

THE STATUS OF INNOVATION IN THE TVET COLLEGES

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NATIONAL ADVISORY COUNCIL ON INNOVATION

The status of innovation in the TVET colleges: An exploratory study has been compiled to examine the state of innovation in the sector. A synoptic literature review was conducted. A range of tools, including a PESTEL situation analysis, an ideographic inquiry, a SWOT analysis and a document analysis, along with an online survey of college principals, was complemented with a series of interviews held with selected college partners and stakeholders.

We welcome comments and suggestions that would enhance the value of the report. Please email such comments and suggestions to naci@dst.gov.za.

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**THE STATUS OF INNOVATION
IN THE TVET COLLEGES:
AN EXPLORATORY STUDY**



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GLOSSARY OF ABBREVIATIONS

Abbreviation	Definition
4IR	Fourth Industrial Revolution
ADB	Asian Development Bank
AI	Artificial Intelligence
AIDS	Acquired Immunodeficiency Syndrome
ANC	African National Congress
AU-AOSTI	African Union's African Observatory for Science, Technology and Innovation
BRICS	Brazil, Russia, India, China, South Africa
CEO	Chief Executive Officer
CERN	European Organization for Nuclear Research
CESM	Classification of Educational Subject Matter
CET	Community Education and Training
CoS	Centre of Specialisation
COSATU	Congress of South African Trade Unions
CPD	Continuous Professional Development
CREST	Centre for Research on Evaluation, Science and Technology
DACST	Department of Arts, Culture, Science and Technology
DHESI	Department of Higher Education, Science and Innovation
DHET	Department of Higher Education and Training
DST	Department of Science and Technology
DSI	Department of Science and Innovation
The dti	Department of Trade and Industry
The dtic	Department of Trade, Industry and Competition

Abbreviation	Definition
EDD	Economic Development Department
FET	Further Education and Training
FETMIS	Further Education and Training Management Information System
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
GII	Global Innovation Index
GERD	Gross Expenditure on Research and Development
GO-SPIN	Global Observatory of Science, Technology and Innovation Policy Instruments
HDI	Human Development Index
HE	Higher Education
HEI	Higher Education Institution
HEMIS	Higher Education Management Information System
IAG-TVET	Inter-Agency Group on Technical Vocational Education and Training
ICT	Information and Communication Technology
ILO	International Labour Organization
IMF	International Monetary Fund
InnoVET	Innovative TVET
INSEAD	Institut Européen d'Administration des Affaires
IoT	Internet of Things
IP	Intellectual Property
IPR	Intellectual Property Rights
ISO	International Standards Organization
IT	Information Technology
M&E	Monitoring and Evaluation

Abbreviation	Definition
MIS	Management Information System
MNC	Multinational Corporation
MOTHS	Mobility of the Highly Skilled
NACI	National Advisory Council on Innovation
NATED	National Technical Education
NCD	Non-communicable Disease
NC(V)	National Certificate (Vocational)
NDP	National Development Plan
NECSA	Nuclear Energy Corporation of South Africa
NESTI	National Experts on Science and Technology Indicators (of the OECD)
NGO	Non-governmental Organisation
NPO	Non-profit Organisation
NSDP	National Skills Development Plan
NSF	National Skills Fund
NSFAS	National Student Financial Aid Scheme
NSI	National System of Innovation
ODeL	Open Distance e-learning
OECD	Organization for Economic Cooperation and Development
PESTEL (analysis)	Political, Economic, Social, Technological, Environmental and Legal (factors)
PESTELV (analysis)	Political, Economic, Social, Technological, Environmental, Legal and Values
PRO	Public Research Organisation
PSET	Post-school Education and Training
QCTO	Quality Council for Trades and Occupations

Abbreviation	Definition
R&D	Research and Development
SACP	South African Communist Party
SAFESTI	South Africa Foresight Exercise for Science, Technology and Innovation
SASSETA	Safety and Security Sector Education and Training Authority
SETA	Sector Education and Training Authority
SDF	Skills Development Fund
SDG	Sustainable Development Goal
SME	Small and Medium-sized Business
SoC	State-owned Corporation
STI	Science, Technology and Innovation
STS	Scientific and Technical Services
SWOT (analysis)	Strengths, Weaknesses, Opportunities and Threats
TB	Tuberculosis
TNC	Transnational Corporation
TVET	Technical Vocational Education and Training
TVET MIS	TVET Management Information System
UIL	University-industry Link
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO-UNEVOC	UNESCO International Centre for Technical and Vocational Education and Training
VET	Vocational Education and Training
WBL	Work-based Learning
WEF	World Economic Forum
WHO	World Health Organization
WIPO	World Intellectual Property Organization

PREFACE

The National Advisory Council on Innovation (NACI) provides advice to the Minister of Higher Education, Science and Innovation, who keeps Cabinet abreast of a range of issues related to science, technology and innovation (STI) policy and its impact on society, the economy and the environment. The government relies on its ability to network and partner with local and international experts in this regard.

In March 2019, Cabinet approved a new White Paper on STI, which advocated for strengthening the monitoring and evaluation (M&E) capability of government to bolster policy performance. In particular, it instructs NACI to assume an M&E function.

The Minister mandated NACI to assess the state of innovation in the technical vocational education and training (TVET) sector in 2020. The Council then appointed Professors Salim Akoojee, Michael Kahn and Moeketsi Letseka to provide technical assistance on the study. The National System of Innovation (NSI) actors had an opportunity to engage with the draft study report through a virtual round-table discussion on 20 July 2021. The Council also appointed an independent reference group (Dr Glenda Kruss, Prof Bennie Anderson, Dr Raymond Patel and Mr Themba Msipha), which offered comments throughout the study.

Overall, both the NSI actors and reference group welcomed and appreciated the pioneering nature of the study and its potential to shape the assessment of the state of innovation in TVET colleges in future. Among others, the study offers conceptual clarity on the understanding of innovation in TVET colleges, deals with contextual and methodological issues, and proposes several indicators. The integration of the two reports, “The status of innovation in the TVET colleges” and the “2021 South African Science, Technology and Innovation Indicators Report”, will evolve in a biennial assessment of the state of STI in future.

NACI welcomes comments and suggestions on this report. Please submit any comments to naci@dst.gov.za.

Dr Mlungisi Cele
Acting Chief Executive Officer



EXECUTIVE SUMMARY

In mid-2020, the Minister of Higher Education, Science and Innovation requested the National Advisory Council on Innovation (NACI) to provide an assessment of the state of innovation in technical vocational education and training (TVET) colleges. The object of the study was the set of 50 TVET colleges and their stakeholders. The associated investigation comprised deskwork, interviews and an online survey conducted over an eight-month period.

In essence, the study reveals a tale of two discourses. On the one hand is the labour market and skills formation, capability and lifelong learning, with the individual at the centre. On the other hand, the study tells the tale of the economics of innovation, with a strong emphasis on the dominant macroeconomic paradigm, with framework conditions that enable private enterprises to flourish.

The literature review reflects TVET as a 'Cinderella' sector that is not renowned for innovation capacity – let alone exercising the role of an innovation actor – and engaging in a limited amount of innovation activity through industry partnerships. The TVET sector has been essentially considered, and is portrayed as a provider of entry- and mid-level skills to respond to national social and economic development.

The TVET sector therefore occupies a complementary role to the usual triple helix of higher education, industry and public research organisations (PROs). It is rare to find advocacy for TVET as an important actor of the National System of Innovation (NSI). In contrast, this report makes a case for TVET's natural place within the NSI.

The assessment makes use of a range of tools – a PESTEL (political, economic, social, technological, environmental and legal factors) situation analysis, an ideographic inquiry, a SWOT (strengths, weaknesses, opportunities and threats) analysis, and a document analysis. The PESTEL analysis is organised according to three major themes: politico-legal, socio-cultural and techno-economic themes. Together with the synoptic literature review, it informs the fieldwork.

In order to examine the state of innovation in the sector, an online survey of college principals was complemented with a series of interviews held with selected college partners and stakeholders. The survey of college principals employed a concise instrument comprising items with pre-assigned drop-down menus, as well as items that invited free responses. A concerted effort resulted in an excellent return rate of 72%, considerably exceeding expectations. The response rate gives validity to the conclusions drawn from the data.

A main finding of the survey is that product innovation in the colleges is rare, with more cases of process innovation (in-college functional innovation)¹. There is a small number of innovation 'leaders' among the colleges, which serves as a basis for optimism for further developments. Besides concerns on resourcing and personnel capacity, the key issue raised by principals is that college governance constrains innovation. The external stakeholder interviews suggest a history of, and a willingness to, collaborate with the colleges, but that earlier interactions were weakened by a breakdown in trust, both with respect to the capacity and the willingness of the TVET sector to engage in a meaningful manner.

The SWOT analysis highlights the possible opportunities to advance the sector with respect to the economy, society and the innovation system. Opportunities include granting more (managed) autonomy to TVET leaders, contributing to the deepening of industrialisation, establishing new and enduring (sustainable) partnerships, expanding the skills of both lecturers and leadership, concerted efforts to develop lecturers, and engaging more deliberately with issues related to the emergent Fourth Industrial Revolution (4IR).

¹ A distinction is drawn between 'product' and 'process' innovation. The former refers to innovation undertaken by the college on products, while the latter refers to innovation at or in the college.

A Value Net positions the TVET sector in relation to its suppliers, beneficiaries, competitors and partners, and serves as a control mechanism to ensure the completeness of the proposed set of input, output, quality and innovation indicators. The TVET sector follows the approach of the United Nations Educational, Scientific and Cultural Organization (UNESCO)-International Centre for Technical and Vocational Education and Training (UNEVOC), linking quality and innovation potential.

The study concludes with a brief note on 'anticipation', titled 'Future imperfect', which situates TVET in the context of ongoing globalisation, climate change, geopolitical and demographic shifts and current technological advances, which include automation, robotics, artificial intelligence (AI), additive manufacturing (3D) printing, machine learning, the Internet of Things (IoT) and blockchain. All of these advances will transform labour market opportunities and challenges.

The publication "Technology and the future of jobs", published by the International Labour Organization (ILO), reports that vocational training is more likely to lead to employment in jobs that are at risk of automation. For now, at least in some areas of the labour market, the likelihood of a 'with Covid-19' future will increase the pressure to automate, reduce working at offices, move to the suburbs and curtail mobility. This suggests the need for a revitalised TVET sector, perhaps with the redefinition of key features, inter alia technology in the service of the community. The key recommendation of this report is to conceptualise and integrate TVET within the NSI. This recommendation is made on the basis that TVET, as a major component of post-secondary education and training, has a crucial role to play in the national development agenda. The mid-level technical skills provided by the TVET sector are an indispensable component of industrial and corporate development in both the public and private sectors – one that needs to be creatively and responsively managed with respect to national development goals. It is evident that the TVET system is in need of far-reaching renewal to fulfil its mandate. The system, which emerged from servicing a fragmented and exclusionary apartheid system based on the mineral-energy complex, must undergo considerable change and transformation in order to meet the needs of the rapidly evolving economy and the world of work.

This calls for three levels of action:

I. The renewal of the policy, governance and leadership environment

The recommendation for the review of policy is made on the basis that current policies on TVET colleges are not designed to enable innovation and innovation activities in, and by, TVET colleges. The top-down governance of TVET colleges has been found to hamper TVET college effectiveness, and to impact negatively on a culture of innovative practice.

The neglect of this aspect has contributed to a moribund system that is less than effective for its core constituents: lecturers, students and employers. Failing to situate the colleges at the centre of curriculum renewal, for instance, makes them less responsive to their immediate environment, especially with respect to labour market demand.

While much has been done to develop national qualifications, admittedly, with the involvement of industry stakeholders, the assumption that these industry players represent local and regional entities to which these colleges have to respond is perhaps unjustified. There is no substitute for local relationship building.

A key gap in leadership thinking concerns innovation itself. It is suggested that a concerted attempt be made to enable colleges to engage with innovators, and thereby to enhance their understanding of the complexities of issues related to the NSI. A comprehensive training programme for the senior management of colleges and departmental supervisory staff is proposed as a starting point on the journey of inclusion.

As pointed out earlier in this report, TVET college leaders should be given the autonomy to experiment even further, and to share that experience among their peers. Such intra-sectoral mentorship through innovation, and innovation through mentorship, could be most valuable going forward. This requires the support of the Department of Higher Education, Science and Innovation (DHESI), sector education and training authorities (SETAs) and the National Skills Fund (NSF).

II. Concerted efforts to develop the functional competence required to fulfil the TVET system's mandate of establishing an innovation system

College effectiveness has been found to be sub-optimal. Staff members are seen to be less than effective in terms of their functional competence, due, in a large measure, to their lack of workplace or industrial experience and expertise in their field. This impacts quite significantly on their ability to link with local labour markets. If there is limited interaction among the main actors of an innovation system, it is a stretch to refer to it as a system. Yet, this is what is required before the sector can be taken seriously by others. The TVET colleges will be part of the NSI through linking and interacting with other colleges and industry. Without some degree of intersectoral linkages and synergy, the TVET system will simply not be able to take its place in the NSI, which requires mutual respect and understanding from all parties.

A process to assess lecturers against recent, relevant experience, coupled with the requirement for both academic and professional qualifications, would be an essential step towards revitalising the sector. Identified shortcomings may then be addressed through continuous professional development (CPD).

In comparison with universities and universities of technology, TVET colleges play a distinctive and unique role in the higher education sector. They are not expected to, nor do they have the capacity to, conduct academic research. Their role in undertaking user-oriented applied research needs to be articulated as a contribution to the NSI. They must therefore be developed to become essential contributors to a range of innovation activities. It is not unreasonable to expect the emerging centres of specialisation (CoSs) to serve as bridges that link TVET colleges with neighbouring higher education institutions (HEIs) and other innovation actors.

III. System-level monitoring and evaluation (M&E) and measurement to ensure policy learning, efficiency and effectiveness

Policy learning depends upon the availability of trustworthy, up-to-date information, and political will and capability to

forge an appropriate and sustainable, but correctable, path. The TVET college system, however, has very little in terms of data that tracks progress.

The centralised TVET management information system (TVET MIS)² remains a work in progress. Information that needs to be publicly available is not yet readily accessible.

Thus, the information systems are lagging behind due to the process of system centralisation. A national management information system for TVET colleges will go a long way towards enabling the TVET system to take its rightful place in the national system of innovation.

The management information system is a critical requirement for the continuous monitoring and evaluation of TVET as a subsystem within post-school education and training (PSET). This will allow the tracking and identification of the continuing challenges of a system long neglected in official discourse.

In conclusion, the following is noted:

- There are pockets of innovation practice in TVET colleges.
- Innovation leaders may mentor those who are lagging behind.
- There is a willingness, and a need, to engage.
- The emerging CoSs may serve as bridges that link TVET colleges and neighbouring HEIs and other innovation actors.
- The three recommendations together provide the basis for the recognition of TVET as an essential actor in the national system of innovation.

It is suggested that policy-makers give urgent consideration of how to include TVET as a contributor to innovation for inclusive development and wellbeing.

NACI extends its appreciation to all who participated in the study, to the authors Professors Salim Akoojee, Michael Kahn and Moeketsi Letseka, to the NACI Secretariat and to the Centre for Research on Evaluation, Science and Technology (CREST) at Stellenbosch University for their technical assistance.

² The long-promised further education and training management information system (FETMIS) (which originated prior to the current change to the TVET college system) is as elusive as current attempts to develop it.

I. INTRODUCTION

The Minister of Higher Education, Science and Innovation requested the National Advisory Council on Innovation (NACI) to assess the state of innovation in technical vocational education and training (TVET) colleges. This request was made immediately prior to the Covid-19 pandemic, and in the context of attempts to redefine post-secondary education and its role in advancing industrialisation and expanding the job market.

The NACI Secretariat duly framed the terms of reference for the associated project along the lines of the definition of innovation in TVET colleges of the United Nations Educational, Scientific and Cultural Organization (UNESCO)-International Centre for Technical and Vocational Education and Training (UNESCO-UNEVOC) as “innovation that comprises a substantial change in the way that TVET is practised by an institution, making it progressively more relevant to its economic, social and environmental context”.

The specific objectives of the terms of reference for this project were to do the following:

- Map out a methodological approach for conducting an investigation into the state of innovation in TVET colleges in South Africa.
- Develop a framework of indicators that would be utilised in assessing the state of innovation in TVET.
- Table a report on the state of innovation in TVET colleges in South Africa.

The consultants argue that an assessment of the state of innovation in TVET colleges requires a broader approach to that defined in the terms of reference. It is their view that the origins of TVET globally and locally go beyond that implied in the UNESCO-UNEVOC approach.

It is deeply embedded in all societies and expressed in institutional forms – both formal and informal.

The consultants therefore aimed to do the following:

- (i) Situate the TVET sector in the larger context of the National System of Innovation (NSI).

- (ii) Examine the meaning of TVET college innovation activities.
- (iii) Explicate the way in which TVET colleges contribute to innovation conducted by other actors in the innovation system, especially through linkages between the TVET sector and other innovation system actors.

It is argued that understanding innovation in the TVET sector requires engagement with two schools of thought. On the one hand is a discourse that concerns itself with the labour market and skills from the learner-worker perspective.

The labour market and skills school of thought is strongly rooted in sociology and philosophy. Its focus is on the individual, as well as skill formation, capability and lifelong learning.

On the other hand, there is the discourse of the economics of innovation. This is largely rooted in the macroeconomic frameworks pursued by the development banks, the International Monetary Fund (IMF), the Organization for Economic Cooperation and Development (OECD), the World Economic Forum (WEF) and many governments.

These frameworks claim to be informed by empirical modelling and place the firm at the centre of the innovation process. Framework conditions that enable private enterprises to flourish are at the centre of this advocacy.

Overall, progress towards innovation is monitored by means of high-level metrics, such as the OECD’s Frascati Manual (OECD, 2015).

This report sets out to break new ground. It ventures into areas of critical importance to skills development, the production of artisans and technicians, employment creation and the functioning of the South African NSI.

However, little is known with respect to the TVET sector’s role and contribution to the NSI, as there is limited data and an absence of specific indicators.

The report is structured according to eleven sections.

2

Section 2 provides the framework for the investigation. It maps out the overarching role that innovation systems play and sketches the varying conceptions of innovation in innovation practices.

3

Section 3 considers the origins and intent of TVET nationally and internationally.

4

Section 4 provides a synopsis of the literature, drawing on the more complete version that has previously been shared with NACI.

5

Section 5 offers a situation analysis based on the conventional PESTEL (political, economic, social, technological, environmental and legal) analysis recast as three integrated pillars: the politico-legal, socio-cultural and techno-economic.

6

Section 6 discusses the conceptual and methodological approaches to the investigation. It includes a description of the effect of the complexities of restricted mobility on the study during the pandemic.

7

Section 7 presents the results of the fieldwork. These comprise the quantitative responses of college principals to the online survey, followed by the qualitative analysis of the interviews conducted with the business sector, government officials, statutory bodies and non-governmental organisations (NGOs).

8

Section 8 offers a SWOT (strengths, weaknesses, opportunities and threats) analysis, which draws on the early discourse and fieldwork analysis, and most importantly identifies opportunities for the development of innovation at TVET colleges.

9

Section 9 positions TVET within the current innovation discourse, the evolving Fourth Industrial Revolution (4IR), and the future world of work.

10

Section 10 proposes the measurement, monitoring and evaluation framework – with 25 indicators – that may serve as a mechanism to track TVET college innovation.

11

Section 11 reflects on the key features that would be necessary to properly enable the TVET sector so that it can enhance and strengthen its role and linkages within the innovation system.

2. INNOVATION SYSTEMS AND TVET

2.1 Innovation systems

Education 2030: Incheon Declaration: Towards inclusive and equitable quality education and lifelong learning for all, UNESCO (2015a) unequivocally states that vocational education and training is a crucial vehicle for social equity, inclusion and the attainment of Sustainable Development Goal (SDG) 4 and its Education for Action 2030 Framework (UN, 2015). It will be argued that TVET is a vital component of any well-functioning innovation system.

What, then, is an innovation system? Since the late 1960s, economic growth in Western economies has been faltering. The work of Gerschenkron (1962), Griliches and Schmookler (1963), Arrow (1962) and others had pointed to the prior role of technological change in raising total factor productivity. The way in which this might be enhanced became a focus of inquiry into the behaviour of firms. On the one hand, researchers turned to the East for inspiration; on the other hand, empirical studies were conducted on industry subsectors in Western Europe. From the early 1980s onwards, innovation surveys and case studies have been undertaken in Germany, in the United Kingdom by the Science Policy Research Unit, and in the United States by Yale University.

The insights gained from these surveys suggested that interactions and linkages among key players – higher education, intermediary organisations, enterprises and public research organisations – were a common element in the successful emergence of innovation. In Japan, government took an active role in promoting such interaction. From the systems viewpoint, it was noted that if one part of the system was weak, the whole would suffer, and little in the way of new products or processes would emerge.

Rosenberg (1976) was a key figure in the survey process, and provided evidence of the importance of non-research-based innovation. He also showed the

close links between innovation and diffusion: “... that most diffusion processes involve long and cumulative programs of post-commercialisation improvements” (quoted in Smith, 2005). Kline and Rosenberg (1986) next introduced the chain-link model of innovation to challenge the then dominant linear model of innovation. The chain-link model described innovation as an interactive learning process with multiple inputs that involved feedback at all stages without necessarily being initiated by research and (experimental) development.

What was lacking was a measurement framework. There was no internationally agreed upon methodology for comparison. Building on the success of the Frascati Manual approach to measuring the inputs of the research and development (R&D) process (OECD, 2015), the Working Party of National Experts on Science and Technology Indicators (NESTI) of the OECD brought together a group of experts to think through guidelines for measuring innovation. In due course, NESTI’s work on innovation was codified as the Oslo Manual, which provided guidelines for measuring innovation.

Etzkowitz and Leydesdorff (2000) subsequently introduced the metaphor of the triple helix model of innovation, a graphic device that sought to emphasise the importance of interactions in the process of innovation. Its articulation argued for the central role of universities in the triple helix of government and its public research organisations, business and the universities. The device gained worldwide currency in the advocacy for innovation as a driver of economic goals, even though some claim that the triple helix ignores the social dimension, and therefore insist that a quadruple helix would be a more appropriate device (Carayannis and Campbell, 2009; Fuzi, 2013; Kahn, 2016).

The triple helix is at the heart of the innovation system approach that has come to influence national science, technology and innovation (STI) policies.

The adoption of a systems view means that the inputs, processes and outputs of the system are linked and observable. If the linkages are barely extant, or weak, the notion of a system becomes abstract (Albuquerque, 1999; Freeman and Soete, 2007): no linkages; no system.

Locally, the innovation system approach was adopted in the White Paper on Science and Technology (DACST, 1996:22), which indicates that the NSI is “a set of functioning institutions, organisations and policies which interact constructively in the pursuit of a common set of social and economic goals and objectives”.

