FACTORS AFFECTING THE RESEARCH PERFORMANCE OF SCIENCE RESEARCH INSTITUTIONS IN SRI LANKA

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ABSTRACT

Research performance is recognized as one of the most critical indices for the evaluation of a research institute. However, very few previous scientific studies have focused on the factors affecting a science research institutes' research performance in Sri Lanka. The study focusses to identify whether the research performance of research institutions coming under the State Ministry of Skills Development, Vocational Education, and Research & Innovation is affected by individual and institutional characteristics.

Purpose *The study is to identify the research performance of research institutions is affected by individual and institutional characteristics*

Design/Methodology/Approach *Primary & secondary data has been predominately used in order to address the research objectives. The research is conducted perusing the recent and major Journals and articles that are published in reliable, high quality Journals on the captioned subject. The data concerning the research performance of academics has been extracted from the questionnaire, NIFS Research Repository, Annual Reports and from NASTEC reports. This quantitative study conducted using a deductive approach through a slightly adopted version of an already validated and reliability checked questionnaire*

Findings

Individual characteristics and institutional characteristics were significantly correlated with the research performance (r=0.356, r=0.568 respectively). Of all variables, institutional characteristics had the strongest positive correlation where it could be used as a significant predictor (R^2_{AD}= 0.320) for the research performance of research institutions.

Keywords *Research performance, Individual characteristics, Institutional characteristics*

Paper Type *Research paper*

1.INTRODUCTION

Since 1970, studies in the performance of research and higher education have gained great significance (Dundar and Lewis, 1998). Universities around the world are transforming their policies away from teaching-centered and move toward research-centered. Scholars at universities are involved in education, learning, and research in general via publishing scholarly articles; scholars or academics achieve recognition, promotion, and funding for future study. In Sri Lanka, there are no "teaching-only" institutions since all academics are expected to do both study and teaching. Research performance refers to creative thoughts and ideas that contribute to publishing publications in leading journals and patents following the theoretical and applied studies. According to previous studies, various types of measurements are used to explain the concept of research performance (Brew, 2001). According to Jauch and Glueck (1975), research performance can be measured by counting the number of publications in high-end journals. Journal quality index, citation indexes, peer and colleague evaluations, number of honors and awards, number of papers presented in meetings, number of dissertations, publications (books and articles), invitations to present papers, success in obtaining research grant funding, No of Research Supervision and positions held in professional associations are among the ten criteria used to evaluate research performance in their study. These KPIs will reflect the success of an Institute, which, in turn, will enhance overall national recognition and achievement. Therefore, exploring the influential factors of KPIs' achievement can help identify the major impact factors on research performance.

The progress of a country depends on national development. And when it comes to national development, the research performance output to the society plays a vast role. A research institution can be called an anchor in the society, a place for knowledge creation and dissemination, a place for creativity and economic progress, a place for economic and workforce development, and, hopefully, a place where productive individuals and leaders are trained for future employment. At the same time, researchers are required to aim towards excellence and to be elitist in certain ways while still "being highly aware of their responsibilities to society at large, social development, and egalitarianism" (Watson, 2007).

This study was conducted in order to identify further and understand whether the individual and institutional characteristics have a significant relationship to research institutions' research performance in Sri Lanka, as measured by Key Performance Indicators (KPI), including the Journal Publications (SCI, SCIE), No of Research Supervision (PhD, Mphil, MSc) and Research Grants received, to seek empirical evidence of such factors, and to add to the literature by helping to develop more comprehensive models of institution research performance as well as to replicate and support previous findings in the literature.

2.LITERATURE REVIEW
Higher education institutions play an important role in society (World Economic Forum, 2017) by raising consciousness, creating knowledge, developing skills, and creating value, all of which are critical elements in ensuring a prosperous future (Cortese, 2003). Similarly, their commitment contributes to industrial growth and, as a result, economic progress (Jayasundara, 2014; Hatakenaka, 2015), which addresses a variety of social issues such as poverty, social disharmony, and inequality among others (Hatakenaka, 2015). The higher education system is supposed to achieve broader economic and social goals, especially in developed countries (Altbach and Salmi, 2011).

2.1 Institute Performance
According to Chen *et al.* (2006), organizational performance can be defined as the "transformation of inputs into outputs to achieve specific outcomes." In terms of material, performance explains the relationship between minimal and effective cost (economy), effective cost and realized performance (efficiency), and output and accomplished result (effectiveness)." There is no consensus in the literature on the criteria to assess organizational performance (DeClerk, 2008; Scott and Davis, 2015).

