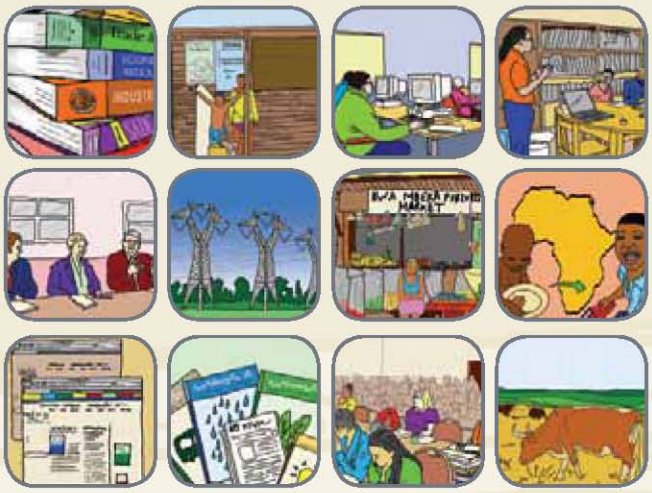
TRADE & INDUSTRIAL POLICY STRATEGIES



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Achieving Asgisa's Aspirations: The Role of the National System of Innovation

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indigenous **growth**

DRAFT – PRELIMINARY

ACHIEVING ASGISA'S ASPIRATIONS: THE ROLE OF THE NATIONAL SYSTEM OF INNOVATION[1]

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Abstract

The ASGISA document identifies several binding constraints preventing South Africa from achieving elevated levels of economic growth (Republic of South Africa, 2006). This paper takes an evolutionary perspective to consider whether the proposed policy interventions will address what is, arguably, a fundamental growth constraint: the current inability of the economic system to generate and support sufficient innovation. A substantial body of literature has accumulated in mainstream and evolutionary economics that indicate the salience of new combinations and ideas in fuelling the 'creative destruction' driving growth in market economies. However, several economists and policymakers still, incorrectly, understand innovation as referring only to high-technology research and development (Lundvall, 2007). Instead, innovation should be broadly conceptualised as referring to a process of identifying new combinations of production factors, product characteristics and functions and service features and also new forms of organising human activity. This implies that innovation is not an aspect of economic activity limited to "high tech" activities in laboratories. Rather, it is the very driving force of economic activity in all sectors and locations, from agriculture to engineering, from Gauteng to the Eastern Cape.

*Based on this broader perspective of innovation, the paper employs the analytical concept of the "national innovation system" to analyse the identity of and relationships between various actors and institutions contributing to innovation. Based on this systemic analysis, the paper will identify problem areas inhibiting innovation in the South African economy. Thereafter, the paper considers whether the ASGISA policy proposals adequately address these "binding constraints" on innovation. One general finding in the paper concerns the importance of understanding innovation as a multi-scalar process, involving both the micro-activities and decisions of individual firms and larger institutional structures (Afuah, 2003). Such a complex system requires a coherent policy framework, where policymakers carefully consider the links between various policies. However, the paper shows that policymaking generally do not appear to follow such a systemic approach, with policies all too often developed in "silos" – resulting in frequently contradicting aims. While South Africa has adopted a policy framework for the national innovation system, other government policies are not consistent with the goal of that framework. By highlighting the problem of policy coherence, the paper contributes to further discussion on how to foster an effective national system of innovation that will make a significant contribution towards accelerated economic growth***.**

1. INTRODUCTION & RATIONALE

When economists turned their attention to economic growth in the 1950s, knowledge was essentially treated as a public good, by virtue of its non-rival (the same piece of knowledge can be used by many actors simultaneously) and non-excludable (once in the open difficult to exclude others) nature. In this view, knowledge could be easily acquired and firms did not need to develop technology – leading neo-classical growth models of the time to treat technology as exogenous (Solow 1956). Neoclassical growth models favoured an explanation for economic growth based on the evolution of factor inputs and, in particular, factor substitution, in order to support the view that economic growth is inherently stable. Subsequent empirical investigation, however, highlighted the role of technology and opened the path for two bodies of growth

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theory in the 1980s and 1990s: the so-called endogenous growth theory and evolutionary economics. Regardless of group sympathies, however, economists now agree that long-run economic progress depends critically on innovation, that is, on advances in knowledge and technology. Analogous to this, constraints on economic progress may very well be traced back to limits on the growth and application of knowledge. It is in this context that the ASGISA growth initiative of the South African government, aimed at addressing "binding constraints" on economic growth, should be assessed. If the aim is to raise the long-run growth path of the South African economy, this policy framework should be directed towards assisting the economy to generate and support innovation. This paper evaluates whether the proposed policy interventions will address the inability of the economic system to generate and support sufficient innovation.

Given the focus on policy analysis, the paper seeks, firstly, to provide a brief outline of the extant body of research on innovation and, secondly, to evaluate South African innovation policy and, in particular, the ASGISA policy program in the light of these insights.

2. INNOVATION IN AN EVOLUTIONARY SYSTEMS PERSPECTIVE

Endogenous growth research, initiated by Romer (1986), essentially models research and development (R&D) as a stochastic process characterised by spillovers among innovative firms (Lucas 1988). While these models have elevated the role of knowledge in understanding long-run growth, they continue to treat the relationship between knowledge and growth in a rational, optimising framework – limiting understanding of the underlying processes of innovation. Of course, this has enabled growth modellers to make impressive use of quantitative data, but empirical success appears to have been limited (Verspagen 2007).

