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The impact of commercializing industrial research and development (IR&D) products under a challenging macro-economic environment: the 5-year case of Zimbabwe's SIRDC

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Impact measures for STPs

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Table of Contents:

List of Table:

List of figures:

List of Annexes:

Acronyms:

AIDS	Acquired immunity deficiency syndrome
ASPEF	Agricultural Sector Productivity Enhancement Facility
BOTECH	Botswana Technology Centre
BRI	Biotechnology Research Institute
BSC	Balancedscore card
BTI	Building Technology Institute
COMESA	Common Market for Eastern and Southern Africa
CPC	Cleaner Production Centre
CSIR	Council for Scientific and Industrial Research
DGIS	Netherlands Development Agency
DTI	Danish Technology Institute
ERSI	Environmental and Remote Sensing Institute (ERSI)
ETI	Energy Technology Institute
ExRate	Exchange Rate[1]: US$1: Z$1, 000, 000.00 (RBZ) and Z$6,000,000.00 (Parallel market) with US$1: Z$3,500,000.00 being a mid-point
FIN	Norwegian Association of Science Parks
FINTRUST	Financial Trust of Zimbabwe (a Reserve Bank of Zimbabwe commercial vehicle)
GAZ	Government Analyst of Zimbabwe
GIS	Geographical Information Systems
GTZ	German Development Agency
IEI	Informatics and Electronics Institute
IR&D	Industrial Research and Development
JICA	Japanese International Cooperating Agency
JVs	Joint Ventures
MCAZ	Medicines Control Authority of Zimbabwe
MCR	Micro-concrete roofing
NEDPP	National Development Priority Programme
NMI	National Metrology Institute
NORAD	Norwegian Development Agency
NUST	National University of Science and Technology
NSSA	National Social Security Authority
PAYE	Pay As You Earn
PEI	Production Engineering Institute
PV	Photo-voltaic
R&D	Research and Development
RRA	Regional Research Alliance
RTO	Research and Technology Organisation
RS	Remote Sensing
SADC	Southern Africa Development Community
SAZ	Standards Association of Zimbabwe
SBU	Strategic Business Unit
SDF	Staff Development Fellow
SIRTECH	Scientific and Industrial Research Technologies
SINTEF	Foundation for Scientific and Industrial Research
SLATE	Science and Laboratory Teaching Equipment
SME	Small and medium scale enterprise
UNESCO	United Nations Cultural and Scientific Organisation
US$	United States Dollar
UZ	University of Zimbabwe
VAT	Value-added tax
WAITRO	World Association of Industrial and Technology Organisations
ZTS	Zimbabwe Technological Solutions
Z$	Zimbabwe Dollar

[1] At the time of writing the IASP paper January-February 2008

Abstract:

The Scientific and Industrial and Development Centre (SIRDC), established in 1993 under the provisions of the Zimbabwe Research Act of 1986, was mandated to carrying out strategic and cutting-edge industrial research and development (R&D) for the benefit of key productive sectors. Mid-2003 SIRDC introduced a business approach to all R&D activities with the full backing of the governing 13-member Board of Directors. The new SIRDC approach was anchored by the Stage Gate process and used two joint venture wings whose impact on Zimbabwean economy have been well-above expectations despite the harsh macro-economic environment. Above 500 direct jobs and over 26 000 indirect jobs for surrounding communities have been created and saved respectively. Some researchers have been retained through placement under better-paying jobs and injections into the fiscus through pay-as-you-earn and value-added tax have been going up monthly whilst key sectors have been seriously anchored through purchases of materials, spares and consumables. Fiscus injections are projected at an equivalence of US$350,000.00 per year whilst purchases from other sectors surpassed an equivalence of US$1.03 million/month. The demand for SIRDC services rose as companies are forced to look within Zimbabwe whilst the current supply constraints have made product and service marketing relatively easy. Various Zimbabwe technical universities, colleges, government technical departments as well as state research centers have now adopted the R&D commercialistion approach. This paper urges peer IR&D centers to commercialise their outputs for the benefit of shareholders, prospective employees, fiscus authorities, financial services sectors and other product sectors supplying raw materials or using IR&D outputs as inputs into own production processes.

Key terms and definitions:

- **Impact**-measurable effects of applying innovative ideas and techniques in actual production and/or service delivery
- **Commercialization** – process of creating viable and sustainable business ventures out of innovation and creativity processes generated by various R&D initiatives
- **IR&D products**-industrial products and/or services that emanate from ideas generated by teams applying various innovative techniques
- **Macro-economic environment**-national or regional operating environment as measured by variables such as inflation, interest rates, foreign currency exchange rates, net trade position (surplus or deficits) as well as ratings generated by various re-knowned global business centres
- **SIRDC**-Scientific and Industrial Research and Development Centre-a wholly owned Zimbabwean IR&D centre established in 1993 in terms of the Research Act (1986) amended in 1988 (www.sirdc.ac.zw)
- **Challenging macro-economic environment-**hyper-inflationary, severe supply constraints amidst rising demand, volatile foreign currency exchange rates, severe foreign currency access constraints, high skills flight with high interest rates and very low appetite for savings that often catalyse economic growth

