

Education Research Quantitative Analysis for Little Respondents: Comparing of Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS

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Abstract

Many researchers are confused about which software to use because there is no research on software comparisons for quantitative research data analysis. The purpose of this study is to compare the results of quantitative research data processing in the field of education management using Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS software for small samples or respondents. This research method is quantitative and research data analysis uses the four types of software to obtain a comparison of the results of the analysis. The analysis in this study focuses on the analysis of hypothesis testing and regression analysis. Regression analysis is used to measure how much influence the independent variable has on the dependent variable. The field of this research is education management and the research data uses quantitative data derived from questionnaire data for a small sample of 40 respondents with three research variables, namely the independent variable of transformational leadership and job satisfaction, while the dependent variable is teacher performance. Based on the results of the analysis using Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS software, the results showed that for a small sample there was no significant difference in the significance value of p-value and t-value. There is also no significant difference in the determination value, and the correlation value in the resulting structural equation also has no significant difference in results, while for CB-SEM represented by Lisrel, Tetrad cannot process data with a Little respondents size. The novelty of this research is the result of comparative analysis of Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS

Keywords: *education management, data analysis, Lisrel, GSCA, Tetrad Amos, SmartPLS, WarpPLS, SPSS*

Introduction

Many different statistical software are available, and each offers a little something different for the user. What one chooses will depend on a variety of factors, including research questions, statistical knowledge, and coding experience. These factors may mean the cutting edge of data analysis, but as with any research, the quality of the data obtained depends on the quality of the

conduct of the study. It is therefore important to remember that while we may have advanced statistical software and the knowledge to use it available, the results will not mean much if the data are not collected in a valid way. Data analysis is one of the research processes that is carried out after all the data needed to solve the problems studied have been obtained in full. Sharpness and accuracy in the use of analytical tools will determine the accuracy of conclusions, therefore data analysis activities are activities that cannot be ignored in the research process. Errors in determining the analytical tools can be fatal to the conclusions drawn and this will have an even worse impact on the use and application of the research results. Thus, knowledge and understanding of various analytical techniques is absolutely necessary for a researcher so that his research results are able to make a meaningful contribution to problem solving as well as the results can be scientifically justified. Some researches in the field of education management use statistical software tools such as Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS. Many researchers in the field of education management are still hesitant in choosing which software to use.

Smart PLS or Smart Partial Least Square is statistical software that has the same purpose as Lisrel and AMOS, namely to test the relationship between variables, both among latent variables and with indicator variables, or manifest. The use of Smart PLS is highly recommended when we have a limited number of samples while the model being built is complex. This cannot be done when we use the two software above. They need sufficient samples. There are many researches in the field of education that use SmartPLS, such as those conducted by Budi Santoso, P., Asbari, M., Siswanto, E., & Fahmi, K. (2021). examines the role of job satisfaction and organizational citizenship behavior on performance. Putra, F., Asbari, M., Purwanto, A., Novitasari, D., & Santoso, P. B. (2021) investigated linking social support and performance in college. Johan, M. (2021) examines the effect of knowledge sharing and interpersonal trust on innovation. Purwanto, A., Santoso, P.B., Siswanto, E., Hartuti, H., Setiana, Y.N., Sudargini, Y., & Fahmi, K. (2021) the effect of hard skills, soft skills, organizational learning and innovation capability on performance lecturer. Novitasari, D., Asbari, M., Purwanto, A., Fahmalatif, F., Sudargini, Y., Hidayati, L. H., & Wiratama, J. (2021). examined the effect of social support factors on the performance of elementary school teachers. Anas Ahmadi, E., Herwidyaningtyas, F.B., & Fatimah, S. (2020) examined the influence of organizational culture, work motivation, and job satisfaction on lecturer management performance. Jayus, J.A. (2021). Examining the effect of distributive justice, procedural justice and interactional justice on teacher involvement and teacher performance. Ahmed, U., Umrani, W. A., Qureshi, M. A., & Samad, A. (2018). examined the relationship between teacher support, academic efficacy, academic resilience, and student engagement in Bahrain. Ahmed, U., Umrani, W. A., Qureshi, M. A., & Samad, A. (2018) examined the relationship between teacher support, academic efficacy, academic resilience, and student engagement in Bahrain. Purwanto, A., J.T. Purba, I. Bernardo, and R. Sijabat. (2021) examines the effect of management innovation, transformational leadership and knowledge sharing on performance. Purwanto, John Tampil Purba, Innocentius Bernarto, Rosdiana Sijabat (2021) examined the role of organizational citizenship behavior (OCB), transformational and digital leadership on performance through mediating organizational commitment.

