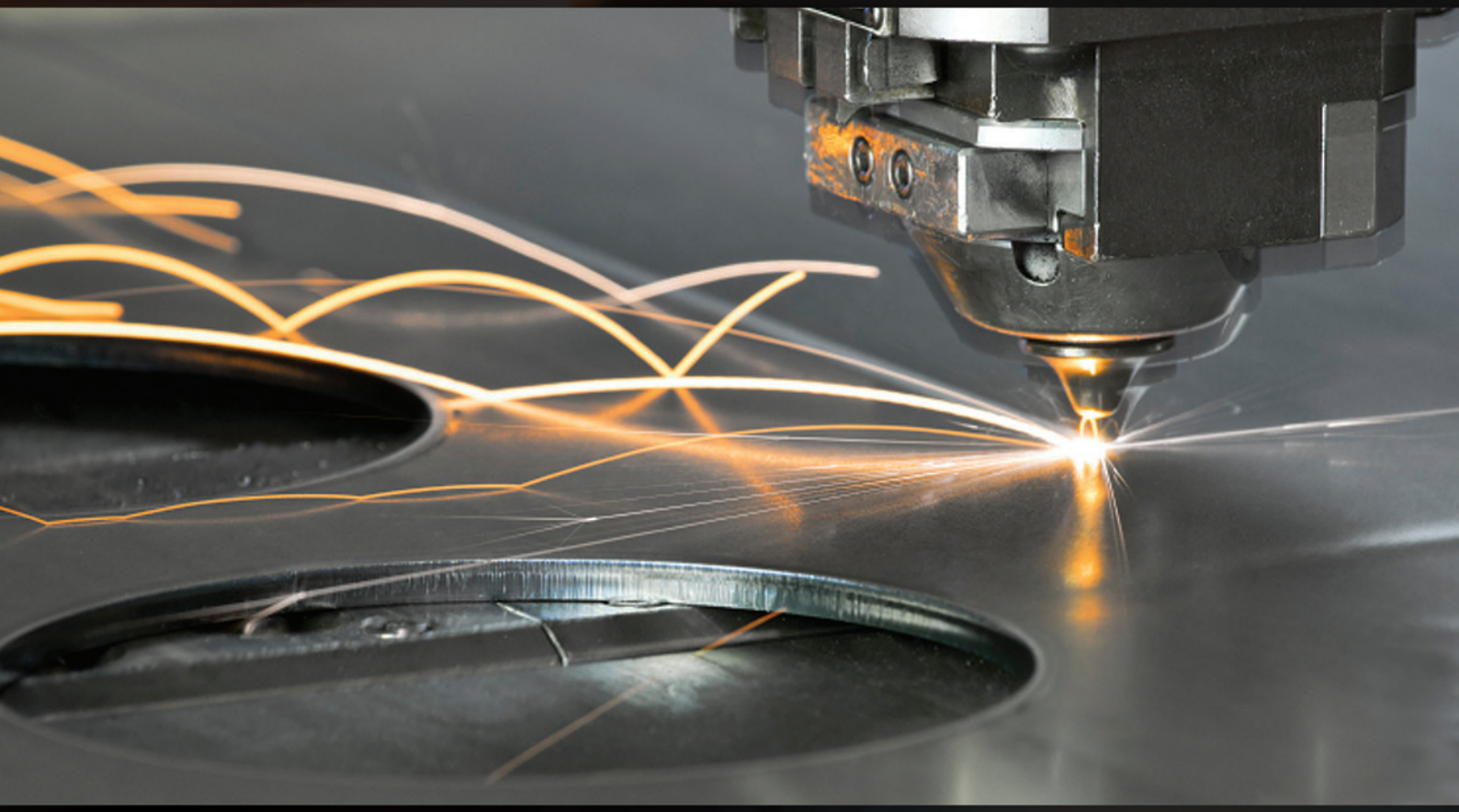
Summary of Recommendations

Manufacturing into the future

Göran Roos



Adelaide Thinker in Residence 2010 - 2011

Manufacturing into the future: Summary of Recommendations

Prepared by Professor Göran Roos
Adelaide Thinker in Residence 2010–2011

Government of South Australia

Department of the Premier and Cabinet C/O PO Box 2343 Adelaide SA 5001

ISBN 978-0-9807470-8-9 www.thinkers.sa.gov.au

Premier's Foreword
Message from Jay Weatherill

Since the mid twentieth century, manufacturing has been a crucial part of the South Australian economy. Starting with the industries built here in World War Two, and continuing with the investments made during the 1950's through the keen government support of Sir Thomas Playford, manufacturing grew rapidly to become one of the biggest employers in our State, and one of our largest economic sectors.

