A NATURAL RESOURCE-DEPENDENT PATH TO SUSTAINABLE ECONOMIC GROWTH IN WESTERN AUSTRALIA

Marc G. Saupin[1]
Faculty of Business, Edith Cowan University, Joondalup, Western Australia 6027, Australia.

ABSTRACT The fount of regional economic growth continues to challenge the minds of economists, policy makers and industry leaders, although the centrality of technological change remains the focal point. Whilst much headway has been made, contemporary theoretical approaches, involving both neoclassical and new growth perspectives, appear to relate to economies able to boast large populations and a rich variety of medium to large scale organisations operating across a diverse industrial landscape. This paper uses the Western Australian minerals and energy sector as an empirical basis to challenge the utility of orthodox theories for economic growth in small, resource-abundant economies. This paper outlines a theoretical platform based on a *natural resource-dependent path* for regional economic growth as being more suitable for Western Australia and similar small, low population, resource-abundant economies.

1. INTRODUCTION

Economic growth theory has advanced over the years with much attention focussing on the role of technological change. The centrality of knowledge networks, galvanised by knowledge flows initiated and sustained by close interactions between technology producers and technology users, has fashioned a new thinking of how regions are able to prosper. However, the importance of natural resource abundance to technological change and the dynamic link to high value-added manufacturing, seem to have been marginalised by growth theorists.

This paper argues that in those economies with a *comparative advantage* in natural resources but limited in industrial scope, potential exists for the natural resource base to initiate the formation of dynamic intersectoral linkages. This process results in the formation of down-stream knowledge-intensive industries able to act as a springboard for creating regional *competitive advantages*.

In developing this argument, a brief sketch is made of neoclassical and new theories of economic growth. The purpose is to highlight that both traditions have marginalised natural resource abundance as a basis for dynamic links to knowledge-intensive industries. Against the particular weaknesses outlined, a *natural resource-dependent* path for sustained economic growth is developed.

The strength of Western Australia's comparative advantage in the minerals

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and energy sector is then set out. The aim here is to outline the potential basis for technological expansion through the creation of clusters of high-value manufacturing enterprises capable of servicing this sector. Case evidence is then presented which shows that formerly small, domestic-orientated, struggling industrial research and development enterprises have developed international competitive advantages through their close association with the local resource sector.

Using the particular strengths of the Western Australian industrial economy as an example, a *natural resource-dependent* path for sustained economic growth is developed. Important policy implications for the Western Australian Government and governments of small, resource abundant economies are discussed.

2. THE SOURCE OF COMPETITIVE ADVANTAGE FOR REGIONS

The contribution of technological change to economic growth has been recognised since the early empirical work of Solow (1957) and Griliches (1957), who attempted to disaggregate technological change from other known factor inputs in the economic growth equation. The neoclassical school attributes the *residual* as the basis for increases in total factor productivity after discounting for labour and capital inputs[2].

The salient orthodoxy upon which this school depends is that technological change results from factors exogenous to the economic system. Economic growth and the comparative factors upon which it depends, are cast in a static context.[3] It follows that the ability of governments and firms to influence either the rate or direction of technological change and economic progress is slight. This orthodoxy has been extended over time to evolve precepts circumscribing international trade theory based on the theory of comparative advantage.

In contrast, the progenitor of new growth theory, Romer (1986), attributes technological change to the actions of firms and governments. From this perspective, industrial research and development and its role in strengthening the quality of knowledge networks, and the rise of manufacturing through the utilisation of applied knowledge, becomes material in the overall growth equation.[4]

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[2] Labour and capital are assumed homogenous and substitutes for each other in a two factor production model. The investigations by Denison (1985) and Jorgenson, Gollop and Frumeni (1987) have lent support to neoclassical approaches.

[3] See Kregel's (1972) summary of growth modelling up to the early 1970s and Freeman (1982); Dosi *et al*. (1988) for later developments in this area. See also Freeman (1990) for an eclectic account of productivity growth, innovation and related phenomena.

