

GREEN CORPORATE GOVERNANCE FOR GREENING UNIVERSITIES: A NON-LINEAR MODEL OF INNOVATION ANALYSIS

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ABSTRACT

This research aims to ascertain how universities' stakeholders perceive the reconfiguration of Corporate/University Governance to enable the production of green knowledge and innovation needed for sustainable development. A questionnaire was applied to 89 academic stakeholders (90% confidence level, 5% relative tolerable error), consisting of three interrelated Likert items, grouped under the Green Corporate Governance (GCG) construct. In the process, the perceptions of five universities' stakeholders (Professors, Senior Lecturers, Academic Managers, Non-Academic Managers, and Students) were successfully collected. Chi-Square tests reflected that all the stakeholders agreed that the reconfiguration of the university governance system is warranted. The data analysis (contingency tables) revealed a chi-square test statistic lower than the chi-square value, signifying that all five stakeholders perceive in the same direction that the conventional university governance system needs to be reformed. This research will spur policymakers, governors, and university or education system managers to take appropriate actions to reconfigure the university governance system towards green corporate governance.

Keywords: Green University, Corporate Governance, Sustainable Development, Non-Linear Model of Innovation, Green Structure, Green Strategy, Green Leadership

INTRODUCTION

Knowledge-Based Economies (KBEs) steer their economies founded on endogenous factors, such as knowledge and innovation, human capital, and technology for sustainable development (Svarc & Dabic, 2017). In this mission of KBEs, the University system is the core institutional framework for producing knowledge and innovation. However, universities tend to conventionally produce knowledge and innovation with the linear model of innovation. The linear model of innovation has recently been subjected to critical evaluation, and it was found that in fact, the non-linear model has a greater impact on resolving complex social problems. In the meantime, social and political pressure starts demanding from the university system contributions to knowledge and innovation to respond to societal challenges, now codified as 17 Sustainable Development Goals (SDGs).

Gibbons, et al., (1994) were the first to show how non-linear innovation models have a greater impact than the linear innovation model in resolving complex social problems. Etzkowitz & Leydesdorff (2000) theorized a non-linear model compatible with KBEs, well known as Triple Helix Model (THM), which advocates that three subsystems can collaboratively create knowledge and innovation, universities, industries, and government. A fourth helix later expanded THM by adding media-based and culture-based public and civil society and is known as the Quadruple Helix Model (QHM) (Carayannis & Campbell, 2009).

Both models, THM and QHM, immensely contributed to the creation of knowledge and innovation. However, there was a *casus omissus* in these two models to bridge the ethical gap inherent in the neoclassical or neoliberal economic model of KBEs. The said gap was later bridged by introducing the Quintuple Helix Model (Quin HM), which expands QHM by

integrating another helix called the natural environment of society (Carayannis & Campbell, 2010). The framework that guided this research elaborates the five knowledge systems (clusters) operating in a continuous flow of processes as “fluid and heterogeneous networks” to create green knowledge and innovation (Figure 01) needed for sustainable development.

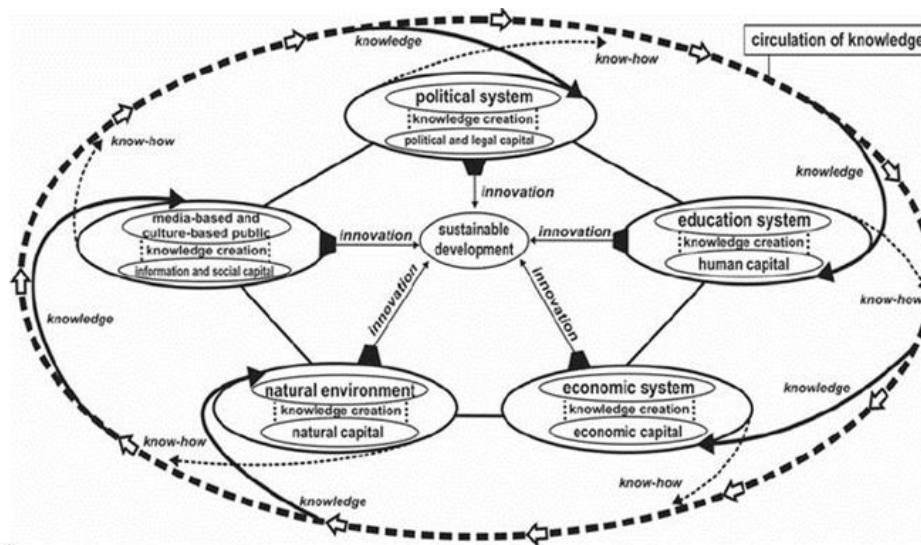


FIGURE 1
QUINTUPLE HELIX MODEL OF INNOVATION AND THE KNOWLEDGE AND INNOVATION FLOWS

Source: The Quintuple Helix model and its function (functions). Modified from Etzkowitz & Leydesdorff (2000), on Carayannis and Campbell (2010).

