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Cultivating the Apex of Human Capital: Doctoral Education as the Catalyst for Innovation and Structural Economic Transformation in Zambia

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Abstract: In the transition toward a knowledge-based global economy, the apex of human capital—doctoral-level researchers—serves as the primary engine for national competitiveness and structural economic transformation. This article assesses the systemic gaps in advanced research training within developing economies, utilising Zambia as a primary case study. Through a Training Needs Assessment (TNA) of 55 master's degree and professional qualification holders, this study evaluates existing self-efficacy in the research cycle. The findings reveal critical deficits in advanced data analysis, scholarly publication, and software utilisation. To harness doctoral education for national development, we argue that training paradigms must evolve beyond traditional academic silos to integrate advanced methodologies (such as structural equation modelling), robust intellectual property (IP) commercialisation structures, and strict alignment with macroeconomic frameworks like the National Development Plan (NDP) and Vision 2030. The article concludes with actionable policy and institutional implications for higher education architectures.

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I. INTRODUCTION

The contemporary global economy is unequivocally knowledge-driven, relying on apex-level human capital to drive industrialisation and solve complex societal challenges. For developing nations, the transition from resource dependency toward high-value, innovation-led economies is fundamentally constrained by a lack of advanced research capacity (Phiri et al., 2023).

A stark asymmetry exists in the global distribution of knowledge creators. While the global average stands at over 1,083 researchers per million inhabitants, Sub-Saharan Africa lags severely, averaging fewer than 92 researchers per million population. In stark contrast, regions experiencing rapid structural transformation possess vast reserves of Level 10 human capital: Switzerland and Slovenia report PhD holder rates of 3.2% and 3.8%, respectively, while the United States sits at 2.2%. Zambia's deficit is particularly acute; the 2010 census reported a mere 1,096 doctoral degree holders nationwide, reflecting a baseline of a paltry 49 researchers per million population. Kaulungombe et al. (2025) also found that even among academics in Zambian universities, only 17.8% are doctoral research degree holders, while the African average ranges from 20% to 40%, with Africa's overall aspiration of 100% by 2063 (Mohamedbhai, 2020). This represents an urgent need for capacity building at the highest academic levels. No wonder, in terms of publications per million inhabitants, Seychelles leads SADC with 364 publications, followed by South Africa (175), Botswana (103), Mauritius (71), Namibia (59) and Zimbabwe (21). Clearly, there is a correlation between the number of researchers a country has and the number of publications per million inhabitants.

This scarcity of doctoral-trained researchers directly correlates with systemic underperformance in global research output and innovation. In the 2023 Global Innovation Index (GII), Zambia ranked 118th out of 132 economies (WIPO, 2023). Crucially, the nation's performance was notably weak

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in "knowledge and technology outputs," indicating that while investments are made in innovation inputs, the specialised human capital required to translate those investments into globally competitive outputs is missing. The macroeconomic consequences are evident in national industrial outcomes, where structural economic transformation requires a shift toward high-value manufacturing; however, Zambia's Manufacturing Value Added (MVA) stagnates at approximately 9.28% of its GDP (World Bank, 2023) compared to global averages of 12 to 16%.

Doctoral degrees are the principal vehicles for training professional researchers who can identify complex market problems and execute studies using state-of-the-art methodologies. To bridge the gap between Zambia and emerging global economies, universities must design robust PhD programs that transcend traditional academic boundaries (Mohamedbhai, 2020). This article investigates the specific training needs required to design a doctoral curriculum capable of transforming mid-career professionals into the architects of structural economic transformation.

II. LITERATURE AND THEORETICAL FRAMEWORK

➢ *Human Capital and Endogenous Growth*

Endogenous growth theory posits that economic growth is primarily the result of internal forces, chief among them being the development of human capital (Romer, 1990). A direct correlation exists between the number of researchers a country possesses and its innovation output, measured in publications per million inhabitants. For example, Seychelles leads the SADC region with 364 publications per million, supported by higher researcher density, while Zambia lags significantly (UNESCO, 2021).

➢ *The Pedagogy of Advanced Research Competence*

Developing the capacity for high-level research requires a deliberate pedagogical framework. This study is grounded in Bandura's (1977) concept of self-efficacy, which suggests that individuals with higher confidence in their abilities are more likely to successfully attempt complex tasks. Developing this self-efficacy in doctoral candidates requires enactive, vicarious, exhortative, and emotive pedagogical approaches. Furthermore, Kolb's (1984) experiential learning cycle dictates that candidates must engage in abstract conceptualisation, active experimentation, concrete experience, and reflective observation. In practice, doctoral students must learn research by executing it actively—akin to learning to drive while under the guidance of an instructor.

