company in conjunction with recommendations regarding ways to source, develop and leverage radical innovation versus Incremental/Evolutionary Innovations.

Keywords: Innovations, R&D, Start-ups, Innovator’s Dilemma, Incumbent’s Curse, Innovation Cube

I. INTRODUCTION

BIG businesses since the 1990s, have been moving away from large central R&D investments and beginning to experiment with new business models and organizational approaches to innovation. However, how best to optimize investments in innovation while staying ahead of the competition, especially new entrants, continues to elude large corporations.

Discussions about Innovation are increasingly diverse and often the term “Innovation” is used to mean different things in different contexts. Booz & Co [1], McKinsey [2], Christensen [3,4], Chesbrough [5, 6], and Muju [7], they each define innovation and types of innovation from various perspectives, each relevant in its context.

To address the central message of this article we will adopt the three segment groupings based on scope and impact, KPMG [8],

- i. *Incremental innovation* - high levels of certainty about business environment and typically about making small changes to existing products/services/business models,
- ii. *Evolutionary innovation* - moderate amount of uncertainty regarding business environment and represents extension to existing products/services/business models, and
- iii. *Breakthrough or Radical Innovation* - involving high levels of uncertainty about the business environment and represents significant departure from organizations previous products/services/business models and could even lead to industry-level disruption.

Big businesses do well when they nurture and provide a suitable environment for conducting evolutionary and incremental innovations. However, various R&D models of the post-World War II era have shown that the benefits company derives out of internal revolutionary innovation efforts is spotty at best and rarely sustainable. Well-known internal corporate R&D and innovation centers like AT&T Bell Labs and Xerox PARC have been quite prolific in generating new innovations in post-World War II era and even received a number of Nobel prizes. However, the benefits accruing to the parent company have not been sustainable from a business stakeholder perspective inevitably leading to repurposing or spin-offs of these R&D units.

II. PACE OF INNOVATION

As we stand at the cusp of Industry 5.0, we cannot help but notice that the pace of innovation has been increasing in our own lifetimes. Homo Sapiens, our ancestors, are believed to have first evolved in East Africa about 200,000 years ago, Harari [17]. For about 200,000 years prior to the invention of the light bulb, innovation was relatively slow because humans could be productive only during the daylight periods and also geographically very localized within the small close-knit groups with virtually no communication with outsiders.

The invention of the light bulb suddenly doubled the potential human productivity by making it possible to continue working even during evening hours. With electricity and the telegraph inventions, the communications to farther lands and across

the seas increased which further increased the pace of innovation with the possibility of idea exchange between peoples that had never known each other. The 100 years after light bulb saw unprecedented innovation across the world but still somewhat restricted to their geographical pockets of nation states and relatively slower communication speeds compared to today and then came the Internet.

The Internet along with mobile cellular inventions yet again revolutionized our productivity through instant communications across the globe and the possibility of complete transformation of global business processes from the way they were before the Internet.

Consumer products and Healthcare industries are at an exciting juncture right now. With analytics, cloud, mobile tools, open APIs, apps, and so much data is being generated and many applications of Artificial Intelligence and Blockchain and Internet of Medical Things (IoMT). Slower Clock-speed industrials are also beginning to adapt to digitization and starting to utilize AI/ML, autonomous robotics, Blockchain, IoT, etc. in taking things to the next level. However, a majority of these innovations are in the realm of the better use of data or “information”, they are not necessarily generating new scientific knowledge *per se*. Also, lot more of these new out-of-the-box innovations are coming out of smaller and entrepreneurial startup organizations rather than big corporations despite having significantly greater resources at their disposal.

Bernard Munos [9] comments regarding Big Pharma’s Freshness Index that in 2012 “the top 13 big pharma reported the sales of 314 products, representing 79% (\$309 bn) of their pharmaceutical sales (\$391 bn) ... only 10% of sales from reported products (\$32 bn) came from drugs approved since 2007, and only 48% (\$150 bn) from drugs approved during the last 12 years, which approximates the effective patent life of medicines. Paradoxically, the majority of sales from pharma’s biggest products (\$159 bn) come from drugs approved before 2001, that are either generic or about to become so.”