The Quintuple Helix Model manifests how a high-level investment in the education (university) system empowers to develop highly skilled human capital embraced with sustainable values blended with the existing knowledge systems. The human capital so developed by the education system moves into the economic system and blends with the existing knowledge of economic capital. The economic capital so developed by the economic system moves into the natural environment and fosters natural capital there with the existing knowledge. The natural capital so developed moves into a media-based and culture-based public and civil society system and creates the social capital required for a green lifestyle. After that, the social capital so developed moves into the political system where political and legal capital required for quality of life is developed. Then, the political and legal capital so developed enters the education system and blends with the knowledge in a never-ending continuously improving quality of all human beings.

Accordingly, universities' knowledge and innovation produced with non-linear innovation models are vital because of the cascading effects on the entire education system – inclusive of secondary, primary, and pre-school levels. In this regard, the reconfiguration of universities' traditional knowledge and innovation processes is imperative for implementing the non-linear model of innovation with Quin HM. The reconfiguration has to address the university's multi processes. These multi processes consist of Green Corporate Governance of the university (GCG), Green Corporate Culture (GCC) of the university, Three Pillars of Sustainability (TPS), Green Education (GE), Green Research (GR), Green Internal Operations (GIO), Green Community Outreach (GCO) and Green Corporate Reporting (GCR). These eight processes used to be aligned with a university's core processes in a systematic way for creating green/sustainable knowledge and innovation urged by KBEs.

The eight processes stated above are equally essential but the reconfiguration of all cannot be discussed in one research article. Hence, this study's scope is limited to one of the processes called 'Green Corporate/University Governance.' In these circumstances, a curiosity

arises on how universities' stakeholders perceive the reconfiguration of corporate governance for being a sustainable university. Consequently, this research aims to ascertain how stakeholders, Professors, Senior lecturers, Academic managers, Non-academic managers, and Undergraduates/postgraduates students perceive the reconfiguration of Corporate/University Governance to enable the production of green knowledge and innovation needed for sustainable development in KBEs. The universities' different stakeholders concerned with the universities' greening were identified to reach the study's aim. Then, the perceptions of the identified different stakeholders are measured. The next step is to appraise stakeholders' perceptions to determine by testing hypotheses if all of them have or not a consensus about the reconfiguration of Green Corporate Governance. The findings that the null hypothesis is rejected or failed to be rejected provide insights to the policymakers, managers in their decision-making if the Green Corporate Governance (GCG) can be incorporated into the university's conventional corporate governance process.

The rest of the paper is structured as follows: Chapter 2 elaborates the recent developments of governance for the production of green knowledge and innovation. It further justifies the reconfiguration of corporate governance for greening the knowledge and innovation. Chapter 3 deals with the methodology under which it is discussed how the quantitative methodology is applied to operationalize the hypothesis. Chapter 4 focuses on data analysis and findings under which it is discussed how Chi-square test with contingency table was used to arrive at findings. Chapter 5 concludes the study.

Green Corporate Governance

Since the Industrial Revolution, unsustainable developmental activities created an imbalance in the ecological system on which all beings are dependent on their livelihood. The imbalance has created significant social problems such as increasing average global temperature, rising sea levels, melting glaciers, extinction of species, overfishing, pandemics, poverty, hunger, and water scarcity. The intensity of the adverse impacts reflects that nature cannot be resilient in the absence of human intervention. As a result, two prudential anthropocentric action plans have now been universally agreed upon by all United Nations members as the 2030 agenda for 17 Sustainable Development Goals (SDGs) and Paris Climate Agreement. Accordingly, Sustainable Development Goals enlisted 17 global issues to be addressed by all nations with an ambitious plan to balance the ecological system within 15 years as 2030 Agenda for 17 SDGs. The other framework is the Paris climate agreement, where two critical targets were set to maintain the global average temperature below 1.5° C or a maximum 2° C by the end of the century (Durán-Romero et al., 2020).

