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The Inquiry Secretary
House of Representatives Standing Committee on Science and Innovation
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Business R&D
Inquiry.doc
HA00466.

Dear Sir / Madam

**Submission to the Inquiry into Business Commitment to Research and Development in Australia**

This submission is based upon the experience and recent independent review of the Australian participation in the Intelligent Manufacturing Systems (IMS) program. We trust it will be of value to the Inquiry.

## About the IMS Program

The Intelligent Manufacturing Systems (IMS) program is an industry-led collaborative international R&D program whose purpose is to develop the next generation of manufacturing and processing technologies and to disseminate the results among the participating firms and nations. IMS is conducted under an international arrangement signed by the governments of Australia, Canada, the EU and Norway, Japan, Korea, Switzerland and the USA. The arrangement runs for ten years from 1995 to 2005. An international working group has recently been nominated by the various governments to consider the future of the IMS program beyond 2005.

Australia's participation in IMS is managed by the Australian regional secretariat and comprises firms and research organisations participating in a portfolio of IMS projects. The projects are formulated and conducted in accordance with R&D themes specified under the IMS Terms of Reference. The Commonwealth Department of Industry, Tourism and Resources funds Australia's IMS membership and the regional secretariat. Sinclair Knight Merz Pty Ltd manages the current secretariat for an initial period of 2 years under a contract let by public tender in June 2001.

Every participant in IMS projects is responsible for securing its own funding. Australian industry participation in IMS therefore depends heavily on business investment in R&D. Where public funding has been secured, this has been mainly through the ARC grants scheme for universities, and the IAccP and START schemes for companies. The global IMS project portfolio comprises 26 projects with a total of over 550 organisations participating. Currently there are over 30 Australian organisations participating in 7 IMS projects. Another 30 participants are undergoing formative activities in a further 5 projects which are expected to formally commence during the course of the next year.

## Australia's Participation in IMS

The Secretariat recently commissioned and received an independent review of the effectiveness of the IMS Program in Australia[1]. The review's report said: "*IMS has given rise to a number of innovations, including improved processes, new materials, standards and enterprise integration methods. Commercial benefits have been limited to a couple of projects but further innovative outputs and commercial benefits are expected. Among teaching institutions IMS is feeding into curricula and Ph.D. studies, and leading to consultancy work. Employees in private and public-sector participants are increasing their skills, satisfaction and job prospects. All these mechanisms and others are helping to diffuse the benefits to the broader community. IMS directly advances key aspects of industry policy since the program is essentially about increasing Australian manufacturing industry's international competitiveness through R&D and innovation. The collaboration aspect of the program would be almost impossible to achieve without government support. Nearly all respondents mentioned lack of funding as a barrier to participating in IMS.*"

"*The fundamental conclusion is that the IMS program has already delivered benefits in excess of its costs and it shows promise of delivering substantial future benefits. But ongoing successes will require sufficient IMS program funding plus continued support for R&D, innovation and technology diffusion to maintain the momentum that is only now building up.*"

The nature and depth of Australian engagement in this program is illustrated in the following table. The data are based on the IMS project portfolio monitoring report dated October 2001[2] and other relevant public data[3].

