THE EFFECT OF DEMOGRAPHIC CHARACTERISTICS OF THE RESEARCHERS ON THE PERFORMANCE OF RESEARCH INSTITUTIONS IN SRI LANKA

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ABSTRACT

A country's scientific research performance influences all aspects of a country's future, its development, economic growth, and greater social well-being of the country. 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 demographic characteristics.

Purpose *The purpose of this research was to identify whether the research performance of research institutions is affected by demographic characteristics.*

Design/Methodology/Approach *To achieve the study aims, primary and secondary data were predominantly used. The study is carried out by perusing recent, major journals and papers on the topic that are published in reputable, high-quality journals. Data on academics' research performance has been taken from NASTEC reports, the NIFS Research Repository, annual reports, and the questionnaire. This quantitative study, which employed a deductive methodology, was carried out using a slightly modified version of a previously validated and reliability-tested questionnaire.*

Findings *The results have shown that researchers with age more than 60 years and more than 20 years of research experience, highest educational qualification of the researchers, university graduation (highest qualification), and the job category have significantly ($P< 0.05$) associated with the research performance where gender and the research field do not influence the research performance.*

Keywords *Research performance, Demographic characteristic*

Paper Type *Research paper*

1. INTRODUCTION

Since 1970, studies mainly on the performance of higher education have become significant. Since then, extensive studies have discussed institutions and university academics (Dundar and Lewis, 1998). Research performance refers to new thoughts and concepts that contribute to publishing publications in leading journals and patent approvals after theoretical and applied studies. According to Zainab (1999), research performance can be elaborated as publishing research findings in high-end journals, patents, conference presentations, impact factors, and reviews. Despite the transition of higher education, globalization and student mobility have encouraged Asian national governments to emphasize the quality of higher education (Hou, 2012). Professors' research performance has been described as a key indicator of higher education quality assurance, whether based on international evaluation, national evaluation, or international higher education rankings, since their research and publications are linked to their teaching contents as well as institution credibility financing, and industry linkage. For decades, researchers have researched the factors that influence research performance. The majority of these studies, from which general models of research performance are obtained, have used cross-sectional designs to examine the influence of possible features that promote research among academics across institutions (Bland *et al*., 2005). As a result, although some researchers have examined the factors influencing professors' research performance, the influence factors and their relative significance in Asian and Western societies might be different. The majority of previous studies

have focused on university research performance. Few studies have looked into the factors that influence professors' research outcomes in Asia, and significantly less on this topic.

Scholars have suggested models of how these characteristics interact based on a synthesis of the literature, but few experiments have validated these models. They were unable to determine the cumulative effect of features by studying all of them simultaneously in a single institution (Bland et al., 2005). Professors at research institutions are expected to produce knowledge in any disciplinary area, use the latest research outcomes in their teaching, and prepare students to perform research. In the developing world, the benefits of academic life for individuals and the prestige of employing institutions are heavily contingent on their research performance. Accordingly, in these conditions, in less developed countries, institutions and scientists will need more knowledge about how to research products and performance vary across departments, disciplines and what are the most significant demographic factors affecting research performance.

2. LITERATURE REVIEW
People are supposed to have high moral standards in Asia's collectivist communities, particularly in the field of education (Zhang *et al.*, 2005). Research performance, which reflects higher education and research, is increasingly considered to reflect a research institute's performance, significantly increasing national recognition and achievement. For decades, researchers have researched the factors that influence research performance. The majority of these studies, from which general models of research performance are obtained, have used cross-sectional designs to examine the influence of possible features that promote research among academics across institutions (Bland *et al.*, 2005).

2.1 Research Performance
A research institute is created for a specific purpose: to research by taking advantage of its environment in the attainment of high value and rare resources to approve its operations. The ability of the institute to achieve its goals can be called the Institute performance, and when it comes to a research institute, its performance will be measured by the research performance (Gu *et al.*, 2011).