In contrast, evolutionary economics has questioned the behavioural assumption of neoclassical growth models, where actors make innovation decisions with perfect foresight. Instead, building on the insights of the behavioural school, Nelson and Winter (1982) and others argue that the rationality of innovators are bounded. In this view, innovations that are deemed to be best adapted to the particular circumstances tend to be selected and, hence, survive – creating an evolutionary trajectory for knowledge and growth. This evolution is different from the evolutionary concept sometimes invoked by neoclassical economists: Alchian (1950) argues that market competition selects the most efficient solution, but Winter (1964) shows that, in evolutionary theory, it is not the most efficient but the *best available* solution that survives.

The evolution of new combinations and technologies is fundamentally an endogenous systemic process. This follows from the nature of knowledge generation and learning, which necessarily requires interaction among individuals and organisations and is shaped by extant knowledge (Metcalfe 2007). Knowledge dissemination depends, firstly, on the cognitive processes of humans. New knowledge is not simply objective information that is easily diffused, as its dissemination depends critically on the absorptive capacity of the agents involved. Behavioural economics research confirms that humans use mental frames and categorisation in sense-making and these categories are shaped by their personal and social circumstances. Absorptive capacity, as Nooteboom (2005) argues, is "…cumulative, and to a greater or lesser extent idiosyncratic and path-dependent". Because absorptive capacity relies on prior experience, much of human knowledge is tacit: i.e. it cannot be codified. This has implications for evolutionary innovation: selection and evaluation of new knowledge requires knowledge to be fairly explicit. Therefore, organisations in which tacit knowledge is pervasive may have difficulty dealing with particular forms of novelty. This applies to many smaller firms, where skills are transferred via learning by doing.

Consequently, high levels of innovation are usually associated with an environment populated by institutions and organisations that facilitate the creation and diffusion of codified knowledge. This is a key driver of the high levels of innovation observed in science-based industries, such as telecommunications and engineering services. However, while codified knowledge is becoming more important and pervasive, the translation of knowledge into a commercially feasible product or service requires "experience-based learning and tacit knowledge" (Lundvall 2007). This is closely related to the differences between physical and social technologies: while physical technological progress is relatively easy to achieve, it is the failure to develop adequate accompanying organisational and other processes (i.e. social technologies) that result in poor innovation performance (Nelson 2003).

The systemic nature of innovation is further underlined by the crucial role of the market process in motivating and selecting sufficient novelty (Metcalfe 2007). Organisations and individuals learn through the market process what solutions are the more profitable ones. This involves not only a process of individual learning, but

involves organisations continuously adapting their overall routines and capabilities, singularly or in joint venture formats with other organisations (Nooteboom 2005).

In sum, the generation and dissemination of knowledge is a multi-scalar, systemic process that involves the flow of knowledge among individuals and within and among organisations and is supported by an elaborate formal and informal institutional structure (Lundvall 2007). Therefore, a systems perspective is appropriate when contemplating innovation policy.

3 THE NOTION OF A NATIONAL SYSTEM OF INNOVATION

Today the concept of a National System of Innovation (NSI) is ubiquitous in government, academic and business circles alike, but it has been a long time in the making. The first kernel of an idea in this direction germinated as far back as the nineteenth century, as Lundvall (2007: 3-15) documents in the family-tree of this concept. While it is thus not our purpose to relate the evolution of the intellectual understanding of a NSI, it is nevertheless important to be clear about what we understand such a system to mean, especially in the light of the vagueness and distortions associated with the concept as it is applied in different environments.

The NSI is considered a very useful tool to focus attention on what needs to be done to enhance the opportunities for innovative activities, since the systemic approach facilitates the identification of obstacles and lacunae which impede the functioning of the system.

Many definitions of an NSI have been offered over the years. The common elements seem to refer to various organisations (e.g. firms, suppliers, customers, research entities), institutions (here meaning the 'rules of the game', i.e. formal and informal institutions, such as customs, norms, laws, etc.), and policies that shape the conditions under which, and the manner in which innovative activities take place. Particular emphasis is placed on the interaction amongst the different parts of the system, especially as far as opportunities for learning are concerned, but also in the sense that weaknesses in some parts of the system have consequences for the rest.

