

A CASE STUDY OF SCIENTIFIC COLLABORATIONS AT HIGHER EDUCATION: TOWARDS VALUES CREATION AND FUTURE SUSTAINABILITY

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Abstract

The purpose of this research was to investigate possible factors that lead to value creation and future sustainability in the field of scientific collaboration management at higher education institutions (HEIs) level. Through a new validated questionnaire that includes the opinions of a variety of research collaborators and alike positions at different Saudi universities, the author argues the emergence of two interesting contradictory factors. A positive and significant effect of funding opportunities, but a lack of a significant strategy development that is planned around resilience. The university self-autonomy is considered as a major burden in maximizing scientific collaborations for HEIs and a major factor of public budget deficit. In addition, benchmarking analysis with elite institutions showed significant divergent across the collaboration spectrum. New studies in this area built on the present findings, may explore a balance between the strategy development and its financial implementation from different perspectives to get meaningful results that add real values and secure long - term sustainability.

Keywords: Collaboration, Value Creation, Resilient Strategy, Sustainability, GLM estimation, Benchmarking.

Introduction

Scientific knowledge collaboration is widely recognized in the literature as finding challenging solutions to many barriers that affect the institution's advancement. Such solutions cannot be achieved from internal stakeholders alone. At higher education level, the need of international scientific collaboration has been well – established in enhancing institution international profile and contributing to world knowledge and discovery (Woolf; 2010; Altbach et al., 2009). However, institutions managing these collaborations require real commitment from partners, effective communication, and a transparent strategy to achieve shared outcomes (Zahner, 2005; Perkins et al. 2011; Jones and Barry, 2011b; Cramm et al. 2013). In general, these outcomes are very challenging to meet due to differences in resources, talent, culture (Sachs et al., 2019; Eckboir et al., 2016), and artificial intelligence adaptability.

In addition, collaboration is considered as a nested phenomenon with inter connected layers that exists simultaneously within the larger community (Geurts, et al., 2022; Woodland and Hutton, 2012; Vangen and Huxham, 2003). Hence, evaluators should possess the rights skills and mindsets to develop a collaboration strategy that is resilient and sustainable. Such collaboration involves inter-collaborations (departments, units, colleges, centers, etc.), intra-collaborations with peers, and non - academic collaborations (government, national private organizations, multinational organizations, public offices, international cooperation agencies, etc.).

Another interesting feature of scientific collaboration is that it creates added value in long - term. The nature of this value depends on shared goals established during the collaboration process (Della Corte and Del Gaudio, 2014; Kang et al., 2007; Lepak, Smith and Taylor, 2007). This a challenging issue for shareholders in a very complex institution to achieve a set of values at the same time and hence, it's beyond the focus of this study. That's said, value creation is treated as a whole dimension and does not explicitly define which one is targeted.

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The literature investigation from Scopus data base showed no single study addressed numerically the scientific collaborations and its environment. It has been partial either by analyzing a specific sector (Ryazanova and Jaskienne, 2022) or not addressing the key issues at international level. For instance,

publishes studies on scientific collaborations and research activities represent only 12%, and 8 % respectively (Table 1). While, the list of diverse research contribution by peer esteems did not exceed the 10% (Table 2).

Table 1: Literature Review Description Process: The Saudi HE Case

	Scientific Collaborations		Research Activity	
	Results	Items selected	Results	Items selected
Articles	23	3	56	8
Review	0	0	36	0
Conference Papers	0	0	8	2
Letters	0	0	7	0
Book Chapter	1	0	11	0
Total (%)	24	3 (12%)	118	10 (8%)

Note: All data are Scopus data base as of May 10TH, 2025. Between parenthesis are the items selection rate. HE stands for higher education.

Table 2: “Continued from Table 1” List of Diverse Research Contribution

Items	Total	Peer Esteem (Ellison & Eatman, 2008)
Articles	16	Advance of scientific scholarly knowledge, culture, engagement, etc.
Conference Papers	3	Enhance research activity, networking, and stakeholders’ satisfaction
Total	19 (10%)	

Note: Peer esteem refers to recognition of the researchers by their peers (publication, invitation, prize, award, etc.)

Hence, the purpose of this research was to investigate empirically scientific collaborations amid disruption in Saudi’s higher education. This investigation is not designed as a collaboration strategy for particular subjects, or geographic regions. Instead, it seeks the keys success that can be used to develop resilient strategies that create added-value and future sustainability. The context of collaboration seeks also to support the Ministry of Education (ME) ambitious goal in improving the international ranking of educational institutions outlined in Vision 2030. In this context, the ME has pledged its commitment to provide support to universities, with respect to strategic planning, as well as in providing any data and report studies that deem to be relevant. The ME has insisted also on the need of private sector support in the financing and construction of education infrastructure, creating new opportunities for foreign investors.