The notion of research performance is comprised of two parts: research and performance. Research is a significant intellectual activity that any researcher is supposed to participate in (Hedjazi and Behravan, 2011). The quality of a paper that allows information acquired from research to be visible and passed on to others can be described as research performance (Bazeley, 2010). There is no agreement among writers on a particular term to describe academic research to date. Researchers have used terms like "scientific research" (Turner and Mairesse, 2003), "scientific productivity" (Bazeley, 2010), "research performance" (Jauch and Glueck, 1975; Wood, 1990), and "research activities" (Jauch and Glueck, 1975) to describe their work.

2.2 Measurements of Research Performance
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, and positions held in professional associations are among the ten criteria used to evaluate research performance in their study. Creswell (1986) emphasized that three common metrics, namely, number of publications, citation counts, and peer-colleague ratings, can be used for data-based studies of science and social science faculty. 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.

Meanwhile, research performance was defined by Dundar and Lewis (1998) as a dependent variable that journal publications can largely measure. According to Zainab (1999), research performance can be identified as publishing research findings in international journals, conference presentations, impact factors, and reviews.

2.3 Factors Influencing Research Performance
It is evident that, even with the same advisor, different researchers can perform differently in their research; therefore, individual variables should affect research performance. The influence of age, ethnicity, social status, and educational history are among the early work with clearly recognizable factors (Tien and Blackburn, 1996; Fox and Mohapatra, 2007). Scholars later began to analyze certain crucial factors in order to understand and explain research performance, but these factors could not be directly identified.

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As stated by Astin (1984), "Researchers have typically looked at the following factors as possible indicators or independent variables: (1) gender, (2) marital status, (3) age, (4) area of specialization, (5) educational demo experience and characteristics of the graduate institution, (6) characteristics of the employer institution". Research is a highly social enterprise that relies heavily on interactions with one's environment. Many factors highly influence academic performance in their external environments , such as administrative structure, employee competitiveness, resource availability, and organizational culture (Bland *et al.*, 2002; Long and McGinnis, 1981).

2.4 Earlier Models on Research Performance
Overall, to better understand the factors that influence research performance, various researchers have grouped these factors into groups or models. The Bland et al. (2002) model is one of the most widely used theoretical models to study research productivity.

(a) Finkelstein Model
Finkelstein (1984) proposed that seven essential variables predict the rates of publication of an Institution: scientists with a research orientation, the highest terminal degree in a particular field, early publication habits, previous activity in publication, collaboration with disciplinary peers, subscriptions to a broad number of journals, and adequate time allocated to research. Finkelstein's early model of research performance is useful because it gives an initial picture of a successful researcher's qualities at the individual institute level.

(b) Dundar and Lewis Model
Dundar and Lewis (1998) suggested a model of individual characteristics with Inherited skills (e.g., IQ, appearance, gender, and age) and personal environmental factors (e.g., the quality and culture of graduate training).

Hedjazi and Behravan (2017) studied demographic characteristics that influenced the research performance of an agriculture institute in Tehran Province, using the Bland *et al.* (2005) model. The findings indicate that age, academic rank, university graduation, department type, innovation, self-confidence, working patterns, research objectives, a network of contact with peers, research opportunities, expertise and ability, and research opportunities all have significant relationships with the researcher's research performance. To identify and confirm the wide range of factors affecting the research performance of the institutions, Bland *et al.,* (2005) model and other studies (Creswell, 1986) on research performance were used to develop the theoretical framework of this study.