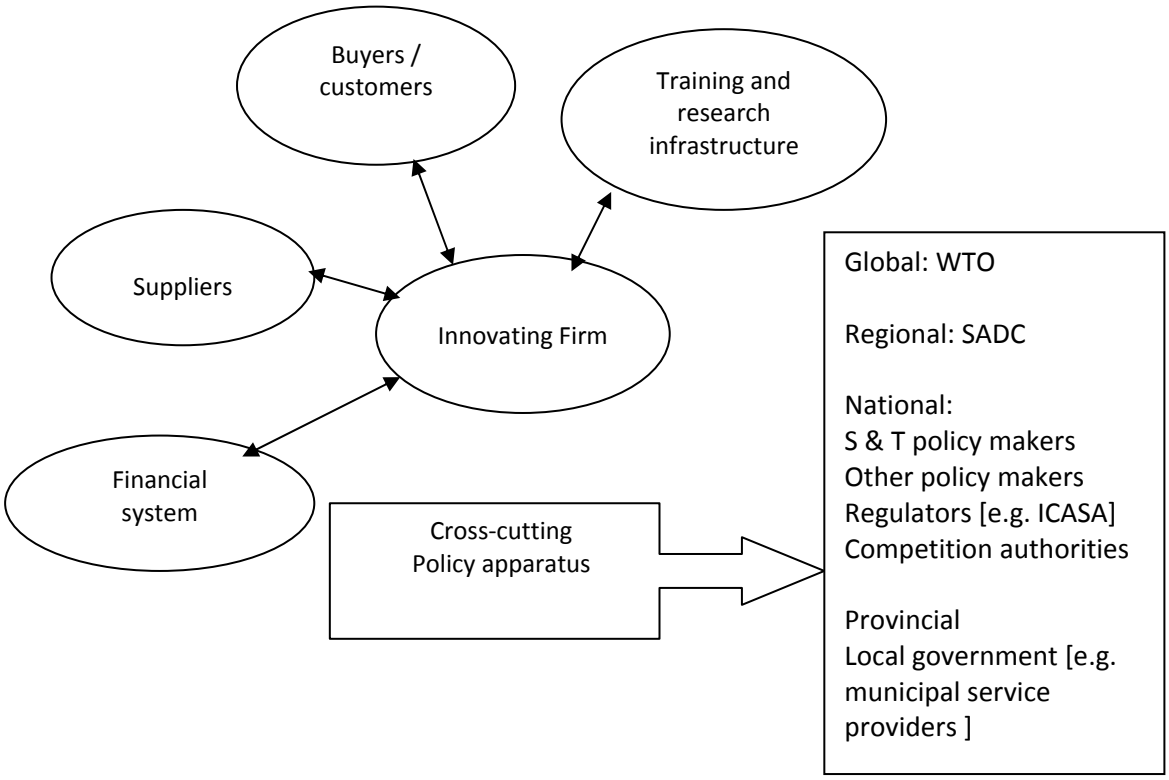
3.1 The NSI in evolutionary perspective

Form the evolutionary Economics perspective, a successful NSI would succeed in generating variety (e.g. in physical and social technologies), effective selection mechanisms (e.g. a well-functioning financial system and product markets), as well as maintaining a stable core of interactions in the system to ensure continuity in the face of changes in the environment (Metcalfe, 2007: 447-449). Underlying all this is the fact that the system is dynamic, i.e. interaction by the actors and institutions in the system generate the patterns and structure of the system over time. In Figure 1 we illustrate the cross-cutting nature of policy in the NSI. The innovating firm is the driving force which combines physical technologies and resources to generate new products and services (product innovation) or cheaper, better quality products and services (through process innovations). The innovating firm, however, is reliant on many other actors in the system. Success depends on finding sufficient suppliers able to deliver the inputs the firm needs at acceptable prices, quality and lead times. On the other side of the market, the firm's customers are important in being willing to pay for the product or services resulting from a new innovation, sometimes having to change their behaviour (e.g. switching from standard to high definition television). The firm is further dependent on factor markets, e.g. the financial system, which could range from the stock exchange variety to venture capital or formal commercial banking, as well as a well-functioning labour market. Here education and training institutions play a crucial role in supplying adequate human resources. Through all this interaction, there are always opportunities for learning, whether it be informal feedback from customers or suppliers or market signals such as share price changes. Also, at every point of interaction, policy and its efficient implementation (or lack thereof) could play a role in enhancing or impeding innovation.

3.2 The NSI in a developing country context

Lundvall et al., (2003:14) consider some weaknesses of NIS in developing countries. According to Lundvall (2007) the NSI concept still lacks a proper treatment of the power aspects of development. Its focus on interactive learning may lead to an underestimation of the significance of conflicts over income and power. Thus, increasing rates of learning and innovation may not only increase productivity but also may increase polarisation in terms of incomes and employment. There is a possibility that in developing countries the interactive learning possibilities may be blocked and existing competences destroyed for political reasons.

FIGURE 1. THE NATIONAL SYSTEM OF INNOVATION: A STYLISED VISION FROM AN ECONOMIC PERSPECTIVE



Source: Adapted from Montobbio (2005: 379)

Edquist (2001) on the other hand, suggested a different approach to developing countries. He calls it a system of innovation for development (SID). The difference between SID and NIS are identified by Martinez-Cisneros (2004:7) as;

a) Product innovations are more important than process innovations because of the effect on the production structure;
b) Incremental innovations are more relevant and attainable than radical ones;
c) Adoption (diffusion) is more important than development of innovations that are new to the world;
d) Innovations in low and medium technology sectors are more attainable than those in high technology sectors.

While these reasons (or Edquist's approach) are not compelling enough to abandon the belief that a NSI designed for developing countries could achieve development objectives, these characteristics of the innovation systems in developing countries deserve further attention. The last aspect is particularly important, since there seems to be a tendency to want to focus resources on high-technology sectors (see for example South Africa's Ten-year Plan for Innovation (DST, 2008). The fact of the matter is that innovation in its broadest sense has a role to play in most areas of human endeavor, also where low technology may be appropriate.

3.3 The role of policymakers and –implementers in the NSI

In a thought-provoking paper Paraskevas Caracostas[4] (2005) considers the usefulness of the NSI approach from what he calls a policy-shaper's point of view. Mostly it has to do with operationalising the concept so that it is

[4] The author is an economist who has spent more than fifteen years in a policy-related position at the European Commission.

clear to policymakers and –shapers what it is they are supposed to do in the system, and what the NSI implies about the scope of their responsibilities. Some of the most significant points are considered in the next section.