1. Introduction:

Early 2005, the Scientific and Industrial Research and Development Centre (SIRDC) and Fintrust of Zimbabwe (a commercial arm of the Reserve Bank of Zimbabwe-RBZ) sharing the same vision and aspiration entered into a joint venture business arrangement in four manufacturing areas: micro-concrete roofing (MCR) tiles, livestock antibiotics, foundry and the local manufacture of science and laboratory teaching equipment (SLATE). These were IR&D spin-offs from SIRDC 4 institutes Building Technology Institute (BTI), Food & Biomedical Technology Institute (FBTI), Metallurgical Research Institute (MRI) and Electronics & Communications Institute (ECI) respectively. Hopes were high that, in a shortage economy like Zimbabwe's, the manufacturing biased projects were to demonstrate success and act as trailblazers for other R&D-industrialist partnerships to emulate. Fintrust holds 60% of the joint venture now under SIRTECH Investments and SIRDC 40%. The financial resources injection amounted to Z$233.5 billion as at 1st July 2005 (equivalent to US$13 million). Issues relating to intellectual property rights -new discoveries in terms of processes, procedures, design improvements, utility models and trade marks were to be communicated to management and the Board and responsive patenting steps taken without delay simultaneously noting the impact on shareholding. The Stage Gate Framework-placing heavy emphasis on teamwork, culture of effective communication, rapid product development, market assurance, financial independence and excellent compensation for employees-was adopted as the anchor joint venture business development tool. Both applied industrial research and subsequent commercialisation were still be anchored by the Stage Gate Process which also places emphasis on market assurance, financial independence and excellent compensation for employees. The impact on the Zimbabwean economy was to be tracked through analysis of expenditures (benefits to other industries), jobs created and retained, revenue and profitability, foreign currency generation, middle persons pressure exerted, foreign currency saved, patentable products, monopolies broken, positive lessons for R&D commercialisation, industrial laboratories created and benefits to other players as well as new frontiers opened in industrialisation. The adoption of a business approach did not in any way imply that SIRDC was abandoning the applied research mandate. Applied research continued within the joint venture projects as well pursuance of new products and processes outside the four areas under consideration.

This unique partnership essentially created a virtual science and technology park (VSTP). The *de facto* creation of a science and technology park had the following ingredients:

- IR&D efforts by 4 institutes that resulted in the 4 main products
- IR&D design improvements, process optimization that continues today under the 4 strategic business units
- Improvement work on spin-off products for maximum value creation
- Production trouble-shooting and reverse engineering for enhanced productivity
- Incubation –from ideas to full production in multiple locations within and outside Zimbabwe
- Expansion of production (on-site, other sites in Zimbabwe and now targeting SADC exports) for the benefit of both shareholders and regional economies
- Continuous customer feedback regarding quality, aesthetics, user compatibility among others for maximum value-addition
- Productivity and competitiveness enhancement for joint venture benefits
- Import substitution and raw material value-addition also accommodated for the good of the Zimbabwean economy

Inputs also came from technical departments of universities, technical universities and colleges, local authorities as well as regulatory authorities with their suggestions being incorporated into respective

business plans. Extra advantages emanated from the fact that it used existing infrastructure, expertise, networks and the fact that this move was conceived at a time when the country is facing supply constraints. Product up-take was quick.

2. Objective of the Paper:

The main objective of this paper is to demonstrate the benefits associated with a virtual science and technology park (VSTP) under adverse macro-economic environments and instill confidence across the continent resulting in increased conceptual up-take and that the adoption of the Stage Gate process guarantees VSTPs successful evolution for the benefit of shareholders, communities, the fiscus and other businesses.

3. Study Approach:

This paper, using a case study approach, explores the impact of science parks within localities, in terms of supporting other production-based initiatives, injections into the fiscus and continuous support from parent IR&D centre in terms evolutionary ideas that enhance productivity, competitiveness and business viability. Skills retention and value-addition are also analysed. The backing tools and crucial development stages as well as specific project activities are also reviewed with the backing of key informant views as well as peer RTO benchmark information. The interface with national economic development programmes is also covered. Results are analysed and recommendations made regarding sustainable RTO development and management of virtual science parks for the benefit of the developing world to emulate.

4. The Stage Gate and Prioritization Process (from 20 to 4 projects):

4.1 Concept:

The Stage Gate concept is briefly illustrated under table 1. The first row outlines the stages with respective activity descriptions being given under the second row of the same table. The corresponding gates and descriptive information are given under the third and fourth rows. The last row outlines criteria for making progress along stages and gates being opened as teams pursue successful product development up to full production and market launch.

