

Creating a sector innovation system

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This article motivates the need to build a culture of technology innovation in South Africa as a means of developing and commercialising technology-based services, processes and products to combat climate change and reduce our reliance on fossil fuels.

Remember a time when we didn't have to worry about energy shortage in the country. There was a surplus and great effort went into creating a market for the surplus which included initiatives that were energy intensive. However, soon clear recognition of the fact that our reserves were shrinking came to light and negotiations around finding palatable solutions were initiated. Soon thereafter the real reserve shortage started to impact on the country's economic growth which resulted in the introduction of many energy efficiency initiatives.

This article provides an overview of how the energy innovation system works, the drivers of energy technology innovation such as sustained increase in demand, diversification of sources of fossil fuel supply, fuel switching and development of new fuels, deregulation and increasing competition, identifying technology opportunities, and the role that the Technology Innovation Agency (TIA) plays in the innovation system to meet the requirements of the energy efficiency initiatives.

Background to innovation system development

Two major components have contributed to formalising the innovation system, the first is the Energy Efficiency Strategy of 2005 which has the aim of:

- Improving the health of the nation
- Job creation
- Alleviate energy poverty
- Reduce environmental pollution
- Reduce CO₂ emissions
- Improve industrial competitiveness
- Enhance energy security
- Delaying the building of new power stations

The second is the White Paper on Climate Change of 2011, which is seen as the flagship programme for energy efficiency and energy demand management. It is expected to be an aggressive energy efficiency programme in industry, which also looks at residential energy efficiency, including the regulation of residential and commercial building standards to enforce better building construction practices, as well as a government building energy efficiency programme.

Sectorial system of innovation

Fig. 1 outlines the key elements that make

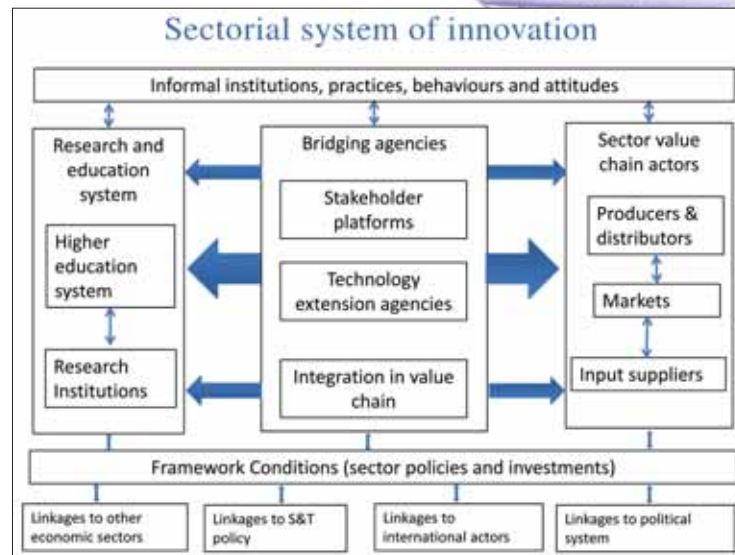


Fig. 1: The structure of the sectorial system of innovation outlined to demonstrate the importance of efficient integration.

up a sectorial system of innovation. On the left of Fig. 1 the research and education system includes the higher education system and research institutions like SANS councils that have specific programmes related to energy, and the CSIR which has programmes tied to improving energy use. On the right of Fig. 1 the sector value chain actors are important to drive the active markets, which includes producers and distributors, for instance in South Africa that would be Eskom, and the input suppliers that support the energy sector as a whole are classified as part of the energy system.

The other key ingredient is the bridging agencies, in the middle column of Fig. 1, that include stakeholder platforms, for example in South Africa that would be the Southern African Association for Energy Efficiency (SAEE), which is one of the stakeholder platforms for specific issues related to their major energy concerns. TIA is another bridging agency, as a technology extension agency that will create the linkage between the various players within the system. The third category of bridging agency is the various players that integrate the numerous parts of the system to bring together the complete sector innovation system. In addition, there are informal institutions, specific fields relate to practices, behaviours and attitudes and they have an impact on how well the system operates. Added to the mix are the formal parties that relate to sector policies, investment policies and this whole system has to interact and create linkages with other economic sectors, science

and technology policy, environmental requirements, international actors, and the political system as a whole. All the actors in Fig. 1 need to work efficiently so that the objectives set can be achieved in the country.

Characteristics of an energy technology innovation system

The sector itself is very diverse, there is no one characteristic type of innovation system. It all depends on which part of the innovation system is referred to, for instance with renewable energies the actors are slightly different to the actors that focus on a different technology. Traditionally, the public sector plays a main role, however the private sector is growing in importance with its involvement in this innovation system. The technology developments are rapidly becoming a lot more diverse and complex. One only has to look at the developments of late around nuclear, renewables, and a need to integrate the various systems to support each other becomes clearly necessary. The system also plays an important role toward research, development and demonstration of technologies. Due to extended timelines for development and commercialisation of technologies, technology lock-in tends to occur, hampering the development of innovative ideas. Various developments are beginning to play a role and are likely to be supported in the innovation system in various ways: for instance developments in fuel cells, co-generation plants, biogas

