4. THE STATE OF INNOVATION IN SOUTH AFRICA AND NATIONAL INNOVATION PERFORMANCE

4.1. HUMAN CAPITAL FOR INNOVATION

According to table 28 of the South African Science and Technology Indicators Report62, dated 2010, researchers employed per 1,000 people employed in South Africa stagnates at 1.5%. Female and black graduates are increasing.

Table 28

Table 28: Availability of graduates in all fields per population group and gender (1994, 1999 and 2004)

Population Group	1994	1999	2004
African	72,475	222,647	392,982
Coloured	19,792	38,396	56,440
Indian	29,678	54,275	77,650
White	390,216	519,081	611,411
Unknown	30,235	37,556	38,014
Total	**542,396**	**871,955**	**1,176,497**

Gender	1994	1999	2004
Female	222,563	395,094	569,544
Male	319,832	476,859	606,951
Total	**542,395**	**871,953**	**1,176,495**

Source: Trends in Public Higher Education in South Africa: 1995 to 2004. SAQA, 2007

Taking into account recent OECD data updated (2017), the number of researchers (indicator) in South Africa is slightly increasing from 1.394 in 2009 to 1.570 in 2013

Researchers Total, Per 1 000 employed, 2009 – 2015

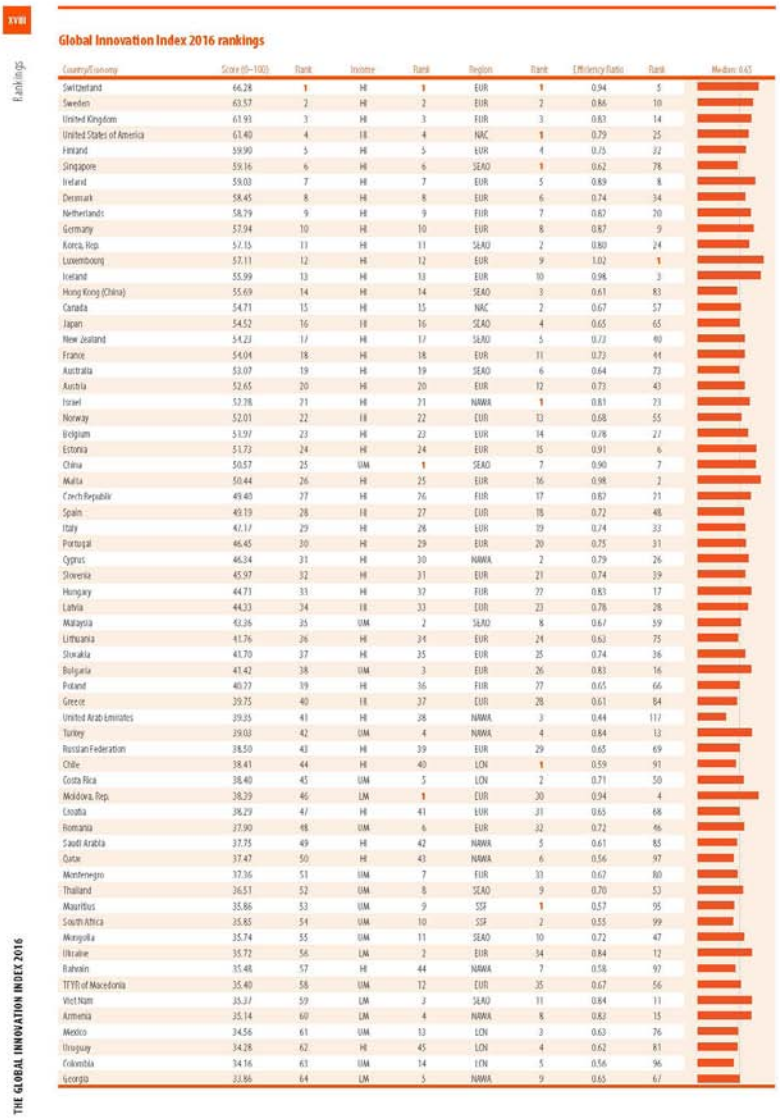
Location	2009	2010	2011	2012	2013	2014	2015
OECD - Total	7.479	7.480	7.670	7.754	7.917	8.051	
China (People's Republic of)	1.520	1.591	1.725	1.830	1.928	1.973	
Czech Republic	5.628	5.779	6.083	6.559	6.745	7.054	7.352
Finland	16.333	16.678	15.902	15.948	15.557	15.267	15.022
France	8.724	9.055	9.195	9.520	9.764	9.758	
Germany	7.760	7.996	8.146	8.379	8.374	8.249	8.304
Greece			5.631	6.041	7.311	7.471	8.724
Italy	4.086	4.176	4.273	4.470	4.776	4.856	4.930
Japan	10.149	10.170	10.206	10.034	10.185	10.470	10.110
Korea	10.384	11.084	11.916	12.787	12.840	13.495	13.743

62 South African Science and Technology Indicators Report, 2010, NACI

Russia	6.372	6.321	6.317	6.196	6.171	6.218	6.211
Singapore	10.211	10.313	10.444	10.168	10.311	10.118	
Slovenia	7.576	8.006	9.275	9.479	9.394	9.210	8.391
South Africa		1.358	1.430	1.482	1.570		
United States	8.801	8.479	8.814	8.733	8.933	9.103	

Source: Main Science and Technology Indicators, OECD (2017), Researchers (indicator). doi: 10.1787/20ddfb0f-en (Accessed on 23 May 2017)

4.2. INNOVATION PERFORMANCE



XVIII

Rankings

Global Innovation Index 2016 rankings

Country/Economy	Score (0–100)	Rank	Income	Rank	Region	Rank	Efficiency Ratio	Rank	Median: 0.63
Switzerland	66.28	1	HI	1	EUR	1	0.94	5	
Sweden	63.57	2	HI	2	EUR	2	0.86	10	
United Kingdom	61.93	3	HI	3	EUR	3	0.83	14	
United States of America	61.40	4	HI	4	NAC	1	0.79	25	
Finland	59.90	5	HI	5	EUR	4	0.76	32	
Singapore	59.16	6	HI	6	SEAO	1	0.62	78	
Ireland	59.03	7	HI	7	EUR	5	0.89	8	
Denmark	58.45	8	HI	8	EUR	6	0.74	34	
Netherlands	58.29	9	HI	9	EUR	7	0.87	20	
Germany	57.94	10	HI	10	EUR	8	0.87	9	
Korea, Rep.	57.15	11	HI	11	SEAO	2	0.80	24	
Luxembourg	57.11	12	HI	12	EUR	9	1.02	1	
Iceland	55.99	13	HI	13	EUR	10	0.98	3	
Hong Kong (China)	55.69	14	HI	14	SEAO	3	0.61	83	
Canada	54.71	15	HI	15	NAC	2	0.67	57	
Japan	54.52	16	HI	16	SEAO	4	0.65	65	
New Zealand	54.23	17	HI	17	SEAO	5	0.73	40	
France	54.04	18	HI	18	EUR	11	0.73	44	
Australia	53.07	19	HI	19	SEAO	6	0.64	73	
Austria	52.65	20	HI	20	EUR	12	0.73	43	
Israel	52.38	21	HI	21	NAWA	1	0.83	23	
Norway	52.01	22	HI	22	EUR	13	0.68	55	
Belgium	51.97	23	HI	23	EUR	14	0.78	27	
Estonia	51.73	24	HI	24	EUR	15	0.91	6	
China	50.57	25	UM	1	SEAO	7	0.90	7	
Malta	50.44	26	HI	25	EUR	16	0.98	2	
Czech Republic	49.40	27	HI	26	EUR	17	0.87	21	
Spain	49.19	28	HI	27	EUR	18	0.72	48	
Italy	47.17	29	HI	28	EUR	19	0.74	33	
Portugal	46.45	30	HI	29	EUR	20	0.75	31	
Cyprus	46.34	31	HI	30	NAWA	2	0.79	26	
Slovenia	45.97	32	HI	31	EUR	21	0.74	39	
Hungary	44.71	33	HI	32	EUR	22	0.83	17	
Latvia	44.33	34	HI	33	EUR	23	0.78	28	
Malaysia	42.26	35	UM	2	SEAO	8	0.67	59	
Lithuania	41.76	36	HI	34	EUR	24	0.62	75	
Slovakia	41.70	37	HI	35	EUR	25	0.74	36	
Bulgaria	41.42	38	UM	3	EUR	26	0.83	16	
Poland	40.27	39	HI	36	EUR	27	0.65	66	
Greece	39.75	40	HI	37	EUR	28	0.61	84	
United Arab Emirates	39.35	41	HI	38	NAWA	3	0.44	117	
Turkey	39.03	42	UM	4	NAWA	4	0.84	13	
Russian Federation	38.50	43	HI	39	EUR	29	0.65	69	
Chile	38.41	44	HI	40	LCN	1	0.59	91	
Costa Rica	38.40	45	UM	5	LCN	2	0.71	50	
Moldova, Rep.	38.39	46	LM	1	EUR	30	0.94	4	
Croatia	36.29	47	HI	41	EUR	31	0.65	68	
Romania	37.90	48	UM	6	EUR	32	0.72	46	
Saudi Arabia	37.75	49	HI	42	NAWA	5	0.61	85	
Qatar	37.47	50	HI	43	NAWA	6	0.56	97	
Montenegro	37.36	51	UM	7	EUR	33	0.67	80	
Thailand	36.51	52	UM	8	SEAO	9	0.70	53	
Mauritius	35.86	53	UM	9	SSF	1	0.57	95	
South Africa	35.85	54	UM	10	SSF	2	0.55	99	
Mongolia	35.74	55	UM	11	SEAO	10	0.72	47	
Ukraine	35.72	56	LM	2	EUR	34	0.84	12	
Bahrain	35.48	57	HI	44	NAWA	7	0.58	92	
TFYR of Macedonia	35.40	58	UM	12	EUR	35	0.67	56	
Viet Nam	35.37	59	LM	3	SEAO	11	0.84	11	
Armenia	35.14	60	LM	4	NAWA	8	0.82	15	
Mexico	34.56	61	UM	13	LCN	3	0.63	76	
Uruguay	34.28	62	HI	45	LCN	4	0.62	81	
Colombia	34.16	63	UM	14	LCN	5	0.56	96	
Georgia	33.86	64	LM	5	NAWA	9	0.65	67	

THE GLOBAL INNOVATION INDEX 2016

Global Innovation Index 2016[63]

Global Innovation Index 2016 rankings *(continued)*

Country/Economy	Score (0–100)	Rank	Income	Rank	Region	Rank	Efficiency Ratio	Rank	Median 0.43
Serbia	33.75	65	UM	15	EUR	36	0.65	70	
India	33.61	66	LM	6	CSA	1	0.66	63	
Kuwait	33.61	67	HI	46	NAWA	10	0.73	42	
Panama	33.49	68	UM	16	LCN	6	0.66	61	
Brazil	33.19	69	UM	17	LCN	7	0.55	100	
Lebanon	32.70	70	UM	18	NAWA	11	0.73	41	
Peru	32.51	71	UM	19	LCN	8	0.51	109	
Morocco	32.26	72	LM	7	NAWA	12	0.66	64	
Oman	32.21	73	HI	47	NAWA	13	0.53	103	
Philippines	31.83	74	LM	8	SEAO	17	0.71	49	
Kazakhstan	31.51	75	UM	20	CSA	2	0.51	108	
Dominican Republic	30.55	76	UM	21	LCN	9	0.62	82	
Tunisia	30.55	77	UM	22	NAWA	14	0.60	86	
Iran, Islamic Rep.	30.52	78	UM	23	CSA	3	0.71	51	
Belarus	30.39	79	UM	24	EUR	37	0.45	116	
Kenya	30.36	80	LM	9	SSF	3	0.76	30	
Argentina	30.24	81	HI	48	LCN	10	0.56	98	
Jordan	30.04	82	UM	25	NAWA	15	0.67	58	
Rwanda	29.96	83	LI	1	SSF	4	0.38	123	
Mozambique	29.84	84	LI	2	SSF	5	0.73	45	
Azerbaijan	29.64	85	UM	26	NAWA	16	0.54	101	
Tajikistan	29.62	86	LM	10	CSA	4	0.77	29	
Bosnia and Herzegovina	29.62	87	UM	27	EUR	38	0.46	115	
Indonesia	29.07	88	LM	11	SEAO	13	0.71	52	
Jamaica	28.97	89	UM	28	LCN	11	0.53	104	
Botswana	28.96	90	UM	29	SSF	6	0.42	119	
Sri Lanka	28.92	91	LM	12	CSA	5	0.70	54	
Albania	28.38	92	UM	30	EUR	39	0.40	121	
Namibia	28.24	93	UM	31	SSF	7	0.54	102	
Paraguay	28.20	94	UM	32	LCN	12	0.62	77	
Cambodia	27.94	95	LI	3	SEAO	14	0.59	90	
Bhutan	27.88	96	LM	13	CSA	6	0.78	178	
Guatemala	27.30	97	LM	14	LCN	13	0.62	79	
Malawi	27.26	98	LI	4	SSF	8	0.74	38	
Uganda	27.14	99	LI	5	SSF	9	0.52	106	
Ecuador	27.11	100	UM	33	LCN	14	0.60	87	
Honduras	26.94	101	LM	15	LCN	15	0.53	105	
Ghana	26.66	102	LM	16	SSF	10	0.60	88	
Kyrgyzstan	26.62	103	LM	17	CSA	7	0.50	110	
El Salvador	26.56	104	LM	18	LCN	16	0.48	113	
Tanzania, United Rep.	26.35	105	LI	6	SSF	11	0.81	22	
Senegal	26.14	106	LM	19	SSF	12	0.66	62	
Egypt	25.96	107	LM	20	NAWA	17	0.63	74	
Côte d'Ivoire	25.80	108	LM	21	SSF	13	0.82	19	
Bolivia, Plurinational St.	25.24	109	LM	22	LCN	17	0.59	89	
Ethiopia	24.83	110	LI	7	SSF	14	0.83	18	
Madagascar	24.79	111	LI	8	SSF	15	0.74	35	
Mali	24.77	112	LI	9	SSF	16	0.74	37	
Algeria	24.46	113	UM	34	NAWA	18	0.49	111	
Nigeria	23.15	114	LM	23	SSF	17	0.67	60	
Nepal	23.13	115	LI	10	CSA	8	0.58	94	
Nicaragua	23.06	116	LM	24	LCN	18	0.41	120	
Bangladesh	22.86	117	LM	25	CSA	9	0.52	107	
Cameroon	22.82	118	LM	26	SSF	18	0.58	93	
Pakistan	22.60	119	LM	27	CSA	10	0.64	71	
Venezuela, Bolivarian Rep.	22.32	120	HI	49	LCN	19	0.46	114	
Benin	22.25	121	LI	11	SSF	19	0.43	118	
Burkina Faso	21.05	122	LI	12	SSF	20	0.28	127	
Burundi	20.90	123	LI	13	SSF	21	0.39	122	
Niger	20.44	124	LI	14	SSF	22	0.36	125	
Zambia	19.92	125	LM	28	SSF	23	0.64	72	
Togo	18.42	126	LI	15	SSF	24	0.36	124	
Guinea	17.24	127	LI	16	SSF	25	0.49	112	
Yemen	14.55	128	LM	29	NAWA	19	0.34	126	

