Towards moral synergy between research and industry in developing countries– the case study of Zimbabwe: Mixed Methods Methodology Experiences

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I.   Working Definition of synergy

*Synergy*refers to the interaction of elements, which when combined produce total effect that is greater than the sum of the individual elements*(*https://www.dictionary.com) while *moral*synergy is for the good of human kind. The associated gains have a development multiplier effect into society in the form of jobs, higher disposable income, food security, marked local supply of raw materials into industry among others. The related gains are enjoyed by the wider economy. The central issue is often what is it that is broken, when fixed, enhances R-I synergy among developing economies like Zimbabwe? It becomes critical to analyze the i*nterface persons, tools, skills and exposure so that r*esistance to R-I synergy can effectively be alleviated.

The resistance to policy calls for R-I synergy was observed when the message was shared through: Keynote speeches at Biennial International Research Symposia (2015, 2017, 2019)and at university R&D expos; through Government of Zimbabwe's Education 5.0 Policy and the Innovation Hubs being set-up; Industry 4 (I.4) dictates and the fact that 85% of State University Councils members are from industry and commerce. The 2017 Higher level tour by 10 state universities andthe parent Ministry officials had same message to Zimbabwe-industrialisation through R&D. Technical Universities' Acts of Establishment have explicit calls for R-I synergy whilst the Confederation of Zimbabwe Industries (CZI) R&D Steering Committee was set up for enhanced R-I synergy. It is widely acknowledged that local state universities are generating <5% of revenue from commercialized projects. They, instead, are heavily relying on student fees and Government grants –a scenario that puts extreme- pressure on parents, guardians and fiscal authorities. This is against international peers who are generating 75% (www.csir.co.za) to 92% (www.sintef.online.no) of income from commercialized projects and service contracts signed with industry. Zimbabwe yearly faces huge foreign payments bill of USD4.8 billion (RBZ, ZIMSTAT) against much lower exports and this position should bother both research, industry and the nation as a whole that boasts of over 92% literacy level.

II.   Theoretical Perspective:

The analysis was guided by four (4) key guiding theories namely: Stage Gate ® Process which emphasizes teamwork, novelty and the market focus among others); Triple Helix (Government, Academia and industry forming one big team); Technology Diffusion (research developing superior products and services for exploitation by industry) and Systems Theory that always calls for feedback at both academia and industry.

III.   Methodology:

The author chose pragmatism where the review of related literature (advice given by champions, policy analysts, and global best practice cases) was triangulated by key informant Interviews (KII) as well as findings obtained through self-administered questionnaire at expert level. The author also made observations relative to international best practice cases. The mixed methods methodology had qualitative bias (QUALI/QUANT).

IV.   Thematic Issues in Qualitative Analysis:

The key thematic issues guiding qualitative analysis were: access to resources (infrastructure, human and financial resources); policies and statutes; incentives; exposure; culture and levels of competence (training, mentorship and experience).

V. Four (4)Broad Analytical Dimensions (covering both R&D; I&C)

Chen Hebert Hongbo (2014) shared four (4) dimensions as: Basic support system of infrastructure; Value-added supporting system; Special supporting system and other critical attributes. These dimensions are qualitatively analyzed below for Zimbabwe.