However, over the last two decades, our traditional manufacturing has come under increasing pressure from a globalised economy. Our previous competitive strengths, relatively cheap land and labour, have weakened, and the high tariff wall that surrounded our industries has been dismantled.

Yet we are determined that manufacturing will be part of South Australia's future. That is why we invited Professor Goran Roos to become our 23rd Thinker in Residence - to help us create a vision – and a strategy – for a renewed manufacturing sector in South Australia.

As Professor Roos noted during his time here, all successful, advanced economies have strong manufacturing sectors. And these sectors are strong because they compete on value, not on cost - value that is created through innovation and advanced manufacturing that result in high quality products that can compete in a rapidly changing global economy.

We will seize every opportunity to help our industries evolve into the advanced manufacturing sector that will underpin their future strength. We can build on our huge advances in defence and clean technology over the past decade, and importantly, use the massive expansion of our mining industry to grow advanced manufacturing to be a sector that offers secure and fulfilling work to many South Australians.

To start this task, the Government has prepared a Manufacturing Green Paper which has been inspired by Roos' recommendations and we have announced a new Advanced Manufacturing Council which will be chaired by Professor Roos. In the second quarter of this year, we will release a Manufacturing Strategy as a result of the Green Paper consultation.

The Government welcomes Professor Roos' report and believes that it is a useful and important contribution to the public debate.

Jay Weatherill

The Hon. Jay Weatherill
Premier of South Australia

Professor Göran Roos

Professor Göran Roos is one of the founders of modern intellectual capital science and a recognised world expert in this field. He is a highly respected adviser to government bodies in UK, Sweden, Norway, Denmark, Finland, Spain, Austria and Australia on issues relating to strategy, research & development, national and regional innovation systems issues, knowledge management and intellectual capital.

Göran has worked as a consultant in most OECD countries and has served in management positions in several European and US-based corporations. He presently serves as a member of the International Scientific Board of Valio.

His extensive work around the world has involved academic and professional work which has had profound impact on the development of the field of Intellectual Capital. In addition his work has had the flow over effects of great influence on the development of the Graphic Art Industry in Australia, Norway and Sweden.

Göran's background also involves work which has had a profound impact on restructuring defence research in Sweden and Austria, primary industries research in Australia and technical research in Finland.

He is the author and co-author of numerous books and articles on Intellectual Capital, Innovation Management and Strategy. He has authored or co-authored papers that have been named as the Literati Club Awards for Excellence Outstanding or Highly Commended paper for the years 2002, 2004, 2005 and 2007.

In other parts of the world and particularly in Australia over the past 18 months, Göran's teaching and influence has had enormous effect on the strategic repositioning of major firms. Professor Göran Roos was appointed Adelaide Thinker in Residence in 2011 with a focus on Manufacturing into the Future.

Professor Roos worked with ten South Australian manufacturing companies, leading them through an intensive program on business model innovation.

The companies involved were:

- Haighs Manufacturing Pty Ltd, Unley
- Intercast & Forge Pty Ltd, Wingfield
- Korvest Ltd, Kilburn
- Philmac Pty Ltd, Hendon
- SAGE Automation, Melrose Park
- SAGE Didactic, Melrose Park
- Seeley International Pty Ltd, Lonsdale
- SJ Cheesman, Port Pirie
- SMR Automotive Australia Pty Ltd, Lonsdale
- Tytronics Developments Australia Pty Ltd, Hendon

His Residency involved a diverse partner group including:

- the Department of Manufacturing, Innovation, Trade, Resources and Energy (formerly the Department of Trade and Economic Development)
- the Australian Industry Group
- Innovate SA
- the City of Marion
- University of Adelaide
- University of South Australia
- Flinders University

In parallel with this program, students and researchers from Adelaide's three main universities were involved in preparing case studies on specific areas of business development for each of the companies.

Objectives of the Residency

The framework for the Residency was a set of five broad objectives set by the partner group in collaboration with Professor Roos.

Objective 1:

Provide guidance in the development of a manufacturing industry strategy and an implementation plan for the strategy that involves government and other partners.

Objective 2:

Transfer knowledge about business model innovation with an emphasis on small to medium enterprises leaving a cohort of 'champions' for the future of manufacturing in the state.

Objective 3:

Assist in bridging the gap between research needed by industry and the instigation of university research projects.

Objective 4:

Raise awareness within the broader community of emerging opportunities in a globally competitive manufacturing sector and accelerate the emergence of a new manufacturing paradigm for South Australia.

