RURAL INNOVATION ASSESSMENT TOOL (RIAT)
CONCEPT PAPER SERIES

Key Concepts in Innovation Studies – Towards Working Definitions

RIAT Concept Paper # 2

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The Department of Science and Technology (DST) contracted the Human Sciences Research Council (HSRC) to develop and pilot the Rural Innovation Assessment Tool (RIAT) in four rural district municipalities. The RIAT aims to enhance the contribution of science and technology interventions to rural development, deepen understanding of the social and institutional dynamics of rural innovations and inform the work of the multi-stakeholder Rural Innovation Partnership. Based on the outcomes of this project, the team must also explore ways to institutionalise RIAT as a self-discovery diagnostic tool for innovators. This is the second in a series of concept notes to strengthen the conceptual framework and evidence base for RIAT. The early conceptual inputs of Dr Nazeem Mustapha of the HSRC are appreciated in helping with the formulation of the definitions of concepts, as are the inputs from members of the RIAT Project Reference Team and other RIAT Project Team members, who are not authors of this specific paper. The views expressed are those of the authors and do not necessarily reflect those of any other party.

EXECUTIVE SUMMARY

There has been an increased focus on the idea of innovation over the past 40 years. At the turn of this century innovation achieved significant prominence when it came to underpin the thinking and planning of the Millennium Development Goals (MDGs). Science and technology were seen as a means to uplift and move people out of poverty. Innovation studies have become an academic discipline in its own right, with several thousand scholars worldwide. However, despite an emphasis on studies on innovation globally since the mid 1970s, it remains an extremely complex subject and there is controversy regarding its role, place in society and definitions of key concepts.

- Actors and networks are considered important, but who they are and how they function need clarifying;
- Innovation has moved beyond the narrow focus of the manufacturing sector and mainstream research and development (R&D). It is agreed that it is also evident and important in other sectors, such as the services sector, health and education fields;
- Social arrangements and organisational structures are important, as are social outcomes and products of innovation.

Working definitions are required for the Rural Innovation Assessment Tool Project (RIAT). The team conducted a broad local and international literature review focusing on key concepts and paradigmatic shifts.

Innovation has its academic roots in the discipline of economics, which is interested in the relationship between technology, innovation and economic productivity and growth. Within the discipline there is diversity and this has flowed through to the following four key paradigms:

- Neoclassical or exogenous growth – growth is externally driven by big science;
- New or endogenous growth – growth is internally driven; internal factors, such as education, R&D investment, physical and human capital are important;
- New institutional economics – the role of internal and external institutions and their characteristics in facilitating technology and economic growth gained prominence. Cultural and political factors are also considered important, especially their influence on institutions and subsequent growth;
- Evolutionary economics – these scholars want to understand how sectors and networks evolve from one dominant technological pathway to another; the diversity of ideas, structures and economic output is seen as crucial to such transitions.

Over the decades there has been a shift from ideas of technical change or progress to more nuanced understandings of what factors influence advances in science, technology and innovation (ST&I) – politics, rivalry, informal networks, exclusionary practices in development and dissemination of knowledge.

Generally innovation is described as both a process and also the outcome/output or product of a process. Within current literature there exist a variety of definitions often based on understandings determined by country, regional or organisational political, economic and social factors and paradigms. The White Paper on Science & Technology: Preparing for the 21st Century (DACST 1996) considered innovation in a number of ways: the generation and articulation of new ideas; the practical application of new ideas, often involving introduction into the marketplace and ideas, products and processes that receive broad acceptance. The United Kingdom-based Young Foundation (YF) argues that 'Creativity and invention are important to innovation but overlook implementation and diffusion which make new ideas useful', i.e. give them value (YF/SIX 2010: 16). The United Kingdom Department of Trade and Industry simply sees innovation as the 'successful exploitation of new ideas' (UKDTI 2003). The OSLO Manual perhaps provides the broadest definition: 'Innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations,' (OECD/Eurostat 2005:46).

From the various definitions it is possible to draw out a minimum core requirement for something to be considered an innovation. This is the idea of *novelty*. To be considered an innovation, an idea, practice, process, product, etc., must be new to the organisation or at least be a significantly improved version. Furthermore, it must be new to the producer and adopter organisation or individual. Adoption indicates the usefulness of an innovation and its potential for further innovation. A secondary requirement for something to be an innovation is that it can be *diffused* beyond the producing individual or organisation. Such dissemination can take place through market and non-market channels. Some consider that R&D is not innovation until the outcome/s thereof connects to a market (Gault 2010). If no diffusion occurs then there will not be any likely economic or social impact. A third important criterion is that to be an innovation, the product or process must have value. However, value need not necessarily be exclusively confined to notions of financial value - social value, welfare, satisfaction, perceived improvement in one's life are all important.

Incremental improvements are more common than revolutionary changes, especially in developing countries. Innovations are not always positive over the long term and can have contingent as well as detrimental outcomes and effects. A country or region's innovation strategy should drive the most important R&D priorities, rather than R&D priorities driving the innovation strategy, as has been the case in South Africa.

Social innovation is a relatively new concept and is consequently under-researched, particularly in the understanding of outcomes, social organisation, contexts within which innovation occurs and reasons for diffusion. Literature on the subject of social innovation is drawn from multiple and diverse disciplines, for example anthropology, commerce, natural sciences, economics and political science. As a result, there is no general understanding of social innovation. Rather, there are three primary understandings of the concept of social innovation, as well as variations of these. The first

understanding considers the organisation or the management of people and things within enterprises or social settings, both informal and formal organisations and arrangements. Examples include trade unions, bargaining councils, stokvels, working parties, job-sharing schemes and distribution methods. Social technologies and the role of institutions in regulating and coordinating resources, people and networks to ensure optimal growth are also important in this understanding of social innovation (Nelson and Sampat 2001).

A second understanding proposes that social innovations are those that have social outcomes or benefits, such as welfare, well-being or upliftment contributions, which enable poorer people to participate more actively in socio-economic and other (governance/service delivery) affairs. Examples include improved health, sanitation, water, electrification, education and security. Such innovations can be products or processes. However, they must involve social value and have inter-generational value/wealth/improvement. Medium-term ideas around sustainable environmental development, reduction of the carbon footprint and promoting the green economy are examples of innovations which have intergenerational value. Loan strategies that are directed to and accessible to the poor, as well as national radio and television broadcasters, are also considered to be social innovations in this category, as the affordability of such products and services is maximised through various means, including state funding. However, some scholars argue that a social innovation must be a social and public good (Harris and Albury, quoted in YF/SIX 2010: 16) and would not consider the private sector development of a necessary vaccine as a social innovation, unless it was subsidised or freely available and accessible. Other scholars see Google as a social innovation despite its origins in the private sector (like the vaccine example above), because its value to society outweighs the profits to the private sector.

The third understanding is a rather narrow combination of the above two. Social innovations are those innovations (new products, services, models and practices) that concurrently meet social requirements and produce new social collaborations. This notion excludes innovations occurring in enterprises. Social innovations must have social means and ends and therefore social innovation must achieve systemic change (YF/SIX 2010).

The White Paper on Science & Technology (DACST 1996) took cognisance of the idea of a systems approach to understanding innovation at the national level and suggested at least a quadruple helix model, which included the public sector, private enterprise, research and higher education institutions, as well as civil society and the non-profit sector. However, the emphasis is unfortunately on formal institutions. The role and effects of informal agencies and actors are ignored, perhaps because they are only seen as users and not developers or contributors to innovation. Also of concern is the lack of recognition of individuals and household innovators in marginal localities, who are perhaps most needful of social innovations in South Africa.

There is a strong emphasis globally and in South Africa on the knowledge economy, which revolves around big science and tertiary education. According to this way of thinking, the ability to innovate is based on education and the ability to use and improve on knowledge; economic growth therefore becomes dependent on knowledge of a particular type and origin. The White Paper (DACST 1996) and latest Ministerial Review (DST 2012) focus on the knowledge economy and tertiary education; both ignore the heterogeneity of society and the impact different types of knowledge will and can make, regardless of the origins. One size does not fit all. Large-scale and small-scale mining and farming activities, as well as formal and informal economic activities, all have different education, skills and technology requirements, often determined by a range of factors, which also include spatial location and environment.