AMOS is a statistical software developed by IBM. Amos software is specifically designed to help test the hypothesis of the relationship between variables. Through this software, we can determine the level of strength of the relationship between variables, both between latent variables and manifest variables. How significant is the relationship between variables, and how fit the hypothetical model is compared to the real data in the field. The advantage of Amos is that we don't need a complex syntax or programming language to operate this software. For

beginners, or those who are unfamiliar with programming languages, of course this is a distinct advantage. Through amos, simply describe the latent variable and the manifest variable, then relate them via the arrows provided. There have been many studies in the field of education using AMOS, such as Mustafa, M. B., Nordin, M. B., & Razzaq, A. B. A. (2020) researching structural equation modeling using AMOS: confirmatory factor analysis for the workload of teachers in special education integration programs. Fathema, N., Shannon, D., & Ross, M. (2015) extending the technology acceptance model (TAM) to examine the use of faculty learning management systems (LMSs) in higher education institutions. Standage, M., & Treasure, D. C. (2002) the relationship between achievement goal orientation and multidimensional situational motivation in physical education. Kulinna, P. H., & Cothran, D. J. (2003) self-reported physical education teacher use and perceptions of various teaching styles. Skaalvik, E. M., & Skaalvik, S. (2010) teacher self-efficacy. Iordanoglou, D. (2007) relationship between emotional intelligence and leadership effectiveness, commitment, and satisfaction. Kokkinos, C. M., Charalambous, K., & Davazoglou, A. (2009) interpersonal teacher behavior in elementary school classrooms on teachers. Mustafa, M. Z. B., Nordin, M. B., Razzaq, A. R. B. A., & bin Ibrahim, B. (2020) organizational commitment of SMK teachers. Woolley, M. E., Strutchens, M., Gilbert, M. C., & Martin, W. G. (2010) The mathematical success of black middle school students is a direct and indirect effect of teacher expectations and reform practices.

SPSS (Statistical Package for the Social Sciences) is an application used to perform advanced statistical analysis, data analysis with machine learning algorithms, string analysis, and big data analysis that can be integrated to build a data analysis platform. SPSS is one of the most widely used and frequently used software for quantitative research. To produce a comprehensive data analysis, a researcher must know the use of this program. SPSS was born as a goal to make it easier for researchers to organize and produce the right data according to the established method. As of 2019, SPSS already has its 25th version. There are many researches in the field of education that use SPSS, such as those conducted by Ebjan, U., & Tominc, P. (2015) on the impact of teacher support and conformity with learning needs on the use of SPSS by students. Murtiningsih, M., Kristiawan, M., & Lian, B. (2019) correlation between principal supervision and interpersonal communication with teacher work ethic. Espelage, DL, Polanin, JR, & Low, SK (2014) Teacher and staff perceptions of the school environment as predictors of student aggression, victimization, and willingness to intervene in bullying situations Comparative study of attitudes, attention, and interaction levels of elementary school teachers and students teacher candidates towards Inclusive Education. Chong, W. H., Klassen, R. M., Huan, V. S., Wong, I., & Kates, A. D. (2010) relationship between school type, teacher efficacy beliefs, and academic climate of Asian secondary schools. There are many researches in education that use WarpPLS, such as that done by Kock, N. (2010) using WarpPLS in e-collaboration studies. Kock, N. (2011) used WarpPLS in an e-collaborative study of descriptive statistics, settings, and key analysis results. Mahipalan, M., & Sheena, S. (2019) workplace spirituality, psychological well-being and the mediating role of subjective stress. Ifinedo, E., Rikala, J., & Hämäläinen, T. (2020) Factors influencing teacher educator technology integration Nigeria considers the characteristics, knowledge constructions, practices and beliefs of ICT. Lim, S. C., & Thien, L. M. (2020) Chinese academic leadership from the perspective of Confucian virtues and their effect on teacher commitment. Thien, L. M., & Adams, D. (2021) distributing teacher affective leadership and commitment to change in Malaysian primary schools: contextual effects of gender and teaching experience. Manalo, R. A., de Castro, B., & Uy, C. (2020) the mediating role of job satisfaction on the effect of motivation on organizational commitment and work involvement of private secondary school teachers. Ali, G. (2017) moderating effect of organizational identification on

the relationship between teachers' perceived organizational justice and burnout behavior at the college level. Matriadi, F., Salim, S. R. A., Dalimunthe, R. F., & Gultom, P. (2019) The effect of compensation and supply chain management on the educational system mediating role of work motivation.