Objective 5:

Provide advice on the skills development needed for modern manufacturing.

Summary of Key Findings

This section is a summary of Professor Roos' key findings as an Adelaide Thinker in Residence. It provides an assessment of the current state of manufacturing in South Australia and internationally, outlines the thinking and the rationale behind Professor Roos' recommendations and identifies the opportunities for the development of the manufacturing sector and longer term economic growth.

A full discussion of Professor Roos' key findings can be found in the Manufacturing into the Future Report, available online at www.thinkers.sa.gov.au.

1.1 Manufacturing, or the business of making things, is a critical component of any advanced economy

- It is the biggest spender on applied research and innovation with spillover effects into the rest of the economy
- It is the key driver of productivity improvements
- It makes up the biggest share of world trade and is critical for export earnings
- It is the largest driver of high value services
- It is the largest generator of employment, with each job in manufacturing generating on average, between two and five jobs in the rest of the economy.

1.2 The importance of manufacturing has been realised by all advanced economies, if not before, then since, the global financial crisis

- There have been several calls to action in both Europe and the United States. The shift to global manufacturing and a lasting lack of concern for the health of the US manufacturing sector has led to the loss of five million manufacturing jobs in the US since 2000. Close to half of all manufactured products sold in the US today are imported; the country exports only a quarter of that volume (for which a large share of the input is imported), which has led to a huge, persistent, and growing trade deficit that has reached 11 % of GDP.
- The countries that have recovered best from the global financial crisis are all based around high value-added export oriented manufacturing (Austria, Denmark, Finland, Germany, Netherlands, Sweden and Switzerland). These European manufacturing belt countries are all doing well in spite of the Global Financial Crisis and the Euro Crisis.
- Chinese growth is also primarily based on manufacturing, of which around 15% is exported.

"A healthy manufacturing sector is a must for any advanced economy with ambitions to maintain economic and social wellbeing."

Professor Göran Roos, 2011

1.3 Manufacturing is changing

- Technology enabled developments are changing the nature of manufacturing to an extent where existing statistics are becoming unreliable – primarily relating to the growing provision of services and solutions from manufacturing firms. Correcting for these statistical omissions leads us to conclude that the business of making things - including services and solutions provided by manufacturing firms - probably represents, as a share of GDP, more than 30% of an advanced (or innovation) economy. A good illustration is Ericsson – the world's leading provider of telecommunication infrastructure products, services and solutions – of their 98,000 employees around 22,000 work in research and development, 50,000 in services and solutions and the remainder in production and administration.
- The emergence of digital and additive manufacturing, biotechnology enabled manufacturing and nanotechnology enabled manufacturing is changing the form of manufacturing in ways that can most easily be described as a new industrial revolution that will impact virtually all manufacturing related activities.
- Design based innovation [the ability to change customer and consumer behaviour] drives rapid shifts in industry profit pool shares.
- Business model based innovation enables the appropriation of a higher share of the value created and hence increases profitability dramatically.

The two latter points are exemplified by Apple's iPhone.

1.4 South Australia is a small economy

- A small economy does not have the opportunity of a large economy to spontaneously generate optimal responses to change. Left to its own devices, compared to a large economy, the small economy as a whole has a higher risk of decline unless there is outside intervention. To express it in neo-classical economic terminology: The smaller the economy the more pervasive market failure is, as an attribute of the economy as a whole.
- Since access to both new knowledge and lead customers is both more probable and more cost effective in a large economy, it is likely that a firm will, over time, move from a smaller economy to a larger one. This relocation decision is also impacted by the ownership structure of the firm. If the decision making power rests with a group of diverse economic actors with no location preference, it is more likely that they will relocate the company to a larger economy. Whereas, if a firm is owned by an individual or family, strongly connected to their community, their decision about the location of the firm may not be made purely on economic criteria. This means that the need for proactive government intervention in the form of industry, innovation and research policy is very high, in order to ensure a strong, diversified and locally embedded manufacturing sector in SA.

1.5 South Australia needs a more balanced manufacturing sector

- According to IBIS World data wine, iron, steel, copper, silver, lead and zinc manufacturing have a turnover equal to the rest of South Australia's manufacturing industry combined. A rebalancing is needed to reduce the state's economic risk and to enable the state to benefit from any rapidly emerging opportunities, for example, the resources boom.
- Without a manufacturing strategy South Australia will not have a diverse and capable manufacturing sector. A well-balanced and capable manufacturing sector should be able to convert the comparative advantages represented by local resources, for example, minerals, wheat, grapes, apples, wood and wool into competitive advantages. Without such a balanced and capable manufacturing sector, there is a risk of South Australia experiencing the surprisingly strong downside of a resources boom.
- Compared with leading manufacturing nations South Australia needs to increase the value add and productivity in manufacturing firms. This is frequently enabled through investments in intangibles like training, digitalisation of operations, research and development.