[4] The Winter 1994 edition of the *Journal of Economic Perspectives*, offers an excellent revision and critical analysis of both neoclassical explanations for growth and the more contemporary growth theories (see Romer 1994; Grossman and Helpman 1994; Solow 1994; Pack 1994). Apart from the appeal which endogenous growth theory has generated, the main criticism stems from its general lack of empirical testing due in part to its

Technological change is argued to arise from factors endogenous to the economic system. Economic growth is cast in a dynamic context arising from the combination in which labour, capital and technology are utilised to increase total factor productivity. As such, the growth path for an economy is linked to endogenously defined, *competitive assets* of a region.

Although the difference between neoclassical and new growth theories relate to the fundamental source of technological change, both perspectives share a common and important conceptual platform. Both agree that the production of knowledge underlies technological change, and that the rate and quality of knowledge flows are vital preconditions to economic growth. By emphasising the production of knowledge, both perspectives are *supply side* orientated.

Accordingly, the contrast and comparisons between the neoclassical school of thought and new growth perspectives remain important in both a theoretical and practical sense for company, industry and government policy aimed at influencing competitive behaviour in industry.

In view of the elevated, but undefined importance of exogenously defined factor assets in the economic growth equation of small resource-abundant economies, it is interesting to examine the way in which it is regarded by growth theorists.

3. NATURAL RESOURCE ABUNDANCE AND ECONOMIC GROWTH

Different regions present unique attributes in terms of natural resource abundance, technical skills, industrial and social structures and the varying demands these attributes make upon local infrastructures. Such attributes are defined as exogenous factors and are of varying significance to national growth depending upon the relative stage of economic development of the region.

The treatment by economists of exogenously defined natural resource advantages in economic growth is particularly revealing. For example, after allowing for differences in natural resource endowments, Pavitt and Patel (1988) and the early empirical studies of Arrow (1962), illustrate that different countries, at the same moment in time, experienced different production functions.

Grossman and Helpman (1990, pp.86), stress that comparative advantage dictates the scope of knowledge production which in turn, limits the range of possibilities for technology development irrespective of factor endowment. Grossman and Helpman (1991a; 1991b; 1994) suggest further that resource-rich countries like Canada and Australia might specialise in international trade based on these assets *rather* than embarking on technological specialisation.

Porter (1990, pp.72-73) goes several steps further arguing that in industries relying on natural resources or in industries lacking technological sophistication, sustainable competitive advantage is unlikely. In the case of Western Australia, McLeod's (1991, pp.40) study of local downstream processing activities found that the existence of high quality natural resources were not altogether sufficient

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relatively short history.

to ensure competitive advantage.

As to be expected these findings have limited appeal to resource abundant economies with a narrow scope of industrial activities, because it relegates these economies to the low end of the value-added spectrum. At the same time, it cannot be overlooked that certain countries or sub-national regions possess the depth of skills, types of industrial systems and supporting infrastructures (factor assets) which allow a broad range of generic technologies to flourish. It seems that these economies are of the type which have helped shape the precepts underlying neoclassical and modern growth theory.

There are, on the other hand, countries or sub-national regions that possess only some factor assets and are, therefore, compelled, at least in the early stages of technological upgrade, to specialise in a limited range of technologies[5]. These kinds of economies, which are typical of Western Australia, are small and open but with a rich abundance of natural resources which has defined the limits of their comparative advantage.

These economies inspire the development of heterodox theories for economic growth. This is because contemporary growth approaches ignore the propensity of the resource sector to stimulate the development of local technology-intensive enterprises and, hence, contribute to the creation of a vibrant and sophisticated internationally competitive industry base.

Drawing on studies conducted in the 1960s, Freeman (1988, pp.69) found that international competitive leadership was based on a cluster of radical and incremental innovations. The quality of the education system, institutional factors such as the role of government research and the depth and strength of inter-company and inter-industry technological and commercial networks were found to be critical. From this embracing perspective, competitive advantage is region-specific, and the national system for innovation, dependent upon it, endogenously defined.