Generalized Structured Component Analysis (GSCA) is a method that has been developed to complete the shortcomings that exist in Partial Least Square, namely in the overall goodness of fit. In this study, the GSCA method was used to model the structural factors that affect the nutritional status of children under five, which is a unidimensional structural equation. This study aims to examine and apply the SEM-GSCA approach with a unidimensional structural equation model for a case study of determining the factors that affect nutritional status in children under five in Genteng-Banyuwangi. The GSCA method in estimating its parameters uses the Alternating Least Square (ALS) method and in estimating the standard error of parameter estimation using the bootstrap method. To evaluate the GSCA model, three stages are carried out, namely, the first is an evaluation of the measurement model by looking at convergent validity, discriminant validity, composite reliability and average variance extracted (AVE). There have been many educational studies using the GSCA, such as those conducted by Sturman, E. D., & Zappala-Piemme, K. (2017) the development of grit scales for children and adults and their relationship to student success, exam anxiety, and academic performance. Kusumawati, A., Pribadi, A., & Astuti, H. M. (2013) analyzed the effect of information system quality, user satisfaction and the net benefits of E-Learning users. Idrus, S., Alhabji, T., Al Musadieq, M., & Utami, H. (2015) the effect of psychological empowerment on self-efficacy, satisfaction, emotional intelligence, job satisfaction, and individual performance. Ismail, N. A., & Awang, H. (2008) mathematics achievement among students. Djati, A. H. S. M. S., & Setyoleksono, A. (2014) learning attitudes and awareness of students in the success of a cultured environment. Webb-Landman, E. (2012) used group counseling to increase attendance of elementary school students with high absenteeism. Hermawati, A., & Mas, N. (2017) the mediating effect of quality of work life, work involvement, and organizational citizenship behavior in the relationship between transglobal leadership and employee performance. Safarudin, A., Astuti, E. S., Raharjo, K., & Al Musadieq, M. (2015) The effect of transactional leadership style and work environment on computer self-efficacy, job satisfaction, behavior and performance of computer operators. Owens, D., Stewart, T. A., & Bryant, R. M. (2011) perceptions, attitudes, and experiences of urban African American high school girls with professional school counselors.

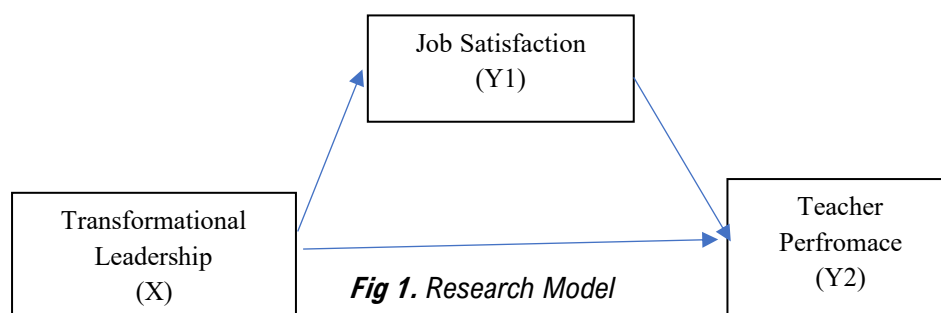
Many educational studies using tetrads such as those conducted by Yatim, N. A. M., Kelana, B. W. Y., & Mohd, Z. H. (2020) the effect of dark tetrad personality traits in cyber aggression behavior among teachers. Moore-Russo, D., & Viglietti, J. M. (2012) using the K5 connected cognition diagram to analyze teachers' communication and understanding of regions in three-dimensional space. Chambers, F. C., & Armor, K. M. (2011) teacher educators supporting student teachers to learn on teaching practice. Xulu, PS (2018) to investigate the effectiveness of Japanese lesson study as a collaborative professional development activity for teachers at school level (Doctoral dissertation). Inayati, D., & Emaliana, I. (2017) the relationship among Pre-Service EFL teachers' beliefs about language learning, Jones, E., & Bergin, C. (2019) evaluating teacher effectiveness using classroom observations. Zhonghua, L. (2012) using contemporary education strategies to improve teaching and learning in a Botany course at Beijing Forestry University. Kenny, R. F., & McDaniel, R. (2011) the role teachers' expectations and value assessments of video games play in their adopting and integrating them into their classrooms. Sarnacchiaro, P., Scippacercola, S., & Malafronte, P. (2019) a statistical model for the self-evaluation of teacher satisfaction in school management: a study in the Italian Secondary

