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The Extent of Policy and Statutory Support towards Research-Industry (R-I) Synergy in Zimbabwe– A Critical Analysis

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I. Introduction:

Synergy between research and industry has turned start-ups into global business giants, with enormous benefits accruing to society in the form of jobs, better health care solutions and marked injections into the fiscus (Association of University Technology Managers-AUTM year 2016 Statistics). Generators of new knowledge have been financially been rewarded as they franchised outputs and earned billions of USD under various technology transfer agreements. Professorial Chairs command huge resources under academia-industry partnerships and continue to chain out new innovations that ultimately create more businesses (Mafoti R, 2021). Contrary to such trends in the 1st World, synergy between research and industry faces resistance in developing countries like Zimbabwe. Every year state research centres and universities pressure Government for financial resources to cover remuneration, capital as well as for operations expenses. There is also regular pressure exerted to the parent Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development to allow increment of tuition fees increment to cover rising costs. The pressure is at the expense of struggling students, parents and guardians the same harsh operating environment. One would be compelled to find out the extent to which policies and statutory provisions facilitate research-industry synergy for wider and rapid business growth, financial independence away from Treasury whilst using Zimbabwe as a case study.

Definition of key terms:

Synergy refers to the interaction of elements that when combined produce a total effect that is greater than the sum of the individual elements and/or contributions (https://www.dictionary.com)

Policy refers to a set of plans used as a basis for making decisions usually in disciplines such as politics, economics and business (www.collinsdictinary.com).

Statutes refer to laws that have been formally approved by a legislative body and written down (https://dicitionary.cambridge.com). Policies give guidance towards better execution whilst statute facilitate enforcements for the betterment of humankind. There are dire consequences if there is no compliance. This article critically analyses selected Zimbabwe statutory provisions and policies relative to the quest for effective R-I synergy.

Critical analysis (Thompson Rivers University www.httpa://tru.ca) is defined as the evaluation of a work's effectiveness. Critical analysis answers the questions - what the policy/statute does well and what it does poorly? The analyses are also supported by views from key informants from industry and academia who were interviewed under DPhil studies on topic: *Towards moral synergy between research and industry in developing countries – the case of Zimbabwe*.

This article reviewed 16 Zimbabwe policies, 4 Zimbabwe institutional strategic plans, 2 USA statutes and 14 Zimbabwe statutory provisions all adding up to 36 documents. The review was carried out in the context of global best practice cases. University Acts of establishment covered include: Zimbabwe Open University (ZOU), University of Zimbabwe (UZ), Harare Institute of Technology (HIT) and Chinhoyi University of Technology (CUT). The provisions of the Council for Scientific and Industrial Research (CSIR) Act were also included. Agricultural Revolving Fund under the Department of Research and Specialist Services (DR&SS), Institute of Agricultural Engineering (IAE), Department of Veterinary Services (DVS) and Pig Industry Board (PIB) were analysed. Table 1 shares the selected statutes and policies covered by the article.

Table 1: Statutes and policies influencing R-I synergy

Statutes	Policies	International, other as specified
• Constitution of Zimbabwe 2013, Chapter 4, Part 2, Sub-section 61 • Research Act Chapter 10:22 • Centre for Education, Innovation, Research and Development Act Chapter 25:34 • Acts of establishment of CUT, UZ, HIT, ZNDU, ZOU • Private Business Corporations Act Zimbabwe [Chapter 24:11] • Companies Act Zimbabwe [Chapter 24:03] • Trade marks Act Zimbabwe (Chapter 26:04) • Patents Act Zimbabwe (Chapter 26:03) • Industrial Designs Act (Chapter 26:02) • Industrial Development Corporation Act (Chapter 14:10)	• 2021-2025 National Development Strategy 1 (NDS1): Zimbabwe • 2018-2021 Transitional Stabilisation Programme (TSP): Zimbabwe • 2013-2018 Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZIMASSET) • 2012 Science and Technology Policy for Zimbabwe • 2019-2023 Zimbabwe Industrial Development Policy • Local Content Strategy • 2020 Agriculture and Food Systems Transformation Strategy-5-Year Agriculture Gross Value Projections • 2020 SIRDC Performance Review & Turnaround Strategy • 2019-2025 UZ Strategic Plan • 2021-2025 SIRDC Strategic Plan • 2016-2022 CUT Strategic Plan for CUT	• USA Bayh-Dole Act of 1980 • USA Technology Transfer Act of 2000 • CSIR Act –RSA-(1945) • Nziramasanga C(1999): The Report of the Presidential Commission of Inquiry into Education and Training: Zimbabwe • Zimbabwe Intellectual Property Rights Policy • Agriculture Revolving Fund (DR&SS, IAE, DVS, PIB) • Establishment of the Confederation of Zimbabwe Industries (CZI) Steering Committee on R&D • Zimbabwe Innovation Commercialisation Fund • Funding Models for Research and Development to operationalize Zimbabwe's Innovation Hubs