The White Paper avers that such constructive interaction would manifest in the conversion, by industry and business, of the resultant knowledge, technologies, products and processes into increased wealth, and an improved quality of life for all members of society. In this context, social innovation is understood to be part and parcel of a drive that identifies skills and capacity development as crucial to technology absorption, transfer and adaptation (DACST, 1996:19).

The contemporary definition of innovation encompasses the above, and entails that an organisation creates or adopts a new or improved product or process (or combination of the two) that differs significantly from its previous products or processes, and that has been made available to potential users or brought into use by the organisation (OECD, 2018). Innovation is understood to arise from a host of innovation activities that involves developmental, financial and commercial activities that are intended to result in innovation.

Technical and vocational skills are vital in innovation management activities, engineering, design and other creative work, marketing and brand equity, R&D activities, intellectual property activities, innovation-related employee training, software and database development, and the acquisition or leasing of tangible assets (OECD, 2018). Innovation may be ‘hard’ or ‘soft’, and occurs in firms, the public sector and civil society.

Measurement of innovation shows that most firms obtain their information on innovation from within their own ranks, followed by interaction with their value chains of suppliers

and users, as well as by studying their competitors. Interaction with universities and public research institutes tends to be of lesser importance.

While R&D in itself is an important contributor to innovation, it is but one of numerous innovation activities; an intramural activity conducted by a small minority of firms.

Even so, the innovation system approach, understood generically or in terms of the triple helix, is centred on the organisations that conduct R&D. Such organisations employ scientists, technologists, engineers, technicians, managers, librarians, lawyers, economists and administrators, and their collective efforts result in the products of R&D.

These organisations interact with one another directly and indirectly, and make use of many intermediary parties, such as providers of scientific and technical services (STS), regulators and standards authorities, and testing and quality control laboratories, all of whom are critically dependent on the supply of technical skills. R&D surveys routinely tabulate the number of researchers, technicians and administrators. By this argument, technical services, and the availability of technical staff, are essential to the functioning of any innovation system. Arguably, the outputs of the TVET sector are required across the innovation system.

The concept of the South African NSI is captured as Figure 2.1, which elaborates on the triple helix model. TVET is explicitly included as a subsector of post-secondary education and training, along with the universities, universities of technology and the global Invisible College of Science. The public research organisations (PROs) are split off from the ‘government’ arm, while the conventional label of ‘business’ is replaced with ‘entrepreneurship’. The innovation system functions within the larger context of the financial system, civil society, regulators, the basic education system and the provision of infrastructure – energy, utilities and communication. The system is open to the world, depends on the mobility of the highly skilled (MOTHS), and interacts with the global Invisible College of Science, local and international donors, and multinational corporations (MNCs). The informal and non-market-facing sectors remain largely unmeasured.

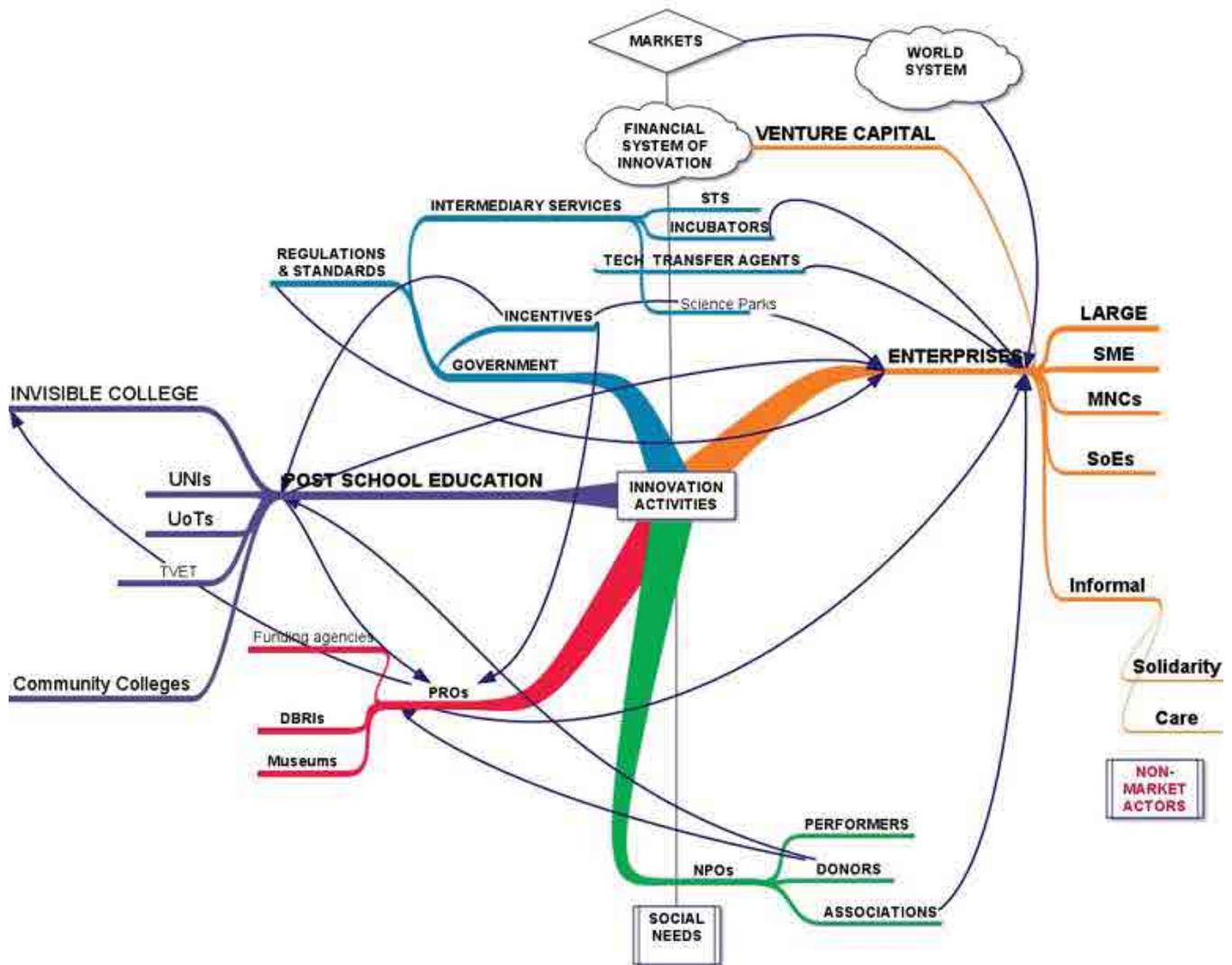


Figure 2.1: TVET within the South African system of innovation

Source: Kahn, 2019

The notion of a triple helix begs the question as to the frequency with which firms, universities and PROs actually collaborate in the innovation process. The evidence for such three-way interaction is weak, as illustrated by the assignment of patents to joint contributors. University-industry links (UILs) are another contentious matter that have been extensively investigated in literature by, for example, Johnston and Huggins (2015), who focused on the knowledge-intensive industry; Perkmann and Walsh (2007), who studied UILs and open innovation; and Britto et al. (2013) and Albuquerque et al. (2015), who conducted research on developing country perspectives.

There is essential interaction among innovation actors through informal networking, meetings, site visits and the natural mobility of personnel, whether they are graduates, researchers, technicians or accountants. Could such collaboration in TVET be enhanced by the secondment elsewhere of staff from any organisation – professors to the shop floor or fields; technologists to the lectern?

This mobility is a rarity in the South African landscape, but is more frequent in Europe and North America, and was widely practised in the People’s Republic of China in the 1960s (Connell and Gover, 1974).

2.2 Measuring innovation

Measuring innovation is a complex and uncertain activity. Unlike the measurement of R&D, there are no sentinel indicators of innovation, except for the tabulation of intellectual property rights (IPR) as a proxy for innovation activity. Much information on the outcomes of innovation remains untapped in company information systems or is untracked as far as behavioural change is concerned.

The field of innovation indicators is underdeveloped, and organisations rely on self-reporting. While there are guidelines for measuring the innovation activities of firms in the formal sector, none such guidelines exist for the public sector or the informal sector. Established methodologies to measure innovation outputs and outcomes tend to overlook the contribution of the TVET sector, which is treated as responsible for supplying skills, and nothing more.

For example, the WEF's Global Competitiveness Index (GCI) only refers to the 'quality of vocational training' under Pillar 6, 'skills', without interrogating its broader sectoral linkage. This gap is perplexing, given that R&D surveys are designed to identify and measure the contribution of technical staff. The OECD member states, the European Union and a number of emerging economies conduct regular R&D surveys. In Africa, only three countries have maintained a time series of R&D surveys: Egypt, South Africa and Tunisia.

A first indicator of the availability of technical skills among R&D performers may be obtained from published R&D survey data. Table 2.1 presents the total number of researchers and technicians in South Africa aggregated across all sectors: higher education, business, government departments, non-profit organisations (NPOs) and the science councils.

Table 2.1: Headcount of researchers and technicians, 2003/04 to 2018/19

Year	Researchers	Technicians	Ratio
2003/04	31 707	8 193	3.9
2004/05	37 001	8 641	4.3
2005/06	39 266	8 325	4.7
2006/07	39 591	9 761	4.1
2007/08	40 084	9 476	4.2
2008/09	39 955	9 761	4.1
2009/10	40 797	9 443	4.3
2010/11	38 081	8 559	4.4
2011/12	40 653	9 260	4.4
2012/13	42 828	10 790	4.0
2013/14	45 935	10 800	4.3
2014/15	48 479	12 183	4.0
2015/16	51 877	11 518	4.5
2016/17	56 761	11 346	5.0
2017/18	61 840	11 219	5.5
2018/19	57 323	10 545	5.4

According to the international norm, the headcount of researchers includes permanent and pensionable staff, experts on contract for six months or longer, as well as doctoral and postdoctoral students. Technicians have many different qualification levels, from a certificate through to a doctorate. It is a truism that researchers depend upon the collaboration of technicians. It is noted that the ratio of researchers to technicians remained fairly constant from 2003/04 to 2015/16.



2.3 Overview

Section 2 provided an overview of innovation and innovation systems, as well as insight into measurement dynamics. It was argued that TVET is a vital component of any well-functioning innovation system.

Innovation requires interactions and linkages among key players: higher education, intermediary organisations, enterprises and public research organisations. Critical in innovative thinking was the development of the chain-link model (Kline and Rosenberg, 1986), which described innovation as an interactive learning process with multiple inputs that involved feedback at all stages without necessarily being initiated by R&D.

The White Paper on Science and Technology (DACST, 1996:22) introduced the idea of a national innovation system as “a set of functioning institutions, organisations and policies which interact constructively in the pursuit of a common set of social and economic goals and objectives”. Innovation has important developmental benefits with the resultant knowledge, technologies, products and processes leading to increased wealth, and an improved quality of life for all members of society. In this context, the notion of social innovation is understood to be part and parcel of a drive that identifies skills and capacity development as crucial to technology absorption, transfer and adaptation (DACST, 1996:19).

Measuring innovation is a complex and uncertain activity. The field of innovation indicators is considerably underdeveloped, and organisations rely on self-reporting. While there are guidelines for measuring the innovation activities of firms in the formal sector, none such guidelines exist for the public sector or the informal sector. Established methodologies that measure the innovation outputs and outcomes of the TVET sector focus on the supply of skills, and nothing more.

Figure 2.1 elaborates on the triple helix model, where TVET is explicitly included as a subsector of post-secondary education and training, along with universities, universities of technology, and the global Invisible College of Science. Accordingly, the consultants aver that the TVET sector is an essential element of the innovation system that includes higher education, business and government.

These sectors have a critical dependence on a flourishing, relevant and productive TVET sector for the provision of technicians, artisans, craftspeople and technologists to the system, failing which, they must be imported from elsewhere. The TVET indicator researcher: technician provides a measure of technical skill provision, which has not substantially improved with respect to the researcher: technician ratio (Table 2.1).

3. THE TVET SYSTEM

3.1 TVET: International and national definition

It is necessary to locate this report within an internationally agreed definition of TVET. UNESCO's *revised recommendation concerning technical and vocational education and training* (UNESCO, 2015b) provides insightful definitions of both the proposed mission and the form, purpose and structure of TVET. In this respect, the mission of TVET is described as follows:

TVET contributes to sustainable development empowering individuals, organisations, enterprises and communities, and fostering employment, decent work and lifelong learning so as to promote inclusive and sustainable economic growth and competitiveness, social equity and environmental sustainability.

and:

Technical and Vocational Education and Training (TVET) is understood as comprising education, training and skills development relating to a wide range of occupational fields, production, services and livelihoods.

As an element of lifelong learning, TVET conventionally takes place at upper secondary, post-secondary and tertiary levels. Importantly, TVET also includes work-based learning and continuing training and professional development, and, most significantly, 'may' rather than 'can' lead to qualifications. The latter provides an important distinction of this particular form of education and training, as the provision of 'formal certification' is not necessarily its key feature. Thus, the kinds of skills provided by TVET include (UNESCO, 2015b) the following:

A wide range of skills development opportunities attuned to national and local contexts. Learning to learn, the development of literacy and numeracy skills, transversal skills and citizenship skills are integral components of TVET.

This broad sweep includes a range of life skills, including skills required in the world of work.

In South Africa, TVET is located within the skills development discourse of the formal education and training system. It is a post-school education and training activity between general schooling and higher education, which includes universities, and universities of technology. As a component of lifelong learning in the post-school education and training system, TVET traverses secondary, post-secondary and higher education in South Africa. Critically, it incorporates work-based learning and continuing training and professional development.

3.2 National context

The local TVET system traces its origins to the early days of the minerals-led industrial revolution that swept through Kimberley from 1867. Pioneer technical institutes at the time included the School of Mines, which was founded in Kimberley in 1896, the Elsenburg Agricultural Training Institute near Stellenbosch, founded in 1898, the College of Cape Town, which dates from 1900, and the South African Institute for Medical Research, which was founded in 1912. The growing needs of a diversifying economy, the demands of World War I, the subsequent positioning of the state as holder of the commanding heights of the economy through entities such as the Electricity Supply Commission, and the Iron and Steel Corporation required a more diverse and reliable technical training system, and this under the early job reservation codes.

Ahead of these developments, the passing of the Apprenticeship Act of 1922 played a critical role in expanding the technical colleges as whites-only institutions (Malherbe, 1977). At the time, the colleges were developed to provide theoretical training for those already engaged in practical, on-the-job learning in apprenticeships (Chisholm, 1992; Badroodien, 2003). The college sector was tightly aligned to the needs of industry, reflecting a set of skills and knowledge for a particular set of crafts that owed much to the historical development of craft training in Britain (Gamble, 2003).

With the formalisation of the apartheid system in 1948, South Africa's development was premised on the objectives of separate social, economic and political pathways. This added to political conflict, as the training system further advantaged whites at the expense of the African and coloured majority.

However, the 1948 De Villiers Commission on Technical Education and Training not only recorded high dropout and low retention rates, but also found serious problems with admission requirements – the likely result of status considerations and the poor structure of the system. There was a subsequent push to ensure that artisanal development was improved (Akoojee, 2013; Wedekind, 2010).

By the 1960s, a major shift of white labour into management and employment in the services sector led to growing pressure on the colour bar in the workplace (McGrath, 2003) and the technical college sector (Chisholm, 1992). This movement led to the leading metropolitan colleges entering the tertiary sector through the Advanced Technical Education Act of 1967, resulting in the emergence of 'technikons', a uniquely South African higher education appellation.

By the early 1970s, the upward movement of the colour bar and 'white flight' from craft work led to growing corporate investment in technical training for black people. Even so, the system was less than adequate: "... despite the shortening of the apprenticeship period and the importation of White artisans, there was still an 8.9% shortage of trades people and 6.7% of apprenticeships" (Malherbe, 1977). Prior to the enactment of the Manpower Training Act of 1982, there was designated exclusion of Africans from apprenticeship training.

The colonial and apartheid systems had ensured that colleges were, in principle, intended for the training and skilling of the (shrinking) white working class. This new dynamic resulted in the colleges being opened to 'African', 'Indian' and 'coloured' South Africans, albeit not as apprentices (Badroodien, 2004). Africans were only permitted to become apprentices in the late 1980s, and the technical colleges remained racially segregated. This was the expected outcome at the time – it was the official government response to the Job Reservation Act of 1957,

whose main purpose was to "safeguard jobs against interracial competition".

Alexander Hepple (Hepple, 1963), a former trade unionist, anti-apartheid activist and leader of the original South African Labour Party at the time, wrote as follows in *The Black Sash* (Hepple, 1963:6):

One of the worst apartheid laws is job reservation. It strikes at the livelihood of hundreds of thousands of South Africa's Non-White workers. The Government defends it as a measure to prevent racial rivalry and friction in the field of employment. It gives reluctant and unambitious White workers a false sense of security. It hangs over the heads of Coloured, African and Indian workers as a constant threat to their economic security.

The denial of technical training to Africans spanned a century of industrial 'progress'. In 1991, white students comprised two-thirds of the 76 500 technical college enrolments. In 1994, 152 colleges were under the control of the then 14 racially defined administrations, of which 78 colleges were for whites, with only 20 for Africans in the self-governing territories (Commonwealth Secretariat, 1991).

The college system demonstrated 'stratified labour market responsiveness', with predominantly white student cohorts being placed in designated and targeted employment.

The modernisation of the TVET sector required equity of access, and a concerted responsiveness to the new economic realities. Extensive restructuring, mergers and institutional relocation duly saw rationalisation into the 50 TVET colleges that now fall under the Ministry of Higher Education, Science and Innovation. As will be shown below, institutional responsiveness and effectiveness to the new dispensation have displayed varying degrees of success.

3.3 TVET, the economy and youth unemployment

TVET colleges are a component of post-school education and training (PSET) alongside other players, community colleges, the sector education and training authorities (SETAs) and the National Skills Fund (NSF). The expansion of TVET has long been advocated as a solution to the problem of youth employment. For instance, *Education Strategy 2020: Learning for all. Investing in people's knowledge and skills to promote development* (World Bank, 2011) regards vocational education as a solution to the unemployment challenge, with TVET promoting both employability and entrepreneurship. The World Bank, with reference to the Mozambican context, notes that the “ongoing Mozambique Technical and Vocational Education and Training Project seeks to transform the existing TVET system into a demand-led training system that will provide beneficiaries more market-relevant skills and economic opportunities”.

To that end, the World Bank (2011:36) posits that “with respect to TVET, policy-makers will need to create sound governance structures and a regulatory framework that maintain a dynamic balance between skills supply and demand, as well as design financially sustainable and socially equitable programs”. Timmons, Eisenman and O'Connor (2015) describe entrepreneurship education as a form of education that aims to raise individuals who are capable of starting new businesses.

In the South African context, Gamede and Uleanya (2017; 2019) argue that the TVET sector has the potential to provide gainful employment to recipients, as the base for industrialisation and technological development in the 21st century. Therefore, the curriculum of any TVET institution should be geared towards suiting and meeting the requirements of entrepreneurial and job creation capabilities.

They define entrepreneurship education as the purposeful intervention by an educator in the life of the learner to impart entrepreneurial qualities and skills to enable the learner to survive in the world of business.

The above read as supply-led motivations.

Allais (2020a; 2020b), McGrath et al. (2020) and Wheelahan and Moodie (2016) challenge the demand-led approach whereby TVET is subsumed to market pull, with little consideration of the economic context under which these systems are located.

Allais (2020a) explores the relationship between industrialisation, economic development and skills formation in sub-Saharan Africa. In examining the key issue of why TVET systems are persistently small and weak despite numerous reform attempts by governments and donor organisations, the conclusion that the economy has an important (and perhaps, central) role to play cannot be avoided.

The inability of sub-Saharan Africa to produce enough opportunities for TVET graduates is a constraint on the development of TVET. The low number of well-paying jobs that require technical expertise is considered the result of the (slow or almost non-existent) ‘process, pace, and levels of industrialisation’ in sub-Saharan Africa.

The lack of economic development and the consequent changes to labour market conditions result in the region's inability to provide meaningful employment opportunities, as well as considerable challenges for TVET policy and provisioning.

Thus, the importance of the economy cannot be underestimated, as the following indicates: “The decline of medium-skilled jobs is a particular challenge. The skills gap arises not because vocational education is not producing graduates with the right attributes and skills, but because jobs at this level are declining ... whilst it can be a factor, vocational education cannot remedy a problem that requires economic and social strategies by governments and social partners” (Allais, 2020a).

On a more positive note, UNESCO (2013) claims that TVET is well placed to respond to the technical skills challenges of industry. Indeed, TVET has been able to resolve skills mismatches and has succeeded in achieving smooth education-to-employment transitions for many young people.

The TVET system is located within the skills development component of the combined Department of Higher Education, Science and Innovation (DHESI). The Skills Development branch of the Department of Higher Education and Training (DHET) is expected to “promote and monitor the national skills development plan” (DHET, 2019a). It is tasked with the responsibility of providing an interface with the world of work, including public and private workplace and learning institutions. Importantly, it is also tasked with the responsibility of aligning skills development outputs with the “broader growth needs of the economy” (DHET, 2020).

As such, the entity brings into focus both the Human Resources Development Strategy and the work of the National Skills Authority as essential skills development components.

For its part, the White Paper for Post-School Education and Training (DHET, 2013:xii) explains the DHET’s highest priority as follows: “to strengthen and expand the public TVET colleges and turn them into attractive institutions of choice for school leavers”.

The government expects TVET colleges “to become the cornerstone of the country’s skills development system” and recognises that “learners exiting TVET colleges are often under-prepared for the world of work” (DHET, 2013:12). There is some confidence that ‘workplace learning’ can resolve key deficits in programme design and perhaps enable employability.

DHET (2013) recognises that workplace learning is an “integral part of qualification and program design”, but also states the following (DHET, 2013:xvi):

In areas of work such as the artisan trades, apprenticeships have traditionally been the pathway to qualifications; however, the apprenticeship system has been allowed to deteriorate since the mid-1980s, resulting in a shortage of mid-level skills in the engineering and construction fields.



A targeted strategy for artisan development was called for to produce the 30 000 artisans per year specified in the National Development Plan (DHET, 2013:iv); this alongside the persistent racial disparities noted by Letseka, Breier and Visser (2009). For Needham (2019:83), the TVET sector does not “align effectively with the economy or provide a platform for promoting the aims of the government’s socio-economic policy”.

This is because TVET colleges are poorly equipped to take advantage of their preferred provider status because they can neither retain the expertise of the industry trainers, nor build internal capacity (Needham, 2019:96). It is concluded in this work that the neo-liberal economic policy has not enabled the TVET system to effectively produce graduates to overcome critical skills shortages that impede growth.

These considerations are essential to an early delineation of the field, and represent critical features of the TVET sector as understood in the South African context. Does one focus on TVET colleges (as the primary TVET entity) or does this widen to the mid-level skills system? If the latter prevails, does the national project incorporate skills development components and innovation within TVET?