School. Lisrel was developed by Karl Jöreskog and Dag Sörbom. Lisrel is the most widely used statistical software among researchers and practitioners. The advantage of lisrel software is its ability to identify relationships between complex variables. How to operate it, which consists of various options, both with syntax and with simple programs, making it more widely used by various groups. Syntax will certainly be preferred for users who are familiar with programming languages. While Simplis or simple lisrel is an alternative for those who are unfamiliar with programming languages. Many educational studies use Lisrel such as Dorman, J. P. (2003) relationship between school and classroom environment and teacher burnout: A LISREL analysis. Yuen, A. H., & Ma, W. W. (2008) exploring teacher acceptance of e-learning technology. Mahdizadeh, H., Biemans, H., & Mulder, M. (2008) determining factors of the use of e-learning environments by university teachers. Geijssel, F., Slegers, P., Leithwood, K., & Jantzi, D. (2003).

Transformational leadership effects on teachers' commitment and effort toward school reform. Lee, M. H., & Tsai, C. C. (2010) exploring teachers' perceived self efficacy and technological pedagogical content knowledge with respect to educational use of the World Wide Web. Karabenick, S. A., & Sharma, R. (1994) perceived teacher support of student questioning in the college classroom: Its relation to student characteristics and role in the classroom questioning process. Kheruniah, A. E. (2013) teacher personality competence contribution to a student study motivation and discipline to fiqh lesson. Ellis, K. (2000) perceived teacher confirmation. The development and validation of an instrument and two studies of the relationship to cognitive and affective learning. Al-Ruz, J. A., & Khasawneh, S. (2011) Jordanian pre-service teachers' and technology integration: A human resource development approach. Zeinabadi, H. (2010) job satisfaction and organizational commitment as antecedents of organizational citizenship behavior (OCB) of teachers. Bolkan, S., Goodboy, A. K., & Griffin, D. J. (2011) teacher leadership and intellectual stimulation: Improving students' approaches to studying through intrinsic motivation.

Method

This research method is quantitative, research data analysis uses Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS software to obtain a comparison of the results of the analysis. The analysis in this study focuses on the analysis of hypothesis testing and regression analysis. Regression analysis is used to measure how much influence the independent variable has on the dependent variable. The data from this study used quantitative data derived from questionnaire data with a small sample of 40 respondents. In the data there are 3 variables, namely three research variables, namely the independent variables of transformational leadership and job satisfaction, while the dependent variable is the performance developed from Purwanto et al. (2020); Asbari et al. (2021) and Novitasari et al (2020) with the following research model:



X is Transformational Leadership, Y1 is Job Satisfaction and Y2 is Teacher Performance. The relationship models to be analyzed are as follows:

1. The relationship between Transformational Leadership (X) and Teacher Performance (Y2).
2. The relationship between Transformational Leadership (X) and Job Satisfaction (Y1).
3. The relationship between job satisfaction (Y1) and teacher performance (Y2).
4. The relationship between Transformational Leadership (X) and Teacher Performance (Y2) through Job Satisfaction (Y1).

Results & Discussion

Testing the Significance of t-Value

The first stage of data analysis is testing the significance of the relationship between the independent variable transformational leadership (X), job satisfaction (Y1) with the dependent variable teacher performance (Y2) by looking for t-Value using Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS, the decision criteria if the t-Value value is greater than 1.96 or > 1.96 then the relationship is significant, if less than 1.96 or < 1.96 then the relationship is not significant. For WarpPLS does not produce a t-statistic value, the significance test can be seen on the p-value, so that the t-statistic value will be obtained.

