INTERNATIONALISATION OF SUGAR INDUSTRY R&D

Graeme Bullock,
General Manager, Sugar Research Institute, Australia

The author has only been part of the sugar industry for two years, after more than 20 years involvement in the food processing industry. Consequently it is by no means certain whether the perspectives presented here will reinforce or contradict the global sugar industry’s self-perception.

Using F.O. Lichts Yearbook as a guide, we have over 50 organisations around the world providing research, development, demonstration, and commercialisation (RDD&C) for the cane sugar industry. These four components make up the full spectrum of technology enhancement. There appears to be a trend towards private or industry funded organisations enhancement. There appears to be a trend towards private or industry funded organisations and away from state-operated or state-funded bodies. In recent years, for example, the Philippines industry has formed Philsurin, and it seems that R&D in the Thai industry will, in future, be partly funded by an industry levy.

In Australia the raw sugar mills who are the members and owners of SRI fund both field and factory R&D in many different ways:

<table>
<thead>
<tr>
<th>Body receiving Funding</th>
<th>Funding Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bureau of Sugar Experiment Stations (BSES)</td>
<td>Levy (legislated)</td>
</tr>
<tr>
<td>Cane Productivity and Protection Board (CPPB)</td>
<td>Levy (legislated)</td>
</tr>
<tr>
<td>Sugar Research and Development Corporation (SRDC)</td>
<td>Levy (legislated)</td>
</tr>
<tr>
<td>SRI</td>
<td>Levy (condition of membership)</td>
</tr>
<tr>
<td>SRI</td>
<td>Syndicated research (discretionary)</td>
</tr>
<tr>
<td>Cooperative Research Centre for Sustainable Sugar Production (CRC)</td>
<td>Cash, and in-kind contribution (condition of membership/ formation of CRC)</td>
</tr>
<tr>
<td>Contract R&amp;D</td>
<td>(discretionary)</td>
</tr>
<tr>
<td>Internal R&amp;D</td>
<td>(discretionary)</td>
</tr>
</tbody>
</table>

The funding of the Australian Sugar industry’s RDD&C effort totals about $40m. The sources of funding (in 1996/97) was approximately as follows:
Table 2: RDD&C expenditure in the Australian sugar industry, by source

<table>
<thead>
<tr>
<th>Source Description</th>
<th>AUD (million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government (state and federal) contribution via</td>
<td>18.5</td>
</tr>
<tr>
<td>BSES, CRC, CSIRO, SRDC, taxation rebates</td>
<td></td>
</tr>
<tr>
<td>Mills contribution to</td>
<td>12.5</td>
</tr>
<tr>
<td>BSES, SRI, SRDC, CRC, CPPB</td>
<td></td>
</tr>
<tr>
<td>Growers contribution to</td>
<td>6.5</td>
</tr>
<tr>
<td>BSES, SRDC, CPPB, CRC</td>
<td></td>
</tr>
<tr>
<td>Private R&amp;D</td>
<td>2.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>40.0</td>
</tr>
</tbody>
</table>

There are a number of reasons for describing this level of detail relating to the Australian industry:

- Firstly, to emphasise that, in a well developed industry, the structure of funding of R&D will inevitably be a mix of historical factors and emerging needs, unique to the circumstances of a national industry and not usually influenced by global industry characteristics to any obvious extent.

- Secondly, to emphasise that there can be benefits from having diverse organisations with differing research interests, but with a mechanism for coordination to ensure the industry’s needs are fulfilled holistically.

- Thirdly, to demonstrate that to maintain a competitive position in a global market corrupted by trade barriers, a well developed industry must maintain a relatively high level of R&D spending.

- Fourthly, and finally, to point out that, despite tendencies to be secretive about technology at the national level, the developed technologies are eventually disseminated to the global industry by a variety of means.

The total expenditure in Australia, about USD27m equates to about 2.3% of the gross product value. If this was mirrored globally, about USD600m would be the total pool, of which 70% or USD450m would be related to cane sugar R&D.

While the achievement of such expenditure may only be a dream, it invites speculation of what could be achieved, particularly if international collaboration ensured a minimum of replication and duplication.

In practice, there is an encouraging trend towards international collaboration at several levels of the RDD&C chain. I will come back to this question later.

**Globalisation of sugar industry RDD&C**

Sugar industry RDD&C is globalised by several mechanisms at several levels. The following comments, made from an Australian perspective, illustrate this point. The author is aware that many other countries are following a similar path.

1. Through sugar technology associations and their annual conferences and published proceedings.

   SRI maintains a collection which includes proceedings from:
   SASTA             South African Sugar Technologists Association

...
SASTA  South African Sugar Technologists Association  
STAI  The Sugar Technologists Association of India  
SIT  Sugar Industry Technologists, Inc  
Aust SSCT  Australian Society of Sugar Cane Technologists  
ISSCT  International Society of Sugar Cane Technologists  
WIST  West Indian Sugar Technologists  
SPRI  Sugar Processing Research, Inc  
HSPA  Hawaiian Sugar Technologists  
ASSCT  American Society of Sugar Cane Technologists  
Research Society of Japan Sugar Refineries' Technologists

It would be useful if this huge body of highly relevant information could be put into an electronic searchable database. SRI would be prepared to take on this task if the organisations agreed, and there was sufficient support from those interested in accessing such a database via the internet. SRI is currently enhancing its database of all its reports so that they can be electronically searched, and accessed via a website, subject to appropriate security. This is being done on a Lotus Notes platform that could be readily extended or duplicated.

