

## **Submission to the Review of the National Innovation System**

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### **Declaration of any Interests and Affiliations**

Shahid Ahmed, Ph.D, M.S.I.E. B.S.I.E, has made this submission to the Review of the N.I.S. in his capacity as principal of Applied Innovations. He does not represent the interest or viewpoint of any other organization/entity in Australia.

Applied Innovations is a firm recently set up to provide collaborative training and consultancy to Australian firms in the field of hard innovation as elaborated herein.

Dr. Ahmed received his entire professional education and training in the USA in industrial/manufacturing engineering. He was affiliated with the Engineering Research Center, and the Center for Collaborative Manufacturing at Purdue University. Dr. Ahmed has worked in industry in the USA and Pakistan. He is a senior member of the Society of Manufacturing Engineers, USA.

### **Submission to the Review of the N.I.S.**

The Hon. Senator Kim Carr, Minister for Innovation, Industry, Science, Research.  
Dr. Terry Cutler, Chair of the Review Panel, National Innovation System.  
Distinguished Members of the Panel.

In the 1960's, an Indian leader quipped that the countries of the Commonwealth had everything in common except wealth. I believe that the National Innovation System is getting predisposed towards a framework wherein it may cater to all innovation-tagged activities except innovation.

To support this assertion, and to identify some less explored regions of our innovation landscape, I will highlight certain issues. I will then propose the following for your consideration for the NIS.

- A standardized definition and nomenclature for innovation.
- The Australian Innovation Engine.
- National Repository for Technology Problems and Needs.
- Utilization of knowledge capital of retired personnel.
- Innovation bonus to new graduates in all disciplines.
- Innovation add-ons to existing and new MBA programs.

### **GAPS AND WEAKNESSES IN THE AUSTRALIAN INNOVATION LANDSCAPE:**

#### **An evolution towards Innoflation.**

I would like to coin the term “Innoflation” to describe the phenomena where the term innovation finds increasing currency in the most distant and diverse fields and yet basic knowledge about its internal structure and processes, its tools, methods and modes of its application, remains relatively unknown.

#### **Vague and imprecise nature of innovation.**

Over time, innovation has become a catch-all term, an undefinable amalgam of diverse disciplines all competing for attention and resources. The essential character of innovation as a science, technology, and engineering based route to wealth creation and national uplift has been over-shadowed in Australia by other more vocal and more numerous advocacies.

In view of this there is a critical need for efficient terminology, and the corresponding taxonomy, so that overlapping components can be differentiated, structured, organized and brought into sharper focus for analysis and policy making.

#### **Hard vs soft innovation**

This is the most basic differentiation that I would like to highlight. Hard innovation comprises the applied innovation process, from idea to market, and is technological in nature. It includes knowledge capture, ideation, creative problem solving, analogical reasoning, patent searches, prototyping, product development, and aspects of commercialization. Soft innovation refers to innovation-studies based on econometrics, entrepreneurial and management aspects, public policy, cultural issues, etc. It would be enticing but misleading to use a computer hardware and software analogy here as both of these are

critical technological inputs to the IT process.

### **Paucity of utilizable information**

To my knowledge, all Australian centres of innovation, their faculty and students, deal predominantly with research on soft innovation issues. The output from this work, albeit of an excellent quality, is not designed to suit the needs of those firms that wish to undertake in-house innovation programs.

The main source of insight and knowledge for anyone interested are the best-sellers by international innovation gurus. The flavours of innovation espoused (open, discontinuous, incremental, radical, disruptive, destructive-constructive), are context-specific studies of selected artefacts. It is not explained how results from these retrospective studies can be successfully deployed in a firm. Also, they generally fail to apply to counter-examples often from the same company, in the same time-frame, and with the same personnel using practically the same innovation processes.

### **Barriers to Innovation**

I believe one of the major barriers to innovation is the lack of availability of innovation know-how which can be delivered conveniently and with an acceptably small footprint.

We learn innovation through effort and practice. The NIS should consider pilot programs for the delivery of innovation expertise based on the principles of customization, longer periods of interaction and collaboration, risk reduction, and internal knowledge enhancement within the firm.

### **Defining national priorities**

I would define our national priorities for innovation as:

1. To boost our technological momentum.
2. To influence and modify the way we think.
3. To preserve our technological knowledge base, and to make it accessible.
4. To provide the foundation for an efficient transition into the knowledge age.