The test results with 4 software for a direct relationship can be seen in Table 1 below:

Table 1. Comparison of t-Value Results Direct Relationship

	Amos	Lisrell	GSCA	Tetrad	SmartPLS	WarpPLS	SPSS	Result
X-Y1	N/A	N/A	-	-	89.509	-	21.424	Significant
X-Y2	N/A	N/A	-	-	1.960	-	2.125	Significant
X-Y1- Y2	N/A	N/A	-	-	0.822	-	1.051	Not Significant

Relationship between transformational leadership (X) and job satisfaction (Y1)

Based on the results of the software analysis, the results of the t-Value using Amos data cannot be processed. The t-Value using SmartPLS is 89,509, which is greater than 1.96, so it can be concluded that the relationship between X and Y1 is significant. The result of t-Value using SPSS is 21.424 which is greater than 1.96 so that it can be concluded that the relationship is significant so that it can be concluded that SmartPLS and SPSS give the same results.

Relationship between transformational leadership (X) and performance (Y2)

Based on the results of the software analysis, the results of the t-Value using Amos using Amos data cannot be processed. The t-Value using SmartPLS is 1.960, which is greater than 1.96, so it can be concluded that the relationship between X and Y2 is significant. The results of the t-Value using SPSS of 2.125 are greater than 1.96 so that it can be concluded that the relationship between X and Y2 is significant, so it can be concluded that SmartPLS and SPSS give the same results.

The relationship between transformational leadership (X) and performance (Y2) through job satisfaction (Y1)

Based on the results of the software analysis, the results of the t-Value using Amos data cannot be processed. The result of t-Value using SmartPLS is 0.822 which is smaller than 1.96 so that it can be concluded that the relationship between X and Y2 through Y1 is not significant. The result of t-Value using SPSS of 1.051 is smaller than 1.96, so it can be concluded that the relationship between X and Y2 through Y1 is not significant, so it can be concluded that SmartPLS and SPSS give the same results.

Testing the Significance of p-Value

The second stage is data analysis, namely testing the significance of the relationship between the independent variable transformational leadership (X), job satisfaction (Y1) with the dependent variable teacher performance (Y2) by looking for p-value using SPSS, Amos, SmartPLS, WarpPLS and SPSS software. The decision is that if the p-value is less than 0.050 or <0.050 then the relationship is significant, if it is more than 0.050 or >0.050 then the relationship is not significant.

The test results with 4 software for direct connection are as follows:

Table 3. Comparison of P-value

	Amos	Lisrel	GSCA	Tetrad	SmartPLS	WarpPLS	SPSS	Result
X1-Y1	-	-	-		0.000	< 0.010	0.000	Sig
X1-Y2	-	-	-		0.046	< 0.010	0.042	Sig
X-Y1-Y2	-	-	-		0.411	0.450	0.302	Not Sig

Relationship between transformational leadership (X) and job satisfaction (Y1)

Based on the results of the software analysis, the p-value results using Amos data cannot be processed. The p-value using SmartPLS is 0.000 less than 0.050 so it can be concluded that the relationship between X and Y1 is significant. The p-value using WarpPLS is 0.000 less than 0.050 so it can be concluded that the relationship is significant. The p-value using SPSS is 0.000 less than 0.050, so it can be concluded that the relationship between X1 and Y1 is significant, so it can be concluded that WarpPLS, SmartPLS and SPSS give the same results.

The relationship between transformational leadership (X1) and performance (Y2)

Based on the results of the software analysis, the p-value results using Amos data cannot be processed. The p-value using SmartPLS is 0.046 which is smaller than 0.050, so it can be concluded that the relationship between X and Y2 is significant. The result of p-value using WarpPLS is 0.410 less than 0.050 so that it can be concluded that the relationship between X and Y2 is significant. The result of the p-value using SPSS is 0.042 less than 0.050 so it can be concluded that the relationship between X and Y2 is significant t so that it can be concluded that WarpPLS. SmartPLS and SPSS give the same result.