Note: World Bank Income Group Classification (July 2015): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification: EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia, East Asia, and Oceania; NAWA = Northern Africa and Western Asia; SSF = Sub-Saharan Africa.

63 Global Innovation Index 2016, WIPO

South Africa

281

II: Country/Economy Profiles

Key indicators

Population (millions)	54.5
GDP (US$ billions)	313.0
GDP per capita, PPP$	13,165.2
Income group	Upper-middle income
Region	Sub-Saharan Africa

		Score (0–100) or value (hard data)	Rank	
Global Innovation Index (out of 128)		**35.8**	**54**	
Innovation Output Sub-Index		25.6	71	
Innovation Input Sub-Index		46.1	47	
Innovation Efficiency Ratio		0.6	99	○
Global Innovation Index 2015 (out of 141)		37.4	60	
1	**Institutions**	**69.1**	**46**	
1.1	Political environment	54.6	56	
1.1.1	Political stability & safety*	61.0	72	
1.1.2	Government effectiveness*	48.2	51	
1.2	Regulatory environment	74.6	38	
1.2.1	Regulatory quality*	52.7	59	
1.2.2	Rule of law*	51.1	53	
1.2.3	Cost of redundancy dismissal, salary weeks	9.3	28	
1.3	Business environment	78.1	38	
1.3.1	Ease of starting a business*	81.2	89	
1.3.2	Ease of resolving insolvency*	64.3	38	
1.3.3	Ease of paying taxes*	88.8	19	●
2	**Human capital & research**	**33.1**	**55**	
2.1	Education	44.4	74	
2.1.1	Expenditure on education, % GDP	6.1	24	●
2.1.2	Gov't expenditure/pupil, secondary, % GDP/cap	19.0	61	
2.1.3	School life expectancy, years	13.2	68	
2.1.4	PISA scales in reading, maths, & science	n/a	n/a	
2.1.5	Pupil-teacher ratio, secondary©	25.0	94	○
2.2	Tertiary education	27.4	89	
2.2.1	Tertiary enrolment, % gross	19.7	92	○
2.2.2	Graduates in science & engineering, %	19.0	63	
2.2.3	Tertiary inbound mobility, %	4.1	37	
2.3	Research & development (R&D)	27.7	40	
2.3.1	Researchers, FTE/mn pop.©	404.7	62	
2.3.2	Gross expenditure on R&D, % GDP©	0.7	45	
2.3.3	Global R&D companies, avg. expend. top 3, mn $US	46.0	37	
2.3.4	QS university ranking, average score top 3*	46.6	32	
3	**Infrastructure**	**37.4**	**85**	
3.1	Information & communication technologies (ICTs)	39.7	84	
3.1.1	ICT access*	53.1	74	
3.1.2	ICT use*	33.7	73	
3.1.3	Government's online service*	38.6	83	
3.1.4	E-participation*	33.3	89	○
3.2	General infrastructure	38.6	54	
3.2.1	Electricity output, kWh/cap	4,762.8	43	
3.2.2	Logistics performance*	3.4	33	
3.2.3	Gross capital formation, % GDP	20.0	85	
3.3	Ecological sustainability	33.8	101	○
3.3.1	GDP/unit of energy use, 2005 PPP$/kg oil eq	4.2	110	○
3.3.2	Environmental performance*	70.5	74	
3.3.3	ISO 14001 environmental certificates/bn PPP$ GDP	1.3	55	
4	**Market sophistication**	**58.7**	**17**	●
4.1	Credit	39.9	44	
4.1.1	Ease of getting credit*	60.0	53	
4.1.2	Domestic credit to private sector, % GDP	151.5	7	●
4.1.3	Microfinance gross loans, % GDP©	0.0	77	○
4.2	Investment	66.0	10	●
4.2.1	Ease of protecting minority investors*	71.7	14	●
4.2.2	Market capitalization, % GDP	266.8	1	●
4.2.3	Total value of stocks traded, % GDP	92.7	6	●
4.2.4	Venture capital deals/bn PPP$ GDP	0.0	49	
4.3	Trade, competition, & market scale	70.3	33	
4.3.1	Applied tariff rate, weighted mean, %	4.0	71	
4.3.2	Intensity of local competition†	72.5	42	
4.3.3	Domestic market scale, bn PPP$	707.1	28	●
5	**Business sophistication**	**32.2**	**56**	
5.1	Knowledge workers	36.4	70	
5.1.1	Knowledge-intensive employment, %	24.8	56	
5.1.2	Firms offering formal training, % firms©	36.8	41	
5.1.3	GERD performed by business, % of GDP©	0.3	43	
5.1.4	GERD financed by business, %©	38.3	39	
5.1.5	Females employed w/advanced degrees, % total	10.2	62	
5.2	Innovation linkages	31.7	59	
5.2.1	University/industry research collaboration†	58.1	30	
5.2.2	State of cluster development†	53.6	32	
5.2.3	GERD financed by abroad, %©	13.1	35	
5.2.4	JV–strategic alliance deals/bn PPP$ GDP	0.0	44	
5.2.5	Patent families 2+ offices/bn PPP$ GDP	0.4	35	
5.3	Knowledge absorption	28.6	63	
5.3.1	Intellectual property payments, % total trade	1.5	15	●
5.3.2	High-tech imports less re-imports, % total trade	9.7	34	
5.3.3	ICT services imports, % total trade	0.9	64	
5.3.4	FDI net inflows, % GDP	1.6	88	
5.3.5	Research talent, % in business enterprise©	21.3	52	
6	**Knowledge & technology outputs**	**24.7**	**63**	
6.1	Knowledge creation	15.7	52	
6.1.1	Patents by origin/bn PPP$ GDP	1.1	62	
6.1.2	PCT patent applications/bn PPP$ GDP	0.4	38	
6.1.3	Utility models by origin/bn PPP$ GDP	n/a	n/a	
6.1.4	Scientific & technical articles/bn PPP$ GDP	15.6	46	
6.1.5	Citable documents H index	292.0	33	
6.2	Knowledge impact	35.4	67	
6.2.1	Growth rate of PPP$ GDP/worker, %	(0.4)	94	○
6.2.2	New businesses/th pop. 15–64©	6.5	18	●
6.2.3	Computer software spending, % GDP	0.4	25	
6.2.4	ISO 9001 quality certificates/bn PPP$ GDP	5.3	61	
6.2.5	High- & medium-high-tech manufactures, %©	28.2	42	
6.3	Knowledge diffusion	22.9	73	
6.3.1	Intellectual property receipts, % total trade	0.1	50	
6.3.2	High-tech exports less re-exports, % total trade	2.5	48	
6.3.3	ICT services exports, % total trade	0.5	94	○
6.3.4	FDI net outflows, % GDP	2.0	32	
7	**Creative outputs**	**26.5**	**77**	
7.1	Intangible assets	38.2	83	
7.1.1	Trademarks by origin/bn PPP$ GDP	29.0	68	
7.1.2	Industrial designs by origin/bn PPP$ GDP	1.1	64	
7.1.3	ICTs & business model creation†	59.2	59	
7.1.4	ICTs & organizational model creation†	56.1	53	
7.2	Creative goods & services	24.7	55	
7.2.1	Cultural & creative services exports, % of total trade	0.1	47	
7.2.2	National feature films/mn pop. 15–69	0.7	83	○
7.2.3	Global ent. & media market/th pop. 15–69	8.1	38	
7.2.4	Printing & publishing manufactures, %©	2.4	15	●
7.2.5	Creative goods exports, % total trade	0.8	42	
7.3	Online creativity	4.8	77	
7.3.1	Generic top-level domains (TLDs)/th pop. 15–69	3.5	60	
7.3.2	Country-code TLDs/th pop. 15–69	10.2	40	
7.3.3	Wikipedia edits/mn pop. 15–69	363.8	93	○
7.3.4	Video uploads on YouTube/pop. 15–69	3.0	67	○

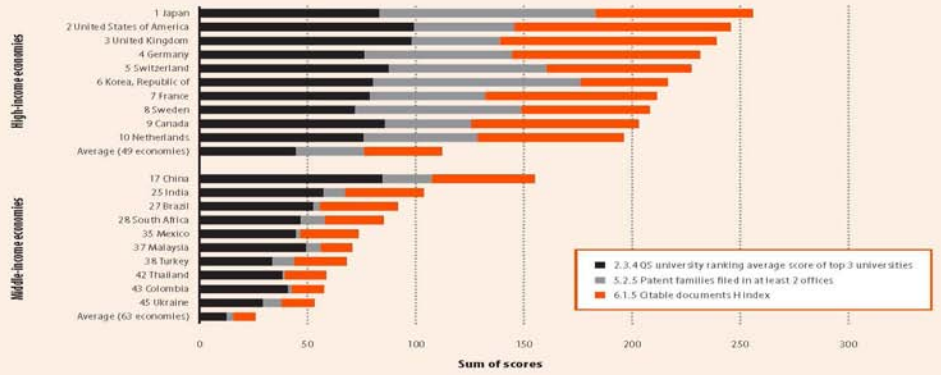
NOTES: ● indicates a strength; ○ a weakness; * an index; † a survey question.
© indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data.
Square brackets indicate a top 10 or 100 or below sub-pillar ranking in the presence of a relevant number of missing variables; see page 172 of this appendix for details.

THE GLOBAL INNOVATION INDEX 2016

In addition to the key indicators of the Global Innovation Index above, Figure 4.1 (below) rates South Africa at 28 of 76 developing countries for a combined index reflecting university ranking, patents and publications.

Box 4: Innovation quality: Japan, the USA, and the UK at the top *(continued)*

Figure 4.1: Metrics for quality of innovation: Top 10 high- and top 10 middle-income economies



Notes: Numbers to the left of the economy name are the innovation quality rank. Economies are classified by income according to the World Bank Income Group Classification (July 2014). Upper- and lower-middle income categories are grouped together as middle-income economies.

the Russian Federation, now a high-income economy, improves in both the GII overall and in the quality of innovation rankings this year. The Russian Federation's overall score for this composite indicator places this country in the 26th spot among all other economies, just between the rankings of India and Brazil.

This year Seychelles, Argentina, and Hungary are no longer part of the top 10 group of middle-income economies in innovation quality. Seychelles is not included in the GII 2016 as a result of insufficient data coverage, and Argentina and Hungary are now being classified as high-income economies.[1] These shifts lead Mexico, Malaysia, and Turkey—three economies that have been in the middle-income top 10 since this innovation quality metric was introduced—to move ahead in the rankings. In particular, their rise can be credited to higher scores in the quality of universities for Mexico; a constant performance in all three innovation quality indicators for Malaysia; and an improved score in patent families for Turkey. These shifts also allow Thailand, Colombia, and Ukraine to enter the top 10 rankings of middle-income economies this year.

Note

1 This classification is according to the World Bank's estimates of gross national income (GNI) per capita for the previous year.

Priority sectors

Appropriate data and reports are to be identified to assess specific sectors such as the mining and minerals beneficiation, health, energy, space science, nanotechnology, biotechnology, dti sector clusters.