Idea Scenario	R&D	I&C	Implications on Synergy
5.1 Basic support system of infrastructure: • Safe Buildings • Good Roads/Rail access • Clean Water Access • Access to Electricity • Data access (Chen Herbert, 2014)	• Ill-equipped labs • Poorly resourced Research Boards • Costly access to data and utilities (water, energy, telephone services) • Costly servicing and lab consumables • R&D on products very low	• Aged processing plants • Costly energy & data access • Scaled down or shut down R&D units • Bias towards cheap end-product imports for local re-sale • Large warehouses for imports vs manufacturing factories	Weak R&D and Industry; Importing warehouses for local re-sale (**Double Negative**)
5.2 Value-added supporting system: • Training • Marketing • Legal • Communication wifi • R&D commercialisation • Funding arrangements (Chen Herbert, 2014).	• Business Development Units • Pro-Vice Chancellor for Bus Development • Directors-Innovation Hubs • Industrial Liaison • Corporate communication & Marketing These are not yet known by I & C though Business approach is emerging at state university level.	• I&C needs are a closely guarded "secret" • Lobbying organisations for policy support (BAZ, CZI, ZNCC) rarely put R&D on their agendas • Import for local resale, "copy paste approach common" –USD4.8 billion (RBZ) • Main business linkages centre on selling products and services to R&D/universities as customers	Skills limitations among units linking R&D and I&C; I&C is often a reserved lot; heavily I&C scaling down on innovations (**Negative**)
5.3 Special supporting system: comprising • Mentor-mentee linkages • Inventor meetings • Arrangements for special expertise and online services (Chen Herbert, 2014)	• R&D on products, processes very low • Intellectual property (IP) policies now being crafted • Linkage events rare • Direct incentives rare • Teamwork – a serious challenge	• Dominance of imports [R&D will have been done outside Zimbabwe] • R&D viewed as costly • Resources for R&D rarely set aside	Very little room for creativity and there are low serendipity chances; one has to follow instructions (innovations/deviations not tolerated) (**Negative**)
5.4 Other critical attributes: • a "good leader" • "stable team" • "good business model" (Chen Herbert, 2014)	• Business approach rare but emerging • Team stability rare • Innovation Hubs waiting for "new ideas, new products"	• Champions for R&D few • Budgets for R&D very low • Needs still a guarded secret, fearing competition	Negative

Both R&D and I&C need to work towards synergy for the benefit of Zimbabwe's economy. Otherwise we continue lagging behind other economies.

VI.   Thematic Framework:

R-I Synergy faces challenges such as *Access toResources* at both academia and industry levels. Operations are hampered by infrastructure gaps –laboratories, equipment and needed consumablesthat are in constant short supply whilst access to utilitiesregularlythrottle industry operations. Internet connectivity is often costly and unreliable whilst industries are setting new warehouses instead of production factories for their own quick survival.Budgets and actual financial disbursements are always against R&D whilst critical human resources(skills)–are always a limiting factor. Brain drain is very high at both R&D and I&C with the 2018 skills audit sharing a 62% overall deficit. Those in-post still need coaching to embrace R&D in decisions. On paper development *policiesand statutes* at both academia and industry levels support R-I synergy. However these do not explicitly compel companies, universities or research organizations to collaborate for the benefit of the wider economy. A modified Bayh-Dole Act is required. At both academia and industry levels, the *culture* of team work, success through creativity and personal hustling for success are limited. The passion to deploy R&D for success is lacking in both industry and academia. The *exposure to* international *b*est practice cases through expo participation, membership to international professional bodies and diaspora connections are limited. Exposure to new, inspiring ideas is limited across academia and industry. The scenario gets worsened by the foreign currency shortages that Zimbabwe faces – critical study tours are not often a priority at the desks of foreign currency allocation authorities. The expert in R&D and I&C is often poorly remunerated. *Incentives (*Remuneration, Notches, Tenure, Promotion, Targeted bonus) are rare and the expert is often looking for greener pastures at the expense of internal, national development. IP rights are often institutional and foot-soldier is often demoralised. The call for R-I synergy is often remote to him/her. R-I *competence*issues are another gap. Training, mentorship and R-I collaboration competence are limited. Complimentary negotiation, techno-business command and lobbying skills are rare among those in-post. Very few realise that start-ups that rule the World today have their origins in R&D.

Emerging issues:

Academia are handicapped in what they can transfer to industry. This is worsened by gaps in teamwork and the absence of a culture of sharing facilities and experiences. The business approach wherebankable business plans are key in resource mobilization are missing in public R&D centres. They need to shift away from the common "revolving fund" and "cost-recovery" models which are ineffective in mobilizing needed financial resources. The R&D Expert who is key is often frustrated, poorly remunerated (*earn a fraction of what's being regionally earned*),poorly tooled; not directly incentivized andnot notched.