1.6 As part of the Australian national resources boom South Australia is on the threshold of developing Dutch Disease

- Dutch Disease can be characterised by:
  - An increasing demand for labour from the booming resources sector, resulting in a production shift from the manufacturing and service (or non-traded) sectors to the resources sector. This effect, although visible, is not normally a major problem since the booming sector is capital intensive rather than labour intensive and hence does not employ a large number of people as a share of the total economy.
  - The extra revenue generated by the booming sector results in a spending effect which takes the form of increased demand for offerings from the services (or non-traded) sector. This increased demand moves labour away from the manufacturing sector.
  - Increased demand for non-traded goods (or services) results in increased prices for these goods. This is to be compared with the prices of the goods in the manufacturing sector which are set internationally and hence cannot change as a consequence of changes in domestic conditions. This outcome can be seen in the form of an increase in purchasing power of the domestic currency relative to other currencies.
- Allowing a shift away from manufacturing will be detrimental to the long-term wellbeing of the State. It takes longer and is much more complex and costly to re-build a competitive manufacturing industry than it is allowing it to die. A case can be made that the cost of regaining a lost competitive manufacturing sector can be higher than the net gains from the resource boom. This is due to the relatively lower speed of technology growth in the booming resource sector and the services (non-traded goods) sector as compared to the manufacturing (traded goods) sector.
- There are two means to reduce the risk of Dutch Disease. The first is to slow down the appreciation of the real exchange rate (this is a federal issue and is therefore outside of the objectives of this Residency). The second is to increase the competitiveness of the manufacturing sector. This will require a number of simultaneous actions, for example:
  - investment in education aimed at and for the manufacturing sector
  - investment in infrastructure benefiting the manufacturing sector
  - encouraging innovation in the manufacturing sector through the implementation of demand side policy tools

- One of the weaknesses that needs to be addressed on the firm level, is managerial capability. Studies show that Australia is mediocre in its managerial capability. In effect, 27% of Chinese and Indian firms are more capably managed than half of Australian firms. (Source: Management Matters Data Set. For further survey work see Nick Bloom and John Feenen, 'Measuring and Explaining Management Practices across firms and Countries', Quarterly Journal of Economics, November 2007; Australian Management Practices Research; as presented by Professor Roy Green at the Australian Camber's Business Congress in June 2011)
- The importance of this is further highlighted by the increased direct competition arising from the Chinese and Indian manufacturing sectors moving to increasingly sophisticated levels of production. In addition, as a consequence of further development and adoption of information and communications-related technologies, structural changes will result from parts of the services (non-traded) sector becoming traded.

"The role of Government in ensuring the future of the manufacturing sector, in a small economy showing early signs of Dutch Disease, is critical."

Professor Göran Roos, 2011

1.7 The resources boom may be shorter than generally believed among decision makers

This is due to:

- Technology developments that make it possible to have economic growth without growth in resource use – sometimes called "the greening of the economy". Sweden has achieved absolute decoupling of increasing GDP and greenhouse gas emissions from 1995 onwards.[1]
- Consumers voting with their wallets and their feet. There is global consumer and political pressure on closed-loop low-resource-footprint manufacturing systems, for example, using the waste of one process as the input for another process . This is called 'Industrial symbiosis'. Good examples of emerging industrial symbiosis clusters can be found in Kalundborg in Denmark and Kwinana, south of Perth.
- Global regulatory pressure and penalty risk exposure. There seems to be a lack of appreciation of Australia's risk exposure if it is not seen to take early steps to manage its carbon impact. Australia cannot afford to be too late in this domain, especially if it is seen to avoid negative economic impacts through rapid expansion of its domestic and international carbon footprints. The consequence is that when international agreement in the carbon footprint domain is reached between the OECD (Organisation for Economic Co-operation and Development) countries and the BRICS (Brazil, Russia, India, China and South Africa) countries, Australia risks being sacrificed. This could be in the form of export taxes based on the carbon intensity of the Australian economy and its carbon footprint. It is, among other things, against this backdrop that the carbon tax should be seen.

This means that the value of any discovered resources will decrease in an accelerating way over time and should be exploited early to maximise their value. It is essential that the exploitation of resources is complemented with associated manufacturing industry development.

