

Differentiate development from research

Every nation spends a substantial amount of its wealth on research and development. The purpose is to stay abreast in technology and fuel industrial growth, which in turn would result in economic development of the nation. India too invests a colossal sum in R&D, even if it is lower than many other countries in terms of percentage of GDP. The question remains, how effective have these investments been? How much benefits have accrued from them? Can they be made more effective, especially in the Indian context? Here the relationship between research and development is considered, and a structure is proposed that clearly differentiates the roles of research and development, so as to make them separately more accountable and effective.

Although the words 'research' and 'development' are often used together, implying that they are strongly related and often practised by the same set of people, in terms of the required skill set, they are widely different. Research requires going deep into certain aspects of a problem and finding solutions to them. It requires an analytical and innovative mind, awareness of current state of the problem and solution tools. Results of research are usually published in journals and conference proceedings, and it is these publications that form the most tangible output of a researcher. Since research addresses only selected aspects of a problem, its solutions do not necessarily translate into development of a product. Development, on the other hand, aims to build a complete solution to a problem within a fixed time-frame. Apart from technical awareness about the solution components, it requires good judgement about the choice of these components at the design stage, keeping in mind their availability, feasibility and suitability. It also requires a high amount of discipline for sticking to the time-frame, ability to interface effectively with approval committees on the one hand, and industries and research groups on the other. It requires taking tough decisions about alternative resources/solutions midway into the project. A developer must be practical, flexible and adaptive to be effective. He may not find enough opportunities to publish in journals, as he often uses established tech-

nologies and serves mainly as an integrator.

Even though the traits are quite different, it cannot be denied that there are some individuals who are good in everything they do, whether research, development or marketing. But the large majority can be classified into one or the other based on their inclinations and abilities. However, instead of labelling people as researcher (R) or developers (D), we can label positions. That would define clearly what is expected of a position. Individuals may be free to migrate from a research position to a developer position or vice versa, according to their interests and abilities.

The need of marking positions as R or D comes from an acute lack of clarity about the scope of work of a scientist in the government research laboratories or academic institutions. While most of the Government research laboratories are development-oriented, it is not unusual for some of their scientists to be occasionally reprimanded for not having any worthwhile publications. On the other hand, a researcher is often reminded that he has not produced any usable product in his career. This ambivalence toward research and development career has at its root a lack of appreciation of the basic difference in the ways of work of a researcher and a developer. This also affects their assessment, resulting in deep disaffection of the scientist community.

If we mark positions as R or D, we know what to expect from that position. We also know how to assess one's performance. We will not ask a D guy to list his publications, or an R guy to showcase the products that he has developed or built. A large number of scientists will heave a sigh of relief if only they are labelled appropriately and assessed accordingly. Their scope of work getting clearly defined, they will go all out to do well in their chosen profession.

In the prevailing 'free for all' situation, a successful researcher is often pushed into a high-stake development project because of his deep knowledge of the area. He may or may not do well, depending on his awareness of what is called for in such a role. Often, in such cases, a researcher gets distracted by research issues that show up on the way.

He tries to solve them to make a better product and get a few publications, but in the process he may fail to pay enough attention to the nitty gritty of a development project, and may slip on schedule. This is one reason why our development projects lose focus and get delayed so often.

What can be the role of a researcher in a development project? He may act like a consultant in the design stage, helping a developer to choose appropriate solution components. He may also deliver well-defined modules to the development project. In this case, he has to work respecting the time constraints of the development project. This is a digression from his research-and-publish cycle to contribute to developments. This is immensely satisfying to a researcher – to see that some of his solutions find a place in a useful product.

A researcher may be favourably assessed for contributing to a development project. But, that is not all. A research group serves as a conduit of knowledge in advanced technologies and practices in the area of development. This constant infusion of knowledge is necessary to keep our developments contemporary and relevant in terms of technology.

What should be the subjects of research? Research for 'joy of discovery' cannot be discounted and may be reserved for a talented few, but for the large majority, they should come from ongoing development projects. The developers encounter various research issues – things that are not well understood – which they may list and pass on to appropriate research groups. This brings in relevance to the research work that is pursued in an organization. A large number of researchers in so many universities in the country keep working in fancy areas that may be relevant to the developed world, because that is how they may be able to publish in reputed international journals and earn respect. Their results and their expertise often do not feed into our development projects. Research topics that arise from a development project, if channelled into academic institutions, will pave the way towards more responsible and responsive research projects. The Government research laboratories have a role to play in

this respect. In fact, this was recognized long back, and all the three departments – Atomic Energy, Space and Defence have established mechanisms for funding research projects in the academic institutions, although they have not produced commensurate results. The reason is that, a researcher in an academic institution can develop a solution, but he/she cannot develop a product, which is the job of a development group in the research centre.

