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THE DEPARTMENT  
OF TRADE AND INDUSTRY  
SOUTH AFRICA



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## A DESCRIPTION OF THE SOUTH AFRICAN ELECTROTECHNICAL INDUSTRY



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# **INTRODUCTION**

## **1.1 Background**

The Department of Trade and Industry is taking an active role in the development of the Information and Communications Technology and Electronics Industry sectors. The responsible business unit is the Electrotechnical unit at Trade and Investment South Africa (TISA)

The purpose of this document is to indicate the organisation and structure of the electrotechnical industry in South Africa and to write up and showcase available information on the industry for a comprehensive overview on the status and capabilities of the industry; Identify and showcase success stories in the SA Electrotechnical sector and to develop and confirm the broader Marketing strategy for the SA Electrotechnical Industry.

## **1.2 Glossary of Terms**

The following Glossary of terms was deemed necessary to allow for common definitions of Industry sectors. This is not only semantic; the objective is that errors and misunderstandings will not be perpetuated. TISA is in process to conduct studies that refer to sectors within the Electrotechnical Industry. Lacking a common language and similar definitions has led to misunderstandings.

This Glossary of terms is not meant to be comprehensive, or linguistically absolute, but focus on those terms and sectors of industry that will be referred to by the participants in the present study (and related Industry sector studies). Further debate and upgrading of definitions will be necessary. Electrotechnical Industry<sup>1</sup> – This is an all encompassing term for the electronics industry, the IT industry, the electrical engineering industry and the telecommunications industry.

The Electrotechnical Industry is concerned with the practical applications of electricity in all its forms, including those of the field of electronics. Electronics engineering is

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<sup>1</sup> It should be noted that the taxonomy of the Electrotechnical industry, as it is used in this report has an accent on the light current part of electrical engineering, what is often colloquially known as "electronics".

that branch of electrical engineering concerned with the uses of the electromagnetic spectrum and with the application of such electronic devices as integrated circuits, radio frequency devices, memory chips, to name a few.

- Electronics Industry - Electronics encompasses an exceptionally broad range of technology. For the purpose of this document, we ring-fence the Electronics industry to include the complete life cycle (design, production, maintenance, etc) of electronic devices from raw material and components, through to Boxes, or subsystems. This industry spans all sectors (telecommunications, IT, Aerospace, etc)
- Power Electronics – The Sector of the Electrotechnical Industry concerned with the management and control of power distribution. This does not include the so-called heavy current engineering.
- Telecommunication Industry – The sector of the Electrotechnical Industry concerned with telecommunication of voice and data, encompassing fixed line and mobile operators. This industry spans the whole spectrum from materials and components to service providers, and e-commerce (with involvement of end-users)
- Information Technology (IT) industry – This sector is concerned with all aspects of information management, and supportive systems. E-commerce is the domain of IT, and through convergence many of the traditional lines between IT, telecommunication and other sectors are blurred.
- Avionics Industry - (derived from the expression “aviation electronics”), the development and production of electronic instruments for use in aviation and astronautics. Avionics nowadays centres on the central processing system of aircraft, which monitors and controls all subsystems required for flight, safety, (offensive or defensive actions, in military aircraft)
- Vetronics Industry – (derived from the expression “vehicle electronics), is for the automotive industry, what avionics is for the aerospace industry.
- Aerospace Industry - The aerospace industry, which of necessity devotes a considerable portion of its effort to research and development in the broadening realm of flight, is a leader of world technological advance. The aerospace industry is highly dependent on products and services supplied by the electrotechnical industry, and in South Africa these industries developed hand in hand.

- Defence Electronics – Concerned with Electronics, as used in the defence industry
- Consumer Electronics – Electronics as part of consumer goods, includes every aspect of a typical first world consumer’s lifestyle (washing machines, photographic devices, entertainment, audio and video equipment)

ICTE, acronym for the industry that comprises Information and Communications Technology (globally known as ICT), and Electronics.

**The dti**, the Department of Trade and Industry of the government of South Africa.

TISA (Trade and Investment South Africa), a division of **the dti**, with investment and export promotion and the development of Customised Sector Programmes as primary responsibilities

The South African Electrotechnical Export Council (SAEEC) is a Public Private Partnership (PPP) between business and **the dti** to support and coordinate export initiatives from the electronics, electrical engineering, and Information technology and telecommunications sectors.

