

Time Component in Polygonal Parameterization of Research Culture in the Academe

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Abstract

This paper presents a definition of research culture and provides a parameterization model for measuring the concept which allows for cross-comparison of research cultures across different universities and across time. Using the hexagonal research culture model of Panduyos in which the research culture is equal to the area of the hexagon, we modify this polygonal research culture model by incorporating the dynamics of interaction of the elements over time. Through simulation, we illustrate the dynamic polyhedral model using only three (3) components: Faculty Involvement (FI), Institutional Policies Supportive to Research (IPR), and Leadership Inclination to Research (LIR). With this, the paper proposed a model for quantifying the concept of a research culture and showed its practical utility through simulation. A Research Culture Index defined as the presence of uniform belief system, practices and ways of conducting a study in the academe. The measure will be most useful for the management and administration of higher education institutions wishing to develop a culture of research.

Keywords: index, research productivity, hexagonal research culture model

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1.0 Introduction

The literature on research management mainly tackles the issue of research productivity in the academe and how such productivity has been influenced by a host of factors present or absent in the University (Bland et al., 2005; Hanover Research, 2014). In many of these studies, research productivity has been often attributed to the University's research culture – a concept that is taken for granted as well-understood but ill-defined. To date, there is no universally-accepted definition of research culture much less, a systematic and measurable characterization of the concept. This paper presents a definition of research culture and provides a parameterization model for measuring the concept which allows for cross-comparison of research cultures across different universities and across time.

The study of Hill (2002) on establishing and sustaining a research culture, averred that at the level of the institution, a research culture might have been fostered when research actions are cohesive, and the school provides an enabling environment which involves the following strategic interventions: (a) sharing of expertise and knowledge, (b) having research direction or niche, (c) institutional support at the top level, and (d) provision for research facilities. The study also considers development of a research culture at the individual level: (a) motivation and incentive, (b) education and training, (c) matching of research culture and organizational culture. It may be noted that these factors are the same conditions necessary to enhance research productivity (Bland et al., 2005). For this reason, research productivity and research culture are interchangeably used both in theory and in practice. In fact, mature research culture foments high research productivity, but

high research productivity need not imply a mature, rich, and diverse research culture. Sunder (2008), in a commentary published in China Journal of Accounting Research equates research culture with a robust tradition of research. Research culture is not something established overnight but something that is built upon years of experience, of academic practices and belief systems in the university. Asian universities' culture of research and innovation suffers under the heavy burden of hierarchy and ranks (Sunder, 2008) where the mature academics held the veto power.

Cheetham (2007) claimed that research culture is both a global term and a local term referring to specific universities. It is global in the sense that all universities in the world aim to establish a culture of research; it is local since each university is different from another university regarding their distinctive cultures of research. In general, he averred that this culture is a concern because research is one of the bases of how a university works.

Obstacles to building a culture of research and research productivity had been identified. Hermanson (2008) and Shama and Kfir (2002) found strategic issues like a University's mission emphasizing applied scholarship and a university struggling to keep financially afloat are most likely not to develop a viable research culture.

Jootun and McGhee (2003), Thomas and Harris (2000) and Brotherton (1998), found that universities with strong teaching tradition, vocational orientation, and unwilling staff are likewise unlikely to build up a culture of research. Deem, and Lucas (2007) and Tynan and Garbett (2007) claimed that overloaded non-research workloads of the faculty also pose as the major obstacle to building – culture

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of research.

Given the resurgence of interest in building a research culture in the university as a means to promote international understanding and cooperation in the 21st century, the need to define and measure the concept of research culture and productivity is all the more pressing. Strategic intervention in universities where obstacles to building a research culture are present will depend upon the ability to capture this concept in a comprehensive and descriptive manner.

2.0 Theoretical Framework

Research culture in the institution of higher education is its way of life cutting across the extensive functions of teaching, administration, and community service. The research itself is a learned behavior; it is started in secondary schools and is enhanced as one progresses through degrees and careers. Cheertham (2007) asserts that research culture is the structure that gives that behavior significance and that allows people to understand and evaluate the research activity. In the University setting, research culture is the cultural structure based around the behavior of the staff, faculty, and students that allow the institution to transfer knowledge gained through this systematic process to the community.

