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Quantifying the Influence of Leadership Styles on Faculty Motivation and Academic Innovation in Higher Education

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Abstract : *The research aims to produce strategies and ways to improve lecturers' creativity through efforts to identify the magnitude of the direct and indirect influence of Transformational Leadership, Empowerment, Effectiveness and Utilization of ICT, and Work Motivation. This study uses a survey method and path analysis techniques, which are then subjected to SITOREM analysis. The population in the study amounted to 269 people, and a sample was taken randomly of 215 lecturers using the Taro Yamane formula. The results of the study prove that there is an influence of Transformational Leadership (βy1 = 0.184), EmpowermentEmpowerment (βy2 = 0.163), Effectiveness and Utilization of ICT (βy3 = 0.275), and Work Motivation (βy4 = 0.148) on Lecturer Creativity. SITOREM analysis proves that increasing creativity is done by improving weak indicators, namely the courage to take risks and work on complex things, developing or maintaining indicators of developing something new and different, providing problem-solving, and openness to new ideas. Transformational leadership is done by improving weak indicators, namely encouraging novelty, having charisma, having consideration, and providing inspiration. The implications of this research suggest that higher education institutions in Indonesia should prioritize the development of transformational leadership styles, empower faculty members, and invest in ICT tools to enhance work motivation, ultimately fostering a creative and innovative academic environment.*

INTRODUCTION

In recent years, there has been growing recognition of the need to enhance creativity among educators, particularly lecturers, as a key driver of quality education (Han & Abdrahim, 2023; Iqbal, 2021; Khahro & Javed, 2022). Creativity plays an essential role in adapting to the ever-changing landscape of teaching and learning, which is influenced by technological advancements, new pedagogical approaches, and evolving student expectations (Deák et al., 2021; Mahmoud Saleh et al., 2023; Piccolo et al., 2021). However, despite the increasing emphasis on creativity in educational institutions, many lecturers face significant challenges in fostering creative teaching practices (Anderson et al., 2021, 2022; Cremin & Chappell, 2021). These challenges include limited access to resources, resistance to change, and a lack of motivation to experiment with innovative methods. The ability of lecturers to overcome these challenges and effectively integrate creativity into their teaching practices is not only important for the academic success of their students but also for the advancement of educational goals at the institutional and societal levels (Kiryakova & Angelova, 2023; Ng et al., 2023; Zen et al., 2022). This research seeks to address the factors that influence the creativity of lecturers, with a focus on transformational leadership, empowerment, ICT utilization, and work motivation.

Existing literature on the relationship between creativity and teaching effectiveness has explored various dimensions of how educators' creativity can be enhanced through different interventions. Recent studies show the role of intrinsic motivation and EmpowermentEmpowerment in fostering creativity in the workplace, which can be directly applied to educational settings (Joo et al., 2023; Karimi et al., 2022; Siyal et al., 2021). Studies by Stanescu et al. (2021) further highlight the importance of transformational leadership in encouraging innovative thinking and creative behaviour among employees, including lecturers. Additionally, integrating Information and Communication Technology (ICT) has enhanced creativity by enabling lecturers to adopt novel teaching methods and access various educational resources (Alenezi et al., 2023; Vermeulen et al., 2022; Zainal & Mohd Matore, 2021). These findings suggest that lecturers' creativity is shaped by leadership, empowerment, technological tools, and personal motivation, which are crucial for improving the quality of education.

This research explores how transformational leadership, empowerment, the effectiveness of ICT utilization, and work motivation influence lecturers' creativity. This study examines the direct and indirect relationships between these variables and how they collectively contribute to fostering creative behaviours in the classroom. The problem addressed in this research is the lack of strategies to optimize these factors in promoting creativity among lecturers, particularly in higher education institutions. By investigating these factors, the research intends to identify key areas for intervention and propose strategies that can be implemented at institutional levels to enhance creativity among lecturers. This will ultimately contribute to developing more innovative teaching practices to improve student learning outcomes.