[1] Mollerston, K et al. (2005) 'Swedish Report on Demonstrable Progress', to the COP1/MOP 1 UNFCCC meeting

1.8 The South Australian policy environment needs to be strengthened substantially

- Economic development should be at the centre of any government's agenda. Without the revenue provided to government through economic activity, no spending dependent policies are possible.
- Any economic value creation policy requires a framework beyond a balanced budget.
- Demand side tools like procurement, cluster initiatives (including industry participation policies) and regulation drive outcomes and are currently underutilised. All three demand side tools are critical, widely used and well proven in the OECD world where they have been shown to deliver very good outcomes. The present focus is on supply side tools that only drive activity.
- Policy development must be grounded in a good factual understanding of the present situation based on reliable data. The lack of reliable data is presently a problem in South Australia.
- Policy development must be grounded in a clear and constantly updated view of the future using, for example, technology roadmaps.
- Policies should be developed relating to the following key industry policy domains

    a. *Transforming* a mature or declining industry that is very large in terms of employees, turnover, geographical dispersion, systemic impact or tax contribution (e.g. firms in the automotive supply chain; firms in the defence supply chain).

    b. *Rejuvenating* a mature or declining industry that is very large in terms of employees, turnover, geographical dispersion, systemic impact or tax contribution (e.g. Wine; Forestry, Paper and Pulp).

    c. *Growing* an existing industry grounded in both comparative and competitive advantages with positive outlooks for its share of global business (e.g. Food; firms in the mining supply chain).

    d. *Building* an industry grounded in future comparative and competitive advantages with positive outlooks for its share of global business (e.g. Functional Food; Scientific Instruments).

- Special projects are instigated relating to key urgent opportunities, to ensure that the economic benefit to the State is maximised.

In South Australia, these opportunities could relate to:

- Developing and executing an industry participation policy around building mining related clusters, centred on resource extraction opportunities. Development of the policy could be undertaken by a working group involving the key stakeholders and drawing on the Ontario, Hebron project in Newfoundland and Norwegian examples.
- Develop and execute a policy around Tonsley Park, drawing on industrial ecology/ symbiosis principles and links with other industry policy domains e.g. the mining related cluster initiatives.
- Industrial triage, or 'corporate welfare' activities should be by exceptions, short lived and only acceptable if a clear transformation or rejuvenation policy is established and associated actions committed to by the receiving firms. Industrial triage activities should be transparent and publically reported.


MOL
TRG
RAPID
TOLL

Summary of Recommendations

Economic philosophy underpinning the recommendations

The prospects for dealing effectively with the structural problems facing the manufacturing sector are bleak, as long as traditional neoclassical economic principles dominate economic growth policy. Despite a growing critique of the efficient market hypothesis in academic circles from the 1970s, which reached a peak in the mid 1990s, it stayed the dominating paradigm until the first dot. com-bubble in around 2000 when it started to be generally criticised. Since the global financial crisis in 2008, the efficient market hypothesis has been widely rejected as unrealistic in its assumptions and governments have begun replacing it with behavioural economics as the underlying theory for public policy.

1: Replace the efficient market hypothesis with behavioural economics as a philosophical basis for government policy.

Industry, Innovation and Research Policy – the foundation of a thriving and sustainable manufacturing sector

Industry, innovation and research policies are aimed at increasing national wellbeing by maximising economic value creation under the constraints of minimum environmental and resource use and impact, combined with maximum positive social and public good effects.

2: Develop an integrated Industrial, Innovation and Research Policy.

3: Establish a South Australian Industry, Innovation & Research Policy Council.

Policy formulation on the macro-economic level sits at the Cabinet/Ministerial level. Individual Departments are then responsible for identifying and delivering the meso-level policies and strategies. Some of these meso-level policies and strategies are then broken down into micro-level strategies and programs which are implemented by the departments' delivery agencies.

4: Establish clear objectives and responsibilities on the macro and meso level for DMITRE and other departments as relates to the industry, innovation and research policy. Establish clear, transparent and continuous evaluation systems for these objectives and responsibilities.

5: DMITRE should articulate the micro-level objectives for its delivery agencies and establish a clear and transparent evaluation system for these agencies.

6: Map the industry landscape in order to enable fact based policy making in the industry domain.

7: Identify the 15% growth oriented SME's and target programs and activities at them.

8: Operationalise the suggested policy objectives by sector, once the industry landscape is mapped out.