- SAVANT is a Public Private Partnership (PPP) between government and industry. It is the official marketing and awareness programme for the South African Information and Communications Technology and Electrotechnical industry sectors

### 1.3 Abbreviations

ANSI	American National Standards Institute
ASIC	Application specific Integrated Circuit
BEE	Black Economic Empowerment
CAD/CAM	Computer Aided Design / computer Aided Manufacture
CCD	Charge Coupled Device
CCTV	Closed Circuit Television
CMOS	Complementary Metal Oxide Semiconductor

CMT	Mercury Cadmium Telluride
COTS	Completely Off The Shelf
DECT	Digital Enhanced Cordless Telecommunications
DRDB	Defence Research & Development Board
DTI	Department of Trade & Industry
EW	Electronic Warfare
FLIR	Forward Looking Infra Red
FPGA	Field Programmable Gate Array
HUMS	Health & Usage Monitoring System
IC	Integrated Circuit
IDC	Industrial Development Corporation
IRD	Integrated recorder Decoder
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
JSE	Johannesburg Stock Exchange
LAN	Local Area Network
LIDAR	Light Detection and Ranging
OEM	Original Equipment Manufacturer
PBMR	Pebble Bed Modular Reactor
PBX	Private Branch Exchange
PCB	Printed Circuit Board
PIR	Passive Infra Red
RFID	Radio frequency Identification
SAAF	South African Air Force

SABS	South African Bureau of Standards
SANDF	South African National Defence Force
SCADA	Supervisory, Control and Data Acquisition
SDH	Synchronous Digital Hierarchy
SIM	Subscriber Identification Module
SMD	Surface Mount Device
SMT	Surface Mount Technology
SONET	Synchronous Optical Network
STB	Set Top Box
THRIP	Technology and Human Resources for Industry Programme
UAV	Unmanned Aerial Vehicle
UPS	Uninterruptible Power Supply
WAN	Wide Area Network

## 2. METHODOLOGY

### 2.1 Models for industry description and marketing message.

The following models were used (inter alia) for industry description, broad marketing strategy development and the development of the marketing messages:

- a. **Crossing the Chasm – Dr Geoffrey Moore.** “Crossing the Chasm” methodology focuses on the marketing of discontinuous innovations (typical of the electrotechnical industry). It is particularly strong on the development of a coherent marketing strategy and message (“elevator statement”).
- b. **5-Forces Model – Michael E Porter.** Porter’s model has been the benchmark for the analysis of industry structure over the past two decades.
- c. **Diamond of National Advantage – Michael E Porter.** Porter’s “Diamond of National Advantage” is defined in his book “The Competitive Advantage of Nations”, 1990. Many industry competitive analyses have subsequently been based on this model. The model is particularly strong in analysing an industry on a national level and in pointing out specific actions that government can take to ensure a strong “diamond”.
- d. **Reputation Management and Analysis.** Fombrun and Van Riel describe the importance of Reputation Quotient (RQ), and ways to manage the reputation through Programs focusing on Awareness and Visibility. This is outlined in “Fame and Fortune: How successful companies build winning reputations”.

### 2.2 Capture success stories from the industry

Success stories from the Industry were captured and evaluated against specific criteria before inclusion in the findings of this report.

#### Definition of Success Story

Most companies mentioned in this report, due to the fact that they are involved in sustainable business in a competitive local and global industry, represents success in one way or another.

We aimed however to identify some exceptional examples, representing the ingenuity and capacity of South African entrepreneurs, engineers and businessmen in different sectors of this industry. The aim of a success stories is to showcase the capabilities and the ingenuity of the South African Electrotechnical Industry, it should resonate with an international audience, as well as with local decision makers.

The criteria used by the team of experts to rank some of the organisations in terms of success, focused attention on the content and context of the message to be created. These criteria are:

- **World Class**, ability to catch the attention and credibly lift the reputation of the company and our country's capabilities
- **Impact**, which includes the size of the success as perceived by both local and global players
- **Technological Pioneering**, i.e. the way in which the product or service has provided for trailblazing opportunities
- **Revenue/Forex** generated, did it make money, the ultimate measurement for business success
- **Comparative advantage** generated, how the product or service enabled the company and related industry to position uniquely in the world of competitive business

### **3. ELECTROTECHNICAL INDUSTRY STRUCTURE AND ORGANISATION**

#### **3.1 Description and Taxonomy of the Industry**

When one considers the Electrotechnical Industry, one is struck by its size, by its pervasiveness, and by its importance.

To enable understanding of this industry, a comprehensive taxonomy is needed, a holistic picture of the complete industry. In this respect the Value Matrix of **the dti** is a useful beginning. The Value Matrix is depicted below:

- Firstly it is useful for Industry Categorisation (figure 1)

- As a flow diagram, it explains graphically participation and value added by contributors in the industry (figure 2)