Therefore, there is no objective reason to ignore the potential of a vigorous resource sector, upon which enterprises have already established international competencies, albeit in the low end of the value-added spectrum, to foster the kinds of endogenous assets alluded to by Freeman.

4. A NATURAL RESOURCE-DEPENDENT PATH TO ECONOMIC GROWTH AND TECHNOLOGICAL EXPANSION

The arguments presented support the central theme that the comparative advantage model for international trade combined with endogenous growth theory offers a normative dynamic growth model for small resource abundant economies. This heterodox model is based on an economy with a relative abundance of resources, resulting in static (immobile) comparative advantage. However, the growth path over time is determined by the rate of technological

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[5] See also Freeman and Lundvall (1988) for supporting evidence in the case of small economies.

development or a combination of dynamic competitive factors. Porter's (1990) model of technological progress and competitive advantage between nations, shares much in common with this approach but differs in fundamental ways.

Porter's competitive advantage paradigm stems from internationally mobile factors such as capital, while some factors such as labour, government, and natural resources are immobile. Porter embraces innovation systems as the ultimate source of technological growth, and at the same time implicitly argues that an economy's initial conditions determine where development starts and the rate of economic growth.

An implicit argument arises because Porter assumes that there exists only the one development path for all countries[6]. He argues that countries and regions would, over time and after significant investment and technological development, move from resource extraction to down-stream processing and finally into integrated manufacturing. The in-built innovation system, which Porter has in mind, is biased towards increased value-adding and presupposes an abundant population. As firms mature, they graduate from being domestic entities to trans-nationals, or multi domestic, progressing from the lower value-added spectrum of manufacturing to the higher value-added spectrum, and from labour-intensive to capital-intensive production.

Yetton, Craig, Davis and Hilmer (1992) provides evidence of why this does not occur in Australia and New Zealand. Small economies cannot provide the adequate *diamonds* or clusters for competitive manufacturing - they just do not have the population to generate demand. Moreover, Australian manufacturing firms tend to become multi-domestic[7]. Thus, Porter's model, for technologically-induced national competitive advantage, cannot be taken seriously for all nations, or indeed, for sub-national regions such as Western Australia.

Hence, the long-term growth path of a resource-rich but population-scarce economy need not follow Porter's route of the technology-induced value chain. Instead of continued down-stream processing with increasing employment in the manufacturing sector *unrelated* to the resource sector, the innovation system will be biased towards increasingly efficient resource extraction and labour-saving production. This will occur through the creation of related sophisticated manufacturers that provide the essential technologies for resource exploration, extraction and processing.

Unlike Porter's conclusions, the long-run growth strategy of the Western Australian resource-rich economy is to stimulate rapid economic growth in a vibrant and innovative capital-intensive industry which services the resource sector. The next stage of development requires the rise of high-technology industries, deriving their growth from local resource producers, graduating

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[6] The path typical of population abundant, capital accumulating economies with mature manufacturing sectors as found the US and Japan.

[7] See Yetton, Davis and Swan (1992) for further treatment of Australia's manufacturing sector, and follow-up comments by Midgley (1992). See also Scott-Kemmis (1993) for a thorough treatment of the limitations of Porter's theoretical framework for the case of Australia.

towards unrelated international markets with a range of diversified technology-based product and services. The general principles described above have much in common with precepts circumscribing cumulative causation.

5. CUMULATIVE CAUSATION AND ECONOMIC GROWTH

Support for Saupin's case evidence flows from models describing *cumulative causation*, where the emphasis for economic growth and technological upgrade is on agglomeration economies. Inherent in these models is the dynamism to arise when rivalry between firms takes place within the same geographical setting. All told, the flows of knowledge, between competing firms creates an environment rich in innovative ideas and heightened flow of new technologies[8].