Source: Author compilation (2021)

II. International perspective:

The USA Technology Transfer Act of 2000 recognizes that the "linking of a network of over 700 Federal Laboratories and the Nation's universities with the USA industry holds great promise for future economic prosperity" and subsequently directs that the "technology transfer process must be industry-friendly". The same Act has a publicity stipulation through an "Annual Report to Office of Management and Budgets (USA) on, among other issues, the "technology transfer programme for the previous year and plans for the current year"; "patents applied for, received, extended and the income generated" and "licenses given to small businesses as well as licenses terminated". The same Annual Report is then distributed to the Secretary of Commerce, Attorney General and US Congress. A yearly summary report is prepared for the USA President, US Trade Representative, Secretary responsible for Technology Transfer and the Congress. The yearly summary to the Authorities "discusses best practices in technology transfer", "improvements of processes for the betterment of the economy" and requires "posting of contents to the Public through internet sites and other electronic means". Another supportive dimension of the Act comes in the form of a Technology Partnership Ombudsman (TPO) – who is a senior official not involved in day-to-day technology transfer activities. The TPO plays a mediation role of the focal point for dispute resolutions, promotes academia-industry collaboration and compiles quarterly report on complaints, disputes and resolutions (all in confidence). Such provisions address R&D capacity of a nation as measured by output and ensure that output is transferred to industry as well as providing a fair mechanism of dispute resolution. Performance is measured across levels, from developers through facilitators up to the highest office in the land.

The American Bayh Dole Act (1980) released USA Federal funded research for exploitation by universities, small businesses and non-profit organisations for the ultimate benefit of the wider USA economy. The released intellectual property (IP) and subsequent and its exploitation by emerging businesses created World class businesses and mobilized billions of USD in revenue for such high technology institutions as the Massachusetts Institute of Technology (MIT), Stanford University, Harvard and university of California (Silicon Valley).

The Council for Scientific and Industrial Research (CSIR) Act No.46, 1988 of the Republic of South Africa (RSA) provides for the "continued existence of the CSIR" and stipulates research focus on: "better utilization of resources", "improvement of productive capacity of RSA population" and "improvement of technological processes and methods to improve industrial production". The Act also provides for the "promotion and expansion of existing industries" and the "establishment of new industries". Under this Act, "intellectual property rights-IPR belong to the CSIR" but the statute provides for "bonuses for discoveries to research staff".

The statutory provisions documented and enforced action among Boards, Management and staff. The issue of resistance was removed and continuity guaranteed as changes in management did imply change in deliverables. The sharing of best practices was actually provided for, allowing benefits of R-I synergy to be shared wider.

III. Zimbabwean Policies and Statutes:

3.1 Policies:

An analysis of yearly fiscal allocations for R&D, that would subsequently feed into industry or creates additional industries, shows limited Treasury support. Over years the aggregate allocations have calculated to around 0.3% of GDP whilst actual disbursements reduced to less than 0.01%. Whilst acknowledging that Treasury caters for researcher remuneration, laboratory equipment and operations for state entities, the support levels have been perennially inadequate. Brain drain has been common with the 2018 critical skills audit showing an average 62% deficit (sciences, engineering, technology, medicine were over 90% deficits). The researcher is always tempted out of post as remuneration levels are 5 times lower than in the region where they join peer Centres at senior researcher/lecturer or even professorial levels. Collectively the funding gap and skills deficit suppress R&D output. Low R&D output becomes a handicap for R-I synergy. This was also compounded by prolonged freeze of recruitment in a bid to cut costs by the Government. Prolonged vacancies curtailed output from research and limiting synergy with industry.