3.4 A case for co-evolution: The learning policy-shaper

Lundvall (2007: 2) laments the fact that, although the concept of an NSI has been adopted by many governments, the standard economics understanding of innovation (the so-called linear model) and the implied role for government, i.e. correcting for market failure, still persists in practice. Caracostas (2007: 475) confirms that this is indeed the case, but offers very practical reasons for it:

"Whether he or she likes it or not a policy-shaper trying to defend the need for more funds for R&D relies implicitly on the famous 'linear model of innovation'. This view of innovation sees the relations between research and markets as forming a 'chain', a straight line extending either from research to market ("technology push") or from the market to research ("market pull"). Despite the fierce criticism they have attracted from the more popular systemic approaches, these linear models paradoxically continue to influence thinking amongst decision-makers and public opinion because they have the virtue of being simple (or of appearing to be so."

He further adds that the idea of market failure and its justification for government intervention then becomes the unchallenged ally of the linear model because this offers a convenient and concrete argument for legitimation purposes (Caracostas, 2007: 477).

In contrast, Metcalfe (2007: 452) is adamant that the proper domain of attempts to enhance the rate of innovation is systems policy:

"The broad rationale is systems failure rather than the traditional market failure arguments. For the latter derive from an equilibrium theory of competitive resource allocation whereas the appropriate framework is one of a competitive process that is ordered but never in equilibrium. Indeed the purpose of innovation policy is to ensure that it never is in equilibrium but is continually challenged from within."

How then, could the role of government in the NSI be articulated in more concrete terms? An emerging approach is that of recognising that innovation policy evolves i.e. is endogenous to the NSI. This brings us to the notion of a learning policy-shaper, notably one that learns by interacting with other participants in the NSI. This learning may also require deliberate attempts to acquire new knowledge. A pertinent example is the case where complex technologies change rather rapidly, to such an extent that those responsible for the legislative and regulatory framework may not have acquired the competences to deal with the nature and implications of the new technology. Not acquiring the necessary knowledge and competences may result in impediments to innovation. In this regard, the institutions such as trust and mutual respect that enhance effective interaction amongst participants in the NSI are crucial. These are norms and value systems that are not easily built, cannot be bought, and definitely are not quantifiable for empirical purposes. However, given their importance, it ought to be worth employing best practice research to find ways to strengthen these institutions.