This study hypothesizes that transformational leadership, empowerment, and effective use of ICT significantly enhance work motivation, positively impacting lecturers' creativity. It is expected that lecturers who perceive strong transformational leadership and feel empowered in their roles will exhibit higher levels of creativity, as they will be more motivated to innovate and explore new teaching methods. Furthermore, the study anticipates that ICT utilization will catalyze creativity by providing lecturers with tools to engage students more effectively and design dynamic learning environments. The research will also test the mediating role of work motivation, hypothesizing that motivated lecturers are more likely to embrace creative strategies in their teaching. These assumptions will be examined through empirical data, contributing to understanding the interplay between leadership, empowerment, technology, and motivation in promoting creativity within the educational context.

RESEARCH METHOD

In general, the research carried out used quantitative survey methods, which were analyzed using Path Analysis (to prove the research hypothesis. Then, the quantitative research results were strengthened with the scientific identification theory for conducting operation research in education management (SITOREM) analysis. SITOREM analysis is used to strengthen the results of path analysis in more detail on research variable indicators so that indicators can be found that need to be immediately improved and maintained or developed (Agostini & van Zomeren, 2021; Lochbaum et al., 2022; Paul & Barari, 2022). In determining the priority order for handling indicators, SITOREM uses three criteria, namely: 1) Strength of influence between variables obtained from hypothesis testing; 2) Priority order for handling indicators resulting from expert assessments; and 3) Indicator values obtained from calculating data obtained from research respondents' answers.

The measurement techniques used will be the rating scaleue and the Likert scale. The rating scale and Likert scale are arranged as statement items for each indicator in the research variable. Each statement is followed by 5 (five) answers indicating the respondent's attitude scale level. The rating scale is used for the Transformational Leadership (X_1) and Empowerment (X_2) variables, while the Likert scale is used to measure the Work Motivation variable (X_3). Meanwhile, the variable Effectiveness of ICT Utilization is measured using a rating scale.

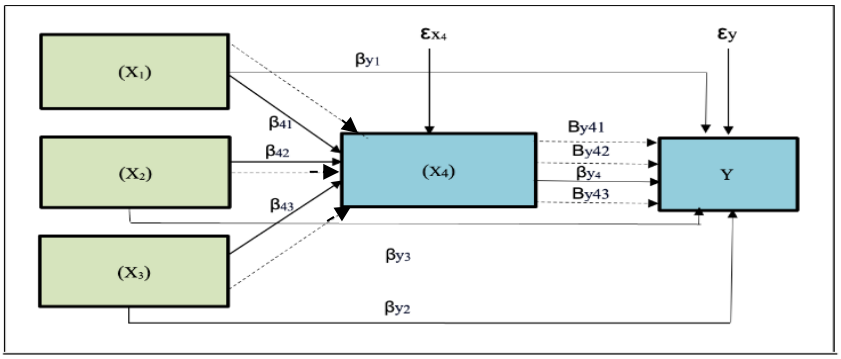

Figure 1. The Constellation of Relationships Between Research Variables

The population in this study were lecturers at universities in the LP3I Group with a total of 380 permanent lecturers, with 2 universities, namely: a). LP3I Jakarta Polytechnic, b). LP3I Polytechnic (Indonesian Institute of Education and Professional Development Polytechnic). The population in this study was 380 lecturers. Meanwhile, to maintain the representativeness of the research sample, the precision value was taken as 5% so that a sample of 195 was obtained.

The primary data in this research is data obtained directly from sources. Data was collected using a questionnaire from the dependent variable creativity (Y) and four independent variables: transformational leadership (X_1), empowerment (X_2), work motivation (X_3), and Effectiveness of ICT Utilization (X_4). Each statement item is given five answer choices indicating the lowest to highest level. The lowest score is given a score of 1, and the highest is given a score of 5. The creativity (Y), transformational leadership (X_1), and empowerment (X_2) variables use an instrument in the form of a rating scale questionnaire, and the work motivation variable (X_4) uses a Likert scale questionnaire instrument. In contrast, Effectiveness ICT utilization (X_3) uses a rating scale. Next, after the data is collected, the data is analyzed as follows: (1) descriptive statistical analysis. (2) test analysis requirements (homogeneity, normality and linearity of regression), (3) test hypotheses with path analysis. After carrying out path analysis, the next stage is analyzing the indicators to determine indicators that need improvement and that need to be maintained or developed using SITOREM analysis.