Political impoverishment of rural areas remains, especially with regard to education at all levels and specifically at the foundation levels. This prevents access to the knowledge required to make use of tertiary and big science knowledge as espoused by knowledge economy advocates. There is a need for a balance across innovation – big science, informal and survivalist innovations – which includes recognition of and support for different contributions. All innovation activities in South Africa should focus on poverty, unemployment and inequality and integrate crucial Global Grand Challenges (GGC) with these, rather than the other way around. For South Africa, immediate to medium-term tackling of poverty, unemployment and inequality are more important than addressing GGCs. However, this does not preclude achieving some sort of medium to long-term balance. In Europe, following the global economic/financial crisis of 2007-2008, it was gradually realised that the need is for empowerment of people and tackling of social and environmental challenges. The focus should be on people-centred innovation, rather than top-down economy and global competitiveness innovation strategies.

To conclude, this paper illustrates that a broad definition of innovation involves: invention, diffusion, adoption, adaption and improvement of both physical and social technologies (and includes products, processes, organisation of people, marketing and market access, improvement of well-being and services). *Novelty*, *diffusion* and *value* are currently key components of a broad definition. Incremental rather than revolutionary innovation is the current trend, especially in developing countries. There are various notions and understandings of social innovation and this topic remains contested. However, a broad working definition would include the three types discussed in this paper: those that involve social processes or arrangements of people and things; those that have products and processes that improve welfare and well-being, including access and integration with public services and governance systems, where the value of the product outweighs any profits or value attributed to producers or a combination of the above, which may result in fundamental systemic change. Innovation strategy should bring about the most important R&D – R&D should not drive innovation strategy. Innovation at a national level in South Africa and in many other countries is too formal and there is too little focus on sub-national, local/regional and sectoral systems. Consequently, there is no real recognition of the role of multiple actors and influences within and on

the system as a whole. There is a need to strongly consider the idea of promoting an innovative society that can respond to challenges at hand, given existing resources, rather than the promotion of a knowledge economy that relies heavily on the ability to understand and generate high-level or big science. Innovation strategy needs to be people-centred and integrated to achieve balance, as well as desired economic and social outcomes.

INTRODUCTION

1. BACKGROUND

Perhaps the first decade or two of the 21st century will historically become known as the 'innovation decades', especially as innovation has become synonymous with achieving human social and economic development. A wide range of organisations worldwide has embraced the idea of innovation as something both desirable and as a means of improvement to existing conditions by participating in the Millennium Development Goals (MDGs). Lorentzen and Mohamed note that:

> '…the Millennium Development Goals are clearly informed by the belief that innovation can unleash the transforming power of science and technology in the interest of lifting large parts of the world's population out of misery' (2010: 1).

Innovation was first alluded to by Joseph Schumpeter in the 1930s and 1940s, becoming increasingly common in the 1980s and 1990s in the fields of research and development (R&D), science, engineering and technology (SET) and economics. Innovation (and innovation studies) has become a scientific discipline in its own right, with an estimated cadre of several thousand researchers worldwide (Martin 2008). The term innovation has gradually expanded on terms such as invention or has replaced older, narrower or less vogue terms such as technology development, research and development (R&D) and competitiveness, that were common in the fields of rural and agricultural development, SET and commerce during the 1960s and 1970s (Scheuermeier, Katz and Heiland 2004; OECD/Eurostat 2005; Waters-Bayer and van Veldhuizen 2005; Scoones and Thompson 2009; Gault 2010; Hartwich and Scheidegger 2010; Lorentzen and Mohamed 2010; Hounkonnou et al. 2012). Also, innovation appears to be a more acceptable concept than competition in that innovative organisations are ones that are seen to be ahead of the pack due to their ability to acquire and use knowledge to their advantage - their success is due to the intelligent use of 'scientific' knowledge, rather than a result of size, brute force, intimidation or similar unsavoury practices. Of course this is merely appearance and tells us nothing about the underlying politics and sociology of knowledge and its applications. But we need to understand why there is this current preoccupation and increase in interest in innovation.

The onset of globalisation during the last decades of the 20th century resulted in an unprecedented rise in access to information, the expansion of markets and the reach of various enterprises around the world. This situation effectively increased international competition and resulted in new organisational structures to manage global supply chains. With the increased flow of and access to knowledge and advances in technology, knowledge and knowledge-based activities are increasingly considered to be the central drivers of economic growth, replacing previous ideas that the exploitation of raw materials, commodities and the development of new technologies were the main

drivers of growth. Simultaneously, innovation has gradually become to be seen as the creation of value from knowledge and that which separates successful companies (and countries) from less successful ones (Gault 2010: 4). Furthermore, the increased interest in and research about innovation has resulted in increased awareness and recognition of the following (RICYT/OAS/CYTED 2001; OECD/Eurostat 2005; Gault 2010; YF/SIX 2010; Marcelle 2012):

i. The realisation of the importance of networks and linkages with other actors in the innovation process;
ii. The acknowledged importance of innovation in service and low-technology manufacturing industries, i.e. those outside the mainstream R&D intensive industries, such as high-technology manufacturing;
iii. The broadening up of the scope of the definition of innovation to move beyond traditional industries and the traditional approach of concentrating on technological product and process innovation (TPP), to consider the social arrangements or organisational structures and social outcomes or products that are equally important for an innovative economy and society as a whole.

Essentially the continued significance of innovation is maintained by its dynamism. As more interest is given to the concept, so its seeming relevance to a range of social and economic development applications becomes increasingly likely and provides a means of explaining earlier constraints in the implementation of development (Hartwich and Scheidegger 2010). Economists have been a leading group of scholars who have attempted to understand the various linkages among technology, growth and innovation for several decades. It is useful to consider some of the theoretical understandings about innovation and growth from economist perspectives.

2. Economists and Innovation Paradigms

This section briefly describes the path-breaking insights in science, technology and innovation (ST&I) in four schools of thought in economics: neoclassical or exogenous growth; endogenous or new growth theory; institutional and evolutionary economics[1]. It is not an exhaustive summary of all the contested scholarly viewpoints on this multifaceted topic. The twofold intention is, firstly, to counter misperceptions that a monolithic view exists of the economics of innovation and to underscore key differences across the most relevant scholarly approaches in economics. Secondly, to offer a broad comparative context to the 'meanings of innovation', without trying to resolve controversies among those economists who effectively work inside one conceptual framework.

[1] For overviews of ST&I in the writings of pre-20th century economists we refer interested readers to Nelson and Nelson (2002); Perez (2010) and Prendergast (2012). This overview does not summarise the insights of radical political economists, who primarily examine how innovations impact on the magnitude and quality of employment.

According to the Solow-Swan model, the cornerstone of neoclassical growth theory, labour-augmenting technical progress adds to secular growth, but technical progress was assumed to be exogenous. In other words, big science mysteriously drives technical change. The saving rate is basically irrelevant to the growth rate, which is determined by exogenous causes. This model draws a distinction between the levels and rates of savings, the former without any long-run effect on long-run *per capita* economic growth, whereas a rise in the latter merely lifts an economy onto a new secular growth path. The length of time it takes for an economy to transition from one growth path to another was never clarified in the earlier versions of neoclassical growth models. However, in a very poor economy, characterised by extremely low levels of savings and 'backward technology', the lack of adequate savings and technology will push *per capita* income lower. In the 1950s and 1960s, the transfer of technological know-how and expertise from the United States to its allies was a chief catalyst of capital accumulation in some countries and enabled them to catch up and converge with income levels in the United States (Archibugi and Michie 1998).

The rapid growth of the South-east Asian economies, coupled with the divergent evidence of growth, opened the space for alternative explanations of the dynamics of technical change in productivity growth, starting with a country's endogenous savings decisions. Paul Romer and Robert Lucas, extending some of the earlier growth models in their seminal papers in the late 1980s, led the way towards the development of new or endogenous growth theory. In these models, education, R&D and other social infrastructures drive technical change and labour productivity. More specifically, in Romer's version of the model, there are increasing returns to scale and technical change proportional to the growth rate of capital stock, comprising two components: physical and human capital. The capital accumulation process generates an externality which helps to produce 'human capital'. In direct contrast to the neoclassical growth models, the saving rate now determines economic and productivity growth. Interestingly, the savings rate directly affects physical capital and indirectly affects human capital, considered to be distinct from traditional conceptions of labour, itself totally absent from the benchmark model (Cesaratto 1999: 785). In the Lucas version of this model, technical change depends upon several sources, specifically investment in education, R&D, etc. The economics of innovation implicit in these models hinge on human capital, variedly measured as the share of time spent in education, labour used to produce designs, the research labour force and so forth.