Theories which foster a role for demand-side factors and promote the linkages which exist between demand and supply, arise from arguments put forward by Kaldor and Young. Extension to their work helps in the formulation of a heterodox theory for growth of particular interest to small economies. Argyrous (1996a; 1996b) synthesises this literature with case evidence from the Australian machine tool industry. The argument presented ascribes a role for demand to set in motion a *virtuous cycle of growth*. In the case of Western Australia, demand derives from local mining firms for a myriad of technologies needed to sustain their international competitiveness. In a theoretical sense, this has relevance for the creation of sustainable international competitive advantage.

Traditional international competitive advantage is linked to static returns to scale, arising from declining production costs and an inward movement of the firm's isocost curve, producing an outward movement of the company's production frontier or isoquant. The overall improvement in a company's production-cost position comes about by increasing market demand.

Technological spillovers, which account for a major proportion of *dynamic returns to scale*, are intrinsic to the production function. They arise from skill upgrades and productivity improvements internal to the company, but interdependent with the environment for industrial innovation. Hence, location and functional integration within a region characterised by intense knowledge production are said to stimulate the development of a virtuous cycle of growth, a precondition to technologically driven sustainable international competitive advantage.

In light of such heterodox developments, it is argued that natural resource-based advantages can provide an initial starting point for demand-led industrial

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[8] There are many industry examples which reflect this approach. See, for example, Whiteman (1990) for the case of Australia's information technology industry; Willoughby (1993) for the case of the New York State biotechnology Industry; and Todtling (1994) for the case of innovation networks in the Greater Boston region. Furthermore, policy tools have been conceived in light of the success in localities such as Cambridge in the UK (see Segal, Quince and Partners, 1985), and California's Silicon Valley and Massachusetts' Route 128 (see Saxenien, 1983). Cooke and Morgan (1994) also bring much of this approach under the rubric of the *spatial dimension of innovation*.

research and development to promote the rise of functionally related technology-based manufacturing. Accepting this line of argument provides a pragmatic theoretical basis for government intervention where decisions regarding economic growth are needed.

6. LIMITATIONS OF CONTEMPORARY GROWTH THEORIES AND THE UTILITY OF HETERODOX APPROACHES

Both neoclassical and modern views on economic growth theory tend to ignore the possibility of specialising in technologies, which have the potential to reach world-class standards, arising from the *demands* made by industrial activities related to the natural resource factor advantages peculiar to a region.

A contrasting approach would argue that dominant industries, with roots in the natural resource sector, are able to stimulate backward and forward linkages that deliver positive externalities which help in the development of peripheral industries. Firms and industries developing adjacent to the dominant industry spur the growth of functionally-related industries through evolving technological sophistication.

That this process is driven by the growth of internal demand for innovative technologies is not inconsequential. In the case of resource rich economies, it is the flow of technological know-how (knowledge), coupled with the accumulation of human, technical and other capital which *converge on* the region's natural resource base to produce innovation-led economic growth at the upper end of the value-added spectrum.

Support for this argument is offered by Tegart (1988). He asserts that in the choice of appropriate technologies one of several key criteria is the ability of the technology to *"reinforce and extend existing competitive advantage such as primary and resource-based industries."* Freeman and Lundvall's (1988) work on the Danish dairy industry illustrates the pragmatic outcomes of this approach. This industry commenced at the low end of the value spectrum but over the course of time has inspired the establishment of a number of medium to high technology firms operating across a variety of sectors such as instrument manufacturing.

This approach provides a stable base for the rise of growth *poles* identified by Perroux (1950), and further refined by Myrdal (1957), Hirschman (1958), Boudeville (1966) and Hansen (1967) who specify that growth stems from what could broadly be described as a core of highly productive technological capability. In a major sense, classical growth pole theory describes the rise of similar technologies from historically accumulated knowledge and skill.

Recasting growth pole theory promotes technological upgrade within a cluster of functionally-related industry activities, facilitated by a network of research-performing firms, universities, government and other institutions. The case evidence produced by Saupin (1995) in Western Australia, illustrates this precept by showing how several Western Australia firms had accumulated a range of international competencies by developing functionally-related equipment with specific application in the Western Australian resource sector. Over time, these enterprises diversified away from the resource sector into other sectors, both domestic and overseas, where customer-led modifications produced an array of technologies utilising their original core knowledge.