RESULT AND DISCUSSION

Result

The research findings in this chapter were obtained through measurements of Creativity (Y) as the dependent variable, Transformational Leadership (X_1), Empowerment (X_2), and the Effectiveness of Information and Communication Technology Utilization (X_3) as independent variables, with Work Motivation (X_4) serving as an intermediary or intervening variable. The presentation of the research results begins with a description of the statistical data, followed by prerequisite tests, including tests for normality, homogeneity, and regression model linearity. Hypothesis testing is then conducted using path analysis to determine direct and indirect effects, followed by SITOREM analysis to support the research's conclusions, recommendations, and implications. The following is a summary of statistical descriptions in Table 1.

Table 1. Summary of Statistical Description

No	Statistical Measures	Results				
		Y	X1	X2	X3	X4
1.	Lots of Data	215	215	215	215	215
2.	Mean	141	135	121.71	109	99
3.	Median	142	137	123	107	99
4.	Modus	145	131	116	103	99
5.	Standard Deviation	12	22	19.38	13	16
6.	Variant	156	482	375.84	174	243
7.	Range	102	134	121	84	84
8.	Maximum Score	70	46	44	51	51
9.	Minimum Score	172	180	165	135	135
12.	Sum	30247	29122	26167	23458	21228

The statistical description in Table 1 reveals consistent sample sizes (215) across all variables, with Creativity (Y) showing the highest average score (mean of 141) and Work Motivation (X_4) the lowest (mean of 99), indicating that on average, Creativity scores are relatively higher.

Median values closely match the means, suggesting a fairly symmetrical distribution. At the same time, standard deviations and variances show that Transformational Leadership (X_1) has the widest score spread (SD of 22 and variance of 482), implying greater variability compared to the other variables. The mode differs slightly from the mean and median, indicating common scores that vary from the central tendency. However, the maximum and minimum score values appear inconsistent, likely due to a typographical error, as maximum scores should logically exceed minimums. The sum totals reflect aggregate levels, with Creativity (Y) having the highest total (30,247) and Work Motivation (X_4) the lowest (21,228), aligning with their mean scores. Overall, this descriptive analysis provides an initial look at the data distribution and variability, setting the stage for further prerequisite testing and hypothesis analysis.

Analytical requirements research is intuitive research that implies the continuity of parametric calculations. The prerequisite tests for this analysis require: 1) Normality test, namely if the data has a normal distribution, then it can be continued with a parametric statistical test; 2) Homogeneity test, namely the intuition to know whether the sample objects under study have the same variance or not. This research is continued using analysis of variance (ANOVA) if the sample objects studied do not have the same variance. 3) The linearity test, namely the intuitive understanding of the relationship between variable Y (inherent) and variable linear regression.

Normality Test

Testing the normality of the estimated standard error using the Liliefors test. The Ltable value for N = 215 with a = 0.05 is 1.969 at the 0.05 significance level. The requirement that the standard error of the estimate comes from a normally distributed population is Lcount < Ltable. The following is a summary of the normality test results in Table 2.

Table 2. Summary of Estimated Standard Error Normality Test

Estimated Standard Error		Scout Label	Level of Trust	Conclusion
Transformational Leadership (X_1)	0.124	1.969	*a*=0.05	Normal
Empowerment (X_2)	0.099			Normal
Transformational Leadership (X_3)	0.075			Normal
Effectiveness of ICT Utilization (X_4)	0.050			Normal
Creativity (Y)	0.061			Normal
The condition for Normal Distribution is the value of L count < L table.				

Homogeneity Test

Homogeneity testing is carried out to determine whether the population variance is homogeneous or non-homogeneous. This test is carried out by grouping research data based on the variables studied. The formula used is the Bartlet Formula with significance testing using the Chi-Square Table, where data

is called homogeneous if the Xcount < Stable value with α = 0.05. The following is a summary of the homogeneity test results in Table 3.