Technology Roadmaps

A South African Additive Manufacturing Technology Roadmap

The Department of Science and Technology (DST) has commissioned the development of an Additive Manufacturing Technology Roadmap for South Africa. The purpose of this Roadmap is to identify future addressable market opportunities and products in which additive manufacturing (AM) technology development is required to position South Africa as a competitor in the global market. In this Roadmap

prioritised focus areas are identified and programmes defined that can guide public and private sector investment in AM research, development and innovation (RDI) in South Africa for the period 2014-2023. This Roadmap was developed through a combination of desk research, international market research, facilitated stakeholder workshops, a survey of local capabilities through meetings and questionnaires, and deliberations within the project core team comprising local experts in AM and technology road mapping approaches.

AM or 3D printing is a new, emerging and disruptive manufacturing technology and is generally considered as one of the key technologies for manufacturing in the future. AM brings a number of advantages to the manufacturer compared to the more traditional manufacturing technologies. Complex designs can be manufactured without the need for hard tooling, wastage of material is significantly reduced during the manufacturing process, and time to market can be drastically reduced since AM allows the rapid production of prototypes, tooling as well as final parts.

The growth in AM systems and services globally is impressive. The **compound annual growth rate** of worldwide revenues produced by all AM products and services over the past 25 years is an **impressive 27%,** with a total market size of US$ 3.07 billion reported in 2013. Wohlers Associates forecasts that the worldwide sale of AM products and services will reach $7 billion worldwide by 2016 and will exceed $21 billion by 2020. This is a modest market size considering that global manufacturing market size is estimated at US $ 10.5 trillion. Predictions, however, become harder if the unknown potential of emerging technologies, such as bio-printing, food, fashion products and integrated electronics, are considered.

The main application area of AM in 2013 was prototyping (38%). However, the use of AM for the production of final parts is increasing rapidly year on year with 29% of all applications of AM in 2013 categorised as the manufacturing of final parts. This is up from only 3.9% in 2003. **The main applications** for AM is in the consumer product/electronics markets, with applications in the automotive and the medical/dental implant market sectors also well established and growing. Internationally, AM is supported through various government-supported initiatives. There are a number of large AM development programmes reported in the USA, Europe, China and Australia.

In South Africa the uptake of the technology is rapidly growing. The first programmes in South Africa in AM started in the early 1990s with the acquisition of a rapid prototyping system by the CSIR. Uptake in the technology was initially slow, but during the past five years there has been an exponential growth in the number of AM or 3D printing systems in the country. R&D competence in the technology has also grown, with very strong areas of expertise established in niches areas at a few South African universities as well as at the CSIR.

A number of promising market applications have been identified for AM in South Africa. South Africa has an abundant mineral resource base and is the world's second largest and third largest producer of titanium and vanadium, respectively. These materials are key to titanium alloys used the medical and dental implants and the aerospace manufacturing industries. These markets also require highly complex designs for parts or parts that have to be customised, which provide an excellent opportunity for value addition through

AM in these markets. The direct tooling market in South Africa amounts to an estimated R13 billion, with an additional R2 billion for maintenance and servicing. The tooling industry is an important industry segment; it supports key manufacturing sectors such as the automotive, aerospace, consumer goods, packaging and electronics sectors. AM has the potential to contribute to the rejuvenation of South Africa's tooling and foundry industries by introducing innovative technologies to improve tool performance, as well as time to market.

By analysing local opportunities identified and considering the local capabilities and competencies, four priority focus areas were identified supported by a set of enabling complementary technologies. The four main priority focus areas identified in this Roadmap are:

- Qualified AM technology for final part manufacturing for the medical and the aerospace markets;
- AM technology for impact in the traditional manufacturing sectors;
- New AM material and technology development; and
- Small, medium and micro enterprises (SMME) development and support programmes.

Programmes that will support these priority areas have been identified. Programmes in support of AM in the formal education sector as well as activities that will raise public awareness of AM were also identified and addressed.

The Roadmap also makes recommendations regarding a structure to be established to manage the implementation of programmes in support of the priority areas identified. It is proposed that an AM Steering Committee consisting of representatives from key industry segments, government, and AM experts from R&D institutions is established to primarily provide the strategic leadership with respect to the further refinement of the AM Technology Roadmap and to oversee the implementation of programmes in support of the defined priority focus areas.

AM technology is in a strong growth phase, with public interest and R&D interest in the technology at very high levels. South Africa has a competitive advantage with respect to a strong mineral resource base, and has R&D capabilities in niche areas in AM that compare favourably with the best in the world. Programmes to further unlock the potential of AM in selected focus areas will ensure that South Africa becomes a leading global player in these fields of AM.

Mapping South Africa's ICT RDI Future

The ICT RDI Roadmap involved five packages of work to define future market opportunities and, by matching these with existing capabilities, identifies whether and how these opportunities can be realised.

Waste Electric and Electronic Equipment landscape Report

- A summary of the main findings and recommendations arising from the study are presented below. Notable sector dynamics and trends:
- The South African WEEE industry has become more integrated, formalised and diversified over the past decade[1].
- Over 100 formerly registered companies operate across the WEEE recycling value chain (from collection to processing) in South Africa.
- The WEEE recycling sector remains dominated by a few well-established 'consolidator' companies (85% of volumes handled in 2015).
- Most small- to medium-sized firms concentrate in earlier stages of the value chain (i.e.
- dismantling). The number of firms offering location-specific2 collection, dismantling and refurbishment activities have increased over the past five years.
- Gauteng remains the central 'hub' for the collection, consolidation, pre-processing and processing of WEEE in South Africa (±55% of volumes handled in 2015). The Western Cape, KZN and Eastern Cape are important provincial aggregation and sourcing nodes.
- The SADC region is emerging as an important supplementary source of WEEE inputs to the South African recycling sector and is expected to increase in importance as competition for local inputs intensifies.
- Barriers to entry are high at the pre-processing and processing stages and in specialised waste streams (e.g. lamps), but comparatively lower at the dismantling stage. Skills and technologyare not the determining factors, rather accessto WEEE volumes is.
- WEEE recycling is not profitable as a standalone business for small firms, with 58% regarding it as a secondary activity. Most small dismantlers complement WEEE recycling with refurbishment, which is regarded as being more profitable (making up to 60% of revenues).
- In 2015, approximately 17,733t of WEEE was handled by the 27 firms3 , with the largest source of inputs being from government departments (45%). ICT & consumer electronics made up the largest contributing waste stream (79%).
- The WEEE recycling sector is currently not a significant employer, with approximately 677 people employed across 18 firms in 2015. However, at 25 jobs/1,000t handled, the sector has the potential to increase this number as more WEEE is unlocked into the value chain.
- The main output fractions produced by firms in 2015 were ferrous (47%) and non-ferrous (16%) metals, and printed circuit boards (PCBs) (16%). PCBs remain the most valuable fraction.
- Firms are committed to process locally as far as possible, but complex fractions are exported – 90% PCBs, 60% phosphor powders, and some ferrous and non-ferrous metals are exported to Asia and Europe.

- The local re-manufacturing of WEEE plastics and glass fractions is still limited in South Africa. Approximately 80% of the 7,500t of electronic plastic fraction produced in South Africa in 2015 was exported, while the remaining 20% was beneficiated locally. In the case of glass, 90% (mostly from lamps) of the 800t produced in 2015 was beneficiated locally, while the other 10%, composed of mainly cathode ray tube (CRT) glass, was landfilled.
- The co-treatment of WEEE by pyrometallurgical processes is an established means of deriving value from precious and other metals contained in dismantled WEEE, specifically PCBs. However, the high levels of capital
- investment required, volumes of WEEE needed to ensure sufficient economies of scale, and associated environmental impacts, suggest that it is currently an unviable business opportunity in South Africa.

Overall, the current growth and dynamism of the WEEE recycling sector in South Africa is not determined by the availability, sourcing and operation of technology per se, but by the availability and volumes of WEEE released into the system to process and recycle. Access to sufficient volumes of WEEE appears to be the most significant constraint to growing the South African WEEE recycling industry and in moving firms from their current manual dismantling and limited pre-processing, to greater processing and local value recovery. The result is that firms are starting to tap into easily accessible WEEE from the SADC region to utilise available, local treatment capacity. Yet recycling of WEEE generated in South Africa remains low at only 11% (DEA, 2012a).

4.3. EQUIPMENT AND FACILITIES

National Research Foundation (NRF)

The National Research Facilities, (NRF DIVISION III) provide unique research infrastructure platforms through a multi-location network of institutions. These platforms support research areas of strategic importance and provide researchers and research institutions with access to "big science" equipment. It is through the National Research Facilities that South Africa can compete and cooperate with international counterparts.

The National Research Facilities provide the infrastructure required to generate and support internationally competitive research.

The facilities have the mandate to:

- Ensure access to state-of-the-art infrastructure;
- Produce internationally competitive research;
- Coordinate and manage large international projects;
- Provide human resources training in a high-tech environment by providing lectures, student

supervision and experiential training in collaboration with higher education institutions (HEIs);

- Use multidisciplinary and multi-institutional programmes as platforms for the training and education of students;
- Develop strong technical competencies to produce high-quality instrumentation and equipment in niche areas;
- Grow scientific and technical collaborations with HEIs locally; and
- Build sustainable international collaborations (particularly in Africa) and enhance the science and technology profile of South Africa internationally.

National Research Facilities[64]

iThemba LABS (Laboratory for Accelerator Based Sciences)

http://www.tlabs.ac.za/

IP Creation	Funding	Policy	Support

The **iThemba** Laboratory for Accelerator Based Sciences is the continent's largest facility for particle and nuclear research as well as one of only a handful of facilities in the world producing radionuclides for commercial, research and medical applications. In addition, its facilities include a full radiotherapy clinic for the treatment of certain cancers using both proton and neutron therapy.

iThemba LABS brings together scientists working in the physical, medical and biological sciences. The

As a national research facility working within the National System of Innovation it is the intention of iThemba LABS to achieve the following strategic objectives:

- Grow the research facilities to increase training, human resource development, international collaborations (especially with Africa) and the Science and Technology profile of South Africa
- Realize the National Particle Therapy Centre (NPTC)
- Grow radionuclide production into a substantial business
- Substantially improve training and research outputs
- Strengthen beneficial collaborations with the higher education sector
- Forge closer ties with South African and African S&T institutions

South African Institute for Aquatic Biodiversity (SAIAB)

64

http://www.saiab.ac.za/about-us.htm

IP Creation	Funding	Policy	Support

Situated in Grahamstown in the Eastern Cape, the South African Institute for Aquatic Biodiversity (SAIAB) is an internationally recognised centre for the study of aquatic biodiversity.

As a National Facility of the NRF SAIAB serves as a major scientific resource for knowledge and understanding the biodiversity and functioning of globally significant aquatic ecosystems. With both both marine and freshwater biogeographical boundaries, southern Africa is ideally placed to monitor and document climate change.

From a marine perspective South Africa forms the southern apex of a major continental mass, flanked by very different marine ecosystems on the east and west coasts, and projecting towards the cold southern Ocean large marine ecosystem. SAIAB's scientific leadership and expertise in freshwater aquatic biodiversity is vital to the national interest when dealing with issues arising from exponentially increasing pressures of human population growth and development.

National Zoological Gardens of South Africa (NZG)

http://www.nzg.ac.za/aboutus/index.php

IP Creation	Funding	Policy	Support

Overview

The National Zoological Gardens of South Africa is a proud facility of the National Research Foundation (NRF). The 85-hectare Zoo in Pretoria houses 3117 specimens of 209 mammal species, 1358 specimens of 202 bird species, 3871 specimens of 190 fish species, 388 specimens of 4 invertebrate species, 309 specimens of 93 reptile species, and 44 specimens of 7 amphibian species. The National Zoological Gardens of South Africa is the largest zoo in the country and the only one with national status. More than 600 000 people visit the Zoo annually. The total length of the walkways in the Zoo in Pretoria is approximately 6km. An Aquarium and Reptile Park also form part of the Zoo facility in Pretoria. The Aquarium is the largest inland marine aquarium in the country. The third largest collection of exotic trees can be found at the Zoo.

South African Environmental Observation Network (SAEON)

http://www.saeon.ac.za/

IP Creation	Funding	Policy	Support

The Southern African environment is characterised by high levels of variability and biodiversity. Rainfall is a

primary driver of the ecosystems, but its high variability limits its usefulness as an indicator of environmental change. Rainfall outcomes are complicated by the timing, frequency and intensity of rainfall events, as well as conditions of surface temperature, humidity, soil, slope and vegetation. These complexities, coupled with differential responses by thousands of species, cause uncertainty about the direction and extent of rainfall-induced change.

Southern Africa's indigenous biodiversity, landscapes and oceans are continuously changed by diverse and adjoining land uses such as mining, farming, conservation, forestry, urban sprawl, communal resource management, fishing and golf estates. Time-series data covering the spectrum of spatial scales is essential for reliable data on significant environmental changes, some of which are slow, while others may be sudden. Data obtained over short periods and at single locations offers limited value.

The advance of climate change is already being observed but how and where it will impact on Southern African society remains uncertain. Rural communities, commonly desperate for resources and information, are particularly vulnerable to climatic variability, which is often aggravated by unsustainable agricultural and fishing practices, not only by those communities themselves, but also by commercial and illicit enterprises.

Earth observation science is thus urgently required to bring more certainty about environmental change, and to enable formulation of adaptive and mitigating management policies and practices, for themes ranging from food production to population health.

The South African Environmental Observation Network (SAEON) was established in 2002 after a process of deliberation within the research community.