The Ministry of Justice, Legal and Parliamentary Affairs (2018) provides needed guidance on intellectual property (IP) issues and shares two (2) main categories of IP: emanating from R&D leading to *industrial property* and creativity leading to *copyrights*. The policy points out that IP is key for "transforming Zimbabwe from a resource-based to a knowledge based economy" and goes further to outline the purpose of the Zimbabwe IP Policy namely: "awareness", "sensitisation on economic benefits", inspiring IP commercialisation" and "capacity building" among others. The issue of IP is very important as it connects R&D, industry and the development aspirations of Zimbabwe. The policy call is mitigated by under-resourced R&D infrastructure, brain drain and limited exposure to international best practices, which, when adopted and adapted leads to rapid development. Stephen Ezell (2019) shares that "Zimbabwe currently looking at implementing Bayh-Dole Act like legislation, recognising its power to help turn their universities into engines of innovation and commercialisation". The policy intention are in line with international best practices but the situation in laboratories negates policy call. The capacity to generate industrial property rights remains weak as laboratories under-manned and under-equipped. The policy must extend to the capacity to generate IP as well.

The Industrial Development Policy, National Development Strategy (NDS1) and various Strategic Plans have sound intentions as they call for value-addition of natural resources, modernization of industries and development of Zimbabwe through exploitation of latest technologies. The void in the form of a weak R&D capacity still needs attention. The "soft" skills for sound research-industry collaboration as well as developing an R-I synergy culture need policy attention. There should also be unbiased platforms where academia-industry collaborations are tracked with best practices being promoted and gaps being addressed. Joint funding for joint R-I projects should be prioritized under when formulating policies. Capitalisation of industry should have research, academia and technological inputs before wider adoption by the parent Ministry of Industry and Commerce.

Nziramasanga C.T. (August 1999) after reviewing Zimbabwe's education and training pointed out that "…synergy between research institutions and users of research results is a key success factor in Zimbabwe's agriculture" and among others, recommended those in decision making positions to "ensure the transfer of research findings to practical usage".

The Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development has appointed industrialists on state university councils. Currently 85% of members of such councils are from industry and commerce in a bid to foster R-I synergy. Mandishona GM (2020) shared that, when appointed, self-interests take over. The quest for R-I synergy gets relegated.

Various public entities have revolving funds where funds collected for services is used internally to fund operations. One such facility is the Agricultural Revolving Fund (ARF) whose scope covers DR&SS, IAE, DVS, and Agricultural Regulatory Services among other under the Ministry of Lands, Agriculture, Fisheries and Rural Development. Whilst such a policy mobilises resources for internal operations, it appears more needs to

be done on sufficiency (maximum value possible) and direct incentives for generators so that they are motivated to generate more money. This needs a review towards a business model that aims for maximum revenue generation per resource available (land, workshops, laboratories, manpower, competence) and direct incentives are needed by foot soldiers. IAE workshops can manufacture products for sale to farmers and provide technical services (repair/maintenance, designs, test-work) for more income. When experts are incentivized brain drain will be reduced.

Traditionally university establishments often included research fellows at department level with a role to back-up lectures with new ideas as well as carrying-out R&D under departments, faculties and across teams set-up for grant-supported research programmes. Some produced novel products like austempered-ductile iron (ADI) that great application potential in automotive industry (Simbi DJ, 2020). Novel products were also developed in pharmacology (Tagwireyi D, 2020). Novel initiatives never reached industry and the developers ended-up leaving Zimbabwe for RSA. The research fellows also crossed the floor into teaching and armed with publications, rapidly attained professorship. Some are now Vice Chancellors/Pro Vice Chancellors – research fellowships are now dormant. This adversely affected R-I synergy as the creativity pipeline dried up.

The setting up of Innovation Hubs at universities is a noble idea and is in line with international best practices. In Zimbabwe, the low R&D output earlier shared stands to threaten the Hubs. What gets commercialized under the Hubs and are we going to import solutions to populate the Innovation Hubs. The programme on Innovation Hubs should also address R&D with a commercial potential from the universities, colleges and training centres. The connection with industry also needs dissemination for wider R-I synergy. When equipped they will also address gaps in industry and can be further availed for wider analytical purpose through paid arrangements. The fees paid would contribute towards operation expenses of the Innovation Hubs.

Policies offer guidelines but fall short on enforcement. As new Boards/Councils and Executive or even Ministerial appointments are made, courses of action often and R-I synergy has suffered along the way. In 2017, a Minister and his delegation of 10 Vice Chancellors toured the World to learn how universities were commercializing R&D and levels of benefits at industry level. The delegation liked what they saw and committed to revolutionize income generation through enhanced research commercialization. Changes happened in administration and the lessons learnt were never put into practice.

