



## Networking—A New Paradigm for Increased R&D Productivity

Arun S. Mujumdar

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## Editorial

# Networking—A New Paradigm for Increased R&D Productivity

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I have long been an advocate of collaboration between academia and industry and also between academia dispersed around the world. It is well known that resources for research and development are dwindling almost all over the world. Increasingly, granting agencies must make choices between disciplines to fund R&D due to the paucity of resources—both financial and human. Some areas can fall through the cracks despite their importance to society at large. The nexus of water, food, and energy has been attracting much attention in recent years. In fact, drying technologies are important in all these thrust areas, but not always in an obvious way. The needs for R&D in drying are often not recognized readily, nor are they articulated well by those in the field. The result is limited, sometimes no, R&D support in many part of the world. In fact, there seems to be an inverse relationship between the availability of research support and the state of economic development of the country involved. Thus, emerging economies that depend heavily on manufacturing and processing of commodities seem to carry out more R&D in drying than those that are infected by the bio-nano-info fever. This is reflected through the contributions to the IDS conference series as well as to *Drying Technology*. However, we must find a way around this dilemma to ensure that drying R&D stays healthy despite the current state of affairs.

Fortunately, drying research is not capital-intensive. Significant and useful output can be obtained with human resources and “brain-work” without the need for expensive instrumentation. As computing resources become cheaper, one can in fact intensify innovation in drying technologies via mathematical modeling, as demonstrated by Mujumdar and Zhonghua.<sup>[1]</sup> Lack of funding is no excuse for lack of innovation in drying technologies. Open innovation and crowd-sourcing are also inexpensive and effective ways that we can enhance drying R&D. Industry can access innovative ideas, lab-scale data, and even scaling procedures developed by academics, typically at no cost. However, industry must devote resources to access such information

via active participation in conferences and proactive collaboration with academics in their own areas or in fact anywhere in the world. The magic of the Internet has opened up a vast storehouse of knowledge to whomever wants it. The free flow of information at negligible cost should encourage networking and indeed lead to vastly improved productivity of researchers in nearly every field. By sharing financial and human resources, we can avoid duplication of effort, basically speeding up R&D and innovation. It is well recognized that multinational and multicultural diversity breeds creativity and hence innovation. The need for increased funding and manpower is reduced without reducing the output. The synergy in well organized international teams can in fact lead to a much higher degree of productivity. It is best when the collaborators are equal and bring different skill sets and expertise to the table. Drying is basically a combination of transport phenomena and materials science. Thus, a team of specialists in materials science working together with experts in transport phenomena can tackle a real drying problem much better than such teams working separately.

I can give a personal perspective in terms of simple statistical data, which are readily available to anyone around the globe. I started the IDS series in the firm belief that globalization and industry–academia interaction was necessary for successful R&D in drying. I put this idea in practice consciously by developing cooperative research projects (many in drying but also some in other areas), as I faced a serious problem in obtaining research funding to support the many ideas I was able to generate and wanted to pursue. Fortunately, in most cases, I could find partners in several countries who had similar ideas and interests but different expertise they could bring to the project. Success in several initial efforts led to new collaborations, and the process continues even to this day. Statistically speaking, out of the 272 journal papers I have co-authored between January 2001 and October 15, 2012, 120 papers have been written with collaborators/co-authors from 16 countries. Major collaborations have been with China (60), Taiwan (14), India (21), Japan (7), Thailand (7), and Iran (6). These numbers exclude collaborations with authors of books and book chapters as well

as conference presentations where the fraction of global authorship is even higher. Thus, the cost in terms of research funds and laboratory or office space (overheads) to host institutions is very low, but the benefit in terms of recognition is rather high as a result of such collaborative effort.

Clearly, this level of output cannot be obtained easily. A very significant value of extra effort has to go into starting and nurturing such an effort, which can stretch over decades. The return on the effort is slow in coming, but it is highly rewarding when it does come. It is a win-win situation for both sides, and if the teams and goals match well, the productivity, expressed as the output per unit of resources expended, can indeed be very high. This means very hard work and excellent interpersonal skills and communication skills as well. I encourage my mentees to follow this path to higher productivity regardless of the area they choose for their future research. Working in a solitary environment will no longer be a cost-effective process in the future. This, in my opinion, is a new paradigm for

enhanced productivity. Of course, I have simplified the process here, as issues of intellectual property rights and institutional differences, problems of communication, etc., can be some of the early hurdles that need to be surmounted. Also, some networks may simply not take off for diverse reasons.

Readers interested in more details about this global networking approach and the outcomes from this process are encouraged to visit <http://serve.me.nus.edu.sg/arun> or simply Google my name and locate the relevant sites.

*Arun S. Mujumdar*  
NUS, Singapore  
and

Institute of Chemical Technology, Mumbai, India

#### REFERENCE

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