Table 3. Summary of Data Variance Homogeneity Test

No	Group	Scout	Stable	Conclusion
1.	X_1 - Y	90.807	249.127	Homogenous
2.	X_2 - Y	-54.445		Homogen
3.	X_3 - Y	-45.615		Homogen
4.	X_4 - Y	-868.245		Homogenous
The condition for a homogeneous population is sig. > 0.05				

Next, a linearity test of the regression equation was carried out. The calculation results showed that all data were declared linear. Therefore, it can be continued at the testing stage of the path analysis of the substructure model, which consists of substructures 1 and 2. The following is Table 4 of the path coefficient values for substructure 1.

Table 4. Path Coefficient Value In Substructure-1

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	41.173	1.970		20.902	.001
	Transformational Leadership (X_1)	.165	.070	**.184**	12.338	**.002**
	Empowerment (X_2)	.183	.085	**.163**	4.826	**.006**
	Effectiveness of ICT Utilization (X_3)	.829	.061	**.275**	13.660	**.002**
	Work Motivation (X_4)	.359	.091	**.148**	7.929	**.001**

a. Dependent Variable: Teacher Innovativeness (Y)

Based on the output of Regression Model I in the "Coefficients" table section, the path coefficient of X1 to Y is β_{Y1} = 0.184; X_2 to Y is β_{Y2} = 0.163; X3 to Y is β_{Y3} = 0.275 X_4 to Y is β_{Y4} = 0.148 where it is known that the significance value of the three variables, namely X_1 = 0.002; X_2 = 0.006; X_3 = 0.002; and X_4 = 0.001. The significance value of X_1, X_2, X_3, and X_4 is less than 0.05. These results conclude that Regression Model I, namely X_1, X_2, X_3, and X_4, significantly affect Y. The magnitude of the influence of other variables outside X_1, X_2, X_3, and X_4 on Y from the empirical model results is presented in Table 5 below.

Table 5. Summary of Empirical Model Results on Substructure-1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.882[a]	**.865**	.864	2.359

a. Predictors: (Constant), Work Motivation (X_4), Transformational Leadership (X_1), Empowerment (X_2), Effectiveness of ICT Utilization (X_3)

The model summary table above shows the calculation of the determination coefficient marked with R Square 0.865 or 86.5%. This shows that the contribution of X_1, X_2, X_3, and X_4 to Y is 86.5%, while the remaining 13.5% is

the contribution of other variables not studied. While the remaining influence is calculated using the formula 1-0.865 = 0.135, the e (error) value can be calculated using the formula $\varepsilon 1 = \sqrt{((1 - 0.865))} = 0.367$.

The influence model in each variable in substructure-2 consists of an endogenous variable, namely Work Motivation (X_4) and three exogenous variables, namely Transformational Leadership (X_1), Empowerment (X_2), and Effectiveness of Utilization of Information and Communication Technology (X_3) and one residue, namely $\varepsilon 2$. Based on this impact, the path model in substructure-2 is $X_4 = \beta_{41}X_1 + \beta_{42}X_2 + \beta_{43}X_3 + \varepsilon 2$. The calculation results using SPSS found that the path coefficient in substructure-2 can be presented in the following table.

Table 6. Path Coefficient Value in Substructure-2

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	41.814	9.416		4.441	.002
	Transformational Leadership (X_1)	.017	.057	**.016**	3.251	**.001**
	Empowerment (X_2)	.144	.043	**.217**	5.367	**.004**
	Effectiveness of ICT Utilization (X_3)	.214	.057	**.158**	9.023	**.001**

a. Dependent Variable: Work Motivation (X_4)

Based on the output of Regression Model 2 in the "Coefficients" table section, the path coefficient of X_1 to X_4 is $\beta_{41} = 0.113$; X_2 to X_4 is $\beta_{42} = 0.182$; and X_3 to X_4 is $\beta_{43} = 0.214$. each is known as the significance value of the three variables, namely $X_1 = 0.002$, $X_2 = 0.001$, and $X_3 = 0.001$. The significance value of X_1, X_2, and X_3 is less than 0.05. These results conclude that Regression Model 2, namely X_1, X_2, and X_3, significantly affect X_4. The magnitude of the influence of other variables outside X_1, X_2, and X_3 on X_4, as well as the empirical model results, are presented in Table 7 below.