➢ *Methodological Rigour and Literature Synthesis*

Modern research requires precision. Doctoral candidates must move beyond simple descriptive statistics and embrace complex variable relationships. Utilising advanced frameworks, such as the Miles (2017) framework for rigorous literature review synthesis, enables researchers to map theoretical boundaries and identify genuine empirical gaps effectively.

III. METHODS

To determine the specific training required to fill this human capital gap, a Training Needs Assessment (TNA) was conducted for doctoral study in business-related fields.

- Sample and Population: The target population comprised current master's degree students in business-related programmes, master's degree holders, and professional qualification holders in academia and industry. The study concentrated on the Lusaka and Copperbelt provinces, which possess the highest concentrations of tertiary qualification holders (23.2% and 18.5%, respectively).
- Data Collection: A self-completion questionnaire was distributed electronically via email and social media to adhere to COVID-19 social distancing requirements. Informed consent was obtained, and confidentiality was assured.
- Statistical Analysis: A sample of 55 respondents was achieved. Data were analyzed using one-sample t-tests against a test value of 4 ("High confidence") on a 5-point Likert scale to evaluate self-efficacy regarding the research cycle. Normality, missing data (<1%), and outliers were checked and deemed acceptable. Bootstrapped samples (1000 iterations at a 95% confidence level) confirmed the reliability of the t-test results.

IV. RESULTS

This section highlights the results, beginning with demographics of the sample and ending with hypothesis testing along the research cycle, interest in doctoral study and perceived benefits thereof.

➢ *Sample Demographics*

The sample in Table 1 indicated a highly educated cohort, with 76.4% possessing a master's degree.

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Table 1 Survey Sample Profile

Variable	Responses	Frequency	Valid Percent	Cumulative Percent
Gender	Female	18	32.7	32.7
	Male	37	67.3	100
Age Group	21 - 30	8	14.5	14.5
	31- 40	22	40	54.5
	41 - 50	16	29.1	83.6
	Above 50	9	16.4	100
Current Qualifications	Professional Qualifications (e.g. ACCA)	4	7.3	7.3
	Master's degree without Research	9	16.4	23.6
	Master's degree with Research	42	76.4	100
Years Post Master's Degree	1	25	47.2	47.2
	2	20	37.7	84.9
	3	4	7.5	92.5
	4	3	5.7	98.1
	5	1	1.9	100
Industry experience	5 years and below	14	25.5	25.5
	6 - 10 years	14	25.5	50.9
	11 - 15 years	8	14.5	65.5
	16 - 20 years	9	16.4	81.8
	Above 20 years	10	18.2	100
Sector	Academia	26	49.1	49.1
	Industry	27	50.9	100
specific discipline	Education	12	23	23
	Business Marketing Finance	17	32	54.7
	ICT and Maths	5	9.4	64.2
	Natural sciences	5	9.4	73.6
	Other social sciences	4	7.5	81.1
	Health sciences	2	3.8	84.9
	Procurement and Logistics	2	3.8	88.7
	Production	4	7.5	96.2
	Construction	1	1.9	98.1
	Mining	1	1.9	100

Table 1 indicates that 23.6% of the respondents had either a professional qualification or a master's degree without research training at all, while 76.4%. 54.4% of the master's degree holders are below the age of 40, signifying enough energy for further studies. Table 1 also indicates that the sample size generated from the online and social media-administered questionnaire was 55. Generally, 30 is the minimum sample size for any inferential tests to be conducted. This is because of the Central Limit Theorem, which justifies the use of the normal distribution if the sample size is large enough. Empirically, it's said to be enough if the sample size is greater than 30. That is why 30 is always considered the minimum number of observations we need to conduct a test.

Be that as it may, the normality tests were conducted on the Likert scale data using the Kolmogorov-Smirnov data and having found most variables significant for violating normality ($P<0.05$), the kurtosis and Skewness statistics were generated, and all of them were found to be within + or – 1. This is an acceptable threshold for psychometric tests (George and Mallery, 2016). Missing data was checked to be less 1 % for all variables; missing data less than 10% is usually acceptable. Outliers checked using the 5% trimmed means compared to the actual means revealed no significant effect of outliers. Lastly, the one-sample T tests conducted for assessing training needs elements also included the 1000 (95% confidence level) bootstrap samples since the sample was small. The results for the boot-strapped and non-boot-strapped one-sample t-tests were largely the same.