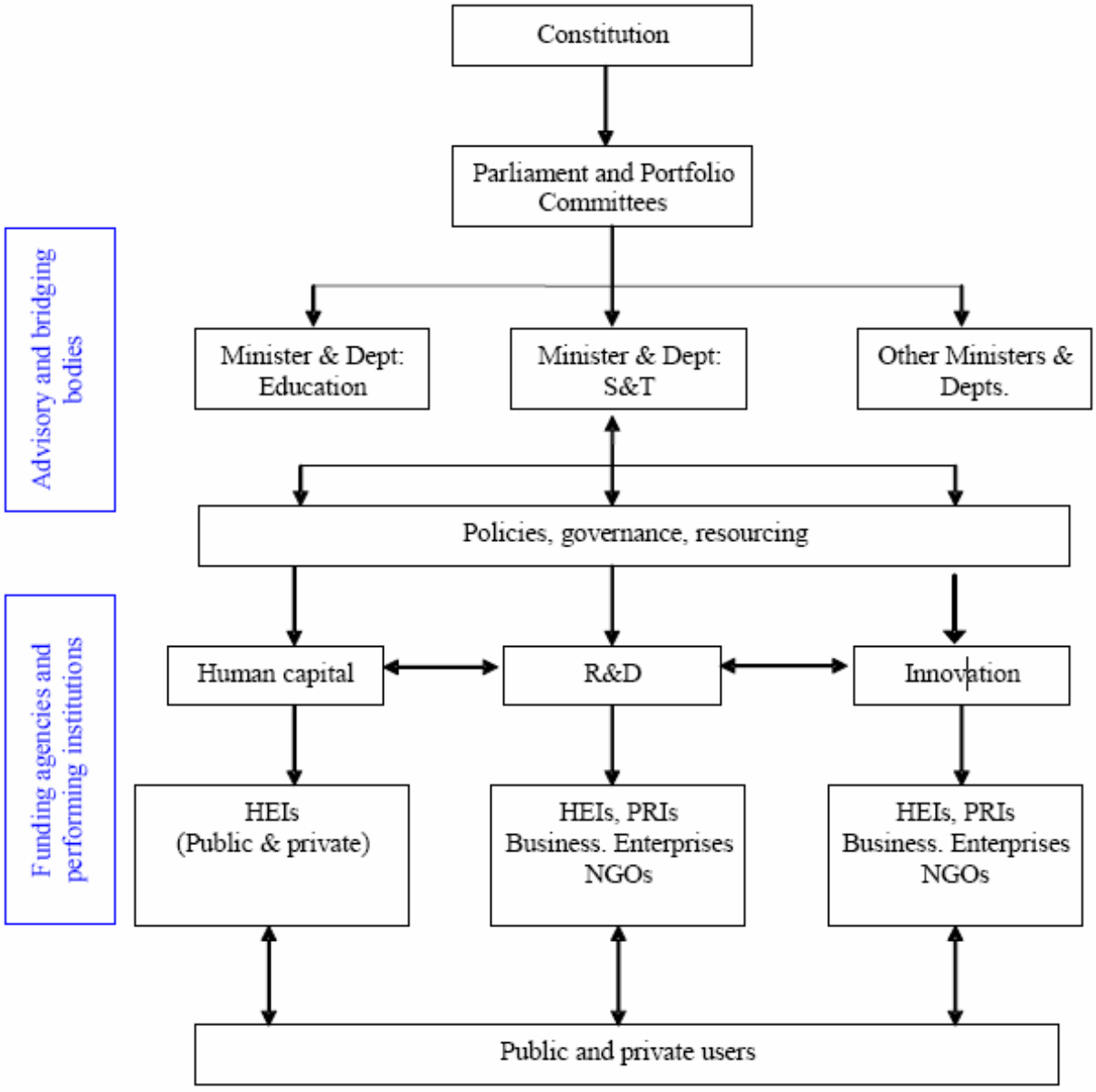
4. THE CURRENT INNOVATION POLICY FRAMEWORK IN SOUTH AFRICA

In South Africa, the White Paper on Science and Technology (1996) adopted the framework of a National System of Innovation for the first time. Since then, an enormous amount of work has been done to build and benchmark the NSI, as well as measure the performance of the system over time. Policy and strategy documents aimed at supporting innovative activities in order to improve the country's chances of achieving sustainable economic development by now must add up to a good few thousand pages. These documents comprise, to name but a few, the technology audits of the 1990s, the technology Foresight documents, the National R & D strategy (2002), the Integrated Manufacturing Strategy (2002), the Biotechnology strategy for South Africa (2001), the Ten-Year Innovation Plan (2008), the legislation creating the National Advisory Council on Innovation (NACI), the NACI benchmark studies (see http://www.naci.org.za).[5] In the South African context, the NSI construct is voiced as:

[5] While this is not an exhaustive list, it suffices to illustrate how much effort is directed at this policy area.

"one of alignment, steering and partnership, rather than command and control, therefore the mainstreaming of science and technology initiatives within the framework of national budgets with consistent and consultative actions amongst stakeholders is important" (Paterson, et al, 2003: 23).

FIGURE 2. THE NSI FROM THE SOUTH AFRICAN GOVERNMENT'S PERSPECTIVE



Source: NACI (2006)

In this section we give a brief overview of the NSI from the perspective of the South African government[6]. The NSI, as presented by the NACI, has two broad categories, namely i) advisory and bridging bodies, and ii) funding agencies and performing institutions (Figure 2). According the NACI (2006), the NSI consists basically of five groups of role players, namely, the policy makers (Parliament, Portfolio Committees and Cabinet), the policy

[6] It is not our purpose here to enter into a comprehensive discussion of the elements of the South African NSI. For a comprehensive discussion, it is worth consulting the NACI's 2006 *Background Report to the OECD Country: Review of South Africa's National System of Innovation*.

executors (Minister of S&T, DST, other Ministers and Line Departments), the National Advisory Council on Innovation, the R, D & I performers (SETIS and HES) and the users of R&D technology and related outcomes (business and other interest groups).

It is striking how the dynamics and relationships amongst the groups in the system from this perspective differ from that presented in Figure 1. Whereas the latter places the innovating firm at the centre of the NSI and emphasises the interaction and feedback processes, the representation in Figure 2 gives the impression of a one-way process where the users of the results of the NSI activities at the bottom are the recipients of knowledge, technologies, and innovation and not active participants in the process.

5. ASGISA

In February 2006, the South African government introduced its most recent economic plan, the Accelerated and Shared Growth Initiative (ASGISA). The plan consists of a number of policy interventions aimed at addressing what policymakers consider to be the "binding constraints" on long-run economic progress. It may be argued that ASGISA is not likely to continue in its exact form in the light of ongoing political changes within the ruling party. However, ASGISA is, in essence, a combination of the individual policy positions of various government departments and interest groups within the ANC and, therefore, likely to be fairly representative of its overall policy aims. In addition, political support at Polokwane for broadly maintaining current economic policies and general comments from the ANC since then indicate that existing policies are unlikely to alter significantly. Consequently, it is appropriate to view the ASGISA document as representing some key policy positions concerning economic development.

ASGISA and the previous policy programme of the ANC, GEAR, are attempts at directing policy focus across different spheres to achieve specified objectives. These objectives are summarized in the document as follows (Republic of South Africa 2006: 2): "Our vision of our development path is a vigorous and inclusive economy where production, products and services are diverse, more value is added to our products and services, costs of production and distribution are reduced, labour is readily absorbed into sustainable employment, and new businesses are encouraged to proliferate and expand". Implicitly, therefore, the aim is one of a dynamic, innovative economy. Consequently, it is vital to assess whether the ASGISA policy interventions are likely to enhance the economic system's capability to generate and support innovation.

This paper is an attempt at using the national system of innovation approach in assessing the ASGISA policy program. As argued in the preceding section, the NSI approach takes an evolutionary, systemic view of innovation. Particularly important for our purposes is the fact this evolutionary slant acknowledges the significant uncertainty associated with innovation. Consequently, the NSI approach should not be narrowly interpreted as implying that there is a single system of innovation which generates all innovations. However, in our view (and the view of scholars such as Metcalfe), the NSI approach acknowledges that most systems of innovation do share a similar set of components and relations (albeit in a variety of formats). Consequently, the aim is here to assess binding constraints that affect all innovation systems, without considering the specificities of sectoral innovation systems.