Following extensive consultation with its sister departments, the Department of Science and Technology (DST) took the lead by mandating and funding the National Research Foundation to develop SAEON as an institutionalised network of departments, universities, science institutions and industrial partners.

According to the SAEON mandate, its responsibilities rest on three mandates: observation, information and education.

Hartebeesthoek Radio Astronomical Observatory (HartRAO)

http://www.hartrao.ac.za/summary/sumeng.html

IP Creation	Funding	Policy	Support

The Hartebeesthoek Radio Astronomy Observatory (HartRAO) is located in a valley in the Magaliesberg hills, 50 km north-west of Johannesburg, in the province of Gauteng, South Africa.

The Observatory began as Deep Space Station 51, built in 1961 by the National Aeronautics and Space Administration (NASA) of the United States of America. An 85 foot = 26 metre diameter antenna was used to get data from, and send commands to, many unmanned US space probes going beyond Earth orbit. These included the Ranger, Surveyor and Lunar Orbiter spacecraft which landed on the Moon or mapped it from orbit, the Mariner missions which explored the planets Venus and Mars and the Pioneers which measured the Sun's winds.

The station was handed over to the South African Council for Scientific and Industrial Research (CSIR) in 1975 and was converted to a radio astronomy observatory. In 1988 the observatory became a National Facility operated by the Foundation for Research Development (FRD). In 1999 the FRD was restructured as the National Research Foundation (NRF).

The original function of the observatory post-NASA was purely research in radio astronomy, but a new science developed at HartRAO from the 1980's, namely Space Geodesy, i.e. geodesy using space techniques. The radio telescopes are used for both astronomy and space geodesy, and we have other dedicated space geodesy instrumentation.

HartRAO operates:

- 26m radio telescope for astronomy and geodesy
- 15m radio telescope for astronomy and geodesy
- Satellite Laser Ranger (SLR) for geodesy
- Global Navigation Satellite System (GNSS) receivers for GPS, GLONASS and Galileo, at HartRAO and at other locations, for geodesy

The South African Astronomical Observatory (SAAO)

http://www.saao.ac.za/

IP Creation	Funding	Policy	Support

Overview

Located in the leafy Southern suburbs of Cape Town, The South African Astronomical Observatory (SAAO) is the national centre for optical and infrared astronomy in South Africa.

Its prime function is to conduct fundamental research in astronomy and astrophysics. It does so by providing a world-class facility to scientists.

The SAAO promotes astronomy and astrophysics in Southern Africa, by sharing research findings and

discoveries. So, to learn more about the wonders of space, start exploring our website now.The South African Astronomical Observatory (SAAO) is a facility of the National Research Foundation, which operates under the Department of Science and Technology.

SAAO's headquarters are in the aptly named suburb of Observatory in Cape Town. The main telescopes used for research are located at the SAAO observation station 15Kms from the small Karoo town of Sutherland in the Northern Cape, a 4-hour drive from Cape Town.

SQUARE KILOMETRE ARRAY

http://www.ska.ac.za/qa/index.php

IP Creation	Funding	Policy	Support

Overview

The SKA project is an international effort to build the world's largest radio telescope, with a square kilometre (one million square metres) of collecting area. The scale of the SKA represents a huge leap forward in both engineering and research & development towards building and delivering a radio telescope, and will deliver a correspondingly transformational increase in science capability when operational.

Deploying thousands of radio telescopes, in three unique configurations, it will enable astronomers to monitor the sky in unprecedented detail and survey the entire sky thousands of times faster than any system currently in existence. The SKA telescope will be co-located in Africa and in Australia. It will have an unprecedented scope in observations, exceeding the image resolution quality of the Hubble Space Telescope by a factor of 50 times, whilst also having the ability to image huge areas of sky in parallel. With a range of other large telescopes in the optical and infrared being built and launched into space over the coming decades, the SKA will perfectly augment, complement and lead the way in scientific discovery.

The SKA Organisation, with its headquarters at Jodrell Bank Observatory, near Manchester, UK, was established in December 2011 as a not-for-profit company in order to formalise relationships between the international partners and to centralise the leadership of the project. Eleven countries are currently members of the SKA Organisation – Australia, Canada, China, Germany, India (associate member), Italy, New Zealand, South Africa, Sweden, the Netherlands and the United Kingdom.

The SKA in Africa

South Africa has already demonstrated its excellent science and engineering skills by designing and building the MeerKAT telescope – as a pathfinder to the SKA. The first seven dishes, KAT-7, are complete and have already produced its first pictures. MeerKAT is attracting great interest internationally – more than 500 international astronomers and 58 from Africa submitted proposals to do science with MeerKAT

once it is complete.

The technology being developed for MeerKAT is cutting-edge and the project is creating a large group of young scientists and engineers with world-class expertise in the technologies which will be crucial in the next 10 – 20 years, such as very fast computing, very fast data transport, large networks of sensors, software radios and imaging algorithms.

Since 2005, the African SKA Human Capital Development Programme has awarded close to 600 grants (2014) for studies in astronomy and engineering from undergraduate to post-doctoral level, while also investing in training programmes for technicians. Astronomy courses are being taught as a result of the SKA Africa project in Kenya, Mozambique, Madagascar and Mauritius (which has had a radio telescope for many years) and are soon to start in other countries.

The South African National Research Network (SANReN)

http://www.sanren.ac.za/overview/

IP Creation	Funding	Policy	Support

The South African National Research Network (SANReN) is part of a comprehensive South African government approach to cyberinfrastructure to ensure successful participation of South African researchers in the global knowledge production effort. Together with the Centre for High Performance Computing (CHPC) and the Very Large Datebases (VLDB) project, SANReN forms a key component of this cyber infrastructure as a core scientific infrastructure for South Africa.

The roles and responsibilities of the de facto South African NREN (SA NREN) are distributed between the Tertiary Education and Research Network of South Africa (TENET) and the South African National Research Network (SANReN) Competency Area (CA) at the Council for Scientific and Industrial Research (CSIR).

The SANReN CA is responsible for the design, acquisition and roll-out of national and international capacity for the SA NREN, as well as the development and incubation of advanced services. It forms part

of a comprehensive South African government approach to cyberinfrastructure, geared at ensuring the successful participation of South African researchers in the global knowledge production endeavour. SANReN is managed and implemented by the CSIR's Meraka Institute and is a key component of the National Integrated Cyberinfrastructure System (NICIS), alongside the Centre for High Performance Computing (CHPC) and the Data Intensive Research Initiative of South Africa (DIRISA).

TENET's main purpose is to secure, for the benefit of South African universities and associated research and support institutions, Internet and Information Technology services. TENET is a service organisation and is committed to service excellence and to services that are strongly aligned and consistent with the organisational requirements of the user community. TENET operates the SANReN Network under the terms of a collaboration agreement with the CSIR.

TENET and the SANReN CA co-operate closely in building and supporting the South African NREN as a research, education and innovation platform for the benefit of its customers and users, and for the realisation of associated national development objectives.

SciELO

IP Creation	Funding	Policy	Support

The Scientific Electronic Library Online (SciELO) SA is South Africa's premier open-access (free to access and free to publish) searchable full-text journal database in service of the South African research community. SciELO SA is managed by the Academy of Science of South Africa (ASSAf).

Technology Stations Programme (TSP)

http://www.tia.org.za/tech-stations

IP Creation	Funding	Policy	Support

The Technology Stations Programme (TSP) was established to enable Universities of Technology (UoT) to provide technology development services to small and medium enterprises (SMEs). The Technology Stations (TSs) provide innovative Science, Engineering and Technology (SET) solutions for complex engineering challenges within the relevant industrial sectors aimed at supporting government's socio-economic priorities.

There are 18 Technology Stations (TS) based at 11 Higher Education Institutions in South Africa, managed by the Technology Stations Programme (TSP) Unit based in Pretoria at the Technology Innovation Agency (TIA) office. The TSP is a management and systems-wide support unit responsible for all Technology Stations across the country. The mission of the TSP is to assist the Technology Stations and Higher Education Institutions (HEIs) in the core, by performing the following functions:

1. Ensure that funds allocated to the TSP have impact and are aligned with the TIA/DST national strategic objectives and performance measures;
2. Reduce transaction and co-ordination costs of activities that involve or benefit multiple TSs to promote synergies and network benefits;
3. Monitor and evaluate the performance of TSs SME-related projects, and initiate interventions where required;
4. Identify opportunities to upgrade and/or expand the TSs high-end technology infrastructure;
5. Facilitate opportunities for technology knowledge transfer and innovation support to TIA's stakeholders; and
6. Promotes the network of Technology Stations to other government programmes and ensure that the TSs are aware of and participating in related national priorities and industry programmes.

The Department of Science and Technology (DST) provides financial support through TIA, to Higher Education Institutions (HEIs) which in turn hosts the Technology Stations. The facilities provides technical services and training support to SMEs.

Technology Station in Electronics, Tshwane University of Technology (TUT)

www.tut.ac.za

IP Creation	Funding	Policy	Support

The Technology Station in Electronics (TSE) operates in the electronic, electrical and information and communication technology industries. The TSE collaborates with various academic departments within the Faculty of Engineering and the Built Environment to fulfil its mandate. It serves as a platform where clients receive expert advice, product development support and low volume manufacturing services targeted at a number of sectors, including mining, automotive, rail, military, energy, etc.

Competencies and Offerings

Consultation

- Contract Research and Consulting

Development expertise includes, but are not limited to

- 8/16/32 Bit Microcontroller Technologies
- FPGA Design

- GPS Technologies
- GSM Technologies
- Wireless Transceiver Technologies
- Various Sensor and Actuator Technologies

Electronic Development

- Needs analysis and specification development
- Schematic development
- Printed circuit board design
- Prototyping and testing
- Existing product line improvement

Electronic Development Services (EDS)

The main focus of the EDS is on innovation through design, prototyping and development of electronic hardware. This includes the design and development of new products from initial concept to production readiness.

Electronic Manufacturing

- Low volume manufacturing
- Prototyping (once-off build)

Electronic Manufacturing Services

The TSE utilises state of the art equipment to manufacture high quality and reliable products for clients using several manufacturing processes and technologies. The Electronic Manufacturing Services (EMS) is executed by experienced and trained staff.

Training

- Short Learning Programmes
- Customised training programmes

Metal Casting Technology Station, University of Johannesburg (UJ)

http://www.metalcasting.co.za

IP Creation	Funding	Policy	Support

The Metal Casting Technology Station (MCTS) is based at the University of Johannesburg (UJ) is a technology transfer partner for the metal casting industry, pioneering development through training, research and technology support. The Technology Station operates in partnership with the Department of Metallurgy in the Faculty of Engineering and the Built Environment. MCTS supports and assists the metal casting industry – foundries, suppliers, related industries – to improve the sectors innovation ability for increased competitiveness and sustainability.

Technology Competencies and Offerings

Casting Design

CAD Design: 2D and 3D Modelling: 3D modelling is the process of developing a mathematical representation of any three-dimensional surface of object using specialised software.

Casting Simulation

The process used to forecast pouring, and solidification of liquid metal at different temperatures and environments with a high level of accuracy before conducting actual casting trials.

Education and Training Focus Area

- Internship and Graduate Programme
- In-house training/short courses
- Skills Development
- Student Exchange programme

Physical Metallurgy

- Chemical Analysis
- Failure Investigation
- Tensile Testing and Impact Testing
- Metallography
- SEM and EDX Analysis
- Hardness (Rockwell, Vickers and Brinell) Testing

Rural and Emerging Foundries

- Development of the rural and emerging foundries

Sand Technology

- Green sand testing
- Full foundry bentonite and coal dust testing and analysis
- Raw silica sand testing - all types of sand
- Resin sand testing, heat cured, gas cured and self-hardening systems
- Moulding systems trouble shooting

Technology Station For Materials & Processing Technologies, Vaal University of Technology (VUT)

www.sasciencepark.co.za

IP Creation	Funding	Policy	Support

The Technology Station for Materials and Processing Technologies (TSMPT) is located at the Vaal University of Technology (VUT) Southern Gauteng Science and Technology Park in Sebokeng. It forms part of the VUT's Technology Transfer and Innovation Directorate. As such, it is supported by an Enterprise Development Unit (EDU); Iscor Innovation Centre (IIC); Engineering Manufacturing Centre (EMC) and Institute for Chemical and Biotechnology.

The TSMPT assists SMME manufacturers of metal-based products and composite-based products to improve their products and their product knowledge, processes, process knowledge and skills. The Vaal University of Technology assists and guides potential clients with any viable and marketable products and ideas. This support extends to the acquisition of potential funding through various institutions.

Technology Competencies and Offerings

- Additive manufacturing (3DP, FDM, LS)
- Contact digitising
- CNC robotic milling
- GRP casting and composites
- Industrial design and product development
- Management and funding support

- Manufacturing
- Metrology
- Non-contact digitising Tooling and machining Training

Advanced Additive Manufacturing V\M

As part of the VUT's advanced manufacturing drive, significant investment has been made in Advanced Manufacturing platforms. The EOS P100 offers the finest Z-axes resolution in polymer-based laser sintering available in the country. Through its cluster projects, the VUT is currently expanding its platforms to three more EOS systems as well as two Voxel jet systems.