KBEs are active partners of the universal packages mentioned above. They rely on green knowledge and innovation to transform their economies into sustainable economies. However, the transformation of economies is so complex that it demands multifaceted knowledge production and dissemination (Grundel & Dahlstorm, 2016) from the linear model of innovation to the non-linear model of innovation, Mode 2 Model of Innovation, Mode 3 Model of Innovation, Triple Helix Model of Innovation, Quadruple Helix Model of Innovation, and in particular, Quintuple Helix Model of Innovation. Since universities are used to producing knowledge with the Linear Model of Innovation, several internal processes need to be reconfigured. Among them, one of the processes is the university governance system. In other words, the transformation of the conventional university governance system to a green university governance system.

UNESCO defines 'Governance' as "... structures and processes that are designed to ensure accountability, transparency, responsiveness, the rule of law, stability, equity and inclusiveness, empowerment, and broad-based participation. Governance also represents the norms, values, and rules of the game through which public affairs are managed in a manner that is transparent, participatory, inclusive, and responsive" (Dettenhofer et al., 2019). The responsiveness, equity, and inclusiveness of governance refer to good governance by managing

societal challenges. Fried (2006) elaborates that university governance's role is to position it to address external expectations while preserving the academic value system's integrity. Moreover, corporate sustainability is known as key for assuring a future for a given organization. Otherwise, organizations are struggling to introduce more sustainable practices to survive environmental threats (Ikram et al., 2020).

The King IV, Code of Corporate Governance, Southern Africa, advocates green governance. It provides that the corporate citizen is an integral part of society and the environment. It is licensed to operate with an inclusive stakeholder approach (Institute of Directors, 2016). It further provides that the governing body has to consider all legitimate and reasonable needs, interests, and expectations of all stakeholders when executing its duties. Accordingly, the integration of sustainability into the corporate strategy has become a norm of the corporate world. Doppelt (2010:96) argues that "... changes in governance structures and processes can provide much greater overall leverage for transformation to sustainability than the implementation of specific sustainability initiatives", even though ad hoc recycling of water or minimization of wastage is also important initiatives for sustainability but not effective levers to contribute to global sustainability equitably. In the same vein, Pollock, et al., (2009) point out that the factors such as complex structure, traditional disciplinary boundaries, ineffective governance, and the absence of shared vision at the universities face difficulties in achieving sustainability goals.

The conventional disciplinary boundaries, called the Linear Model of Innovation/Mode 1 Model of Innovation, produce basic research in separate disciplines, such as business management, marketing, finance, physics, and chemistry. These domains are not interdisciplinary. The scientists maintain their hegemony in their field. Their research outputs are published in peer-reviewed scientific journals and, as a result, these scientists and their institutions advance the knowledge in the field and enjoy autonomy in their field. The body of knowledge is produced hierarchically by a scientist or team of scientists who possess a homogeneous scientific background. These structures protect the epistemic values of their scientific domains. However, the disciplines' hegemony has created a dilemma in solving social problems by creating a division between natural sciences and social sciences, and non-scientific knowledge and scientific knowledge, in brief, resulting in a social separation.

Consequently, a reconfiguration of the conventional production of knowledge and innovation systems is a prerequisite for producing green knowledge and innovation aligned with Mode 2, Mode 3, and helix models. There are two striking features in these non-linear productions of innovation. These two features are interwoven in solving complex social problems. One of them is the production of applied green knowledge and innovation. Carayannis & Campbell (2010) elaborate on the fundamental difference between the linear and non-linear models of innovation: basic research and applied research. They metaphorically elicit that the linear model of innovation refers to 'first then' and the non-linear innovation model refers to 'simultaneously, simultaneously.' The second feature is the collaboration with different disciplines. In other words, the production of interdisciplinary knowledge. The next characteristic is the collaboration of different knowledge hubs, such as government, industry, culture-based public and civil society, and the natural system. It means the production of transdisciplinary knowledge.