With the proliferation of endogenous growth theory, a diverse menu of critical innovation topics also received coverage: self-generation of knowledge in technical change; various forms of technical change and how market structures and institutions impact on technical change, including the role of the state in R&D and education (Hounie et al. 1999). How progress in ST&I impacts on a country's broader development path depends on several factors – monopolistic structure of the market; externalities linked to technological knowledge, although there is no agreement among endogenous growth scholars on the degree of importance assigned to these determinants of economic growth.

In the 1960s, institutional economists began interrogating a large body of historical evidence to better explain the unevenness in technological catch-up across countries. They identified varied institutional barriers that impeded 'learning processes' in technologically lagging countries, including 'social rigidity, stratified class structures, lack of incentives for innovators, formal activities to generate innovation, expertise in capital goods sectors, degrees of international integration' (Archibugi and Michie 1998: 6-7). Nineteenth century Russia served as a widely cited case in point: its deeply rooted feudal system hampered its ability to adopt British technology and thus industrialise. A chief lesson was that countries should build their own 'endogenous expertise', because the lack of technological competencies frustrates catching up. Another challenge for countries at early stages of development is to strike an appropriate balance between investing limited resources in imported know-how ('imitative activities') and the production of original knowledge ('innovation'). Long-term economic dynamism requires that underdeveloped countries fuse 'imitation with innovation' (Archibugi and Michie 1998: 7).

In addition to technological competencies, institutional economists also incorporate the sector or industry composition of economic output as a primary determinant of economic growth. This requires careful tracking of the science, technology and innovation (ST&I) activities across different sectors, coupled with shifts in their technological capability profiles. As new industries displace declining industries it is vital for the technological capabilities to keep pace with these shifts if a country is to stay on the frontier of technological innovation.

Joseph Schumpeter, an American economist who left a lasting imprint on innovation studies with his seminal contributions during the interwar period, coined the notion that 'capitalism is a system of creative destruction' (cited in Iwai 2000: 168). In this context, firms that earn high profits possess higher levels of technological efficiencies than their low profit competitors. Distance from the technological frontier features prominently among the determinants of leadership in ST&I. In addition to the technological gap, factors such as technological investment being a lagged function of sales and profits and market structure-driven selection also separate innovation leaders from 'laggards' (Hounie et al. 1999).

Firms are distinguished in terms of diversity and inequalities and these features explain their behavioural differences. While evolutionary theorists do not premise their analyses on any representative firm as is common among neoclassical economists, they stress that in learning to innovate or imitate, firms follow decision-making rules or routines. In order to predict firm behaviour one should be able to detect and map routines that govern learning to create or adapt new knowledge. The unit of analysis in evolutionary economics goes beyond the individual firm. Ultimately, evolutionary economists strive to understand how sectors and networks evolve and transition from one dominant technological trajectory (or type of knowledge) to another. So-called structural thinkers in evolutionary economics, according to Laranja, Uyarra and Flanagan (2008), emphasise that the evolution of new ideas depends on diversity in the structures and composition of

economic output and diversity in the cognitive capacities of agents within an economy. These elements, among a host of factors, help to explain the selective exploitation of 'good innovations' and thus prevent an economy from being trapped along one ST&I pathway. Table 1 below summarises the four main schools of thought on innovation and growth within economics.

Table 1: Summary of perspectives on economics of science, technology & innovation (ST&I)

Economic Paradigm	**Drivers of ST&I [Mechanics of ST&I Growth]**	**Developmental Spill-over from ST&I**
Neoclassical Growth Theory [Solow-Swan Model]	Technical change is 'residual' that drives growth; technology is a public good; Exogenous technical change; Exogenous productivity growth; Modernise capital stock for 'embodied technical change'.	Growth convergence with poorer countries growing faster; Catch-up development rests on free tech know-how; Gap: Silent on common access to technological frontier for countries at different stages of development; no interventions needed to spur innovation.
New Growth Theory [Endogenous Growth Theory]	Technical change depends upon several sources, specifically investment in education, R&D, infrastructures etc.; Self-generation of knowledge in technical change.	Systemic divergences in cross-country growth rates; Depends on monopolistic control over technology supply; differentiation in capital goods sector; externalities generated by innovation; resources allocated to knowledge accumulation.
Evolutionary Economics	Organisational routines to maximise profits compel firms to 'innovate (bursts) and imitate (continuous)'; Unequal distribution of technological efficiencies between high- and low-profit firms.	Long-run economic growth follows patterns of 'technological disequilibria'; Differential growth rates across high- versus low-profit firms; Productivity growth depends upon technology embodied in capital stock, selection mechanism & diffusion rates from innovator to industry.
Institutional Economics	Technological competence-building determines ability to exploit imported knowledge; Properties of technologies are important for innovation.	Catch-up is not automatic; Key determinants: institutional factors, social rigidity, unequal class structures, lack of incentives for innovators.

Note: This table is far from an exhaustive summary of perspectives on ST&I activities in economics. Some political economists, excluded from this summary, are critical of how innovation and knowledge-economies impact on workers, work and working conditions (See Meiksins (1998) and Huws (2006)).

To sum up: an old view of innovation common in economics simply associated this concept with 'technical change' or 'technological progress', but in recent times economists have drawn more nuanced distinctions between advances in science, technology and innovation (ST&I). More importantly, scholarly camps in economics disagree on the properties of 'technological innovation': at the one extreme it is viewed as a public good, while at the other end it is defined in terms of rivalry in use and exclusionary ownership. Investigating the micro-dynamics of innovation - how new knowledge gets produced and adapted through learning processes - is dominated by evolutionary

and institutional economists. For scholars working in these traditions, innovation in sectors and networks form their core analytical unit: one concentrates on how a system evolves, whereas the other explores how institutions (including informal customs) shape the direction and rate of learning within sectors and networks.

The purpose of this paper is to present and consider the usefulness of some of the key concepts and definitions used in the academic policy documents, policy briefs and applied research literature on innovation. The concepts discussed in this second paper in the RIAT series include innovation, social innovation, systems approach to innovation and the idea of a knowledge economy. It is important to develop and understand the strengths and weaknesses of the various definitions in order to develop working definitions. As Scoones and Adwera (2009) note, definitional issues are crucial to generating common understanding of broadly used terms such as innovation.

3. METHODOLOGY

This conceptual paper draws on some key literature deemed relevant to grasping recent understandings of innovation in this century in South Africa and globally. Such literature includes key official South African policy documentation such as the 1996 White Paper on Science & Technology: Preparing for the 21st Century (DACST 1996), the 2007 Innovation towards a knowledge-based economy: Ten year plan for South Africa (2008-2018) (DST 2007) and the 2012 Department of Science and Technology Ministerial Review Committee on the science, technology and innovation landscape in South Africa: Final report (DST 2012). Reference is also made to the 2007 Organisation for Economic Cooperation and Development (OECD) review of South Africa's innovation policy. International literature on innovation surveys includes the 2005 OSLO Manual (OECD/Eurostat 2005) and the 2001 Bogota Manual (RICYT/OAS/CYTED 2001) in order to provide a 'Northern' and 'Southern' perspective. The more academic work of Fred Gault (2010), papers produced by various academic experts in the broad field of innovation are also reviewed. Practical papers and policy briefs produced by National Endowment for Science Technology and the Arts (NESTA), the Young Foundation (YF) and members of the international multi-stakeholder platform, Promoting Local Innovation in Agriculture and Natural Resource Management (PROLINNOVA), are also incorporated. Literature was obtained at the suggestion of colleagues and various members of the RIAT Reference Group. The paper also draws on literature recommended by various interviewees during the initiation period of the first phase of the study and on information obtained from the initial review of literature. Internet searches using the input of key words such as 'innovation', 'innovations' and 'rural innovation' into some of the online databases described in Jacobs and Hart (2012), were also conducted. A detailed list of the references cited is included in the Reference List at the end of this paper.