The study was performed as follow: (i) An empirical analysis of a questionnaire that includes the opinions of a variety of research collaborators and alike positions at different Saudi universities, chosen from Times Higher Education rankings list (THEs). This analysis involves a validity of the questionnaire, followed by an ordered outcomes estimation of the defined model. The estimation values of the marginal effects and their respective significances are also analyzed. (ii) A benchmarking analysis with top ranking list that

was published by THEs. The purpose of this analysis is to support the ME goals in enhancing international ranking for Saudi’s universities (Khedhiri, 2025). The criteria chosen for benchmarking are research environment, research quality, industry, and international outlook. And, (iii) discuss the significance of the study results and their implications to decision making policy seeking new concepts and practices to achieve a meaningful value at international level.

Methods

The data analyzed in this study were obtained from a new questionnaire that includes the opinions of a variety of research collaborators and alike positions at different Saudi universities retrieved from THEs league Table (November 2023). This Table includes 2 private universities and 20 public universities. If we assume that each university has in the average 30 research collaborators, then the total sample population (N) was 660. By using Richard Geiger equation, the computed sample size was 243 participants, with a margin of error set at 5%, and a confidence level of 95%. After questionnaire submission, a total of 205 responses were obtained with a response rate of 80% ($n = 205$).

The dependent variable is a single measure and an ordered choice. Respondents were asked to rate on a 4-point scale (1 = *very poor* to 4 = *excellent*) the

following statement: “*The management of scientific collaborations creates value and future sustainability to the university.*” But the independent variables are classified into five dimensions: Strategy Resilient Development (5 items, Dimension1), International Collaboration with Peers (4 items, Dimension2), Collaboration with Non-academic Sector (4 items, Dimension 3), Increasing Funding Rate (4 items, Dimension 4), and Digital Opportunities for Competitive Advantage (4 items, Dimension 5). All respondents were asked to rate on a 4-point scale (1 = *strongly disagree* to 4 = *strongly agree*). In addition, one variable was used as a dummy variable university autonomy (1 = if the university is autonomous and 0 = otherwise).

Statistics descriptive analysis for all variables was performed via “IBM SPSS Statistics version 23.” For the questionnaire validity, the study used the internal reliability consistency of each dimension: Cronbach coefficient, $\alpha > 0.70$ and the construct validity, Pearson correlation coefficients, $\rho > 0.30$

(Khedhiri, 2017 and 2022). While for the quantitative analysis, generalized ordered logit model regression (GLM) is chosen since it outperforms the linear regression model (Khedhiri, 2018).

Result, Discussion and Implications

Descriptive statistics for all variables are displayed in Table 3. It's worth noting that around 80% of respondents agree on the management of scientific collaborations adding a meaningful value to the university, and only 10% considers their university as autonomous. The reliability of all dimensions showed an overall alpha scale greater than 70% acceptable criteria (Table 4), suggesting that all variables met internal reliability consistency at aggregation levels. The validity of instruments used in each dimension met the convergent criteria as all correlations were greater than 0.30 and statistically significant at 1% level.

Table 3: Statistics Descriptive for All Variables

Dimensions	Mean	Min	Max	SD	SE
Dimension 1: Strategy Resilient Development (5 items)	10.988	5	20	2.168	0.019
1. Clear set of principles that guide collaborative activities	2.269	1	4	0.699	0.026
2. Readiness to address risk and uncertainty	2.179	1	4	0.818	0.308
3. Well-chosen set of benchmarking with peers	2.098	1	4	0.753	0.028
4. Consultancy and advisory	2.569	1	4	0.819	0.308
5. Great talents for achieving greater results (strategy champion)	1.873	1	4	0.857	0.032
Dimension 2: International Collaboration with Peers (4 items)	10.803	4	16	2.070	0.077
6. Faculty inbound and faculty outbound	2.854	1	4	0.821	0.030
7. Joint education program	2.928	1	4	0.901	0.033
8. Joint research relevance to the Vision 2030 goals	2.699	1	4	0.943	0.035
9. Potential impact of joint research	2.322	1	4	0.722	0.029
Dimension 3: Collaboration with Non-academic Sector (4 items)	9.885	4	16	2.809	0.105
10. Collaboration and engagement with national private organizations	2.427	1	4	0.904	0.034
11. Collaboration and engagement with multinational organizations	2.322	1	4	0.919	0.035
12. Collaboration and engagement with public offices (e.g. ministry)	2.655	1	4	0.780	0.029
13. Collaboration and partnership with international cooperation agencies	2.481	1	4	0.871	0.032
Dimension 4: Increasing Funding Rate (4 items)	10.560	4	16	5.905	0.222
14. Knowledge and skills of the funding decision making team	2.678	1	4	0.978	0.036
15. Efficiency in securing news funding's resources	2.644	1	4	0.912	0.034
16. Effectiveness of grants and funds management	2.580	1	4	0.915	0.034
17. Partners funding commitment over time	2.658	1	4	0.912	0.035
Dimension 5: Digital Opportunities for Competitive Advantage (4 items)	11.769	4	16	2.332	0.105
18. Efficient resources collaboration	3.779	1	4	0.801	0.023