Further, Jim Carroll [10] wrote “big pharma’s 10 biggest companies spent \$50 billion on R&D last year. For that sum, they could buy the entire US biotech industry, excluding the top five companies. Yet, nearly 75% of all newly approved drugs approved came from small biotech labs.”

III. INNOVATOR’S DILEMMA

On the other end of the spectrum, boot-strapped start-ups are continuing to upend established corporations even in other capital-intensive industry segments like the Telecom industry. Ubiquiti [11] is of particular interest. Ubiquiti’s founder Robert Pera used to be an Apple employee and left Apple to work on his own startup idea out of his apartment and in a matter of years grew to hundreds of millions in annual revenues. How did Apple miss this opportunity? More importantly, why did Apple miss this opportunity? Perhaps it is the Innovator’s Dilemma [4]. Perhaps it is a result of the tendency to become risk averse with increasing success [7, 13], the so-called Incumbent’s Curse [12].

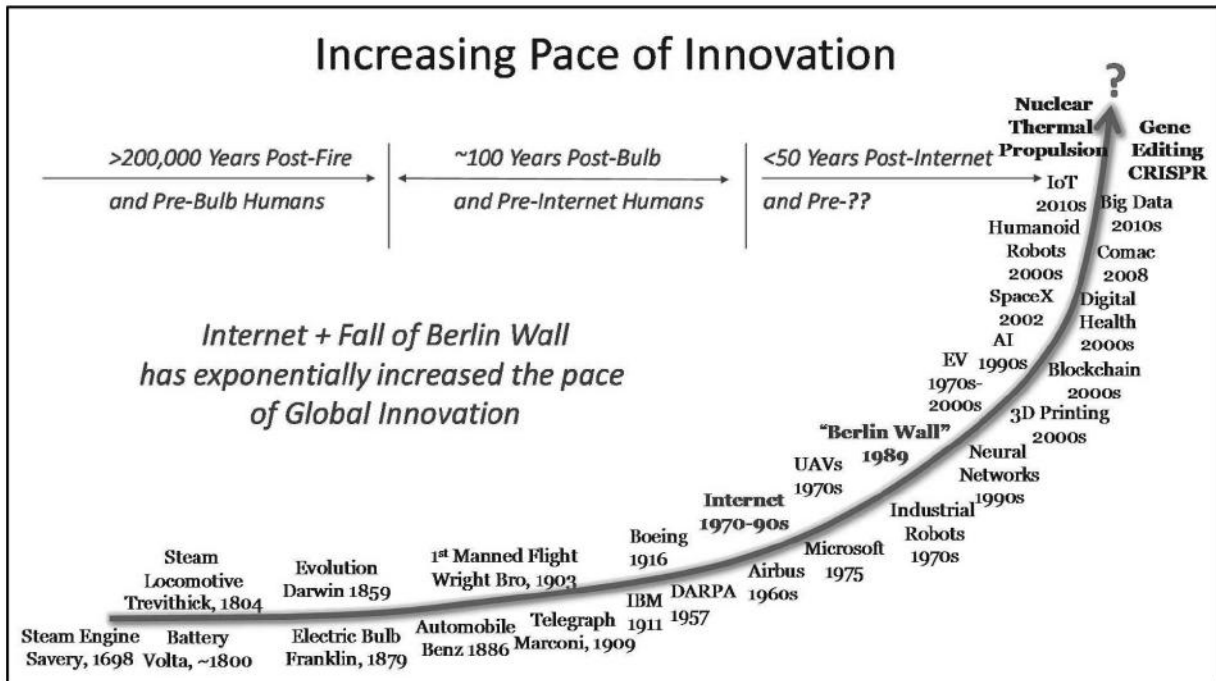


Figure 1. Increasing Pace of Innovation (© Sandeep Muju, 2018).

The Ubiquiti-Apple scenario is not a unique example in this recent generation of entrepreneurs. How did Microsoft or Apple, and especially Google with a virtual hold on internet mapping and search, miss the Mobile GPS Application idea that the startup Waze capitalized on? Waze won the Best Overall Mobile App award at the 2013 Mobile World Congress. Within a few years of its existence, Waze is now valued over \$1B. Other similar examples include AppDynamics, the brainchild of Jyoti Bansal, an IIT Delhi graduate who initially bootstrapped the idea himself and eventually sold to Cisco for \$3.7B in 2015 and the 2018 acquisition of Bangalore-based Sigmoid Labs by Google.