3.4 Overview

This chapter provided an appropriate definition of TVET as an essential element in development. As an element of lifelong learning, TVET comprises education, training and skills development. These aspects encompass what is conventionally referred to as the ‘formal’ learning environment, as well as the ‘informal’ and ‘non-formal’ learning contexts.

The chapter traced the origins of TVET in South Africa to the early days of the minerals-led industrial revolution from 1867 onwards, illustrating the exclusionary racialised nature of the sector. The stage had been set for the entrenchment of the race-based structure with the formalisation of the apartheid system in 1948. The colonial and apartheid systems ensured that colleges were, in principle, intended for the training and skilling of the (shrinking) white working class. Africans were only permitted to become apprentices in the late 1980s, and the technical colleges remained racially segregated. The modernisation of the TVET sector therefore required equity of access, and a concerted responsiveness to the new economic realities, coupled with extensive restructuring, mergers and institutional relocation with the rationalisation of 152 institutions into 50 TVET colleges.

The demand-led perspective that traditionally underpinned TVET provisioning (World Bank, 2011) has recently been challenged by accounts that suggest that, in the sub-Saharan region, the economy is simply unable to produce the employment demand required for the sector to take its place in the innovation system (Allais, 2020a). Thus, although the impact of TVET is constrained by the economy, without TVET, economic development is just not possible.

TVET is well placed to respond to the technical skills challenges of industry and is able to resolve skills mismatches. In addition, it has succeeded in achieving smooth education-to-employment transitions UNESCO (2013).

In the South African case, TVET has been constrained by objective circumstances resulting from years of neglect. TVET colleges represent an indispensable component of PSET alongside other players, community colleges, the SETAs and the NSF. Much still has to be done for TVET colleges “to become the cornerstone of the country’s skills development system”, as envisaged by the White Paper for Post-school Education and Training (DHET, 2013:12).

4. SYNOPTIC LITERATURE REVIEW

4.1 Introduction

This review captures emergent trends from the literature and draws on the 42-page document, “An overview of the literature on TVET and innovation and innovation systems”, compiled by the consultants. The methodology utilised for the literature review entails an overview of three critical areas: tracing the genesis of TVET in South Africa with the emphasis on its recent trajectory as crucial to national development; providing an overview of the relationship between TVET and innovation; and examining the relationship between TVET and innovation – first internationally and then nationally. The essential purpose of the review is to clarify existing notions of innovation and TVET as a precursor to the fieldwork of identifying the perspective of the various stakeholders surveyed in the South African context.

The synopsis is structured as follows: Section 4.2 provides a review of the literature on understanding innovation and development. This is followed in Section 4.3 by an overview of key features of TVET in an international context. It then proceeds to link innovation and TVET in Section 4.4, first in the international literature and then in the South African context. Section 4.5 provides an overview of the earlier conceptual considerations that underpinned South African TVET. This is followed by a review of the purpose underlying TVET, as identified in the legislative and policy contexts. Section 4.6 draws on a TVET and innovation study undertaken by the Safety and Security SETA (SASSETA).

4.2 Innovation and development

Over the past two decades, innovation has come to be seen as the driver of socio-economic development, with numerous countries, agencies or multilateral bodies issuing statements to that effect, such as “The OECD Innovation Strategy: Getting a head start on tomorrow” (OECD, 2011), the “Ten-year Innovation Plan” (DST, 2008),

the “Science, Technology and Innovation Strategy for Africa” (AU, 2014), and “Made in China 2025” (Kennedy, 2015). These initiatives follow the Oslo Manual definition of innovation as “a new or improved product or process (or combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)” (OECD, 2018). That definition has changed, but only slightly from its formulation in the early 1990s, which was informed by the five-fold typology of Austrian political economist Joseph Schumpeter:

- i. Introduction of new products
- ii. Introduction of new methods of production
- iii. Opening of new markets
- iv. Development of new sources of supply for raw materials or other inputs
- v. Creation of new market structures in an industry

The measurement framework of the Oslo Manual (OECD, 2018) ascribes importance to types i and ii, locating innovation activity in an existing firm, rather than in a firm that may be trying to enter the market, or firms that are further up the value chain. Types iii to v are of particular interest to parties in emerging economies that seek to enter markets dominated by large local firms or MNCs. For instance, Tawfik (2009), referring to Egypt, describes innovation as a process by which “... value is created for customers through public and private organisations that transform new knowledge and technologies into profitable products and services for national and global markets.

“A high level of innovation, in turn, contributes to more intellectual capital, market creation, economic growth, job creation, wealth and a higher standard of living, and pay-back to the innovation cycle.” The World Intellectual Property Organization (WIPO), INSEAD and Cornell University (2017) offer a broad conceptualisation of the importance of innovation, even as it pertains mainly to the private sector:

First, innovation is important for driving economic progress and competitiveness – both for developed and developing economies. Many governments are putting innovation at the centre of their growth strategies. Second, the definition of innovation has broadened – it is no longer restricted to R&D laboratories and to published scientific papers. Innovation could be and is more general and horizontal in nature and includes social innovations and business model innovations as well as technical ones. Last but not least, recognizing and celebrating innovation in emerging markets is seen as critical for inspiring people – especially the next generation of entrepreneurs and innovators.

Similar to the OECD, UNESCO-UNEVOC (2019:9) defines innovation as “a new or improved product or process (or combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)”. The definitions of innovation of UNESCO-UNEVOC (2019) and the OECD (2018) remain the blueprint definitions that continue to influence the way governments, multilateral organisations and the global development banks frame their positions with respect to their conceptions of innovation and innovation systems.

These definitions converge on the position that innovation is the remit of the private sector. Universities conflate educational change and innovation, while the measurement of innovation in the public sector, informal sector or townships remains a work in progress. Although innovation is everywhere, it is difficult to pin down.

Enhancing the idea that innovation is everywhere, South Africa’s White Paper on Science, Technology and Innovation (DST, 2019) regards innovation as “a critical tool for the goal of an inclusive and sustainable economy and society”. The White Paper adopts a whole-of-society approach to innovation that endeavours to provide for the evolution of an integrated, dynamic and well-functioning society with social good as its defining feature.

The NACI’s flagship “South African Science, Technology and Innovation Indicators Report” (NACI, 2019:1) echoes

this position, calling for a widened notion of innovation, as well as more work on the social innovation landscape, and states the following:

... the networks of vastly untapped and often unrecognised social or ‘grassroots’ innovations and innovators, which are often only tangentially connected with the formal NSI. As we move into the future, it will be imperative to better indicators to recognise innovations generated by a significant network of solidaristic, community, non-governmental, cooperative and social enterprise movements.

4.3 International context: Local implications

The origins of TVET can be traced back to the Industrial Revolution and the philosophy of ‘productivism’ (Anderson, 2009), in which TVET was conceived of as fundamentally instrumental for providing the necessary human capital required by industry (Tikly, 2013:5). International literature on TVET has been marked by its relationship with the ‘education for development’ discourse. Early work on this discourse was espoused in terms of the rate of economic returns to education (Psacharopoulos, 1981), which pointed to the returns to education related to years of schooling. While this provided the necessary logic of the value of education to development, the argument was extended to TVET and its value to development.

Consistent with that view, international agencies such as the World Bank advocate policies that promote TVET as an investment in human capital and contend that it is an essential element in supporting economic growth. The TVET system should therefore be geared towards economic productivity. Its main focus is viewed to be skills development for employability by preparing successful candidates with a TVET qualification to meet labour force requirements (Fien and Wilson, 2005; Maclean, 2010; Tikly, 2013; Maclean and Pavlova, 2013). The Asian Development Bank (ADB) (2014) more pointedly defines TVET in terms of an economic livelihoods’ perspective, associated with the objective of enabling participation in the economy, whether as an employment-seeker or for purposes of self-employment. In the case of the latter, the economy is a strong determinant of the overall push for skills.

In addition, there has been a broadening of the human capital role towards alleviating poverty and promoting social welfare, including women's welfare, as a basis for promoting growth and human security (Hanushek and Wößmann, 2007; World Bank, 2011; McGrath, 2012; Tikly, 2013). In the early 21st century, the onset of a nuanced rights approach, stressing agency and human development, was framed under what has been considered a 'capabilities approach', initially espoused by Sen and subsequently elaborated on by others (Sen, 1999; Walker and Unterhalter, 2010; Wheelahan and Moodie, 2016).

The two schools of thought on TVET – the human-centred approach and the human capability approach – are outlined below.

- The human-centred approach, which is based on the principles of environmental, economic and social sustainability, seeks to overcome disadvantage and achieve social and economic goals by driving TVET teaching and learning that are impactful to social inclusion, social cohesion, health and personal wellbeing. It proposes linkages between TVET policies and social policies with a view to ensuring efficiency and service delivery (UNESCO, 2012:17). Even so, as King (2009) observes, there are tensions between the ideas of TVET for sustainability and creating the wider macroeconomic conditions of growth under which TVET itself can become sustainable in the current global financial context in which TVET remains underfunded.
- The human capability approach draws on the work of Amartya Sen (Sen, 1999; 2005; 2009). It advocates an expanded view of TVET that supports the development of human capabilities and functions that individuals, communities and society at large have reason to value. Given the range of capabilities that individuals have reason to value and that make up an individual's capability set, there is no single purpose for TVET. Concomitantly, the purpose of TVET ought to be based on an aggregated evaluation of the needs of different individuals and groups. The human capability approach incorporates divergent aspects of ways to harness forms of knowledge such as lifelong learning and indigenous knowledge (UNESCO, 2004).

These human capability approaches to development gave rise to other perspectives that explored the role of education in human development (McGrath, 2010). The dominance of economic conceptions of the role of TVET is tempered by the 'human rights approach', which sees human development as more important than economic development.

However, the human rights perspective has not provided a comprehensive alternative. As King and McGrath (2012:12) observe, "... there is need for caution regarding how this approach can generate improved well-being in the contexts of local and global forms of capitalism".

At policy level, TVET is widely regarded as an enabler for innovation and competitiveness (Haughey, 2015). This perspective, which understands innovation as "working together to create new ideas", and as a "new positive response to circumstances that produce sustainable and quality outcomes", provides an important starting point to understand innovation in the TVET sector. Thus, contemporary debates on TVET are targeted at a convergence of a range of imperatives that focus on economic vs human development perspectives. The latter seeks to achieve the delicate balance between the two.

The result is that TVET systems are under constant and persistent political pressure to transform (Nieuwenhuis and Shapiro, 2004). In the South African case, where the need to ensure that economic development is not hampered, and that unemployment is a particular feature of an overall national project, the deliberative linkage with employment (sometimes referred to as the quest to ensure employability) is particularly important.

TVET has assumed global significance, with UNESCO advancing the view that it represents the "master key that can alleviate poverty, promote peace, conserve the environment, and improve the quality of life for all and help to achieve sustainable development" (Burnett, 2008). Elements of this can be found in the UNESCO perspective, which asserts that TVET is considered "... integral to education and lifelong learning, and to refer to all forms of learning of knowledge, skills and attitudes relating to the world of work. TVET comprises education, training and skills development activities relating to occupational fields, production and livelihoods" (UNESCO, 2015a:2).

In similar vein, the SDGs posit TVET as crucial for human development, through the subgoals listed below:

- **Subgoal 4.3:** By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university
- **Subgoal 4.4:** By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship
- **Subgoal 8.6:** By 2020, substantially reduce the proportion of youth not in employment, education or training

Turning to provisioning, TVET is subsumed into formal, informal and non-formal education and training structures.

The non-formal component comprises training that is organised outside the formal education and training system, whereas the informal component entails the acquisition of skills through what appears to be outside the institutional context, such as learning on the job or apprenticeship in both the formal and informal economy (Table 4.1).

Table 4.1: TVET provisioning

1. Institution-based training	(i) Provided by the formal education system	(a) Under the supervision of a ministry of education (b) Outside the supervision of a ministry of education
	(ii) Provided outside the formal education system	(a) Public (b) Non-public
2. Work-based training	(i) Pre-employed training	(a) Modern apprenticeship (b) Traditional apprenticeship
	(ii) In-service training	
3. Combinations of multiple types of training (e.g. sandwich programmes, dual systems)		

Source: Adapted from the Inter-Agency Group on Technical Vocational Education and Training (IAG-TVET), 2012.

The International Labour Organization (ILO) (1975; 2004) considers the apprenticeship model to be a mix of ‘formal’ and ‘informal’ education, with concerted attention being placed on incorporating the informal within the national formal education system. In some contexts, however, it is very much embedded in the formal TVET system, with formalisation for certification purposes.

4.4 InnoVET: The functional link

The notion of InnoVET (Innovative TVET) is useful for making TVET more responsive to the innovation agenda. In driving TVET to become more responsive to innovation, this sector and the actors of the NSI must work in synergy. The subsection that follows explores the role of TVET and innovation as understood in international discourse. This will be followed by the South African experience.

4.4.1 TVET and innovation

There is emerging consensus in the literature on innovation studies that the TVET sector is a vital component of any functional innovation system (Edler et al., 2016; Vivarelli, 2012; Schneider, Günther and Brandenburg, 2010; Tether, 2005). According to this view, innovation is not solely based on research, science or technology, or even entrepreneurial skills. Managerial and marketing skills, organisational, social, economic and administrative knowledge, and intellectual and creative capacity are also required to successfully translate new opportunities, ideas and discoveries into innovation.

Edler et al. (2016) promote the idea of ‘bundles’ of skills for innovation. They argue that these bundles comprise individuals’ skills and competencies, and that

teams and organisations are bundles of people, with complementary skills. Finally, networks are bundles of people, organisations and value chains. Schneider et al. (2010) identify differences in the human capital endowment between sectors, as classified according to the Pavitt taxonomy, noting that sectors with a high share of highly skilled employees engage in above-average product innovation.

However, within, as well as across these sectors, the mere presence of a large share of highly skilled employees does not substantially increase the probability of a firm being innovative. Indeed, small firms that employ 15 or more staff members demonstrate the capacity to absorb and use new knowledge. Toner (2011) notes that innovation in firms is mainly incremental, and points to the role of a broadly skilled workforce as enabling this process.

According to Tether (2005), innovation drives the demand for skills, while the supply of skills drives innovation performance. Lam and Lundvall (2007) introduced the notion of a 'national system of competence building and innovation' that links skills formation and labour market dynamics to the micro-level processes of knowledge creation and learning within and between firms. These ideas point to shifts in understanding the importance of workplace skills. For example, the OECD (2011) notes the following:

As production becomes increasingly globalised, societies cannot sustain a model in which innovation is driven by a small, trained elite and supported by a large body of relatively low skilled production workers. Instead, all workers must have the skills to adapt, to engage with innovation, modify their tasks or change jobs. Such skills may be best achieved through a generalist education and on-the-job training.

The conversion of ideas into innovations requires engaging the range of skills embodied in 'know why, and know how'.

4.4.2 TVET and innovation in South Africa

While the Department of Science and Technology (DST) (2008) reserved its thinking on skills to those directly related to R&D, the later White Paper on Science, Technology and

Innovation (DST, 2019:19) takes a broader perspective, noting that "... technological progress might also leave many people behind, increasing the premium for present and future workers to acquire special skills or education.

Retraining and educating today's workers will be crucial to prevent skills mismatches, mass unemployment and growing inequality. Increased investment will be required to drive STI in response to these changes." This is a significant shift in emphasis. However, TVET itself is not specifically mentioned in the White Paper.

This oversight is not unusual. The influential Global Innovation Index (WIPO et al., 2017), which is a product of WIPO, INSEAD and Cornell University, makes no mention of the vocational or technical. Similarly, it is only in the 2020 edition of the Global Competitiveness Report (WEF, 2020) that the WEF introduces the 'quality of vocational training' as a measurable index. However, the WEF has begun investigating the relationship between skills and labour market development, and innovation. This is a work in progress that is long overdue.

For its part, the National Development Plan (NDP) places TVET outside the immediate remit of the NSI, implicitly adopting a triple helix conception of universities, government and the private sector, while excluding civil society. In this schema, despite the optimism of quality-led demand, TVET is relegated to a supply role.

The recent narrative around the role of education sheds further light on its envisaged contribution to national development. Both the economic and social purposes are mutually reinforcing, with the former overshadowing the latter. The unequivocal position of the Ministerial Committee on the Review of the Funding Frameworks of TVET Colleges and CET Colleges is clearly indicated below (DHET, 2017:1):

Education impacts on economic development through its effects on labour productivity, poverty, trade, technology, health, income distribution and family structure. Education provides a foundation for development, the groundwork on which much of our economic and social wellbeing is built. It is the key to increasing economic efficiency and social consistency.

The above suggests a somewhat confused view that the relationship between education and the economy is ‘mutually reinforcing’. Improved education has a positive impact on labour productivity; hence, it is stated that “... economic growth is a necessary (but not sufficient) condition for improvements in living standards and for enabling higher levels of investment inter alia, in education, health and innovation” (DHET, 2017:10).

As might be expected, the Industrial Policy Action Plans of the Department of Trade and Industry (the dti)/Department of Trade, Industry and Competition (the dtic) are sharply focused on specific industries, and continuing problems of “deep-seated skills shortages and mismatches which have acted as a barrier to growth” (the dti, 2018) are mentioned only in passing.

This is somewhat counterintuitive, given significant investment by the private sector and state-owned corporations (SoCs) in establishing their own learning academies and training centres, such as the Denel Technical Academy, Ford Resource and Engagement Centre, Mercedes-Benz SA Learning Academy, Monyetla Work Readiness Programme and the Nuclear Skills Development Centre at the Nuclear Energy Corporation of South Africa (NECSA). There is no independent appraisal literature on these initiatives. They may be noted as developments with high potential.

4.5 Functions and purpose of TVET

4.5.1 Conceptual considerations

On the one hand, the contestation in South Africa occurs around a belief that TVET should provide broad and foundational learning in preparation for a future occupation. On the other hand, it is expected that TVET should be focused on work preparation and the development of closer linkages with workplaces. The New Growth Path (EDD, 2011) and NDP are couched in the language of a developmental state in which the “state builds the capabilities of people to improve their own lives, while intervening to correct historical inequalities. Neither government nor the market can develop the necessary capabilities on their own” (NPC, 2012:20). Tackling endemic poverty is a strong commitment of the plan.

Reference to the TVET college sector is predominantly about building the relationship between colleges and industry for the quick absorption of skilled employees into the labour market. It is emphasised that industry should play a significant role in curriculum development and provide opportunities for practical learning (NPC, 2012:321). This paradigm aligns with that of global financial institutions such as the World Bank and the IMF, which principally sees TVET as an investment in human capital, as well as a means for supporting economic growth. The underlying view is economic, in which progress is measured in relation to levels of economic growth and prosperity. The rationale for investing in TVET lies in its ability to contribute to economic growth.

From a policy perspective, the TVET colleges are situated within an economic paradigm that is a ‘blowback’ from its historical apartheid roots, and this despite aspirations to build a capable developmental state with the necessary technical skills (McGrath, 2000).

In essence, the expectation that TVET may contribute to reducing poverty and inequality is posited on the neo-liberal perspective of training for growth (Needham, 2019). The assumption is that skills lead to employability, which, in turn, leads to jobs (skills for jobs). It is evident that many developing countries, including South Africa, remain gridlocked in assigning the role of supplier of skilled labour to industry to the TVET sector. There has been little change since Anderson (2009) observed a culture of productivism in TVET, which appears to be presupposed as a permanent and necessary feature of human existence, regardless of its environmental impact and consequences. Giving precedence to economic interests, productivism subordinates the needs of individual learners to the design of economic systems, reproducing apartheid capitalism in a different form.

With this in mind, COSATU (2012:75) avers that social development is the basis for effective participation in political and economic transformation, and that political transformation should provide the basis for social upliftment of the masses. A pragmatic stance would therefore be needed to acknowledge the economic rationale of TVET provisioning, while highlighting the needs of a broader developmental agenda.

4.5.2 Reviewing the purpose of TVET

The Further Education and Training Colleges Act (RSA, 2006:12) set out the purpose of the colleges as providing students with essential skills and attributes for employment. With respect to skills, further education and training (FET) colleges were expected to provide the “necessary knowledge, practical skills and applied vocational and occupational competence”, while the attributes expected to be imparted related to those necessary for employment or further education: “... entry to a particular vocation, or occupation or trade OR entry into a higher education entity” (RSA, 2006: 2.1). Subsequent legislation addressed governance and management, and most significantly, the consolidation of the TVET colleges as a national resource (RSA, 2010; 2012; 2013).

More recently, the role of TVET colleges has, in addition to the initial foci, emphasised the absorptive capacity of the sector in the post-school education and training system. The National Skills Development Plan (NSDP) (DHET, 2019a:9) therefore refers to TVET colleges as follows:

... the cornerstone of the post-school education and training system for South Africa and proposes an expansion of this institutional type to absorb the largest enrolment growth in the post-school system. The NDP also situates TVET colleges as critical pillars of the emerging post-school system and vital for social and economic development.

Expansion of enrolment to incorporate the growing demand for PSET represents an additional objective, together with the purpose of “expanding the provision of mid-level technical and occupational qualifications”. There is still an expectation that colleges “... will articulate directly into the world of work for the growing numbers of young people leaving the schooling system”. The NSDP (DHET, 2019a) also cites research that claims that the employment prospects of those at TVET colleges are much higher than those of matriculants³. With regard to post-schooling training, it is expected that TVET colleges will respond to social and economic needs, in particular, those at the intermediate level in the labour market.

The considerable obligation of the sector to resolve skills deficits, together with the recent emphasis on resolving the challenges of ‘university’ demand, makes the ambit of responsibility considerable. The view that TVET colleges are expected to resolve deeper socio-economic challenges of unemployment and job creation, together with the responsibility to resolve the youth development challenge, is particularly overwhelming. While it is no wonder that “TVET is a high priority for government” (DHET, 2019a), the reality that all of this is achievable with limited resources is perhaps unrealistic.

It is unsurprising, therefore, that the NSDP characterises the outcomes in the following manner (DHET, 2019a:19):

The TVET colleges are starting to show results, but the system has been asked to do too much, too fast, with too little support.

A more nuanced notion of what ‘showing results’ means is called for. It would come as no surprise that ‘achievement’ would be expressed via enrolment data, without the concomitant attention to quality and responsiveness. There is a need for quantitative and qualitative metrics alongside outcome and impact evaluation.

4.5.3 Articulation between TVET and higher education

The confluence of TVET and higher education (HE) is an issue of major concern for governments and international agencies worldwide. Spottl (2013) argues that vocational education targets professional and practical employability, while higher education emphasises scientific employability. Historically, TVET and HE have emerged from opposing traditions, with the university having produced systematic scientific knowledge, while TVET has been perceived as a sector responsible for providing training for specific field occupations (Maclean and Pavlova, 2013).

