

# Inquiry into Business Commitment to R&D in Australia

A Submission to the Standing Committee on Science & Innovation

Submitted by 34 Australian Industrial Designers

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## A. Summary of Recommendations

This submission to the Standing Committee on Science and Innovation has been drafted by a coalition of Australian industrial design professionals. Within the terms of reference provided by the Committee and in response to the specific questions provided, we present the following recommendations:

- R1.** That Australian product developers make use of industrial design as part of their strategy to reduce the risk associated with Research and Development (R&D), where perceived high risk would otherwise deter private sector investment in R&D.
- R2.** That industrial design be given a key participatory role in both publicly and privately funded R&D activities, whereby emphasis is placed upon Research, *Design* and Development (R,D&D) rather than R&D alone.
- R3.** That the Australian Government endorse the adoption by business of organisational models which provide design with a participatory role in managing business strategy, with a view to improving Australian business competitiveness.
- R4.** That the Australian Government partner with the national peak body representing industrial design (the Design Institute of Australia) in developing R&D policies which support the integration of design as an key element of Australian business strategy.
- R5.** That the Australian Government partner with the Design Institute of Australia in the collection of case studies and industry luminaries which will demonstrate to Australian business the benefits achievable through the integration of *design* into an R,D&D strategy.

## B. Introduction

The House of Representatives Standing Committee on Science and Innovation has identified that, although Australian business investment in R&D has increased in the period between 2000-01 and 1999-2000, as a percentage of GDP this expenditure remains significantly lower than the total investment made by business in other major nations.

The Committee is seeking comment on the following questions (2002, <http://www.aph.gov.au/house/committee/scin/r&d/index.htm>):

- Q1.** What would be the economic benefit for Australia from a greater private sector investment in R&D?
- Q2.** What are the impediments to business investment in R&D?
- Q3.** What steps need to be taken to better demonstrate to business the benefits of higher private sector investment in R&D?

The Committee also asks that any response consider the following:

- The R&D drivers in small to medium-sized enterprises (SMEs)
- The needs of fast-growing companies
- The considerations by which major international corporations site R&D investment.

### **Q1. What would be the economic benefit for Australia from a greater private sector investment in R&D?**

R&D is widely understood as one of the fundamental factors underlying long-term business competitiveness, and by extension, economic growth and job creation. According to a report published by the Prospectus organisation (2001, [http://www.prospectus.ie/mergers\\_report/drivers.htm](http://www.prospectus.ie/mergers_report/drivers.htm)), 'for technology companies [R&D] is fundamental to the success of a company's product offering in the marketplace', yet R&D is equally

important to the survival of other businesses in sectors as diverse as food manufacturing and minerals exploration. In Australia, manufacturing is the greatest contributor to R&D, and this R&D is the major driver of our innovative, growing economy (Campbell: 63).

The British Government's Future & Innovation Unit clarifies the relationship between R&D and innovation in the following extract from their *2001 R&D Scoreboard*:

*R&D is the key investment that leads to new products, processes and services. It is only part of the innovation process since there are other business functions which will contribute to the overall process of identifying customer needs (including latent needs) and satisfying them with profitable new products and services. However, it is the role of R&D to generate technical advances, which drive the flow of innovative new products and services, providing enhanced value for customers and value added growth for the company.*

The US Government approved the largest Government R&D expenditure in history as part of its 2001 budget (2000, [https://radius.rand.org/radius/00615\\_2.html](https://radius.rand.org/radius/00615_2.html)). In the following extract from a report on American R&D activity authored by the Rand Corporation on behalf of The White House Office of Science and Technology Policy, the social and economic importance of R&D is well argued:

*R&D activities have enormous payoffs at the national level. These investments enable our nation to compete successfully in the global marketplace, protect our environment and manage our natural resources in a sustainable manner, safeguard our national security from emerging threats, and spur the technological innovation that has contributed so much to our economic prosperity and quality of life.*

*We see the fruits of . . . R&D innovation every day. Many of the products and services we have come to depend on for our way of life in America—the Internet, the Global Positioning System (GPS), lasers, computers, magnetic resonance imaging (MRI), Teflon and other advanced materials and composites, communications satellites, jet aircraft, microwave ovens, solar-electric cells, modems, semiconductors, storm windows, genetic medicine and biotechnology, and many others—are the products of . . . R&D investments made over the past 50 years. These innovations also mean jobs and economic prosperity for America.*