The relationship between transformational leadership (X1) and performance (Y2) through job satisfaction (Y1)

Based on the results of software analysis, the p-value using SmartPLS was 0.411 more than 0.050, so it was concluded that the relationship between X and Y2 through Y1 was not

significant. The result of p-value using WarpPLS is 0.450 which is greater than 0.050 so that it can be concluded that the relationship between X and Y2 through Y is not significant. The results of the p-value using SPSS of 0.302 is greater than 0.050 so that it can be concluded that the relationship between X and Y2 through Y is not significant.

Coefficient of Determination Test

Testing the coefficient of determination to calculate the influence of the independent variable on the dependent variable. In this study, the R Square termination coefficient was calculated for the independent variables of transformational leadership (X), Job Satisfaction (Y1) and Performance (Y2). The results of the R Square test using Amos, SmartPLS, WarpPLS and SPSS are as follows:

Table 4. Comparison of R Square Hasil Results

	Amos	Lisrel	Tetrad	GSCA	SmartPLS	WarpPLS	SPSS
Y1	-	-	-	0.945	0.941	0.95	0.939
Y2	-	-	-	0.859	0.852	0.85	0.844

Based on the results in Table 4, the R Square value for Job Satisfaction (Y1) using Amos cannot be run. The value of R Square for Job Satisfaction (Y1) using SmartPLS is 0.941 or 94.1%, meaning that the Job Satisfaction variable (Y1) is influenced by the transformational leadership variable (X) of 94.1% while the remaining 5.9% is influenced by other variables that are not discussed in this study. The R Square value for Job Satisfaction (Y1) using WarpPLS is 0.95 or 95%, meaning that the Job Satisfaction variable (Y1) is influenced by the transformational leadership variable (X) by 95% while the remaining 5% is influenced by other variables not discussed in this section. this research. The R Square value for Job Satisfaction (Y1) using SPSS is 0.939 or 93.9%, meaning that the Job Satisfaction variable (Y1) is influenced by the transformational leadership variable (X) by 93.9% while the remaining 6.1% is influenced by other variables not discussed in this study. .

Based on the results in Table 4, the R Square value for Performance (Y2) using Amos cannot be run. The value of R Square for Performance (Y2) using SmartPLS is 0.852 or 85.2%, meaning that the performance variable (Y2) is influenced by transformational leadership variables (X) and job satisfaction (Y1) is 85.2% while the remaining 14.8% is influenced by other variables not discussed in this study. The R Square value for Performance (Y2) using SmartPLS is 0.85 or 85%, meaning that the performance variable (Y2) is influenced by transformational leadership variables (X) and job satisfaction (Y1) by 85% while the remaining 15% is influenced by other variables. which were not discussed in this study. The value of R Square for Performance (Y2) using SmartPLS is 0.844 or 84.4%, meaning that the performance variable (Y2) is influenced by transformational leadership variables (X) and job satisfaction (Y1) is 84.4% while the remaining 15.6% is influenced by other variables not discussed in this study.

Correlation Coefficient Test

The correlation coefficient shows the strength of the linear relationship and the direction of the relationship between variables. If the correlation coefficient is positive, then the two variables have a unidirectional relationship (Purwanto et al, 2020). This means that if the value of the variable X is high, then the value of the variable Y will be high as well. Conversely, if the correlation coefficient is negative, then the two variables have an inverse relationship. This

means that if the value of the variable X is high, then the value of the variable Y will be low and vice versa. According to Hair et al (2017) to make it easier to interpret the strength of the relationship between two variables, the following criteria are provided:

- 0 means There is no correlation between two variables
- >0.00 – 0.25 means the correlation is very weak
- > 0.25 – 0.50 means enough correlation
- >0.50 – 0.75 means strong correlation
- > 0.75 – 0.99 means the correlation is very strong
- 1.00 means perfect correlation

The results of testing the correlation coefficient for structural equations using Amos, SmartPLS, WarpPLS and SPSS software are as follows:

Table 5. Comparison of Structural Equation Results

Software	equation
Amos	-
SmartPLS	Y1=a + 0.970X + e Y2=a + 0.642X1 + 0.287Y1 + e
Lisrel	-
Tetrad	-
GSCA	Y1=a+ 0.972X1 + e Y2=a+ 0.703X+ 0.229Y1 + e
WarpPLS	Y1=a + 0.973X + e Y2=a+ 0.658X + 0.271Y1
SPSS	Y1=1.83+ 0.950X + e Y2=0.219+ 0.642X1 + 0.324Y1 + e