2.2 Research Performance
Performance is generally regarded as a single dimension concept referring to the performance and success of a certain objective or task. Research findings play a crucial role in producing and evaluating scientists' academic accomplishments, referred to as research performance (Gu *et al.*, 2011). The concept of research performance explicitly refers to the act of publishing an article for publication in an academic journal, publishing or editing a book or monograph; publishing a book review; or presenting a paper at a meeting (Pellino *et al.,* 1984). Over the past decades, three approaches have been used to measure research performance in higher education: the quantitative, the qualitative approaches, and the comprehensive approach. The most commonly used quantitative approach of measuring research performance is analyzing the number of publications in selected outlets, such as academic journals (Baird, 1991; Reinstein and Hasselback, 1997; Dundar and Lewis, 1998), or calculating comprehensive indices from counts of conference papers, journal publications, and books (Hartley *et al.,* 2001). According to previous studies, various types of measurements are used to explain the concept of research performance (Brew, 2001). According to Harris (1990), a variety of performance measures may be used to evaluate academics' research performance. The most often utilized metrics are peer ranking, the amount of research grants obtained, the number of reviewed publications, and the number of citations.

2.3 Factors Influencing Research Performance
Many studies (Clark and Lewis, 1985; Meador *et al.,* 1992) have looked into the factors that influence university and academic research performance. A consistent collection of supporting characteristics that have an impact on institutional research performance has been identified in numerous studies on research performance. According to Wamala and Ssembatya (2015), efficiency in the institute is widely regarded as a measure of research work carried out by individuals, institutions, nations, and regions as a whole. Some researchers have arranged these characteristics into clusters or models to better understand the main factors on research performance and generate a model that describes institute research performance.

According to Kotrlik et al. (2002), graduate students' skills and trust in performing research and research assistants' ability were found to have a substantial effect on institute professors' research article output. Bentley and Blackburn (1990) stated that professors' psychological perceptions and context variables, such as tension, motivation, gender, and age, influence their research performance.

However, environmental factors, such as research support culture, solid research space and facilities, and good colleague interaction, are also important variables for predicting institute research results (Bentley and Blackburn, 1990).

2.4 Earlier Models on Research Performance
Several models had been proposed to measure the factors affecting research performance. One of the most commonly used theoretical models to study research productivity is the Bland et al. (2002) model.

        (a) Bland (2002)
Bland and colleagues synthesized the literature on academic research performance into a model that claims that eight individual characteristics, fifteen institutional characteristics, and four leadership characteristics have been closely correlated with high research performance. According to Bland *et al.* (2002), model research performance will be high when an academic has unique individual traits, works in an institution conducive to research, and is led by someone who has important leadership skills and uses an assertive-participatory approach to management.

        (a) Bland et al. (2005)
Bland *et al.* (2005) have used a questionnaire based on theoretical clusters identified in their previous model (Bland *et al.*, 2002). According to this study, relationships within the three broad clusters affect research performance; additionally, it refers to the complex interplay of individual and institutional characteristics, accompanied by effective leadership, which ultimately decides the performance of individuals and departments.

3.Methodology
3.1 Design
A stratified random sampling has been used for the focus group of with two strata, considering the Morgan table (Krejcie & Morgan, 1970). Due to the time limitation, the research samples have been taken from 09 Research Institutions under the State Ministry of Skills Development, Vocational Education, Research and Innovation in Sri Lanka. There are 923 research staff employed in these 9 institutions, and 315 samples have been taken. A slightly adopted version of an already validated and reliability checked questionnaire was used for the data collection. The questionnaire has been pilot tested to assure the clarity and ease of competition. The conceptual framework was designed accordingly as per the Figure 1.
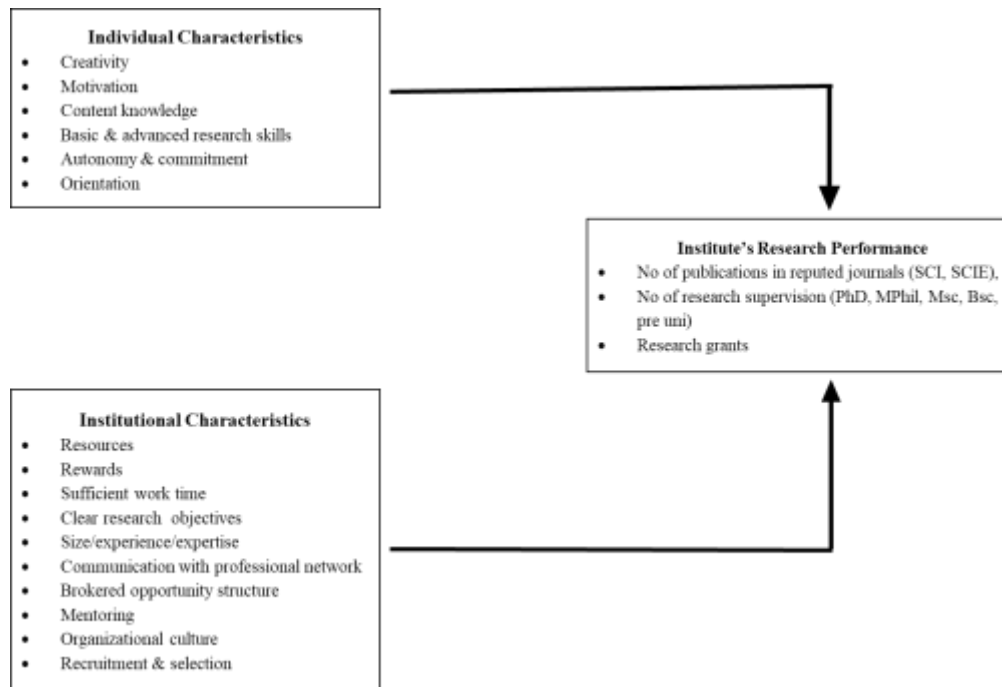