*[The Rand R&D Report] provides clear evidence of the payoffs that R&D investments have at the state and local level, as well as how they ripple through regional and local economies and spur the growth of high technology start-up companies.*

(2000, [https://radius.rand.org/radius/00615\\_2.html](https://radius.rand.org/radius/00615_2.html))

This pronouncement reminds us that Australians are fundamentally reliant on innovations resulting from R&D undertaken in the US and other nations. It also suggests that our current emphasis on the so-called *Creative Industries* as increasingly important generators of economic activity through digital content provision may be short-sighted if the *Creative Industries* are defined as content-producing or cultural industries only. Australia's content producers (and many other Australian industries) are working with tools and technologies that are products of the successful commercialisation of R&D undertaken in other countries—a fact which contributes to our negative trade balance as we import the technologies and products necessary to keep our businesses competitive in domestic and global markets. Computer game development could not exist as a digital content provider and generator of economic activity without the hardware, software, and infrastructure which underpin this creative pursuit. Howkins (1991) broad definition of the *Creative Industries* as including all industries that create intellectual property (eg, copyrights, patents, *designs*, trademarks) acknowledges the fundamental contribution of R&D to economic growth and competitiveness, and should be the definition officially adopted by all departments within the Australian Government. While content provision's significant contribution to our economy (particularly in view of its low R&D and capital expenditure requirements) should be recognised, R&D investment which may lead to fundamental technological innovation and long term economic growth should not be marginalised. The Rand R&D Report warns that:

*We have come to rely on technology and take it for granted in our everyday lives. But the marvels of today are really the fruits of research seeds planted decades ago—investments that have not only*

*given us new technologies, but have helped educate generations of engineers and scientists who now form an essential component of our workforce. The very fact that these advances required decades of investment stands as a warning against complacency in our future investment strategy. The government and the private sector must work together to ensure that today's investments in R&D are sufficient to yield similar payoffs to society in the 21st century.*

(2000, [https://radius.rand.org/radius/00615\\_2.html](https://radius.rand.org/radius/00615_2.html))

The extent of public and private R&D investment in the US and EU is enormous. According to Rand technology policy fellow Parry Norling (2001: 237) investment by US industry has grown by nearly 10% per annum since 1995. Total R&D investment by US industry in 2001 has been estimated at \$214 billion. Given these figures, it is a logical assumption that an increase in private R&D investment will provide no net increase in benefit to Australia if this is offset by a corresponding decrease in R&D expenditure by the Federal and State Governments. In other words, we would indeed be a very 'lucky country' were we to out-compete other nations in the Science & Technology stakes while reducing our total R&D investment.

Perhaps the question is not so much what economic benefit to Australia would result from a greater private sector investment in R&D but rather, what economic detriment would result from a private sector resistance to shouldering their share of R&D expenditure? In identifying the key challenges to Queensland's future R&D efforts, the Queensland Government R&D Strategy Issues Paper (2002; 3) notes that 'the growing cost of, and demand for, government services will place limits on the capacity of governments to fund R&D and pressure will grow for R&D institutions to source increasing amounts of revenue from the private sector and other sources'. Clearly the private sector must compensate for any shortfalls in Government R&D investment if Australian business is to remain competitive in the global marketplace.

While acknowledging the fundamental importance of R&D to the Australian economy, the greatest economic benefit can only result from the successful transfer of technologies resulting from R&D efforts. In short, the knowledge acquired through R&D activities must be successfully commercialised. Norling (2001: 238) reminds us that 'the R&D process is in turn part of the overall, more general innovation process where innovation is taking an idea and turning it into something unique and tangible that has utility'. In a proposal on how best to strengthen their research and technology policy (Wolff, 2001: 4), the European Council acknowledged that 'Europe's comparatively poor ability to transfer the results of research work and scientific and technological breakthroughs into industrial, economic and commercial successes is one of its most notable weaknesses'. Australia faces these same challenges. Neither the public nor the private sector can afford to fund R&D which fails to generate a return on investment through technology licensing, the sale of new products, or the provision of new services.