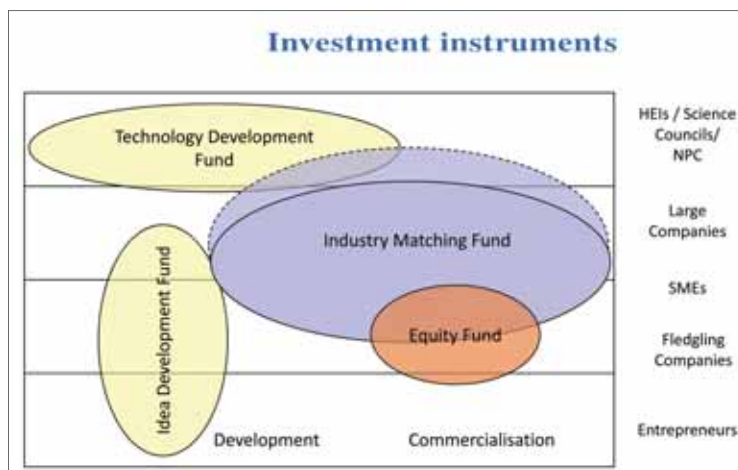


Fig. 2: Investment instruments available through TIA to develop a successful innovation system.

digesters, UPS, solar and PV, heat pumps, solar water heaters, waste recovery systems and wind turbines, etc – these encompass many of the energy efficiency activities that the TIA is looking at. The other areas that have various contributions to make in the innovation system include HVAC systems, motors and drives, energy management systems, lighting systems, etc. TIA also considers monitoring and verification, for example, and systems that guide the successful implementation of energy management. These all form the characteristics of an energy technology innovation system, we now look at what the TIA views as the characteristics of an energy efficiency innovation system.

Characteristics of an energy efficiency innovation system

The energy efficiency innovation system forms a rapidly growing sub-sector of the larger energy technology innovation system and there is a need to allow for emerging and mature energy technologies. The system is changing fast – again various actors in it play major roles like the industrial sectors that traditionally fall outside the energy field, firms of differing sizes and specialisation, and diverse scientific disciplines. Many government programmes and research consortia are aboard the energy efficiency innovation system. Within TIA there are energy initiatives in the energy policy itself, but some aspects are driven from the advanced manufacturing programme, with other aspects driven from the industrial biotechnology and environmental arenas, for example -all part of developments to create a well-functioning and efficient system.

Challenges in enhancing innovation in energy efficiency

A challenge of major concern is the decreasing overall research and development activities in both the public and private sectors. Sustaining such expenditure is a priority toward ensuring future energy innovation activities. A need also exists to create effective partnerships and funding for public/private partnerships,

as well as with research consortia that support the system's development.

Measures to stimulate networking opportunities to deploy these innovations are necessary as the actors and stakeholders are dispersed in diverse sectors of the innovation system. This also needs to be extended into creating a more efficient matrix regionally as well as with strategic partners such as network groups and other aligned countries as well.

The success of the energy efficiency innovation system will depend on how it is supported with sufficient funding for research, development, innovation and demonstration, and a good supply of highly qualified human resources that work within an appropriate framework in terms of regulations, competition policy, as well as intellectual property protection.

TIA bridges the gap to ensure continued innovation

TIA's role is to facilitate the opportunities and overcome the challenges discussed by making a contribution in terms of supporting the creation of an appropriate framework with workable conditions in terms of funding support for research, development and demonstration, as well as support mechanisms for intellectual property protection. Primarily TIA was established to create a bridge between ideas and the commercial environment. It is recognised that South Africa has a very active research and industrial environment, however, many ideas end up in the cradle of death, and therefore TIA's role is to make sure that these ideas can smoothly move from development phase into the commercial phase.

The mandate of TIA

The TIA Act, no 26 of 2008, mandates the Agency: *"The object of the Agency is to support the State in stimulating and intensifying technological innovation in order to improve economic growth and the quality of life of all South Africans by supporting the development and exploitation of technological innovations"*.

The strategic objectives of TIA

TIA's objectives are to stimulate the development and commercialisation of technology-based services, processes and products supporting the establishment of technology-based commercially viable enterprises using the Agency's funding for investments to ensure that the mandate can be implemented within the regulations that govern the TIA. Facilitating the development of human capital and building a culture of innovation within the workforce is important to sustain the initiatives.

Investment instruments and framework

The sectors that are focussed on, to fulfil the TIA objectives and mandate, include industry and biotechnology where co-investment funding will be leveraged from the Technology Development Fund to drive the initiative. Fig. 2 demonstrates these investment instruments available through TIA.

The smaller fund targets idea development which relates to intellectual property protection when developing prototypes. A much larger pool of funding targets industry and deals with the requirement of creating a viable system with partnerships between private and public sectors.

The investment policy framework determines where investments are allocated, how risks are managed and what is expected to be achieved in terms of what has been agreed with the minister of science and technology. The framework guides the selection criteria in terms of the opportunities that TIA will fund and looks at potential financial returns, its alignment with national policy and TIA sectors, the technical and commercial viability, amongst other aspects.

Conclusion

As an initiative of the department of Science and Technology, TIA has already invested towards the Adept aircraft engine which does not require jet fuel. The intention of this innovation is to develop it for a variety of fields and has been tested and successfully demonstrated. Other investments have gone towards the Joule electric motor vehicle, and towards thin film solar panel developments.

TIA provides entrepreneurial support through 15 technology stations and 14 technology platforms, as well as partnerships with universities, development agencies and local governmental department.

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