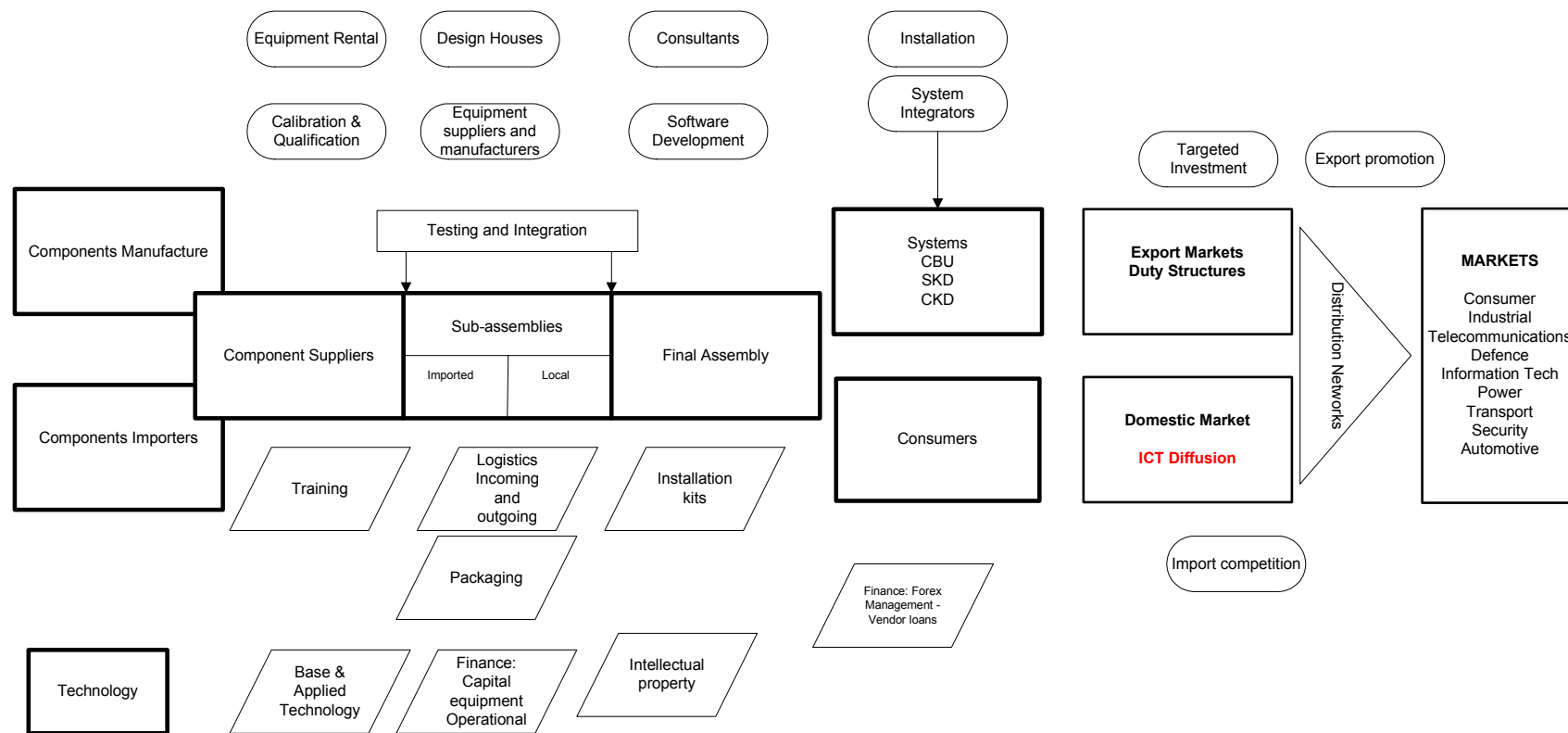


Figure 1: Value Matrix - Electrotechnical Industry

# VA Matrix for