These scenarios with otherwise very successful entrepreneurial companies like Apple, Google, and Cisco further support that even for otherwise entrepreneurial and successful companies, it is often not possible to always count on internal innovations and need to also partner externally or source new technologies and ideas from outside rather than trying to develop it all internally.

As a new high growth company bringing successful product or service to market, it often needs to keep an eye on improving the quality and/or features of their first-generation offerings as well as try to generate sufficient returns to be able to payback early investors and stakeholders. That automatically puts a burden on their capacity to continually invest in radical innovation and rather focus on the incremental and evolutionary type of innovation to generate greater returns for their emerging portfolio. In some ways, Ubiquiti and Waze are simply *Deja Vu* scenarios where once Microsoft and the Apple in their startup days had similarly upended established companies like IBM and Xerox, and now are beginning to experience the incumbent's curse themselves.

The evidence continues to point towards a continuation of this cycle of rise and decline, and over the long-run historically there is virtually no company that has been able to sustain its leadership position when it comes to radical (breakthrough) innovations, even in their own sphere of competencies. Case in point, General Electric has been one of the most admired large corporations during our lifetime, an original member of the DJIA in 1896 and a member continuously since 1907. Yet, in 2018 GE's 111 years run on the Dow Jones Industrial Average came to an end, signaling a significant shift in US economy and GE's inability to stay ahead of those changes.

IV. THE WAY FORWARD

So, what is the solution? One usual prescription is to focus on transforming the organization into a nimbler and innovation-oriented culture that is continually evolving. The more important question though is, is that really what is needed or appropriate? And if so, to what extent and how to go about it? When it comes to the incremental and evolutionary type of

innovations the organizational practices, reward systems, and performance management processes should, in fact, be such as to encourage open-minded innovation-oriented company culture. However, trying to transform an entire organization for encouraging revolutionary or radical innovation is a losing proposition.

For a big business trying to pursue revolutionary innovation, in-house is like having a Clydesdale also compete with Thoroughbreds in horse racing. It may simply not be their internal core competency.

In immediate post-World War II era size indeed mattered and vertical integration was common. Markets were arguably viewed more based on national boundaries rather than global reach. However, in the past quarter-century of internet age with an abundance of available information and easy exchange of ideas, there is an increased focus on specialization, core-competencies, and globalization. Further, in this global market with lower entry barriers and relatively easier availability of financing, innovators are increasing in numbers [7].

Changing the organizational design by setting up multiple R&D centers around the globe is a prudent step for driving local-global aspects to incremental and evolutionary products and services portfolio. However, it still suffers from the same issues relative to revolutionary or radical innovation.

The solution lies in revisiting the basics, the core-competencies, and entrepreneurialism. What big companies need to do is to look at their revolutionary innovation investments through the emerging startup innovator's perspective [13]. An innovator-oriented approach to the radical innovation, and instead of necessarily conducting it internally having an "outside-in" orientation with an eye on their core competencies. There are already millions of outside innovators including, entrepreneurs, startups, contract research organizations, and university office of technology transfer type external innovators conducting cutting-edge R&D or testing radical business models that one can source from and develop early-stage radical innovations. Revolutionary innovation, in the long run, is better sourced, managed and perhaps co-conceived externally until it is ready enough to be brought in-house for further development and commercialization.

These outside innovators are likely to be more motivated and insightful on the ideas they have, suggest or are already pursuing. Internal R&D staff will typically look at all radical ideas through their own areas of expertise and organizational constraints risking insufficient insights or personal specialization drift. Also, outside innovators can and will take more risk, primarily because their rewards are directly linked to the success of the idea or innovation they are working on. Further, Big company's past successes give rise to increas-

ing expectations and a tendency for risk aversion [7, 13] as often the performance management systems become geared towards rewarding consistency in results rather than generating disruptive gains.

