EDITORIAL

Evaluation of R&D

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With limited human and financial resources available for R&D in most locations around the world, with notable exceptions, it is always a hard choice for policy makers to determine in the most logical fashion how the R&D funds are to be distributed among competing disciplines. There is always the basic conflict between fundamental and applied research, between research and development, between emerging areas and the traditional ones, between the sunrise and the (so-called) sunset areas, etc. For larger economies it is possible to distribute the funds covering a wide gamut of research areas while for smaller or emerging economies the choice is harder and limited. Often, the selection is made to suit local needs while at some other times the selection is made based on what global experts recommend. Both policy making processes have merits and demerits but that is not the theme of this editorial. R&D policies that simply mimic those of successful nations may not typically be appropriate if the size and diversity of the economies are vastly different. Also, “me-too” research does not lead to good return on investment in R&D since the larger economies will always have an edge. Academic research in “hot” areas of massive commercial interest and which require huge R&D expenditures by very large industrial sectors also faces severe competition and the outcome may not justify the effort.

Drying has been considered a mature area and hence in need of little R&D. Only after the first energy crisis it was realized that it is certainly an old unit operation but its age did not result in great depth of knowledge of the fundamental of the complex heat and mass transfer coupled with material science relevant to the product being dried. The high energy intensity of drying processes and the resulting impact on greenhouse gas emissions stimulated research in an otherwise moribund area. In 2009 alone there were over half a dozen large-scale drying conferences, which attests to the high level of R&D interest. Still, if we compare the resources devoted to other “hot” areas of R&D, e.g. bio-nano-info, drying attracts only a miniscule of the total budgets everywhere in the world. Yet, I believe its impact can be sizable, far in excess of what the level of funding might convey. One can do very useful and innovative R&D in drying with little expenditure of resources relative to other areas, which consume massive resources to make even a minor dent in existing knowledge.

I propose definition of a Research Productivity Index (RPI) as the useful research output per unit of resources expended in a given area or for a given R&D project, then drying technology R&D would have a much higher value compared to, say, nanotechnology research. When massive infusion of research funds is made to a new area, often there is not enough creative talent and an adequate supply of novel ideas to utilize the large level of funds very effectively. By nature most research is carried out in serial and not in parallel fashion. Previous research results are used to take the next step. If numerous projects are initiated simultaneously at different locations, chances are high that much of the effort is duplicated. Thus, in my opinion, there is a sustainable level of R&D in any field; too much as well as too little give rise to low values of RPI. In the former case if no funds are devoted to research, there is no output while in the latter case even a decent level of output can be marred by the high level of funding, which appears in the

denominator of the RPI. The optimum level of R&D support will depend on the area of R&D; some are intrinsically expensive while others are not. However, a sustainable optimal level must exist at any given time and location; too little as well as too much funding can be counter-productive.

Unfortunately, selection of a limited basket of R&D themes is much harder since that requires policy-makers to look into a hazy crystal ball. Globalization does influence the choice since what other parts of the world decide can affect the economic outcome elsewhere. Selection must therefore be made based on anticipated local needs. For example, countries with huge commodity production must and do provide considerable support for R&D in relevant drying problems. The research intensity in drying averaged over the whole globe has been nearly constant over the past two decades. There has been dramatic variation, however, on individual country basis.

I believe that we will see further changes in patterns of support of drying R&D in several countries in the years to come. Rapidly industrializing countries will likely increase their share of global R&D as it is immediately relevant to their economic heath and prosperity. Service-oriented countries will necessarily reduce their activity level as the manufacturing base is outsourced. Such changes are dynamic and will continue to evolve at least over the next decade or two. Unfortunately, since R&D is generally considered as an expense rather than an investment, there is generally a short term focus particularly in strategic funding policies for R&D. It is still a very difficult task to carry out a meaningful cost-benefit analysis of R&D; even harder to carry out such an analysis of basic or academic research.

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