Electrotechnical Industry (2)

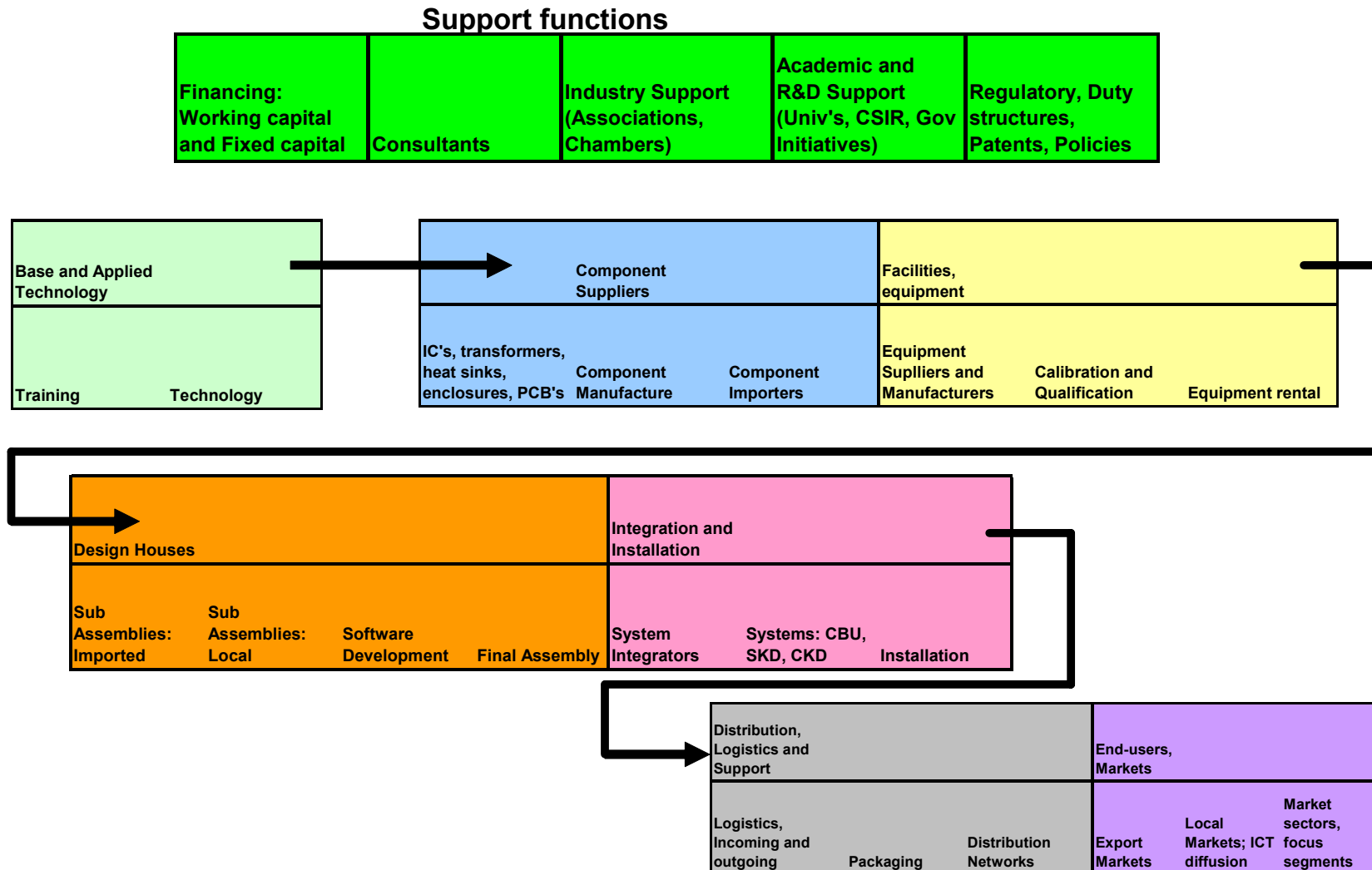
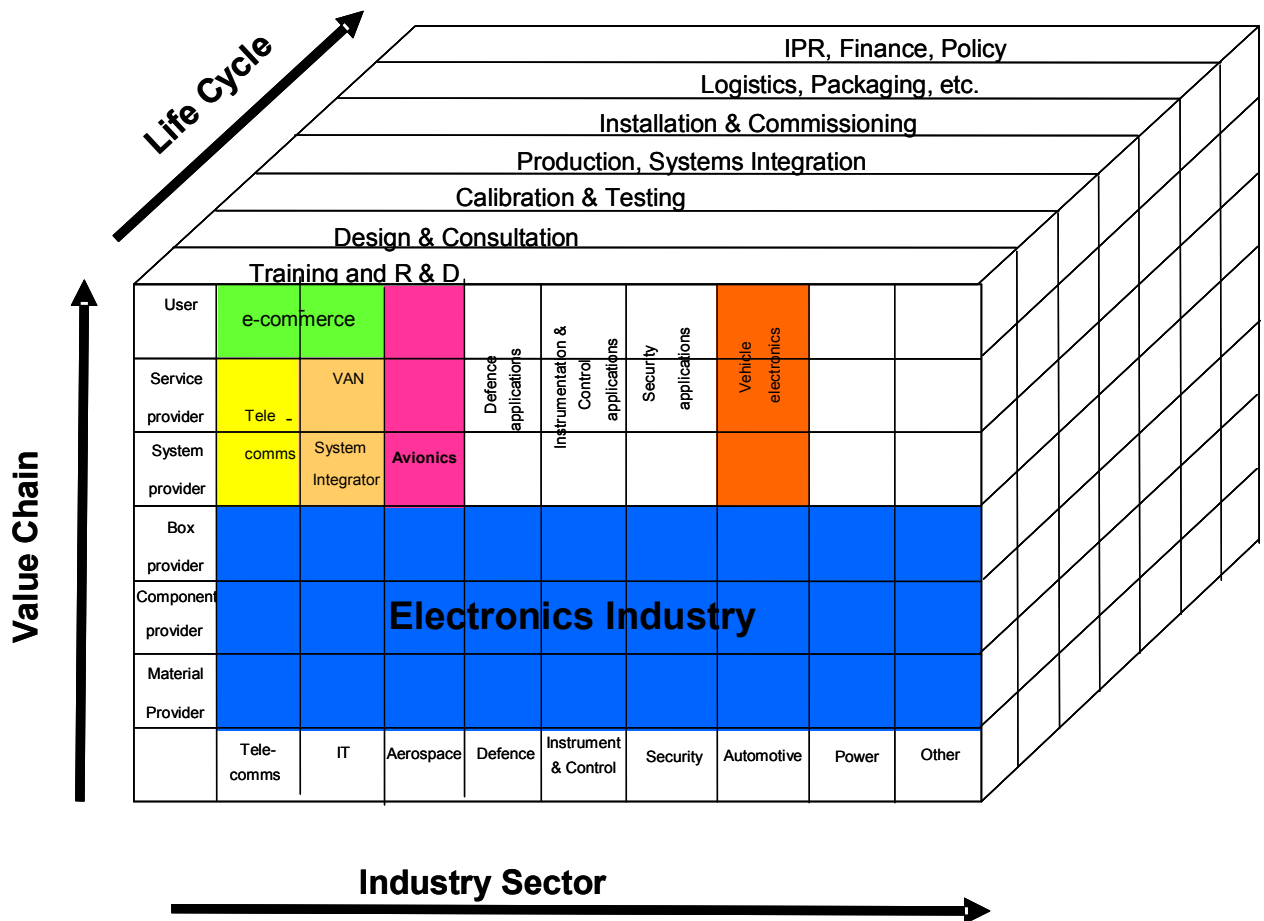