Internal employees even when very well rewarded will invariably lack that level of direct risk-reward incentive linked to a particular radical innovation that an entrepreneur or smaller innovator has. Further, a Big company's R&D or innovation group no matter how big will invariably not be able to continuously match the new skills specialization needed over time especially in fast-moving technologies nor can they induce its internal staff to the level of enthusiasm that exists in millions of new and upcoming entrepreneurs or innovators on a sustainable basis. This is the play between experiential learning versus the current know-how related to new to the world technologies.

In the context of Breakthrough or Radical Innovation, we are in agreement regarding some of the Open Innovation [5, 6] type approaches, especially in early stages of the innovation's life-cycle. However, a carte blanche Open Innovation approach may not be optimal, especially for Big businesses.

Where we differ from the Open Innovation type models is that we are recommending Incremental and to a large extent Evolutionary Innovations are best conducted by Big companies themselves. This is based on a combination of core-competency and market leadership considerations. Generally, incremental and evolutionary type innovations lie squarely in a Big company's realm of core-competencies and existing successful business models. Also, it is strategically important for a Big company to maintain a first-mover advantage in their existing space and so incremental and evolution type innovations are more prudent to be advanced internally rather than opening up their near future market launch portfolio to competitors and new startups too soon.

A caveat in the high-stakes radical innovation comes from government-funded research and innovation. Government contracts are funded via taxpayer funds directly or via military contracts and tend to be oriented towards deep scientific discoveries and "cost+" scenarios as the motivation is not to maximize returns rather maximize benefits to the government or the taxpayers. The objective of government funding usually is to invest in early-stage R&D that a typical commercial company may not be willing to invest on its own but may be able to commercialize it once basic research looks promising.

From a broader societal benefits perspective, governments invest in high-risk early-stage technology development such as ARPANET the predecessor to the Internet, Hypertext system a precursor to GUI, NAVsat predecessor to GPS, etc. These

were eventually leveraged by commercial businesses once the commercial viability becomes clearer. Such government and/or pseudo-governmental funding mechanism is, in fact, an excellent source of early-stage radical technologies that commercial organizations can and should leverage, provided they have the ability or desire to comply with additional government regulatory processes and disclosures. Whether such government investments are efficient enough is arguable and not subject of this paper.

V. INNOVATION CUBE

Further, we are also recommending looking at innovation not simply as one homogeneous business process but through multiple perspectives, such as in the form of an Innovation Cube. Leveraging the optical similarity to the Rubik's cube [14] we are proposing to look at Innovation multi-dimensionally in terms of (a) the innovation spectrum (Incremental, Evolutionary, and Revolutionary) and (b) the three core pillars of innovation in business environments (Technology, Internal Operations & Processes and Business Models).

Technology can be in the context of a new product invention or discovery of a new phenomenon by employing formal scientific techniques. More broadly, technology is not exclusively the product of science, but also about the application of existing technology or scientific know-how to new spheres of applications such as the application of space technologies in the medical field. Internal Operations and Process refers to the internal working (the cost side) of a business that allows it to take an idea or proposal and convert it to something that a customer is interested in, whether it is a physical product or a service. Business Model in the classical sense refers to how the company will go about generating revenues and make a profit leveraging its Internal Operations and Processes and Technology.

Organizational structure or organizational design is an aspect that could be viewed as either part of Internal Operations and Processes or the Business Model, depending on its context. For example, if used in the context of setting up global R&D or Engineering centers as back-office say in India or China primarily for purpose of servicing the parent company say in US or EU, then this organizational design would be a part of Internal Operations and Process as it is primarily cost or resource centric. On the other hand, if such global centers have independent revenue mandates then this organizational design may be viewed as part of the Business Model. So while the Business Model and Internal Operations and Processes must work synergistically the former is oriented towards revenue generation aspects while the latter towards cost centric aspects.