3.2 Statutes:

The Research Act [Chapter 10:22] and the Centre for Education, Innovation, Research and Development [Chapter 25:34] and the SIRDC Constitution (registered under Research Act) provide for "promotion, direction, supervision and coordination of research" and "to provide engineering and technological solutions to industry and the community to generate income". These are declarations in support of national development through technology. However they omit the nuts and bolts that compel Boards, Management and Staff to take R-I synergy seriously. IP rights belong to the Research Council of Zimbabwe (RCZ) and no incentive is explicitly extendable to researchers. There is no provision for neutral mediation in case of disputes between research (university, centre) and industry. The R&D output and industry needs are less frequently shared and rarely matched.

The ZOU and UZ Acts "provide for research" but the link with industry and commerce is silent. The CUT, ZNDU and HIT Acts have additions that include "development, practice of design and technology"; "create opportunities for income generation"; "making university a self-sustaining entity"; "incubation, transfer and commercialization of technology" and "continual relevance to industry" among others. These Acts seem to be moving towards R-I synergy. Relative to the USA statutes earlier shared more needs to be done for academia-industry synergy to be strengthened.

The University Research Committees/Boards are provided for under various ordinances but are not well-resourced financially. The statutes are silent on capacity to conduct research and development, that is, the need for state-of-the-art laboratories, needed equipment/ consumables and servicing expenses which are often in foreign currency. There no statute facilitating facility and skills sharing – so that there is relevant output to transfer to industry and commerce. There is silence on neutral mediators in technology transfer matters. The TPO role of fair mediation remains weak or non-existent. Incentives for researchers are not legislated and IPR are in the hands of the centre (RCZ, DR&SS, and SIRDC) or university or company. The act is silent on the welfare of the researcher so that he/she is retained to complete projects and ultimately create vital IP. Of late Technology Transfer Offices, Innovation Hubs and Pro-Vice Chancellor posts have been part of universities in an attempt to enhance collaboration. Personnel manning these offices need exposure to international best practices so that they R-I synergy needs effectively.

The R-I synergy, emanating from research/academia is not covered by the Private Business Corporation and Companies Act, key statutes establishing industry. For now efforts remain restricted to moral suasion.

The Industrial Development Corporation Zimbabwe (IDCZ) Act [Chapter 14:10] provides for "establishment and conduct of industrial undertaking", "facilitate, promote, guide and assist in the financing of new industries" and "finance expansion, …, modernization of existing industries". The intentions are noble but the limitations are on the details of how to implement the provisions. The funding, skilled personnel and the will to put provisions into practice remain limiting. The inclusion of R&D unit(s) or serious collaboration with academia within Zimbabwe or diaspora should have been added to the statute. Progress reports and sharing of best practices should also have been added.

The Constitution of Zimbabwe 2013, Chapter 4, Part 2, 61 (1) provides for (a)"freedom to seek, receive, communicate ideas"; (b) "freedom of … scientific research and creativity" and (c) "academic freedom". This provides breathing space for R-I synergy within Zimbabwe. However exploitation remains weak.

The Patents, Industrial Designs, Trade Mark, Copyrights Acts are in place for Zimbabweans to benefit from through the safeguarding to their IP but these statutory provisions are not being exploited due to weak R&D capacity and limited awareness by wider public.

IV. Critique of the People:

The R-I synergy involves the Boards, Executive Management and experts in administration and research offices. The interface persons such as Corporate Communications Managers, Technology Transfer Managers, Innovation Hub Managers, Public Relations Managers and personnel manning Customer Service desks weigh in in facilitating R-I synergy. There are delegates that are occasionally selected to represent the company/ research centre/the university) at local and international events. Such persons should be equipped to pick and link capacity and needs across R&D and I&C. Respecting confidentiality, progress reports should cover yearly linkages, income raised, jobs created and benefits accruing to the economy so that they are convincing when engaging Treasury. They should also be passionate about R-I synergy.

V. Message from key informants:

Academia:

Key informant interviews during the fieldwork in 2020/21, captured in put on R-I synergy within Zimbabwe. Mandishona Gibson (2020) shared that "vested interests and personality differences at top level" hinder R-I synergy whilst Mafoti Robson (2021) observed that "Zimbabweans are averse to technology across all levels", "you ask for R&D funding, unfreezing of researcher positions and retention of critical skills to be prioritized and they don't listen to you". Kutywayo Dumisani (2020) opined that "the Zimbabwe seed industry was set up and still relies on R&D. However there are limited flows into R&D from private sector". Tagwireyi Dexter (2021) observed "university linking offices not strong enough to drive the R&D agenda into industry" whilst Simbi David Jambwa (2020) reminded that "research fellows strengthened delivery of university mandates – strengthened teaching and produced novel products". He called for the "revival and strengthening" of the research fellowship position for R-I synergy in Zimbabwe. Zimba J (2021) "harness diaspora skills and regularly organize online sessions in technology advances" in order to move with latest trends in R-I synergy. Authorities under research organisations and universities "take time to approve agreements for cooperation whilst industry wants timely decisions" remarked Magombo Lovemore (2021). The delays in the signing of memoranda of agreement as well as secrecy and non-disclosure agreement (S/NDA) to pay way for R-I synergy allows space for hesitancy on the way forward.