THM strategizes the collaboration of three knowledge clusters, the university, industry, and government (Etzkowitz & Leydesdorff, 2000). The strategy of QHM is to collaborate four knowledge clusters by including the fourth helix, media-based and culture-based public and civil society (Carayannis & Campbell, 2009). QuinHM strategizes the collaboration of five knowledge clusters by including the natural environment (Carayannis & Campbell, 2010). It has been further designed not only to co-evolve, co-specialize, and co-opetition but also to adapt with newer dynamics for the objective of producing green knowledge and innovation. Hence, the Quintuple Helix Model as a fluid and heterogeneous innovation network (Garcia-Teran & Skoglund, 2019; Durán-Romero et al., 2020) is the superior strategy to create knowledge and innovation towards sustainable development.

METHODOLOGY

This study's social phenomenon is to ascertain the perceptions of five types of stakeholders, Professors, Senior lecturers, Academic managers (such as Deans and HODs), Non-academic managers, and Students (such as undergraduates and postgraduates). Their perceptions are measured to ascertain if all of them are of the view that the conventional university governance system should be reconfigured for green corporate governance.

Consequently, hypotheses are framed as follows:

H₀: There is no significant difference among the stakeholders regarding Green Corporate Governance.

In other words, different universities' stakeholders perceive, in the same direction, that the conventional Corporate/University Governance is required to be reconfigured for greening a university.

Consequently, the alternative hypothesis (*H_a*) is presented below:

H_a: There is a significant difference among the stakeholders regarding Green Corporate Governance.

In other words, different universities' stakeholders do not perceive in the same direction that the conventional corporate/university governance is required to be reconfigured for greening a university.

Likert Scale instrument is preferred for this quantitative study because a particular social phenomenon can be quantitatively measured by a Likert scale instrument (Jakobsson, 2004). Data were collected on a five-point Likert scale questionnaire. The five points of Likert scale are, strongly disagree =1, disagree=2, undecided=3, agree=4 and strongly agree=5. Since the value assigned to each category cannot be considered equal, for example, the perception between strongly disagree to agree is not equivalent to the perceptions of other consecutive categories of the Likert scale, the data collected is mostly considered as ordinal measurement scale and therefore non-parametric tests are more appropriate.

The questionnaire was designed under eight latent variables of green university constituents: Green Corporate Governance, Green Corporate Culture, Three Pillars of Sustainability, Green Education, Green Research, Green Community Outreach, Green Internal Environment, and Green Reporting (This results in 24 Likert items for eight latent variables except for demographic information of the respondents). However, this research is focusing on one of the eight latent variables, the Green Corporate Governance. There are three Likert items for the construct, Green Corporate Governance.

Before administering the questionnaire, it was pre-tested by a pilot running to ascertain if the respondents can understand the questionnaire. In the pilot run, it was uncovered that it is indispensable to recognize the respondents' discriminative capacity and, therefore, some demographic questions were dropped. Choices were reduced to five points, which is the most frequently used Likert Scale. Likert, who introduced the Likert scale in 1932, also used five points (Lozano et al., 2008).

Cronbach's alpha for the Likert Scale consists of three Likert items for Green Corporate Governance: 0.724 is sufficient for internal consistency because three items represent all the useful information. In support, Cronbach (1951) points out that even though the high value of alpha is desirable, the critical point is if the score obtained is interpretable. He further explains that adding more items may be redundant if they provide little additional information despite the alpha value is increased but causes administering difficulties.

Having been satisfied with the face validity, 94 cases were collected, but 89 were used in this study after data cleaning. However, before collecting data, the sample size was decided to be 65 cases at 90% confidence level (but 257 cases are needed at 95% confidence level), 5% relative tolerable error, 3 Likert items, 0.5 coefficient of variation of population, and 0.5

pairwise correlation coefficient (Park & Jung, 2009). The questionnaires were administered among stakeholders residing in different African countries during the last three years. Concerning demographics, 64% of the respondents are male, and 36% of the respondents are female.

DATA ANALYSIS AND FINDINGS

Perceptions of universities’ stakeholders concerning Green Corporate Governance (GCG) were measured. The professional status of stakeholders is Professors (P₁), Senior lecturers (P₂), Academic managers (such as Deans and HODs) (P₃), Non-academic managers (P₄), and Students (such as undergraduates and postgraduates) (P₅).

Hypotheses are framed on perceptions of different stakeholders as follows:

H₀: that there is no significant difference among the stakeholders regarding Green Corporate Governance.