- *Competency Gaps in the Research Cycle*

Based on Creswell[1] (2012), the elements of the research cycle and process were used to generate appropriate questionnaire items. Respondents were asked to indicate the extent to which they were confident about their ability to execute the tasks in the research and innovation process from start to finish. This was on a scale of 1 to 5, where 1 = no confidence and 5=very high confidence. This is in line with Bandura's (1977) concept of self-efficacy, indicating that individuals who are more genuinely confident about their ability to perform a task are more likely to attempt to undertake it. To account for the notion of social desirability, i.e., the tendency for respondents to answer questions in a manner that presents them positively in their social setting, a test value of 4 (High confidence) was used in conducting a one-sample T-test for each research process task to assess the need for training. The results are presented in Table 2.

[1] Creswell (2020) Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research, 6th Edition, Pearson,consistent with Bandura's (1977) concept of self-efficacy, indicating that individuals who are more genuinely confident in their ability to perform a task are more likely to attempt

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Table 2: Level of Competence to Execute Specific Research Process Task

	One-Sample Test			Test Value = 4		
Variable	N	Mean	Std. Dev	Std. Err	t	df	Sig. (2-tailed)
Topic	55	3.890	1.031	0.139	-0.785	54	0.436
Problematising	55	3.550	1.119	0.151	-3.012	54	0.004
Conceptualising	55	3.490	0.998	0.135	-3.784	54	0.000
Theorising	55	3.550	0.997	0.134	-3.382	54	0.001
Conceptual model	55	3.200	1.078	0.145	-5.502	54	0.000
Hypothesising	55	3.450	1.152	0.155	-3.512	54	0.001
Research Objectives	55	3.840	1.118	0.151	-1.085	54	0.283
Research Philosophy	55	3.310	1.120	0.151	-4.575	54	0.000
Research Design	55	3.550	1.086	0.146	-3.105	54	0.003
Unit of Analysis	55	3.200	1.026	0.138	-5.785	54	0.000
Collection Instruments	55	3.490	1.086	0.147	-3.475	54	0.001
Analyses Techniques	55	3.330	1.055	0.142	-4.729	54	0.000
Research Ethics	55	3.440	1.102	0.149	-3.795	54	0.000
Actual data analyses	55	2.960	0.981	0.132	-7.838	54	0.000
Results Interpretation	55	3.330	1.055	0.142	-4.729	54	0.000
Reporting	55	3.580	1.134	0.153	-2.736	54	0.008
Concluding	55	3.510	1.034	0.139	-3.521	54	0.001
Scholarly contributions	55	3.530	1.052	0.142	-3.334	54	0.002
Findings Implications	55	3.350	1.092	0.147	-4.444	54	0.000
Further research	55	3.530	1.136	0.153	-3.086	54	0.003
Scholarly Writing	55	3.350	1.126	0.152	-4.312	54	0.000
Writing a Journal article	55	3.110	1.066	0.144	-6.199	54	0.000
Publication process	55	2.690	1.069	0.144	-9.079	54	0.000
Dissemination and defence	55	3.380	1.209	0.163	-3.791	54	0.000
Software Use	53	3.000	1.209	0.166	-6.022	52	0.000

The results in Table 2 reveal that besides the confidence to generate a research topic and to set the research objectives and research questions (sig.>0.05), all the other elements of the research cycle were statistically significantly lower than the test value of 4 (sig.=<0.05) i.e. the respondents had less than high and less than very high confidence in their ability to execute the research tasks in the research cycle/process. Particularly, of acute need was the journal article publication process, actual research data analyses, and software use, which had a mean of equal to or less than 3. This entails that there was a need for specialised training to transform the master's degree holders into professional researchers who would be highly confident and very highly confident in their abilities to undertake research tasks at a very high level.

- *Appetite and Preferences for Doctoral Study*

There is a substantial appetite for terminal degree progression. In Table 3, 72.2% of respondents indicated they would "most definitely" or "certainly" pursue a PhD if it were flexible and affordable. Moreover, 73.6% expressed a readiness to commence studies within six months to one year. Regarding delivery modes, traditional full-time study was highly unpopular, capturing only 3.8% of preference. Professionals overwhelmingly preferred flexible models: 64.2% favored part-time study, and 32.1% preferred a sandwich model.