Figure 2: Value Matrix - Flow Diagram

This Value Adding Network leads, effortlessly, to the Taxonomy of the electrotechnical industry, which describes the overall electrotechnical industrial space. This is shown below as figure 3.



**Figure 3: Taxonomy of the Electrotechnical Industry**  
*Figure 5: Taxonomy for the Electrotechnical Industry*

Some explanation of this holistic model for the Electrotechnical Industry is required.

Firstly, it should be noted that it was impossible to be exhaustive, in this first round, and not possible to cover all players in Industry.

Three axes of Industry character are identified as critical:

- Industry Sector (Telecommunications, IT, Defence, Aerospace, Automotive, etc)
- Value Chain progression (depicting focus from material provider through to service provider and end-users)
- Life cycle stage (from concept, through implementation to operations and maintenance)

The taxonomy describes the industrial space of electronics in terms of some 400 entrepreneurial cells. In an analysis of the industry, it was found that a remarkable population of all these cells by South African companies exists.

A Storybook was also compiled of the successes of some 120 of South Africa's premier electrotechnical companies, but there are many others. The Taxonomy provides a useful tool for identifying them as well as for finding new opportunities.

This combination delivers the uniqueness of the South African electrotechnical industry, and this combination is a powerful formula for future success. This is further detailed in the following Industry overview.

### 3.2 Industry Overview (including our Competitive advantages)

***South Africa has an Electrotechnical Industry, which is superior, in terms of size, level of advancement, and technological depth, to that of a typical nation of a similar stage of development.***

This advantage was created from heritage factors, which includes:

- **Mining, non renewable resources.** South Africa has a long and rich history in mining. Its mining industry faced considerable challenges in mining gold ore at very deep levels.
- **State-initiated utilities and infrastructure.** The major utilities such as electricity, water, transport and telecommunication have all been (and continue to be) state controlled. The focus of these utilities over the years was on technological advancement in contrast to cost competitiveness.
- **Large programs, strategically motivated.** These include **Industrial development** programs such as Iscor, Sasol, Alusaf, Mossgas, Nuclear Energy and **Defence initiatives** such as the development of a world-class Armaments Industry as well as investment in a Space program.

**The bottom-line of the above mentioned initiatives was an artificially high investment in Research and Development over a protracted period, sponsored**

by government. This is much higher than the R&D investment that companies would have made if they had to use their own funds.

***The South African Electrotechnical industry is shown to be an “enabler” (the essential glue) for integrated industrial growth.***

Its success is, therefore, a prerequisite for economic growth. The estimated size of the industry is described, but these figures must be considered with caution: In the first place – they are estimates. In the second place – boundaries are fuzzy. In the third place – as one is dealing with added value networks, there may be some double counting.