In practice, this created opportunities for forward and backward linkages enveloping technology-related supplier and user organisations into a *complex web* of technological relations centred on Western Australia's minerals and energy sector. Against the foregoing theoretical setting, this paper now looks at the Western Australian industrial economy to highlight the State's particular comparative factor advantages as the source of the state's competitive advantage.

7. WESTERN AUSTRALIA'S COMPARATIVE ADVANTAGE

Table 1 shows that relative to most other Australian states, Western Australia is a small economy. With around 10 per cent of the nation's GDP and nine per cent of the population, Western Australia is ranked fourth in size against other Australian states and territories.

However, Table 1 shows, that with around 27 per cent of the nation's total exports, Western Australia is the nation's export leader. The basis of Western Australia's export leadership and its main strengths is revealed in Table 2.

Table 1. Population, GDP and Exports Australia at June Quarter 1992

	Population ('000)		GDP (A$m)		Exports
NSW	5,932	34%	118,880	35%	22%
VIC	4,436	26%	89,021	26%	18%
QLD	2,996	17%	53,858	16%	21%
SA	1,452	8%	25,584	7%	7%
WA	1,647	9%	36,000	10%	27%
TAS	468	3%	7,805	2%	3%
ACT	291	2%	4,040	1%	3%
NT	166	1%	7,711	2%	0%
AUST	17,388	100%	342,899	100%	4%
					100%

Source: ABS Cat. 3101.0, 5242

Table 2. Composition of WA Exports 1992 -1993
Mineral and Petroleum Resources

	(A$b)	
Minerals & Energy	9.00	60%
Manufactures	1.35	9%
Agriculture	2.85	19%
Processed Raw Materials	1.65	11%
Other	0.15	1%
WA Total	15.00	100%

Source: DCT (1994)

From an export perspective, Western Australia's comparative strengths lie in the minerals and energy sector (60 per cent), which is heavily biased towards low value-added commodities. It deserves emphasising, however, that export proficiency in this case, is the result of a rich endowment of resources *coupled* with sophisticated exploration, extraction and processing technologies. These firms are leading the world in resource production. Example's include BHP, Western Mining, CRA, Alcoa and Woodside Petroleum. The basis of their competency stems from their leadership in the application of new process and product technologies, which enable efficient location, extraction and processing of premium grade resources.

The export orientation of these firms and their impact on international and national markets is impressive. Data for the 1991-1992 period shows that Western Australia's contribution to the world supply of mineral sands was around 35 per cent, diamonds 30 per cent, alumina 20 per cent, iron ore 10 per cent, nickel 7.5 per cent, and salt 2.5 per cent. Moreover, Australia is the fourth largest gold producer in the world with Western Australia contributing around 70 per cent to this output (WAIMS, 1993).

In Western Australia, the level of investments in new projects for mining and petroleum activities in 1991-92 was A$1.4 billion. This was in addition to the A$3.3 billion already committed investment funding and incomplete project activity (Department of Mines, 1992).

A striking example of the contribution of the mining and energy industry to the Western Australian economy is the North West Shelf Gas Project. Western Australia holds 80 per cent of the nation's oil and gas resources of which a vast proportion is being exploited by this project. The project's total estimated expenditure of A$12 billion has potential to boost the Western Australian economy in many ways.

By comparison, Western Australia's Gross State Product (GSP) was estimated in 1993 at just over A$33 billion, Western Australian Government expenditure was A$4 billion, and private investment was around the same level. The project is expected to generate export revenue of around A$2 billion annually which is roughly equal to 20 per cent of the state's exports, and is equivalent to around 6 per cent of GSP. Both investment and export earnings are calculated to increase Western Australia's GSP by 12 per cent and employment by 91,000 jobs (Clements and Greig, 1991).