DEFINITIONAL ISSUES

1. INNOVATION

The multi-stakeholder international platform PROLINNOVA draws a distinction between innovation and innovations. Innovation is seen as a process and innovations are considered to be the outcomes or outputs of such a process (Wettasinha, Wongtschowski and Waters-Bayer 2006). However, other sources use the terms interchangeably and refer to innovation as both a process and the output of this process. Innovations are used to refer to more than one process and more than one output or outcome of the innovation process. For the purpose of simplicity and standardisation, we adopt this latter form of usage in this and subsequent conceptual papers. Consequently, we consider innovation to be both a process and the outcome or output of such a process.

According to the 1996 White Paper on Science and Technology '[i]nnovation is the application in practice of creative new ideas, which in many cases involves the introduction of inventions into the marketplace' (DACST 1996). The White Paper goes on to say that creativity is the generation and articulation of new ideas. This means that people can be creative without being innovative. While creative people may have novel ideas or invent new products, they are not innovative because they do not:

> '… try to win broad acceptance for them [their products or ideas], put them to use, or exploit them by turning their ideas into products and services that other people will buy or use'.

Similarly, innovators need not be creative or inventive. All they need do is to apply or implement the ideas or inventions made by others, i.e. turn these into innovations that are broadly accepted and used by other people. In this respect a first time user becomes an innovator.

According to the Young Foundation in the United Kingdom, an innovation is distinct from 'improvement' or 'change' and from 'creativity' and 'invention' (YF/SIX 2010: 15). While creativity and invention are crucial to innovation, they both overlook the important stages of implementation and diffusion which make new ideas useful, i.e. give them their value. On the other hand, the United Kingdom Department of Trade and Industry quite simply considers innovation to be 'the successful exploitation of new ideas. Often it involves new technologies or technological applications' (UKDTI 2003: 4). This definition is rather normative as it considers notions of profitability, growth and better organisation, while attributing value in terms of better products, services, processes and organisation.

The 3rd Edition of the OSLO Manual provides us with a very broad definition of innovation:

'An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.' (OECD/Eurostat 2005: 46).

This edition of the OSLO Manual increased the previous definition of innovation contained in the 2nd Edition, published in 1997, to include four components:

i. Product innovations – significant changes in the capabilities of goods and services, including new and/or significant improvements to existing goods and services;
ii. Process innovations – typify considerable changes in production processes and methods of delivery;
iii. Organisational innovations – the use of new organisational methods, such as new or changed business practices or changes in external relations with other organisations; and
iv. Market innovations – the use of new marketing methods, such as changes in product design and packaging, product or service promotion and placement and methods for pricing products and services.

In earlier versions of the OSLO Manual only products and processes were included in the definition[2]. The effect is that now non-technological innovation is added to technological innovation. The application of the new definition of innovation in the 3rd Edition of the OSLO Manual now extends innovation to the entire market economy (e.g. service enterprises, non-profits) and not only the manufacturing sector. This broad definition includes the activities required to develop and adopt innovations, acknowledging that some of these activities may be innovative and lead to the implementation of innovations. The purpose of innovation activities is to improve performance, and can involve addressing uncertainty, product differentiation, improving production processes, investment or asset accumulation, marketing, organisational structure, accessing knowledge and maintaining or attaining competitive advantage (OECD/Eurostat 2005: 31-36).

The minimum core requirement for something to be called an innovation is that the product, process, organisational or marketing method must be new (or at least a significantly improved version) to the organisation. This requirement refers to both organisations and businesses that are the first to develop these products, processes, marketing and organisational methods and also to businesses or firms that are first time adopters or users of those products, etc. developed by others. Adoption of innovation is vital as it indicates the flow of knowledge from one organisation to others and it can lead to further improvements and innovations. Using new things or existing things in new or novel ways is considered to be an innovation indicating that innovation is definitely not confined to invention. The question then becomes how new is new? Here it seems that new is generally interpreted as four different types: new to the organisation/firm; new to the market; new to the

[2] The Bogota Manual (RICYT/OAS/CYTED 2001: 30), an attempt to standardise indicators of innovation across Latin America and building on the 1997 2nd Edition of the OSLO Manual, introduced ideas of organisational and marketing innovations into its definition of innovation, directly based on the Latin American experience.

world and disruptive innovations (OECD/Eurostat 2005). While the first three are self-explanatory and focus on novelty, disruptive innovations are those whose impact can have a number of effects, including change to the structure of the market, creation of new markets or rendering existing products obsolete.

A second requirement relates to diffusion of the innovation. This is the way that innovations are disseminated through market or non-market channels from their first implementation in a particular organisation to different consumers, organisations, markets, sectors, regions and countries (OECD/Eurostat 2005: 17). A new or improved product, service, etc., is implemented when it is introduced on the market, which simply means that it is brought into actual use in the developer or adopter organisation's operations (OECD/Eurostat 2005). The common economic understanding is that R&D is not innovation until the outcome of R&D connects to a market (Gault 2010) and that without diffusion, innovations have no economic impact (OECD/Eurostat 2005). Innovation must therefore be deemed to add value to an existing situation, at least be deemed to do so by some people - consumers or users - if diffusion is to occur. However, as we shall see below in the discussion on social innovation, innovations can have welfare or social value, as well as financial value. Connection to the market is perhaps a narrow idea and rather we should say that once an invention is desired by others and put to use by them, then it is an innovation, even if there are no or only small or indirect financial spin-offs. The contribution of value other than simple financial value is crucial for generating support across global civil society – now increasingly recognised as an important actor in the national system of innovation (NSI) of many countries. Furthermore, the value of a particular product, process or other innovation can be different for those actors located at different parts of the value chain. For some it may have financial value, while for others it may have well-being value.

Innovation thus goes beyond simple R&D, because the adoption and value addition of R&D outputs, including technologies and practices, is important. Innovation is about the creation and diffusion of new knowledge, thereby expanding the economy's potential to develop new products and more productive methods of operation. Revolutionary departures (the desktop computer), as well as incremental inventions (software improvements) that are implemented, can all be categorised as innovations (OECD/Eurostat 2005; Gault 2010). Overall, incremental improvements tend to be more rewarding innovations and more common than revolutionary departures. The diffusion of inventions and innovations is a crucial aspect for further innovation, especially of the incremental type. Gault (2010) goes as far as suggesting that a country or region's innovation strategy should bring about the most suitable R&D and not the other way around, as was believed last century.

As we shall see below, innovation occurs in what some refer to as a system of innovation approach (Gault 2010). This system can be national within a particular country, while simultaneously linked into the global, complex and dynamic system of innovation. This means that innovation is non-linear and therefore contingent or unanticipated outcomes may result and give cause for concerns about

some innovations. These innovations may not advance developmental ideals or lead to desired growth. The opposite might occur (Gault 2010), even after such innovations have been diffused and believed to have contributed value.

2. SOCIAL INNOVATION

Social innovation is an emerging and therefore under-researched field within the broader area of innovation and innovation studies (YF/SIX 2010; Marcelle 2012) and consequently no single definition exists. In fact YF/SIX (2010) argue that the situation is compounded because many people and organisations use social innovation to describe things that are neither social nor innovative. Social innovation does not have clear boundaries and cuts across the various national system of innovation (NSI) actors such as government, private enterprise, tertiary education and health institutions, civil society and households, as outlined in the White Paper on Science and Technology (DACST 1996)[3], and cuts across the health, housing, energy, education and other sectors. Consequently, it involves numerous and different examples. These range from new models of learning, early childhood development and elderly and health care, to ways of organising groups or communities to obtain their demands or labour to be more productive, businesses to create new markets or develop new ways of reaching existing markets. Other examples include new ways to reduce waste and the carbon footprint or even develop new products that increase energy saving, health and well-being. Much of the available social innovation literature is extracted from economics, management studies, agricultural extension and development, business, technology development, development studies, sociology, political science and social anthropology. As a result, the applications and understandings of social innovation are enormous.