3. METHODOLOGY
3.1 Design
For the focus group, two strata of a stratified random sampling have been utilized, taking the Morgan table into consideration (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. In these 9 institutions, there are 923 research staff members working, and 315 samples have been taken. For the data collection, a slightly modified version of a validated and reliability-checked questionnaire was used. To ensure its clarity and competition-friendly nature, the questionnaire has undergone pilot testing. The conceptual framework was designed accordingly as per the Figure 1.
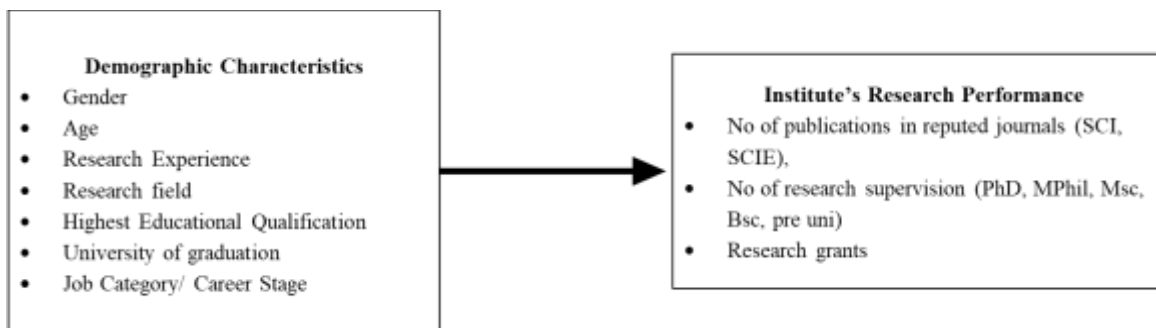

Figure1: Conceptual Framework

Source: Researcher Developed, 2021

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3.2 Hypotheses development

The hypotheses are developed to determine the relationship, the demographic characteristics are having on research performance (RP) in the academics of science research institutes in Sri Lanka.

As per Hedjazi and Behravan (2017) demographic characteristics have a positive relationship with the research performance of an agriculture institute in Tehran Province. The findings indicate that age, academic rank, university graduation, department type, working patterns, research objectives, and research opportunities all have significant relationships with the researcher's research performance.

Frandsen et al. (2015) and Ebadi & Schiffauerova (2016) have found a significantly higher total number of publications by men than women. Furthermore, few other researchers identified that gender reflects a strong relationship with research performance (Stack 2004; Milburn and Brown 2003).

Therefore, the relationship could be stated as follows,
H_1: Gender has a significant impact on research performance in science research institutes in Sri Lanka
High research performance is more likely to be rewarded at prestigious universities (Konrad and Pfeffer 1990; Long et al. 1998). Therefore, researchers who attend prestigious universities may accumulate benefits that would enable them to achieve great research performance (Bayer and Dutton 1977).

Therefore, the relationship could be stated as follows,
H_2: University of graduation has a significant impact on research performance in science research institutes in Sri Lanka

According to a study done by Gingras *et al.* (2008), older professors who remained involved in research maintained a high degree of performance until their retirement. The fact that older researchers are more productive than younger ones clearly support Merton's theory of cumulative advantage (Merton, 1973) and the "Matthew" effect (Merton, 1968).

Therefore, the relationship could be stated as follows,
H_3: Age has a significant impact on research performance in science research institutes in Sri Lanka

Researchers with rich research experience not only have greater ability in research and an improved research methodology, but also have more advanced educational concepts, better teaching methods, and improved skills in educating students (Brewer et al. 1999; Bentley and Blackburn 1990).
Therefore, the relationship could be stated as follows,
H_4: Research experience has a significant impact on research performance in science research institutes in Sri Lanka

According Wood (1990), variations in academic RP can be explained to some degree by differences in research fields and differing conceptions of what constitutes acceptable research performance in these fields. He has noted that the amount of time needed to conduct research and the time between completion and publication will be determined by the research field and that these factors can be cited as related factors to RP.
Therefore, the relationship could be stated as follows,
H_5: Research field has a significant impact on research performance in science research institutes in Sri Lanka

The highest educational qualification would somewhat reflect ability in research and research performance, as well as represent research area influence. The tenure position and a higher academic rank, according to Yoakum (1993), are directly related to research performance. Those who have earned a doctorate will be better researchers, which will significantly improve their potential to produce high-quality research (Whitely et al. 1991).
Therefore, the relationship could be stated as follows,
H_6: Highest educational qualification has a significant impact on research performance in science research institutes in Sri Lanka
According to Creswell (1986), good researchers, as those who appear to hold a senior professorship, spend at least one-third of their time on research activities, publish early in their careers, and earn favorable reviews from peers for research efforts.
Therefore, the relationship could be stated as follows,

H₇: Job category/career stage has 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 6: **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.

