

Collaborative Contract Research / R&D Outsourcing in India

The Gap and the Solution



Dr. K. Subramanian
Executive Director R&D
Powergear Ltd. Chennai
, subramanian.k@powergearlimited.com

Introduction

There is a common belief in India and some parts of the world that most research is performed at universities or educational institutions and that industry is merely a receiver of the output of the research performed at these institutions in order to commercialize the outcome. While this notion may be true in part, it accounts for only a small fraction of the research performed. A very significant amount of Research & Development actually happens entirely within industrial entities for their own specific requirements. Why is this so? If educational institutions have the skill, infrastructure, low-cost labour and Government support to deliver R&D, then why is all R&D not outsourced to them and why does significant captive R&D happen within industry? Given that there exists such a gap between industry and academic entities, what can and is being done to effectively close this gap? We will dwell on these issues in the paragraphs below and potentially shed some light on the R&D outsourcing scenario in India and the world.

The problem

The way most Government R&D grants work, the funds are either provided entirely to academic institutions or provided under the condition that industry will cost-share about 20%-50% of the total funding requirement. In other words, the Government provides a portion (typically equal or a majority) of the R&D funding to the academic institution while industry needs to support the balance. The rationale behind this scheme, presumably, is that industry gets to do subsidized research at the academic institution towards their own R&D problems and academia gets to work on applied problems that are relevant to the industry. While the intention is noble, the assumption behind this process is fundamentally flawed. It is quite obvious that the thought process behind these schemes springs from the root assumption that academia need to feed R&D to industry and the assumption that R&D can be effectively realized in this mode. The major flaw arises from the fact that in these schemes, R&D performed within industry is not specifically encouraged. **There is an entire ecosystem where R&D is performed “by industry” “for industry”, which is ignored in these schemes, especially where such R&D can immensely benefit from Government participation.**

My own personal experience as a scientist has naturally started in the academic world, that I have immense respect for. Where else would a student learn the fundamentals which are the precursors of all scientific knowledge, when industry has neither the time, resource nor motivation to impart such knowledge? Having reaped the benefits on rigorous academic training via a PhD, I however quickly realized that industry is an entirely different entity to deal with. Academic knowledge barely scratches the surface of what industry expects and in many cases, does not train one sufficiently for the real world. Timelines and deliverables take on a new dimension in industrial research. Though this may sound trivial, it should be appreciated that the phrases “R&D” and “timelines” do not often occur in the same sentence as research is viewed as an exploratory activity that should be accommodated within flexible schedules. Industry insists that path-breaking research be performed within a short to medium time frame, beyond which it is potentially useless to the market.

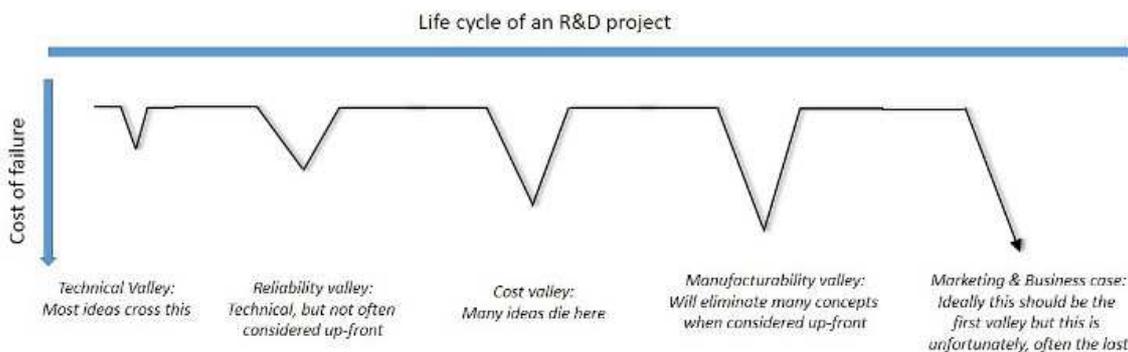
Likewise, industrial research takes on new dimensions such as cost, reliability, supply chain and manufacturing. Though these terms do not sound like research criteria, imagine a situation where someone invents a new material and later realizes that it is prohibitively expensive for the application. The effort involved in going back and re-engineering the material is equivalent to working on an entirely new project starting from scratch. Industry forces its scientists to consider the entire business case as a criterion from the beginning of the effort – in fact, in many cases the commercial case needs to be

presented well before any technical development even starts. Reliability, or lifing, is a similar trap. It is very possible for scientist to go down a technically valid path that ultimately results in a wonderful lab-scale demonstration but not robust to failures in actual usage. Reliability can make or break the entire R&D exercise unless it is analyzed up-front and again throughout the course of the project.