It is our position that the *design* is key to the appropriate targeting of R&D. *Industrial design* in particular—if fully integrated within the R&D activity at management level and below—can improve the likelihood of successful commercialisation of R&D. Wakoh and Collins (2001, 36) propose that 'a demonstrable link to customer needs' is a primary criterion for SMEs when evaluating the probability of success of R&D project proposals. At the same time, Norling (2001: 20) warns that 'an excessive customer focus can prevent firms from creating new markets and finding new customers for the products of the future'. By definition, *industrial design* can provide a balanced understanding of customer needs while also applying this understanding to commercial outcomes. The following description of industrial design practice has been extracted from a full definition provided by the Industrial Designers Society of America (IDSA):

*Industrial design is the professional service of creating and developing concepts and specifications that optimise the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer.*

*Industrial design services are often provided within the context of cooperative working relationships with other members of a development group. . . . The industrial designer expresses concepts that embody all relevant design criteria determined by the group.*

*The industrial designer's unique contribution places emphasis on those aspects of the product or system that relate most directly to human characteristics, needs and interests. This contribution requires specialized understanding of visual, tactile, safety and convenience criteria, with concern for the user. Education and experience in anticipating psychological, physiological and sociological factors that influence and are perceived by the user are essential industrial design resources.*

*Industrial designers also maintain a practical concern for technical processes and requirements for manufacture; marketing opportunities and economic constraints; and distribution sales and servicing processes. They work to ensure that design recommendations use materials and technology effectively, and comply with all legal and regulatory requirements.*

(1996, <http://www.idsa.org/whatis/definition.htm>)

The industrial design profession has been providing this service to business for over 75 years. If we accept that an understanding of human (customer) needs is a significant factor in determining which R&D activities are most likely to provide financial returns, then *industrial design* is well-qualified to fill a critical role in R&D. Moultrie et al (2002) notes that 'the role of the industrial designer is changing and many designers now view themselves as creative leaders, innovators and strategists', a trend which suggests 'a spectrum of possible involvement for industrial design, from traditional styling through to leading the development of business strategy, irrespective of product type'. In evaluating the function of industrial design in Indonesian industry, Sulfikar (2001) found 'the industrial design role in product competitiveness is between important and very important'. The Irish Council for Science, Technology and Innovation (STI) identified industrial design as an investment priority for Government spending in 1999, acknowledging that 'industrial design is recognised as an effective and economical way of gaining competitive advantage and an important route to product innovation' although '[it] does not enjoy the priority it should' (1999, <http://www.forfas.ie/icsti/statements/statexp99/summary.htm>). The Council recommended that up to £6m be made available for industrial design programmes in 1999 alone. This followed from the Council's observation in the previous year to 'make greater use of its power to promote and support industrial design' in view of 'the importance of industrial design to product innovation' (1998, <http://www.forfas.ie/icsti/statements/statexp98/indus.htm>).

In a report published by the Urban and Regional Innovation Research Unit in Thessaloniki, Dumas (2001: 5) offers the following observations:

*The use of industrial design does make a contribution to economic performance and companies, investors and governments need to understand the importance of design spending for the innovation process. Design expenditure ranks with R&D expenditure as a strategic investment for companies, however, the lack of sophisticated techniques applied to design spending often holds back design investment. . . . The benefits of design spending are systematically undervalued across companies and therefore the economy as a whole.*

*Decisions on new product development are rightly made at board level in companies. But many executives lack the knowledge of industrial design and this makes it difficult to create a common vision of new product strategy particularly among executives with different backgrounds. Indeed, the need for integration of knowledge is not often emphasised, with the result that a less than optimal strategy is frequently adopted.*

And finally, support for the integration of design within R&D activities was expressed within the Australian Government's own *National Design Review Report*:

*It is accepted that there is a clear relationship between the research and development activity of firms and their innovativeness. Research and development is central to Australia's innovative capacity and it lies at the heart of our ability to develop and maintain an internationally competitive industrial base.*

*Design is the "missing" third component of research and development. It has tended to be considered very much as a peripheral activity.*