Australia's technological momentum has not kept up with some of the other countries in the neighbourhood, especially when considering the head-start we had a half-century ago. Many of the reasons given, small population, the tyranny of distance, etc., seem vacuous in retrospect when compared with the examples of Singapore, Taiwan, South Korea, and Japan.

I believe that over time we have acquired a preference for financial, economic, legal, marketing, managerial and entrepreneurial modes of thinking, and tend to favour these before considering other more technological options.

We need to look closely at how China, Japan, Singapore, South Korea, or India have formulated their national innovation programs, formally or otherwise. Have they utilized the most capable and proven scientific, engineering and technological minds available to them, or have they opted for other considerations?

### **A re-alignment of innovation thinking**

There are two modes in which innovation provides national economic benefit:

- Through the commercialization of new ideas, products, processes, and systems.
- Through the enrichment of a firm's or a nation's internal knowledge base.

The mainstay of our past and current innovation policies has been commercialization. I believe that it is now time for a re-alignment in policy and for a consideration of both modes of innovation.

Not every innovation warrants commercialization, and not every patentable idea leads to a strong, worthwhile patent. We should realize that innovation processes and thinking, ingrained within a firm's culture, are highly beneficial in the form of ideas generated, processes improved, new products developed, etc., without requiring the entire innovation cycle to be concluded by seeking IP protection, and commercialization.

### **Preserving and building on our knowledge base**

We need to pay special attention towards preserving the accumulated knowledge and experience capital of our baby-boomer generation as it approaches retirement. They are a phenomenal source of invaluable ideas and insights. The challenge is how to tap into this resource in an efficient manner.

I am convinced that a crucial yet overlooked reason for the observed trends in Western and Eastern manufacturing are the informal and tacit mechanisms for knowledge capture in the Asian cultures. In addition to the tradition of transfer of knowledge from master to pupil, we also see increasing evidence of the use of formal mechanisms for this purpose.

The Toyota Motor Company, for example, collects ideas and suggestions in the hundreds of thousands per year. The outstanding ones are developed onto a form that will enhance the company's knowledge capital. No doubt IP protection / patents are secured where necessary, yet a very large proportion of the

knowledge based is of maximal value only when protected from dissemination to the outside.

### **The duality between innovation and knowledge**

There is the old saying, "In War there is no substitute for Victory." I will paraphrase it by saying that "In innovation there is no substitute for knowledge."

Knowledge is the basic raw material for innovation, its quality and quantum determines the overall outcome of any innovation program. The innovation cycle can be compressed in time only if the requisite knowledge is available or can be quickly obtained through analogical reasoning. All tools of analysis and reasoning are knowledge based. The medium in which the innovative process is executed, is knowledge. The outcome of an innovation effort is also knowledge.

An advanced knowledge framework will help us extract the maximum advantage from the proposed Broadband network.

### **NEW IDEAS PROPOSED FOR THE NATIONAL INNOVATION SYSTEM:**

#### **A standardized definition, nomenclature and taxonomy.**

It is necessary to formulate a definition which is context-neutral, precise, compact and elemental, in that it cannot be reduced further. After numerous iterations, I have developed this definition:

**Innovation: "The processing of knowledge for commercial gain."**

An innovation is therefore an activity which enhances the known knowledge base, and this enhancement must be directly convertible into some form of commercial advantage when required. The commercial advantage can remain internal to the firm.

We also do not possess a precise vocabulary to classify aspects of innovation - a generic term that is freely and interchangeably used to describe the mindset, the capability, the process, its outcome, and the reasoning involved.

I have mentioned above a general classification of innovation research into "hard" and "soft" categories. Hard or applied innovation should be further separated into pre-innovation, which I represent by "<I", and post-innovation activities, represented by "I>" as follows:

<I = {knowledge capture, ideation, creative problem solving, analogical reasoning, TRIZ, axiomatic design, and patent review}

I> = {variant design, prototyping, product development, innovation management, market analysis, IP and commercialization}

We can come up with other symbols to uniquely identify components of the innovation spectrum. This should also provide the taxonomy to classify, structure and thus differentiate between activities that may be poles apart yet fall within the overall ambit of innovation.

### **The Australian Innovation Engine.**

There is a real need in Australia for an institute that focuses exclusively on the hard innovation side, and specifically on pre-innovation technologies. The AIE would be the first point of contact for the innovation needs of all Australians. It will be a growing repository of knowledge on applied innovation.