Figure1: Conceptual Framework
Source: Researcher Developed, 2021

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3.2 Hypotheses development

The hypotheses are developed to determine the relationship Individual characteristics (IC), institutional characteristics (ITC) are having on research performance (RP) in science research institutes in Sri Lanka.

Bland *et al*. (2005) found a positive correlation between research performance and individual characteristics. As per Rushton et al. 1987, a productive scholar is a creative person. Scientific productivity was explored by Pelz and Anderews (1976) and Merton (1973), who also recognized that prolific researchers had certain research habits.

Therefore, the relationships could be stated as follows,

H$_1$: Individual characteristics have a significant impact on research performance in science research institutes in Sri Lanka

In previous studies, a positive association was found between the institutional characteristics and the Research performance. Hadjinicola and Soteriou (2006) have identified the funds received from outside sources for research purposes and enhanced library services would improve the research performance. Levin and Stephan (1991) presented a research performance model where the researchers work not only in the hope of getting rewards but also for the mere happiness of problem-solving.

Therefore, the relationships could be stated as follows,

H$_2$: Institutional characteristics have a significant impact on research performance in science research institutes in Sri Lanka

4. DISCUSSION

To determine whether the data follows a normal distribution, a normality test was performed two tests were run to check the normality, and the test statistics are shown in Table 1.

Table 1: **Tests of normality**

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
RP	0.066	280	0.051	0.990	280	0.053

[a.] Lilliefors Significance Correction

Since the data set is smaller than 2000 elements Shapiro-Wilk test was used to analyze the data. Accordingly, the P-value is 0.053, which is greater than the significance level of 0.05 (P> 0.05). Therefore, it can be concluded that the data comes from a normal distribution.

Since the data set is normally distributed, parametric tests were conducted to achieve the objectives of the study.

Correlation of the dependent and independent variables

Pearson correlation was done to see the association between the dependent variable and the independent variables and the independent variables themselves. Pearson correlation coefficient was determined to examine the strength and the direction of the linear relationship between two continuous variables. The larger the absolute value of the coefficient, the stronger the relationship between the variables.

Table 2: **Correlation between the variables tested**

	IC	ITC	RP
IC	1		
ITC	.514[**]	1	
RP	.356[**]	.568[**]	1

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
IC= Individual Characteristics, ITC= Institutional Characteristics, RP= Research Performance

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All the tested predictor variables were significantly correlated (P< 0.05) with the RP (r= 0.356, r= 0.568 respectively). ITC was the most tightly correlated predictor variable with the RP.

Linear Regression Analysis

Finally, stepwise linear regression analysis was performed to help determine which of the two predictor variables (IC and ITC) could be used to predict the RP. Two models were tested, which provides the data regarding which model could statistically significantly predict the dependent variable.

Analysis of variance (ANOVA)

The Table of ANOVA shows if the regression models are statistically significant.

Table 3: Analysis of variance (ANOVA) in the dependent variable

Model		Sum of Squares	df	Mean Square	F	P value
Model 1 IC	Regression	8.61	1	8.61	40.40	P< 0.05[b]
	Residual	59.27	278	0.21		
	Total	67.88	279			
Model 2 ITC	Regression	21.87	1	21.87	132.09	P< 0.05[b]
	Residual	46.02	278	0.17		
	Total	67.88	279			

Dependent variable: RP
[b] Predictors: (Constant), IC, ITC

Results have shown that the two regression models are statistically significant (P< 0.05), F (1, 278) = 40.40, P= 0.000; F (1, 278) = 132.09, P= 0.000.

Goodness of fit

The summaries of the two models have revealed the R and R^2 values, which indicate how much of the total variation in the dependent variable can be explained by the independent variable, and the results are shown in Table 4.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.356[a]	0.127	0.124	0.46
2	0.568[a]	0.322	0.320	0.41

[a] Predictors: (Constant), IC, ITC

According to the results, the adjusted R^2 values obtained for the two models are 0.124 and 0.320, respectively. This indicates that the independent variables, including IC and ITC explain 12.4%, and 32% of the variability of the dependent variable, respectively.