*The position of Design is not secured firmly in the research and development milieu and this could help explain why many innovations are conceived, but not commercialised, in Australia. Failure in the innovation process in Australia occurs largely at the commercialisation stage.*



*Design is, in reality, a core element of research and development, a key part of the continuum, not merely a support activity, and this is worthy of recognition by industry and government. The research and development process is more correctly described as research, design and development.*

*There is a requirement for Design to be elevated to be a core element of the technological innovation process and, therefore, to emerge as a major source of business innovation and competitiveness.*

(National Design Review Steering Committee, 1995: 31)

We encourage the Government to emphasise *design* as integral to R&D activities through the following actions:

- Integrate *industrial design* into R&D through reference to Research, Design and Development (R,D&D) rather than R&D alone.
- Incorporate the important contribution of industrial design into all R,D&D strategies and policies.

## Q2. What are the impediments to business investment in R&D?

A business would typically possess or have access to the following elements before undertaking investment in R&D:

- The ambition to undertake R&D
- A strategy which targets the R&D process
- The skills to manage the R&D process
- Capital to fund R&D activities
- Confidence, defined as a reasonable certainty of return on R&D investment

The absence of any one of these ingredients may be seen as an impediment to business investment in R&D. Each of these elements maintains some relationship with risk, and risk can never be eliminated from the equation in its entirety. Anything that serves to minimise this risk will also serve to remove obstacles to R&D investment. In our view, a collaborative approach to R&D is one way to reduce the risk inherent in R&D investment, and this business strategy should be strongly endorsed the by Australian government.

Many companies are leveraging their innovation capability through a collaborative strategy—and for good reason. For example, Thompson (2001: 22) describes the situation which led pharmaceutical company Eli Lilly to pursue collaborative R&D:

*Less than 1 percent of drug discovery efforts will result in a commercial product. Those that succeed will take 10 to 15 years to reach the market, with an average invested cost of nearly \$0.5 billion [US]. Complicate this equation with the fact that only three of ten products produce a profit.*

Also with regard to collaborative R&D, Wakoh and Collins (2001: 32) acknowledge that SMEs 'face growing pressure to create value and reduce costs at every stage of the production process', with the consequence that 'R&D activities typically face severe resource constraints'. The formation of partnerships for the purpose of collaborative R&D can extend resources and even provide synergy. In a Memorandum of Understanding (MOU) between the United States Department of Energy (DOE) and the Electric Power Research Institute (EPRI) the organisations defined three reasons why their 'R&D of common interest should be managed as collaborative and cost-shared activities wherever possible':

1. *Greater assurance is achieved in reaching common visions, goals and objectives, and in eliminating duplications and gaps.*
2. *Greater leveraging of resources and stronger rationale for increasing the R&D investment by respective R&D funding sources is achieved.*
3. *The ability . . . to draw additional support from overseas is increased significantly when [the two organisations] are in partnership.*

(1999, [http://nepo.ne.doe.gov/docs/vol1\\_appd\\_nov00.pdf](http://nepo.ne.doe.gov/docs/vol1_appd_nov00.pdf))

According to Norling (2001: 237) nearly 70% of total US R&D in 2001 was funded by industry rather than the Government. By comparison, in 1960 the US Government funded 65% of US R&D. The primary reason underlying this role reversal is the continued growth of R&D expenditure by US industry in relation to US Government R&D investment. Norling offers nine reasons for the growth of private sector R&D investment in the US:

1. A number of companies compete in businesses (eg, health care, information technology, automotive industry) where success in R&D can make a major difference.
2. Technological innovation is an increasingly important factor in corporate growth.
3. With newer techniques, processes, and practices, R&D has become more productive. In addition, the forming of teams, alliances and linking of skills has made success more certain.
4. More scientific discoveries now exist which provide opportunities for developing new businesses, products and services.
5. The US economy has enjoyed a strong performance between 1996 and 2001.
6. With more research (and more research results) we see more opportunities for development efforts, which are considerably more costly.
7. The scope of R&D has broadened, with R&D becoming global.
8. R&D itself has become a thriving business, with technologies now traded, licensed, or sold.
9. Industrial R&D is growing because of the availability of talented researchers.