Table 1: Stage Gate process

Stage 1- Preliminary investigations/ Ideation	Stage 2-Building a Business case	Stage 3- Development	Stage 4-Testing and Validation	Stage 5- Production and Market launch	Post-Implementation review and continuous review
-Quick review -Preliminary market analysis and technical assessment	-User needs and wants analysis -Customer testing of concepts - Techno-feasibility assessments-Legal and viability analyses	-Pro-type development -Market and financial analysis continue -Business and market plans developed	-Done to products, processes -In-house, at local industry level, across borders	Operationalising business, marketing and production plans	-Progress evaluated against set targets and plans -6 to 18 months -lessons learnt shared among team members for better future executions
Gate 1-Initial screening	Gate 2- Second screening	Gate 3- Decision on business	Gate 4- Post-development review	Gate 5-Pre-commercialisation business analysis	Micro-level gates for tasks within main production/ business line
Work on ideas from R&D, customers, seed projects, creativity	Greater look at synergies; market potential; profitability	A point at which project can be killed without heavy losses	-Re-check technical, market & viability after development, testing & validation	Opens doors to full-scale commercialisation	Sub-teams execute tasks assigned, "new" members share ideas with "old" team members

Source: Adapted from Dr R Mafoti's inaugral presentation in 2003

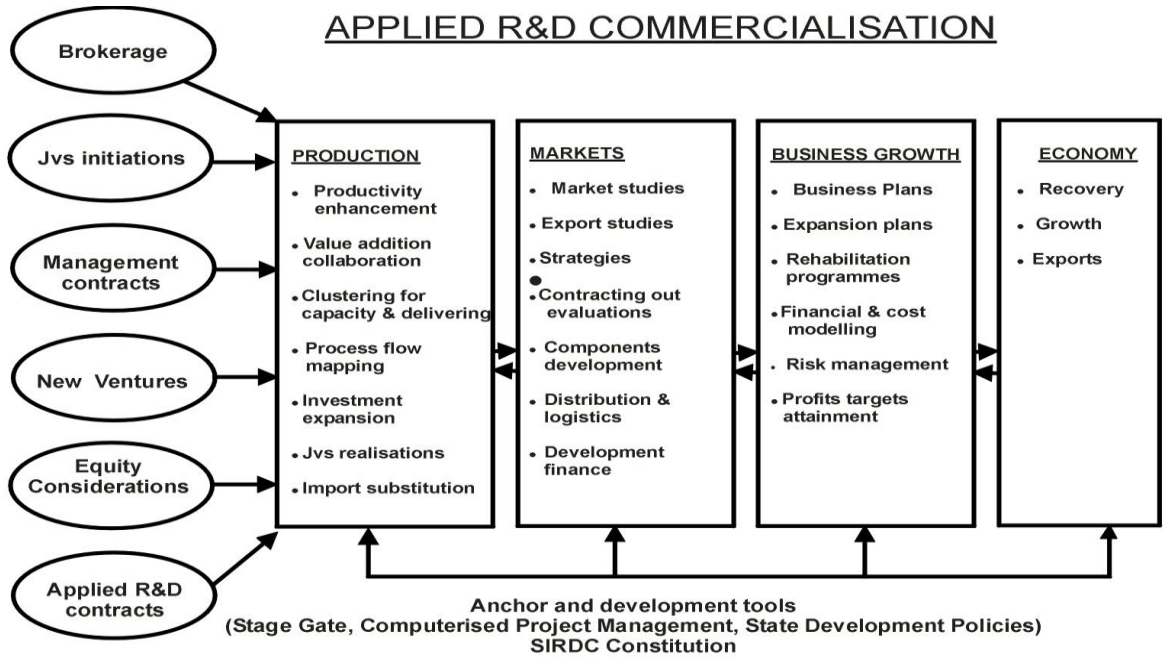
One might wonder what the Stage Gate process does to assure successful product development up to full production. By pooling all technical and human resources, the Stage Gate process attains several accomplishments and according to Dr R Mafoti (2003) it avoids the situation where "there is too much thunder and very little rain" as success is guaranteed for projects that pass Gate 5. The multi-disciplinary as well as multi-experienced teams cover virtually all critical aspects of the development of the product/service in question with corrective steps being taken timely. The process also enables teams and their leaders to spot winners early. The stage gate also prevents heavy commitment of resources to projects that fail. One is forced to do his/her homework early as interrogations from members act as wake-up calls. The fact that more than 15 multinational corporations have implemented it (in full or at subsidiary level) with success inspires all adopters of the Stage Gate. Its relatively simplicity assures full participation at all levels. It is quite easy to communicate facilitating quick enterprise up-take of ideas.

With this vital tool which has been tried and tested globally, SIRDC managed to analyse its pool of more 20 IR&D products and prioritized 4 that now form SIRTECH Investments Private Limited 's portfolio. Apart from viability and the potential to generate foreign currency through exports, the national development priorities were also factored-further demonstrating the versatility of the Stage Gate process. The very same approach is now being applied under projects prioritization under Zimbabwe Technological Solutions (ZTS) Private Limited-a newly created second technology commercialisation vehicle.

4.2 SIRDC Adoption of business approach

Having noted resource constraints, SIRDC reviewed its activities. The resultant new strategic thinking (figure 1) centers on stronger industrial linkages, commercialization of R&D results for enhanced resource generation and enhanced enterprise support, creation and realization of new business opportunities for Zimbabwe, productivity and competitiveness focus and incorporation of State directives for the shared economic prosperity aspirations.

Figure 1



Source: Kwaramba P K (2006): The SIRDC Evolution 1996-2006: from Applied R&D to Applied R&D with Commercialisation: 8th Symposium on Science and technology (Zimbabwe).