The Coefficient values
The coefficient table also determines if the predictor variables statistically significantly contribute to the model.

Table 5: **Coefficient values of the Dependent variable**

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	P value
1	Constant	1.837	0.239		7.693	P< 0.05
	IC	0.377	0.059	0.356	6.357	
2	Constant	0.525	0.247		2.128	P< 0.05
	ITC	0.749	0.065	0.568	11.493	

The results of Table 5 show statistically significant unstandardized coefficients for models 1 and 2.

The predictor with non-significant regression coefficient (IC) was removed and the final regression analysis conducted had an adjusted R square of 0.32 {F (1, 278) = 132.09, P= 0.000}, with one significant predictor of RP (ITC).

Table 6: **Linear Regression Analysis for the estimation of RP**

	Regression equation	R Square	Adjusted R Square	P value
Model 2	RP= 0.525 + (0.749 ITC)	32.2 %	32.0 %	P< 0.05

IC= Individual Characteristics, ITC= Institutional Characteristics

H₁: Individual characteristics have a significant impact on research performance in science research institutes in Sri Lanka
H₂: Institutional characteristics have a significant impact on research performance in science research institutes in Sri Lanka
As per tables 2, 3, 4 and 5, the individual and institutional characteristics have a positive significant impact on research performance in science research institutes in Sri Lanka. Therefore, both the hypotheses are treated as strongly supported and the alternative hypotheses are accepted. However, ITC was the most tightly correlated predictor variable with the RP.

5. CONCLUSION AND MANAGERIAL IMPLICATIONS
The scientific research performance of a country influences all aspects of a country's future by helping its development, economic growth, and greater social well-being. Research performance is recognized as one of the most critical indices for the evaluation of a research institute. Very few previous scientific studies have focused on the factors affecting a science research institutes' research performance in Sri Lanka. Consequently, identifying the individual and institutional factors that influence the Institutions' research performance is potential of great value. Individual characteristics and institutional characteristics were significantly correlated with the research performance (r=0.356, r=0.568 respectively). Of all variables, institutional characteristics had the strongest positive correlation where it could be used as a significant predictor (R^2_{AD}= 0.320) for the research performance. Based on the current study results, it can be concluded that individual characteristics are the foundation of and prerequisite for many of the institutional characteristics. Taken together, these separate analyses strengthen the perception that a highly research performed institution is indeed a function of the combination and interaction of the individual and institutional characteristics.

Dedicating money to research funds is the simplest way to encourage research. As a recommendation, the government can encourage research at the policy level. Grant funding should be distributed to eligible institutions by either a competitive mechanism or subsidies. Research institutions can be strengthened by increasing collaborations and coordination at the governmental level, allowing researchers to conduct research with more freedom, creativity, and collaboration. Industry mentorship improves the research

publication output more than institutional mentorship. As a result, a deliberate effort must be made to form alliances with industry partners in the form of mutually beneficial partnerships and initiatives involving funding or data collection access.

To keep the high journal standards, workshops or guidelines can be posted on journal websites to allow the researchers to develop their research credibility. Reviewer workshops should be developed, and good reviewers should be rewarded to make the process run more smoothly. Establishing systems and facilities to encourage leading Sri Lankan immigrant scientists to return, join with the institutes, and contribute to research in the prioritized research areas will also be a good approach to achieving higher research performance. It is recommended that systems be put in place to identify, reveal, train, and nurture skilled, capable, and high-caliber young researchers and provide career pathways for rapid advancement and, where possible, to create additional opportunities.

It is recommended that a competitive, comprehensive, structured training program for researchers be developed, including an entry-level orientation program to teach the basics of research planning, procedures, implementation, and ethics and management skills. For a researcher, individual characteristics are factors within their control. Creativity is undoubtedly an important factor in scientific breakthroughs and general research. Thus, special training programs can be arranged for the researchers to develop their creative mind free thinking. Since the institutional research performance is the whole sum average of individual research performance, the institute leadership should focus on developing team-based research productivity so that every faculty member should be the Best Researcher.

6. LIMITATIONS OF THE STUDY
The health risks and government measures introduced by COVID-19 have limited traditional mechanisms for primary data collection. Therefore, this questionnaire has been distributed online as a google form to minimize the disruption, mitigate risk and reduce bias when acquiring data. Data collection has been restricted to 09 research institutions in Sri Lanka due to the difficulty in gathering information from all the other research institutions within a short period. However, the results could be generalized to any institution or industry as the results of the study are in compatibility with the past research findings. Future studies could focus this aspect and conduct a similar study with large sample size, including all the institutes in Sri Lanka. This would change some of the significance of the variables or add predictive power to the model. This would also allow replicating or confirming the findings.

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