Indeed, it is found that university outputs are most strongly evaluated on the basis of their contributions to scientific disciplines, while vocational education outputs are concerned with the ability to undertake useful work (Maclean and Pavlova, 2013).

³ Labour market analyses show that job prospects for a TVET college graduate are comparable to those for a matriculant at 50%, but much higher for qualified artisans, where a study showed a placement rate of 79%.

Questions are being raised as to whether there can be a seamless and mutually beneficial, or symbiotic, relationship between TVET and HE. This might take the form of compatibility between the contents of vocational and higher education, as well as compatibility between the curricula of vocational and higher education (Spottl, 2013). Maclean and Pavlova (2013) argue that many countries have taken steps to improve the articulation of secondary vocational education with higher education, with a view to opening up more options for students and to meet an increasing demand for skills and qualifications.

There is a view that a re-imagined higher education system can potentially contribute to TVET and sustainable development (Pavlova, 2007). In the Republic of Korea, for example, some 40% of secondary students are enrolled in TVET. In some schools, academic and vocational students share almost 75% of the curriculum. By so doing, the Korean government is opening up new pathways for TVET students to access higher education (Maclean and Pavlova, 2013).

In Germany, higher education is more vocationally oriented, and sets out to impart skills that are closely tied to a particular occupation (Hoelscher, 2005). In order to improve their employment opportunities, it is quite common for German graduates with a bachelor's degree to undergo apprenticeship training (Rauner, 2005). In Germany, technical education is admired, rather than stigmatised.

In contrast, in South Africa, TVET is located within the 'skills development' discourse of the formal education and training system. It is regarded as a low-status post-school education and training activity between general schooling and higher education (incorporating universities and universities of technology).

As a component of 'lifelong learning' in the post-school education and training system, TVET traverses secondary, post-secondary and higher education. While it incorporates work-based learning and continuing training and professional development, it generally functions in a complementary role to higher education. Moreover, while public higher education institutions are generally

autonomous, TVET is wholly a national competency. It lacks the autonomy to experiment and then share experiences with higher education. This is somewhat perplexing, given the earlier commitment to a seamless National Qualifications Framework that would have ensured multiple pathways to continuous professional development.

As a component of post-secondary education and training, TVET is neither expected, nor capacitated, to conduct research. It therefore seems that South Africa's higher education system needs to adapt to become, for example, more like Germany's higher education system, where graduates with a bachelor's degree undergo apprenticeship in order to acquire practical, work-oriented skills that improve their employment opportunities.

4.6. The SASSETA TVET innovation study

A research project undertaken by SASSETA in 2019 explored the notion of innovation in TVET colleges. The researchers defined innovation as action that "... involves deliberate application of information, imagination and initiative in deriving greater or different values from resources and includes all processes by which new ideas are generated and converted into useful products" (SASSETA, 2019:10). They found that there was little or no innovation in the TVET sector, and identified the main reasons for this as a "perception and stigma attached to TVET colleges" and legislative factors that "... contribute more towards the lack of innovation because each and every public sector entity is promulgated through prescriptive legislation and policy".

SASSETA recommends the development of strategic partnerships, training and development (mentorship), and improved communication between employers, colleges and learners as key requirements for the revitalisation of innovation in the TVET sector. The report concludes that "it is noteworthy to address mechanisms that will enable and inspire innovation within TVET colleges in South Africa, in order to make colleges institutions of choice amongst students ... there is a need to strengthen partnerships between TVET colleges, employers and SETAs" (SASSETA, 2019:43).



4.7 Overview

This literature review has highlighted various perspectives on the role, purpose and intent of TVET. These include the instrumental and human capabilities approaches. It examined the international literature, especially the discourse led by the United Nations system through UNESCO-UNEVOC and the ILO. The role of innovation in TVET has been catalysed by the UNESCO-UNEVOC study on trends in TVET, which underscores the fact that “... innovation is an important subject for discussion given its capacity to significantly impact (positively and negatively) many spheres of social and economic life” (UNESCO-UNEVOC, 2019:10). Important differences in approach remain, with a range of views found in political economy, human capital formation and labour market studies. Bringing TVET and innovation together represents a new challenge for what has often been seen as the ‘Cinderella’ sector.

A strong theme is that innovation is seen as “a critical tool for the goal of an inclusive and sustainable economy and society” (UNESCO-UNEVOC, 2019). Concomitantly, TVET is deemed critical for skills development, especially for scientific and technical services. Without these skills, the innovation system would be permanently dependent on the importation of skills. Furthermore, TVET should be accountable

to key stakeholders, responsive to local, national and global labour markets, and attractive to prospective learners, their communities and employers to promote inclusive and sustainable economic growth. TVET should play a critical role in addressing inequality and ensuring sustainable methods to deliver effective skills.

The TVET sector is not known for its innovation capacity, much less is it required to innovate, given the expectation that it serves as a mid-level skill sector. The little innovation that has been achieved involved partnerships where industry acted as the lead innovator, and the colleges served a complementary function.

Critically, the review sought to understand the extent to which TVET can be regarded as a vital component of any functional innovation system. Bringing TVET and innovation together represents a new challenge for what is often seen as the ‘Cinderella’ sector. The triple helix of higher education, industry and government, the pivotal actors of the innovation system, should be expanded to give due recognition to actors that are currently seen as mere adjuncts. In particular, TVET should be recognised as a vital actor in the NSI.



5. SITUATIONAL ANALYSIS

This situational analysis of the TVET sector employs the widely used PESTEL (political, economic, social, technological, environmental, legal) analytical system. Such schemas were originally structured as STEEP in the anglophone countries, and as PESTE in the francophone and lusophone countries. PESTEL is often augmented with the inclusion of a 'values' dimension, hence PESTELV. Another variation used in the UNESCO Global Observatory of Science, Technology and Innovation Policy Instruments (GO-SPIN) methodology is the PESCE formalism, which includes 'culture' and 'education' as separate categories, with technology brought in as the overarching theme. Whichever schema is deployed, it is obvious that the separate categories are permeable, with overlaps such as the politico-economic, socio-economic, enviro-legal and techno-economic.

The situational analysis is informed by secondary sources, including NACI (2017), the National Development Plan Diagnostic (Presidency, 2011), and the indicator-based Global Competitiveness Report (WEF, 2009; 2019). For conciseness, the consultants developed the following three overlapping themes:

- Politico-legal
- Techno-economic
- Socio-educational

5.1 The politico-legal theme

The post-1994 constitutional democracy established a three-tiered confederal system of governance, with national and concurrent co-competencies in health, housing and basic education. Currently, higher education, science and innovation, teacher education and TVET are national competencies. Although multi-party elections are held, the tripartite alliance of the African National Congress (ANC), the South African Communist Party (SACP) and the Congress of South African Trade Unions (COSATU) has prevailed in a form of one-party rule.

In recent years, good governance has been eroded, with high-profile breaches in the public and private sectors. The WEF's series of global competitiveness reports

(WEF, 2009; 2019) provides a measure of changes in the quality of governance, the investor climate and technological readiness in South Africa. Perhaps the strongest indicator of decline is the precipitate fall in 'strength of auditing and accounting standards' from rank 1 in 2009 to rank 49 in 2019. Corporate fraud and state capture have emerged. In the public sector, this has involved financial mismanagement of SoCs and government departments extensively accused of corrupt practices underpinned by 'tenderpreneurship'. These actions have resulted in the weakening of the functionality of critical organs of state, including South African Airways, Transnet and Eskom. The respected independent Afrobarometer report (Dryden, 2020) provides the following comment on this state of the situation:

Afrobarometer survey findings from mid-2018 show support for democracy weakening and acceptance of authoritarian alternatives growing. Many citizens see both freedoms and economic prospects as declining, and a solid majority remains willing to forego democratic elections in exchange for security, housing, and jobs. Findings suggest that South Africa was entering a democratic recession well before Covid-19.

The introduction of new or amended legislation may be understood as intended innovations. This is often accompanied by unintended consequences. Legislation that impacts TVET includes policy innovations such as the Constitution of the Republic of South Africa of 1996, the Higher Education Act, Act No. 101 of 1997 (RSA, 1997), the Further Education and Training Colleges Act, Act No. 16 of 2006 (RSA, 2006), the Further Education and Training Colleges Amendment Act, Act No. 3 of 2012 (RSA, 2012), the Higher Education and Training Laws Amendment Act, Act No. 25 of 2010 (RSA, 2010), and the White Paper for Post-school Education and Training (DHET, 2013). While higher education institutions remain autonomous, and the delivery of schooling is a provincial competency, TVET is now a wholly national competency – an innovation that carries unintended consequences, resulting from top-down control.

5.2 The techno-economic theme

The South African mining-led industrial revolution of the late 19th century triggered the growth of the secondary industrial sector and associated scientific and technological institutions. This growth accelerated through World War I and World War II, so that by the 1960s, the state owned the commanding heights of the economy. The result was that a racially exclusive, diversified and dual system of higher education institutions was in place, alongside a set of PROs that served specific industrial and social needs. The economy of the day was dominated by the mining finance houses on one side, and the state on the other.

Today's mixed economy comprises a moderately diversified private sector alongside a large corporatised public sector. The former is dominated by transnational corporations (TNCs) – both national and international – some of which are near-monopolies, especially in mining, chemicals, banking, telecommunications and retail. In addition, many SoCs that can be considered as monopolies continue to dominate the commanding heights of the economy, including energy generation and transmission, bulk water supply, rail, pipelines,

telecommunications, ports, highways, oil and gas supply, and interests in mining and agriculture.

Measured by the ratio of outward to inward trade, the economy is now more open, rising from the 1983 low of 38% to the 2014 high of 64%. The fundamental changes in the economy are not so much in trade volumes, but rather in ownership. Foreign portfolio investors now own the largest share of publicly listed entities. This represents a major shift from the 1980s, when the Anglo-American mining house and its affiliates dominated the Johannesburg Stock Exchange. In complementary fashion, the easing of foreign exchange restrictions and globalisation have allowed many domestic companies to transform into TNCs with significant foreign earnings.

Further efforts to diversify the economy into medium- and high-technology activity have seen very limited success. Globalisation, the information and communication technology (ICT) revolution, and the rise of China and other Asian countries as factories for the world have contributed to a stagnation in manufacturing output (Figure 5.1) and caused real contraction over the last decade.

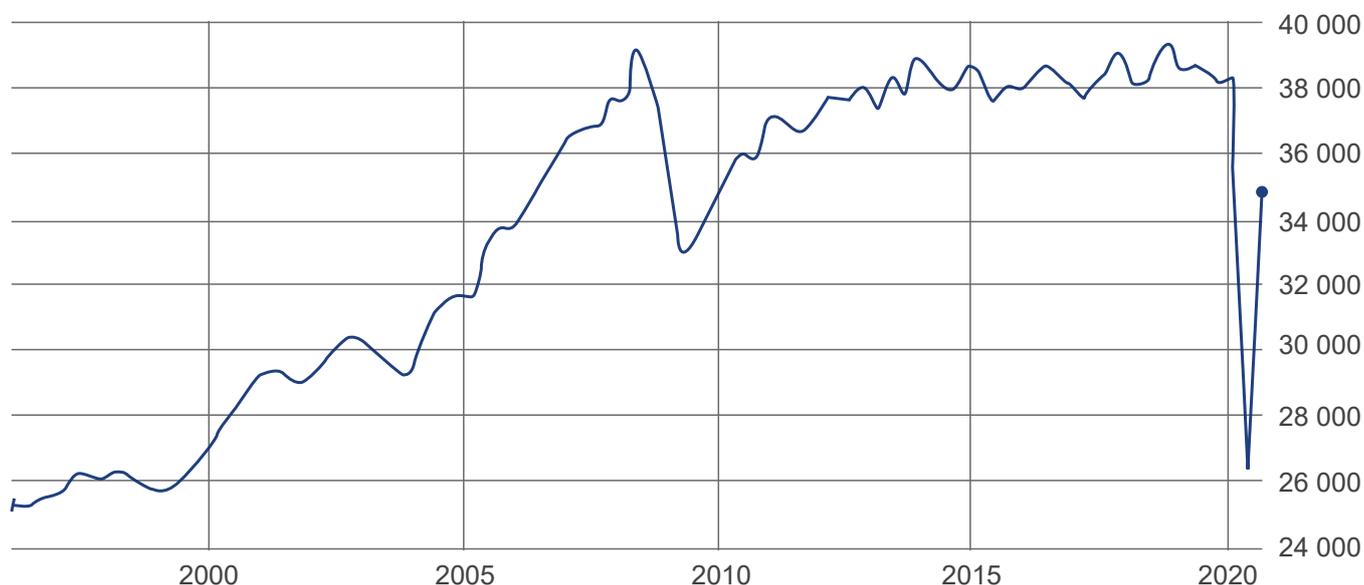


Figure 5.1: Manufacturing contribution to gross domestic product (GDP) (current rand)

Sources: Tradingeconomics.com; Statistics South Africa

The economy remains strongly resource-based, with primary products comprising the bulk of exports. 'King Coal' dominates the electricity, chemical and cement industries, but the Highveld has the highest nitrous

oxide emissions in the world. A compact summary of the environmental issues is provided by considering progress towards the attainment of the SDGs. South Africa shows some progress in clean water and sanitation (SDG 6) and

life on land (SDG 15). However, stasis set in with regard to affordable and clean energy (SDG 7), responsible consumption and production (SDG 12) and life below water (SDG 13).

The progress on these SDGs reflects a patchy record, and a decline in climate action (SDG 13).

Following the 2008 global financial crisis, the economic expansion of the first decade of democracy faltered, after which stasis set in. It was further compromised by a ballooning public sector wage bill, together with decaying infrastructure. Formal unemployment has risen, and remains among the highest of middle-income countries (Figure 5.2).

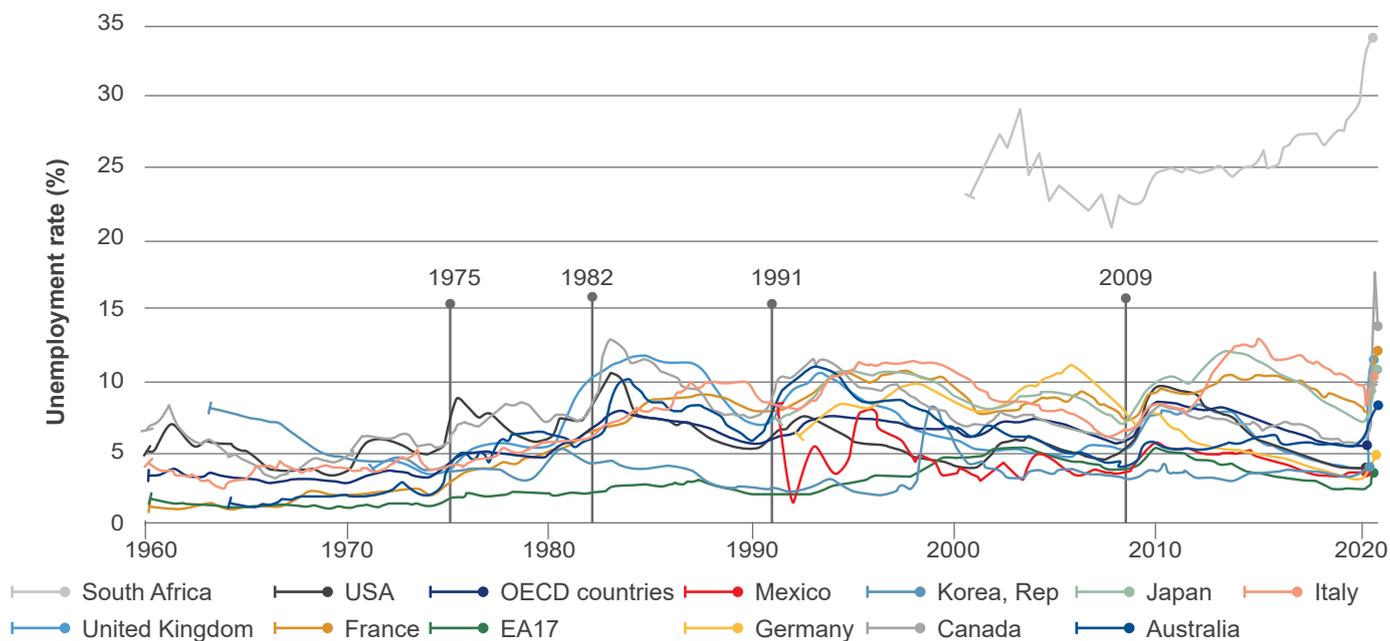


Figure 5.2: Unemployment rate in selected countries and regions, 1960–2020

Source: Tradingeconomics.com

Sector-wide pay determination, international price competition and, most recently, Covid-19, have impacted on employment. The issue of labour market flexibility remains highly contested. Table 5.1 indicates South Africa’s labour market flexibility, as rated in the Global Competitiveness Report (WEF, 2019). The WEF draws data from official statistics, as well as from its Executive Opinion Survey. South Africa’s labour flexibility is ranked 111th among the 142 countries surveyed.

Table 5.1: Labour market flexibility

Category 8: Flexibility			52	111
8.01	Redundancy costs weeks of salary	9.3	89.0	25
8.02	Hiring and firing practices (1–7)	2.9	31.3	129
8.03	Cooperation in labour-employer relations (1–7)	3.2	36.4	139
8.04	Flexibility of wage determination (1–7)	3.5	41.1	134
8.05	Active labour market policies (1–7)	2.5	24.9	110
8.06	Workers’ rights (0–100)	86.0	86.0	26
8.07	Ease of hiring foreign labour (1–7)	3.4	40.6	123
8.08	Internal labour mobility (1–7)	5.1	67.6	18

Source: Global Competitiveness Report (WEF, 2019)

The above numbers bifurcate between the gains that labour has made in the democratic era (Category 8.01, 8.06 and 8.08) and those that capital and management must deal with. As manufacturing has declined in importance, the composition of gross domestic product (GDP) has shifted further towards the services sector, with a demand for higher-level white-collar skills. Ongoing poverty and economic exclusion further limit the size of the domestic market and the demand for labour. These changes impact on the provision of, and demand for, technical skills. This is shown in Figure 5.2 by the high unemployment rate in South Africa from 2000 to 2020.

Furthermore, the corporatist, 'lean government' agenda of the 1980s encouraged SoCs to reduce their expenditure on in-house training, which then weakened the apprenticeship system.

In the last half-century, a number of innovations have changed workplace and social organisation. These originate from the ICT revolution of the early 1970s, which gave rise to microcomputers, the internet, portable read/write memory and communication devices, mapping and location systems, robotics, social media, Big Data, geo-positioning and electronic surveillance. These changes have propelled globalisation, deindustrialisation, the expansion of the services industries, and the monetisation of intangible assets and services.

The actors in the NSI develop and contribute highly skilled personnel, generate new products and processes, and codify intellectual property and research findings. Government has generously supported basic research that now accounts for 28.2% of gross expenditure on R&D (GERD). For comparative purposes, one may note that, at a similar stage of economic development, South Korea was spending only 5% of its GERD on basic research.

As measured by scientific output, the research system is highly diversified. Over the period 2016–2020, plant sciences accounted for 4% of all publications, with electrical and electronic engineering at 3.6%. This diversification provides a benefit in the form of a wide range of expert advice available on request or through own initiatives. The downside is that critical mass in research teams is elusive, so that promising research may dissipate when a lead researcher migrates or passes on. A company such as Germany's BioNTech deployed 500 researchers to develop its mRNA vaccine for SARS-CoV-2 (Covid-19). No South African health science research or pharmaceutical entity can marshal that magnitude of frontier-level research capacity.

While international patent awards are static in number, foreign trademark registrations have soared, and plant cultivar registration remains strong. Plant cultivar development is a critical resource, and even more so as climate change has more significant impacts, such as water scarcity and the emergence of new pests. These measures reflect the path dependence of the economy and innovation system. The 2020 Global Innovation Index (GII) (WIPO et al., 2017) ranks South Africa at 60th position among the top-performing middle-income countries.

Yet, the country lags behind other similar economies, such as Malaysia and Mexico, and is even trailing a number of other BRICS (Brazil, Russia, India, China, South Africa) nations. On the positive side, the GII lists the country as an 'innovation achiever' that performs better than expected relative to GDP. All these innovation and research activities are critically dependent on the availability of the highly skilled – researchers depend on their technicians to set up and maintain equipment, and to jointly solve problems.

Box 1

The World Wide Web

A case in point is the role of Tim Berners-Lee at the European Organization for Nuclear Research (CERN), Geneva, who initially worked in its engineering division. After a year of experimenting with hypertext, he returned to the UK, joining the technical department of a computer company. From 1984 he was back at CERN, where he transformed the internet by combining a number of existing protocols to create the World Wide Web. His data network solution is an example of human networking, and of industry-research interplay.

TVET colleges, local industry training centres and foreign study play an essential role in pre-service and in-service skills development for STS. The STS sector is the most diverse in Africa, in addition to working with local industry and research organisations. The STS sector comprises a wide range of activities performed by personnel with equally diverse qualifications, from those holding a doctorate to others with advanced machining or welding skills. Starting a business in the STS sector has a relatively low cost of entry, but is often ignored in discussions about business opportunities. The STS sector enables the country to stay abreast of, and make a modest contribution to, the new opportunities of the ongoing ICT revolution as it segues into the 4IR.

The Covid-19 pandemic has disrupted modern economies and hastened the dissemination of the technologies that constitute the 4IR, which is understood to entail a merging of biological, ICT, mobility, energy and algorithmic applications. This merging is evident in, for example, mRNA vaccine technologies, and the accelerating growth of artificial intelligence applications and new energy storage systems. The implications are cross-sectoral, societal and environmental. TVET colleges must now contend with remote learning, simulators, new forms of lecturer-administrator-student interactions, all

positioned on fit-for-purpose, reliable, efficient and secure communication.

5.3 The socio-cultural theme

The societal damage of colonialism and apartheid remains a fact in the everyday life of the majority of South Africans. While education and healthcare are free to the poor, homelessness and the spiralling increase in informal settlements peripheral to urban centres are indicators of enduring socio-economic inequality and a vicious cycle of poverty among the previously disadvantaged.

Health and poverty are closely related. Linked to the pre-existing high burden of disease – including acquired immunodeficiency syndrome (AIDS), tuberculosis (TB) and non-communicable diseases (NCDs) – is the sudden but persistent impact of Covid-19. Before the outbreak of Covid-19, life expectancy was already far below that of countries with a similar GDP per capita. Figure 5.3 depicts the AIDS mortality-driven fall in the Human Development Index (HDI) from 0.65 in 1995 to 0.62 in 2005 due to the drop in life expectancy from 65 years to a low of 52 years – a collapse unprecedented outside times of war.