The ASGISA policy program identifies six "binding constraints" on long-run economic growth in South Africa:

- The volatility and level of the currency
- Transport infrastructure problems
- Labour skills and cost
- Limited competition
- Regulatory environment
- Government administrative failures

Table 1 assesses how and where these six binding constraints and the accompanying policy interventions are likely to influence the various components of a national system of innovation – in order to see how ASGISA is likely to contribute towards elevated levels of innovation. The subsequent discussion will centre on this table.

TABLE 1. BINDING CONSTRAINTS IDENTIFIED IN ASGISA AND WHERE THESE CONSTRAINTS ARE LIKELY TO INFLUENCE FIRMS' INNOVATION ABILITY

Features of innovation systems / **ASGISA Binding Constraints**	Forces favouring innovation-based competition	Knowledge subsystems		Commercialization subsystems				
	Competition and Demand	Generation	Dissemination & Absorption	Sectoral and industrial policies	Labour markets	Financial markets	Macroeconomic conditions	Infrastructure
Volatility and level of currency						X	X	
Transport infrastructure problems		X						X
Labour skills and cost		X	X		X			
Limited competition	X			X		X		
Regulatory environment	X			X				X
Government administrative failures			X		X		X	X

Innovation, as described earlier, involves knowledge and its transformation into market solutions under conditions of uncertainty. From a systemic perspective, one can therefore argue that innovation systems can be subdivided into a core set of knowledge building subsystems and a set of subsystems supporting the commercialization of knowledge.

5.1 Knowledge building and ASGISA

As far as the first set of activities are concerned, the departure point is that humans are the bearers of fragmented knowledge and that organizations aggregate these fragments into knowledge that has commercial value. Innovation, in the first instance, involves expanding these knowledge bases. Consequently, a fundamental policy challenge is the enhancement of knowledge generation, dissemination and absorption.

ASGISA recognizes this problem in its binding constraint related to labour skills. A more skilled population is likely to enhance innovation, because it raises absorptive capacity: knowledge is easily disseminated and absorbed among educated people. Furthermore, knowledge is also more easily transformed by skilled individuals, because education confers an understanding of the underlying principles of a technology (whether social or physical) and this allows for experiments in improved solutions – enhancing innovation levels. ASGISA, then, seems to acknowledge this by highlighting the need for improving the quality of education. Consequently, ASGISA reiterates government's substantial commitment to education in order to raise skills levels, especially among the larger part of the population who suffer from illiteracy and are limited to low skills job opportunities.

However, the development of skills must be understood as a long-term process. Skills retention, therefore, is as important in maintaining and enhancing the dynamism of the economic system in the short to medium run. Equally important, the retention of skilled individuals is necessary for the capability building process: much of process-related knowledge is tacit and can only be transmitted via learning by doing from experienced individuals. This is perhaps strongly related to the binding constraint concerning deficiencies in state capacity, where ASGISA has aimed, for example, to draw on extant skills to solve local government capacity problems.

Beyond education, knowledge building also requires significant investments in basic research and development. It is for this reason that universities and other research institutions receive government funding to conduct basic research in a variety of disciplines. Lack of research is one of the factors contributing to the failure of new firms in agriculture, including the dismal performance of the land restitution programme. Funding of research and employing individuals with the requisite skills of the relevant industry (that should consist of practitioners and qualified academics) is essential to spread more codified knowledge.

Whereas the discussion on learning and competence building in the NSI focuses on the link between *higher* education, research, innovation, and economic growth, the South African reality suggests that the discussion should start at a much lower level, i.e. back to the basics of education where numeric and reading with comprehension skills are to be acquired. The argument is quite simple: if the foundations of education are not properly laid at the outset, the learning process in future will be compromised with predictable results for the outcome of the ASGISA aspirations.

5.1.1 Moving from STI-learning to DUI-learning

Knowledge building involves *far* more than education or skills development and basic R&D supporting structures. The latter factors accord scientific knowledge a high priority: in this view, the goal of education and of basic R&D should be the enhancement of individuals' ability to understand scientific principles so that these principles can be mastered and improved upon. Of course, this is correct in its own right: as we noted in our discussion on the nature of innovation, one of the reason for the rapid advances in physical technologies has indeed been the fact that scientific research has enabled the codification of the principles underlying these technologies. Also, clearly, increased education levels increasingly enable humans to understand these technologies and experiment with them. This view is what Lundvall (2007) calls STI-learning – science-technology-innovation. However, as Lundvall notes, much of human knowledge remains tacit and requires what he terms DUI learning: doing, using and interacting.

This has two implications from a policy perspective. Firstly, it implies that it is incorrect to understand innovation as limited to high technology sectors. Innovation occurs in all sectors of the economy, from agriculture to engineering, from Gauteng to the Eastern Cape. Consequently, it is just as valid to refer to the

national system of tourism innovation as it is to refer to the national system of IT innovation. While tourism innovation may not involve an extensive and codified body of knowledge about software programming or the hardware components of a particular laptop, it requires extensive tacit knowledge about how to creatively combine various features of a game reserve to create a pleasurable weekend stay. Secondly, it implies that the learning process continues during commercialisation, so that it is, in some ways, artificial to distinguish between knowledge building and commercialisation. We return to this issue towards the end of the following section.