2. Specialist sugar industry periodicals. The industry is well serviced by journals which act as communications vehicles for RDD&C as well as general industry matters. Among the popular titles are the following:

Cuba Azucar  
International Sugar Journal (UK)  
Sugar Journal (USA)  
South African Sugar Journal  
Sugar Y Azucar  
Taiwan Sugar  
Zucker Industrie  
Sugar Industry Abstracts

Notably, the Australian industry has no journal as its mouthpiece, instead the various representative bodies and research agencies all publish periodical digests, bulletins, newsletters and the like.

3. Annual reports and research reviews published by R&D institutions, which, in particular, identify programs of work and research focus.

4. Technical reports on projects. Although many are regarded as confidential within industries' R&D organisations, many eventually do end up being exchanged for similar information.

5. Development and sales of equipment:

1. by manufacturers operating internationally  
2. by R&D institutions

It is the author's view that the sugar industry does not always compare favourably with many food processing industries in terms of the role of manufacturers in leading technological change and technology uptake. In industries such as dairy, fruit juice cereals and cocoa processing, for example, there are benchmark technologies and integrated designs against which advances can be compared.
The sugar industry does not seem to have the same sort of accepted benchmarks, a point which will be further discussed in this paper.

On the other hand, there are several companies operating globally or at least regionally who can provide turnkey sugar mills, including, for example, STG/GCB and Bundaberg Foundry in Australia, Fletcher Smith, Tongaat Hulett, Honiron/ Cameco and others.

It may be that R&D institutions need to increase their collaboration with manufacturers to enhance the rate of technology transfers.

SRI does, from time to time, work closely with individual manufacturers to enhance their designs. Recently SRI has assisted Triveni Engineering with the design of a continuous vacuum pan suited to requirements in India, and this is currently being installed in their Khatauli factory.

6. Consultancy, training and audit activities. By way of example of this last category, SRI has, for many years, provided training and assistance to Cenicana, in the Colombian sugar industry, and has undertaken audits of individual mills in Thailand, Pakistan and elsewhere. Recently SRI participated in a holistic review of the Fijian sugar industry.

Technological maturity of the industry

There is an attitude expressed all too frequently, by various people in our industry, that all the major technological advances had been made and all that remains is incremental enhancement. This is an absurd and patently false view. To give but three examples:

- new milling technology.

  Both STG (in collaboration with CSR) and Bundaberg Foundry have developed new designs involving simpler and lower cost structures, which have the potential to radically reduce the costs of new installation.

- new clarifier technology.

  The widely used clarifier design developed by SRI in the 1960’s has now been fundamentally redesigned to achieve a doubling of capacity for the same size clarifier.

- new bagasse boiler designs

  New designs are now available, developed through computational fluid dynamics modelling, which give much greater steam output for combustion chamber size, and boiler tube erosion related problems have been virtually eliminated.
obvious, and impactful are:

- gasification of bagasse for cogeneration
- continuous vacuum pan design
- evaporators, using technologies developed in other industries
- continuous fugals
- vertical crystallisers
- ultrafiltration
- process control devices
- cane quality and payment methodologies (specifically near infrared reflectance and digital image analysis techniques)
- enhanced harvester designs for harvesting unburnt cane
- biotechnology applied to:
  - enhancing sugarcane varietal characteristics
  - disease and pest resistance

SRI has an active RDD&C program in all but the last of these areas.

There are some specific areas where international collaboration would prove invaluable to R&D providers. The five unit processes listed above viz. CV pans, evaporators, continuous fugals, crystallisers and ultrafiltration all have competing designs available around the world. What is missing is an accepted methodology for performance assessment, and no generally accepted benchmarks. I believe there is scope to systematically evaluate different designs against defined set of performance criteria, to establish the benchmarks. This will in turn, speed up the impact of R&D into design enhancements, and may in some cases lead to radical change. This point can be illustrated by reference to technologies which are accepted benchmarks in cereal, cocoa and dairy produce processing.

One major research area deserves special mention. A recent study, reported elsewhere at this Congress, has established the potential of bagasse gasification to double the electricity export potential of sugarmills. To prove this, through a demonstration 5MW installation, a project costing over AUD20m is now planned in Australia. Commercial installations of 50 to 150 MW will probably cost AUD70 to 250m to construct. The attitude of SRI and its partners is that we welcome international collaborators to participate in the demonstration project. The scope and potential impact of this project is such that it makes no sense to approach it on any basis other than international collaboration. Indeed, there is already one internationally funded biomass energy project which operates on the basis that its reports will be freely available.

SRI has a dialogue with the Sugar Milling Research Institute of South Africa, and with Copersucar in Brazil and the USDA in Louisiana with the intention of establishing some collaborative projects on a more formal basis. If successful, these steps may help our global sugarcane industry to be more outward-looking in the overall conduct of research and development.

In conclusion, there are three particular actions which could assist in "internationalising" sugar industry R&D. These are:

- better accessibility of technical literature in a consolidated database enabling electronic searching.
- collaborative benchmarking of equipment performance.
- genuine collaboration between R&D institutions, particularly on fundamental or early-stage research before commercial aspects become a constraint.