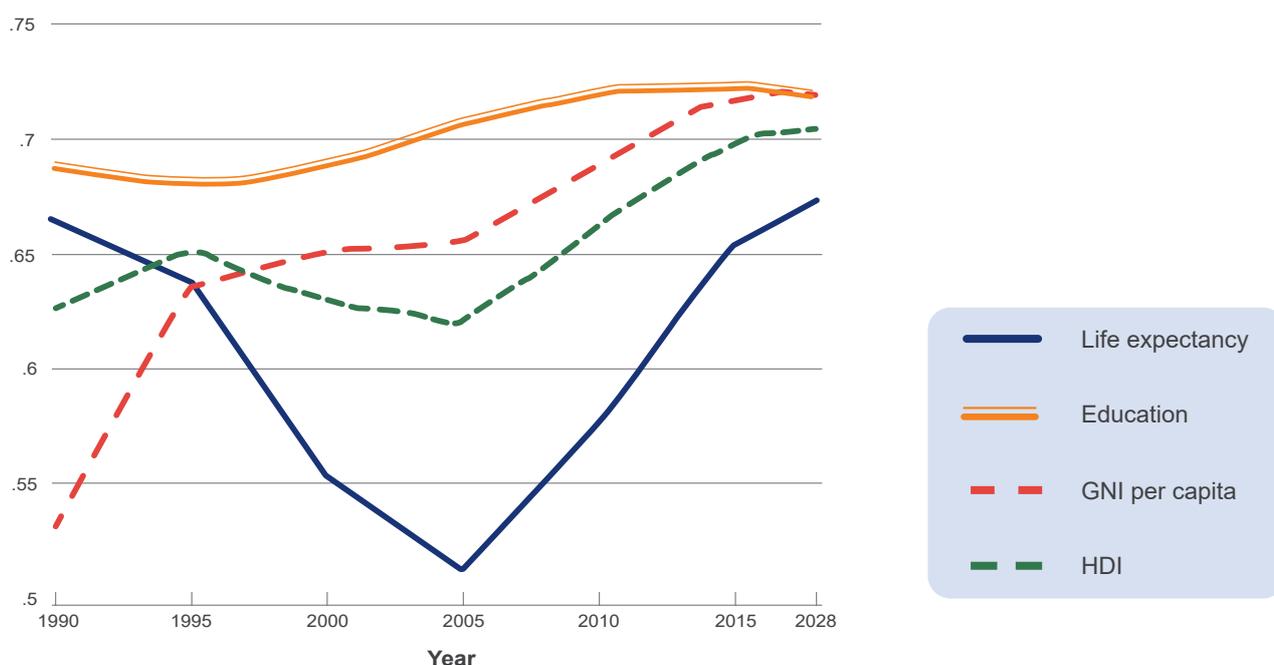


Figure 5.3: South Africa's indicators on the Human Development Index, 1990–2018
Source: United Nations Development Programme, 2020

On the positive side, the system of social grants has resulted in a decline of absolute poverty. However, childhood stunting, foetal alcohol syndrome and obesity persist. In addition, other non-communicable diseases are increasing. Gains in school participation (the brown dashed line in Figure 5.3) have been cancelled by decreased life expectancy. It is cold comfort to note that South Africa hosts the world's largest antiretroviral and tuberculosis treatment programmes, while it conducts world-class research on infectious disease, immunology, and public and environmental health. However, the 2016 Joint External Evaluation Tool of the World Health Organization (WHO, 2018), which measures health security preparedness, revealed health system

weaknesses that became only too apparent under the impact of Covid-19.

With regard to education, net primary enrolment is now close to 100%, and Grade 1 enrolments have been steady at around 1 million over the last two decades. The number of learners writing the National Senior Certificate examination shows a small variation around the 530 000 level, indicating that progression has remained static. At the aggregate level, mean years of schooling has increased, having saturated at around 10 years. Illiteracy among those aged 15 years and above has settled at around 5%. TVET enrolments have almost doubled over the last seven years (Table 5.2).

Table 5.2: TVET enrolments, 2010–2017

Qualification category	2010	2011	2012	2013	2014	2015	2016	2017
NC(V)	130 039	124 658	140 575	154 960	166 433	165 459	177 261	142 373
Report 191 (N1-N6)	169 774	222 754	359 624	442 287	486 933	519 464	492 026	510 153
Occupational qualifications	23 160	20 799	62 359	19 000	19 825	20 533	13 642	10 969
Other	35 420	32 062	95 132	23 371	29 192	32 424	22 468	24 533
Total	358 393	400 273	657 690	639 618	702 383	737 880	705 937	688 028

Source: Department of Higher Education and Training (2019b)

Cosser et al. (2011) recorded that, in 2010, 96% of TVET students were black; by 2017, this number had risen to 99% (DHET, 2019b). Of these students, 70% were younger than 24 years of age. This implies that the TVET colleges are functioning as a continuation of schooling, serving as a holding zone for youth. Furthermore, working-age persons are still not using TVET for upgrading their skills, a problem also noted by Cosser et al. (2011:38).

In 2017, the most popular subject of the National Certificate (Vocational) (NC(V)) was Office Administration (21.3%), followed by Engineering and Related Design (12.4%), and Electrical Infrastructure and Construction (11.9%). Some 27% of female students enrolled for Office Administration, while 22% of male students enrolled for Engineering and Related Design, and Electrical Infrastructure Construction (17%). Females dominated enrolment in Office Administration, and Education and Development; and males dominated enrolment in Engineering and Related Design (DHET, 2019b:37). During 2017/18, 21 151 candidates received the National Trade Certificate, most

of which were in Gauteng (40%). The numbers represent a significant increase on the 2 500 artisans who qualified in 2004 (Cosser et al., 2011). The 2030 target to train 30 000 artisans annually may still be attained. However, enrolment in artisanal training shows a gender bias, with males comprising 70%. DHET (2013:8) acknowledges that, since 2011, poor students in TVET colleges have not been able to pay tuition fees, accommodation or transport.

This bears witness to hardship that is partly alleviated by the extension of the National Student Financial Aid Scheme (NSFAS) to the TVET sector. It is somewhat ironic to note that the higher education funding shortfall of 2012 was bridged by transfers from the National Skills Fund.

With respect to staffing, the group composition of lecturing staff has shifted from 63% black in 2010 to 96% black in 2014. A staff survey of the same year generated 5 712 returns, suggesting that only 15% of staff were deemed to be academically and professionally qualified.

A larger survey in 2016 obtained 8 375 returns, and recorded 4% of staff as fully qualified. This is the sentinel weakness of the TVET system. JET Education Services (2016) translates this shortfall into training requirements, as indicated in Table 5.3.

Table 5.3: Lecturer training requirements

Diploma TVET or BEd TVET	683
Advanced Diploma TVET	2 202
Advanced Certificate TVET	2 640

The Higher Education Management Information System (HEMIS) recorded the number of TVET qualifications, based on the Classification of Educational Subject Matter (CESM) 070800, as shown in Table 5.4 below.

Table 5.4: Lecturers trained (2016-2019)

2015	131
2016	19
2017	36
2018	201
2019	36

Table 5.5: GCI Pillar 6 – Skills, South Africa

Skills of current workforce (0–100)	-	46.1	101
6.02 Extent of staff training (1–7)	4.5	58.0	40
6.03 Quality of vocational training (1–7)	3.5	41.0	119
6.04 Skillset of graduates (1–7)	3.7	44.5	102
6.05 Digital skills among active population (1–7)	3.3	37.9	126
6.06 Ease of finding skilled employees (1–7)	3.9	49.0	98

Source: World Economic Forum (2019)

In contrast, the low score for ‘quality of vocational training’ (6.03) augurs poorly for instituting a capable and innovative polity that is responsive to constitutional precepts. External stakeholders were concerned with the lack of professionally trained staff, the weak connection with the workplace, an out-of-date curriculum and the restricted autonomy of the colleges. There was a view that the main focus of the DHET remained on higher education institutions (HEIs), and that its “officials don’t understand the marketplace”. In many ways, TVET was a ‘stepchild’ of the Department.

It is clear that this upskilling route is failing to deliver the numbers required by the system. The above numbers serve as the best available data on staff qualifications and associated continuous professional development (CPD) needs.

A particular concern is that no TVET Management Information System data was available to the research team. It is clear that TVET demonstrates the highest intensity of transformation of all sectors, with the overwhelming majority of students and staff being black.

However, it must be a major concern that TVET staff do not hold the requisite qualifications to deliver the curriculum.

Table 5.5 provides Global Competitiveness Report (WEF, 2019) measures on skills levels and availability for South Africa, a set of measures presented for the first time for 2018/19.

The reported extent of staff training (6.02) is much higher than might be expected from the evidence provided in tables 5.3 and 5.4.

Business has lost confidence in the colleges and government’s ability to introduce the necessary changes.

Figure 5.4 displays the correlation between skills and the labour market, and the innovation capability for the countries that are assessed by the Global Competitiveness Index (WEF, 2019). South Africa (red circle) is included in the scatter plot. The regression line has a high correlation coefficient of 0.68.

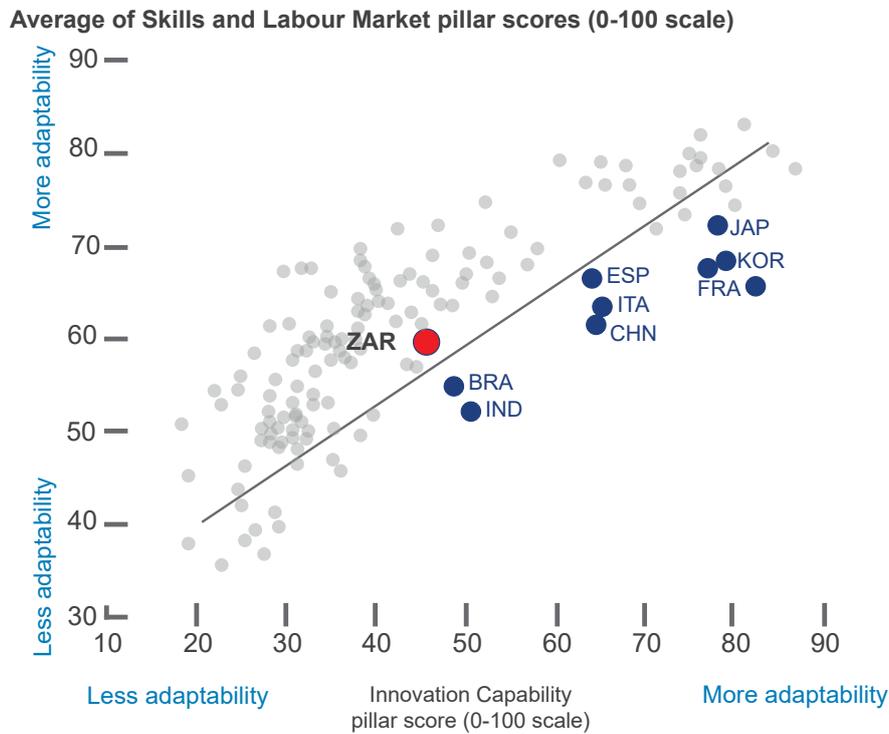


Figure 5.4: Skills and labour market pillar scores vs innovation capability

Source: World Economic Forum (2019)

Note: BRA –Brazil; IND – India; ESP – Spain; ITA – Italy; CHN – People’s Republic of China; JAP – Japan; KOR – Korea; FRA – France

Although it is tempting, the high correlation between skills and innovation capability should not be used to ascribe causality. South Africa lies close to the regression line, in the company of two of its BRICS partners, Brazil and India. The higher score on skills and labour market parameters might tempt one to assume stronger innovation capability.

This shortfall might, in fact, arise because of the quite uneven spread of the skills and labour market parameters due to high performance on measures of protection of organised labour.



5.4 Overview

Positioning, developing and celebrating TVET in the milieu of the PESTEL analysis is no mean task. The quadruple burdens of inequality, unemployment, poverty and high morbidity bear down on the task of building a nation in which “there shall be work and security”. Divisions of language, class and group are features of daily life, so much so that one might aver that South Africa is a state without a nation.

These divisions, coupled with the unintended consequences of policy, hinder the visionary goals of the NDP.

Add globalisation, deindustrialisation, offshoring, inflexible labour markets, self-interest, rapid technological and climate change, and now a pandemic, and the challenge of intervention may present as impossible.

Perhaps the most troubling information gathered in the analysis is that relating to TVET staff, and the quality of outputs. The studies of

JET Education Services (2016) show that the massive increase in student enrolments has not been accompanied by the provision of adequately trained staff, and the Global Competitiveness Index records the overall quality of the TVET system at rank 119. While this is a subjective score, it is far behind South Africa’s overall rank of 60. TVET now acts as a receptacle for youth who have completed schooling, but it is struggling to equip these beneficiaries with marketable skills. This is far from what is intended.

6. METHODOLOGY

In keeping with the transformative notion of TVET and innovation, the following definition for TVET innovation, referred to as the InnoVET(ive) perspective, is offered:

TVET innovation is to be understood within a transformative perspective that considers any sustained change and transition as one that contributes positively to its internal functioning AND enhances its key purpose as an education and training form responsive to its students, staff and community, as it pertains to a country's core national development responsibility in providing skills for livelihoods.

This definition of innovation indicates that TVET's innovation potential is realised by its core constituencies, in line with its national development responsibility. This definition informs the methodological lens. In the quest to gain an improved understanding of the role that TVET plays as a supplier of skills, and as an innovator in its own right, the consultants sourced both primary and secondary data. Primary data was obtained in two ways: through direct interaction with cognates, and indirectly through online survey methods.

The construction of the associated interview schedules and the survey instrument was informed by the results of the situation analysis. The literature review served as an initial source for this purpose, directing key features of the schedules to be developed. A project of this nature carries inherent risks. The stakeholder-driven approach required careful attention to effective and targeted communication strategies being employed at every level of the project as it unfolded. Participative strategies required not only effective consultation regarding outcomes, but also on inputs. The project had to be designed for maximum effect.

The result is shared ownership of what is not only important for the successful execution of the project, but that has bearing on the effectiveness and likelihood of success of the task at hand.

The key element of effective TVET research is often the product of an analysis of stakeholder partnerships, i.e. between education systems, employment partners, employers and labour. The responsibility of the consultants in this context is primarily to ensure that adequate information is provided for stakeholders to arrive at evidence-based (rather than stakeholder interest-driven) data on innovation.

The participatory approach favoured by the consultants ensured that relevant stakeholders were consulted. Identified stakeholders were those who were deemed to be adequately aware of the purpose and the underlying rationale for the strategies employed by specialists. The ongoing research and interim drafts produced timely and regular engagement with project principals, the NACI Working Group, the Reference Group members and technical specialists. The combination of qualitative and quantitative inquiry, with due regard for the strengths and weaknesses of each, is guided by the thinking of evaluation leader Michael Patton (Patton, 2008), who avers as follows:

Because qualitative and quantitative methods involve differing strengths and weaknesses, they constitute alternative, but not mutually exclusive, strategies for research ... Both qualitative and quantitative data can be collected in the same study.

The pragmatism of this approach considers the need for 'research questions', as opposed to a 'research position'. Three broad questions were proposed as follows:

1. How is innovation understood by TVET colleges and various TVET stakeholders?
2. How is innovation manifested in the TVET college sector?
3. What are the key drivers and constraints for innovation in the TVET college sector?

The mixed-methods approach of Lincoln and Guba (2000) was applied to triangulate the claims, issues and concerns of the various respondents.

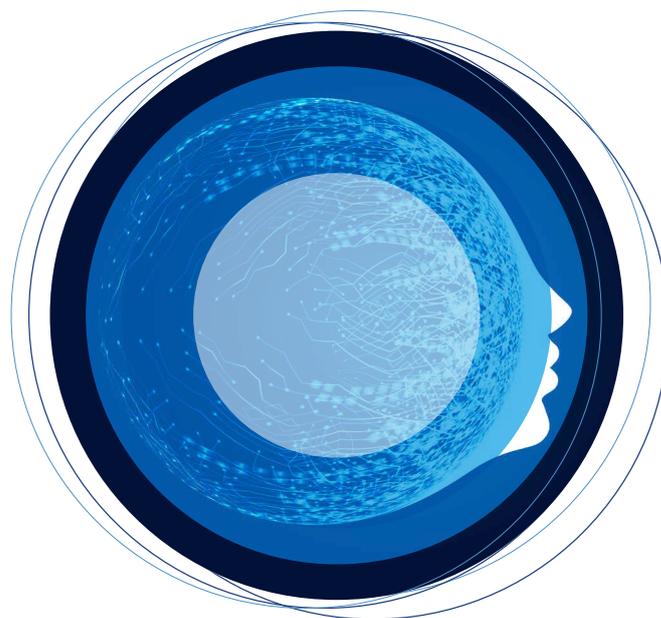
An intensive period of fieldwork was undertaken from November 2020 to April 2021. Given the limitations on mobility that the pandemic imposed, the fieldwork was conducted remotely. Gauging the perspectives of the TVET colleges took the form of an online instrument using the SurveyMonkey™ platform.⁴ The instrument comprised eight items: five using drop-down menus with pre-assigned fields, and three free-text response items (Appendix 1). This was followed by disseminating the instrument via email to each of the 50 TVET college principals or chief executive officers (CEOs) as a personalised request.

In order to achieve an acceptable return rate, dissemination was preceded by personal communication with each college principal or CEO in the form of an official letter written and signed by the Director-General of the Department of Science and Innovation (DSI).

Furthermore, all colleges were contacted telephonically prior to the survey being distributed. After the initial return from some 10 to 12 colleges, the consultants began contacting principals that had not responded to request feedback. Two further opportunities were provided for those that had either not been contacted or who were unable to access the survey. College principals entrusted with the completion of the survey were contacted telephonically via direct line for a second time. The assistance of the NACI Secretariat, and counterparts in DHET and DSI in facilitating access to the colleges'

personal data and contacts contributed to obtaining data that was utilisable. The online survey yielded 36 responses out of 50 – a 72% response rate. This is highly commendable, considering the massive constraints due to the Covid-19 conditions, end-of-year routines and timetable disruptions. With the exception of the Eastern Cape (where three out of eight principals responded) and the Western Cape (where all principals responded), the realised sample was evenly distributed across the provinces so that, pending more in-depth research, urban-rural bias might be put aside.

The interviews were preceded by rigorous preparation with purposefully selected respondents for their suitability, perceived knowledge, understanding and involvement in the TVET sector. Respondents were selected to cover key constituents: TVET policy-makers (at the DHET national office, as well as provincial representatives or alternates), listed companies (in the mining, fishing and banking industries), development agencies, think tanks, state-owned companies and a government-industry-labour planning group. A simple semi-structured questionnaire was developed to guide the interviews and was sent to each respondent prior to the interview. Interviews were conducted by telephone, email, WhatsApp™, Zoom™ and Microsoft Teams™. This approach provided the means to listen to the voices of the college principals and major stakeholders, and to compare the views of principals and stakeholders.



⁴ The consultants acknowledge support from the Stellenbosch University Centre for Research on Evaluation, Science and Technology for assistance in mounting, disseminating and collating the survey.

7. INNOVATION IN TVET COLLEGES

This section of the report presents the key features revealed by the fieldwork on the status of innovation in TVET colleges. The sample consisted of two voices: that of the TVET colleges, and that of their stakeholders. Section 7.1 avers that the origins of TVET globally and locally go beyond those implied in the UNESCO-UNEVOC approach. It was therefore necessary to perform the following tasks:

- (i) Situate the TVET sector in the larger context of the NSI.
- (ii) Examine the meaning of TVET college innovation activities.
- (iii) Explicate the way in which TVET colleges contribute to innovation conducted by other actors in the innovation system, especially through linkages between the TVET sector and other innovation system actors.

Task (i) was extensively covered in sections 2, 3 and 4 of the report. The fieldwork addresses tasks (ii) and (iii).

7.1 Voice of the college principals

The TVET colleges' perspective is provided in the words of the principals/CEOs, as collected through the online survey (Appendix 1). The responses to the eight items of the instrument are analysed below.

7.1.1 Services and/or products provided by the college

The dominant form of service is 'college-based' (91.4%), followed by 'combination of types of education and training' and 'career and employment guidance', which both scored 60%. Third was 'blended learning – remote and onsite theory programmes', which scored 48.6%. 'Work-based education and training' scored a low 25.7%, a level consistent with the following stakeholder concerns (quoted verbatim):

- *College staff are academically trained, but they lack workplace experience.*
- *There is a poor match with industry needs and market demand; no successful partnerships; out-of-date curriculum.*
- *Work placement is problematic [establishing placement units in each TVET was suggested].*
- *Build firm-TVET relationships.*
- *How to engage in firm-TVET secondments – both directions.*

The very low level of remote practical training (8.6%) serves as a red flag, although this hiatus might be attributed to the impact of Covid-19 and measures taken to restrict on-campus activity.

However, that qualification could be invalidated, given that the impact of Covid-19 and the lockdown levels only came into effect from 26 March 2020, whereas stakeholder concerns and issues suggest that the challenges around work-based education and training, and remote practical training have a longer prevalence and are enduring challenges across the entire spectrum of the TVET sector.

7.1.2 How college principals define innovation

Item 2 of the survey instrument asked for an open-ended response to 'how you define innovation in your TVET college'. College principals' responses (19 of 33) generally understood innovation in a very broad sense as entailing novelty in processes, or 'thinking out of the box'. Examples of such include the following (quoted verbatim):

- *Innovation is to find new ways to improve programme offering.*
- *The college wants to improve teaching and learning using technology, and to provide and sharpen the skills.*
- *Innovation is coming up with new approaches of doing things, including teaching and learning using technological means.*

- *Innovation is the combination of teaching and using online teaching, as well [as] introducing new products that are meant to make our lives much easier.*

Mention was also made of specific innovations such as the introduction of online portals or remote working. Verbatim responses are as follows:

- *Innovation includes all activities that support the second income stream for the college.*
- *The college provides online teaching as additional support to enrolled students.*

Some 20% of responses regarded linkage with the labour market as innovative, with a third of responses identifying the introduction of technology as innovative in itself. Some of these responses were as follows (quoted verbatim):

- *New and cost-effective ways of delivery of applicable industry-required courses. Short skills courses or programmes designed and packaged specifically for a company in a defined [service level agreement] to address the specific skill and operational requirements for a client. The use of latest technology/software/programs to maintain support services, tasks and functions efficiently and cost-effectively.*
- *Innovation is a culture of continual [improved] renewal and change to keep abreast with trends, technology and the needs of learners, staff parents, ... communities and ... society. It involves finding new, unique and better teaching and learning technologies and programmes to meet social and economic needs and challenges.*

One principal made mention of the looming 4IR, viewing the deployment of an online portal as an introduction to the imminent changes. In summary, the principals' views concentrated on innovation as change, or as novelty, without distinguishing between product or process, purchase of equipment, or setting up new divisions.