Industries have an important role to play in this whole scheme. When they are roped in suitably into a development project, development can be considerably faster. They have a lot of experience and expertise in select areas that are almost impossible to substitute by a development group. So development projects have to find means of involving the right industries to accelerate their development cycle. This has not happened so far in the absence of a transparent and reliable mechanism.

The question arises, why do we not hear about the distinction of R and D in the developed world? There are several reasons. They work at the frontier of knowledge where research and development go hand in hand. Often a researcher opens a company to build a product that uses his research results. The academic institutions in the developed world do mainly research work, and they are ably supported by industries that are technologically up-to-date. The hardship of development is more acute in a developing world like ours, where poor infrastructure results in uncertainties on all fronts. Many components have to be developed from scratch, and there are umpteen procedures to be followed for placing a purchase order. That calls for a different set of people who are skilled in handling such non-technical issues and push the project forward. That is why we need the D guys. In fact, they hold the keys to our national development. Only they need to be recognized as such and given their

due. That will also hopefully clear the mess around research groups. They will now have a clear mandate of finding solutions to relevant research issues generated by development projects.

Admittedly, the picture given above is rather simplistic, and may not apply as such to research and development of all kinds and in all areas. An attempt to bring in distinction between R and D positions will surely throw up finer issues of who does what, etc. but it will be a move in the right direction. Meanwhile, hopefully the hurdles of development typical in this part of the world will gradually lessen to make developments faster, easier and more fun, until some day it becomes indistinguishable from research, as in the developed world.

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Riverscapes also need long-term ecological observatories in India

The recent decision of the Ministry of Environment, Forests and Climate Change (MOEF-CC), Government of India to set up long-term ecological observatories (LTEOs)¹ across the country is a welcome step. Long-term ecological research (LTER) was started in USA in 1980, as a follow-up of the International Biological Programme, but was soon transformed (by 1988) to an international and socio-ecological research programme (ILTSER), with many countries joining it². In India, the forest preservation plots set up in several climatic zones since 1930 for long-term monitoring³, were poorly managed and mostly disappeared. A single 50-ha plot set up in dry deciduous forest in Madumalai, Tamil Nadu has been regularly investigated since 1988 (refs 4, 5). However, several calls for a network of LTER sites in different biomes and kinds of ecosystems and for a national repository of data remained unheeded⁶⁻⁸.

The Indian LTEO programme centres around a terrestrial landscape approach focusing on protected area network, although coastal and marine systems are

also included. Freshwater ecosystems are represented by the Dal Lake integrated with its Dachigam NP catchment, and to some extent by the theme on fish populations, obviously in the water bodies within the protected forest areas. However, the riverscapes have not received due attention. Riverscapes – a term first used in 1993 by Gopal and Sah⁹, and elaborated in 1998 by Ward¹⁰ – are a dynamic and heterogeneous mosaic of the river systems (including all tributaries) and their floodplains, interacting with the rest of the drainage basin.

It is noteworthy that the LTEO programme is rooted in the national climate change action programme with particular focus on the impacts of climate change. In this context, it should be emphasized that climate change will have more serious impacts on the riverscapes – directly through altering their flow regimes as well as through human strategies for managing their water resources. Greater warming at high altitudes will have a severe impact on the downstream riverscapes. Small reaches within the protected areas and particularly the fish

populations alone, do not represent the riverscapes and cannot reflect adequately the climate change impacts on the riverine ecosystems. Floodplains (including riparian zones) are distinct ecological systems within the riverscapes which deserve special attention for their dynamics in a changing climate. It is necessary that the suitable riverscapes, especially those in the Brahmaputra, Ganga and Indus basins are also included in the LTEO programme. In the case of these rivers, large sub-basins should be treated as one site with several observatories. In this context, I wish to point out also that whereas some level of protection of the sites is necessary for long-term monitoring of ecosystem dynamics driven by climate change, impacts of several other natural and anthropogenic factors need to be examined in the case of the riverscapes. Dal Lake shrank in area due to siltation as even the protection of its catchment in Dachigam NP did not prevent inflow of sediments into the lake. Elsewhere also, the protected areas do not guarantee that the riverine systems will not be affected; rather a river-based intervention within