As with innovation in the technology or business environments, social innovation involves the processes of invention, diffusion and adoption of new services, products or organisational models in private enterprise, government, the non-profit sector, tertiary institutions and households. But it also seems to describe the outcome, i.e. the product, service or process being developed should tackle social problems or meet social needs (NESTA 2008; YF/SIX 2010). As we noted above, traditional definitions of innovation did not consider this purpose; rather, they were more interested in profit, competitiveness and firm growth, which would bring about economic growth and gains would be achieved more broadly through 'the trickle-down effect'. Furthermore, social innovation is diffused by organisations whose key objectives are social rather than purely economic and where any ensuing

[3] The Young Foundation also identifies the significance of households and individuals as innovators within the NSI (YF/SIX 2010). However, most schematics seem to ignore these mostly informal actors who are extremely common to developing and Low-Income Countries.

profit is reinvested into the organisation. This could include non-profit organisations, as well as government and possibly private enterprise corporate social investment (CSI) programmes.

From the literature reviewed there appear to be at least three different primary understandings of social innovation. There are other understandings, but these are generally variations of the following three.

Firstly, we can adopt a social lens to view social innovation as the process of organising or managing people and things. Such organisation can take place in enterprises or in social settings such as communities and these organisations can be formal or informal. Similarly, organisations within a particular environment can overlap with other organisations or management systems. Organisational innovation results in improved means of accessing services, markets or arranging labour or other groups. Examples can include village work parties, women's savings groups and organising new distribution methods or means to enter markets or to improve access to or diffusion of products. It can also relate to flexi-time initiatives in the workplace or job-sharing schemes. Here the outcome of innovation is the more effective coordination or organisation of people and institutions in the sense that this increases profits or well-being or both and not the improvement of specific products and practices/recipes to develop these products. Nelson and Sampat (2001) talk about social technologies and refer to the role of institutions and the coordination of networks, labour, people and resources to ensure optimal production and growth - good performance and governance. Nelson (2008) conceptualises institutions as the factors and forces (organisations as well as regulations or regulatory frameworks) that shape and hold social technologies in place. This is very much in the tradition of the new institutional economics (NIE) way of thinking.

A second way of using a social lens to examine innovations is to view social innovations as those having social outcomes or benefits that intend to impact on society by uplifting poor people, enabling them to participate more actively in socio-economic and other affairs. In this regard, social innovations are those innovations that have social or human well-being benefits, such as improved health, water, sanitation, education and other social services, including security. The innovation must involve social value and perhaps intergenerational wealth/value creation, for example ideas of sustainable environmental development, reducing the carbon footprint and moving towards a green economy. A new vaccination or cure for a disease is also considered a social innovation. As a social benefit, social innovation can involve products (technologies) and services, as well as social organisational arrangements. For example: improved or innovative food preparation or storage, improved transport means (or social arrangements to achieve this, such as a vehicle lift club) or the Grameen Bank, which provides loans to the poor, are all considered to be social innovations. The UK's Open University, as well as most national radio and television broadcasters, are considered to be social innovations when using this lens. However, within this definition there is disagreement.

Some purists, such as Harris and Albury (quoted in YF/SIX 2010: 16) argue that social innovation is innovation explicitly for the social and public good – it is inspired by the desire to meet social needs that are considered major social challenges. It is likely that they would not consider a vaccine as a social innovation as it is not a public good. Other scholars argue that the value created must accrue primarily to society as a whole, rather than to private individuals (Phillis, Deiglmeier and Miller 2008). It is likely that they would include a vaccine developed by a private medical company, as well as the Google internet search-engine, as social innovations, because the value of such innovations to society at large surely outweighs the benefits accrued to individual shareholders of the developing and sales companies.

A third way of using a social lens to understand innovations is a very narrow combination of both of the above. The Young Foundation and the Social Innovation eXchange (YF/SIX 2010: 18) define social innovations as innovations (new products, services and models or practices) that concurrently meet social requirements more effectively than existing alternatives and produce new social collaborations. This definition is slightly more focused than previous ones in that YF/SIX do not consider social innovations that occur in business or technology environments. For YF/SIX, social innovations must be socially oriented in both their ends and their means.

While extremely useful, it is our opinion that this definition tends towards excluding those social organisational innovations that are found in private enterprises. This is simply because they might have more profit-oriented than social-oriented purposes. Innovative marketing strategies would first and foremost benefit the company, but may benefit employees in the form of bonuses or reduced working hours. Other strategies, such as flexi-time, are normally believed to firstly benefit the company, in that satisfied employees are believed to be more productive, although there is no ignoring the fact that such allowances do benefit employees. Also, this definition excludes products and processes that are of value to society when they are developed by private companies and there is a cost involved. Examples could include vaccines, energy-saving light bulbs and better crop production methods that involve less pesticide use.

The YF/SIX (2010) understanding of social innovation also considers systemic change to be the ultimate goal of social innovation. Systemic change is different from changes in social products and services and innovation in business. It involves numerous actors from government, private enterprise, tertiary education and health institutions, civil society and households, elements such as laws and infrastructure, as well as shifts in power relationships, whereby old power holders are replaced by new ones. Quite simply, systemic change requires significant change in structure, components, relationships, operations and outcomes. The green movement has driven innovations around carbon footprint reduction across social and economic sectors for decades. While new technologies have been necessary, they have not been sufficient conditions for change. More important conditions have been new ways of organising social and physical infrastructure (transport, energy and housing) and new ways in which people perceive their own responsibilities now and in

the future (YF/SIX 2010: 30), such as the willingness to become involved in anti-litter campaigns, recycling of waste or adoption of energy-saving practices and products. In this regard, Butkeviciene (2009 in Neumeier 2011) notes that social innovations are shaped by the socio-economic system in which they arise and influence change within that same socio-economic system. It appears then that actors within a system have the power to make and direct change and that they are also affected by other actors, as well as the system as a whole. The idea of systemic change as an ultimate goal of social innovation refutes the assumption of the hegemony of any group or individual actors within the system.

We suggest that all three of the above perspectives of the social dimensions of innovations need to be considered when investigating, understanding and assessing the 'socialness' of an innovation. While there are similarities, there are also differences, which no single one of these three definitions of social innovation adequately captures. Given the newness of the field of social innovation and the fact that this is a scoping concept paper, rapidly reviewing innovation concepts and their meanings, we do not feel it justified or useful to propose a further definition of social innovation at this point. Rather it seems more justified to capture the broad range of innovations that have a social component in terms of process and outcome.

The 1996 White Paper on Science & Technology recognises social innovation, calling it a great national need, and describes it as 'the design of South Africa's social and economic institutions, and … system of governance…' which is as important as innovation in products and production processes in the economy (DACST 1996). However, the White Paper (and other policy documents) remains unclear as to whether it is just the design of and arrangement of people within these institutions that is important or if the products and services of these institutions must address social needs. Unfortunately, the White Paper and subsequent policy documents do not give adequate attention to the idea of social innovation, merely mentioning it in passing and dealing more with the bureaucratic and management requirements of a proposed national system of innovation (NSI), i.e. the NSI's components.

3. A NATIONAL SYSTEM OF INNOVATION

In order to improve our understanding of the process of innovation we need to understand innovation activities other than R&D, the nature and type of interactions among the various actors and that of the various knowledge flows. The systems of innovation approach arising from the work of Freeman (1988), Lundvall (1992) and Nelson (1993) examines the influence of external organisations on the innovative activities of organisations and other actors that comprise the national innovation system. The emphasis within the system is on the diffusion of ideas, knowledge, skills and information about the many types and the channels or linkages through which these

circulate, acknowledging that these linkages are embedded in a social, cultural, political and economic environment. This environment influences innovation activities and capabilities both positively and negatively. Some scholars, like Freeman, argue that the state must have a very decisive role. Others suggest that this should be no more than the role of monitoring, regulating and fine tuning this framework (OECD/Eurostat 2005: 33).

In South Africa and parts of Latin America the understanding of an innovation system is similar. According to the White Paper, a national system of innovation (NSI) consists of a set of functioning institutions, organisations and policies that interact positively in the pursuit of a common set of social and economic goals and objectives (DACST 1996). The Bogota Manual (2001) describes the NSI in a similar fashion: 'the environment, institutional regulations, the network of relations between agents and institutions, the macroeconomic settings' (RICYT/OAS/CYTED 2001: 19). In its broadest sense, an NSI is the means through which a country intends to create, acquire, diffuse and put into practice new knowledge that will help it and its people to achieve their individual and collective goals (DACST 1996). As noted above, innovation is the implementation and diffusion of this knowledge. The NSI of individual countries differs in accordance to its institutional, structural and infrastructural conditions, composition and background factors. However, there seems to be a similarity across innovation systems as to who are considered the crucial actors and agents in the system and these include government, private enterprise, R&D and higher education institutions (HEIs), as well as non-profit organisations (RICYT/OAS/CYTED 2001; OECD/Eurostat 2005).