### Approximate Industry Size

Sub-sector	Electrotechnical Industry Size	Total Industry Size
Telecoms (Including Broadcasting)	R85 bill	R85 bill
Information Technology	R43 bill	R43 bill
Aerospace	R5 bill	R20 bill
Defence	R5 bill	R10 bill
Instrumentation & Process Control	R5 bill	R5 bill
Security	R2 bill	R3 bill
Automotive	R2 bill	R20 bill
Power	R2.5 bill	Not Available
Other	R2.5 bill	Not Available
<b>Total</b>	<b>R152 bill</b>	

***South African Electrotechnical Industry can be marketed as a “one-stop-shop” destination for many potential clients.***

The South African Electrotechnical Industry covers all essential components required for whole product or whole service provision. From supportive Research and Development Institutes and the provision of raw material and components, to fully integrated products and services, the industry has achieved a remarkable level of self-sufficiency, driven by the requirements perceived during the “siege economy”. We have sufficient capacity in provision of raw materials and components. We can provide highly specialised IC’s and related products. We have capacity to supply top quality cabling and fibre optics material. We can manufacture complex designs and mount these on PC Boards, and manufacture subsystems. We have proven that we can integrate these in large systems, and operate and maintain these to the most stringent specifications, in the harshest and most demanding environments on earth.

***A combination of entrepreneurship, with design and implementation discipline, sets our industry apart from any other in the world today.***

Our Industry with its many success stories was formed in an environment where some important drivers determined our response to the business challenges of the day. These drivers were firstly determined by situational factors:

- The Resource “Curse”, with abundant natural resources which leads to low levels of local value adding and could create underdevelopment in knowledge industries.
- A siege Economy, and relative isolation, and large distance from suppliers and markets, which forced our engineers and technicians to become self-sufficient, and provide for all aspects of the value chain.

The personality characteristics of our people, which are creative and innovative, with ambition and an aptitude for risk-taking, meant that the challenges were met, and our needs addressed. Coupled to this, a “can do” attitude is common amongst South Africans, and no challenge too big, no hurdle too high to overcome.

Furthermore, and most importantly, our engineering discipline was spawned mainly by;

- Large number of active engineers and technicians that were trained in the defence and aerospace industries with a strong emphasis on systems engineering and project management.
- Safety requirements from a mining industry faced with operating the deepest gold mines in the world as well as methane rich coal mines.

In these industries, a disciplined approach to design and implementation are non-negotiable. Throughout the lifecycle of products and services in the mining and armaments industries, errors, oversight or failure could result in loss of life, and disaster.

**The combination of all the above, led to a unique response to the challenges faced by our industry, and therefore a unique blend of capabilities found in our South African Electrotechnical Industry sector**

<b><i>Our Electrotechnical Industry has the ability to provide First world Quality at Third world prices, or...</i></b>
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<b><i>The SA Electrotechnical industry provides cost-effective, and price competitive offerings at World Class Standards</i></b>
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The vast majority of companies covered in this review are certified to the international quality management system ISO 9000. Local certification bodies are accredited by the South African National Accreditation System (SANAS), this same body accrediting calibration, testing and inspection laboratories. A large number of accredited electrical laboratories covering all relevant fields of electrical measurement are located throughout the major industrial areas of the country. South Africa is a member of the BIPM (Paris) and the national measuring standards are maintained by the NML (CSIR). In terms of calibration and testing laboratories, South Africa is a signatory of the ILAC Arrangement, and calibration certificates and test reports issued by local accredited laboratories are recognised internationally.

***The South African Electrotechnical Industry is not good at internationalisation, and is exposed to the risk of losing Intellectual Property at transition points in business development***

The SA industry is bad at internationalisation and successful SA firms usually capitulate during this phase by selling the business to international players.

***The South African Electrotechnical Industry is relatively unknown globally and therefore “undersold”***

The SA electrotechnical industry is unknown globally and for the most part poorly/weakly marketed internationally by the incumbents. This is unrelated to the competitive advantages, strengthening the correctness of the resolve of **the dti** with programmes like Savant to make a difference.

## 4. SUCCESS IN OUR ELECTROTECHNICAL INDUSTRY

### 4.1 Prevalence of success stories

**Successes are found in all parts of Industry.** Factors which seem to have little or no bearing on success are:

- The size of the Company,
- The specific sector served, and
- Whether local or international markets are the marketing focus.

The factors which are common to success, which created the correct environment for prospering businesses, are:

- **A “*benevolent benefactor*” is always in the background**

Companies servicing some of the large governmental initiatives are typical at the forefront, or created opportunity for individuals to use their expertise and make success happen. They piggybacked on large industry e.g. Telecoms, the automotive Industry, the mining sector. In many instance technologies created by military phase were used and expanded. The Government therefore played a crucial role, not in direct funding of the venture, but more so in the provision of capacity and skills through large programs which in all cases were government initiatives.

- **Individual championing, *risk taking*, and a *focus strategy***

Without the individual championing of opportunities, no success is possible. In all cases the vision of individuals with determination and perseverance was a necessary ingredient.