9: Identify the targeted industry policy sectors along the following dimensions:

a. *Transforming* a mature or declining industry that is very large in terms of employees, turnover, geographical dispersion, systemic impact or tax contribution (e.g. firms in the automotive supply chain; firms in the defence supply chain).

b. *Rejuvenating* a mature or declining industry that is very large in terms of employees, turnover, geographical dispersion, systemic impact or tax contribution (e.g. Wine; Forestry, Paper and Pulp).

c. *Growing* an existing industry grounded in both comparative and competitive advantages with positive outlooks for its share of global business (e.g. Food; firms in the mining supply chain).

d. *Building* an industry grounded in future comparative and competitive advantages with positive outlooks for its share of global business (e.g. Functional Food; Scientific Instruments).

10: Put in place a voucher system for SME's to encourage them to link with universities, TAFEs, research and technology organisations and public and private providers for problem solving purposes. The purpose of the voucher is to enable the firm to begin addressing a problem that it cannot solve on its own and for which there is no obvious solution available of-the-shelf. The objective is not that the problem should be solved but rather that the firm can see that it is possible to solve the problem through working with the provider. In other words the purpose is to foster productive linkages in the innovation system.

Policy Instruments

Policy instruments are the tools which can be used to overcome problems and achieve objectives. The available policy instruments are only limited by the law of the land, political acceptability and the innovativeness of the policy development team. The fundamental difference between supply side and demand side policy tools is that the supply side policy tools tend to drive activity while demand side policy tools tend to drive outcomes. Demand side policy tools include procurement, regulation and clusters and research from the European Union suggests that demand side policy tools are between 50% and 100% more effective as drivers of innovation.

11: Ensure a balanced use of policy tools from both the supply side (primarily for research policy use) and the demand side (for innovation and industrial policy use).

Demand side policy tools: Regulation

Regulation can be a powerful tool to drive innovation within specific sectors (e.g. construction) and technologies (e.g. green technologies). Although innovation is a rather important impact dimension of regulation, its explicit appearance within regulation is rather limited. An analysis of the objectives and missions of institutions and bodies responsible for regulatory policies in the European Union, the USA and Japan revealed that for those bodies responsible for competition issues, or operating in very dynamic sectors such as telecommunications, the promotion of innovation is stated as an objective.

12: **South Australian regulatory bodies responsible, for example, for the protection of competition, health and safety or the environment, have to adequately consider the opportunities of innovation in general for achieving their stated goals.**

13: **South Australian regulatory bodies have to become more proactive in identifying the trends in science and technology relevant for their regulatory framework by:**

- intensifying contact with the science and technology communities
- implementing "regulatory foresight" exercises
- observing on-going standardisation processes elsewhere.

14: **South Australian regulatory bodies have to focus on those types of regulation, or shape regulation, in a way which maximises the positive and minimises the negative impacts for the development and market introduction of innovations.**

15: **The performance criteria of South Australian regulatory bodies have to integrate indicators measuring the promotion of new products and services in balance with their other objectives.**

16: **Since innovation is a complex process, the promotion of innovation by South Australian regulatory policies requires a comprehensive approach, co-ordinating or even integrating the regulatory policies of all the regulatory bodies.**

17: **The implementation of regulation has to be consistent across agencies in order to reduce the risk and the costs to companies introducing innovations.**

18: **Shaping the regulatory framework for new products and services should also take into account windows of opportunities to establish lead markets which may generate trade advantages and are therefore a source of future growth.**

19: **Approval times have to be reduced, since they negatively impact the expected return on investment in long-lasting and expensive research and development that results in innovative products and services.**

Demand side policy tools: Procurement

Public procurement is an area of great economic, political and legal significance, involving governments at various levels buying goods and services from private firms, thereby representing a significant proportion of economic activity in most jurisdictions. Public procurement cannot only be a means of delivering policy, it can be used as a key instrument in economic and social change.

While acknowledging that the inherent complexity of multiple procurement policy objectives may sometimes be in tension, public procurement has significant positive effects on innovation success and the contribution of innovation (technology based, design based and business model based) to economic development is undisputed.