The White Paper (DACST 1996) suggests that individuals are important actors in this system, but when it comes to describing the stakeholders (or more accurately role players), individuals appear to be overlooked and the focus is on formally recognised actors (enterprises of different sizes, organisations and other agencies). These actors include government at various levels, such as policy and line departments, state agencies and corporations, science, engineering and technology institutions (SETIs)), private enterprises, higher education and non-government or non-profit organisations (NGOs). It also appears that these organisations are all legal entities in their own right (e.g. government institutions or registered profit or non-profit companies). In other words, South Africa's NSI appears to only include formal organisations and any reference to individuals would appear to be confined to individuals who are employees or members of such formal organisations, irrespective of the size of the organisation or enterprise. This rather appears to be the adoption of a very narrow perspective on innovation actors, but one that is largely in line with global trends and orthodox ideas about innovation.

The international literature seems to imply that only formally constituted organisations are the key focus of innovation and similar surveys, as the literature continually refers to an entity called 'the firm' (RICYT/OAS/CYTED 2001; OECD/Eurostat 2005; Gault 2010). The 'firm', as the unit of analysis, always appears to be something that is easily recognisable and identifiable, although none of the literature truly defines this concept clearly (the OSLO Manual describes a firm as having at least ten

personnel (OECD/Eurostat 2005: 58-59)). The best one can do is to assume that none of this literature on innovation surveys and measurement (RICYT/OAS/CYTED 2001; OECD/Eurostat 2005; Gault 2010) considers the innovation potential of the individual outside of the firm or other formally constituted organisation. Of course, the idea of focusing on a formally or legally constituted entity such as 'the firm' makes the implementation and sampling for innovation surveys and assessments much easier than if informal actors, specifically individuals and groups of people who are outside of formally constituted enterprises, are considered to be part of the population from which the sample is drawn. As noted above, some of the literature on social innovation (YF/SIX 2010) makes mention of the role of households in innovations and as innovators. Such would be the case in developing countries and in rural areas in particular (Scoones and Adwera 2009; Piembert 2012). An increasing amount of empirical evidence from developing countries indicates that sometimes poor farming households and individual farmers are the leading experimenters and innovators in remote rural areas, largely in the absence of formal extension and research and that such innovations involve product, process, organisational and marketing improvements (Scheuermeier, Katz and Heiland 2004; Waters-Bayer and van Veldhuizen 2005; Wettasinha, Wongtschowski and Waters-Bayer 2006; Scoones and Thompson 2009; Gupta 2012; Hounkonnou et al. 2012).

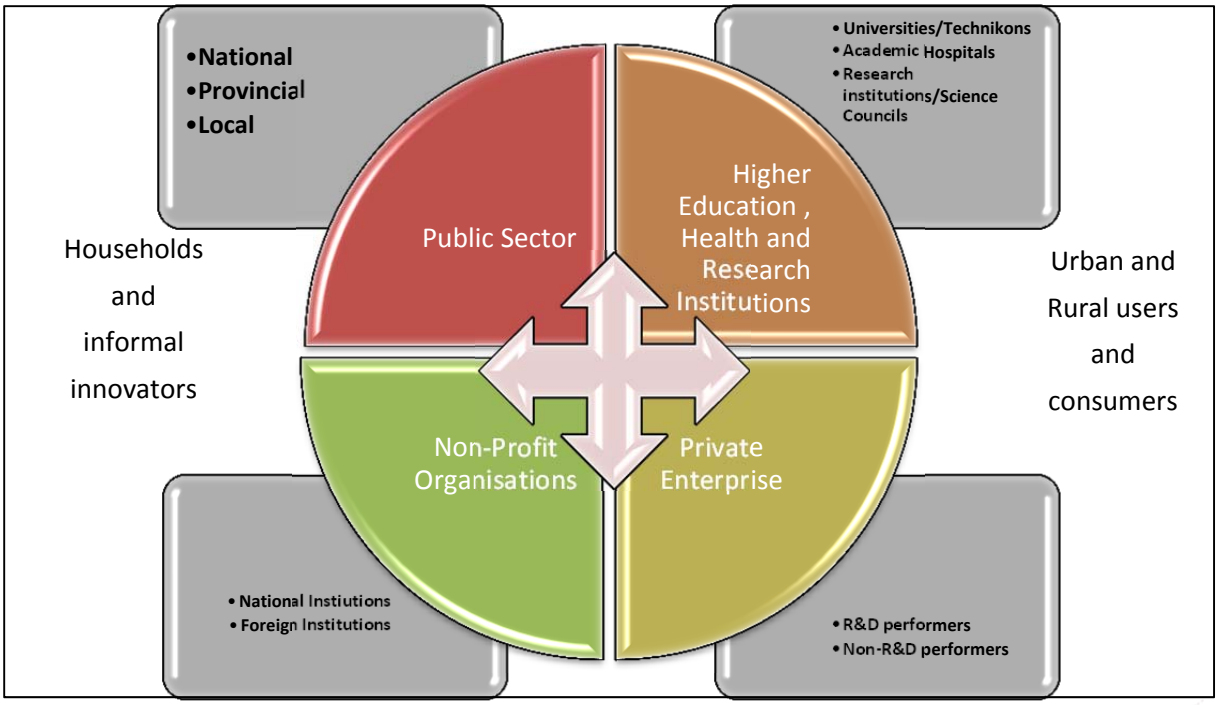
In a thought-provoking paper, Lorentzen and Mohamed ask the pertinent question 'Where are the poor in innovation studies?' and come to the conclusion that innovation studies do not focus on the poor in any meaningful way. Rather these studies excel '… at explaining technological learning and upgrading of *firms* who are linked to other *important actors* in dynamic evolutionary settings supported by *institutions* conducive to change. Due to its systemic perspective … it [innovation studies] produces convincing stories of why catch-up at times works, and why other times it fails' (Lorentzen and Mohamed 2010: 18). The conceptual and methodological apparatus used in innovations studies was developed for advanced industrial societies and only recently considered some accommodation for middle-income countries, both of which have socio-economic conditions that differ vastly to those experienced in most low-income countries (Lorentzen and Mohamed 2010: 18).

While some of the rural development literature, including that cited here, focuses on the pressing issues of poverty reduction, food security and livelihood improvement and the role of individuals as innovators, it generally results in these local innovations appearing to be piecemeal solutions to multiple problems, while with a little more care and collaboration, these studies could result in a coherent narrative of rural innovation and the systems involved in rural areas. We take up the discussion of the South African national system of innovation (NSI) in more detail in the third conceptual paper in this series, where we focus on the history, evolution, assumptions and conceptual premises currently underpinning the NSI. The point here is that many official representations of innovation systems ignore the role of informal networks and also the role of individuals as actors, knowledge holders, inventors and innovators.

Because it is believed that innovation takes place within a system, the ability to innovate is determined by a range of factors, including cultural, social, economic, political, legislation and regulatory. Factors that can negatively impact on innovation include high costs, lack of demand, lack of knowledge and skilled personnel and lack of organisational leadership. A range of bidirectional linkages connect innovating organisations with other actors and agencies within the innovation system. It is via these bidirectional linkages that knowledge is diffused in both directions between the actors in the system. The nature and strength of these linkages, in combination with the cultural and other factors noted above, will affect diffusion and adoption and thus further innovation, as well as the likelihood of original invention. As Kraemer-Mbula (n.d.: 20) puts it 'Innovation is a multilayered complex process of interactive learning'. Without interaction there can be no learning. We represent our understanding of the national system of innovation and the linkages between actors below in Figure 1. Here we show that other actors such as households, informal innovators, urban and rural consumers and users all inhabit the space in which the NSI and its subcomponents are embedded. Their access to and influence on the NSI is determined by their relationships to various components that affect the NSI. The point is that they cannot be ignored, even if their recognition and influence differs markedly from one NSI to another. If we follow Freeman (2002), for example, with his ideas of national, sub-national, regional and local systems of innovation, it is likely that households and users will have more influence at these levels below the national system.