Bland et al. (2005) mentioned the fundamental pillars that enhances research productivity. These pillars include (a) faculty involvement (FI), (b) institutional policies supportive of research (IPR), and (c) leadership inclination to research (LIR) validated as being primal elements to building a culture of research as well. Hanover (2014) adds that: (a) research integration into the curriculum (RIC), (b) research-based policies (RBP), and (c) research valuing by the community of stakeholders (RVS), also provide a more holistic view of the university's research culture. These six (6) elements constitute the vertices of a hexagon:

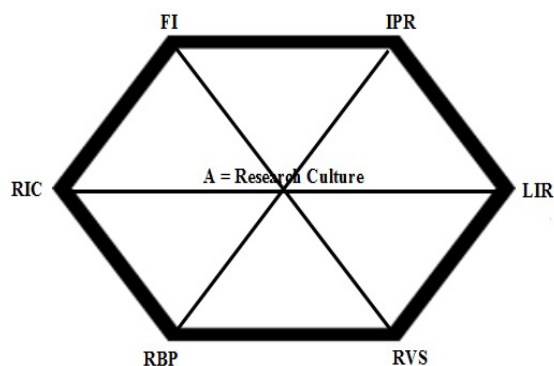


Figure 1. Panduyos' Hexagonal Research Culture Model

Panduyos' (2016) proposed this hexagonal

research culture model as a way to visualize the concept. She defined research culture as:

$$\text{Research Culture} = \text{area of the hexagon} \quad (1)$$

Since the area of the hexagon is affected by the length of the sides of the polygon, so is the research culture. The richness and diversity of the research culture will therefore depend upon the strengths of interaction (sides) of the elements.

Panduyos' (2016) model is a static model in the sense that the evolution of research culture over time is not considered. Thus, to modify this polygonal research culture model, we incorporate the dynamics of interaction of the elements over time. Time becomes the height of the polygon and for each time, T, we observe a sequence of the polyhedron.

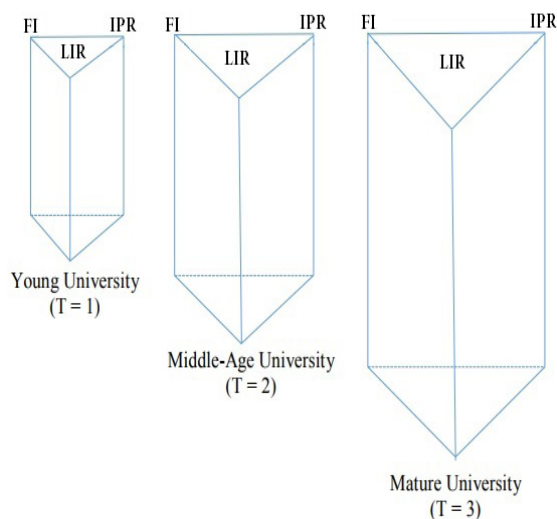


Figure 2. Bland et al. (2005) Trihedron Research Culture Model

From a two-dimensional static research culture model, we propose a three-dimensional dynamic research culture model. Mature research universities have the richest and most diverse research cultures among the other types of Higher Education Institutions (HEIs) based on their chronological orders. Research culture is now quantified as:

$$\text{Variance in beliefs, practices in research} = \text{Volume of the Polyhedron} \quad (2)$$

$$= \text{Face Area} \times \text{Height}$$

$$\text{Research Culture} = 1 - \text{variance in beliefs and practices in research} \quad (3)$$

When the elements in the institutions no longer vary regarding their beliefs and practices and ways of doing research, then the Institution is said to have achieved a distinctive research culture. This culture

is attained when the measure (3) is 1 or close to 1. In this formulation, we distinguish amongst various types of research cultures that may be derived from an institution's profile such as:

Non-Research or Mainly Teaching Culture: This happens when the research culture index is 1 but the indicators for research are within the low end of the spectrum.

Teaching-Research Culture Split: This happens when the research culture index is 1 or close to 1 but the indicators for research are midway between high and low values.

Research-Led Culture. This occurs when the research culture index is 1 or close to 1 and the indicators for research are within the high end of the spectrum.