Advanced Manufacturing Education and Innovation

The VUT's unique I-2-P concept (Idea 2 Product™ Lab) offers 14 seats with entry level advanced manufacturing and CAD technologies available to students, school learners, individuals and SMMEs companies to test innovative ideas and develop these into physical products.

High End Facilities

The Technology Station offers facilities that can be used for technology transfer and demonstration that also supports research, training and skills development, as well as undergraduate education. As part of a strategic positioning, much of the planned and acquired infrastructure serves industry in a cluster approach, hence making a significant impact.

Robotic Milling

TSMPT developed unique 5-axes and 8-axes Robotic CNC milling capabilities, which currently serves diverse industries in a wide array of applications, varying from artistic master patterns for the casting industry. Similar scale work has been completed for the automotive industry where moulds for composites fibre moulding have been developed at significantly reduced costs, compared to conventional technologies. The VUT is one of the only few institutions world-wide using the complex 8-axes milling solution.

Product Development Technology Station, Central University of Technology (CUT)

www.cut.ac.za/pdts/

IP Creation	Funding	Policy	Support

The Product Development Technology Station (PDTS) is located on the campus of Central University of Technology (CUT) in Bloemfontein.

PDTS is involved in product design, prototyping and short run production. The Technology Station develops new ideas into products, or improves existing products with detailed engineering. In this way PDTS supports businesses and individuals through the entire 'new product development' process. The Station makes use of first-class engineering expertise from CUT, as well as specialized prototyping equipment from the Centre for Rapid Prototyping and Manufacturing (CRPM).

PDTS currently focuses on the development of new products, especially enclosures for consumer products, and assists SMEs and corporate clients with development from an idea to a first generation prototype. The functioning of PDTS is strengthened by the services of Nahul Product Development and Manufacturing (Vacuum casting) and the Centre for Rapid Prototyping and Manufacturing, located next to PDTS.

The PDTS services big corporations like Coca-Cola, Aurecon, SA Truck Bodies, Avbob through to SMEs and individuals with an idea that they would like to take further.

Technology Competencies and Offerings

- Product design and development (from idea to final design and first generation prototype in various materials)
- Reverse engineering, where 3D data of an existing product is obtained through scanning technology and then used in the CAD of the new product
- Limited-run tooling (where injection-moulded products need to be tested for function and market research)
- Growing of tool inserts (for fast turnaround times on tool-making where traditional mould-making and the latest technology are combined)
- Conformal cooling of mould inserts through Metal Laser Sintering (where traditional drilling for cooling channels cannot achieve the required results)
- Machine building

eNTSA, Nelson Mandela University (NMU)

www.nmu.ac.za/eNtsa

IP Creation	Funding	Policy	Support

eNtsa is recognised as a prominent research, design and technology support unit for the advanced manufacturing sector in South Africa, based in Port Elizabeth at the Nelson Mandela Metropolitan University (NMMU

eNtsa's main focus is to support and stimulate engineering innovation in order to improve the

competitiveness of local manufacturers which will enable industry exploit and development of new markets.

Growing the manufacturing economy in South Africa holds the key to sustainable job creation and improved quality of life. This forms the drive of eNtsa to provide innovative research and advanced technical training for support to the local manufacturing industry according to international best practices.

Technology Competencies and Offerings

Development and Design

- Mechanical design
- 3D Modelling
- Finite Element Analysis (FEA)
- Rapid prototyping

Material and Mechanical

- Mechanical Testing (e.g. Chemical, tensile, fatigue)
- Residual stress analysis
- Portable x-ray diffraction (non-destructive)
- High speed hole drilling (semi-destructive)
- High speed camera

Product Engineering

- Product and process development
- Fatigue analysis
- Failure analysis

Process Control and Automation

- Automation
- Quality Control
- Robotics
- Vision

Small and Medium Enterprises Development

eNtsa provides support for enterprises in the first, second and emerging economy (SMEs) within the engineering and manufacturing sector, with a specific focus on the automotive components component sector with the aim of making South African automotive industry more globally attractive.

Downstream Chemicals Technology Station (Innoventon), Nelson Mandela University

IP Creation	Funding	Policy	Support

InnoVenton: Institute for Chemical Technology is a formally registered Research Institute at the Nelson Mandela Metropolitan University (NMMU), whose principal research focus is in Product and Process Development.

The institute incorporates the Downstream Chemicals Technology Station, a Government funded initiative to make available high level research, technological services and training to technology-based SMMEs and South African Industry as a whole.

The institute includes amongst its research facilities, a pilot plant for R&D and teaching, the Fuel Chemicals Testing Platform, a Small Production Platform laboratory, and a microalgae production platform. Through the Downstream Chemicals Technology Station, it provides technical support services and training to technology based SMMEs and companies in the chemical industry sector.

Technology Competencies and Offerings

- Micro algae technologies
- Micro algae to coal fines recovery and agglomeration
- Direct Liquefaction of microalgae to bio-crude oil
- General chemical process development/evaluation
- New product development

The three principle service areas are:

- **Chemical Analytical Service** provides a comprehensive range of chemical and material testing and analysis services for industry in the areas of general chemical analysis, materials testing; environmental analysis; biofuels and transport fuels analysis and testing. The laboratory carries South African National Accreditation System (SANAS) for specific methods.
- **Chemical Process Technology Demonstration** (Kilo Lab) a facility for the scale up (milligram and gram quantities) of laboratory – developed chemical process and products, to kilogram quantities.

The faculty is also used for the demonstration and development of technology on a kilogram scale, as well as for the production of kilogram quantity samples for the industry and for research.

- **Training** is in areas of chemical technology and skills development. DCTS/Innoventon offers a Special BSc Hons programme in Formulation Science and Professional Science Masters courses. It also offers various non-degree applied statistical methods courses, such as data analysis with Excels or analysis scientists and engineers; Statistical process control with Excel or process operators; analysts and engineers and applied biostatistics with Excel.

Technology Station, Clothing &Textile, Cape Peninsula University of Technology (CPUT)

www.tsct.co.za

IP Creation	Funding	Policy	Support

The Technology Station in Clothing and Textiles (TSCT) is located at the Cape Peninsula University of Technology (CPUT), Bellville Campus. The TSCT was established to provide innovation support to SMEs in the clothing and textile industry to become more competitive.

Technology Competencies and Offerings

Manufacturing Advisory Services

- Manufacturing process assessment and productivity improvement solutions
- Provide advice on the acquisition and use of improved technology

Product Analysis and Testing

- Materials analysis and testing service to the clothing, textiles and related industries
- Provide advice on material usage and care

Product Development

- Develop specifications, pattern making, and prototyping, using CAD
- Product development advice and services

Technology Platform

A facility to demonstrate range of specialised technology and available to SMEs to develop prototypes. A number of specialised machines available for use of small business on an appointment basis:

- Electronic button-hole machine

- Electronic button-sew on machine
- Electronic bar-tacking machine
- Electronic eyelet button-hole machine
- Embroidery machine and digitiser (for samples)
- Cover seam machine (elasticating)
- Feed off the arm machine
- Hemming machine
- Jet pocket machine
- Merrow edge machine
- Ultrasonic Welding machine
- Walking foot machine

Research

- Product and process development
- Anthropometry (Body sizing)

Short Courses

- Advanced Work Study
- Textiles and Fabrics
- Textile Testing – Introduction to Textile Testing (1 day)

Training

Programmes are mainly offered on a one-day per week release basis but a number of our courses are also offered after hours to accommodate smaller manufacturers.

Agrifood Technology Station, Cape Peninsula University of Technology (CPUT)

www.cput.ac.za/ats

IP Creation	Funding	Policy	Support

The AgriFood Technology Station (ATS) assists SMMEs and large companies to improve their efficiencies through the use of technology. The Technology Station (ATS) is well placed in a state of the art complex on

the Bellville campus of the Cape Peninsula University of Technology (CPUT). This includes a Pilot Plant with different processing areas for baked goods, meat products, beverages, chocolate & sweets, spray-drying & extrusion, general heat processing and drying. Besides general and cold stores, there are also a number of laboratory areas such as an R&D lab (for small-scale product development), Research Lab, Instrument Room, Chemistry Lab, Microbiology Lab and a Physical Food Properties Lab.

Technology Competencies and Offerings

New product and process development

- Baking and milling
- Brewing
- Canning, bottling and pouching
- Chocolate and confectionery production
- Freeze-drying and spray-drying
- Fruit, vegetable, meat and dairy processing
- Labelling and packaging advisories
- Large processing equipment base in 1 700 m^2 Pilot Plant
- Pasta extrusion
- Rental of facilities and expertise for trials
- Thermal and non-thermal processing

Food analysis

- Chemistry
- Microbiology
- Sensory studies
- Shelf-life determination
- Texture, viscosity, colour

Research

The Station conducts collaborative research with academics in the following areas:

Auditing of food premises - An initial appraisal may be done by ATS staff but more in-depth audits and implementation of systems may be outsourced to professionals in the field.

Labelling - Considering the national labelling and advertising legislation as amended, it is essential that your product package / label complies.

Free-standing research projects - In some instances, your company may require free-standing or once-off research to be done on a specific topic. The research may be long or short-term, it may involve bench-work and experimentation or it may just be a literature-based report required. This can be arranged after appropriate consultation and scoping. In some instances, this type of project could also lead to formal qualifications being obtained by students of CPUT or by your own staff involved in the project.

Niche analytical services - ATS offers routine food analytical services such as full nutritional analysis, microbiological testing and testing of food physical properties such as colour, texture, viscosity, etc.

Shelf-life evaluation - Real-time and accelerated studies may be conducted using our facilities for temperature and humidity control. Standard parameters monitored are microbiological safety as well as pertinent chemical characteristics such as water activity and rancidity.

Sensory evaluation - A range of sensory services are available through the Technology Stations own expertise and staff and also via external sensory analysts. Both bench-top analysis and trained panels are available.

Small-scale trials - Our unique food processing facility and its wide range of modular and mobile equipment allows for tailor-made production trials in many instances.

Training and Compliance – The Technology Station can design and offer short courses suited to your company needs. Training with regard to individual instruments or concepts related to food production and analysis can also be offered on a free-standing basis.

Limpopo Agro-Food Technology Station, University of Limpopo (UL)

www.ul.ac.za

IP Creation	Funding	Policy	Support

Food Technology Station (LATS) is based at the University of Limpopo, Turfloop Campus in Polokwane. It provides analytical and agro processing services to SMMEs and large companies through the use of cutting edge technologies.

Technology Competence and Offerings

Food product testing and analysis

LATS tests food products and diagnoses the presence of pathogenic and spoiling microorganism in food products that are ready for markets, using high-tech equipment like Vitek 2 and ICP. Tests on food products includes fats, crude fibre, protein, ash, moisture, carbohydrates by difference, energy, vitamins, minerals, antioxidants, polyphenols, tannin and mineral elements.

New Product Development

Provision of support to SMMEs from idea generation through to product design and detailed food engineering. The Station ensures that the newly developed food products meet SABS standards and that health risks are eliminated.

Product and Process Improvement

This involves improving the quality of substandard products or processes already in use to the standards required by SABS and the Departments of Health and Agriculture. The SMEs are introduced to management systems in which food safety is ensured through the analysis and control of biological, chemical, and physical hazards all the way from raw material production, procurement and handling to manufacture, distribution and consumption of the finished product.

Research and Development

The Station ensures that research questions related to SME agro processing are addressed through the use of the university's research academics. Research projects include chemical and microbial profiling of indigenous food product, new product development and food product shelf life.

Technology Audit and Training

Food technologists visit SMMEs in order to audit food-product processing equipment and processes onsite. The SMMEs are trained in good manufacturing practice (GMP) and hazard analysis and critical control points (HACCP).

Technology Station in Chemicals, Tshwane University of Technology (TUT)

IP Creation	Funding	Policy	Support

The Technology Station in Chemicals (TSC) offers a wide range of services designed to assist SMEs in the Chemical sector. The Station is located at the Tshwane University of Technology (TUT), Ga-Rankuwa campus and is supported by the Chemistry and Chemical Engineering Departments of TUT. TUT's experienced staff, consisting of Scientists, Technologists, Technicians and external service providers, participate in product

development of various projects.

Technology Competencies and Offerings

Development of Material Safety Data Sheets (MSDS)

The MSDS is a very important official document reflecting the hazards and reactive reaction required in time of emergencies during the process of handling the product.

Formula Development

TSC has the capability of developing new formulations that will meet the customer's needs. Development or revision of existing formulations is part and parcel of reformulation. N.B. It is extremely important to note is that the Station does not sell formulations.

Hazards and Operability Studies

The Station can conduct Hazards and Operability studies to identify risks and hazards in settings of SMEs, including the process of manufacturing, raw materials handling and packaging.

Product Analysis

TSC conducts both routine and non-routine speciality inorganic and organic analysis and testing.

Product Development

Products are developed to meet the customer's need or South African Bureau of Standards (SABS) specification. Developments include pH adjustments, viscosity balancing emulsification, preservation and other corrections of physical and chemical parameters required to render the approved quality product.

Product evaluation and quality Test

TSC provides specialized testing services to analyse and evaluate existing products.

Product Research

TSC conducts research on developing new products and also on improving and optimizing existing products. The research also involves conversion of ideas into prototypes.