Table 7. Summary of Empirical Model Results on Substructure-2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.894[a]	.887	.887	1.779

a. Predictors: (Constant), Effectiveness of ICT Utilization (X_3), Transformational Leadership (X_1), Empowerment (X_2)

The model summary table above shows the calculation of the determination coefficient marked with R Square 0.887 or 88.7%. This shows that the contribution of X_1, X_2, and X_3 to X_4 is 88.7%, while the remaining 1.13% is the contribution of other variables not studied. While the remaining influence is calculated using the formula 1-0.887 = 0.113 then for the value of e (error) can be calculated using the formula $\varepsilon 2 = \sqrt{((1 - 0.887))} = 0.336$. According to the calculation of substructure-1 and substructure-2, 7 (seven) coefficients studied have path coefficients identified as significant at $\alpha = 0.005$. The empirical path diagram of the study can be seen in Figure 2 below.

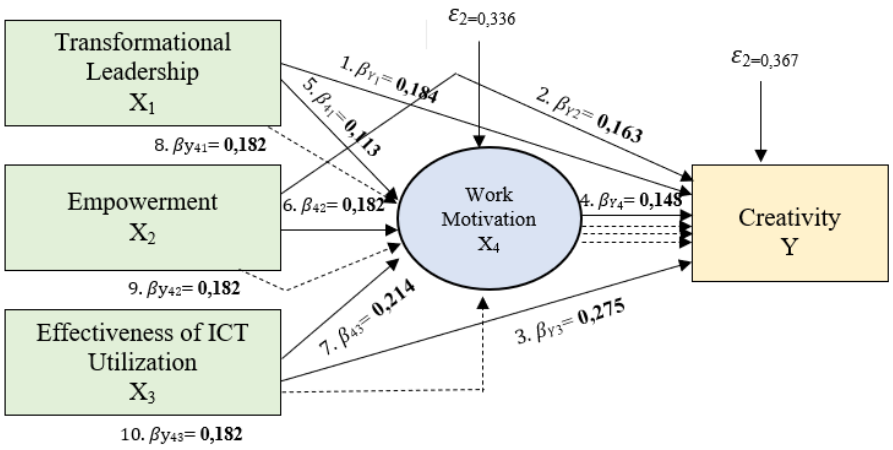

Figure 2. Path Coefficient of Transformational Leadership, Empowerment, Effectiveness of ICT Utilization, Work Motivation towards Creativity

The empirical path diagram illustrates the influence of Transformational Leadership (X_1), Empowerment (X_2), and Effectiveness of ICT Utilization (X_3) on Creativity (Y), with Work Motivation (X_4) as an intervening variable. Each of the variables X_1, X_2, and X_3 has a direct, positive effect on Work Motivation, with path coefficients around 0.182, indicating their balanced and significant impact on motivation levels. Work Motivation then directly influences creativity with a path coefficient of 0.145, showing that higher motivation is associated with increased creativity. The model also includes error terms (ε2 = 0.336 for X_4 and ε2 = 0.367 for Y), indicating that while the relationships explain a considerable portion of the variance in Work Motivation and Creativity, some variability remains unexplained. The significant path coefficients (at α = 0.005) confirm that enhancing transformational leadership, empowerment, and ICT effectiveness contributes to higher motivation and supporting creativity.

Discussion

Transformational leadership plays an important role in increasing lecturer creativity. With an inspiring vision and the ability to motivate individuals, transformational leaders can encourage lecturers to think innovatively and generate new ideas that support the learning process. Research shows that transformational leadership increases employee creativity by increasing perceptions of organizational support and innovative culture (Fu et al., 2022; Hameed et al., 2022; Teoh et al., 2022). Similar research by Anderson et al. (2021) revealed that transformational leadership directly impacts lecturer creativity by increasing self-confidence and developing a supportive work environment. SITOREM analysis proves that increasing creativity is done by improving indicators that are still weak, namely the courage to take risks and work on complex things, as well as developing or maintaining indicators of developing something new and different, providing problem-solving, and openness to new ideas.