In a broader setting, the direct benefits from mining and energy activities to the Western Australian economy are visible in many other ways. For example, mining firms have built 25 new towns since 1967, complete with housing, schools, hospitals, related infrastructures and other services. They have constructed 12 new ports, more than 20 airfields, and 1900 kilometres of railway line (WAIMS, 1993). By the end of 1991 total purchases by the mining industry amounted to A$3.2 billion, wages paid were around A$1.1 billion, and the contribution to the State Government revenue from royalties and lease payments totalled almost A$400 million. Moreover, the mineral sector has provided the source of raw materials to establish four major alumina refineries, a nickel smelter refinery, synthetic rutile and titanium oxide plants (Western Australian Chamber of Commerce and Mines Monthly Report, 1992).

The importance of the minerals and energy sector to the growth prospects of the Western Australian economy is clear. Accepting that the royalties are an essential source of income to Western Australia, and not discounting the valuable infrastructural contribution to remote areas, the vast majority of benefits derive from unprocessed or semi-processed raw materials.

These activities involve skills and technologies at the low end of the value-added spectrum. At the same time, industry observers suggest that the North West Gas Shelf Project will only become a significant contributor to the Western Australian economy if local industrial competencies develop. Hence, policy should be aimed at developing Western Australia's industrial capacity to respond to project demands by strengthening local industrial capability at the high end of the value-added spectrum.

Utilising Western Australia's natural resource advantages as a springboard for such advancement, Saupin (1995) demonstrates how this might happen with several detailed case studies of small Western Australian enterprises. These firms experienced rapid growth through technological and market expansion because of strong dynamic linkages with local mining and energy firms. The firms which have experienced double digit growth since 1990 are Transcom International Group (TIG) Pty Ltd, World Geoscience and Earth Resources Mapping Pty Ltd (Saupin 1995). The case of TIG serves to underscore the basic thrust of this paper.

8. TRANSCOM INTERNATIONAL GROUP (TIG) PTY LTD

Located in Perth, Western Australia, TIG's core technology is the Radio Area Network (RAND) communication system. Developed by TIG engineers in the early 1980s, trialing of the RAND communication system commenced in 1986 in conjunction with the former Clackline Mining Exploration Company Pty Ltd. At the time, Clackline saw the need for an efficient device which could transfer facsimile messages between the company's head office in Perth and their fleet of vehicles in remote locations.

In response to this need, TIG successfully employed its first generation of RAND data link controllers. The device offered complete security and total accuracy when communicating data. Impressed with its performance and capabilities, Clackline installed several in specially modified lap-top computers used by their field personnel. With Clackline's field personnel interacting with various counterparts from other small mining companies, news of the device soon spread.

Eventually, RAND became one of the most favoured choices amongst small mining enterprises. Importantly, each of these companies had their own particular needs. Building their requirements into various design configurations enabled TIG to develop RAND into a communication system that could be regarded as the industry standard for those particular small enterprise users. When opportunities arose to install RAND in larger mining companies, TIG faced the problem that most companies already possessed personal computers. Incorporating RAND into their existing computers was difficult and commercially unrealistic. These obstacles were, however, important in helping TIG develop and launch a range of portable stand-alone RAND data link controllers.

The first model produced in this class was the RAND TC 1103 data link controller. However, further demands from the larger mining companies called for further reductions in the overall size of the new model. As a result, the RAND TC 1103 was quickly superseded by the RAND TC 2101 which was smaller, more compact and lighter than any device previously produced by TIG. Having established the basic design and configuration of their data link controller TIG became more confident in the RAND's technological merits and marketable features. TIG began concerted efforts to interact more with some of the larger mining companies in Western Australia. Early clients included Western Mining Corporation Ltd, Woodside Petroleum Ltd, Hamersley Iron Pty Ltd and Mt Newman Mining Ltd.

These interactions led directly into widening the scope of application of the RAND. For example, the original configuration of the RAND communication system for Clackline needed only to accommodate facsimile message transfers. Trials conducted with Western Mining led to vast technological improvements in terms of improved interconnectivity with PC systems and more robust exterior designs for use under the harsh climatic conditions experienced in remote areas of Western Australia.