- Local market opportunities were sometimes the drive
- Pure export orientation were sometimes successful

## 4.2 Thrusts for Success in Our Electrotechnical Industry

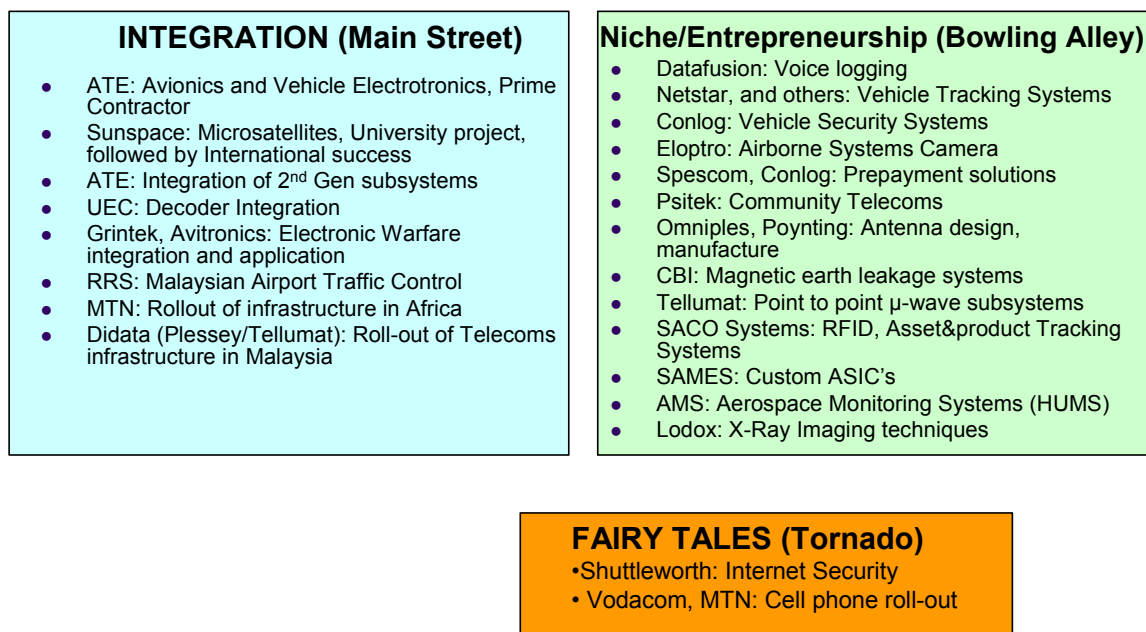
We were able to group and categorise success stories in industry, and found some common underlying themes or thrusts. Three groups emerged, and these are shortly summarised:

**Strong integration capabilities.** The SA electrotechnical industry has a long record of working as prime contractor on complex and ambitious projects such as missile systems, satellites, telecommunications networks (copper, optical fibre, microwave and cellular) fighter aircraft and tracking radars. As such the industry has a solid foundation in systems engineering and integration.

**Niche successes.** The industry has been extremely successful in finding niche application and exploiting niche markets, especially for medium to low production runs.

**“Fairy Tale” successes.** Examples of success stories which created amazing results, with substantial riches for the individuals involved, can also be found on the South African landscape. These stories are difficult to replicate, as they happened with a combination of factors “at the right time and place”. However, the opportunity was created by the same underlying capabilities for success in the two thrusts identified, Integration and Niche opportunities.

The diagram below summarise some of the success stories in these different groups. The success stories are detailed in Appendix A, B and C of the report.



**Figure 4: Thrusts for Success in the Electrotechnical Industry**

Summaries of more than 100 companies in different sectors of the SA Electrotechnical Industry have been compiled. (Annexure A) These stories provide a good overview of the general capabilities and successes of the industry.

The general trends emerging from the company summaries are:

- SA has a good spread of companies, representing all the major sectors of the industry.
- Most of the companies reviewed are internationally competitive.
- A large number of the companies have international shareholding and/ or joint venture agreements with international partners.

The general trends emerging from the success stories are:

- Successes have been achieved against established, international players.

- Successes often lead to international joint venture

## 5. MARKETING

### 5.1 Does the world know about the SA Electrotechnical Industry?

The SA electrotechnical industry is unknown globally and for the most part poorly/weakly marketed internationally by the incumbents. This is unrelated to the competitive advantages, strengthening the correctness of the resolve of the DTI with programmes like Savant to make a difference.

The picture below provides a graphical illustration of Consumer Rating vs. Media Rating<sup>2</sup>.