20: **Establish a South Australian version of the United States' Small Business Innovation Research (SBIR) program drawing on the UK experience.**

21: **Ensure coordination of procurement objectives in individual ministerial domains with the industry, innovation and research policy objectives to ensure maximum net present value returns to the economy.**

22: **Develop an evaluation mechanism for larger procurement projects.**

23: **Develop competence and processes that enables the deployment of procurement as a demand side policy tool for Industry, innovation and research policy objectives. This involves, for example, life cycle cost procurement and procuring beyond existing offerings.**

24: **Develop specific procurement policies to support the industry, innovation and research policies according to the two dimensions of societal need and market development.**

25: **Develop a Lead Market Initiative around Industry, Innovation and research domains drawing on experience gained from Finland and the UK, and underpin these with appropriate procurement policy tools as demand side drivers.**

26: **Implement a South Australian version of the UK's successful internet-based public procurement system for contracts up to about A$100k.**

27: **Within specific procurements there needs to be an efficient and effective means of managing procurement that aligns with current business practice. The UK's SMART procurement system offers such an approach and has established a track record of dealing with requirements creep, cost over-run and delay. This should be adopted and adapted for use in South Australia.**

28: **Develop a principle around intellectual property rights that results in the intellectual property developed in a project being handed to the party with the best opportunities and capabilities to commercialise it further.**

29: **Develop a risk-based framework around procurement that underpins the type of procurement situation to be managed.** [A framework is provided in Professor Roos' full report available online at www.thinkers.sa.gov.au]

Demand side policy tools: Clusters / Ecosystems

Economic activities tend to agglomerate in time and space which can result in benefits for individual firms and an economy more broadly. There are four types of economic agglomerations, three of which are highlighted here.

The first is Cities: when all firms benefit from being in a single location. These benefits lead to the emergence and growth of metropolitan regions and the centralisation of specific activities for example, manufacturing belts. A subset of this agglomeration is the so-called Knowledge City which is characterised by: high levels of economic success and knowledge intensity; a diverse industry base including distinctive specialist niches and a tertiary education sector that has a mutually beneficial relationship with the city, leading to industries based on research strengths, knowledge transfer to businesses and the retention of graduates.

30: **Develop a Knowledge City strategy with associated actions for Adelaide.**

The second is Creative Regions which refers to knowledge creation in a region that is not sector specific. This occurs due to the presence of a variety of skills and competencies that interact in an unplanned manner and hence generate new and often unforeseen knowledge that can be embodied in product-service-systems, designs and business models.

31: **Develop a Creative Region strategy with associated actions for on the one hand the City of Marion/McLaren Vale/ Fleurieu peninsula region and on the other hand the North Adelaide/Adelaide Hills/Barossa Region.**

Clusters refers to a group of linked actors (firms, financial actors, public actors, universities, media, etc.) where the group's sustainable competitive advantage is grounded in resources (monetary, physical, relational, organisational and human) linked to a particular location.

There is substantial evidence to suggest that innovation and economic growth are heavily geographically concentrated so clusters provide an environment that is conducive to both innovation and knowledge creation.

32: Develop a set of cluster initiatives focused around Greater Adelaide:

- Food/wine and agri-tourism
- Equipment and services for the mining sector
- Closed loop and low resource footprint production processes.

33: Reconstruct the Automotive Cluster drawing on successful case examples.

34: Develop and execute a policy around building a mining cluster centered around the large resource companies drawing on the Ontario and Norwegian examples.

The role of universities in the innovation system

The role of universities in the innovation system is a complex but important one. Universities are a source of highly educated people and a major source of new ideas. Along with their teaching and research activities, they attract new knowledge and resources from external sources and adapt existing knowledge to local conditions.

35: De-emphasise the commercialisation of intellectual property at universities and de-emphasise the focus on start-ups by academics without student participation.

36: Encourage universities and TAFE's to establish a path for promoting start-up firms by students.

37: Encourage a technical evaluation service, provided by universities, for business product-service-system ideas, along the lines of the Medical Device Partnering Program.

38: Establish an interdisciplinary research and teaching centre within the domain of integrated innovation management. The centre will develop and transfer tools and competence in this domain to students, researchers and firms and ideally, be joint venture between the three universities.

39: Establish specific structures, programs, competencies and linkages at universities and TAFE's enabling lifelong learning in firms.

40: Establish specific program for competitiveness development in firms operating in sectors with critical technology change:

- ICT system (software, hardware & edgeware) competence for all sub-suppliers in the automotive value chain
- Functional food competence for food firms
- Management of luxury goods competence for high value add business to consumer firms
- Digital manufacturing and additive manufacturing (also known as 3D printing) competence for plastic and metal manufacturing firms
- Service innovation and product-service-system management competence for all product manufacturing firms
- Solutions development and management competence for firms with product-service system offerings
- Design based innovation competence for manufacturing firms.

41: Encourage higher numbers of science and engineering students from an early age in the school system. This can be coordinated with the Australian Academy of Technological Sciences and Engineering, the Australian Industry Group and Business SA.