Figure 1 also shows how the adoption of a business approach interfaces with the Stage Gate process. Technical, financial and market matters are all addressed per product such that by the time a product a product is fully launched all pre-requisites will have been addressed.

5. Product briefs:

5.1 Under SIRTECH Investments Private Limited:

MCR Tiles generated by the Building Technology Institute (BTI) (branded Sirtile):
This centers on production and marketing of MCR tiles, 50% cheaper than conventional tiles. The use of low-cost technology and relatively low labour rates coupled with local availability of

raw materials further enhance the product competitiveness. Colour and sandblasting aesthetics offer variety to customers. Initially the focus was on the domestic market with satellite locations acting as catalysts for business growth. COMESA and SADC satellites were to be developed later. 73 machines were set to produce over 5 000 000.00 tiles/year covering 1 265 houses at 4 000 tiles per house, with the export component expected to add another 1 500 000 tiles/year after introducing shifts. Market acceptance was enhanced by the existence of an MCR Standard, curtsey of Standards Association of Zimbabwe (SAZ 863:2002) and its international adoption will enhance the regional market acceptance of the Sirtiles.

Ivermectins generated by the Food and Biomedical Research Institute (FBTI) (branded Sirdamectin):
Ivermectins are dual-purpose antibiotics poured onto the back of an animal such as cattle killing ticks (external parasites) and worms (internal parasites). Zimbabwe is set to be the only producer of this drug across the continent and this is set to revolutionise the cattle industry in Zimbabwe and the sub-region. Dependence on dip tanks, where labour demands for women and children tends to be very high, will be reduced significantly and rendered irrelevant in the long-term as adoption picks-up. Zimbabwe and the Sub-region with over 55 million cattle are set to benefit providing business opportunities to the venture. The cost-effectiveness of the drug beats the current practices substantially as the animals will be safe for 4 to 6 months. The Medicines Control Authority of Zimbabwe (MCAZ) and the Government Analyst of Zimbabwe (GAZ) are verifying performance parameters before giving a seal of approval. Foreign currency earnings are a distinct possibility for Zimbabwe.

Foundry generated by the Metallurgical Research Institute (MRI) and the Production Engineering Institute (PEI) (branded Sirmet):
The 1.5tonne induction-based foundry project was set-up in direct response to requests by concerned sectors in mining, agriculture, transport and manufacturing after realising costly imports amidst foreign currency shortages. Quality gaps of existing castings were also pointed out and requests were made for this to be addressed fully under the created venture. There are market shortages in the SADC/COMESA regions creating opportunities of earning foreign currency through exports assuming required capacity and quality are reached. The focus is on iron, steel castings as well as ADI exploitation.

SLATE generated by Electronics and Communications Institute (ECI):
The SLATE business was set-up in response to calls by the education ministries, standards directorate, and local examinations boards for the local manufacture of affordable science equipment. All along these parties have relied on costly imports and often encountered back-up service problems at critical moments such as examination times. Though starting with Physics, this was to be extended to Chemistry, Geography and Biology. More than 5000 primary schools, more than 1600 secondary schools and over 30 tertiary institutions in Zimbabwe were the primary market. SADC schools and colleges sharing same challenges were to be covered through exports.

5.2 Secondary priority projects under Zimbabwe Technological Solutions (ZTS) Private Limited:

Since the first venture comprising four products was taken up by two institutions, further value-unlocking could only be realized through additional special purpose vehicles (SPVs). SIRDC has just formed another vehicle for commercializing the next set of IR&D products named Zimbabwe

Technological Solutions (ZTS) Private Limited. Its product portfolio includes: the gravity grinding mill developed by PEI, mushroom fruit and spawn both oyster and white button (developed by BRI), indigenous cereal blends (developed by BRI), egg incubator (developed by ECI) and solar lighting (developed by ETI). Our print media (The Herald advertisements) as well as direct invitations for partnership have generated substantial interest within Zimbabwe and the diaspora. We have entered serious due diligence engagements with 2 banks, 1 corporate financing company and a parastatal-industrializing vehicle. Current policy deliberations include share participation by researchers as a rewarding and skills retention tool

5.3 The Regional Research Alliance (RRA):

The virtual science park concept is already being considered by peer IR&D centers in the SADC region namely CSIR (RSA) and BOTECH (Botswana) with Zambian and Malawi centers showing strong desire. SIRDC, CSIR and BOTEC have just created the Regional Research Alliance (RRA)[2] illustrated by figure 2. More products set to be uprooted from laboratories into production for the benefit of the sub-region. The Stage Gate process will certainly guarantee success.

Figure 2

Source: R Mafoti (2007)

Products and services developed by the three members are set to follow the commercialisation path with benefits being enjoyed by the SADC region. Though the initial focus covers 3 thematic areas, more sectors will be added as focus expands to other vital sectors. In process the VSTP concept will be growing in scope with benefits following suit.

[2] The RRA has a combined 38 research units, 14 commercialising special purpose vehicles (SPVs), over 50 products/projects and over 60 services. If commercialized on a large-scale (in part or in full), the positive impact would be enjoyed across the continent and beyond.