VI. CONCLUSION

In conclusion, similar to how one can rotate the Rubik's cube in three dimensions, we are proposing visualizing rotation of

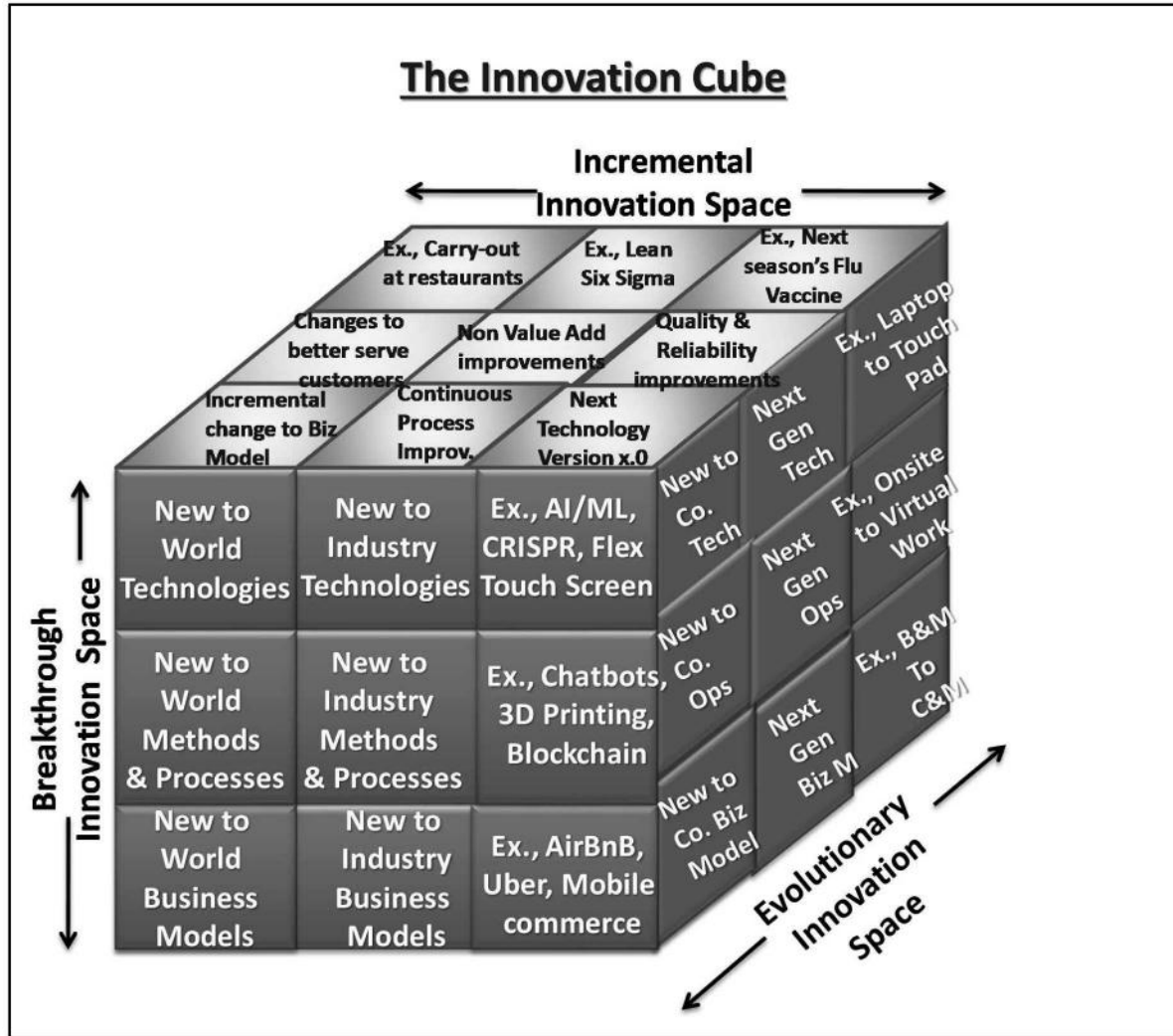


Figure 2. The Innovation Cube [18].

the Innovation Cube facets to mix-n-match and arriving at a holistic innovation landscape (portfolio) that is most relevant and optimal for the company as well as their near-term and longer-term objectives. Most Big companies do not need to or for that matter have the capacity to be working on Breakthrough innovations in all its ramifications. By definition, the Big companies have become “Big” because they have been successful at certain things and have developed certain core-competencies.

This Innovation Cube is a visualization tool that offers to help refine the annual and longer-term strategic vision for the company in conjunction with our recommendations regarding ways to source, develop and leverage radical innovation versus Incremental/Evolutionary Innovations. A novel and structured approach to the broad innovation landscape, while keeping an eye on the company’s core-competencies, organizational development, and future market leadership aspirations.

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