Association of the Gender (GEN) with the RP
An Independent t-test was carried out to realize if there is a statistically significant difference between males and females towards the RP. Table 2 shows the statistical difference in the mean values of RP according to gender.

Table 2: **Mean differences between males and females for the RP**

	RP		
	Independent difference		
	Mean	**Std. Error**	**t – value**
Male - Female	0.67	0.59	1.13
RP – Research Performance	P> 0.05		

Table 2 illustrates that there is no significant difference in the mean values obtained for the RP between males and females.

Association of the University of Graduation (UG) with the RP
An Independent t-test was carried out to realize if there is a statistically significant difference between the two types of the university of graduation towards the RP. Table 3 shows the statistical difference in the mean values of RP according to the university of graduation.

Table 3 **Mean differences in the University of Graduation for the RP**

	RP		
	Independent difference		
	Mean	Std. Error	t – value
Local - International	- 0.23	0.6	- 3.93
RP – Research Performance	P< 0.05		

Table 3 illustrates a significant difference in the mean values obtained for the RP between local and international universities. It was noted that the mean value for the RP was significantly higher in the highest educational qualification obtained from an international university than a local university.

For the variables with more than two categorical levels, one-way ANOVA was carried out to see if the independent variables affect the dependent variable. As a requirement for the ANOVA test, to see the variances of the variances that indicate that each comparison group's variances are equal, Leven statistic was tested for all variables, including AC, YRE, RF, HEQ, and JC, before running the test.

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For all the tested variables, the Levene statistic based on comparison of medians is greater than 0.05 which means the homogeneity of variance has been made, and the ANOVA test is considered stronger and more sensitive.

Association of the Age with the RP

Table 4 shows if there is a significant difference among different age categories for the research performance.

Table 4: Analysis of variance (ANOVA) for the age category

	Sum of Squares	df	Mean Square	F	P value
Between Groups	5.79	4	1.45	6.41	P< 0.05
Within Groups	62.09	275	0.23		
Total	67.88	279			

Table 4 illustrates a statistically significant difference among the means of the different age categories as demonstrated by one-way ANOVA (F (4,275) = 6.41, P = 0.000).

Tukey Post Hoc Test has generated multiple comparisons among different age categories. The results are shown in Table 5.

Table 5: Multiple comparisons of the mean values for the age category

	Mean Difference	Std. Error	P value
AC 5 – AC 1	0.46	0.09	
AC 5 – AC 2	0.38	0.09	P< 0.05
AC 5 – AC 3	0.35	0.10	
AC 5 – AC 4	0.28	0.09	

AC= Age Category
AC 1: 20 – 30, AC 21 - 31 – 40, AC 30 - 41 – 50, AC 40 - 51 – 60, AC 5: Above 60

Accordingly, the test results have shown that the researchers with age above 60 years have significantly higher research performance than the researchers with age groups 20 – 30, 31 – 40, 41 – 50, 51 – 60 years, respectively.

Association of the years of research experience (YRE) with the RP

Table 6 shows a significant difference among different years of research experience for the research performance.

Table 6: Analysis of variance (ANOVA) for the years of research experience

	Sum of Squares	df	Mean Square	F	P value
Between Groups	6.16	4	1.54	6.87	P< 0.05
Within Groups	61.71	275	0.22		
Total	67.88	279			

Table 6 illustrates that there is a statistically significant difference among the means of different years of research experience as demonstrated by one-way ANOVA (F (4,275) = 6.87, P = 0.000).