19. New technology development with impactful collaboration	3.278	1	4	0.789	0.024
20. Upskill and reskill staff to accommodate with the new technology	2.210	1	4	0.710	0.021
21. Simplified digital processes that can save time and increase efficiency	2.502	1	4	0.798	0.027
Single Measure					
22. Management of scientific Collaboration	3.232	1	4	0.571	0.012
23. University Autonomy	0.102	0	1	0.002	0.008

Notes: Richard Geiger Equation: $n = \frac{\left(\frac{Z}{d}\right)^2 (0.5)^2}{1 + \frac{1}{N} \left[\left(\frac{Z}{d}\right)^2 (0.5)^2 - 1\right]}$, where $d = 0.05$, $Z = 1.96$, and $N = 660$, $n = 205$

Table 4: Internal Consistency, Convergent Validity, and Correlation Between Dimensions

Dimension	Internal Consistency Criteria	Convergent Validity Criteria	Correlations			
			1	2	3	4
1. Strategy Resilient Development	0.861	0.38 – 0.84				
2. International Collaboration	0.770	0.40 – 0.53	-0.292*			
3. Non-Academic Collaboration	0.911	0.42 – 0.70	-0.619*	-0.226*		
4. Increasing Funding Rate	0.876	0.75 – 0.85	0.554*	-0.292*	0.569*	
5. Digital Opportunities	0.932	0.78 – 0.92	-0.756*	0.344*	0.301*	0.786*

Notes: $\alpha > 0.70$ and $\text{correlations} > 0.30$ stand for Cronbach's Alpha and Pearson coefficients respectively Responses are in Likert scale, with 1= very poor, 2 = poor, 3 = good, and 4 = excellent

*All correlations are significant at $p < 0.01$; Number of observations $n = 205$

Table 5 shows the estimates of the ordered outcomes model and their respective p -values. Model fit indices are also reported. As expected, the cutoff points were all significant at the 5% level satisfying the relationship that $0 < \text{Cut point } 1 < \text{Cut point } 2 < \text{Cut point } 3$, and justifying no misspecification errors in the GLM regression (Maddala, 1983). From the statistical side, all parameter estimates were all significant, except that estimates of finding new digital opportunities was not significant at any level. This suggests that decision making policy should perhaps; (i) upskill and reskill its staff to accommodate with the new technology if any exists; and (ii) simplify digital processes that can save time and increase efficiency. In terms of sign, strategy resilient development and university autonomy had a negative sign while international collaboration and increasing funding's rate had positive sign, providing support for scientific collaboration management.

More importantly, Table 6 shows the marginal probability effect estimates and their respective standard errors for the generalized ordered Probit.

Observe that the sum of all marginal effects estimates is equal to zero, implying the consistency of the estimates. On average, respondents are 22% points less likely to rate strategy resilient development variable as "excellent", while only 4% points are likely to rate strategy resilient development variable as "very poor." But 12% points likely to rate strategy resilient variable as being "excellent", while only 2.2% points are less likely to rate strategy resilient development variable as being "very poor."

As for the benchmarking analysis displayed in Table 7, it is important to observe that scientific co-authorships for the top three collaborators in Saudi Arabia represent zero percent, suggesting total disconnect in terms of collaborations and partnerships. the same picture emerges with peers, where collaboration did not exceed the 23.5% level, showing low diversity and inclusion with top performer countries.