42: Emphasise that applied research is as valuable as basic research. Work on changing how academic staff work with industry.

R43: Broaden the visiting positions from industry to include not only visiting professors but also: visiting lecturers, visiting laboratory supervisors, visiting thesis supervisors etc.

The role of research and technology organisations in the innovation system

Public research and technology organisations (VTT in Finland, the Fraunhofer Society in Germany, TNO in the Netherlands and for some industry sectors, the CSIRO in Australia) are an important part of the innovation system. They differ from Universities in that the most common output of the international research and technology organisations is specific to a firm with a focus on achieving commercial outcomes.

44: Establish monthly briefings on emerging technology-based opportunities with practical examples and probable timelines as well as industry impact in key sectors. The provider being a public research and technology organisation or application oriented university institute.

45: DMITRE to ensure a local presence of national and international public research and technology organisations, with local research executing activities.

Lead Customers

Lead users or lead customers, can be described as:

- customers that are among the first to adopt a technological innovation
- users who benefit significantly from a technological innovation, meaning that adoption results in a significant reduction in cost or a significant improvement in performance
- users of substitute or complementary products or technologies, as they are potential customers for the technological application under development.

Lead customers can be public or private organisations. They are important drivers of innovation and several case studies demonstrate the potential value of lead customer input in the commercialisation of radical technologies.

By formally identifying who are (or could be), the lead customers in South Australia and combining private sector demand with public sector procurement practices, regulation and cluster policies, there is an opportunity to positively influence the industrial landscape more broadly.

46: Identify key lead-customers in the private (e.g. resource firms) and public (e.g. Hospitals) domains.

47: DMITRE to identify existing potential private sector lead customers and a process by which future potential private sector lead users can be identified.

48: DMITRE to articulate objectives for these identified potential private sector lead users. These objectives must be an integral part of the integrated industry, innovation and research.

Acknowledgements

Being appointed Thinker in Residence has been a great honour but without the support and contribution of numerous individuals and organisations it would have been impossible to deliver meaningful outcomes of the Residency.

I thank former Premier Mike Rann, as originator of the program, for both the invitation to become a Thinker in Residence and for the personal support provided throughout my time as Thinker. I would like to thank the cabinet members for engaging in a constructive dialogue around some of my suggestions and especially Premier Jay Weatherill for embracing some key suggestions.

The Residency partners were critical both before, during and after the Residency. Given my need for a rapid learning curve I would like to thank especially Lance Worrall, Len Piro and Rebecca Murrie who, together with many other members of the (then) Department of Trade and Economic Development provided insight, input and assistance for me during my Residency. I would also like to express special thanks to the AiGroup and in particular Stephen Myatt, whose guiding hand was greatly appreciated throughout the Residency.

Innovate SA, particularly Greg Boundy, provided me with assistance in understanding the support environment for small firms. Adelaide University, University of South Australia and Flinders University provided support and authors of the firm case studies. Special thanks go to Allan O'Connor for his coordination of the University interactions throughout the Residency and to Kelly Burton for her unwavering assistance in capturing the learning from the workshops.

Neil McNish and the City of Marion deserve a special thank you for their engagement in regional manufacturing and innovation issues.

This Residency operated on two levels. The first being on the meso- and macro-level and the second being on the micro level. On the micro-level I have had the great privilege of working with 10 very successful firms led by world-class management teams. I take this opportunity to thank the management teams of these firms for allowing me to spend 11 days with each of them: Paul Sandercock and the team from SMR Automotive Australia Pty Ltd; Alexander Kachellek and the team from Korvest Ltd; David McNeil and the team from Tytronics Developments Australia Pty Ltd; Frank Seeley and the team from Seeley International Ltd; Andrew Downs and the team from SAGE Automation and SAGE Didactic; Stephen Richter and the team from SJ Cheesman; Mark Canny and the team from Intercast & Forge Pty Ltd; Chris Stathy and the team from Philmac Pty Ltd; Alister Haigh and the team from Haighs Manufacturing Pty Ltd.

During my Residency I had the opportunity of drawing on the knowledge and experience of many individuals who kindly put aside some of their valuable time to engage with me. A special thanks to all of them.

Last but definitely not least I would like to express my deep felt thanks to the Thinkers Office under the management of Gabrielle Kelly and especially to Anne Rhodes who was my exceedingly efficient minder and confidante during my Residency.

Göran Roos

ADELAIDE thinkers IN RESIDENCE

Bringing world leading thinkers to Adelaide to assist with the strategic development of South Australia.

Government of South Australia

www.thinkers.sa.gov.au