Industry:

Views from industry and commerce (I&C) included Munyeza S (2019) who strongly advised that "Zimbabwe missed the 1st, 2nd, 3rd industrial revolution and cannot afford to miss the 4th industrial revolution". The 4th industrial revolution is dominated by technology and R&D from universities and research centres will be key. Gowo Alois (2021) pointed out that "there are infrastructure challenges both at I&C as well as R&D levels as laboratories are not well equipped and not manned by skilled personnel". He shared that "ZISCO had no R&D Unit and new ideas were generated outside Zimbabwe. "We just implemented what was imported. When operating environment worsened we responded by shutting down until today". Mukono Lovemore (2021) shared that "the strategy must be right" if R-I synergy is to be realized. He further shared that "have been in courts fighting theft of intellectual property, ranging from designs through brands and trademarks" on global markets. Karonga Farai (2021) advised that "research facilities must be equipped with modern technology for relevance to current industry needs/challenges" whilst Moyo Busisa, Javangwe Sifelani and Dadirai Rangarirai (2020) advised "we now have a Standing Committee on R&D under CZI" to support calls for R-I synergy in

Zimbabwe. Nguwi Memory (2021) advised that there are "very few corporate leaders that have research experience and interest" and this limits R-I synergy. Mugaga Christopher (2021) "Prof Charles Mbowa-Pro Vice Chancellor Partnerships, Industrialisation (UZ) regularly contributes to and attends ZNCC deliberations/Events". He further committed to "strengthen Industry-Academia collaboration". Sibanda Derrick (2021) shared that "there should be a thorough needs assessment of R&D at industry level" whilst Ncube Sehlule (2021) advised that "many Corporate Executives want quick earnings, have no time to invest in R&D whose returns are realized after a long time".

Key informants in both R and I acknowledge that R-I is very low in Zimbabwe. Reasons range from poor resourcing, gaps in interface skills and limited awareness about benefits associated with R-I synergy. There are gaps in champions to drive the R-I synergy agenda. Gaps in policies and statutes also weigh in, in terms of missing guidance and enforcement mechanisms.

VI. Conclusion:

R-I synergy is key rapid economic development and national prosperity. R&D capacity requires both policy and statutory attention. Weak R&D compromises synergy with industry and commerce as the nation will be forced to rely on imports. Boards and Management must mobilise resources and implement policies. Development policies and statutory provisions need revamping within the context of international best practices. The welfare of the researcher must be attended to in order to curb skills flight. Exposure through attendance of international technology fairs and study tours is vital and must be funded.

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[41]. Professor Robson Mafoti: Renowned Chemist, Member of Presidential Advisory Council (PAC), past Chairman of Council for a Chinhoyi state technical university, Chief Executive Officer - SIRDC
[42]. Professor David Jambwa Simbi: Vice Chancellor of Chinhoyi University of Technology, former Dean-Faculty of Engineering (UZ) and former Engineer (ZISCO)
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[48]. Sifelani Javangwe, Busisa Moyo: Business Executives, Past Presidents of the Confederation of Zimbabwe Industries (CZI)
[49]. Dr Rangarirai Dadirai: Business Executive and Chairman of CZI Standing Committee on R&D
[50]. Dr Shingi Munyeza: Business Executive and renowned Motivational Speaker
[51]. Eng Allois Gowo: Retired Chief Executive of a State Steel Company, Board member -SIRDC
[52]. Eng Lovemore Mukono: Business Executive, Entreprenuer, Design Engineer in Electronics/Innovator, Fellow of Zimbabwe Institute of Engineers (ZIE), Philanthropist in development and promotion of science, engineering and technology among youth and students (high schools, colleges, universities)
[53]. Christopher Mugaga: ZNCC Chief Executive Officer, renowned Economist
[54]. Memory Nguwi: renowned Human Resources expert, Managing Director of IPC Consultants

[55]. Derrick Sibanda: Corporate Public Relations Executive-IDCZ
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