6. SIRDC Experience:

6.1 Enabling factors:

- **Staff Development Fellowship (SDF):**

The key founding model centred on Staff Development Fellowship (SDF) whereby top-notch graduate scientists and engineers were sent overseas for higher degree studies [MSc, PhD] followed by bonding equivalent to double the respective study period. Only specified areas of competence were targeted. The skills and experience had vital inputs into successful commercialisation of IR&D. However this was abandoned in 2002 due to resource constraints and the fact that trained scientists did not return to Zimbabwe to take-up respective research posts.

- **Partnership for Capacity:**

SIRDC entered into collaborative partnerships with peer RTOs under donor-funded arrangements, some of which include:

- Danish Technology Institute (DTI) Cleaner Production Centre (CPC) technologies funded by DANIDA
- GIS and Remote Sensing funded by GTZ
- Application of Renewable Energies such as Solar funded by UNESCO
- SINTEF SME Capacity Development funded by NORAD, among others.

These efforts resulted in transfer of technology covering expertise, tools, equipment, training, literature, referral contacts and advisory secondments. Research and commercialisation management and administration were equally improved. Profit center modeling and business development models such as the balanced score card (BSC) were also introduced. The 2001-2 SIRDC Annual Reports and 2001-2 Quarterly Technology Monitor Magazines give respective programme progress.

- **Matching Infrastructure Development:**

The building of capacity had parallel infrastructure development comprising laboratories, engineering workshops, equipment procurement as well as power and sewer installations.

- **Staffing pool:**

Though occupation of positions varied, the centre had over 150 posts reserved for technical experts whose role centred on generation of new products and processes through IR&D. This has been boosted by appointment of over 20 business operatives (market and investment analysts) to interact with the engineers and scientists for enhancing the successful commercialisation of SIRDC technologies. Table 2 gives the staffing trend over four years. The gender profile is commendable. Treasury has since approved 40 additional posts to raise capacity.

Table 2: Staffing Trends: Personnel Profile: 2003-2006

Category	Year 2003	Year 2004	Year 2005	Year 2006
Senior Experts	18	30	29	32
Technical Experts	94	65	81	69
Technical Support Staff	21	35	55	39
Total Technical	***133***	***130***	***165***	***140***
Women technical	27	27	43	36
% Technical Women	***20.3***	***20.7***	***26.0***	***25.7***

Source: Kwaramba P K (2006): The SIRDC Evolution 1996-2006: from Applied R&D to Applied R&D with Commercialisation: 8th Symposium on Science and technology (Zimbabwe).

Other enabling factors include:

- The adoption of the Stage Gate concept that marshaled all needed resources (technical, financial, human capital)
- Comprehensive and top quality business plans for the projects that attracted Fintrust funding
- Convergence of skills; experience and exposure in "walking the talk" that speeded progress
- Convergence of industrializing models: USA; Germany (Bayer Corporation), Scandinavian (Norway-Danish-Swedish-Finnish) and Japanese ways of commercialisation of technologies resulting in the hybrid VSTP in which experiences are being shared through this paper.
- The Zimbabwean Government Directive to generate own resources and sustain own operations- effectively embracing large scale commercialisation of technologies
- SIRDC Constitution allows commercialisation of technologies thus effectively endorsing the same.
- Broader skills base (scientists; engineers) as tabulated above
- SDF programmes across the globe with experiences shared at the melting "pot" further supporting the venture under deliberations
- Combined zeal to succeed in pioneering this developmental work.

6.2 Tight supervision:

As industrialists dismissed the SIRDC initiative as a joke, banks laughed at the new SIRDC thrust and other private players deemed everything too risky for a try, the SIRDC Executive took the bull by its horns and became determined to succeed. Measures taken to guard against relapses included:

- Serious warnings against sabottuers within the SIRDC family
- The Executive became very strict- the first discussion point of any activity or project was the Stage Gate.
- Serious Stage Gate training for teams, team leadership, gate keepers and for every employee at the beginning
- Serious Stage Gate inductive training for new employees twice a year
- Refresher courses of employees when deemed necessary
- Thwarted detraction from all quarters including those outside the SIRDC family
- Tight supervisory audits
- Weekly and monthly Stage Gate meetings on progress regarding Gant charted activities
- All minutes and deliberations were kept strictly confidential.

6.3 Impact:

New jobs created, both full-time and part-time, are given under table 3. Among these are three general managers, six production managers, business development executives, quality controllers, sales team just to name a few. For the semi-skilled positions, the recruitment priority areas were nearby high density residential areas of Hatcliffe and Hatcliffe Extension as well as rural business centres of Domboshava and Goromonzi. These recruits would just walk to and from work reducing pressure on the town-SIRDC commuting bus.