Preliminary Empirical Dashboard Findings:

Defined Likert Scale Ratings	1-4 Red [Classical, Traditional]	5-7 Orange [Changing towards Ideal]	8-10 Green [Current Global Best Practice]
Parameter	**R&D Likert Scale Rating**	**I&C Likert Scale rating**	**IDEAL**
Expert views within context of Organisations, Companies (I&C) relative to Universities, R&D centres (R&D)			
Level of R-I Synergy deemed and **rated highly** in Zimbabwe	4	4	10
Extent of R-I Synergy support by **Statutes/Ordinances/Policy/Strategic Plans**	4	4	10
Extent of lobbying by professional bodies in R and I	3	2	10
Extent of **exposure to international best practices-** R&I synergy-	2	2	10
Degree of **inclusivity in search of ideas**	7	6	10

Customer view given top priority by both R and I	6	6	10
Bankable business plans by both R and I in place, supporting synergy	6	6	10
Extent of **encouragement to read latest product literature and/or product patent information**	6	6	10
Skilled, capacitated, empowered personnel in place for R&I synergy	6	6	10
Joint R-I review of lecture material, case studies, student practical sessions	7	6	10
Generators of novel ideas in both R and I being **rewarded effectively**	7	6	10
Extent of **teamwork** (within, across) R and I	6	6	10
Regular (quarterly) R - I engagement sessions in support of synergy	2	2	10

Expert personal views			
Extent to which R-I synergy is positively influenced by organisation **culture, staff skills and their competence levels**	4	4	10
Mentors, senior management, management role in support of R-I synergy	2	2	10
Personality differences are effectively mitigated in support of R-I synergy	4	3	10
Fair valuation of R&D services and IP are key in R-I synergy	4	4	10
After agreeing on confidentiality issues, organisation's access by **time and distance** are key for R-I synergy	6	3	10
Extent of inclusion of R-I synergy in **strategic plans, policies, keynote speeches**	3	3	10
Development projects across R & I are broken down into **manageable stages with decision points in between**	7	6	10
Overall [All]	4.9	4.5	10

Source: Author's Fieldwork (2020, 2021)
Both R and I are in red zone relative to international best practices. Both are below 50% and both R&I need to adjust towards synergy in a positive way.

VII. Methodology lessons:

Mixed methods methodology lessons include: one must have authorisations ready, the thorough knowledge of the subject (Philosophy, Business Economics, IT, Collaboration) is very important, the valueone attaches to the study has a bearing on acceptance by respondents and one must handle the expectation factor professionally whilst balancing ethical considerations. One must also be prepared to land into some past "storm" and ethical considerations remain vital at all stages of data collection and analysis. Some findings appear

"obvious" BUT one needs to "observe, think, discuss seriously" in order to pick x-factor issues which, when addressed, solve the research problem comprehensively.

1.   Selected cases where R&D and I&C have collaborated effectively:
During fieldwork, the author managed to identify some cases where R&D and I&C produced synergistic fruits and these included:
•   DR&SS and Delta in Sorghum breeding, production, value-addition with wider benefits to the brewing industry for Zimbabwe and the sub-regional economy
•   SIRDC/ZTS-AFC Bank -funding commercialisation of drought tolerant Sirdamaize 113 seed-food security, raw materials agro-industry and stover for livestock with over one thousand tonnes sold in the 2021/22 season generating in excess of USD3 million equivalence to an R&D centre
•   Popularization of Mobile money services (an unknown idea then) by university students (acted conversation in pairs and in public buses) and targeting 1.5 million people (a then tipping point). This was through Jingles & Skits in, Public Buses, Omini buses and Public spaces by hired university students (with institutional concurrence). Now everyone with a registered mobile phone line now has a bank account and the Tele-density improved from <5% to now 115% www.econet.co.zw
•   Universities production of PPEs such asFace masks, Sanitisers, Sanitiser dispensing devices, Safety gear, Case tracking software, Impact studies, feeding into COVID 19 alleviation policy
•   Mr. Kumbirai Katsande (KK) or Mr. Cerevita, Food Technologist (University of Reading), now retired Corporate Executive and Advisor/Consultant: Nestle Zimbabwe and who developed **Cerevita ("adults' cerelac"),** Now globally preferred – UK, Europe, Australia, Continent of Africa, www.nestle.com
•   Innovations Hubs, starting with state universities namely: UZ, NUST, MSU, HIT, ZNDU, CUT creating space for innovations to develop into industries.

VIII.   Conclusion:

Success in R-I Synergy for Zimbabwe will derive success from such key factors as:passion to turn around holistically and convert research into industry, teamwork, mentorship, targeted Incentives, state-of-the art infrastructure (research, industry) as well as exposure to international best practices.

Acknowledgements:

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