The Case for a New Branch of Manufacturing to Provide Smart Equipment for the Mining Industry

March 1990

WESTERN AUSTRALIAN
TECHNOLOGY & INDUSTRY
ADVISORY COUNCIL

MANUFACTURE OF SMART MINING EQUIPMENT

How significant is the potential for a new branch of manufacturing industry in Western Australia/Australia to provide smart equipment for mining and civil engineering?

EXECUTIVE SUMMARY:

1. It is neither practical nor appropriate to argue in favour of Australian industry rapidly developing the capacity to compete with Japan, Sweden or Canada in supplying a large proportion of the demand for traditional heavy mining and engineering equipment.

2. Australia's advantage gained by usage and CSIRO research presents an opportunity to develop an export niche which will involve:

   * the redesign of existing equipment;

   * the adaptation of existing equipment by the addition of "smart optional extras";

   * development of entirely new equipment and systems, especially parallel processing, computer simulations, robotics, laser guidance systems and advanced materials.

3. The development of a marketing strategy which links R & D with customer needs (both Australian and international) is required and should perhaps be done by government and/or the CSIRO and/or industry.

OBJECTIVE:

The development of an Australian-based industry which manufactures and exports "add on enhancements" and develops smarter mining, drilling, cutting, communications and transport equipment specifically designed for hostile and hazardous environments in the mining and civil engineering industries.

THE AUSTRALIAN RESOURCE SECTOR:

* The Australian resource sector involves a minimal level of local manufacturing activity.

* Most of the heavy equipment used in the mining industry is imported.

  e.g. Most of the world's trucks larger in capacity than 100 tonnes are in Australia - none are manufactured here.

* The current manufacturers of mining industry equipment are slow to innovate. Most manufacturers are located in economies where mining is not a vital aspect of their economy.

* A good deal of the innovation which does occur arises from pressure exerted by Australian customers; innovation which is followed through overseas and ultimately sold back to Australia.

* The existence of Australia's massive resource sector comprises a competitive advantage in the successful development of manufacturing and service industries designed for both national and international markets.

* Relatively little has been done to develop industries to serve this significant customer base.

CRITICAL MASS:

It is widely accepted that a critical mass of activity is required in order to drive industries which are large and successful. Critical mass is attained when effort and interaction between entrepreneurs and users of goods and services, scientists and technology providers, is strong and vital. There are four basic ingredients to developing critical mass:

* leading edge customers who create a large and technologically-demanding market place by world standards;

* the presence of a world class scientific endeavour;

* an international marketing capability to link R & D with end-user requirements; and

* government policies oriented towards innovations so as to capture global business opportunities.

a) Leading Edge Customer:

The resource sector within Australia constitutes a leading edge customer. The industry is a major importer of capital equipment and is technologically advanced. In order to increase the international competitiveness and productivity of this sector, even greater advances in technology are needed in the near future. Moreover, in many mining situations safety is a major issue for the future. If Australia moves fast enough, it is possible to compete with other countries such as Canada, Sweden and Japan to the production of these "add ons" to enhance the next generation of mining and civil construction equipment.

The resource sector, as a leading edge customer, presents many opportunities for the application of new technologies. Two specific examples include:

1) Parallel processing, which is widely accepted as a computer application of considerable potential for the future. However, it is just as widely accepted that the development of algorithms and architectures that make use of parallel processing is in its infancy. The resource sector abounds with problems and applications that are intrinsically parallel by nature. These include seismic data processing, image processing, computer simulation of geological processes, stress analysis for mine design, subsurface reservoir engineering, robotic vision systems, and process control systems.

Clearly, the development of a group of people devoted to parallel processing but dedicated to user-driven applications in the resource sector could not only develop fundamental principles and knowledge within the field of parallel processing, but supply the resource sector with much needed technology that is the basis both for a competitive advantage and for a new industry within Australia.

2) "High temperature" superconductors (such as those that become superconducting at liquid nitrogen temperatures) have been in the news of late, but so far have not been put to much application. There is a pressing need within the minerals exploration and mining areas to develop ground probing radar equipment that has greater penetrating power and better resolution than present equipment. A way around this problem is to build new antennae based on superconductors. This enables very powerful but small antennae to be constructed. The result would provide a technological advantage to Australian miners and could also be an export market of considerable magnitude.

b) <u>World Class Scientific Endeavour - Australian Capability</u>:

Australia, with less than 1% of the world's population, writes or receives citations for approximately 2% of the worlds scientific publications. We are particularly good in five areas, namely:

* Biology
* Earth and Space Sciences
* Clinical Medicine
* Mathematics
* Biomedical Research

Having world class research is another competitive advantage, and the expertise in medical research has already been widely recognised and utilized in Australia with the development of a very successful medical scientific instrument industry.

In Earth Sciences a similar development has not yet occurred.

On a per capita basis, Australia produces about the same number of scientific publications in Earth Sciences as the U.K.; 1.2 times more than the USA; 2.5 times more than Sweden and 10 times more than Japan. Only Canada produces more papers than Australia. Thus, Australia has a clear competitive advantage in scientific productivity over most countries, and we should ensure that we utilize this advantage to the maximum.

Australia does have some degree of manufacturing expertise and part of this is directed at innovative new equipment for the resource sector.

c) International Marketing Capability:

Although increasing the international competitiveness and productivity of Australia's resource sector is perhaps the primary objective, the long-term goal should be to create products for export and an international marketing capability which understands the end-user requirements, and which is closely linked to what is happening at the R & D front.

Australia has been notoriously bad at this critical step in the chain of innovation, and particular attention should be paid to this step as far as the resource sector is concerned.

This challenge is essentially the business of the new industry itself and careful mechanisms have to be put in place to ensure that firstly, marketing is given very high priority, secondly that the marketing process understands what the end-user wants, and thirdly that the R & D process is thoroughly integrated into this scheme.

d) Government Policies:

A fourth step in the chain of successful innovation is the development of appropriate Government policy.

In this respect attention should be given to:

* encouragement of flexible arrangements to promote secondments and exchange of staff between institutions;

* specific incentives for industry to move into manufacturing for the resource sector;

* mechanisims to ensure and promote top calibre communication links between customer-scientist-technician-manufacturer-marketing and sales people;

* funding of carefully directed, large scale R & D projects aimed at distinct commercial targets (in areas such as parallel processing applications, new materials and robotic systems).

CONCLUSION:

1. It is neither practical nor appropriate to argue in favour of Australian industry rapidly developing the capacity to supply a large proportion of the demand for traditional heavy mining and engineering equipment.

2. An opportunity exists, however, for Australia to generate new industries which supply the next generation of equipment, software and services to the Australian resource sector.

3. The next generation of smart mining and civil engineering equipment will involve:

   - o the re-design of existing equipment;
   - o the adaptation of existing equipment by adding 'smart optional extras'.
   - o development of entirely new equipment and systems, especially parallel processing, computer simulation, robotics, laser guidance systems, computer-aided vision systems and advanced materials.

4. A marketing strategy which links R & D with customer needs (both Australian and International) is required and should perhaps be done by government and/or the CSIRO and/or industry.