Table 3: New jobs created/Jobs saved

SBU	Full-time (F/T) part time (P/T)	2007	2008 forecasts	Continuous R&D support from teams SIRDC institutes	Estimates of jobs saved/created indirectly in 2007
Sirtile	F/T	260	360	-	
	P/T	100	150	25	15 000+
Sirmet founders & engineers	F/T	70	120	-	
	P/T	40	50	20	10 000+
SLATE	F/T	20	110	-	
	P/T	10	30	25	1 000+
SIRDAMECTIN	F/T	-	10	-	
	P/T	-	10	25	
Total		**500**	**840**	**95**	**26 000+**

Source: Author's interviews with SBU Management (2008)

Before the commercialisation of technologies there were only 2 people working full-time under one SPV. After commercialisation the initial 500 jobs are projected to rise to 840 by the year 2008 (table 3). The SBUs also continue to get sessional support from SIRDC engineers, scientists and business analysts. Product promotion material being distributed by the sales team and corporate dress being worn by staff from both SIRDC and SIRTECH continuously raise awareness about the good production initiatives emanating from IR&D. The SIRDC website www.sirdc.ac.zw continuously promotes the products and achievements of the teams for the benefit of Zimbabwe and the SADC region. Those recruited from surrounding environments have since relocated to affluent suburbs of Harare reflecting a change in their welfare. However this increases pressure to the town bus. The staffing gender profile is given under table 4 whilst financial injection highlights are estimated under table 5.

Table 4: Gender profile of SIRTECH staff

SBU	Staff -male	Staff-female	Total
Sirtile	280	80	360
Sirmet	100	10	110
SLATE	21	9	30
Total	401	99	500

Source: Author's interviews with SBU Management (2008)

Table 5: Financial injections

Receiver	Monthly U$ Equivalence	Yearly US$ Equivalence
Fiscus (VAT, PAYE, Corporate Tax)	US$21,430.00	US$278,590.00
Licenses, payment for utilities to local authorities	US$860.00	US$10,320.00
NSSA	US$720.00	US$8,640.00
Pensions	U$1,430.00	US$17,160.00
Medical aid societies	U$2,000.00	US$24,000.00
AIDS Levy	U$860.00	US$10,320.00
Sum	U$27,300.00	US$349,0930.00
US$ Equivalence (1:3,500,000)	27,300.00	349,030.00

Source: Author's projections based on insights given by management (2008)

Imagine what the case would have been if RSA's CSIR, Botswana's BOTECH (annexes 1 and 2 give product and service insights), the Zambian IR&D centre, the Malawi IR&D centre, the Namibia polytechnic centre follow the VSTP concept and commercialise their technologies. Peer institutions are given under table 6 below.

Table 6: Selected R&D Centre in Africa

Country	Centres	Polytechnics or Technical Universities
Zimbabwe	SIRDC	NUST, CUT, HIT, BUSE, Harare Polytechnic, IAE, FITC[3], ..
RSA	CSIR, MINTEK	University of Capetown, University of (Pretoria) /Tswane University of Witwatersrand,..
Botswana	Botech, Rural Industries Promotion Corporation (RIPCO)	University of Botswana
Zambia	Industrial Research Centre	University of Zambia
Malawi	Malawi Industrial Research and Technology Development Centre	University of Malawi
Namibia		Namibia Polytechnic, UNAM
Ghana	CSIR	
Egypt	Industrial Research & Tech Centre	Cairo University
Kenya		University of Nairobi
Tanzania	Centre for Innovation & Engineering	University of Dar es Salaam
Uganda		Makerere University
Nigeria	Sheda Science & Technology Complex	University of Nigeria
Rwanda	Kigali Institute of Science & Technology	

Source: Various SIRDC Experts (2007; 2008)

The job creation concept as well as financial resource injections into various developmental pools would be experienced regionally. The resultant benefits would add value to respective economies and move them towards self-sufficiency.

[3] NUST-National University of Science & Technology; CUT-Chinhoyi University of Technology; HIT-Harare Institute of Technology; BUSE-Bindura University of Science & Technology Education; IAE-Institute of Agricultural Engineering; FITC-Forestry Industry Training Centre

In the future, aspirant nations and centres need to consider pursuing other resource mobilization channels besides the Central Banks and development banks as the scope and capacity may not cover commercialisation of technologies. Efforts must be made to lure prominent sports personalities in soccer, golf, rugby, cricket, athletics who wish to diversify their investment portfolios as well as seasoned black economic empowerment (BEE) players and campaigners.

Share schemes benefiting researchers and management buy-outs may also be considered as this has a dual effect of assuring success as they know what needs to be done technologically and ensuring retention of critical skills. Other sources of capitalization could be: deliberate seed funds from Treasuries of each country, trust funds, national economic diversification funding initiatives, SADC/COMESA/AU funding facilities, development vehicles for regions and provinces and not forgetting regional/global well-wishers. However innovativeness and commercialisation roll-out governance must remain strong so that injected resources are used in line with investor plans.

6.4 Sectors supported:

As requirements were being procured by various stage gate teams to implement commercialisation programmes under the 4 SBUs, other sectors benefited from the purchase orders and table 7 gives highlights.