| Item | Aus | Can | EU+N | Jap | Kor | Swi | USA |
|---|---|---|---|---|---|---|---|
| Population (Millions, 2001) | 19 | 31 | 381 | 127 | 47 | 7 | 275 |
| GDP (US$B, 2001) | 366 | 695 | 8,054 | 4,141 | 422 | 247 | 10,143 |
| GDP / head (US$, 2001) | 18,889 | 22,344 | 21,141 | 32,556 | 8,918 | 34,172 | 36,835 |
| Participation (No. orgs) | 36 | 21 | 245 | 102 | 20 | 48 | 79 |
| ( %) | 6.5% | 3.8% | 44.5% | 18.5% | 3.6% | 8.7% | 14.3% |
| Participation rate (per M pop. per USD20k GDP) (rank) | 1.97 (2) | 0.60 (5) | 0.61 (4) | 0.49 (6) | 0.95 (3) | 3.89 (1) | 0.16 (7) |
| International Project Leaders | 2 | 0 | 12 | 9 | 0 | 2 | 1 |
| Large Firms | 3 | 5 | 96 | 48 | 2 | 13 | 34 |
| (No., %) | 8% | 24 | 39% | 47% | 10% | 27% | 43% |
| (Rank) | (7) | (5) | (3) | (1) | (6) | (4) | (2) |
| SMEs | 18 | 3 | 59 | 4 | 5 | 17 | 15 |
| (No., %) | 50% | 14% | 24% | 4% | 25% | 35% | 19% |
| (Rank) | (1) | (6) | (4) | (7) | (3) | (2) | (5) |
| Research & Academia | 15 | 13 | 90 | 50 | 13 | 18 | 30 |
| (No., %) | 42% | 62% | 37% | 49% | 65% | 38% | 38% |
| (Rank) | (4) | (2) | | (3) | (1) | | |
| Proportion of participants' GNP | 2% | 3% | 33% | 17% | 2% | 1% | 42% |
| Effort Contributed (%) | 6% | 3% | 48% | 28% | 1% | 7% | 7% |
| Commitment (Effort/Part. %) | 92% | 79% | 108% | 151% | 28% | 80% | 49% |
| (Commitment Rank) | (3) | (5) | (2) | (1) | (7) | (4) | (6) |
| Value of Effort (US$M, 2001) | 3.9 | 2.0 | 31.2 | 18.2 | 0.65 | 4.6 | 4.6 |
| Dedicated Public IMS Project Funding in Region | Nil | Nil | 50% | 50% | 60% | 50% | Nil |
| New Projects Proposed | 0 | 3 | 23 | 3 | 0 | 2 | 2 |

[1] "Review of the Intelligent Manufacturing Systems Program" by G.Hollander, July 2002
[2] "Project Portfolio & Project Monitoring 2001" – IMS International, October 2001
[3] OECD GDP and Population Data, 2001

This comparative data shows the significant challenge Australia's size poses to significant engagement in the program, and how that is affected by low business R&D expenditure - for example:

- Although having a modest participation in absolute terms, Australia still ranks second to Switzerland (also a small country) in participation rate when adjusted for population and Gross Domestic Product (GDP);
- Australia contributes 3 times the effort to the program (at 6%) than its proportion of program GNP (2%);
- Australia ranks first on participation rate by SMEs, but lowest on participation rate by large companies. It is important this be increased as large companies are able to more effectively appropriate the benefits and/or provide initial markets for the participating SMEs;
- In contrast, Australian university and research institution participation rate is about average internationally, and it is they that generally have accompanied the SMEs into the program;

A further item to note is that some participating regions dedicate significant public funding to the IMS program. There is a strong correlation of participation, effort and new proposals with the availability of earmarked public funds for IMS projects – contrast the indicators for the EU & Norway with public funding and the USA without, both with similar populations and GDP.

## Business Drivers for Involvement in IMS

The Australian Bureau of Statistics' 1996-97 survey of Innovation in Manufacturing[4] found that over 80% of businesses rated the following the most important objectives in undertaking R&D (in order of importance):

- Reducing costs
- Maximising profits
- Improving productivity
- Responsiveness to customers
- Improving quality/speed of service
- Increasing market share

These are clearly motivations of self-interest aligned with the individual commercial success of the businesses and with a near-term focus. To recruit Australian firms into IMS, the challenge is therefore twofold:

1) to positively differentiate the program from other potential avenues of undertaking innovation, and
2) to encourage participation in a program of global, collaborative and pre-competitive R&D where results are shared and appropriation of benefit occurs in the medium to long term.

The value proposition put to Australian industry emphasises the following benefits of participation in IMS:

- Access to the 98% of global R&D that occurs outside Australia.
- Excellence through access to the world's best research skills, technologies and resources bases.
- Exposure to businesses who epitomise global best practices.
- Sharing of the risks inherent in R&D, and consequently also the rewards.
- Leveraging the R&D investment by sharing the developed intellectual property through a proven framework of IP rights management that permits small companies to cooperate effectively and on an equal footing with large firms.
- Trialing new technology on a large-scale basis, involving a global user community and ensuring general applicability of the technology developed.
- Building business relationships with companies and market intelligence in diverse countries and industry sectors that facilitate entry to new markets, and not purely in the subject areas of the R&D.

[4] Australian Bureau of Statistics' survey of Innovation in Manufacturing, 1996-97 (8116.0)

- Learning to think globally.
- Avoid 'innovating in the dark' – that is, being more aware of the current state of the art and so being able to focus efforts on new innovations.
- Through involvement in global networks and their larger reach and range, having access to a greater range of opportunities for business growth and development.