Reviewing how European countries constructed their respective national innovation systems, Freeman (2002) points out that each country's innovation system evolved with changes in a country's physical territory and type of political regime. As city-states transitioned into nation states, driven primarily by major socio-economic transformations and a new scientific culture, the geographic boundaries of innovation activities also altered. At least up to early Renaissance Europe, innovation was confined to sub-national regions and districts, from where it diffused very unevenly. The social capabilities and institutions to facilitate and stimulate technological progress thus took shape within physical territorial borders and its overarching type of political system.

Figure 1: The typical quadruple helix with the traditionally ignored informal key actors included



Source: Adapted from original schematic by Nazeem Mustapha presented informally to the RIAT team in July 2012)

4. A NOTE ON THE NOTION OF A KNOWLEDGE ECONOMY

Much of the economic literature on innovation refers to the presence and growth of a knowledge or knowledge-based economy – one in which knowledge is considered to be a key driver of economic growth. This expression is used to describe trends in 'advanced economies', where there is an increasing 'dependence on knowledge, information and high skill levels, and the increasing need for' prepared access to all of these by both public and private enterprises across the economy, including the manufacturing and service sectors (OECD/Eurostat 2005: 28). Knowledge is increasingly complex, necessitating constructive linkages between enterprises in these sectors and also between them and other actors, such as research institutes and higher education facilities as a means for them to acquire or share specialised knowledge. A knowledge-based view of innovation emphasises a focus on interactive processes, through which knowledge is created and exchanged within, across and outside of the organisations that make up the innovation system. It also necessitates the need for knowledgeable, skilled and specialist human resources, partnerships and interactions that are conducive to learning and exploiting primarily R&D knowledge in order to innovate.

The widespread use of the expression 'knowledge economy' is probably due to the fact that most literature and innovation survey manuals consider the link between innovation and economic change to be of central importance. However, while this may be undeniable in many instances, some of the literature focusing on social innovation argues that not all innovation should be understood from an economic perspective (maximising profits and returns and reliance on trickle-down effects), as it also has social value, including welfare and contributes to a better quality of life in multiple ways (see earlier discussion on social innovation).

In light of the realisation that social upliftment and well-being is vital for society at large, we need to rethink our ideas about the paramountcy of a knowledge economy! A lot of time is spent in policy documents indicating that qualifications and knowledge must be improved at tertiary levels, largely for the purpose of creating and utilising knowledge. There is an overemphasis on formal knowledge when people are expected to enter the economy or those parts of it that require high levels of skill and expertise. Undoubtedly, the types of activities and the skill levels required are changing in the South African economy. In a broad study of the primary agricultural, agribusiness and food retail sectors in South Africa, Hart et al. (2010) noted that between 2000 and 2009 there was a definite increase in demand for more skilled personnel across all three sectors. Some of these sectors draw much of their labour from the rural areas and increases in skill level requirements may well mean that those without the necessary skills will increasingly be unable to find employment. But does this mean that conventional ideas of a knowledge economy or knowledge society are ideal and what we need to focus our energy on?

Considering agriculture across the developing world, Tripp (2001) suggests that primary agriculture's ability to drive and contribute to rural development is strongly dependent on the generation and

delivery of new agricultural technology. However, he argues that future policy will need to differentiate very clearly between the requirements of emerging commercial farmers versus those of semi-subsistence farmers, many of whom are part-time farmers or cyclically engage in agriculture. While commercial farmers engage in global commodity chains and require technology and support to do this, semi-subsistence farmers require simple, cost-effective and often labour-saving technology (see also Letty, Shezi and Mudhara 2012). Primarily targeted at the first group, conventional and new technologies such as genetically modified organisms (GMOs) will require new crop management and business skills. The education levels of farmers will need to be boosted, especially as farmers engage in more sophisticated input and output markets. Similarly, the existing extension services will need to improve (Hart and Aliber 2010; Hart 2011); like the rural education systems, they are inadequate for the future.

In the first of these concept papers (Jacobs and Hart 2012), we briefly described the current situation with regard to education and skills in rural areas. There is a serious need for improved education and training facilities at all levels in South Africa's rural areas. An analysis of the 2009 General Household Survey, Table 2, illustrates that the level of education of household heads from agricultural households drawn primarily from South Africa's rural areas is very low. While 6% have a tertiary level of education, 22% have no education and the remaining 72% are split almost evenly between having obtained a secondary or a primary level of education.

Table 2: Level of education of female and male household heads involved in agriculture 2009

Level of Education	Female and Male Household Heads	
	Number	Share
No schooling	585924	22%
Primary schooling	914902	35%
Secondary schooling	958207	37%
Tertiary	148523	6%
All	2607556	100%

Source: Adapted from Hart and Aliber 2010

With figures like this and the evidence from the first paper in this series, South Africa does not appear to be producing entrants to a rural-based knowledge economy. Urban figures are slightly better, but emphasis appears to be on tertiary education and knowledge diffusion is not strengthened in primary and secondary education. Poor conditions exist in many schools and there appears to be little support for those who suffer mental and physical disabilities. Relatively speaking, rural areas remain inadequately resourced in terms of education and skills development and rural universities are typically under-resourced in terms of funding, staffing, curricula and materials. The country needs opportunities to innovate and environments that make innovation sustainable. However, the way this is envisioned through ideas of a knowledge economy and the current almost exclusive and formal nature of the national system of innovation, despite some recent and minor changes proposed by the Ministerial Review (DST 2012), it seems that such opportunities are unlikely

in the immediate future. Crucial shifts that align South Africa's needs with those that will attract investment and knowledge sharing are important. The 2007 Innovation towards a knowledge-based economy: Ten-year plan for South Africa (DST 2007) highlights the Global Grand Challenges, including climate change, security, renewable energy, etc., which Gault (2010) argues are the key problems for the world that innovation must address in a sustainable manner. Moving towards innovations that address these challenges in this fashion is undoubtedly noble, but novel considerations are required to guide South Africa's role in related innovations, for our key problems are somewhat different.

After eighteen years of democracy, tackling poverty, reducing inequality, increasing employment opportunities and addressing the range of social and environmental challenges remain crucial to South Africa. Of course Global Grand Challenges such as water and energy are important. However, South Africa's specific problems should not be overshadowed by these challenges. Both sets of problems must be addressed concurrently to ensure long-term and sustainable growth. This can be achieved through the right balance between innovation in economic sectors, as well as social innovation. However, this will require the recognition of innovations arising from the rural and other marginal areas, whether they are developed through formal or informal networks, their diffusion to other areas, as well as better diffusion and adoption of innovations in rural areas. To achieve this ideal, constraints within rural areas must be acknowledged and addressed in new and creative ways in order to ensure an enabling environment for the adoption and diffusion of innovations. The continual top-down identification and development of technology with its subsequent top-down diffusion needs to be changed and consideration given to informal innovations and methods of diffusion. South Africans will need all sources of knowledge if most are going to innovate effectively and optimise the use of innovations to address our most pressing problems.

Perhaps we should seriously consider moving away from emphasising the notion of a knowledge society or economy, as it is so often called in the innovation literature, to an innovation society. An innovation society would be one in which knowledge (R&D and technology) is only one of the elements and the focus would be on how an innovative mind-set can trigger broader systemic (social, economic, political, etc.) changes across society as a whole, including but not confined to, the economy, as is the present discourse. Here some lessons from the European Union can be learned. The 2000 Lisbon Strategy, with its focus on developing the most competitive knowledge-based economy in the word through focusing on innovation based on R&D, was important in stimulating economic growth and creating jobs across Europe. However, this strategy does not seem to have been able to address the many social and environmental challenges which Europe faces today (YF/SIX 2010). The current European Union strategy, Europe 2020, arose out of the financial and economic crisis of 2007 - 2008 and an awareness of the need to tackle the numerous social and environmental challenges. The latter are recognised by the creation of a competitive green economy and the realisation of the need to empower people. However, the strategy makes no mention of social innovation in any form and still remains focused on knowledge and innovation driven by R&D rather than by people. What is required therefore is people-centred innovation – innovation that

focuses on people's multiple needs, rather than simply one part of society, such as the economy and its global competitiveness. We are all too familiar with the fact that the neoliberal idea of the 'trickle-down effect' makes no real contribution to overall social well-being.