Meanwhile, transformational leadership is carried out by improving indicators that are still weak, namely encouraging novelty, having charisma, having consideration, and providing inspiration (Jayadih, 2024). Lecturer empowerment is a key factor in enhancing creativity in the academic environment. Through empowerment, lecturers are given the autonomy, resources, and support needed to explore new ideas and implement innovative learning methods. This empowerment encourages individual creativity and creates an environment that supports collaboration and collective innovation. Piccolo et al. (2021) research shows that effective empowerment can increase intrinsic motivation and encourage workplace creativity. Lecturer empowerment contributes directly to achieving this goal by enabling lecturers to develop and implement innovative learning strategies, improving the quality of graduates per the KKNI standards.

Effective use of Information and Communication Technology (ICT) greatly influences the creativity of lecturers in higher education environments. Along with technological advances, lecturers are expected to be able to integrate ICT into their learning and research processes to encourage innovation and creativity (Deroncele-Acosta et al., 2023; Miranda et al., 2021; Valverde-Berrocoso et al., 2021). Thus, educational institutions can create an environment that supports innovation and creativity, ultimately improving the quality of academic output and lecturers' contributions to the development of science and technology. SITOREM analysis proves that increasing creativity is carried out by improving indicators that are still weak, namely the courage to take risks and do complex things, as well as developing or maintaining indicators of developing something new and different, providing problem-solving, and openness to new ideas (Setyaningsih & Sunaryo, 2021).

The influence of work motivation on lecturers' creativity is an important aspect of improving the quality of higher education. High work motivation can encourage lecturers to be more innovative and creative. Research Schneider et al. (2022). High work motivation encourages lecturers to explore new teaching methods, collaborate with colleagues, and develop innovative research. High work motivation helps lecturers meet KKNI standards by improving their academic and teaching performance and contributing to the development of relevant science (Vermeulen et al. (2022). Modelling and optimization of human resource strengthening, in this case, involve strategies to increase lecturers' work motivation through various approaches, such as award programs, training, and professional development (Deák et al., 2021; Mahmoud Saleh et al., 2023; Piccolo et al., 2021). Work motivation is achieved by improving indicators that are still weak, namely recognition, self-actualization, conducive work environment, compensation, appreciation, self-development and responsibility, and developing or maintaining indicators of Achievement (Han & Abdrahim, 2023; Khahro & Javed, 2022; Vermeulen et al., 2022).

The theoretical contribution of this research lies in developing an understanding of the factors influencing faculty creativity, particularly in the context of higher education in Indonesia. By integrating transformational leadership theory, empowerment, the utilization of information and

communication technology (ICT), and work motivation, this study presents a holistic model that links these factors to explain how they interact in fostering faculty creativity. Furthermore, this research introduces the mediating role of work motivation in the relationship between transformational leadership and faculty creativity, an area that has not been extensively discussed in existing literature. Practically, the findings of this study provide a foundation for policies and strategies aimed at professional development for faculty members, as well as contributing to the enhancement of teaching quality in higher education by leveraging approaches focused on strengthening faculty motivation and empowerment.

CONCLUSION

Based on the research results, strategies have been found to increase creativity through reinforcing Transformational Leadership, Empowerment, Effectiveness of Utilization of Information and Communication Technology, and Work Motivation. In comparison, the way to strengthen these variables is to identify which indicators must be maintained and improved. Increasing lecturer creativity can be done through self-development. Lecturers need to continue to develop creativity and innovation in learning, both through new methods and the use of technology. This creativity and innovation can be in the form of using video-based learning technology, gamification, or a flipped classroom approach, which can stimulate the creativity of lecturers and students. In addition, applying an interdisciplinary approach is also important to encourage cross-disciplinary collaboration so that lecturers can gain new perspectives in problem-solving and teaching. Mastery of information and communication technology (ICT) must also be improved so lecturers can present more creative and interactive teaching materials, such as e-learning platforms or AI-based applications. Lecturers are also advised to engage in collaborative research, which will broaden scientific horizons and stimulate creativity in the research process and development of new ideas.

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