The responsiveness of businesses to this still depends on a clear alignment of the projects on offer with the commercial imperatives outlined above. The response is noticeably a reactive response to a marketing approach from the secretariat and / or universities, and not (so far) a pro-active seeking out of opportunity. This indicates that R&D does not rate high in the priority order of business leaders and they are not systematically searching for R&D investments based on strategic business plans.

With regard to the actual experience of Australian organisations, the review of the IMS program found: "*The program does give access to a wide range of global technology and gives participants immediate access to international and domestic research networks. Participants unanimously praised the IP arrangements that are integral to any IMS agreement, which meant that knowledge sharing occurred quite freely. When research produced concrete results applicable to the project's partners, technology diffusion was excellent. In projects where there are few Australian partners, diffusion will be effected more broadly through commercial products coming out of the project. Another way in which technology is diffused through Australia and beyond is via the education system and employee mobility*."

In some instances, firms did not proceed with their original intention to participate in IMS. The review found: "*Reasons (for not proceeding) included lack of commitment, lack of a champion with management clout, failure by a project leader to 'sell' the concept to potential partners, and changes in management. Some potential partners gave consideration to joining but decided not to, because there were no relevant projects or because the structures and constraints of IMS are not suitable for one reason or another." "This study did not find any institutional barriers (to Australian industry benefiting from the IMS program). However, there are limitations imposed by general features of Australia's industrial structure … where a relatively low proportion of the economy (less than 14%[5]) is devoted to manufacturing." "With some notable exceptions, Australian industry does not have an R&D mindset, let alone one emphasising pre-competitive collaborative R&D*."

Further barriers to business participation were found to be the availability of R&D funds; poor marketing of the program (and projects) to potential partners; shortcomings in managing the collaborative relationship that affected SMEs' satisfaction with the program; and attitudes of management, including the use of alternative collaborative methods.

## Addressing the Inquiry's Terms of Reference

The Australian experience in the IMS Program, related above, provides some empirical evidence that may help to answer the questions posed by the Inquiry. The following are responses drawn in summary from this experience.

### 1. What would be the economic benefit for Australia from a greater private sector investment in R&D?

- Economic Activity - the commercialisation of the results of R&D generates economic activity through some or all of: investment and jobs, greater operating efficiency and consequently profits, contributing to taxes, further investment capital, and discretionary expenditure by shareholders.

[5] DITR Key Australian Industry Facts 2001

- Innovation and Entrepreneurship – direct involvement in R&D has been shown to correlate with greater absorptive capacity and consequent uptake of new knowledge by industry[6] thereby improving its innovativeness. Companies with medium and high levels of innovativeness displayed faster growth in sales than less innovative firms[7].
- Stock Market Investment – various studies[8] have found strong positive correlations between levels of R&D investment (and more significantly patent registrations), and subsequent company share valuations. Intuitively, patents and R&D investment are a proxy for capacity to generate future wealth. It follows then that more R&D investment by business ought to attract greater investment in their shares and thereby generate an increase in the total value of the stock market.
- People Skills – IMS participants have reported a beneficial effect on people skills through transfer of knowledge between researchers who collaborated on R&D, generation of post-graduates with global research experience, and better commercial and functional skills from exposure to best practices.
- Employment – a slight increase of researcher employment in research institutions who collaborate with industry, and enhanced employability of personnel on a global basis.
- Improved Economic Capability – arising from technology transfer between those undertaking R&D to their supply chain partners (customers and suppliers), commercialisation partners through licensing, and training & experience of individual employees. Further diffusion occurs into the wider economy through publication of papers and presentations, consulting services, and the mobility of skilled employees.
- Exports – firms participating in global R&D initiatives are more likely to produce goods and services that are attuned to global markets and are successfully exported, which in turn has a favourable impact on the balance of trade.
- Sustainability – engagement by firms in international R&D which seeks solutions to problems of sustainability in manufacturing benefits the Australian economy by adapting Australian goods and services to be suitable for those markets where environmental performance is an important discriminator, and also by improving the sustainability of domestic manufacturing products and processes.