7.1.3 Innovation activities

Item 3 of the survey probed the type of innovation activities deployed in the colleges. The predominant innovation activities were investment in equipment and capital resources (91.4%) and in CPD (91.4%).⁵

The second largest proportion of respondents (60%) cited participation in skills competitions. This is followed by a little over half (54.3%) who indicated attention to marketing and promotional activities, while 45.7% of respondents cited the development, introduction and/or presence of incubators for TVET learners as innovation activities. Lower scores were recorded for the development or introduction of internationalisation strategies (28.6%), the development of related financial expertise (17.1%) and activities related to intellectual property rights, such as patents and trademarks (11.4%). The ranking of IPR is very high when compared to the innovation activities of firms, as reported in the national innovation surveys, and might reflect misunderstanding on the part of respondents.

7.1.4 Specific innovations introduced

Item 4 asked respondents to describe a specific innovation that had been introduced in their college. This is arguably the most important item in the survey. It is typical of self-assessment items that are used in innovation surveys, such as the OECD/Eurostat exemplar. Self-assessment is obviously subject to response bias – what firm or college wants to declare that they have not introduced an innovation, and thereby attract attention to themselves as an innovation laggard?

There is also the problem of deciding what type of innovation is being described. In the case of the OECD/Eurostat exemplar, the only responses can be “yes” or “no”. In this case, the respondent was asked for a description. It then behoves the consultant to further interrogate the response. A total of 33 usable responses were received for Item 4 and were analysed according to the high-level typology of Table 7.1.

⁵ It may be noted that the National Innovation Survey of the business sector records that investment in equipment and ICT resources is the largest expense on innovation by innovating firms.

Table 7.1: Typology of innovations

	No.
Product	1
Institutional	9
New to sector	3
Online platforms	7
Infrastructure/equipment	5
Partnerships	9
Survivalist	3

The survey responses show but a single home-grown product innovation, described as follows:

- *A new app for the college and online teaching.*

Five respondents referred to intentions and future plans, such as the following:

- *To partner with key organisations to select and deploy information technology-related innovative solutions that grow and further the mission and vision of the college.*

There was a tendency to describe new institutional forms as innovation (nine respondents), so a new academy, workshop, division, or centre was identified as such.

Along with the development of an app, seven colleges introduced online platforms. Five colleges identified infrastructure and equipment as examples of innovations, rather than as innovation activities. The use of information technology (IT), digitalisation and internet-enabled instruction was a strong theme. One college responded as follows:

- *Use of 'cloud' computer processing technology workstations... 'fire-walling' is centrally managed, and virus-protected. Students cannot upload any unwanted information onto the computers ... the working life span of the units is at least 10 years and per-unit cost is 30% cheaper.*

There were three examples of what might be termed 'survivalist' innovation. One rural college reported that it had established a guesthouse for the college students, which served as work placement for college graduates.

The guesthouse was not only generating an income for the college, but was creating employment opportunities and changing the lives of rural families. Another college collaborated with a local retail chain store to supply agricultural products. The third college referred to 'macadamia farming', whereby a hectare of land was obtained from the local tribal authority for each student. This was cited as an important initiative in resolving the key issue of postgraduation destinations.

Partnerships were very important (nine respondents), as found in these responses:

- *The college-partner (X) initiative that assists in investing in resources.*
- *Partnering with other institutions of higher and private organisations in introducing green [economy mechanisms] (such as solar power systems, energy savers).*

It is accepted that partnerships and launching new institutions may involve elements of innovation, but judgement on these must be reserved for more detailed inquiry. The extent to which partnerships are a form of linkage will be discussed in the overview. A strong claim on novelty was evident, with 82% of responses referring to this. Even so, the level of what is generally accepted as innovation is low: a single app, and three survivalist rollouts. The above responses suggest that the understanding of innovation and innovation practice varies considerably from college to college, with a small set of 'leaders' who introduce new organisational structures and partnerships, and more 'laggards'. The terminology of leaders and laggards is in common use in the international literature (WIPO, 2019; EY, 2017).

7.1.5 Elements present in the specific innovation

The survey sought to determine the occurrence of pre-defined elements in the specific innovation as described by the respondents in Item 4. Topping the list was providing people with relevant skills for the labour market (68.8%), providing staff with CPD (62.9%) and establishing business-education partnerships (60%). Below the 60% mark are providing higher-level TVET programmes or learning pathways (57.1%), and participating in national and international skills competitions (54.3%).

There is a clustering of three elements in the sub-50% level. These are the development or introduction of entrepreneurial competencies, and working with small and medium-sized businesses (SMEs), which both scored 48.6%, and fostering the transnational and international mobility of learners and staff (40%).

Below these were the development or introduction of business incubators for TVET learners (37.1%), followed by the development or introduction of TVET curricula together with stakeholders, and innovative mechanisms for on-the-job or work-based training, which both registered 34.3%. At the lower end of the spectrum was the development or introduction of project-based learning (28.6%), acting as or supporting innovation and technology hubs (25.7%), providing guidance services or validation of prior learning (22.9%) and developing sustainable financial models (17.1%). There appears to be a disjuncture between these responses and the activities reported earlier.

7.1.6 Main partners in the development and implementation of innovation

The SETAs and National Skills Fund (88.6%) were flagged as the main partners in developing and implementing innovation. This was followed by business (65.7%), and other TVET colleges and trainers (54.3%). International organisations (37.1%), business chambers and industry associations (31.4%), and incubators, clusters and industrial parks (31.4) followed in the 30% range. Below these are organised labour (28.6%), public research institutes (25.7%), NGOs (17.1%) and the DHESI (8.6%).

While it might be debatable whether the DHESI should be identified as a partner, UNESCO-UNEVOC (2019:24) demarcates the following different types of partnerships between TVET institutions and external actors:

- Partnerships in public policy, whose aim is to shape public and political debates and bring about substantial changes in TVET legislation and governance
- Partnerships in systemic educational improvement, which combine and channel resources in different ways and implement specific TVET policies
- Partnerships in TVET management, which provide TVET managers with support on running an

organisation and with business expertise in a broad range of areas

- Partnerships in teacher training and development, which provide opportunities to TVET personnel to maintain or upgrade their skills
- Partnerships in classrooms, which aim to bring business and occupational expertise directly into classrooms
- Partnerships in special services, whose aim is to provide short-term, project-based or student-specific activities or resources to help with a specific problem or a need identified by external actors

It would therefore seem reasonable to regard the DHESI as the macro-structure under which the TVET colleges exist as micro-dependencies. Partnerships between TVET colleges and the DHESI can be described as partnerships in public policy, partnerships in systemic educational development and partnerships in TVET management.

The same can also be said of the SETAs and the NSF. In the same vein, the identification of the college council as a partner can be deemed as falling into the category 'partnerships in TVET management'. This is surprising, given that college councils are oversight structures of the TVET colleges.

The fact that business (or business chambers) and industry associations are not considered as the most important partners is of major concern, suggesting that TVET colleges are inwardly focused on internal effectiveness (such as funding and incentives for funding).

7.1.7 Barriers to development and implementation of innovation

The analysis of barriers commences with those that were cited to have an impact 'to some extent' or 'to a great extent'. Top of the list were a lack of resources (83%) and a lack of incentives (72%). These were followed by resistance to change (65%), a lack of staff (64%) and a rigid policy environment (56%). Below this level, barriers identified were reluctance of partners for collaboration (48%), a lack of a shared vision (43%), an inability to respond to labour market demands (39%) and a lack of time (21%).

Barriers that were cited as being moderate or low included a lack of time (63%), an inability to respond to labour market demands (52%), a rigid policy environment and a lack of a shared vision, which both scored 32%.

Others included a lack of staff (28%), a lack of incentives (20%), resistance to change (15%) and a lack of resources (13%). It seems strange that a lack of incentives is a main barrier to the development and implementation of innovative practices. It raises the question as to whether incentives are regarded as a motivating factor for TVET colleges to embrace innovative mindsets and dispositions.

7.1.8 Other comments

A thematic analysis of ‘other comments’ was applied to the 33 usable returns, as indicated in Table 7.2.

Table 7.2: Thematic analysis

	No.
Resource constraints	19
Relations with DHET	9
Incentives	4
Focus/articulation	7
Internal culture	6
Curriculum change	12
Partnerships	9

A thorough reading of the responses identifies four groupings:

First, that of resources, infrastructure and incentives, which tally with the same issues identified as barriers in Section 7.1.7 (83% and 72%, respectively):

- *We wish for more resources and quicker responses to needs ... to fund the occupational programmes which respond to the need of the labour market.*
- *College should be resourced in order to function effectively. Technological infrastructure is expensive; hence it is the way to go.*

Funding during Covid-19 was a special challenge:

- *During the current challenges related to Covid-19 and the economy, it is difficult to procure resources that could be utilised for innovation.*

Second is the relationship between government and the TVET colleges, which is associated with ‘red tape’ and curriculum maintenance (65% and 56%, respectively):

- *The rigidity of the curriculum of the ministerial approved programmes is outdated and limitational [sic] nature. The defined autonomy of colleges is stifling [sic] in nature when compared to universities.*
- *Ministerial programmes of NC(V) and Report 191 will have to be relaxed somewhat to allow for the increase of scope in programme delivery.*
- *... DHET has to speed up with revision of the curricula especially the NATED [National Technical Education] programmes and also start with the plan to fund the occupational programmes which respond to the needs of the labour market.*

The **third** grouping has to do with internal culture, awareness of innovation, focus and the limits of leadership. These matters are consistent with the high score given to ‘resistance to change’ in Section 7.1.7.

The **fourth** grouping refers to the importance of partnerships:

- *Innovation must be focused on how we can open doors and provide additional support to our students, specifically also focusing on partnerships for workplace-based training.*

Some respondents proposed the incorporation of work-based learning (WBL) to resolve the issue of placement opportunities for practical experience. A number of responses made reference to entrepreneurship initiatives. One college referred to its Centre for Entrepreneurship and Incubation as an important element, that:

- *... trains and mentors small business enterprises and exiting students to be able to start their own businesses. The centre also assists with the business plans, secures funding and monitors their finance management.*

Due to the outbreak of Covid-19, the use of ICT was regarded as an innovation through ‘blended learning’, the use of mobile phones, social media, television and local radio stations that enabled access to teaching and learning, and the introduction of online platforms such as Moodle.

Using the conventional definition of what constitutes an innovation, one might be constrained to identify but one of the 50 colleges as an innovator.

This would be a harsh judgement, given the constraints under which the sector operates. Survivalist innovation entails entry into a new market, which is an accepted Schumpeterian innovation; going online is a somewhat routine action, but also entails local problem-solving, learning and adaptation. Using this argument, the survey attests that there are pockets of innovation activity that may yet be nurtured.

7.2 Voice of the stakeholders

A total of 24 interviews involving some 40 persons were conducted by means of a semi-structured three-item interview schedule. Parties interviewed included listed companies, business organisations, government officials, board members of statutory bodies, think tank analysts, interest groups and informed independent experts.

A broad spectrum of informed opinion was thus elicited, and the assistance of the NACI Secretariat

and counterparts in DHET and DSI in facilitating the connections is appreciated.

The analytical approach followed used the Fourth Generation Evaluation organisers – claims, concerns and issues – of Lincoln and Guba (2000). Claims are understood to be positive statements, with concerns being negative, and issues being unresolved matters.

A less-pressured investigation would have involved an iteration of the responses back to respondents so that the items captured under the three organisers would regress towards consensus positions. The summaries below are therefore somewhat broader in viewpoint than might otherwise have emerged.

This qualification aside, valuable perspectives have been elicited through the interviews. The consultants thank all participants for their time and patience.

7.2.1 Claims

The colleges are critical sites for skills acquisition, artisan training and the promotion of industrial development, reindustrialisation, localisation and community development. They constitute a geographically distributed resource that can be optimised for access, redress and equity.

There is evidence of pockets of excellence and some enlightened initiatives. Business is willing to work with colleges to build the sector. Foundational skills, business English, digital skills and enterprise development training and support would further contribute to the colleges' and youths' chances of success.



7.2.2 Concerns

A first cluster of responses involves governance and the role of DHET. TVET colleges are understood to enjoy low autonomy, and are subject to a top-down culture. Further, the main focus of DHET is on the universities:

- *They don't understand the skills market.*
- *The workplace link with occupational training has been lost.*

Centralisation and a top-down governance model have led to the absence of an entrepreneurial spirit in the TVET colleges: "There is no innovative mindset in the TVET colleges" and this despite a champion in the person of the Minister. This was appreciated, "but does not necessarily translate into real change". The challenges are deep-seated, and "historical in nature ... a by-product of transformation".

There was a perception of policy inconsistency, with poor alignment across business, DHET, the SETAs and the colleges.

The second cluster concerns the curriculum, facilities and lecturers. The curriculum is seen to be outdated (NATED/N91). It was alleged that infrastructure was often poor, and even where adequate, was often underutilised. Business was prepared to address the gap, but needed to feel confident that positive outcomes would be achieved.

There was a poor match with industry needs, and few successful partnerships. Business exhibited low trust in government initiatives and capacity; there has been a loss of relationships with colleges, and low trust manifested in resistance to job placements. Instead, a two-way street is needed.

With regard to staffing, a twofold view emerged. On the one hand was the observation that "lecturers are academically trained but lack workplace experience" and that there is a high turnover rate of staff. On the other hand, a more empathetic view was expressed that problems are compounded by staff being demotivated because they were underpaid relative to university staff, even though the colleges are of a similar size as universities. Greater responsibility should translate into higher remuneration and capacity development.

It was suggested that students viewed TVET study as a third choice (after a university or university of technology). This was worsened by their lived experience that work placement was problematic. There was an allegedly lukewarm response to the Covid-19 crisis by the college, as shown by the absence of a policy to provide laptops to students.

Some respondents alleged governance failures, including perverse incentives (enrolment vs quality), fraud and plagiarism, and that SETA funds were misdirected.

The question was posed whether the SETAs were fit for purpose. There was a predominance of negative concerns among the respondents, best summarised as "we are not in the business of seeing to an ailing child".

7.2.3 Issues

In the analytical organiser, 'issues' are matters of common interest, one such being the need to build firm-TVET relationships as captured in the statement: "... fix the house, then worry about innovation".

This may be counterposed with the useful proposal that placement units be instituted in all colleges. It was stated by a respondent that the government discourse on research-led innovation would necessarily bypass the colleges; it would be more appropriate to emphasise incremental learning.

There was agreement that an insistence upon recent, relevant experience as a criterion for the continued employment of lecturers could transform the sector; this could be met through mentorship. It was noted that the dtic's master plans were largely silent on innovation, R&D, technology transfer and even skills upgrading.



7.3 Overview

The intense policy disruption of the technical college and skills development sectors over the last decades must be recognised. A number of system-wide innovations flowed from the promulgation of the Skills Development Act, Act No. 97 of 1998, namely the Skills Development Levy on business, the establishment of the SETAs and the establishment of the Skills Development Fund.

At the same time, new provinces were formed and technical colleges were transferred to these new entities. The next repositioning was the centralisation of governance under the national government, which was followed by relocation and rationalisation. These changes were accompanied by a massive shift in student demographics, as well as staff demographics and experience.

These considerations form the backdrop to the interpretation of the fieldwork. The survey highlighted four critical concerns of TVET principals:

- Resources, infrastructure and incentives
- The perceived bureaucratic relationship between government and the TVET colleges
- TVET colleges' internal culture, low awareness of innovation and the limits of leadership
- The place and importance of collaborative partnerships

The stakeholder interviews served to expand and triangulate the findings of the survey, providing an external lens for viewing TVET stakeholders and role players who either benefit from the outputs of the TVET colleges or who are invested in TVET college policy, governance and structures. The interviews raised important claims, for instance, the importance of the TVET sector vis-à-vis the optimisation of access, redress and equity. As noted, the TVET sector shows the greatest degree of transformation, compared with public basic education and higher education.

However, there were also strong concerns with regard to the capacity and lack of workplace experience of staff, and the absence of an innovative mindset in the TVET sector. The business sector's distrust of government with regard to the provisioning of TVET colleges must be an issue of concern for policy-makers who are now promoting the goals of self-reliance and reindustrialisation.

The interviews highlighted deep-seated issues such as the declared need "to fix the TVET sector first in terms of governance, infrastructure and staff capacity, and only then, expect the sector to demonstrate innovative capacity". While college principals feel that they are in touch with the labour market, potential employers would appear to disagree. Three surprising statements emerged:

- TVET is the stepchild of the education system.
- Business does not need the colleges; the colleges need business.
- The greatest innovation (for TVET) would be a listening government.

An interpretation of the silences detected in one voice and a stridency in the other suggests that the colleges demonstrate a low awareness of innovation as such, being more concerned with 'bread and butter' matters, while stakeholders advocate a need to 'get back to basics'. This is not to imply or suggest a total lack of innovation activity in TVET colleges. However, the interviews support the survey finding that the majority of colleges fall into the category of 'laggards'.

This observation prompts the idea, expressed by some stakeholders, that the 'leaders' should be given autonomy to experiment even further, and then to share that experience across the sector. Such intrasectoral mentorship through innovation, and innovation through mentorship, could be the most valuable way of nurturing innovation.



Task (iii) of the terms of reference calls for the interrogation of the contribution of TVET to innovation conducted by other NSI actors, especially through linkages. The survey was designed to interrogate partnerships. Evidence of partnerships was captured in sections 7.1.4 to 7.1.8. In general, TVET's primary contribution to innovation is supplying newly skilled employees, as well as employees who have further upgraded their skills. How these personnel are deployed to participate in innovation in firms or the public sector rests within the ambit of management.

The main contribution of TVET towards innovation is therefore indirect, through the transfer of skills to the workplace. The same applies to the universities, whose contribution to the economy is in the form of appropriately educated graduates who bring new knowledge and skills to the workplace.

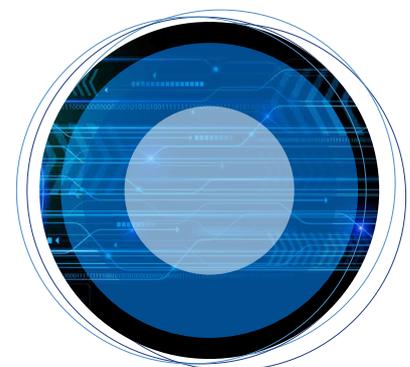
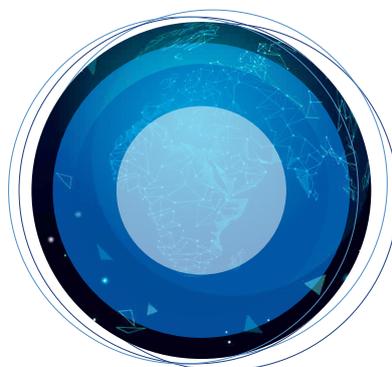
This transfer should be interactive and should entail linkages and partnerships. Linkages take a variety of forms in the generation of innovation. Parties may come together to share expertise and intellectual

property (IP); they may contract-in resources from others; they may be linked by a one-way flow of funds; they may share information; or they may second staff to one another.

These activities may be labelled as linkages, and involve the movement of people, ideas and money, as well as the joint use of facilities. It is clear that the principals understood the importance of the relationships between TVET and the business sector: 60% viewed business partnerships as important in TVET innovation activities, and 66% rated business as the most important partner after government.

This 'lower' rating arises from principals identifying government as a 'partner', whereas it should rather be understood in its role of funder and enabler.

Universities as partners were scored at 42% and PROs at 25%. Based on this analysis, TVET would appear to be strongly linked with the NSI actors. However, this begs the question as to how such partnerships work in practice.



8. SWOT ANALYSIS

The SWOT analysis is a strategic tool used by business marketing researchers and strategists to determine an organisation's resource capabilities and deficiencies, as well as its market opportunities and the external threats to its future. A SWOT analysis assists researchers and strategists to find gaps and matches between competencies and resources in the business environment (Gürel, 2017; Helms and Nixon, 2010). Typically, organisational strategists will use the 'top rows' of internal strengths and weaknesses to assess the organisation's image, structure, access to natural resources, capacity, efficiency and financial resources. They will then use the 'bottom rows' of external opportunities and threats such as customers, competitors, market trends, partners and suppliers, social changes and new technology, as well as the various environmental, economic, political and regulatory issues, to postulate ways to overcome the organisation's threats and weaknesses (Helms and Nixon, 2010; Leiber, Stensaker and Harvey, 2018). The SWOT analysis of the TVET colleges is shown in Figure 8.1.

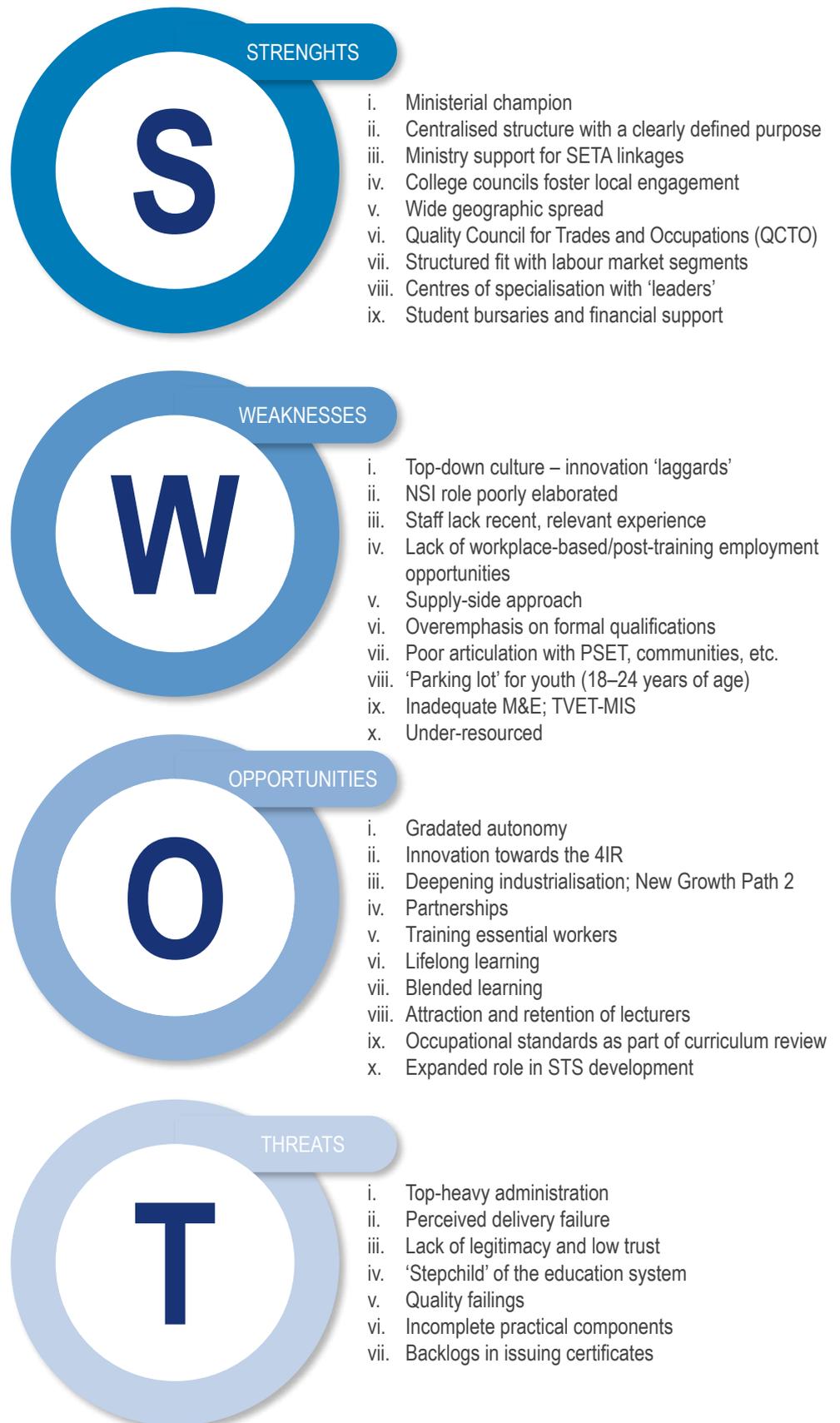


Figure 8.1: SWOT analysis

The four SWOT analysis pillars spell out the situation of an organisation or portfolio, and the actions that need to be taken. The pillars provide a framework for analysing the strengths and weaknesses of the organisation or portfolio, and for taking the greatest possible advantage of opportunities available (Gürel, 2017). The identified strengths, weaknesses and threats follow directly from the fieldwork of Section 7 and require no further elaboration.