Characterization of Research Cultures. Ideally, older universities ($T=3$) should have a more robust, dynamic and vibrant research culture. However, it is also possible for younger institutions in higher education to have higher research culture indices because of the more driven establishment and active interaction of the elements than for older universities. The implication of these situations is that it is possible for younger universities to be in the league of more mature HEIs regarding research by properly establishing and developing the cultural elements of research.

3.0 Simulation Design and Methods

In this paper, we illustrate the dynamic polyhedral model of Bland et al., (2005) using only three (3) elements: FI, IPR, LIR. Faculty involvement in research (FI) is a vector consisting of:

$$FI = \begin{pmatrix} \text{No. of Publication} \\ \text{No. of Research Proposal} \\ \text{Attendance to training} \end{pmatrix} = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} \quad (4)$$

where each element is scaled from 1 (very low) to 5 (very high). Five (5) faculty respondents are assumed to have been included in the sample.

Institutional Policies Supportive to Research (IPR) is also a three-dimensional vector (scaled from 1 to 5):

$$IPR = \begin{pmatrix} \text{Support to Paper Presentation} \\ \text{Support to Publication} \\ \text{Research Incentives to faculty} \end{pmatrix} = \begin{pmatrix} y_1 \\ y_2 \\ y_3 \end{pmatrix} \quad (5)$$

Finally, Leadership Inclination to Research

(LIR) is the three-dimensional vector (scaled also from 1-5):

$$LIR = \begin{pmatrix} \text{Publication of the Head} \\ \text{Leadership by Example} \\ \text{Membership to Research Organization} \end{pmatrix} = \begin{pmatrix} z_1 \\ z_2 \\ z_3 \end{pmatrix} \quad (6)$$

From (4) to (6), the F-score, I – score and L – scores are derived as:

$$\begin{aligned} F &= \sqrt{x_1^2 + x_2^2 + x_3^2} \\ I &= \sqrt{y_1^2 + y_2^2 + y_3^2} \\ L &= \sqrt{z_1^2 + z_2^2 + z_3^2} \end{aligned} \quad (7)$$

The average of the F , I and L scores are obtained as:

$$\begin{aligned} \bar{F} &= \text{Average (F Score)} \\ \bar{I} &= \text{Average (I Score)} \\ \bar{L} &= \text{Average (L Score)} \end{aligned}$$

The average F , I , L scores are coded as 1, 2, and 3 respectively. The coordinates $(1, \bar{F})$, $(2, \bar{I})$ and $(3, \bar{L})$ are then plotted for times $T = 1$, $T = 2$ and $T = 3$ as heights.

4.0 Results and Discussion

Fig. 1 shows the result of simulating a relatively young academic institution whose research culture is not yet defined. In this institution, variations in the research activities of the faculty members are more pronounced than for the other two elements of the model. However, faculty involvement in research will only vary from being low to moderate. Institutional Policies supportive of research may be high, but the Leadership's Inclination towards research is still low.

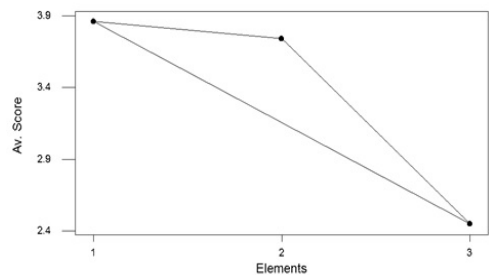


Figure 1. Typical configuration of an undetermined research culture

Table 1 shows the summary statistics for this typical undetermined research culture. Tabular

Table 1. Statistics for Underdeveloped Research Culture

F-score	I-score	L-score	elements	average	distance	perimeter	culture
3	3.741657	2.44949	Faculty	3.861807	1.007192	2.544754	0.413991
4.690416	3.741657	2.44949	Institutional Support	3.741657	1.633921		
5.196152	3.741657	2.44949	Leadership Inclination	2.44949	2.448395		
4.690416	3.741657	2.44949					
1.732051	3.741657	2.44949					

values reveal that the Institutional Scores and the Leadership Scores are all the same for all the faculty respondents. Moreover, while the average Institutional Support Factor is slightly higher than moderate, the Leadership Inclination Factor is lower than moderate. This situation is typical of institutions which have a tradition of teaching. Jootun and McGhee (2003) found that universities with strong teaching tradition, vocational orientation, and unwilling staff will likely lead to a situation of immature research culture. The Research Culture Index of 0.413991, however, suggests that after some time in the future, the Institution may diverge into having a Teaching-Research Split Culture or a Research Led Culture.