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Table 7: **Multiple comparisons of the mean values for the years of research experience**

	Mean Difference	Std. Error	P value
YER 3 – YER 1	0.19	0.70	
YER 4 – YER 1	0.41	0.99	P< 0.05
YER 5 – YER 1	0.48	0.13	
YER= Years of Research Experience YER 1: 01 – 10, YER 3: 21 – 30, YER 4: 31 – 40, YER 5: 41 – 50			

According to the Tukey Post Hoc Test results, it has been shown that the researchers with more than 20 years of research experience have significantly higher research performance than the researchers with less than 20 years of experience.

Association of the research field (RF) with the RP
Table 8 shows if there is a significant difference among different research fields for the research performance.

Table 8: **Analysis of variance (ANOVA) for the research field**

	Sum of Squares	df	Mean Square	F	P value
Between Groups	0.96	4	0.24	0.98	P> 0.05
Within Groups	66.93	275	0.24		
Total	67.88	279			

Table 8 illustrates that there is no statistically significant difference among the means of different research fields as demonstrated by one-way ANOVA (F (4,275) = 0.98, P = 0.418).

Association of the highest educational qualification (HEQ) with the RP
Table 9 shows if there is a significant difference in the highest educational qualification for the research performance.

Table 9: **Analysis of variance (ANOVA) for the highest educational qualification**

	Sum of Squares	df	Mean Square	F	P value
Between Groups	2.34	4	0.59	2.46	P< 0.05
Within Groups	65.54	275	0.24		
Total	67.88	279			

Table 9 illustrates that there is a statistically significant difference among the means of various highest educational qualifications as demonstrated by one-way ANOVA (F (4,275) = 2.46, P = 0.046). However, the multiple comparisons have demonstrated sufficiently large P values for most all the comparisons.

Association of the job category/career stage (JC) with the RP
Table 10 shows if there is a significant difference among different job categories for the research performance.

Table 10: **Analysis of variance (ANOVA) for the job category/career stage**

	Sum of Squares	df	Mean Square	F	P value
Between Groups	5.01	2	2.50	11.03	P< 0.05
Within Groups	62.87	277	0.23		
Total	67.88	279			

Table 10 illustrates a statistically significant difference among the means of different job categories as demonstrated by one-way ANOVA (F (2,277) = 11.03, P = 0.000).

Table 11: **Multiple comparisons of the mean values for the job category/career stage**

	Mean Difference	Std. Error	P value
JC 3 – JC 1	0.31	0.07	P< 0.05
JC 3 – JC 2	0.18	0.07	

JC= Job Category

JC 1: Early career (Research Fellow), JC 2: Mid-career (Associate Research Professor/Research Professor), JC 3: Late career (Senior Research Professor)

The results of the multiple comparisons have shown that the researchers who are in their late-career as senior research professors have significantly higher research performance than other research categories.

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.

Table 12: **Correlation between the variables tested**

	AC	YRE	RF	HEQ	UG	JC	RP
AC	1						
YRE	.908**	1					
RF	.067	.063	1				
HEQ	.735**	.650**	-.020	1			
UG	.713**	.663**	.074	.656**	1		
JC	.871**	.847**	.087	.705**	.760**	1	
RP	.262**	.295**	-.030	.161**	.229**	.271**	1

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

AC= Age Category, YRE= Years of Research Experience, RF= Research Field, HEQ= Highest Educational Qualification, UG= University of Graduation, JC= Job Category, RP= Research Performance

All the tested predictor variables were significantly correlated (P< 0.05) with the RP except RF.

H_1: Gender has a significant impact on research performance in science research institutes in Sri Lanka

As per table 2, It has been shown that there is no significant relationship of gender with the RP in science research institutes in Sri Lanka. Therefore, the alternate hypothesis is rejected.

H_2: University of graduation has a significant impact on research performance in science research institutes in Sri Lanka

As per table 3, the University of graduation has a positive significant impact on research performance in science research institutes in Sri Lanka. It was noted that the mean value for the RP was significantly higher in the highest educational qualification obtained from an international university than a local university. Therefore, the hypothesis is treated as strongly supported and the alternative hypothesis is accepted.