5.2 The wider setting: incentivising and supporting innovation and ASGISA

The economic system generates innovation because the profit motive incentivises firms to seek improvements in current products and services in order to capture above-normal rents. Market competition necessarily and increasingly requires firms to experiment, via trial-and-error, with improvements in products and services and related processes. This is a far cry from the conventional price competition sometimes emphasised, as competition is here for an entire niche market, not simply within a market. Clearly, the level of innovation depends on the extent to which firms are encouraged to experiment and the amount of support offered by the system in the commercialisation of new experiments. Consequently, beyond the subsystems concerned with knowledge building, as discussed in the previous section, NSIs also contain a variety of other components aimed at supporting the transformation of knowledge into commercial solutions, including labour and financial markets, macroeconomic conditions and the institutional framework. While the skills shortage constraint discussed previously severely affects knowledge building processes in the economy, the direct effects of the other five binding constraints in ASGISA are likely to be felt in this wider setting. Two of these constraints – currency volatility and transport infrastructure – have specific focus. However, these factors are, at best, wider background conditions important to the commercialisation of ideas and inventions. However, the last 3 binding constraints are of much greater importance, given their broad scope: limited competition, regulatory environment and government administrative failures. These three constraints are all directly related to either the regulatory frameworks developed by government or the performance of government departments. Consequently, it is in these where the greatest role lies for government in direct improvement of the economic system's ability to innovate. We will focus on these issues in this paper.

5.2.1 Barriers to entry, limits to competition and limited new investment opportunities.

The ASGISA document argues that several sectors – including the steel, paper, chemicals, telecommunications, energy, and paper industries – are highly concentrated. It claims that these concentrated structures have adverse consequences for the creation of new firms and products.

The ASGISA arguments ignore the path-dependent, historical nature of economic development in these sectors. All of these industries have been, and many continue to be, highly regulated. These are sectors that have been shaped decisively by government intervention over the course of several decades. However, since 1994, the government has failed to reduce the high levels of government interference and, therefore, low levels of competition, in these sectors. Instead, its actions have served to protect and prolong the incumbent status of companies such as Telkom and Eskom. From an evolutionary perspective, these government monopolies (*de jure* or *de facto*) prevent the experimentation associated with market processes from working, by precluding a significant part of the "solution space" via regulation. Consequently, one may expect that government would seek to address these fundamental problems if the aim is to raise levels of innovation. However, instead of considering the substantial constraints introduced by government policy on economic dynamism, ASGISA seeks to emphasise "the strengthening" of competition law and industrial policies.

Of course, competition policy is an essential policy to ensure the functioning of market processes. However, its success in any particular sector should not be measured in terms of the number of participants in a market, where the mythical "perfect competition" is the ultimate prize. This is quite clear from within the competition economics literature itself, which increasingly recognises effects over form: what looks anti-competitive in form may yet have substantial pro-competitive effects. In particular, the difficulty and cost of developing specialised capabilities and significant economies of scale may justify the existence of larger firms in an industry. Furthermore, there is nothing in the claim that larger firms in upstream sectors necessarily inhibit possibilities of downstream production, as the proliferation of downstream innovations by upstream producers, including category management and customer service provision, illustrate. Therefore, the ASGISA argument that "market structure negatively influences the possibilities of downstream production or service industry development" is not empirically supported. More generally, the claim that existing companies earn above-normal profits due to

high barriers to entry is not undisputed. Some authors, using particular datasets, have concluded that South African companies earn relatively high profit margins. However, based on other data, the persistence and level of profitability of South African firms are found to be fairly similar to those in the US.

Consequently, it may be argued that sectoral regulatory frameworks are the main contributing factors to entry barriers in the industries mentioned in ASGISA. Consequently, the adverse effects of these sectoral regulatory frameworks on innovation should receive significant policy attention.

5.2.2 Regulatory environment and the burden on small and medium businesses.

Given the preceding discussion, one may expect that the regulatory environment should be the central issue from government's perspective – given that policymakers have direct control over regulatory variables. The ASGISA document identifies several constraints including tax administration, municipal regulation, labour law administration and sectoral regulatory environments. The first three basically concern transaction costs in the economy. As ASGISA notes, these factors constrain especially smaller businesses in that they require proportionally larger dedications of resources to be diverted away from productive activity. However, as argued under the previous heading, it is sectoral regulation that hampers business development by creating an unfavourable environment for innovation.

Apart from the fact, then, that sectoral regulatory policies generally prevent firms and new ideas to freely enter markets and industries, regulatory policies in South Africa are also *mutually incoherent*. One of the difficulties that South African policymakers will have to face if they seek to enhance innovation and, hence, South African economic performance, is the *systemic* nature of an economy's institutional structure. Policymakers cannot afford to develop policies in silos. Policymakers have to be cognisant of the interrelationships between sectors. Innovation in the IT industry, for example, is strongly influenced by telecommunications regulations. For example, the IT industry's capacity to respond to the emerging challenges of convergence between communication and information technologies is constrained by the continued (albeit *de facto*) monopolisation of fixed line telecommunications. Similarly, innovation in the mining sector, including the development of new mines or the employment of new mining techniques, is directly dependent on the availability of electricity. Unfortunately, the ASGISA document does not present a clear strategy on how policymakers are planning to better coordinate their sectoral strategies.

5.2.3 Deficiencies in state organisation, capacity and leadership.

Finally, identifying the deficiencies in state organisation and capacity as a central constraint on long-run growth is encouraging. ASGISA appears to recognise that a lack of skills in the public sector is detrimental to economic development, as it impairs the functioning of government. ASGISA therefore proposes some interventions at the local government level as well as in key state-owned enterprises, such as the IDC, the Land Bank and the DBSA. However, it should be borne in mind that improving the administrative capacity of government institutions responsible for regulation and enforcement does not necessarily improve innovation if the regulation itself is detrimental.