For all these reasons and more, it has proven more difficult for academia to provide R&D that can seamlessly transition into industrial product. Many companies have hence withdrawn into a shell of sorts where every company has setup its own R&D lab if it can afford one. The benefit is clear. In spite of the enormous investments required in creating these R&D facilities, the benefit is worthwhile in the fact that the team of scientists is closely tied in to the product teams. Hence product requirements are paramount in the research performed while the associated technological innovations directly serve product purpose. Thus a captive, focused team of applied scientists can work wonders for the future of the company, assuming they are well-funded. The word “captive” brings us to another key difference between academic and industrial perspectives on research. Academia has the non-selfish intent of propagating its research throughout the world via publications. Industry, on the other hand, largely refrains from such knowledge sharing. While sharing certainly helps accelerate the overall rate of research, it creates conflicts with Intellectual Property. Industry typically believes that it should own the research funded by itself, which incentivizes itself in the long run to innovate more. Both viewpoints, in this case, have their advantages.

An industrial entity attempting to outsource R&D to an academic institution, therefore faces the following key issues: There is often a lack of seriousness on timelines, compounded by the fact that the work-force is a floating population with commitments outside of their projects as well (such as classes for students). There is resistance to sharing Intellectual Property rights as IP prerogatives are widely different on either side. The combination of these factors results in a serious gap in academic R&D output as many of the above mentioned factors have not been thoughtfully considered – as a result the R&D is not ultimately useful for product. Often, there is ignorance among researchers in factors such as supply chain and manufacturability. The invention may be so interesting (read “exotic”) that a supply chain may not even exist for volume production. Manufacturability considerations including usage of standard processes, production yield and quality issues often take a back-seat in favour of technical achievements, which is very hard to correct at an advanced R&D stage. Consider Figure 1 showing the various “valleys of death” that a technology goes through before it can mature. It is interesting to note that the technical hurdles present only a fraction of the risks involved. Most research projects, in fact, cross the technical hurdles but fail at one or all of the other valleys.

Fig.1 Valleys of Death from Concept to Manufacturing



Another critical function provided by academic institutions is the training and providing of skilled talent to the industrial work force. Here again, there are deep shortfalls due largely to the gaps mentioned above as the same reflect in the way students are trained. Industry often has to impart significant training to its fresh graduates to make them useful in the real-world.

The Solution

The gap between academic output and industry requirement is plainly obvious and is killing the R&D eco-system, which begs the question as to what can be done to bridge this gap. **The answer lies simply in placing the words “R&D” and “industry” in the same phrase and therefore facilitating the creation and funding of industrial R&D labs.** These are R&D entities that are owned entirely under an industrial umbrella but not necessarily performing captive research for their

own products. Why does this solve the problem and quite efficiently at that? Such an industrial R&D entity would have both the necessary research skills and also a complete understanding of the rigour required to take research all the way to product. They would gain trust from an industrial user quite promptly. Thus the existing gap between academic research and industry requirements would be aptly filled. Not only that, such an industrial R&D lab would serve the purpose of providing R&D solutions for many small and medium enterprises as well, who simply don't have an internal R&D setup but need an industrial partner to make innovations happen.

An industrial R&D lab would have the following aspects working in its favour:

- A full time dedicated staff of scientists who do not have work commitments beyond their assigned research projects
- Well-paid staff, who do not need to conform to Government pay scales
- Multi-disciplinary skills under one department. As the saying goes, innovation happens at the intersection of disciplines, hence ensuring that different disciplines integrate seamlessly is of vital importance.
- Very flexible IP sharing terms, or in many cases, complete transfer of IP to the client
- Tightly integrated with on-site supply-chain staff, marketing staff, quality personnel and manufacturing facilities thereby resulting in much higher probability that the R&D is successful and manufacturable

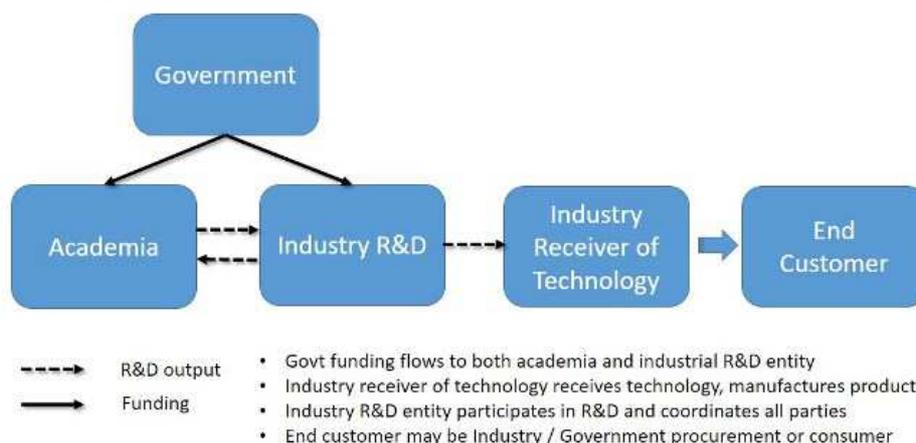
On the other hand, the following disadvantages present themselves:

- Higher R&D costs as salaries and overheads are higher than academia
- Limited capital budget for expensive R&D equipment

Precisely to cater to the disadvantages above is why the Government needs to step in. The higher costs may be subsidized by Government grants provided the Government has the willingness and the mechanism in place to fund private industry directly. Such grants may help in building a good asset base of research equipment too, in the long run. Having said this, it has proven difficult to impossible at the grassroots to channel Government funding to private industry.