H_a: that there is a significant difference among the stakeholders regarding Green Corporate Governance.

The contingency table was used to test the differences among the five groups with 89 samples consisting of 15 Professors, 24 Senior Lecturers, 16 Academic Managers, 13 Non-academic Managers, and 21 Under/Postgraduates students. Even though there were five categories of responses (Likert scale), they were consolidated into two categories, that is Disagree (Strongly disagree+Disagree+Undecided) and Agree (Strongly Agree+Agree). Hence the contingency table (2 x 5 table) is used to calculate Pearson’s chi-square statistic (X^2) with the following equation:

$$X^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(O_{i,j} - E_{i,j})^2}{E_{i,j}}$$

Keys: *r* is row, *c* is column, *i*=1...*I*, *j*=1...*J*, Σ =sum, O=Observed value, E=Expected value.

Table 1 THE GREEN CORPORATE GOVERNANCE ACCORDING TO THE FIVE STAKEHOLDERS GROUPS						
Green Corporate Governance						
Likert scale	Group 01	Group 02	Group 03	Group 04	Group 05	
Agreed	40	61	42	28	53	224
Expected	37.75	60.40	40.27	32.72	52.85	224
Disagreed & Undecided	5	11	6	11	10	43
Expected	7.25	11.60	7.73	6.28	10.15	43
Agreed & Disagreed	45	72	48	39	63	267
Sigma(O/E)^2/E	0.13	0.01	0.07	0.68	0.00	0.90
	0.70	0.03	0.39	3.55	0.00	4.66
	Chi-Square Statistics					5.56
	D/F=4 and at 10% significance level					7.78
Source: primary data.						

Since the distribution for the chi-square for *H₀*, for large *N*, approximately X^2_f where *f* is the degrees of freedom is (I - 1) (J - 1), namely, (2-1) (5-1)=4; α is taken as 0.10. Consequently, the significance test, *H₀*, is rejected, as follows:
 $X^2 \geq X^2_f(\alpha)$.

Chi-square statistics of 5.66 is less than the critical value of 7.779, which means H_0 cannot be rejected. In other words, there are no significant differences among the stakeholders at α at 0.1 level of significance.

DISCUSSION

There are many processes of the organization that need to be reconfigured. Galpin, et al., (2015) point out that the organization's multi processes: vision, mission, values, strategies, goals and objectives, and Human Resource value chain should be aligned for sustainability. It means that a university's governing body must have a governance system consisting of rules, regulations, procedures, processes, and practices to strategize for greening purposes.

A key issue to be explored is the reconfiguration of the structure, strategy, and leadership for the knowledge production process. It is because universities' current structure is not conducive for sustainability and, therefore, a fundamentally different structure is required to produce green knowledge and innovation (Dale & Newman, 2005; Farley & Smith, 2014; Weisser, 2017). The strategy is meant to produce green knowledge and innovation, including collaborative or non-collaborative knowledge production, a linear model of innovation, or a non-linear model. However, collaborative knowledge creation with other knowledge clusters is superior to the non-collaborative production of knowledge and innovation (Ferasso & Grenier, 2019). Hence, Likert item 01 is designed as "a system of governance consists of rules, regulations, procedures, processes, and practices to strategize for greening a university is an important aspect in greening a university."

Apart from the structure and strategy, another important aspect of green governance is leadership. Likert Item 02 is designed to ascertain the leadership approach, namely, greening a university, a top-down approach, a bottom-up approach, or a mixed approach is appropriate. The transformation of a conventional university to a sustainable university is a challenge for organizations. Kim, et al., (2014) point out that three applied strategies, namely, Theory "E" called Economic – Top-down approach, Theory "O" called Organization development – Bottom-up, and a combination of both strategies. Beer's Theory "E" (2001) argues that a change in an organization is a matter of dealing with changing formal structures and systems, which can be achieved by management's deliberate actions. Hence a change from the present state to the desired state can be achieved by implementing strategic management by way of aligning the structures and system for the desired change.

In Contrast, Theory "O" argues that a change in an organization naturally arises without pre-planning and programs by the organization's highly committed culture by which the bottom-line is motivated to be involved in change when it is emergent (Beer, 2001). Beer (2001) argues that both theories are valid for achieving a necessary change in the organization, trading off both theories' benefits and negative consequences. He further elaborates that two approaches could be used for trading off between these two theories, but he prefers to implement Theory "E," Economic value, which could be followed by Theory "O," Organizational capability. Otherwise, the simultaneous implementation of both theories even-though it would be more difficult.