As sketched in the situation analysis, it is the opportunities for innovation and for innovation activities that will affect the future. With three exceptions (opportunities iii, v and x), these are consistent with the voices captured in Section 7.

Graded autonomy recognises that the colleges are a heterogeneous set, comprising 'leaders' and 'laggards'. This should not be understood pejoratively, but is a phenomenon that characterises organisations in general, whether they are logistics companies, schools or universities. Some of the 'leaders' have the capability to drive centres of specialisation, and some do not.

They are an asset to the system as a whole, and deserve the type of 'framework autonomy' that was devolved to the science councils some three decades ago. Organisations need freedom to innovate. A ministerial champion may be necessary, but in praxis is not necessarily sufficient.

The colleges have specific roles to play: as providers of technical skills to industry, to provide scientific and technical services (item x), and to offer short courses to fill specific technical needs – such as training health workers, and upskilling and re-skilling those displaced by the Covid-19 disruption. Lifelong learning is the business of TVET.

Deepening industrialisation (iii) and New Growth Path 2 must act as pull responses to the disruption of global supply chains, the need for self-reliance in certain fields, and the ongoing crisis of under-employment. In addition, there is the opportunity of tailoring short courses to address immediate skill shortages, such as those

driven by Covid-19, as well as launching completely new initiatives such as the promotion of spoken fluency in the official languages at national scale. Innovation towards the 4IR beckons.

A number of process innovations are also needed. For example, should it become a binding condition of employment that college lecturers must display recent, relevant experience in the fields in which they offer instruction, it may lead to a high-scale mobilisation that would link colleges, businesses and government departments. This would require innovation on a macroscale.

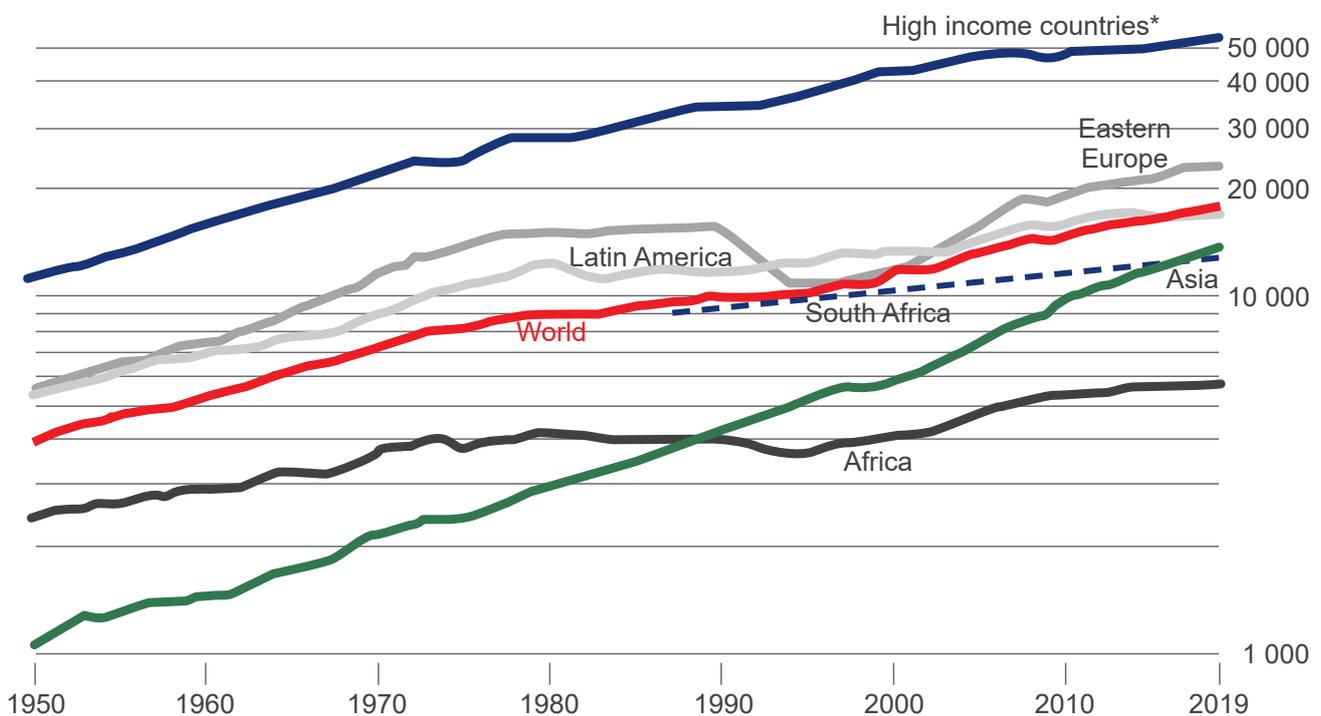
Furthermore, there is an objective need to promote articulation between TVET and the system actors. To reiterate, the very concept of an innovation system stands or falls on the existence of such linkages, whether they are shared training, staff exchanges, partnerships or even joint facilities.

The emerging TVET centres of specialisation could be part of a linkage-building process. Once again, this entails large-scale process innovation.



9. POSITIONING TVET: 4IR, ANTICIPATION, A WORLD WITH COVID-19

Positioning TVET in this 'Age of Uncertainty' is no mean task. The world of the 2020s is immeasurably different from that of a half-century ago, when the secondary industrial sector was the driver of the industrialised and industrialising economies. The massive impacts of new digital technologies, the wave of globalisation, and various experiments with the market economy have enabled the rise of the East, even as Latin America and Africa have lagged behind. As the graph in Figure 9.1 shows, the rise of GDP per capita in the East (read: China) has been exceptional.



* Western Europe, North America, Australia, New Zealand

Figure 9.1: Global average GDP per capita, purchasing power parities in US dollars, 2018 (log scale)

Source: <https://www.ft.com/content/e82a1f48-a185-11e9-a282-2df48f366f7d>

Although the graph indicates that Africa started ahead of Asia, the East reached a breakpoint from the mid-1990s, and China and its periphery continued to soar. South Africa (shown as a dotted trajectory), with its complex history of natural and human resource exploitation, has failed to meet expectations, and remains trapped in path dependency. In the 'advanced' economies, the decline of employment in secondary industries is akin to the

decimation of agricultural employment in the late 19th century. The social and economic consequences of the shift from rural villages to industrial towns were grave. Currently, the decrease in absolute poverty and improved healthcare is leading to demographic imbalances, with declining populations in advanced economies, and a youth bulge in Africa. The social and economic consequences are likely to be as grave as those described above.

Education systems display inertia and tend to lag behind societal and economic change. South Africa, like many other industrialised economies, has experienced a shift away from the manufacturing industry to services. In the South African case, the last decade has also seen very strong growth in the size of the public service. External drivers of change include the green agenda, geopolitical forces, globalisation and its contraction, the risk of further zoonotic pandemics, and the deepening of the ICT revolution that manifests in Industry 4.0 or the 4IR. The rise of the gig economy and a parallel decline in union membership are but two of the consequences of these new upheavals. Managing and meeting the challenge of these drivers require methodical future and anticipation studies.

In the mid-2000s, government sought to bring about a shift from the long reliance on commodity exports by moving into medium-technology exports. The best example of this is the automotive industry. For a variety of reasons, the advocacy of the Harvard Group (Rodrik, 2006) failed to gain traction. Today, in part as a reaction to the Covid-19 disruption of global supply chains, and because of gross underemployment, the goal of reindustrialisation based on high local content is being pursued. Alongside the capital for new infrastructure and technology, significant upskilling and sourcing of skills will be required, even as automation reduces the demand for certain types of labour.

Each step along this new growth path entails innovation as part of the journey and as an end goal, with new products to be created and new processes to be experimented with. All economies are unique in their social and organisational dimensions. The South African case is perhaps more unique in the attempt to grow manufactured exports with a strongly organised and relatively well-paid workforce. This is quite unlike countries that progressed from low-technology natural resource exports to manufactured goods based on low-cost labour. That option is not present here.

What might be termed 'New Growth Path 2' demands a new social compact that exploits the full potential of the hard-won progressive frameworks that are in place, and that provide a sustainable social safety net. Such a vision must mesh with future uncertainty, as, for

example, sketched in the South Africa Foresight Exercise for Science, Technology and Innovation (SAFESTI), produced for NACI by the Higher School of Economics, Moscow, and Non-Zero-Sum Game. The SAFESTI anticipated that "... the number of task-based jobs will dwindle as these are taken on by robots, and labour-intensive jobs and jobs that involve simple judgement are likely to disappear. The education system will need to change significantly to ensure that workers are reskilled, and that school-leavers have the right skills to meet the changing workplace demands" (NACI, 2019:93).

Competing in the high-technology domain requires its own skill set, whether it is deployed to introduce new-to-world, new-to-market or new-to-firm innovations. The South African Science, Technology and Innovation Indicators Report (NACI, 2019) indicates that "South Africa needs to embrace advanced manufacturing approaches rapidly to improve competitiveness and arrest further job losses and deindustrialisation likely to emerge as the 4IR approaches. The high-tech industrialisation domain includes advanced manufacturing and technologies such as robotics, artificial intelligence, IoT and additive manufacturing" (NACI, 2019:93).

The SAFESTI suggests that consideration be given to promoting firms that will take the risk of entering space, green chemistry, cybersecurity, biometric security, additive manufacturing and autonomous mining vehicle markets. The emergence of such firms rests on visionary leadership and skills, as well as the ability to upskill, to attract skills from the local and global market, and to venture into the unknown.

Futurist Riel Miller (Forskningspolitikk, 2018) cautions that "supply-demand forecasting and planning have repeatedly failed in the past and all around the world. Because, as it turns out, one of the fundamental characteristics of 'market economies' is the complex emergence through cycles of birth and death of companies, sectors, jobs, etc. It is not predictable". No one who was aware of the reluctance of interest groups to allow the dissemination of renewable energy systems in South Africa could have predicted the rapid deployment that occurred without local R&D, but with sufficient technical skills to install and maintain the equipment. Miller (2018) is a leading

exponent of the emerging discipline of ‘futures literacy’ or ‘anticipation’, in which futures unconstrained by the institutional forms of the past and present are envisaged. He counsels “futures literacy as the way people use-the-future... if we see that knowing how to use-the-future differently means we can change what we see and do in the present. Enabling us to take a different approach to uncertainty, reconciling our idea of human agency with the constant novelty of our unescapably complex emerging reality” (Miller, 2018). It might well be appropriate to combine ‘empirical’ foresight exercises with the ‘fuzzy’ art of futures literacy.

Technological advancements, globalisation, climate change and demographic shifts, together with the fast-changing world of work, establish the reality that one job for life is no longer valid for individuals. The ILO’s “Global employment trends for youth 2020: Technology and the future of jobs” (ILO, 2020) highlights this challenge, as well as opportunities of the future labour market. The report notes that vocational training is more likely to lead to employment in jobs that are at risk of automation.

Technological advances – notably in such fields as automation, robotics, artificial intelligence, 3D printing, machine learning, the Internet of Things (IoT) and blockchain – will transform labour market opportunities

and the challenges faced by young women and men (ILO, 2020:49). To remain employable, people (and organisations) need to engage with continuous learning to acquire and update their skills throughout their working lives.

Furthermore, increased longevity also implies that working lives are increasingly extended. Therefore, older workers who choose to stay in the labour market should be provided with adequate opportunities for lifelong learning.

Furthermore, the reality of a world still in the throes of the pandemic, with seemingly little room for optimism that it will soon end, will have a significant impact on the future of work. The pressure to automate, to reduce office working, the flight to the suburbs and the curtailment of flights are features of the immediate ‘with Covid-19’ world. As vaccination rollouts increase, one may but speculate as to the changed character of societies.

The trends that Covid-19 has shifted may have profound effects on the workforce even after the pandemic recedes. McKinsey & Company (2021) asserts that “while some workers will return to the office, shoppers will return to stores, and diners will return to restaurants, many of the behavioural changes in consumers and businesses are likely to persist”.



10. MEASURING TVET INNOVATION: M&E AND INDICATORS

Science, technology and innovation indicators serve to inform national policy, as well as to benchmark country performance. However, measuring the outputs, outcomes and impacts of innovation is not a simple task. Even where metrics are defined and put in place, these may not necessarily be fit for purpose in a given organisational setting. Metrics or indicators are devices that serve 'to tell a story' (Gault, 2012). They seek to summarise the behaviour of a phenomenon, and may be descriptive, operational or synoptic, or they may review aspects of the phenomenon.

The databases of multilateral organisations – the OECD, the United Nations (UN) system, the World Bank Group, the African Union's African Observatory for Science, Technology and Innovation (AU-AOSTI), the European Commission and organisations that track STI performance, the Times Higher Education rankings, the Baldrige awards, the WEF's Global Competitiveness Report and the Global Innovation Index (South Africa ranks in position 60 for 2020) – provide such indicators. The major consulting firms also publish innovation indices and country rankings, for example the Accenture Innovation Maturity Index (Accenture, 2020). The International Standards Organisation (ISO), through its product ISO 56002:2019 innovation management (ISO, 2019), lays out broad guidelines that organisations might follow to improve their practices. A common proxy measure of innovation is provided by noting the awarding of IPRs, especially patents awarded to institutions or countries, with a strong emphasis on the 'triad' comprising the United States Patents and Trademark Office, the European Patent Office and the Japan Patent Office. The discourse tends to give less attention to other modes of IPR, such as registered designs, trademarks and plant cultivars.

For its part, the South African government has done well in compiling science, technology and innovation indicators that are generated from the data collected from regular

R&D and innovation surveys conducted according to OECD guidelines. These are augmented with education indicators, national statistics and IPR indicators. The National R&D Survey of 2018/19 recorded the GERD: GDP ratio at 0.76%. The absence of a generally agreed notion of what is meant by 'innovation in TVET' presents difficulties to the analyst who seeks to measure, monitor and evaluate, and compare such innovation. Richtner et al. (2017) aver that "the crux of effective innovation measurement is to understand the problem that measurement should solve for the organisation, and based on that insight, to design and implement a useful and usable innovation measurement framework appropriate to the organisation's needs".

This difficulty characterises the measurement of education outcomes in general. The various notions of TVET held in different countries, underpinned by the practices in different countries (in-school, TVET colleges), and types and forms of provisioning add to the problem. This is even more so where real outcomes are most likely to be measurable in the workplace, outside of the institutions. The development of a set of common, feasible, maintainable and timely TVET innovation indicators is a work in progress.

The work presented below is thus groundbreaking, and in an exploratory phase. It forms a contribution to the discourse that seeks to bring about a positional change whereby TVET is more than 'training', constituting only one among many innovation activities. In many cases, TVET remains locked into 'training' production that is dedicated towards the realisation of innovation in the hands of other agents, typically a firm or a government agency. In such cases, innovation is most likely to take the form of curriculum changes, rather than the creation of artefacts. Training institutions may stimulate innovation by taking the actions in the Oslo Manual (OECD, 2018: 1.36)

that firms (and governments) pursue to generate innovation:

- Engineering, design and other creative work
- Marketing and brand equity
- Research and development
- Intellectual property registration
- Employee training
- Software engineering and database development
- Acquisition or lease of plant and machinery
- Innovation management

Employee training – which might entail TVET study locally, in the company or abroad – is understood as an essential part of developing and rolling out innovation. The fieldwork, especially the analysis of Section 7.1.4, pointed to the difficulties of applying the categorisation of innovation in the Oslo Manual to TVET innovation activity. For all intents and purposes, internationally agreed upon

indicators of TVET innovation performance are absent. To address this gap, the project team used two models: that of the Asian Development Bank and that of the international Inter-Agency Group on TVET (IAG-TVET). The Asian Development Bank’s perspective of using a ‘simple’ supply- and demand-side perspective is useful. In this model, supply-side elements, which incorporate the institutional training elements (including students, staff, curriculum and delivery modes), are complemented with demand-side perspectives that determine student destinations (ADB, 2014). Both supply and demand need to complement one another to ensure that a ‘widened’ notion of TVET is used that is consistent with the conceptual lenses that underpin the earlier analysis based on the politico-legal, techno-economic and socio-cultural themes.

The second TVET evaluation framework is that of the IAG-TVET (IAG-TVET, 2012), indicated in Figure 10.1.

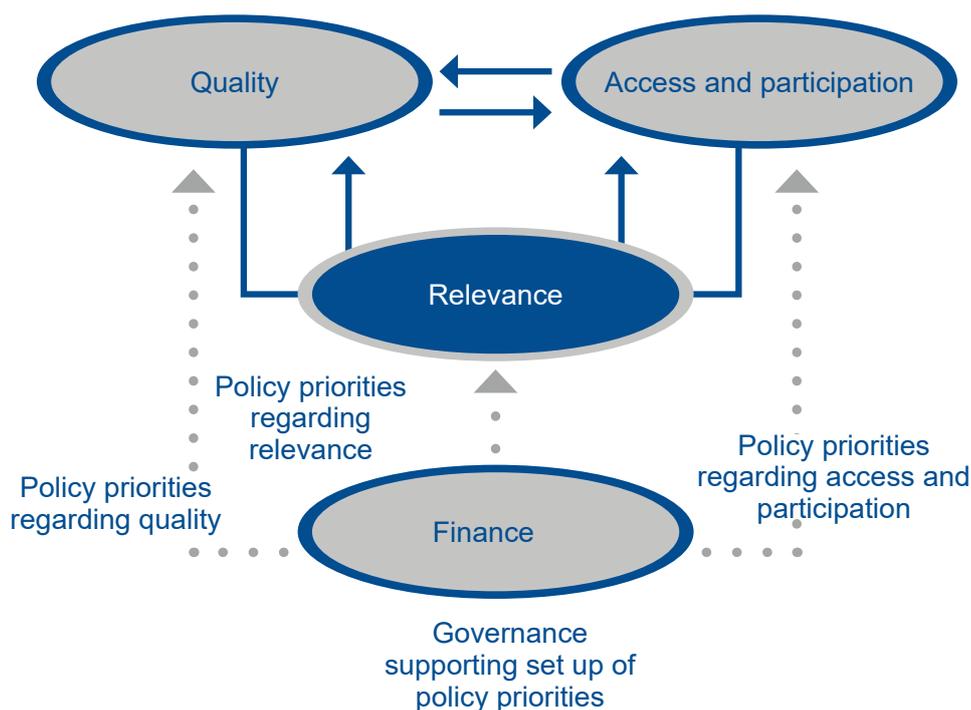


Figure 10.1: Conceptual framework for evaluating selected policy areas

Source: Inter-Agency Group on Technical Vocational Education and Training (2012)

This framework builds on the assumption that policy-makers and stakeholders have to agree on the need for relevance, as a primary deliberative goal. According to this perspective, the funding regime will provide the necessary conditions for both ‘access’ and ‘participation’

(as the equity dimensions), and ‘quality’ (teaching and learning as ‘institutional’ elements) to ensure that this goal is achieved. The use of proxy measures is commonplace in seeking metrics of intangibles. For example, quality in higher education institutions is often measured using

the proxy indicator of citations of peer-reviewed journal publications. The IAG-TVET argues that the attainment of 'quality' in the provision and outcomes of TVET serves as a proxy measure for innovation. The consultants endorse this position. Based on the above, 25 TVET system indicators are proposed.

In so doing, the consultants do not minimise the difficulties entailed in populating these indicators. Some data will already be available, while other data will have to be collected. Most of the indicators may be classified as the 'review' type. A few may appear to be review indicators, but are quasi-synoptic.

10.1 Input indicators

- i. Expenditure on formal TVET (National Budget Vote 17)
- ii. TVET expenditure per student (Section 9.1.1 and DHET statistics)
- iii. Percentage of apprenticeship and other types of training in labour cost
- iv. Expenditure on lecturer training
- v. Share of expenditure spent on ICT training activities

10.2 Future capacity indicators

- i. Lifelong learning rate of the 25- to 64-year population
- ii. TVET enrolment by economic subsector
- iii. Transition rate from secondary education to TVET colleges
- iv. Work-based learning⁶ (RSA, 2018) participation rate
- v. First-time PSET completion rate of the 18- to 24-year group

10.3 Quality and innovation indicators

- i. Student: lecturer ratio in TVET colleges
- ii. Percentage completion of TVET programmes
- iii. Percentage of apprentices completing registered programmes, and having been tested and/or certified for a trade
- iv. Percentage of fully qualified lecturers in TVET
- v. Percentage of TVET colleges with industry partnerships

- vi. Percentage student placement in industry during study
- vii. Percentage employment of graduates (self-employment; employer)
- viii. Percentage of companies providing apprenticeship and other types of training (see WIPO, INSEAD and Cornell University (2019:section 5.1.2 – South Africa in rank 37 for 2018)
- ix. Employer satisfaction with TVET graduates
- x. Quality of TVET according to GCI Pillar 6
- xi. Technician: researcher ratio across NSI institutions
- xii. Percentage of colleges that introduced a product innovation in the last two years
- xiii. Percentage of colleges that introduced significant curriculum changes in the last two years
- xiv. Percentage of colleges that introduced new e-learning and management tools in the last two years
- xv. Percentage of colleges that introduced new partnerships in the last two years

The five input indicators measure budgeted DHESI expenditure on TVET, as well as expenditure per student, and expenditure on lecturer development and apprenticeships. The indicator for ICT development is quasi-synoptic in nature. The future capacity indicators include a proxy indicator for lifelong learning consistent with emerging global interest in this need. The 15 quality and innovation indicators are most relevant to the purpose of the study. The collection and collation of the data needed to populate these indicators will require a dedicated survey at a level comparable to that needed for the triennial National Innovation Survey. Such a survey could benefit from close interaction with the parties responsible for producing South Africa's contributions to the GCI and GII.