Table 7: Supporting other sectors of the economy

SBU	Sectors supported through the purchase of critical requirements
Sirtile	Cement, washed river sand, timber, bricks, textiles & clothing for work suits, transport, water, standards bodies, furniture, polymers for moulds, plastics, SAZ, electric motors
Sirmet	Scrap merchants, foundry sand, Fuel-petrol/diesel, grid power, timber for patterns, mining, agro-industries, farms, local authorities, water reticulation, plastics
SLATE	Electronics, education, furniture, grid power
SIRDAMECTIN	Plastics & polymer, electronics, computing, furniture

Source: SIRDC, SIRTECH Purchasing Departments (2008)

On average over 20 sectors and sub-sectors were covered and monthly bills ranged from Z$280 billion (US$80,000.00 @1:3,500,000.00) to Z$3,600.0 billion (US$1,030,000.00 @1:3,500,000.00). More than 10 clients indicated that SIRTECH orders saved their businesses from closure. This implies that shareholders, workers and the fiscus injections were saved by the commercialisation under the VSTP.

A VSTP winner's matrix is given under Table 8. Generally at the beginning gains may not be apparent and at times insignificant. With tight implementation under the Stage Gate model gains start emerging. Under situations where demand exceeds supply, gains pick up very quickly as happened under Sirtile roofing tiles. In some cases monopolies are broken for the benefit of consumers.

Table 8: VSTP/Sirtech Investments Winners matrix

Stakeholder	Relative Impact-Immediate	Relative Impact-Long term
SIRDC Resources, Image, Mandate	+	+++
Social security schemes	+	+++
Pensions	+	+++
Levies	+	++++
Medical aid societies	+	++++
The poor (those below the poverty datum line)	+	+++++
Retired	?	++++
Women & vulnerable children	?	++++
Economic diversification initiatives away from one resource domination	+	+++++
Researchers	+	++++
Treasury/Fiscus	++	++++
Business	+	++++
Industry	+	+++++
Wholesalers, Retailers, Dealers	++	++++
Employees	++	+++++
Foreign currency savings	+	+++++
Foreign currency earning	+	+++++
Peer R&D centers	?	+++
Universities, colleges	?	++++
Partnerships	++	++++++
Productivity & Competitiveness Improvement Centre	?	++++

Key:
? means not sure; - means negative; + means positive; +++ means relatively more positive; ++++++ means highly positive
Source: Kwaramba P K (2006): The SIRDC Evolution 1996-2006: from Applied R&D to Applied R&D with Commercialisation: 8th Symposium on Science and Technology (Zimbabwe), Authors' Consultative Analysis (2008).

Other positive impact indicators include: better designs, more efficient processes, reverse engineering put into practice successfully for peers to emulate, long-term monopolies broken, banker respect earned, de-bugging technology ends-up with more robust versions and widening of product range. In some cases market share is raised (from zero) and better balance sheets (from zero) often follow. Of the 1st 4 priority projects under SIRTECH Investments the success rate was 100% and of the second 8 priority projects, the success rate is moving towards 100% as well.

7. IASP Lessons:

Lessons for IASP Conference attendees vary. VSTPs are feasible funding needs are reduced to investments needs for up-scaling production as these use existing infrastructure and skills network. The use of the Stage Gate process enhances success. The benefits go beyond shareholders. The VSTPs also anchor other developmental programmes and business in other feeder sectors. Under tough environments, some good things emerge. Putting heads together can produce results. Commercialisation of technology is the route to effective industrialization Even AU Summits are urging nations to follow suit. When impacts assumes continental scope, Africa will rise. Spreading the gains across the African continent could attract the attention of other R&D centers (table 6). The SIRDC initiative was funded 100% by Zimbabwean resource mobilization efforts. The myth of heavy reliance

on foreign resource-injections to guarantee successes of Science Parks across the African continent was watered down heavily.

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- Zimbabwe Academy of Sciences (ZAS)

Persons interviewed:

- Dr J Mapiravana-Director –Metallurgical Research Institute (MRI)
- Eng F Chaparadza-Director –Building Technology Institute (BTI)
- Mr M Chidavaenzi-Director –Environmental Sciences Institute (ESI)
- Dr K Murwira-Director –Geo-Informatics Research Institute (GRSI)
- Dr E Khosa-Director Biotechnology Research Institute (BRI)
- Dr T Nyamupingidza-Deputy Director BRI
- Mr O Mutero - Sirtile General Manager
- Eng Nyemba-Acting Sirmet General Manager
- Mr Nyoni-Production Manager Sirtile Bulawayo
- Mr Mushunje-Production Manager Sirtile Harare
- Mr E Rozi-Production Manager Sirdamectin
- Ms C Chinamora-Customer Service Executive SIRTECH
- Mr CJ Matembo-Senior Information Officer SIRDC
- Mr Mukono-Chairman-Mukonitronics (Pvt) Ltd
- Mr Onisms Manyewe: Energy Technology Institute (ETI)- Acting Director
- Eng Freddie Gweme: SLATE General Manager
- Dr E Kapuya-Electronics & Communications Institute (ECI) Director
- Dr Xavier Carelse: Principal Scientist
- Mr Ernest Chivero: Food & Biomedical Research Institute (FBTI) Director
- Dr Oscerline Carelse: Principal Research Scientist, BRI
- Dr R Mafoti: CEO
- Dr L Madzingaidzo: ED-T
- Dr G Chada: ED-F&A