Technologies Available

- Bar Soap Making Technology
- Cosmetic Technology
- Detergent Technology
- Electroplating Technology
- Essential Oils Technology
- Perfume Making Technology
- Surface Coating Technology
- Technology for manufacturing different types of paints and vanishes

Training

Training is offered in the following courses:

- Basic Cosmetic Technology
- Batch adjustments, filling and flushing
- Detergent Technology
- Emulsion Technology
- Large Manufacturing
- Quality Management System (QMS)
- Safety Health and Environment

Technology Station In Chemicals, Mangosuthu University of Technology (MUT)

IP Creation	Funding	Policy	Support

The Technology Station in Chemicals (TSC) is situated at Mangosuthu University of Technology (MUT) in Umlazi. MUT provides technological support and promotes innovation for Small Medium Enterprises in the Manufacturing and Chemical sector.

Technology Competencies and Offerings

Environmental Pollution Control

- Conduct Environmental Impact Assessments.

- Provide Quality testing services on water (and wastewater), effluent and soil samples.
- Tests conducted include; BODs, CODs, DOs, inorganics (metals and salts); presence of microorganisms, algae and organics.

Pilot Batch Processing Unit

- Demonstrate optimal batch mixing techniques for high-quality production. Production of soaps and detergents and cosmetics.

Process Design and Development

- Assist in designing new processes to gain a competitive edge and develop (improve) existing processes for increased efficiency and throughput.

Product Design, Development and Improvement

- Provide assistance in designing 'tailor-made' products for specific markets (Product Formulation Services) and improve performance and characteristics of existing products for increased competitiveness.

Setting Product Quality Standards

- Improve quality standards through product testing and product formulation services.

Technology Audits

- Provide assessment on the status of technologies in use and provide strategic direction for technology upgrading and/or acquisition where necessary.

Technology Information Support

- Provide information and advice on new trends in product quality, product and process developments, local and international markets, and viable technologies.

Training

- Internship

Waste and Effluent Management

Small and Medium Enterprises receive training on techniques and methods that can be used to control effluent volumes (move towards zero effluent) and reduce contaminant levels.

Reinforced and Moulded Plastics Technology Station, Durban University of Technology (DUT)

www.dut.ac.za/technology_stations/reinforced_moulded_plastics

IP Creation	Funding	Policy	Support

Reinforced & Moulded Plastics Technology Station (RMPTS) is located in the Durban University of Technology (DUT) in KwaZulu Natal, Durban at the Steve Biko Campus. RMPTS is the technology transfer mechanism for the Centre for Advanced Material, Design & Manufacture with a mission of advancing the reinforced and moulded plastics sector through technological innovation, forward thinking and research & development.

The main focus of the Station is to provide companies within the reinforced and moulded plastics sectors with assistance in product design, prototype development and tooling design, development and manufacture.

Technology Competencies and Offerings

Advanced Manufacturing Laboratory

In the moulded plastics arena, the AML is equipped with CNC machine tools and focuses on:

- Product design
- Tooling design
- Tooling manufacture

Design Unit

The Industrial Design Unit specialises in conceptual design and design verification of metallic and non-metallic fabrications and systems and makes use of some of the most sophisticated design analysis software and techniques (like finite element analysis – FEA) available. The Unit focuses on conceptual design, design analysis, optimisation and verification of non-metallic (and metallic):

- Aerospace and other advanced structures
- Custom fabrications
- Pressure and vacuum vessels
- Process tanks and vessels
- Specialized process equipment
- Piping and ducting systems

The Station can also carry out:

- Design and fabrication of injection moulds and tools
- Design and fabrication of mechanical parts and systems, jigs and fixtures
- Failure analysis
- 3, 4 and 5-axis CNC milling
- CNC turning
- Metrology
- 3D printing

Prototyping and Testing Unit

The PPT Unit specialises in the fabrication of prototypes and tooling for the composites sector. Materials and structural testing can also be undertaken.

Institutes for Advanced Tooling

IP Creation	Funding	Policy	Support

The Institutes for Advanced Tooling (IATs) are occupational centres of excellence for skills development; technology transfer and diffusion for accelerating the country's growth in the Tool, Die & Mould (TDM) making sector (Tooling sector). Their core business is to promote sustainable tooling in collaboration with international leading tool-making private institutions, academia and the local tooling industry.

The aim is to change tool manufacturing from a resource-driven process to a knowledge driven process by offering a well - balanced combination of technology enablers for all steps of the extended product life cycle to SMME's in the tooling sector. There are three Institutes for Advanced Tooling within the Technology Stations Programme located at different Higher Education Institutions. These are:

a) Institute of Advanced Tooling – Tshwane University of Technology, Soshanguve

b) Institute of Advanced Tooling – Walter Sisulu University, East London

c) Institute of Advanced Tooling – Stellenbosch University, Stellenbosch

The focus of the Tooling Institutes is on tool design, tooling technology transfer, research and innovation.

Institute for Advanced Tooling, Tshwane University of Technology (TUT)

IP Creation	Funding	Policy	Support

The Institute for Advanced Tooling is based at the Tshwane University of Technology (TUT), Soshanguve South Campus.

Technology Competencies and Offerings

Consultation Services

Engineering Change Requests (ECR) - Injection Moulds modifications for the automotive sector. The work involves making changes to existing moulds as a result of changes to parts or components designs.

Part Inspection/Measurement - 2D and 3D part inspection and/or measuring using the Coordinate Measuring Machine (CMM).

Product Development/Design/CAD/CAM Technology - Any product design and/or development for tooling in any of the three-specified tool design specialisation.

- CAD (design) using AutoCAD, NX or PowerSHAPE
- CAM (machining) using PowerMILL (CNC machining on the 5-Axis & 3-Axis machines) or FeatureCAM (CNC machining on the Wire EDM machine);
- CNC Machining - High precision machining with the following machines a 5-Axis High Speed milling; 3-Axis milling; Turning; Wire EDM or EDM Die Sink

Tool Design & Manufacturing

- Jigs & Fixtures
- Press Tools
- Injection Moulds

Tool, Die and Mould (TDM) Training

- Internship Programme in the TDM field
- CNC (Turning & Milling) training in both programming and machining – specialised training for National Tooling Initiative Programme (NTIP) students
- On-Job-Training (OJT) for NTIP students
- Specialises in Tool, Die & Mould modules as part of the Work-Integrated-Learning (WIL) for Mechanical Engineering students

- Skill Development & Transfer

INSTITUTE FOR ADVANCED TOOLING, WALTER SISULU UNIVERSITY

IP Creation	Funding	Policy	Support

This Institute of Advanced Tooling is based at Walter Sisulu University (WSU) Buffalo City, satellite Campus in East London. IAT-WSU focuses mainly on mechanical design, concept and product development, metrology (3rd Party measurement), analysis, skills development and more recently, advanced manufacturing and reverse engineering.

The strategic objectives of the Station are to provide technology support services and training to the (predominantly) regional manufacturing sector, SMME's, inventors, individuals, academic partners and in some cases large companies.

Technology Competencies and Offerings

Advanced Manufacturing

- 3 & 3+2 Axis CNC Milling (Digital Tool & Work Piece Setting)
- Large Formant CNC Robotic Milling (Pattern/Plug Machining)

Analysis / Simulation

- FEA (Linear Static, Buckling & Dynamic)
- CFD (Static & Transient)

Applied Research and Development

- Renewable Energy
- CNC Robotic Milling

Consultancy Services

- Technology Audits
- Industry Surveys

Design

The IAT is equipped with Siemens NX CAD/CAM/CAE software modules including:

- 3D Solid &Assembly Modelling, 2D Layouts
- 3D Surfacing (engineered & free-form shapes)
- Basic Plastic Injection Mould Design
- Basic Jigs & Fixture Design
- Computational Fluid Dynamics (CFD)
- Component Design (Mechanical Design)
- General CAD, Component Design, Core & Cavity Extractions & Model Optimisation
  - Solid & Surface Modelling (Advanced CAD)
- Product Design, Development, Prototyping and Mould Design
- Quality Assurance (CMM, 3rd Party Measurement)
- Research & Development and renewable energy projects
- Sheet Metal Design
- Mould Wizard (plastic injection mould design)
- Motion Simulation
- NX Nastran Simulation (FEA linear static, buckling & dynamic analysis)
- NX **CAM** (NC programming for milling & turning)
  - 3 Axis NC Programming
  - 3+2 Axis CNC Programming
  - NC Robotic Milling Programming & Simulation (Kuka CNC)

General Manufacturing

- Mechanical Fabrication
- Steelwork Fabrication

Metrology / CMM

- 3rd Party Measurement, Metrology & Conformance

Reverse Engineering

- Digital Laser Scanning & CAD Model Development

Technology Demonstration and Training

- AutoCAD Basic & Advanced
- Internship
- Introduction to CNC Programming/Machining (manual G-Code)
- Jigs & Fixture Module
- Plastic Injection Design Module
- Press Tool Module
- Siemens NX

Institute for Advanced Tooling, Stellenbosch University

IP Creation	Funding	Policy	Support

Technology Competencies and Offerings

- 3D Digitizing and Reverse Engineering
- Additive Manufacturing
- Aluminium Components Forming Assemble
- Conformal Cooling Design and Realisation
- Five Axis High Performance Machining
- Plastic Flow Simulation
- Sheet Metal Simulation

Quality Control

Part inspection of large and small objects on CMM Mitutoyo Bright 710. Part inspection of large and small objects by GOM Digitising camera or Cimcore Infinite Measuring Arm.

Adaptronics Advanced Manufacturing Laborotory, Cape Peninsula University of Technology (CPUT)

http://www.cput.ac.za/academic/faculties/engineering/research/amtl

IP Creation	Funding	Policy	Support

Adaptronics Advanced Manufacturing Technology Laboratory (AMTL) is located at the Cape Peninsula University of Technology (CPUT), Bellville Campus. The primary objective of the unit is to specialise as a national manufacturing, research and educational resource centre for Adaptronics Technologies in South Africa. Adaptronics is the technology that integrates sensor and actuator functions into materials, components and structures so that they may react to environment stimuli thus making them intelligent.

Technology Competencies and Offerings

Adaptronics Technology - Research and technology projects into the development of intelligent structures, MEMS and Nano-Sensing Devices.

Automotive Technologies - Research and technology projects related to motorsport and alternative/ green propulsion systems.

Ocean Engineering - Research and technology projects related to maritime applications.

Unmanned Platforms - Research and technology development of nano, micro, mini, and close/short range unmanned aerial vehicles for both military and civilian applications.

Universal Design - Research and technology projects providing access to physically challenged individuals.

These areas form the foundation of the Adaptronics AMTL's Human Capital Development Programme, and include student R&D projects ranging from Internships, Bachelors, Masters, Doctoral and Post-Doctoral activities. AMTL has dedicated staff of Technologist, Technicians, and Artisans involved in industry related activities ranging from design, prototyping, testing; and process and programme development.

Process Energy and Environmental Technology Station, University of Johannesburg (UJ)

IP Creation	Funding	Policy	Support

Process Energy and Environmental Technology Station (PEETS) is located at the University of Johannesburg (UJ) Mapulong Building, Doornfontein Campus. The primary mandate for the PEETS is to support the competitiveness of industry through the application of specialised knowledge, technology and facilitating the interaction between industry (especially SMMEs) and the academia in order to enable innovation.

PEETS is committed to provide the highest level of quality and professionalism in interaction with stakeholders. We pride ourselves in stating that we are the only organization that serves as a catalyst to shorten the gap between Academia and Industry in the Energy and Environmental sector.

Focus Areas

- Environment &Water; Solid Waste Management, Waste Water, Clean Water, Air Pollution
- Renewable & Solar Energy; Bios-gas, Energy and Energy Efficiency
- Photovoltaic Cell Bio-energy Bio Diesel

Technology Competencies and Offerings

- Air Quality Auditing
- Energy Auditing
- Engineering Consultation
- Environmental Impact Assessment
- Process Optimization
- Product and Process Development / Improvement
- Prototype Assembling
- Testing /Analysis
- Technology Research and Development
- Training and Demonstration
- Waste Characterization

Technology Station in Rural Sustainable Development, Vaal University of Technology (VUT)

www.vut.ac.za

IP Creation	Funding	Policy	Support

The Technology Station in Rural Sustainable Development (TSRSD) is located at Upington in the Northern Cape. The Station is affiliated to the Vaal University of Technology (VUT) Sebokeng's campus. It forms part of the VUT's Technology Transfer and Innovation Directorate. It is supported by an Enterprise Development Unit (EDU); Iscor Innovation Centre (IIC); Engineering Manufacturing Centre (EMC) and Institute for Chemical and Biotechnology at the Sebokeng Campus.

TSRSD offers consulting and training services in;

- Product development and the improvement of product knowledge and skills.

- Process improvement and the improvement of process knowledge and skills.

The aim is to create a sustainable Station, which can be used to broaden the applied research base of VUT, build research and innovation capacity, facilitate technology transfer skills to the Upington community – including commerce, industry, agriculture, rural/urban and informal community settlements.