## 2. What are the impediments to business investment in R&D?

- The IMS review found that the most cited reason for difficulty in committing to an R&D project was the scarcity of finance, both public and private, and difficulty in gaining access to available funds. Difficulties included the effort spent on submissions, the hurdles and processes that needed to be satisfied, and the time taken. Businesses in particular felt their time could be more effectively spent elsewhere, even to the point of abandoning projects.
- The inherent uncertainty and risk of achieving positive outcomes militate against investment in R&D when compared to other available investments, particularly as most Australian investors are risk-averse.
- Pre-competitive R&D, such as IMS, takes some time (typically 2-3 years) to show results. This time frame does not sit well with SMEs whose main competitive advantage is speed of action and who do not have the resources to dedicate over prolonged periods. Larger companies are more tolerant of time and have the resources to spend, provided the potential rewards are high enough.
- Some benefits of R&D invariably spill over into the public domain. The inability of business to appropriate all the benefits of R&D generates the view that the costs ought be shared with the public purse to the extent that the public good is being served. When partial public funding is unavailable, or requires considerable effort to obtain, business finds it easier to pursue alternative investments.

[6] Yencken & Gillin "Public Research Agencies as Sources for Innovations and the Entrepreneurial Absorptive Capacity of Manufacturing Enterprises", 2002

[7] Bureau of Industry Economics' 1993 report "R&D, Innovation and Competitiveness, an evaluation of the research and development tax concession", Research Report 50, AGPS, p150

[8] eg. Intangibles Research Project – Baruch Lev, Stern School of Business, New York University

- Most R&D projects require some form of collaboration and a willingness to disclose existing knowledge as a foundation to new knowledge. Many SMEs in particular are unwilling to share information for fear of disclosure to competitors and therefore preclude themselves from participating in collaborative R&D.
- Most business owners are not aware of the research programs that are open to them. This was certainly true of the IMS program and is now being addressed through marketing by the secretariat with some positive results in terms of companies willing to commit to IMS projects.
- The lack of R&D mindset among business leaders and the absence of strategic R&D programs in company business plans (as compared to say marketing and brand recognition) means there is little drive behind investing in R&D, and low probability that R&D initiatives will survive the loss of individual champions in companies.
- Companies' profit orientation leads to short-term innovation policies and neglects the long-term benefits of complex research programs. R&D investments are also treated as expenses, not capital investments, and so are liable to be cut in the quest for reduced costs and higher current-year profitability.
- Few businesses have strategic relationships with research groups (eg. CSIRO, CRCs and universities) that provide the combination of research need and research capability required to generate and sustain R&D investment. Basic research in publicly financed institutions has spillover effects that stimulate research in private companies. Most small and medium-sized firms cannot afford large R&D departments and are therefore not able to provide the technological basis for their innovation activities. Therefore the lack of business-research network relationships is a barrier as there is no stimulus to business R&D investment. The IMS experience has shown the most successful R&D projects are those where private businesses and public sector research organisations collaborate. This provides the necessary balance between self-interest and public good motivation, and addresses the real-world need with appropriate research capability.

## 3. What steps need to be taken to better demonstrate to business the benefits of higher private sector investment in R & D?

The remarkable renaissance in Australia's sporting performance internationally since the inception of the Australian Institute of Sport provides an example of what can be achieved given national focus and resources. Even so, sport has a natural advantage in popular appeal over science and technology in the Australian culture. We are not familiar with the details of the sports program, but make a few suggestions that may help stimulate business investment in R&D.

1) Demonstrate Success - The most effective tool to market the IMS program to Australian business has in our experience been the formulation of case studies where businesses have undertaken R&D resulting in demonstrable benefit. The formulation and dissemination of such success stories, with examples drawn from and targeted to industry segments would help stimulate other businesses into investigating R&D opportunities relevant to them. These stories provide the cultural icons for others to aspire to and emulate.
2) Leadership – business, community and scientific leaders could be identified and given the role of roving R&D ambassadors who emphasise publicly and consistently the benefits of business (and public) R&D investments, and the dangers to companies and the national interest of having little or no R&D activity.
3) Training and Guidance – R&D is alien terrain to many business leaders who do not have a scientific or technological background, who may not be well informed regarding intellectual property and who may also find the myriad of federal, state and local public programs and regulations confusing and even daunting. An analogue of the Australian Institute of Sport could be contemplated which provides a uniform integrated national resource from which to gain coaching in R&D management, through tuition, information, advice and mentoring. This may assist in easing the path for firms who have not previously embarked on R&D activity.
4) Fostering of Research Relationships – encouragement could be given to the formation and maintenance of relationships between groups of businesses and research organisations, nationally and internationally, wherein R&D needs and benefits could be identified and

serviced. The IMS program is one such vehicle for the development of these relationships internationally.

Provided on behalf of the IMS Program and the IMS Australia Advisory Committee (IMSAAC).

Yours sincerely,

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