Annex 1: Regional Research Alliance (RRA) Member overview

Institution	Year Established	Governance	Core Units	Business Development Vehicles
SIRDC	1993	State Enterprise, Research Act, Has own Constitution	**15**: 12 R&D Institutes and a BOU	**4: 2 Active**: SIRTECH Investments (SIRDC-RBZ JV); ZTS and **2 Dormant** (NOUGAT Investments P/L; DONCOTE Investments P/L)
BOTEC	1988	Private Company, has founder members	**8**: 3 Departments; 3 Units; 2 Service Centres	**One**
CSIR	1945	State Enterprise, Scientific Research Council Act	**15**: 8 Business Units, 7 Centres/Initiatives	**10** Companies (Subsidiary / Associate JVs): South African Inventions Development Corporation (SAIDCOR), Technovent P/L, CSIR International, QUO-TEC, SILVERBREZE, Technology Finance Corporation P/L, Brilliant Security Solutions P/L, Plasmatherm P/L, Thermaspray P/L, Agrimage P/L
Totals	-	-	38	14

Source: Extracts from Annual Reports: 2005 (SIRDC), 2003/4 (CSIR), 2004/5 (BOTEC) &Websites

SIRDC Units:

- Biotechnology Research Institute (BRI)
- Food and Biomedical Technology Institute (FBTI)
- Building Technology Institute (BTI)
- Energy Technology Institute (ETI)
- Production Engineering Institute (PEI)
- Geo-Informatics & Remote Sensing Institute (GRSI)
- Environment & Remote Sensing Institute (ERSI)
- Electronics & Communication Institute (ECI)
- Informatics Institute (II)
- National Metrology Institute (NMI)
- Metallurgical Research Institute (MRI)
- Polymers Science Institute (PSI) & Business Operations Unit (BOU)

BOTEC Units:

- Technology Development (TDD)
- Technology Information Department (TID)
- Finance & Administration Department (FAD)
- Technology Assessment & Economics Department (TAEU)
- Internal Audit & Public Relations
- Calibration Centre & Discovery Centre

CSIR Business Units & Centres/Initiatives:

- Building & Construction n Technology
- Defence Technology
- Food, Biological and Chemical Technologies
- Information and Communication Technologies
- Manufacturing and Materials Technology
- Mining Technology
- Roads and Transport Technology
- Water, Environment and Forestry Technologies
- Centres: National Laser, National Metrology Laboratory, Satellite Applications, Crime Prevention
- Centres: Open Source, Sports Technology, Technology for Development

Annex 2: Selected Projects/Products and service brief for RRA Members

Institution	Selected Products, Projects, Research Areas	Selected Services
SIRDC: www.sirdc.ac.zw	• Value-addition in Indigenous Food Crops • Land Information Management Systems • Schools E-Learning Environment • Small-Scale Agro-processing technologies (dehuller, gravity grinding mill) • Herbal Products Production & Processing for Therapy • Science & Laboratory Equipment • Mushrooms Production, Value-Addition • Solar technologies (Water heaters, pumping systems) • Alternative Energies including Jatropha bio-diesel • Fuel cell technologies • Water harvesting • Livestock antibiotics • Technology Adaptations • GPS Car/Goods Tracking	• Cleaner Production • GIS & Remote Sensing • Calibration • Energy Audits • Production Management • Process Improvement • Technology Commercialisation • SME Mentorships • JV Facilitations • Due Diligence Exercises • Management Contracts • Projects Management • Rapid R&D Support • Industrial instrumentation & control systems • Electronic circuit designs • Herbal remedies for poverty alleviation and disease control • Business Training • IT Applications in Production, Business Operations, Materials use • E-marketing • Rapid prototyping • Laboratory Analytical service • Feasibility studies
BOTEC: www.botec.bw	• Emergency light • Solar street light • Micro-controllers • Solar chimneys • Automatic weather station • Community User Information System • Rainwater harvesting	Building capacity towards: • Calibration • R&D support in electronics • R&D support in architecture, housing and construction • Water management • IT adaptations for local use Can do: • Feasibility studies • Projects Management Systems
CSIR: www.csir.co.za	• Recombinant pharmaceuticals from plants for human health • Nutritional enhancement of African cereal crops • Promotion of African traditional medicines • Water use modeling • State of the Environment (SOE) reporting • Environmental Resource Economics tools for natural assets accounting • Storymaker IT Programme • Managing Illegal land use via GIS • Satellite technologies	• Advanced calibration • Advanced testing laboratory services • Advanced Computer assisted designs • Satellite support services • Training & Capacity building • Resource moblisation • Access to global markets • Industry-R&D linkages mentorships • Advanced analytical & testing services • R&D commercializing • Global collaborations • Feasibility studies • Industrialisation policy support • Information exchange • Continental-wide sectoral analyses

	• Transport management • Rapid R&D • Integrated Product Development • Designs [DesigNation-National System of Design] • Goafwarn-Coal Mines danger warning system • CoalTech 2020-over 30 coal mining projects • Multi-computer simulations • Value-addition in platinum	• Trade data access • ICT Support • Capacity building

Source: Extracts from Annual Reports: 2005 (SIRDC), 2003/4 (CSIR-South Africa), 2004/5 (BOTEC)