After this induction stage, one can again measure the research culture of the same institution after approximately five (5) years to see if the research culture had improved. Fig. 2 shows the configuration after five (5) years of the same institution.

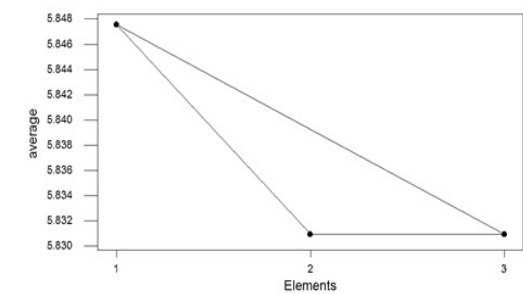


Figure 2. Research Culture Configuration after Five Years

The Institutional Support for Research (Element 2) is now aligned with the Leadership Inclination Towards Research (Element 3). This alignment suggests that a culture of research is about to be established. Table 2 shows the summary

statistics for this case.

The research culture index had reached to 0.99169 which shows that variances in the practices, beliefs and ways of doing research in the Institution had been minimized. There is uniformity regarding what the faculty and staff inside the institution believe about the role of research in their existence as an academic institution. This shift from the former paradigm is made possible because of the drastic change in the perspectives of the Leader as well as the Governance of the Institution regarding research policies. Nonetheless, it is possible that another scenario may happen after five years as shown in Figure 3 for the same Institution.

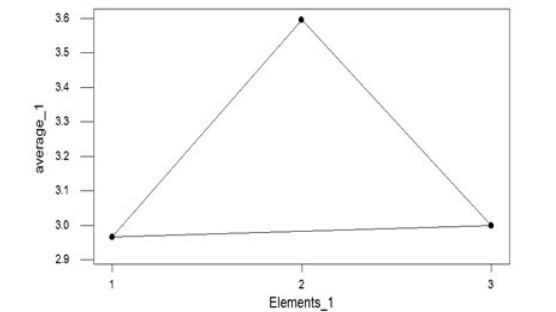


Figure 3. A Different Research Culture Scenario After Five Years

The graph suggests that while the Institutional Policies (Element 2) has remained relatively high, the Faculty (Element 1) and the Leadership Inclination to Research (Element 3) have both gone down to very low levels. What happens to the research culture index? Table 3 shows the summary statistics for this scenario:

Tabular values suggest that if these were the statistical characteristics of the institution after five

Table 2. Summary Statistics for Institution's Research Culture after Five Years

F-score	I-score	L-score	elements	average	distance	perimeter	culture
6.403124	5.830952	5.830952	Faculty	5.847572	1.000138	2.000104	0.99169
6.928203	5.830952	5.830952	Institutional Support	5.830952	1		
5.830952	5.830952	5.830952	Leadership Inclination	5.830952	2.000069		
5.385165	5.830952	5.830952					
4.690416	5.830952	5.830952					

Table 3. Summary Statistics for a Different Scenario After Five Years

F-score	I-score	L-score	elements	average	distance	perimeter	culture
3.464102	3.464102	3	Faculty	2.965437	1.182154	2.17327	0.386816
2.44949	3.464102	3	Institutional Support	3.595902	1.164087		
3.464102	3.464102	3	Leadership Inclination	3	2.000299		
2.44949	3.464102	3					
3	4.123106	3					

years, it is more likely to settle to an equilibrium where the institution will never develop a research culture. The elements necessary to establish a research culture will be acting in different ways, will have distinct points of view about research, and will hold various belief systems about the role of research in the institution.

5.0 Conclusion

We have proposed a model for quantifying the concept of a research culture and showed its practical utility through simulation. A Research Culture Index defined as the presence of uniform belief system, practices and ways of doing research in the academe is introduced. The measure will be most useful for the management and administration of higher education institutions wishing to develop a culture of research.

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