The scope of the proposed AIE would include:

1. To conduct applied research in hard innovation, so as to overcome the paucity of the knowledge base available to the public.
2. To develop and deliver content matched to the needs of SMEs that are currently innovation-averse.
3. To provide fast search facilities linked to international patent databases, and to develop more efficient autonomous search mechanisms.
4. To provide various levels of on-line services to subscribers ranging from newsletters, lessons, exercises, innovation contests, etc., (all free of cost), to a range of more specialized services, all at subsidized rates.
5. To provide trusted services, where warranted, to help accelerate innovations deemed in the national interest, by constituting virtual groupings of experts, academia, and industry, around an innovation.
6. To develop a environment which is supportive without being predatory towards the innovator.
7. To provide a mechanism whereby retired professionals from the technology domains can re-connect with the state of the art in their fields, and get compensated for providing their expertise to the interested subscriber.

### **National Repository for Technology Problems and Needs.**

The most common refrain that one hears from others after an innovative idea or product is unveiled is that if they had heard about this problem earlier, they may also have worked out a solution. Our creative energies remain dormant unless faced with a need or, preferably, a necessity.

The National Repository for Technology Problems and Needs is proposed as a component of the Australian Innovation Engine. It will enable individuals, firms, and larger organizations to post technology-related problems to the repository, where these will be classified and passed on to the appropriate interest groups.

Interested individuals, firms, universities and research organizations may subscribe to and access this information, which will be presented in a non-proprietary format. They may provide anecdotal or more specific information, or advise of specialized services they can provide on a commercial basis.

Most importantly, the NRTPN will enable us to be much more aware, individually or collectively, about problems that otherwise would never have registered in our thinking.

### **Utilization of knowledge capital of retired personnel.**

Once a person retires, there is no available mechanism for them to stay connected with their disciplines or for industry and other organizations to tap into their accumulated experience. This is a considerable and irretrievable loss.

The Australian Innovation Engine would provide a mechanism for a person to re-establish their links with their field of specialization. The participation would be entirely on-line, and a person could connect from home and interact to any degree that they may prefer.

The aim would be to provide a mode of engagement that builds a distributed national knowledge-base. It would be financially advantageous for the participants, who would be valued more for what they know than to be brought down to what is often menial levels of part time employment.

Participants would gain additional competence in areas like patent search, and would be able to provide direction and insight from their own field of specialization. A subscriber to the Australian Innovation Engine would have the option to utilize dedicated expertise at subsidised costs and if desired, progress to a virtual cluster of expertise and resources that the AIE could arrange for them.

By developing formal mechanisms of knowledge capture, the AIE would provide incentives for non-active professional to participate in the development and evolution of the knowledge bank available within Australia.

**Innovation coupons to new graduates in all disciplines.**

I would suggest that new graduates in all disciplines be given coupons as an inducement to innovation in the years following their graduation. The coupons would provide them with the resources to innovate, including a subscription to the proposed Australian Innovation Engine, as well as much reduced costs on filing for patents. In case a graduate utilizes say all three of the coupons within 5 years, a fresh set of coupons could be provided that would carry additional incentives.

**Innovation add-ons to MBA programs.**

Our business schools graduates have strong financial and marketing skills. They lack the tools and the training to launch value enhancement and revenue generation initiatives. Typically, the mindset is that of cost-cutting with the aim of impacting the bottom line as quickly as possible.

Add-ons to existing management programs need to be developed which provide participants with a balanced exposure to <I and I> techniques, and a set of innovation tools and methodologies. The focus should be on value creation, dialectic reasoning, re-framing the problem, utilizing hard constraints to maximum effect, and varying their assumptions.

Graduates would demonstrate competence in linking up on-line with the proposed Australian Innovation Engine, to quickly compile known alternates to any given problem, and to rapidly formulate alternate avenues of tackling the problem in an innovative manner. Graduates should also be exposed to basic knowledge management concepts.

**Concluding**

The NIS, like any other system, must have a boundary of demarcation as well as clearly defined components. These should interact harmoniously, even synergistically. The weakness of any critical component should be readily observed and addressed. The motive energy source driving the system is the convenient availability of applicable knowledge. Accelerating the generation of new knowledge as well as the prevention of the temporal erosion of the existing knowledge base are the two functions of this system. The submission contains several unique proposals to address these issues.