Table 3: Interest in Pursuing a PhD Study, Study Mode Preference

Variable	Responses	Frequency	Valid Percent	Cumulative Percent
keen to undertake PhD study	Not at All	1	1.9	1.9
	May be	7	13	14.8
	Definitely	7	13	27.8
	Most Definitely	6	11.1	38.9
	Certainly	33	61.1	100
Start PhD studies	Within 6 months	25	47.2	47.2
	Within 1 year	14	26.4	73.6
	Within 2 years	7	13.2	86.8
	Within 3 Years	3	5.7	92.5
	Within 5 years	4	7.5	100
Study mode	Full Time	2	3.8	3.8
	Sandwich	17	32.1	35.8
	Part Time	34	64.2	100

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➢ *Perceived Macroeconomic Benefits*

In Table 4, respondents strongly agreed ($p < 0.05$ against a test value of 3) that increasing the number of PhD graduates provides systemic institutional and national benefits. This includes driving innovative solutions to industry challenges, increasing journal article output, elevating university rankings, and ultimately enhancing Zambia's industrialisation and participation in the knowledge economy.

Table 4: Benefits of a PhD

		One-Sample Test Test Value = 3						
#	Variable	N	Mean	Std. Dev	Std. Error	t	df	Sig. (2-tailed)
1	More innovative solutions	53	4.340	1.108	0.152	8.799	52	0.0005
2	More professional researchers	53	4.430	0.991	0.136	10.539	52	0.0005
3	Publication increase	53	4.420	1.027	0.141	10.029	52	0.0005
4	high universities rankings	53	4.340	1.091	0.150	8.940	52	0.0005
5	participation in knowledge economy	53	4.280	1.045	0.144	8.941	52	0.0005
6	Industrialisation	53	4.190	1.144	0.157	7.561	52	0.0005

V. DISCUSSION

The findings illustrate a critical paradox in the developing world's higher education ecosystem: a high willingness among young professionals to engage in doctoral studies coexists with a profound lack of self-efficacy in the technical mechanisms of knowledge production (Overall et al., 2011).

If researchers cannot confidently utilise advanced software or execute complex data analysis, their ability to accurately diagnose national challenges is fundamentally compromised. To catalyse economic transformation, doctoral training must mandate proficiency in advanced qualitative and quantitative methods, such as structural equation modelling (SEM). SEM allows researchers to test intricate theoretical models, evaluate mediating and moderating variables, and build robust conceptual frameworks that accurately reflect the complexities of national economic landscapes (Hair et al., 2019). Furthermore, the overwhelming preference for part-time (64.1%) and sandwich (32.1%) models suggests that future researchers are actively embedded in the workforce. Universities must leverage this by turning industry challenges into laboratories for doctoral inquiry, effectively bridging the gap between theoretical knowledge and practical application (Costley & Lester, 2012).

VI. IMPLICATIONS

➢ *Institutional Integration and Intellectual Property*

For universities to drive national competitiveness, knowledge creation must be paired with knowledge protection. Doctoral programmes must explicitly train candidates in Intellectual Property (IP), covering patents, utility models, and geographical indications. Crucially, universities should institutionalise Technology Management Offices (TMOs) governed by equitable net income-sharing models. Structuring IP policy to distribute commercialisation revenue efficiently—such as a 40% allocation to the researcher, 40% to the university, and 20% to the supporting faculty—creates a vital financial incentive for researchers to transition academic theories into market-ready innovations.

➢ *Strategic Policy Alignment*

Higher Education Authorities and policymakers must recognise that producing fewer than 30 PhDs nationally per year is insufficient for macroeconomic transition. Doctoral curricula validation should require a direct, demonstrable alignment with national strategic blueprints, specifically the National Development Plan (NDP) and Vision 2030. Research proposals must be evaluated not just on academic merit, but on their capacity to solve infrastructural, technological, or policy bottlenecks identified within these national frameworks.

VII. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The primary limitation of this study is its sample size (n=55) and its reliance on electronic distribution methods. While bootstrapped analyses confirmed internal validity, the findings should be generalised cautiously. Future research should undertake longitudinal studies across a broader geographical scope to map the specific industrial sectors where Level 10 human capital is most urgently required.

VIII. CONCLUSION

A nation's competitiveness is constrained by the innovative capacity of its highest-level researchers. While Zambia faces a severe deficit of doctoral graduates—amounting to only 49 researchers per million —there is a highly eager professional class ready to undertake advanced training. However, these candidates report low self-efficacy in empirical execution and publication. By redesigning doctoral education to be pedagogically rigorous, focused on advanced methodologies like structural equation modelling, anchored by robust IP commercialisation structures, and aligned with national development visions, universities can forge the human capital necessary to drive sustained structural economic transformation.

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