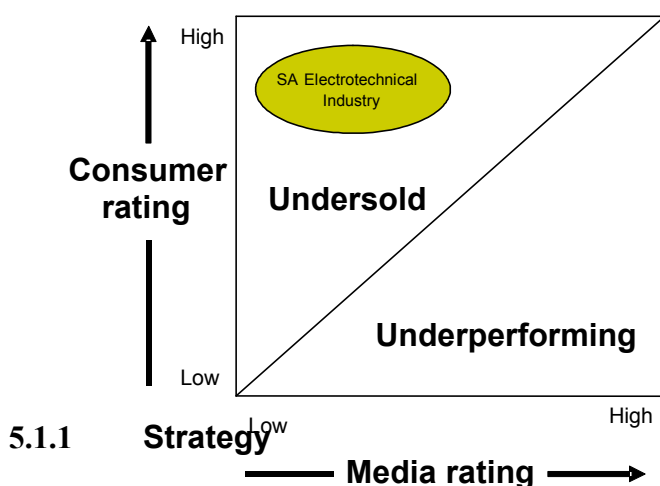


Figure 5: Comparing Consumer Ratings and Media Ratings

The picture emerging and descriptive of our electrotechnical industry is the **competence at the integration (solution) level and niche successes**. Marketing messages should therefore be focused on these competencies.

Another dimension to be taken into consideration is the target market's receptiveness for a specific message. It will, for instance, be difficult to sell the integration (solution) capability to 1<sup>st</sup> world customers. On the other hand, 3<sup>d</sup> world customers would be much more receptive to an integration marketing message.

A **targeted marketing approach** is therefore required to best leverage the industries' competencies in markets that will be receptive for the message.

<sup>2</sup> This figure repeated from the Executive Summary, for clarity

The following diagram correlates the above mentioned dimensions for foreign target markets:

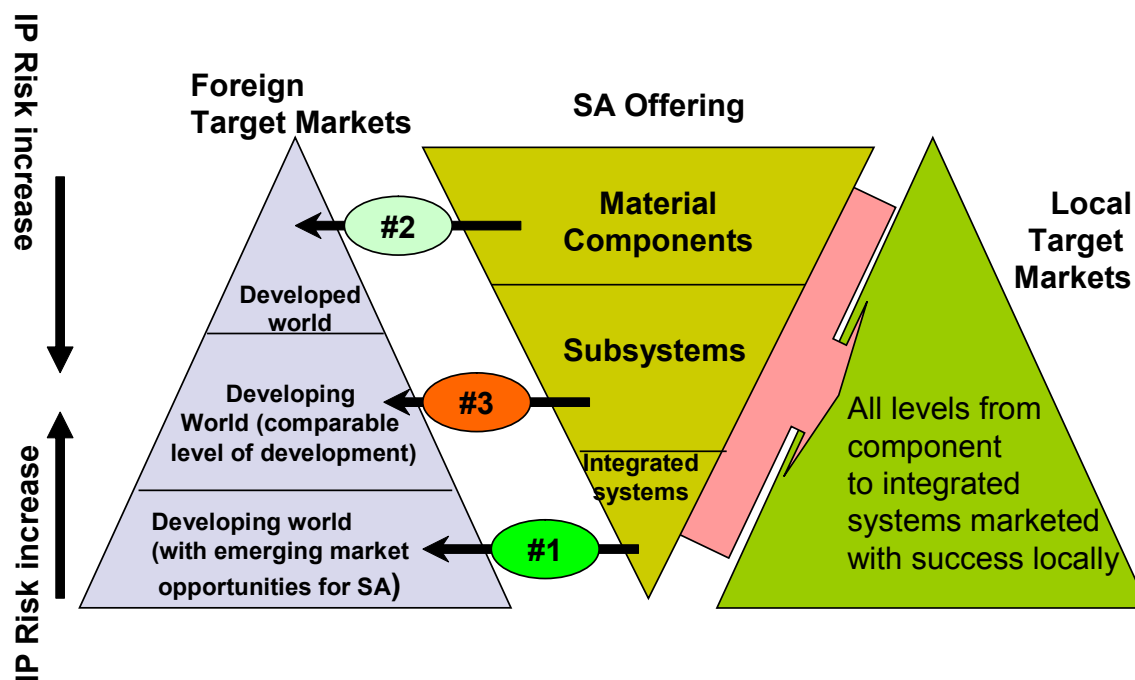


Figure 6: Marketing Strategy

### #1 Target Market to achieve market leadership in the developing world

- Integrative capabilities has an edge
- Needs are understood, solutions tried and tested
- Comparative advantage strongest in developing world
- Partner with European companies, they need SA support into developing world
- Align with national strategy: SA (into Africa), Brazil (into South America) and India (into far east)

### #2 Target Market to achieve market leadership in niches in developed world

- Build on successes, replicate
- Dependent on entrepreneurs, SA companies'

### #3 Target Market into environments with comparable technologies and development levels

- Assure protection of Intellectual Property (IP)
- Maintain edge through continued R&D investment
- Nurture sources of comparative and competitive advantage