Cartwright & Craig (2006) recommended Johnson & Scholes' (2002) ethical stance 4, Multiple Stakeholders and Shaper of Society, as the proactive ethical stance by which a corporation can contribute to global sustainability equitably. They further developed a model with seven pathways that would operate for the contribution of global sustainability. The model depicts that the pathway 1: Compliance alignment process required by the regulations of the government policy is unable to contribute to sustainability beyond the threshold because the compliance alignment is restricted by the ethical stances 1 and 2 by the weaknesses of government and the ability of the organization to internalize the negative externalities by the taxes and prices. Pathway 2: The responsiveness alignment process of the leadership induced by government policy is also rather complimentary but not central in achieving global sustainability beyond the threshold. Pathway 3: Ethical investors' responsiveness alignment process does not necessarily go beyond the threshold, but with the public awareness and concern, they are

amenable to change. Pathway 4: Responsiveness alignment process by shareholder awareness and concern is crucial for going beyond the threshold because of mainstream influence, but the process is slow because of reactionary behavior despite ethical investors' influence. Pathway 5: Responsiveness alignment process by Customer views on responsible consumption puts pressure on governance to meet customers' sustainability needs. Path 6: Responsiveness alignment process by NGOs influence communication with the governance about public awareness and concern relating to sustainability. Path 7: Leadership alignment process by Personal director/Manager Awareness control is the most critical pathway to achieve global sustainability beyond the threshold because the commitment for sustainability in the governance arises not by the compliance or responsiveness but by the conviction for doing the right thing for sustainability.

It means that the strategic leadership, path 7 for transforming an organization to a sustainable organization, is decisive, but government/state policy, ethical investors, shareholder awareness, responsible consumption of customers, and NGOs' influence are all complementary. Accordingly, Likert item 03 is designed as "A member of the board of directors/governing council is required for accountability of greening the university to the rest of the university's board or governing council."

Accordingly, three interrelated Likert items were grouped under the Green Corporate Governance (GCG) construct. Three Likert items collected the perceptions about a green governance system's necessities, including structure, strategy, and leadership. The data collected were quantitatively analyzed for accepting or rejecting the hypothesis.

CONCLUDING REMARKS

Universities conventionally produce knowledge and innovation with basic research. It is called the Model 1 or linear model of innovation. The linear model of innovation has two drawbacks. The first drawback is that knowledge and innovation production occurs within the disciplines, but complex social problems can be resolved by interdisciplinary and transdisciplinary knowledge and innovation circulation. The other drawback is the delay in implementing such knowledge and innovation because the basic research is first published and then applied.

With the passage of time, social and political pressures have mounted against the university system demanding to contribute to economic development and resolution of social problems by producing knowledge and innovation towards sustainable development, which is called green knowledge and innovation. What is required in this respect is to reconfigure the corporate governance system to enable universities to produce green knowledge and innovation in a non-linear model of innovation. For that knowledge and innovation production, Mode 2, Mode 3, and Helix Models of Innovation out of which Mode 3 and the Quin HM are the superior collaborative and non-linear ways of producing green knowledge and innovation.

Hence, this study aimed to ascertain if the university's internal stakeholders perceive in the same direction that the reconfiguration of the university governance system for the production of green knowledge and innovation is required. Consequently, quantitative data relating to the perceptions of five stakeholders of universities; Professors, Senior lecturers, Academic managers (such as Deans and HODs), Non-academic managers, and Students (both undergraduate and postgraduate) were consulted. The analysis of data with the contingency tables enables calculation of chi-square test statistics, which was less than the critical value. It means that all five stakeholders perceive in the same direction that the conventional university governance system needs to be reconfigured so that the universities enable the production of green knowledge and innovation.

This study is subject to certain limitations. The first limitation is that the sample size did permit to calculate the chi-square statistics at a confidence level of 90%. A higher confidence level, such as 95% or 99%, is more reliable than a 90% confidence level. Another limitation is that some other stakeholders' perceptions were not considered, such as parents, sponsors, or

industry. Yet, another limitation is that this study focussed only on the reconfiguration of university/corporate governance. However, there are seven more dimensions needed for reconfiguration, providing promising research avenues in future.

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