Table 5: GLM Estimates for Managing Scientific Collaboration (N = 205)

	Estimates	p-value
Strategy Resilient Development	-0.176**	0.011
International Collaboration	0.040**	0.025
Non-Academic Collaboration	-0.062**	0.028
Increasing Funding Rate	0.085**	0.045
Digital Opportunities	0.085	0.321

University Autonomy	-0.142***	0.000
<i>C1/Constant</i>	2.072***	0.000
<i>C2</i>	3.179***	0.000
<i>C3</i>	5.172***	0.000
MODEL FIT INDICES		
<i>Model χ^2 (Likelihood Ratio)</i>	357.6*	
<i>df</i>	6	
<i>-2LogL</i>	1352.1	
<i>BIC</i>	1404.6	
<i>AIC</i>	1368.1	

Notes: A prior test of proportional odds of the dependent variable showed $\chi^2 = 27.377$, $p = 0.002$, and $DF = 11$, violating the proportional odds assumption. Hence, generalized ordered logistic model (GLM) was performed for this regression.

Table 6: Average Marginal Probability Effect Estimates and Their Respective Standard Errors for the Generalized Ordered Probit*

Independent Variables	Rating Level			
	1 "Very poor"	2 "Poor"	3 "Good"	4 "Excellent"
Strategy Resilient Development	0.045 (0.002)	0.077 (0.007)	0.098 (0.013)	-0.220 (0.022)
International Collaboration	-0.005 (0.001)	-0.013 (0.003)	-0.022 (0.006)	0.040 (0.010)
Non-Academic Collaboration	0.005 (0.002)	0.019 (0.009)	0.034 (0.016)	-0.058 (0.027)
Increasing & Securing Funding	-0.026 (0.002)	-0.041 (0.007)	-0.053 (0.014)	0.120 (0.073)
Digital Opportunities	-0.013 (0.104)	-0.035 (0.224)	-0.051 (0.012)	0.099 (0.102)

Notes: *See Holey (2011), James, et al., (1982). Standard errors are between parenthesis.

Table 7: Research collaboration: A Comparison Analysis within the GCC

Countries		Top three collaborators for scientific co-authorship (2017 - 2020)			
		1 st Collaborator	2 nd Collaborator	3 rd Collaborator	GCC (%)
GCC	Saudi Arabia	Egypt: (11,523)	USA: (9,023)	China: (6,118)	0.0
	UAE	USA: (3,451)	UK: (1,782)	Canada: (1,421)	0.0
	Qatar	USA: (2,895)	UK: (1,627)	China: (1,195)	0.0
	Kuwait	USA: (890)	Egypt: (465)	SA: (435)	24.3
	Bahrain	SA: (241)	Egypt: (171)	USA: (169)	4.5
	Oman	India: (733)	UK: (473)	Pakistan: (444)	0.0
Average		-	-	-	4.8
America	USA	7,236 (36.7%)	9,023 (66.6%)	169 (1.7%)	38.1
Europe	UK	0 (0.0%)	3,882 (28.7%)	0 (0.0%)	9.2
Average		-	-	-	23.5

Source: Khehdiri, 2025

Conclusion and Future Research

The present research investigated possible factors that create major barriers in the field of scientific collaboration management at higher education level. The investigation used two different methods: (i) a new validated questionnaire that includes the opinions of a variety of research collaborators and alike positions at different Saudi universities; and (ii) a benchmarking analysis with top ranking list that was published by THEs.

Questionnaire results show the emergence of two

interesting contradictory factors. A positive and significant effect of funding opportunities, but a lack of a significant strategy development that is planned around resilience. In addition, the university autonomy is considered as a major burden in maximizing international collaboration impact since the government controls top leader appointments and all financial activities. This however has maintained the government's budget deficit for many years and affected the budget of many universities.

The author acknowledges the limitation of questionnaire studies in terms of sampling and scientific collaborators responses. It is reasonable to recognize that some high productive scientific collaborators did not participate or unintentionally overlooked. But mixed studies that involve qualitative analysis along with opinions from external experts may contribute to enhance the results efficiencies. The greater contribution of this study is that new studies in this area built on the present findings, may explore a balance between the strategy development and its financial implementation from different perspectives to get meaningful results that add real values and secure long - term sustainability.

In addition, as researchers seek to investigate more in this area, it is suggested that they consider the following: (a) a strategy should be developed with a wide range of resilience type could result in identifying different outcomes. Hence, researchers need to deepen their model specification on the resilience type to be included in the model, and conduct empirical studies to test such specification. (b) Universities seeking international scientific collaboration that create added value, may be reluctant to provide internal information such as their main key performance indicators (KPIs). This however, may create information asymmetries which make it difficult for partners to collaborate and managers to develop the right strategy.

Conflict of Interest

The author declares no conflict of interest in conducting this research.

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