Technology Competencies and Offerings

- Business Support
- Entrepreneurship support
- Manage the execution of projects to fulfil identified needs, through the collaboration between TSMPT and TSRSD and other stakeholders.
- Product Development (partnership with TSMPT)
- Technology auditing and identifying the needs within Upington and the surrounding districts
- Technology facilitation agent and coach clients in the optimal use of developed resources and technology platforms
- Transfer identified needs into executable and fundable projects and business plans

Training

- E-skills training facility
- Solar Energy Products (Manufacturing and Installation)

Artisan Training (Welding, Renewable Energy, Mechanical and TIA Technology Platforms

http://www.tia.org.za/technology-platforms

IP Creation	Funding	Policy	Support

The Technology Platforms provides key technical infrastructure and expertise that enables technological innovation in the life sciences and biotechnology technology areas. The TIA funding ensures that the Technology Platforms acquire cutting-edge research equipment and facilities, and associated world-class expertise to lower barriers for public and private users to engage in technology innovation. The Platforms in turn provide access to the infrastructure for technology innovation in specific technology areas that would otherwise not be available and supports the development of technologies.

Centre for Proteomic & Genomic Research (CPGR): Provides support services in the fields of high-throughput genomic & proteomic research; capacity development via joint projects to empower researchers to use cutting-edge technologies ultimately for the development of market-driven products

and services, Cape Town, WC

http://www.cpgr.org.za

IP Creation	Funding	Policy	Support

Bioprospecting: This is a university-based research programme that focuses on the screening plant-derived bioactives for anti-HIV properties as well as using indigenous knowledge to develop nutraceutical products, University of Venda

Drug Discovery and Development Platform (H3D): Provides support services in the field of drug discovery through access to resources and expertise in the area of "hits to lead" development. Provision of support in chemical synthesis and purification for Drug Metabolism and Pharmacokinetic (DMPK), University of Cape Town

http://h3d.co.za

IP Creation	Funding	Policy	Support

National Metabolomics Platform (NMP): The Metabolomics platform focuses on the identification of biomarkers based on metabolic profiling to improve the disease identification, prognosis, monitoring and treatments by providing insight into drug metabolism and toxicity, North West University.

http://www.nwu.ac.za/centre-human-metabonomics

IP Creation	Funding	Policy	Support

Screening Applications & Exploring Novelty in Speciality Environments (SAENSE): SAENSE provides services in the discovery and exploitation of novel industrial (such as water and soil bioremediation) applications that emanate from unique environments. It further provides complementary services in water and soil testing, University of Free State.

http://natagri.ufs.ac.za/content.aspx?DCode=112&DivCode=D032

IP Creation	Funding	Policy	Support

Bioprocessing Platform: The platform offers four dedicated bioprocessing suites designed for fermentation process development and downstream processing. The facility also offers general laboratory space supporting industrial microbiology, process biochemistry, analytical chemistry, product development and formulations, Durban, KZN.

IP Creation	Funding	Policy	Support

Institute for Diagnostic Research (IDR): The facility forms part of the Bioprocessing Platform. It provides access to capabilities that are critical in the rapid diagnostics value chain: hybridoma technology, in vitro mAb production, immuno-biochemistry, lateral flow technology. Durban, KZN

IP Creation	Funding	Policy	Support

Biosafety South Africa (BSA): Provides guidance and assistance to all stakeholders in the GMO product value chain to ensure compliance with the regulatory and biosafety requirements across all the stages of GMO research and development, e.g. contained use, field tails and commercial release. Cape Town, WC.

IP Creation	Funding	Policy	Support

Kwazulu Research (KRISP): KRISP is a new platform that provides access to technical expertise and infrastructure in genomics and bioinformatics in an accredited facility with dedicated, professional technical staff. University of Kwa-Zulu Natal, KZN.

IP Creation	Funding	Policy	Support

Cape Universities Body Imaging Centre (CUBIC): The platform provides access to a high resolution, 3 Tesla Magnetic Resonance Imaging (MRI) and related expertise to support research, development and innovation that will lead to useful biomedical applications. The facility also provides training on the use of MRI technologies, University of Cape Town, WC.

IP Creation	Funding	Policy	Support

Microalgal Technology Development and Demonstration Centre (MTDC): A facility that provides for post-proof of concept technology development and the commercial scale-up of the production and processing of microalgal biomass. The target industries include the food, feed, beverages, bio-ingredients (biochemicals, enzymes, microorganisms, colourants, nutraceuticals (vitamins), bio-pharmaceuticals (enzymes, bio-active compounds), diagnostics, cosmeceuticals and biofuels (biodiesel, bioethanol). Upington, Northern Cape.

4.4. IP PERFORMANCE

IPR: structure, models, governance, standards

A) Objectives

This section follows a market-oriented approach by illustrating the relevance of intellectual property (IP)

protection throughout the whole cycle of innovation of a company as a potential and practical issue for an European company willing to approach with the South African market and vice versa.

Within a strategy of internationalization and business cooperation, the defence of IP during the process of innovation is crucial, because it may:

- generate an income through the licensing, sale, or commercialisation of the IP protected products or services;
- contribute to making a company's products and services more attractive to consumers;
- enhance the value or worth in the eyes of investors and financing institutions;
- significantly raise the value of a company in the event of sale, merger, or acquisition;
- help in the creation and maintenance of competitive jobs.

B) IPR trade and international legislation: the case of European patents

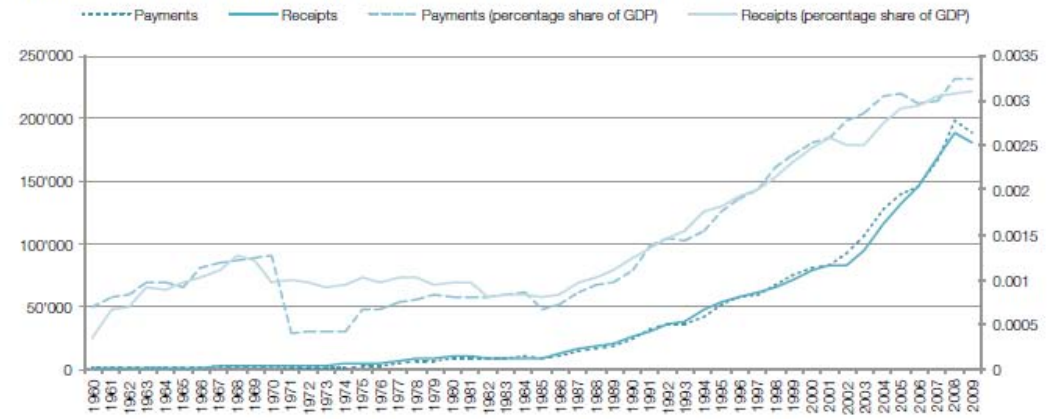
Ideas and knowledge are an increasingly important part of trade. Most of the value of new high technology products lies in the amount of invention, innovation, research, design and testing involved. On the other hand, evidence suggests that the tradability of IP has increased over the last few decades, leading to a considerable growth in IP rights licensing and the emergence of new technology market intermediaries (such as technology transfer offices or IP clearinghouses, exchanges, auctions and brokerages). Particularly, some statistics recently elaborated by the World Intellectual Property Organization (WIPO) shows how receipts coming from international royalty and licensing fees increased from USD 2.8 billion in 1970 to USD 180 billion in 200965.

International royalty and licensing payments and receipts (1960-2009)[66]

65 http://www.wipo.int/export/sites/www/freepublications/en/intproperty/944/wipo_pub_944_2011.pdf

66 Source: WIPO – World Intellectual Property Report 2011, p. 9.

RLF payments and receipts, in USD millions (left) and as a percentage share of GDP (right), 1960-2009



In recent times, South African organizations have been quite engaged with Europe on IPR matters. As an example, 23 patents have been granted by the European Patent Office (EPO) to South African institutions in the last decade. Council for Scientific and Industrial Research (CSIR) is the leading organization with 11 granted EPO patents:

EPO Patents granted to South African institutions (2001-2007)[67]

Assignee	Document Count
CSIR	11
Mintek	4
North West University	4
University of Pretoria	2
University of Stellenbosch	1
University of Johannesburg	1
University of Free State	1
South African Medical Research Council (MRC)	1
Total EPO patents	23[14]

IPR are granted through several legal instruments, such as copyrights, patents, trademarks, and industrial design rights amongst others. Governments and parliaments have established various forms of IPR protection as an incentive for creators to produce ideas that will benefit society as a whole. On the other hand, States have frequently established legislation in order to ensure that IP emanating from publicly financed research is commercialised for the benefit of their citizens.

The extent of protection and enforcement of IPR varied widely around the world; and as intellectual property became more important in trade, these differences became a source of tension in international economic relations. New internationally-agreed trade rules for intellectual property rights were seen as a way to introduce more order and predictability, and for disputes to be settled more systematically.

67 Source: WIPO, The Economics of Intellectual Property in South Africa, p. 124.

An example about this trend could be found in the **European Patents** granted by the **European Patent Office (EPO)** for (technical) inventions that are new, involve an inventive step and are industrially applicable.

The great advantage of European patents lies in the fact that it allows inventors to file **a single application** for obtaining patent protection in all the **40 European contracting states**[68] to the **European Patent Convention (EPC)**. European patents are released by EPO with a centralized and thus cost-effective and time-saving procedure, providing the same legal effects as national patents in all the countries for which they are granted. Plus, European patents offer strong protection, inasmuch they undergo significant examination and can be obtained for states which otherwise have "registration-only" systems69.

Besides that, European patents can be requested also by natural or legal persons having neither their residence nor their principal place of business in one of the 40 contracting States to the EPC. In this case, applicants will be requested by EPO to appoint a professional representative who will be in charge of conducting patent proceedings[70].

On the other hand, 25 EU Member States and the European Parliament agreed in 2012 on a legislative initiative which laid ground for the creation of unitary patent protection in the EU. After having adopted two Regulations in December 2012, the contracting States have started the process which will lead to the ratification of the Agreement on a Unified Patent Court. Once the Regulations and the Agreement enter into force, inventors will be able to obtain a European patent with unitary effect – a legal title ensuring uniform protection for an invention across 25 Member States, providing huge cost advantages and reducing administrative burdens[71].

C) IPR in EU-South Africa trade relations and the role of international standards

About EU-South Africa situation, in some cases the national IPR legislation can serve as a basis for claiming so-called "convention priority" in most other countries, provided a corresponding application is filed in that other countries within the time period conceded by the convention of reference(e.g.: South African patent applications at CIPRO – Companies and Intellectual Property Registration Office)[72].

Agreements between EU and South Africa should be supported in order to boost business cooperation along the principles commonly followed and the national specific needs[73]. In this context, standardisation plays a key role as a bridge between research, innovation and markets. Standardisation implies several benefits, and it could play an important role in boosting commercial relations between countries inasmuch:

- it helps in ensuring compatibility and interoperability of products and services →so it facilitates the creation of new markets;

68 http://www.epo.org/about-us/organisation/member-states.html
69 Some countries have only a patent registration system where there are only requirements of form to be fulfilled and no substantive examination of the patent takes place.
70 www.epo.org/representatives
71 http://ec.europa.eu/internal_market/indprop/patent/index_en.htm.
72 https://www.sabs.co.za/content/uploads/files/ip_guide_fa_web.pdf
73 http://www.wipo.int/wipolex/en/

- it supports exports by removing technical barriers to trade so it provides entrepreneurs with easier access to existing foreign markets;
- it is the best tool to ensure the commercialization of innovative products and technologies at the earliest stage possible - so it contributes to shortening time-to-market at global level.

In Europe and South Africa the recognised Standards Organisations are:

CEN[74] (the European Committee for Standardization);

CENELEC[75] (the European Committee for Electro-technical Standardization);

ETSI[76] (the European Telecommunications Standards Institute);

SABS[77] (the South Africa Bureau of Standards)

International agreements have equally been established in order to coordinate the standardisation work at global level and to optimize the use of available resources and expertise. CEN and CENELEC, for example, closely cooperate with their international counterparts, respectively the **International Organization for Standardization** (**ISO**) and the **International Electrotechnical Commission** (**IEC**). This close collaboration has been materialized by the signature of the **Vienna Agreement** (ISO-CEN) and the **Dresden Agreement** (IEC-CENELEC). On the South African side, it is equally worth highlighting the full membership acquired by SABS both in ISO and IEC.

Furthermore, CEN and CENELEC are always open for cooperation with third country National Standardization Bodies (NSBs) or with regional standardization bodies. CEN and CENELEC also recognize that this kind of cooperation may take several shapes, depending on their counterparts' links with Europe, wish to participate in technical activities and interest in the results of the European Standardization process. Therefore, they propose four big models of cooperation: **Affiliation, Standardization Partnership (PSB), Cooperation Agreement** and **Memorandum of Understanding**[78].

Finally, any company or organization with an interest in the creation of telecommunications and related standards can become an ETSI affiliate. Currently, there are 3 South African organizations among the 750 ETSI members (namely SABS, OIC and TELKOM SA)[79].

D) Role of IPR in enhancing business competitiveness abroad

74 http://www.cen.eu
75 http://www.cenelec.eu/
76 http://www.etsi.org/
77 https://www.sabs.co.za
78 http://www.cen.eu/cen/AboutUs/CENnetwork/EurIntOrg/Pages/default.aspx
79 http://www.etsi.org/membership/current-members

Before embarking on an export operation, enterprises go through a series of crucial steps which range from identifying an appropriate export market and estimating demand, to finding channels of distribution, estimating costs and obtaining funds. IP rights, however, are territorial, implying that they are usually only protected in the home country or region where protection has been applied for and obtained. Protecting IP in export markets is therefore crucial so as to enjoy the same benefits of protection abroad as are enjoyed in the domestic market. It should be carefully considered applying for IP protection well in time in all countries to which an organization is going to export or license its products or services.