Further developments in the configuration and application of the RAND communication system resulted from the demands of Hamersley Iron Pty Ltd. Hamersley sought to couple the RAND data link controller to a network of solar powered closed circuit television cameras, driven by microwave link and VHF telemetry system. Hamersley Iron's aim was to oversee vehicle loading operations at their open mine sites. Once RAND was successfully designed and commissioned for this application. Hamersley Iron began utilising the RAND data link controller for remote polling of onboard data logging equipment for its vehicle fleet.

This particular development led to important research with Griffin Coal Mining Co Pty Ltd. In collaboration with TIG engineers, Griffin Coal was able to modify the basic configuration of the RAND for their fleet of Caterpillar haulpacks. The RAND system was re-configured to interface with on-board computers linking the vehicle with the company's office network of PC's. These modifications allowed Griffin Coal to download operational data from their Muja mine site and transfer this information to their head office in Perth office without disabling their earthmoving vehicles.

Importantly, the demands for technological advancement required that TIG seek out specialist suppliers. Over time, this requirement led to the formation of a close network of user-producer-supplier firms built on the exacting demands of the mining industry. At the same time, changes in the direction of TIG's industrial research and development inspired by existing and emerging needs of their clients led to critical advances in the technological base of both TIG's client base and

TIG's operations. This provoked TIG's international market expansion and saw their technologies applied in a variety of settings unrelated to the resource sector.

TIG's case points to the development of a demand-led network of enterprises, linked through specialisation, to form a cluster of high technology specialist organisations with dynamic links to the Western Australian resource sector. The outcome characterises a dynamic intersectoral expansion of the knowledge base relating to equipment used in the minerals and energy sector. This is associated with the incremental development and application of various new technologies in other sectors of industry, in both local and overseas markets.

9. IMPLICATIONS FOR GOVERNMENT POLICY

The conditions which favour an *evolutionary* perspective of competitive advantage, with its focus on natural resource advantages, has important implications for Western Australian government policy. The State's economy does not possess the breadth and scope of industrial activities which allow a wide range of industries to either flourish or develop international competencies. While modern growth theory posits that it is the activities of firms, as well as the action of government policy, which lead to the creation of internationally competitive firms, the implicit line of argument *is* one of *picking winners* from amongst a pool of rival firms.

In the case of Western Australia, however, there are few firms, outside of the minerals and energy sector considered among the category of *world-class performers*. Therefore, it is not a matter of picking winners. This is the theoretical limitation imposed by previous traditions because of their limited utility in the case of resource-rich economies.

The fundamental departure in this paper over previous approaches is that it respects the traditional economic, technical and infrastructural characteristics of Western Australia's comparative advantage as a potent influence on the investment behaviour of firms with the potential to offer internationally competitive services to the resource sector. In this vein, the utility of the natural resource-dependent path for competitive advantage, is offered as a theoretical construct for population scarce but resource abundant economies to shift their activities towards higher value-added production.

10. CONCLUSIONS

Orthodox theories for economic growth do not adequately explain the basis for regional competitive advantage for economies like Western Australia and others which are population scarce but abundant in natural resources. For the case of Western Australia, this paper has taken steps towards fashioning a heterodox theoretical approach for sustainable regional growth, by emphasising an evolutionary demand-led path, which fosters dynamic linkages between static comparative factor assets and dynamic competitive factors.

The natural resource-dependent path for economic growth articulates how the minerals and energy sector, at the low end of the value chain, are able to contribute to the development of enterprises concentrated at the high end of the value chain. The cluster of producers sets up a virtuous cycle of dynamic growth involving the application of sophisticated industrial research and development to manufacturing, leading to related technological diversification and international market expansion.

The natural resource-dependent path for regional economic growth presents a compelling argument for industry leaders and policy makers interested in the link between industrial research and development, manufacturing and programmes and policies held critical to regional competitive advantage. The implications for Western Australian government policy relates to the basis, upon which the State Government and industry leaders acknowledge the potential scope of opportunities for creating value-added networks arising from the minerals and energy sector.

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