5.2.4 Policy knock-on effects on knowledge building

This section has argued that, in addition to knowledge building processes, NSIs also consist of a variety of other components aimed at supporting the transformation of knowledge into commercial solutions. Consequently, the focus in this section has been on the likely impact of the ASGISA policy proposals on this "wider setting". This distinction (between knowledge building and commercialisation processes) is useful for the purposes of highlighting the impact of different policies on innovation. However, it is important to emphasize that policies affecting commercialisation also, indirectly, influence knowledge building. That is, policies cannot be neatly grouped into those affecting knowledge building and those affecting commercialisation.

From an evolutionary perspective, firms learn through a trial-and-error process initiated and facilitated by market processes. When firms are active in competitive markets, they are continuously required to experiment with new and improved products, services and processes. This imperative to commercialise new innovations, in turn, forces firms to acquire and build knowledge bases. Therefore, where policy frameworks do not facilitate, or (even if unintended) prevent firms from participating in markets, it is likely that the absorptive capacity and

skills bases in those industries will also be harmed. For example, it is unlikely that South African firms and workers will build strong IT knowledge bases if their commercial incentives are constrained by sectoral regulatory policies. This speaks again to the issue of policy coherence: clearly government's education and skills development policies are being counteracted, even though unintended, by government's own industrial policies. If ASGISA is to seriously address the growth constraints in the South African economy, these policy coherence and constraints will have to receive serious attention.

6. CONCLUSIONS

The ASGISA document identifies several important constraints on the long-run growth potential of the South African economy. From an innovation perspective, these include problems in knowledge generation and absorption as well as the wider supporting structures for the commercialisation of knowledge. However, this paper has shown that ASGISA omits important constraints. In general, an over-arching policy framework such as ASGISA will only be successful in boosting innovation levels if it contributes towards creating an enabling environment which appropriately rewards diversity and novelty. The results of the qualitative analysis suggest that policy attention should be focused on removing the ambiguities present in current policy approaches by adopting a systems approach. This will recognise that innovation is a multi-scalar process where individual firms occupy the core of the system and where government provides important support for the system.

References

Alchian, A. 1950. Uncertainty, evolution and economic theory. *Journal of Political Economy* **43**(1) 211-221.

DACST (1996) "*White Paper on Science and Technology: Preparing for the 21st Century"*, Department of Arts, Culture, Science and Technology, Pretoria.

Edquist, C. (2001) "The systems of innovation approach and innovation policy: An account of the state of the art." *Paper presented at the DRUID Conference*, Held June 12-15 2001 at Aalborg.

Lucas, R.E.B. 1988. On the mechanics of economic development. *Journal of Monetary Economics* **22** 3-42.

Lundvall, B.-A. 2007. Innovation System Research: Where it came from and where it might go *Globelics Working Paper No 2007-01*. Global Network for Economics of Learning, Innovation, and Competence Building System, Saratov.

Martinez-Cisneros, B. (2004) "National Innovation Systems: Lessons from East Asia to Latin America. Case studies of Costa Rica and Chile." *Georgia Institute of technology: School of Social Policy.*

Metcalfe, S. 2007. Innovation systems, innovation policy and restless capitalism. F. Malerba, S. Brusoni, eds. *Perspectives on Innovation*. Cambridge University Press, New York.

Montobbio, F. 2005. Istituzioni e attività innovativa: i sistemi innovativi, in Malerba, F (ed.). 2005. *Economia dell'innovazione*, Roma: Carocci.

NACI, 2006. "The South African National System of Innovation: Structures, Policies and Performance." *Background Report to the OECD Country: Review of South Africa's National System of Innovation*, Pretoria: National Advisory Council on Innovation.

Nelson, R.R. 2003. Physical and Social Technologies, and their Evolution *Laboratory of Economics and Management LEM Working Paper 2003/09*. Sant'Anna School of Advanced Studies, Pisa.

Nelson, R.R., S.G. Winter, eds. 1982. *An Evolutionary Theory of Economic Change*. Harvard University Press, Cambridge, MA.

Nooteboom, B. 2005. Innovation, organizational learning and institutional economics. S. Casper, F.v. Waarden, eds. *Innovation and institutions: a multidisciplinary review of the study of innovation systems*. Edward Elgar, Cheltenham, UK.

Paterson, A., Adam, R., and J. Mullin, 2003. The relevance of the National System of Innovation approach to mainstreaming Science and technology for Development in NEPAD and the AU, draft working paper for the Preparatory meeting of the first NEPAD Conference of Ministers and Presidential Advisers responsible for Science and technology, Nairobi, 13-15 October 2003.

Republic of South Africa. 2006. Accelerated and Shared Growth Initiative - South Africa, Pretoria.

Romer, P.M. 1986. Increasing returns and long run growth. *Journal of Political Economy* **98** 71-102.

Solow, R.M. 1956. A contribution to the theory of economic growth. *Quarterly Journal of Economics* **70** 65-94.

Verspagen, B. 2007. Innovation and economic growth theory: a Schumpeterian legacy and agenda. F. Malerba, S. Brusoni, eds. *Perspectives on innovation*. Cambridge University Press, New York.

Winter, S.G. 1964. Economic natural selection and the theory of the firm. *Yale Economic Essays* **4**(Spring) 225-272.