The M&E of TVET systems must necessarily address formative, summative and outcome dimensions, with the latter interrogated against stakeholder priorities. The situational analysis of Section 7 serves to provide the politico-economic, socio-cultural and education context within which TVET M&E is conducted.

A properly grounded M&E exercise would consider the TVET system within its particular Value Net.

⁶ Workplace-based learning is defined as an educational component of an occupational qualification that provides students with real-life work experiences where they can apply academic and technical skills and increase the prospect of employability. A workplace-based learning programme means an intervention as contemplated in an occupational qualification during which a person internalises knowledge, skills and competencies, and gains insights through exposure to work by achieving specific outcomes and which enhances employability (RSA, 2018).

Nalebuff and Brandenburger (1997) developed the Value Net conceptual tool to examine businesses with respect to their suppliers, customers, competitors and ‘co-opetitors’, the latter normally being competitors, but with whom a short-term collaboration is engaged in; hence ‘co-opetition.’ A suitably modified Value Net for TVET is shown in Figure 10.2.

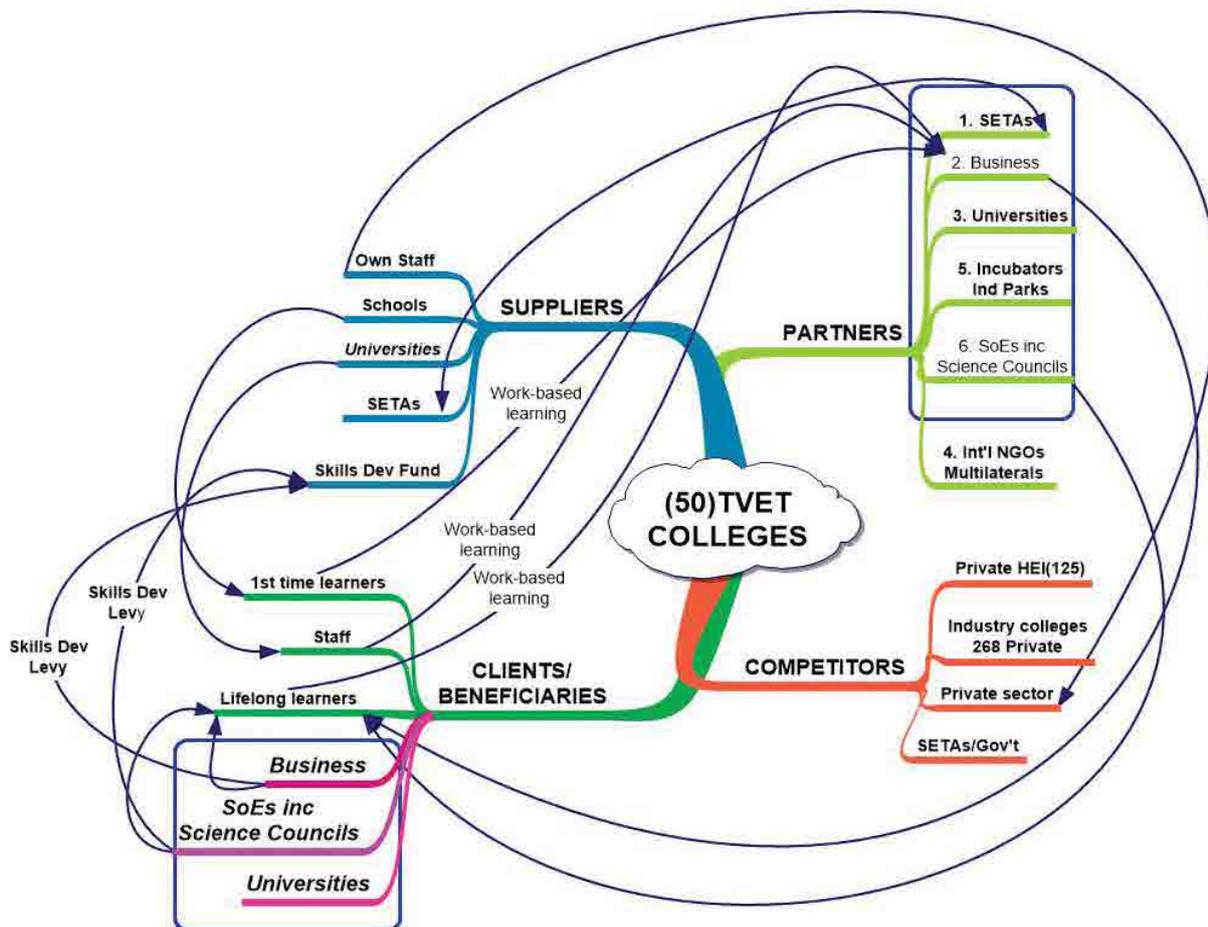


Figure 10.2: TVET Value Net

Source: World Economic Forum (2019)

This entails re-thinking the tool to suit non-profit educational institutions that function in the space of public goods. Accordingly, suppliers are replaced as ‘inputs’, customers are understood to be ‘beneficiaries’, competitors remain ‘competitors’, and co-opetitors become ‘partners’. The main linkages among the members of the Value Net, especially those of SETA/SDF flows and WBL, are provided below.

- Inputs include the sources of funds (DHESI, SETAs, SDF) and people, be these staff or students. Other organisations such as universities and NPOs also provide inputs to TVET.
- Beneficiaries include business, SoCs, science councils, universities and lifelong learners.
- Competitors are the numerous private TVET-equivalent colleges, HEIs, industry training centres and foreign bodies.

- Partners include beneficiary organisations, some competitors and the SETAs.

The Value Net serves as a completeness check for the 25 indicators.

With the outbreak of the Covid-19 pandemic and the enforcement of related protocols, in particular the imperative for social distancing, which prohibits large gatherings, an open distance e-learning (ODEL) mode of interaction has become vital.

The critical question might need to be posed: How would the measurement, and monitoring and evaluation of innovation in TVET change under the ‘with-Covid-19’ scenario?

II. TVET, OR NOT TVET? THERE IS NO QUESTION

This report has provided an overview of the status of innovation in TVET colleges. The document review, online survey and interviews with key stakeholders, together with situational and SWOT analyses, provide the basis for identifying a set of 25 TVET indicators, representing a groundbreaking contribution to our understanding of the sector. It has been found that the level of innovation, seen through the lenses of the conventional measurement scheme of the Oslo Manual and the UNESCO-UNEVOC conceptualisation, is low. The reasons for this are many, and include the absence of a culture of innovation, significant organisational disruption and the massification of the sector alongside staff provision with no or inadequate industry experience. Yet, there are examples of creative innovation in some colleges, and these should be celebrated.

As argued in the report, both globally and nationally, TVET has mainly been situated outside the ambit of the NSI. In recognition of this silence, the consultants broadened the scope of the study to address the hiatus. Specifically, tasks (i) to (iii) were added to the terms of reference.

The key recommendation of this report is to re-conceptualise and integrate TVET within the NSI. This recommendation is made on the basis that TVET, as a major component of post-secondary education and training, has an indispensable role to play in the national development agenda. The mid-level technical skills provided by the TVET sector are an indispensable component of industrial and corporate development in the private sector – one that needs to create employment and be responsive to a range of national development goals. It is evident that the TVET system is in need of far-reaching renewal to fulfil its mandate. The system, which emerged from servicing a fragmented and exclusionary apartheid system based on the mineral-energy complex, must undergo considerable change and transformation to meet the needs of the rapidly evolving economy and world of work.

This calls for three levels of action:

- i. The renewal of the policy, governance and leadership environment
- ii. Concerted attention to the functional competence to fulfil its mandate
- ii. System-level monitoring and evaluation, and measurement to ensure policy learning, efficiency and effectiveness

These are detailed below.

i. **The renewal of the policy, governance and leadership environment**

The recommendation for the review of policy is made on the basis that current policies on TVET colleges are not designed to enable innovation and innovation activities in, and by, TVET colleges. The top-down governance of TVET colleges has been found to hamper the effectiveness of colleges, and to impact negatively on a culture of innovative practice.

The neglect of this aspect has contributed to a moribund system that is less than effective for its core constituents: lecturers, students and employers. Failing to situate the colleges at the centre of curriculum renewal, for instance, makes them less responsive to their immediate environment, especially with respect to labour market demand.

While much has been done to develop national qualifications, admittedly with the involvement of industry stakeholders, the assumption that these industry players represent local and regional entities to which these colleges have to respond is perhaps unjustified. There is no substitute for local relationship-building.

A key gap in leadership thinking concerns innovation itself. It is suggested that a concerted attempt be made to enable colleges to engage with innovators, and thereby to enhance their understanding of the complexities of issues

related to the NSI. A comprehensive training programme for the senior management of colleges and departmental supervisory staff is proposed as a starting point on the journey of inclusion.

As pointed out earlier in this report, TVET college 'leaders' should be given the autonomy to experiment even further, and then to share that experience among their peers. Such intra-sectoral mentorship through innovation, and innovation through mentorship, could be most valuable. This requires the support of the DHESI, the SETAs and the NSF.

ii. Concerted attention to the functional competence required to fulfil its mandate

College effectiveness has been found to be sub-optimal. Staffing is seen to be less than effective in terms of employees' functional competence, due in a large measure to their lack of workplace or industrial experience and expertise in their field. This impacts quite significantly on their ability to link with local labour markets. As is noted for conventional innovation systems, if there is limited interaction among the main actors, it is a stretch to refer to it as a system. Yet, some interaction is what is, in fact, required before the sector can be taken seriously by others. TVET colleges will be part of the NSI through linkages and interaction, and without some degree of intersectoral linkages and synergy, it will simply not be able to take its place in the NSI, which requires mutual respect and understanding from all parties.

A process to assess lecturers against recent, relevant experience, coupled with the requirement for both academic and professional qualifications, would be an essential step towards revitalising the sector. Identified shortcomings may then be addressed through CPD.

TVET colleges play a distinctive and unique role in education, compared to universities and universities of technology. They are not expected, nor do they have the capacity, to conduct academic research. Their role in undertaking user-oriented applied research needs to be articulated as a contribution to the NSI. They must be considered as essential contributors to a range of innovation activities.

It is thus not unreasonable to expect the emerging centres of specialisation to serve as bridges that link TVET colleges with neighbouring HEIs and other innovation actors.

iii. System-level M&E and measurement to ensure policy learning, efficiency and effectiveness

Policy learning depends upon the availability of reliable, up-to-date information, and political will and capability, so that an appropriate, sustainable, but correctable, path may be forged. The TVET college system, however, has very little data that tracks progress.

The centralised TVET-MIS remains a work in progress and is not up and running – at least not for information that needs to be publicly available. While the system is currently in the process of being centralised, the information systems are lagging behind. A national management information system for TVET colleges will go a long way towards enabling the TVET system to take its rightful place in the NSI.

The management information system is a critical requirement for the continuous monitoring and evaluation of TVET as a subsystem within post-school education and training. This will allow for tracking and identifying the continuing challenges of a system long neglected in official discourse.

It is suggested that policy-makers give consideration to the role of TVET in innovation for growth and wellbeing. The advantages of inclusion are manifold, not the least because of the importance of this level of skills development to economic and social development.

In conclusion, the following is noted:

- There are pockets of innovation practice in the TVET colleges.
- Innovation leaders may mentor those that are lagging.
- There is a willingness, and a need, to engage.

The three recommendations together provide the basis for the recognition of TVET as an essential actor in the NSI.

The consultants hereby express their appreciation to all those whose efforts contributed to this work: the NACI Secretariat, DHESI officials, TVET colleges, stakeholders and CREST. We have learnt a great deal.

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APPENDICES

Appendix 1: Online survey instrument



science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



STATUS OF INNOVATION IN TVET COLLEGES

Dear Principal

The Minister of Higher Education, Science and Innovation has requested the National Advisory Council of Innovation (NACI) to carry out a study on the **status of innovation in TVET colleges**.

This survey (adapted from that of the UNESCO-UNEVOC project) is conducted by professors Akoojee, Kahn and Letseka under commission to NACI, and seeks to collect data from the TVET colleges on the nature and effectiveness of the TVET sector as a source of, and contributor to innovation. A letter of endorsement from the Director-General of the Department of Science and Innovation is attached.

It is understood that a survey cannot fully replace direct interaction with stakeholders. However, we appreciate that the Covid-19 pandemic presents unique challenges for all activities in homes, fields, laboratories, enterprises and education facilities. It may well be that we shall live with the Coronavirus into the foreseeable future.

Innovation arises from many innovation activities involving developmental, financial and commercial activities. Such innovation activities include technology management, engineering, design and other creative work, marketing, research and development (R&D), intellectual property registration and licensing, employee training, software and database development, and the acquisition or leasing of machinery, software, computers and infrastructure. Innovation may be 'hard' or 'soft,' and occurs in firms, the public sector and civil society.

Your cooperation in responding to the eight items of the survey is requested. We expect that this will require some 10 to 15 minutes of your time. The survey autosaves as you proceed. Kindly respond by Friday, 20 November 2020.

The provisions of the Protection of Personal Information Act apply, and all responses will be treated as strictly confidential and remain non-attributable.

Completion of the survey is understood as your acknowledgment of informed consent.

Should you have any queries, please email Professor Michael Kahn: mjkahn.innovate@gmail.com.

Thank you for your comments, insights and wisdom.

Michael Kahn, Salim Akoojee and Moeketsi Letseka.



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Dear participant

THE STATE OF INNOVATION IN THE TVET SECTOR

We live in the most challenging of times. Innovation in the time of Covid-19. The challenges of poverty, inequality and unemployment are now joined by the unforeseen complexities of Covid-19. Much has been disrupted; much will change. Innovation, the art and science of doing new things, will be critical to shaping and managing these changes. We understand that there can be no return to 'business as usual', and, among others, parties look to the actors of the National System of Innovation to take us forward. The National System of Innovation includes universities, TVET colleges, public research organisations, business and civil society that work together to generate innovation. Such innovation contributes to sustainable development, wellbeing and improving our quality of life.

The Department of Science and Innovation (DSI) has therefore requested the National Advisory Council on Innovation (NACI) to conduct an in-depth study into the role of the TVET colleges in the National System of Innovation. The study will be a first for our country, and is expected to offer groundbreaking insights. This confidential survey is an important component of the study.

We request that you give some time to complete the survey and thereby share your views on TVET college innovation activities. It is anticipated that the study will report early in 2021. Your cooperation is appreciated.

Warm regards
Phil Mjwara
Director-General
2 November 2020



STATUS OF INNOVATION IN TVET COLLEGES

**1. What type of services and/or products are provided by your college?
(More than one answer possible) [Mark with X as appropriate]**

- a. School/institution/college-based training only
- b. Workplace-based training (on-the-job instruction) only
- c. Combination of types of training (institution and on-the-job instruction)
- d. Blended learning – remote and on-site academic programmes
- e. Remote practical training
- f. Career and employment guidance
- g. Recognition, validation and certification

**2. Provide a statement as to how you define innovation in your TVET college
(Maximum 50 words)**

**3. What types of activities are deployed by your institution in order to develop and
implement innovation? (More than one answer possible) [Mark with X as appropriate]**

- a. Infrastructure and advanced equipment investment
- b. Marketing and promotional activities
- c. Development, introduction or presence of incubators for TVET learners
- d. Intellectual property-related activities (patents, trademarks, etc.)
- e. Training activities for academic and support staff
- f. Software development and database activities
- g. Development of related financial expertise
- h. Participation in national and international skills competitions
- i. Development or introduction of internationalisation strategies

4. For a specific innovation that your TVET college has introduced, please name and describe the initiative, its objectives and expected outcomes. (Maximum 100 words)

5. Which of the following elements are present in this specific innovation? (More than one answer possible) [Mark with X as appropriate]

- a. Providing people with labour market-relevant skills
- b. Providing higher-level TVET programmes or learning pathways
- c. Providing guidance services or validation of prior learning
- d. Establishing business-education partnerships
- e. Working with SMEs
- f. Development or introduction of TVET curricula with stakeholders
- g. Development or introduction of innovative teaching/training methods
- h. Development or introduction of entrepreneurial competences
- i. Development or introduction of project-based learning
- j. Development or introduction of business incubators for TVET learners
- k. Providing and supporting staff continuing professional development
- l. Internationalisation to foster transnational mobility of learners and staff.
- m. Acting as or supporting innovation and technology hubs
- n. Participating in national and international skills competitions
- o. Developing sustainable financial models
- p. Innovative mechanisms for on-the-job training
- q. Innovation with respect to practical and workshop training

6. Who are your main partners in the development and implementation of innovation? (More than one answer possible) [Mark with X as appropriate]

- a. Business
- b. SETAs and NSF
- c. Incubators, clusters, industrial parks
- d. Chambers and associations
- e. Organised labour
- f. Other TVET colleges and trainers
- g. TVET College Council
- h. Universities
- i. DHESI or other national entities
- j. Public research institutes
- k. NGOs
- l. international organisations

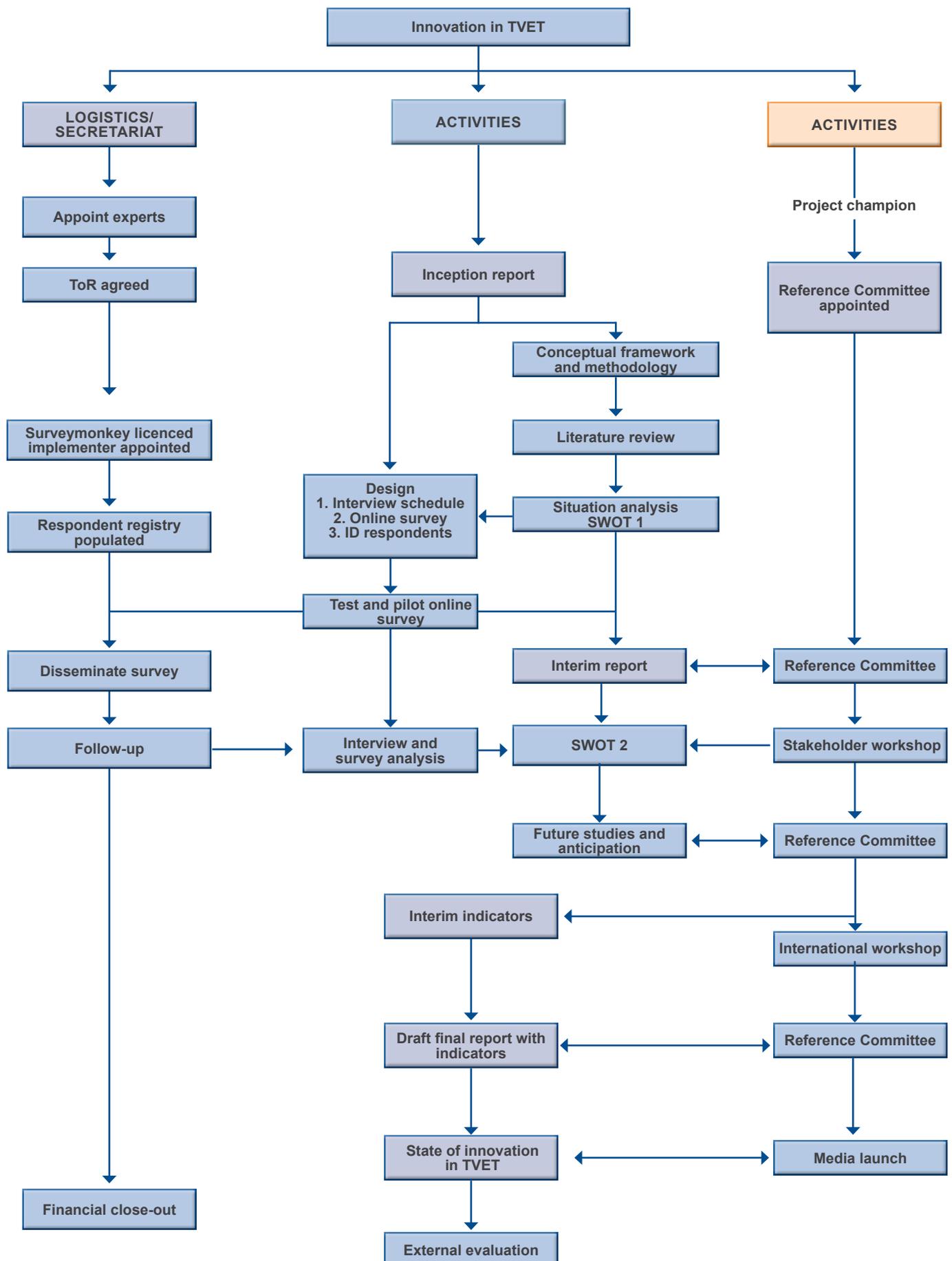
7. What are the main barriers to the development and implementation of innovative practices in TVET? (Rank from 1 (low) to 5 (high))

	1	2	3	4	5
a. Lack of time	<input type="checkbox"/>				
b. Lack of resources	<input type="checkbox"/>				
c. Lack of staff	<input type="checkbox"/>				
d. Inability to respond to labour market demands	<input type="checkbox"/>				
e. Resistance to change (internal)	<input type="checkbox"/>				
f. Lack of a shared vision	<input type="checkbox"/>				
g. Lack of autonomy	<input type="checkbox"/>				
h. Absence of partners for collaboration	<input type="checkbox"/>				
i. Limited experience in collaboration	<input type="checkbox"/>				

8. We would appreciate any other comments that you might wish to share (Maximum 200 words)

Your assistance is most appreciated
Thank you

Appendix 2: Project milestones and critical success factors



Appendix 3: The project team

Prof Salim Akoojee

BA HED (Postgraduate), BEd, MEd, PhD (Wits) and Associate Professor at the University of Nottingham (UK)

He is currently an international education and training technical advisor specialising in TVET and skills development for economic and human development in sub-Saharan Africa and developing contexts.

Prof Moeketsi Letseka

DEd (Unisa), MEd (Wits), BA(Ed) (National University of Lesotho), Professor of Philosophy of Education and incumbent of the UNESCO Chair on Open Distance Learning (ODL) at Unisa

He is an independent researcher, has chaired a technical task team in the Human Resource Development Council, and is in consortia partnerships with Norwegian and Swedish higher education institutions (Erasmus and the Norwegian Programme for Capacity Development in Higher Education and Research for Development), as well as Canadian universities, supported by the New Frontiers in Research Fund.

Prof Michael Kahn

PhD, MA(Ed), DIC, BSc(Hons)

He is an independent analyst specialising in innovation policy, strategy, planning and evaluation. He is an expert facilitator, and is skilled in future studies and synthesis. He advises governments and works with many multilateral organisations, including the United Nations system and the development banks.



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