It is fundamental to gather as much information as possible in order to being informed of the features of the export market, the technologies already available in it, the potential partners and their particular business positions and objectives.

A company willing to explore foreign market needs to:

- analyse its products or services so as to discover what kind of IP it is using;
- Identify its business goals and the IP strategy to be implemented, as well as the pressure it has to meet them (e.g. the need to license in);
- ascertain what are its accounting options (e.g. whether it prefers to amortise the IP-related costs over the expected life of the asset, or pay them immediately as costs of sales);
- segment its patent portfolio, to grasp the core area of business and determine its technology needs.

In this perspective, the valuation of IP detained by your organization assumes particular relevance. Indeed, knowing the economic value of your IP will help you in taking strategic decisions on your intangible assets, but will also facilitate the commercialization and transactions concerning IPR80.

To assist in particular **SMEs** performing **basic valuation in-house**, several national IP offices in the EU and other public organizations have created free tools, such as the following:

- **IP score** (tool provided by European Patent Office for evaluating patents and development projects): http://www.epo.org/searching/free/ipscore.html
- **IP Tradeportal** (tool provided by the Danish Patent and Trademark Office for assigning a score to patents, trademarks and design):

http://www.ip-tradeportal.com/valuation/ip-evaluation.aspx

- **IP Panorama** (set of e-learning modules dedicated to IP issues, jointly developed by the Korean Intellectual Property Office, the Korea Invention Promotion Association and the World Intellectual Property Organization):

80 http://www.iprhelpdesk.eu/sites/default/files/newsdocuments/Fact_Sheet_IP_Valuation_0.pdf p. 2.

http://www.wipo.int/sme/en/multimedia/

- **IP Healthcheck - Agreeing a price for intellectual property rights** (booklet published by the UK Intellectual Property Office to help companies on the valuation of their IP assets in the context of business transactions):

http://www.ipo.gov.uk/iprpricebooklet.pdf

Further information about IP matters could be acquired by contacting European and African IP offices such as:

- European Patent Office (for European patents):

http://www.epo.org/

- Office for Harmonization in the Internal Market (for European Community trademarks and, in the future, industrial designs):

http://oami.europa.eu/ows/rw/pages/index.en.do

- African Regional Intellectual Property Organization (ARIPO, the regional IP office for English-speaking Africa for patents, trademarks and industrial designs): http://www.aripo.org/South African Online Patent Search facility (delivering information on publicly accessible patents):

http://patentsearch.cipc.co.za/home/default.aspx

Copyrights

Copyright and related rights provide an incentive for the creation of investment in new works and other protected matter (music, films, print media, software, performances, broadcasts, etc.) and their exploitation, thereby contributing to improved competitiveness, employment and innovation. In fact, the field of copyright is associated with important cultural, social and technological aspects, all of which are taken into account in formulating related policies.

In EU there has been significant harmonization of the substantive copyright law to reduce barriers to trade and to adjust the framework to new forms of exploitation. Several efforts have been made in order to build common ground with respect to the rules on the enforcement of rights, i.e. on access to justice, sanctions and remedies regarding infringements. In order to grasp the full potential of marketing intellectual property rights in the Single Market, complementary measures on the management and licensing of these rights may also prove necessary. The task of the EC is to enforce the "acquis" on copyright and related rights; to advance it further and to modernize and adapt it to new developments in technology or the markets concerned as this is an evolving scenario. In fact, the copyright industries are critically important to the EU because they involve media, cultural, and knowledge industries. Development in these industries is

indicative of performance in post-industrial society especially where related to the information society. The EC is also responsible for conducting negotiations on industrial and intellectual property within World Intellectual Property Organization (WIPO) (e.g. audiovisual, broadcasting, resale right, databases, etc.), for participating in the relevant WIPO General Assemblies, and for contributing to the work of other international fora on IPR related matters with a view to ensuring adequate protection of intellectual property rights (IPR) internationally.

In July 2012, as announced in its Communication A Single Market for Intellectual Property Rights, the European Commission adopted its proposal on collective management of copyright and related rights and multi-territorial licensing of rights in musical works for online uses (IP/12/772).

Collective management organizations act as intermediaries between right holders in a variety of industries such as music, books and films, and the service providers intending to use their works. They license rights and collect and distribute royalties in circumstances where negotiating licenses with individual creators would be impractical and entail high transaction costs. Cases of mismanagement of rights revenue and long-delayed payments have shown that there is a need to improve the functioning of collective management organizations. Furthermore, the collective management of rights also plays a key role in the licensing of online music service providers (music download services or streaming services). Online service providers often want to cover a multitude of territories and a large catalogue of music. Many collective management organizations have not been able to meet these challenges, and service providers have faced difficulties when trying to obtain the licenses necessary to launch online music services across the EU, resulting in fewer online music services available to consumers.[81]

Additionally, on the 4th February 2014, the European Parliament adopted the new Directive on collective rights management and multi-territorial licensing of musical works for online use. This Directive is a cornerstone of the digital single market as it aims at facilitating the entry of smaller innovative suppliers on the European market. It will also contribute to wider availability and better choice of offers of online music in Europe. The Directive modernizes the functioning of collective management organizations (also referred to as 'collecting societies') which manage copyright and related rights on behalf of right holders, such as authors or performers, across Europe. It strengthens and improves the governance and transparency of these organizations. For example, it gives right holders the possibility to be more involved in the decision-making processes of their collective management organisations, set out minimum requirements relating to the governance structure of collective management organisations and ensure timely and accurate payments of royalties to right holders. In addition, the new rules foster and improve multi-territorial licensing by collective management organizations for online music services (such as music download services or streaming services). Going forward, it will be easier for those services to cover a multitude of territories and a large catalogue of music, which in turn will increase the offer available in the EU.

Trademarks

Trademarks are indicators of business origin, distinguishing products and services of one company from

81 For more information on collective rights management: http://ec.europa.eu/internal_market/copyright/management/index_en.htm

those of another. They enable consumers to recognize a product as one which they have liked, or disliked, in the past and thereby allow them to make an informed choice when making the purchase or asking for a service. Trademarks are also essential marketing tools for modern business as principal instrument used by businesses for advertising their products, and offer a guarantee that all the goods originating from the same producer have a certain quality. In a world of increasing consumer sophistication, branding, supported by trademarks, can assist businesses of all sizes in their quest for innovation and entry into new markets.

Trademarks are territorial rights. They guarantee a protection to their owners only in the territory of the country or countries concerned. In Europe, several systems for trade mark protection exist:

- National trademarks are registered by the intellectual property (IP) offices of Member States on the basis of a harmonized system. Currently, there are 24 national offices, and one regional office – the Benelux Office for IP (BOIP)[82] . National trade marks generally serve users seeking registration in one, or a limited number of, countries, as well as users that want to obtain much broader protection in geographical terms but are not able[83] or willing to opt for a Community trade mark.
- Community TradeMarks (CTM), available since 1996, grants their proprietors a unitary IP right with an equal effect throughout the entire EU. They are registered by a specialized EU agency, the Office for Harmonization in the Internal Market (Trade Marks and Designs) (OHIM) which was established in 1994 in Alicante, Spain. The CTM does not replace national trade mark systems, but provides an additional legal framework ("a 26th regime") for obtaining trade mark protection in the territory of all 27 Member States.
- Finally, international trademark registrations are administered by the WIPO, and secure protection in several countries, through the system of the Madrid Agreement and the Protocol to that Agreement. These trademarks can be obtained in a single procedure; however, once registered they do not become a single IP right, as the CTM, but split into a bundle of national and/or Community trademarks, depending on the choice of the applicant. International applications have limited added value within the EU and are more advantageous for users seeking trade mark protection in countries outside Europe and/or worldwide.

The national, Community, and international trade mark systems not only coexist passively but are closely interrelated with each other[84].

Such European trademark system has undergone a significant development over the last 20 years. This process started with the harmonization of national trade mark laws in 1989 and was followed by the

82 Hereinafter, the 24 national IP offices and the Benelux Office for IP are referred to jointly as "national IP offices" and the national and regional trade marks as "national trade marks".

83 Given the unitary character of a Community trade mark (Article 1(2) CTMR), protection cannot be obtained if absolute grounds for refusal exist in any part of the EU (for example, trademarks that would be purely descriptive in one of the EU languages and/or would be contrary to public policy in one Member State). Similarly, the existence of an earlier national trade mark in a single Member State can prevent the registration of a CTM for the whole territory of the EU.

84 In principle, companies should be able to freely choose between registration at national, Community or international level, depending on their business needs and the type of protection that they want to secure for their trade mark rights. Ideally, their choice ought to be guided by considerations regarding plans for future expansion, existence of prior rights in some territories, investment in IP protection etc. In practice, however, their free choice is often biased by uneven conditions at individual IP offices. For more details about these issues see chapter 3.2, problem definition.

creation of the CTM in 1994. Since then, it has not been subject to any major modifications[85]. The business environment, however, has changed significantly over the past two decades, notably with the expansion of the internet and other electronic business tools. The numbers of trademark applications have been growing, both at national and Community levels[86], as are the numbers of trade mark users. Stakeholders increasingly demand faster, higher quality, more streamlined trademark registration systems, which are more consistent, user friendly, publicly accessible and technologically up-to-date.

In 2007, the Council[87] recognized that it was over a decade since the introduction of the CTM Regulation and the establishment of Office for Harmonization in the Internal Market (OHIM)[88], and under the principles of better regulation, emphasized the need for an overall assessment of the functioning of the CTM system. It invited the Commission to start work on a comprehensive study on the overall functioning of the CTM system.

The Commission committed itself, in its 2008 Small Business Act[89], to make the CTM system more accessible to SMEs. Furthermore, the 2008 Communication on an Industrial Property Rights Strategy for Europe[90] stressed the Commission's commitment to effective and efficient trademark protection and to a high quality trademark system. It concluded that it was time for an overall evaluation which could form the basis for future review of the trade mark system in Europe, and the further improvement of cooperation between OHIM and national IP offices. As regards the international dimension, the Communication announced that the Commission would prepare the ground for the accession of the EU to the Singapore Treaty on the Law of Trademarks and encouraged Member States to ratify that treaty. In 2010, in the Communication on Europe 2020 strategy under the Flagship Initiative Innovation Union, the EC committed to modernize the trademarks framework in order to improve the framework conditions enabling business to innovate. Finally, in its new IPR strategy for Europe[91], the Commission announced a review of the trademark system in Europe, with a view to modernising the system both at EU and national levels, by making it more effective, efficient and consistent as a whole.

The Competiveness Council adopted on 25 May 2010 conclusions on the future revision of the Trade Mark system in the EU[92]. The Council called on the Commission to present proposals for the revision of, respectively, the CTM Regulation, and the Directive approximating the laws of Member States relating to trademarks, and flagged up those issues which it would like to see addressed therein. Therefore, on the 27th March 2014 the EC presented a package of initiatives to make trade mark registration systems all over the European Union cheaper, quicker, more reliable and predictable. The proposed reform would improve conditions for businesses to innovate and to benefit from more effective trade mark protection against counterfeits, including fake goods in transit through the EU's territory.

85 The 1989 Trade Mark Directive was amended only once in 1992 as regards its transposition deadline. The 1994 CTM Regulation was amended in 2003 in relation to the EU accession to the system of international trademark registrations under the Protocol to the Madrid Agreement. In 2004, the CTM Regulation was subject to some further amendments on substantive law and procedures. Both the TM Directive and the CTM Regulation were codified in 2008 and 2009, respectively, but without any changes on substance.

86 For more details refer to section 3.1.2.

87 Council Conclusions of 21 and 22 May 2007, Council document 9427/07.

88 The OHIM website is at: https://oami.europa.eu/ohimportal/en/

89 COM(2008) 394 final.

90 COM(2008) 394 final.

91 COM(2011) 287 final.

92 Council document 2010/C 140/07.

As regards fees, the EC proposes a principle of "one-class-per-fee" that will apply both for Community trademark applications and for national trade mark applications. This will enable any business – particularly SMEs – to apply for trademark protection according to their actual business needs, at a cost that covers those individual needs only. Under the current system, the fee for registering a trademark allows for the registration of up to three product classes. Under the revised system, a trademark can be registered for only one product class. So at EU level, businesses will pay substantially less when they seek to obtain protection for one class of product only. In order to foster innovation and growth by making trade mark systems in Europe more accessible and efficient for businesses, the proposed revision would:

- Streamline and harmonize registration procedures, including at Member State level, taking the Community trade mark system as a benchmark;
- Modernize the existing provisions and increase legal certainty by amending outdated provisions, removing ambiguities, clarifying trade mark rights in terms of their scope and limitations and incorporating extensive case law of the Court of Justice;
- Improve the means to fight against counterfeit goods in transit through the EU's territory; and
- Facilitate cooperation between the Member States' offices and the EU trademark agency – the Office for Harmonization in the Internal Market (OHIM) - in order to promote convergence of their practices and the development of common tools.

The proposed package contains three initiatives:

1. Recast of the 1989 Directive (now codified as 2008/95/EC) approximating the laws of the Member States relating to trademarks;
2. Revision of the 1994 Regulation (now codified as 207/2009/EC) on the Community trademark; and
3. Revision of the 1995 Commission Regulation (2869/95) on the fees payable to OHIM.