Another solution presents itself at this juncture. Given that academia does not have the specific disadvantages listed above, a 3-way collaboration between Government, academia and an industrial R&D house may solve all of the problems in entirety. This is shown schematically in Figure 2 where the industrial R&D house is central to the process. Both industry and academia perform the research together while the industry R&D entity ensures that the research is steered to product goals. Coordination of all parties is done by this central entity, which makes it easier for the receiving industry to ultimately accept the technology and manufacture it. Such an arrangement would dramatically increase the probability of success of an R&D project, where "success" includes all steps from innovation to commercialization. This entire model is hinged on the "hope" that Government can find a simple way to fund an industrial R&D organization as easily as it funds academic entities today.

Fig.2 Proposed R&D model centered around Industrial R&D



In line with this proposed scheme, Powergear has created an R&D services division with full-time scientists who are tightly integrated with manufacturing units that are co-located with R&D. Powergear also makes IP discussion very simple by transferring all IP to the customer. While this model has been successful in attracting industrial clients, the Government needs to realize the potential that this model offers. Government would stand to benefit by achieving a significantly higher ROI (Return on Investment) on its R&D grants due to the fact that many more R&D projects would see the light of day.

Powergear performs both fundamental research and product development in multi-disciplinary areas and strongly believes that even fundamental research should be applied. Powergear's capability is highlighted here not to market the company's activities but to stand behind our words and show that we practice what we preach. The strength of this model will be fully realized when many such industrial R&D houses come up in India with strong Government and academic support. Another natural outcome of this approach will be a pool of better trained talent available to the industry in the long run. **When students at educational institutions are closely engaged with industrial R&D houses during their education, their skills will naturally be honed towards real-world productivity.**

Today, a Google search for the term "contract search" will result in almost entirely biology and medical organizations. While this is encouraging, there is a huge gap in contract research services in all other facets of technology. We sincerely hope that the Government will incentivize companies attempting to fill this gap and make India a power house in R&D.

Summary

There is a wide gap today between industry's R&D expectations and what academia can deliver working alone. This gap needs to be bridged by bringing research output much more in line with industry expectations. The foreseeable way to make this happen is for industrial R&D labs to participate in research on equal terms with academia from day one of the project. This way, the wealth of knowledge and infrastructure that exists in academia can be tapped and made to engage with the best scientists who are already delivering break-through innovation in industrial environments. **All of this should be facilitated by the Government through the funding of private industrial organizations who are serious about their R&D.** Many companies in the R&D outsourcing space will be MSMEs who cannot invest their own funds or provide a cost share, which makes Government funding all the more relevant. These MSMEs will hugely benefit from a combined R&D service offering that includes both academia and an industrial R&D lab. All parties will thus work together in a collaborative mode coordinated by the industrial R&D entity that understands both R&D and industrial needs and constraints. Ultimately, enabling MSMEs to innovate will revolutionize the technological future of the country. If the Government does not fill this gap then it is only a matter of time before industrial contract R&D matures on its own and fills the market, but unfortunately, academia will be left out in the process and the Government will end up with minimum ROI on its research endeavours. The contract R&D market is quite mature in many parts of the world and India needs to take bold decisions and giant leaps to win in this space. An incentive in doing so will be that India will eventually show the world that the world's innovation needs can be outsourced to and fulfilled in India and that our best brains can match their output at significantly lower cost. **India will become a hub for innovation and R&D, which is the holy grail at the highest end of the product development chain.**

About the Author:

Dr. K. Subramanian obtained his PhD from Cornell University in Electrical Engineering with specialization in Micro ElectroMechanical Systems or MEMS. He obtained his Bachelor's degree in Mechanical Engineering from IIT Madras. He is currently Head of R&D at Powergear Ltd., MEPZ, Chennai where he works on implementing several novel technologies in Energy and other sectors. He previously worked at GE's Global Research Center in New York. Subramanian has filed more than 50 patent applications in his field. He managed a large program on MEMS at GE and received two prestigious awards for his research. One of them, the Hull Award, is presented to early-career researchers at GE Global Research. The other award, the Whitney technical achievement award is for a project that is viewed as a potential market game changer. Subramanian is a Six Sigma Black Belt. He has made significant contributions to multiple unique projects and has authored numerous publications and technical reports. The current R&D initiative at Powergear aims to showcase India's innovative talents to the world.

Same Hyd school has produced Microsoft, Adobe, Mastercard CEOs: Microsoft CEO Satya Nadella had attended the Hyderabad Public School in Begumpet, Hyderabad, which also produced Adobe CEO Shantanu Narayen and Mastercard CEO Ajaypal Singh Banga. The high school was established in 1923 for the sons of aristocrats.

Microsoft once offered to buy Facebook for \$24 billion: Microsoft's former CEO Steve Ballmer in an interview in 2016 revealed he once offered Mark Zuckerberg \$24 billion to buy Facebook. While Zuckerberg refused the offer, Ballmer said, "I respect that. You have to have a willing seller". Zuckerberg is currently world's seventh richest person with a net worth of \$62.6 billion, while Facebook is valued at around \$450 billion.