The report *From Producing to Thinking Nations* (2002, <http://www.nistep.go.jp/achiev/abs/eng/rep015e/rep015ae.html>) explores the underlying reasons for expansion of R&D expenditure by Japanese manufacturers. According to this report 'companies are tackling R&D not just because of competition with other companies in the same industry, but also because of their expansion into other industries, and this they are doing to ensure their own survival'.

While acknowledging that the Australian business environment is very different from the US or Japan, some of these underlying reasons for the growth of US business R&D provide insight into how Australia might improve its own private sector R&D investment. The following suggestions are based on this premise, and we acknowledge that some of these issues are already under consideration or are being addressed by the Australian Government:

- Encourage the private sector to form alliances with Universities, Government, non-profit bodies and other research organisations for the purpose of undertaking R&D activities.
- Persuade the private sector to seek collaboration with other companies and industries (both in Australian and overseas) in undertaking R&D.
- Adopt policies which serve to keep Australian research talent in this country, and attract overseas talent to augment our own capabilities.
- Assist businesses with programs which seek to improve R&D productivity and the commercial success of spin-off products and services.
- Reconsider any Government policies or legislation which impede progress in achieving any of these actions. This may involve an examination of tax or intellectual property legislation, or a reassessment of environmental, trade and immigration policies.

Once again, it remains our view that the integration of *industrial design* within an R&D organisation at both management and operational levels can improve R&D targeting and outcomes, and the extent to which the private sector is unaware of this benefit represents an impediment to business R&D investment in the long run. When asked why designers must take a lead in the New Economy, *Business Week* magazine editor Bruce Nussbaum responded:

*[Companies] are in the business of growing, expanding and creating, and that is what design does best. . . . For top-line growth, you have to sell something. For that you need design. Design innovation will provide the new products. Designers can tell you how to grow, how to innovate, how to change your culture. . . . Design has become very much an innovation industry. We're not just talking about the design of one product. We're talking about the design of the whole process of innovation in a company. Designers are thinking of themselves more as consultants and moving into what traditionally has been a management consulting function, providing "tutoring" on innovation as well as product design. . . . Design has to be a central concern of top management—the CEO or senior VP level—to work. If design is a peripheral function, the company will only get about 5% of what design*

*can deliver. It's critical that it is brought close to decision makers in an institutional framework. . . . Design, in the end, is about creating better things for people. Along the way, it can generate better profits as well.*

(2000, [http://www.cdf.org/cdf/atissue/vol4\\_1/Bruce\\_Nussbaum/bruce\\_nussbaum.html](http://www.cdf.org/cdf/atissue/vol4_1/Bruce_Nussbaum/bruce_nussbaum.html))

Business management authority Tom Peters identified design as a critical factor in business success in his 1982 book *In Search of Excellence*. Peters (2001, <http://www.cdf.org/tompeters/tompeters.html>) considers 'viewing design as something you do at the end of the process to "tidy up" the mess, as opposed to understanding that it's a "day one" issue and part of everything to be a fundamental flaw in any business strategy.'

The Design Institute of Australia (DIA) underscores both Nussbaum's and Peter's statements when it notes that 'with the integration of design into the business planning process of many large national and international companies, and the identification of design as a major factor in competitive advantage, the management of design has become a specialisation in its own right' (2002, <http://www.dia.org.au/media/Success.pdf>).

As part of a recent study regarding the relationship between design and business management, the following observations were made:

*Good organisation design paves the way for effective action. Badly designed organisations do not produce well-designed products, except by luck and then infrequently.*

*At a time when innovation and creativity are being called for, managers will need to learn . . . design. If managers do not design effective organisational systems, designers will not be able to design effective products. . . .*

*Good design will not guarantee success but bad design will certainly thwart it.*

*Unless managers take up the challenge to become better designers the possibility for creative ideas to emerge will be limited, and the innovators throughout the organisation will be frustrated and go elsewhere. It is about time that design entered the boardroom.*

*Design is truly moving into a more pivotal role within the corporate world, and design managers should rejoice at the prospect of developing design into a continuous element of corporate strategy. Strategic design management should emphasise design as a source of sustainable competitive advantage and as an element that can change the direction of an organisation.*

(Rees, 2002: 53)