Perhaps a strong and clear set of reasons for desiring an innovation society before we are able to achieve a knowledge economy can be drawn from the closing words of a recent paper by Lorentzen and Mohamed:

> Obviously, life in the LICs [low income countries] is not neatly divided into manufacturing and agricultural and health [and other livelihoods] issues. They are connected: healthier people have a better chance of earning an income, educated people are more likely to make informed health choices, higher incomes (or the provision of safety nets) … can help people avoid getting locked into low-risk, low-reward situations and open up opportunities for investing into more dynamic activities (2010: 19).

Consequently, innovation needs to be integrated, rather than remain specifically focused on one part of society (the informal economy) and on specific actors such as R&D, private enterprise, etc. An innovation society would ensure that all members of society have access to a variety of knowledge that enables them to innovate for social and economic or livelihood outcomes and ensure that priority and attention is not only directed towards those engaged in the formal economy.

5. A NOTE ON SPATIAL INNOVATION SYSTEMS

Innovation systems operate at various territorial scales that usually range from supra- to sub-national levels (Freeman 2002; Laranja, Uyarra and Flanagan 2008; Asheim, Boschma and Cooke 2011). Historical evidence, at least, supports the notion that territory or spatial location does matter for the production, flow and adoption of new knowledge. More recently, Gossling and Rutten (2007: 254) observed that regions 'rich in technology, in demanding customers and an educated workforce' offer a milieu which is more conducive to innovation. Looked at from a sub-national viewpoint, this means knowledge spill-over (Breschi and Lissoni 2001) and interactive learning differ across localities as well as regions, which could simply be thought of as a physical spatial network made up of various smaller localities inside the boundaries of a nation-state. What are the unique features and determinants of these sub-national territorial systems of innovation?

Innovation activities in 'learning regions', 'industrial districts', 'local clusters', Silicon Valley and other smaller geographic spaces within nation-states (Freeman 2002) now receive closer scrutiny (Asheim, Boschma and Cooke 2011). A central proposition in this literature, according to Breschi and Lissoni (2001) amongst others, flows from statistical trends showing that the rate of innovation among firms that are geographically closer to important knowledge sources is much faster than competitors in distant locations. Furthermore, the increasing availability of spatially disaggregated data on

innovation inputs and outputs, such as the stock of R&D activity concentrated in a geographic space, has made it possible to systematically evaluate the performance of these sub-national spatial innovation systems.

A local innovation system is driven by a common awareness that rests on local and traditional practises and a collective aspiration to local economic progress and technological capability development (Doloreux, Dionne and Jean 2007). Regional innovations systems (RIS) are characterised by a combination of localised clusters (Todtling and Kaufmann 1999), often merely local components of industrial clusters, sectors and networks with linkages that span across regional boundaries.

Three interacting factors underpin innovation activities within 'bounded space' (Breschi and Lissoni (2001: 978), namely: properties of knowledge sharing and learning; forms of proximity and agglomeration. Let us briefly elaborate on each factor to illustrate how it influences the uniqueness of innovation in local nodes and regions.

Properties of knowledge sharing and learning: An innovation system critically rests on knowledge availability and learning capability among actors. Asheim, Boschma and Cooke (2011) distinguish between the features of science-based, engineering-based and art-based knowledge and the knowledge inputs, processing, output and circulation actions linked to each domain. Moreover, the skills sets that make up each knowledge domain differ. Knowledge with a strong scientific content and demanding abstract analytical skills they define as science-based knowledge. Applied knowledge used to solve practical problems, typically generated through 'on-the-job learning' and experimentation, is classified as engineering-based knowledge. Finally, art-based knowledge is associated with types of cultural production which rely on imaginative and interpretive skills. Even though space-bounded innovation systems are usually characterised by a combination of these knowledge domains, the differential distribution of the latter across territorial spaces is readily observable.

Within each domain, knowledge could be exchanged through informal, direct and repeated contact (Breschi and Lissoni 2001; Asheim, Boschma and Cooke 2011). This is context-specific and captures the tacit feature of knowledge. Alternatively, knowledge sharing depends upon a highly specialised vocabulary and models, demanding specific cognitive skills and sometimes protected through strict intellectual property rights (Johnson, Lorenz and Lundvall 2002). These are the prominent characteristics of codified knowledge. While the knowledge domains 'contain different mixes of tacit and codified knowledge' (Asheim, Boschma and Cooke 2011: 897), codified knowledge is more common in the scientific domain compared to the tacit dominance of art-based knowledge.

Proximity: It is important to distinguish between geographical distance and the other forms of non-spatial proximity. Physical closeness is vital in contexts where the transfer of information, technical skills and know-how depends on frequent face-to-face interactions. Spatial proximity is a necessary

but not sufficient requirement to facilitate constant interaction. Non-spatial proximity is concerned with the ability to diffuse inward knowledge, regardless of whether actors in the innovation space are geographically concentrated in the same space.

Agglomeration: Innovators operate in tight proximity to achieve and exploit the benefits of economies of scale. Intensive knowledge sharing among actors in close physical proximity is a catalyst to more efficient and competitive innovation. Many factors induce this agglomeration, such as lower production costs - for example, the cost to transfer skills and factors of production - and optimal access to supporting infrastructure.

CONCLUSION

1. CONCLUSION

By way of conclusion we reflect on some of the key gaps and concerns that arise from our review of what we consider to be crucial concepts and their definitions.

There are numerous definitions of innovation and these are varied, although it would seem that there are at least three crucial requirements. The primary requirement is that an innovation must exemplify some novelty, either by being new or at least indicating some new improvement. There appear to be two secondary requirements. For something to be an innovation it must be able to be diffused (disseminated) and diffusion must take place, as this indicates its value and encourages further innovation through adaption or incremental change. Financial and social value is important, although both may not be met simultaneously or even through a single innovation. Although appearing to have value, it is quite possible that innovations can illustrate contingent outcomes and negative effects over the medium to long term.

The unfolding debate on social innovation illustrates the newness of interest in this dimension of innovation, implies the further evolution of perspectives in this area, often rife with disagreement and the need for a broadminded approach to understanding social innovation and innovation in general.

Because of the multiple definitions, we have drawn on a combination of more recent definitions which indicate that innovation broadly involves: invention, diffusion, adoption, adaption and improvement of both physical and social technologies (and includes products, processes, organisation of people, marketing and market access, improvement of well-being and services).

A country's innovation strategy should bring about the most important R&D – R&D should not drive innovation strategy. The latter still seems apparent in South Africa and there is a desire to focus on Global Grand Challenges and European models of innovation and innovation thinking. South Africa's national system of innovation is too formal, with little focus on sub-national and local/regional systems. Despite statements to the contrary, there is no real recognition of multiple actors and influences.

We should be focusing on the idea of an innovative society, rather than a knowledge economy. The idea of a knowledge economy revolves too much around the perceived importance of big science, underplays the importance of incremental shifts and informal contributions and over-emphasises tertiary education, which is actually redundant if the pre-school, primary and secondary phases are poor, as is generally the case in South Africa, particularly in rural areas. An innovative society

approach emphasises the focus on needs and social requirements as the primary areas of innovation. There is a need to become more people-centred to effectively address South Africa's key problems of poverty, unemployment and inequality. In contrast, the notion of a knowledge economy emphasises that the ability to innovate is based upon tertiary education and the ability to use and improve on knowledge for economic growth – economic growth is therefore dependent on knowledge and the ability to use it. The White Paper (DACST 1996) and latest Ministerial Review (DST 2012) focus on the notions of knowledge economy and tertiary education. Both approaches ignore the heterogeneity of South Africa's society and the diversity of innovations. Effective policy and a sound innovation strategy needs to recognise that one size does not fit all, even within a specific sector. Within large-scale and small-scale farming, formal and informal economic activities, large-scale and small-scale mining, education and technology, requirements are different, as are the purposes of these activities.

South Africa's key problems are poverty, unemployment and inequality. That these must become the core focus of innovation strategy and policy and be of relevance to the poor, rather than the elite, cannot be overemphasised. Such a people-centred focus must also be integrated to achieve some measure of balance. For example, it might be useful in cases where South Africa experiences similar problems as those identified as Global Grand Challenges, that these become integrated with regard to addressing poverty, unemployment and inequality. They should not overshadow the latter! For example social and technical innovations in the fields of water and energy service delivery could increase employment, reduce poverty and inequality. Where they do not achieve this, they should be treated with caution.

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