H_3: Age has a significant impact on research performance in science research institutes in Sri Lanka

As per table 4 and 5, age has a positive significant impact on research performance in science research institutes in Sri Lanka. The test results have shown that the researchers with age above 60 years have significantly higher RP than the researchers with other age groups. Therefore, the hypothesis is treated as strongly supported and the alternative hypothesis is accepted.

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H₄: Research experience has a significant impact on research performance in science research institutes in Sri Lanka
As per table 6 and 7, research experience has a positive significant impact on research performance in science research institutes in Sri Lanka. It has been shown that the researchers with more than 20 years of research experience have significantly higher research performance than the researchers with less than 20 years of experience Therefore, the hypothesis is treated as strongly supported and the alternative hypothesis is accepted.

H₅: Research field has a significant impact on research performance in science research institutes in Sri Lanka
As per table 8, It has been shown that there is no significant relationship of research field with the RP in science research institutes in Sri Lanka. Therefore, the alternate hypothesis is rejected.

H₆: Highest educational qualification has a significant impact on research performance in science research institutes in Sri Lanka
As per table 9, Highest educational qualification has a positive significant impact on research performance in science research institutes in Sri Lanka. Therefore, the hypothesis is treated as strongly supported and the alternative hypothesis is accepted.

H₈: Job category/career stage has a significant impact on research performance in science research institutes in Sri Lanka
As per table 10 and 11, Job category/career stage has a positive significant impact on research performance in science research institutes in Sri Lanka. The results have shown that the researchers who are in their late-career as senior research professors have significantly higher research performance than other research categories. Therefore, the hypothesis is treated as strongly supported and the alternative hypothesis is accepted.

5. CONCLUSION AND MANAGERIAL IMPLICATIONS
The purpose of this research was to identify whether the research performance of research institutions is affected by demographic characteristics. The study also aims to address the gap in empirical research by investigating the factors affecting the research performance of research institutes in the Sri Lankan context. The results have shown that researchers with age more than 60 years and more than 20 years of research experience, highest educational qualification of the researchers, university graduation (highest qualification), and the job category have significantly ($P < 0.05$) associated with the research performance where gender and the research field do not influence the research performance.

Retaining the old scientists and increasing their retirement age is an approach that should be considered more by the heads of the institutions. At the same time, a positive group climate can be created by facilitating other young researchers to upgrade their qualifications to higher qualifications and improve their knowledge and skills. Researchers whose age is more than 60 years and who have attained senior researcher level will be poised as role models to young researchers to encourage research interest among them. This will encourage all of the institute's researchers to develop a mindset that encourages them to involve themself in new knowledge creation, which will eventually improve research performance. This study results suggest that having experienced researchers is necessary for research performance. Hence, it is recommended for the HR division of the institutes to recruit researchers who have research experience or passion and inclination on research and publications. It is also recommended to create adjunct professorial posts and them to be filled with experienced researchers. This might benefit in two ways in helping the younger researchers. International exposure and standards will help improve an institute's research output. Therefore, it is most recommended that the institute's leadership motivates the young researchers to get their highest educational qualification from an international university.

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. Promoting and reinforcing joint postgraduate research between government research institutes and international universities will help to strengthen the currently available 'pathways' for training researchers. It is most recommended that the institute's leadership motivates the young researchers to get their highest educational qualification from an international university. A mechanism can be implemented that the promotions and the increments should be strictly depending on the individual researchers' performance towards the institute. The institute leadership is recommended to review the research performance of the researchers through an annual self-appraisal report.

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6. LIMITATIONS OF THE STUDY

Traditional primary data gathering methods have been constrained by the health risks and governmental restrictions brought forth by COVID-19. To minimize disruption, minimize risk, and reduce bias when gathering data, this questionnaire has been distributed online as a google form. Due to the difficulty of collecting data from all other research institutions in a timely manner, the data collection has been limited to nine research institutes in Sri Lanka. 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 research might concentrate on this issue and carry out a large-scale, representative study involving all Sri Lankan research institutions.

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