In the publication *How Design Helps your Business*, released by the Irish government as part of its Design Ireland initiative, the importance of design within business is affirmed:

*When integrated with a business, design can provide an arsenal of tools for uncovering new directions and development strategies. When the future of a business depends entirely on finding the right directions for development, it is certainly not the time to neglect this aspect of your enterprise. When the future is unclear, design can lead you out of the fog.*

(2002, <http://www.designireland.ie/resources.asp?id=175>)

Michael Agustin, Managing Director of Lumascope Lighting Industries in Brisbane, describes the value of industrial design within his business in concrete terms:

*In our company design is paramount. We can have the very best technical outcome from R&D but without good industrial design we are unable to sell our products. As a result of our approach to design, our company has doubled in size in the last 5 years and exports to many countries around the world.*

(Email correspondence, 29 August 2002)



In the event that an SME has not yet integrated an understanding of design within management, that business should at least seek external strategic design advice prior to investing in R&D, with a view to reducing the risks associated with making the wrong R&D decisions. We believe that the Australian government must actively encourage SMEs to factor industrial design into their organisations at the management level, with a view to developing the innovative capacity of our knowledge-intensive industries. To this end, we make the following recommendations to business and Government:

- That Australian product developers make use of industrial design as part of their strategy to reduce the risk associated with Research and Development (R&D), where perceived high risk would otherwise deter private sector investment in R&D.
- That industrial design be given a key participatory role in both publicly and privately funded R&D activities, whereby emphasis is placed upon Research, *Design* and Development (R,D&D) rather than R&D alone.
- That the Australian Government endorse the adoption by business of organisational models which provide design with a participatory role in managing business strategy, with a view to improving Australian business competitiveness.
- That the Australian Government partner with the national peak body representing industrial design (the Design Institute of Australia) in developing R&D policies which support the integration of design as an key element of Australian business strategy.

### **Q3. What steps need to be taken to better demonstrate to business the benefits of higher private sector investment in R&D?**

The potential benefits to business and/or society from a higher private sector investment in R&D include:

- Business survival
- Increased business productivity
- Improved business competitiveness
- An increased scientific knowledge base
- Product innovation
- Business growth
- Economic growth
- A stronger tax base
- A healthier society
- A cleaner environment

Not all of these benefits will motivate the businesses to increase their R&D expenditure. Norling (2001: 244) reminds us that 'companies have incentives to do R&D that supports and grows their businesses', while allowing that 'there may . . . be ways to create incentives for them to do applied research in the national interest'.

Although attractive once the decision has been made to undertake R&D, an increase in tax concessions is not reason enough for Australian business to increase their R&D expenditure. Business must first understand R&D as the key to achieving their long-term objectives. They must be convinced that R&D represents an investment rather than an expense. Furthermore, they must acquire the confidence that informed R&D investment will lead to certain returns. To this end, it is our belief that Australian business will most likely to respond to the following:

- The collection of case studies which demonstrate real benefits resulting from a higher private sector investment in R&D.
- Presentations from industry leaders who have achieved demonstrable business success as a result of increased investment in R&D.

International design and business organisations (eg, Design Management Institute, Corporate Design Foundation, British Design Council, Danish Design Centre) have amassed numerous case studies which support the benefit strategic design can provide to businesses undertaking R&D; however, case studies should ideally be drawn from Australian companies and research organisations, as Australian businesses take a cautious view of case studies which profile the success of overseas companies operating in conditions unlike those in this country. The Australian design industry has compiled a series of *Dividends by Design* case studies which were first presented at the *Innovation By Design* conference in 1994. These case studies likely require updating, and can be extended to include profiles of additional businesses which have integrated design strategy into their management, R&D, and product development activities. The Design Institute of Australia can partner with the Government in collecting and updating appropriate case studies.

Industry leaders who can demonstrate successful outcomes from R&D investment can be sourced both from Australia and overseas. While overseas business conditions are different to those in this country, successful international business leaders are popular drawcards at Australian seminars and can provide motivation to our own industries.

We recommend that the Australian Government partner with the Design Institute of Australia in the collection of case studies and industry luminaries which will demonstrate to Australian business the benefits achievable through the integration of *design* into an Research, *Design* and Development strategy.

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