The results of structural equations using Lisrel, Tetrad and Amos software cannot be run. The results of the structural equation using SmartPLS software obtained the equation is $Y2 = 0.642X1 + 0.287Y1 + e$, meaning that the correlation coefficient value of the influence of transformational leadership variable (X) on performance (Y2) is 0.642, meaning that there is a strong correlation and indicates that if the value of transformational leadership (X) increases by 1 unit, while the value of job satisfaction (Y1) remains, the performance value (Y2) will increase by 0.642 units. This means that the partial effect of transformational leadership on performance is 64.2%. The correlation coefficient value of the influence of job satisfaction variable (Y1) on performance (Y2) is 0.287, meaning that there is a sufficient correlation and shows that if the value of job satisfaction (Y1) increases by 1 unit, while the value of transformational leadership (X) remains, the performance value (Y2) will increase by 0.287 units. This means that the effect of job satisfaction (Y1) on performance partially is 28.7%.

The results of the structural equation using WarpPLS software obtained the equation is $Y2 = 0.658X1 + 0.271Y1 + e$, meaning that the correlation coefficient value of the influence of transformational leadership variable (X) on performance (Y2) is 0.658, meaning that there is a strong correlation and shows that if the value of transformational leadership (X) increases by 1 unit, while the value of job satisfaction (Y1) remains, the performance value (Y2) will increase by 0.658 units. This means that the partial effect of transformational leadership on performance

is 65.8%. The correlation coefficient value of the effect of job satisfaction variable (Y1) on performance (Y2) is 0.271, meaning that there is a sufficient correlation and indicates that if the value of job satisfaction (Y1) increases by 1 unit, while the value of transformational leadership (X) remains, the performance value (Y2) will increase by 0.271 units. This means that the effect of job satisfaction (Y1) on performance partially is 27.1%.

The results of the structural equation using SPSS software obtained the equation is $Y2 = 0.219 + 0.642X1 + 0.324Y1 + e$, meaning that the correlation coefficient value of the influence of transformational leadership variable (X) on performance (Y2) is 0.642, meaning that there is a strong correlation and indicates that if the value of leadership transformational (X) increases by 1 unit, while the value of job satisfaction (X2) remains, the performance value (Y2) will increase by 0.642 units plus a constant of 0.219 units. This means that the partial effect of transformational leadership on performance is 64.2%. The correlation coefficient value of the influence of job satisfaction variable (Y1) on performance (Y2) is 0.324, meaning that there is a sufficient correlation and indicates that if the value of job satisfaction (Y1) increases by 1 unit, while the value of transformational leadership (X) remains, the performance value (Y2) will increase by 0.324 units plus the constant 0.219 units. This means that the effect of job satisfaction (Y1) on performance partially is 32.4%.

The results of the structural equation using the GSCA software obtained the equation is $Y2 = a + 0.703X + 0.229Y1 + e$, meaning that the correlation coefficient value of the influence of transformational leadership variable (X) on performance (Y2) is 0.704, meaning that there is a strong correlation and shows that if the value of transformational leadership (X) increases by 1 unit, while the value of job satisfaction (X2) remains, the performance value (Y2) will increase by 0.703 units. This means that the partial effect of transformational leadership on performance is 70.3%. The correlation coefficient value of the influence of job satisfaction variable (Y1) on performance (Y2) is 0.229 meaning that there is a sufficient correlation and indicates that if the value of job satisfaction (Y1) increases by 1 unit, while the value of transformational leadership (X) remains, the performance value (Y2) will increase by 0.229 units plus the constant 0.229 units. This means that the effect of job satisfaction (Y1) on performance partially is 22.9%.

PLS-SEM is a causal modeling approach that aims to maximize the explained variance of the dependent latent construct. This contradicts the goal of CB-SEM to reproduce a theoretical covariance matrix, without focusing on the variance described. PLS-SEM becomes important when we deal with empirical research challenges such as smaller sample sizes. The estimation of the CB-SEM model requires a series of assumptions that must be met, including the normality of multivariate data, minimum sample size, and so on. But if the assumption of CB-SEM cannot be met, or the aim of the study is prediction rather than confirmation of structural relationships, then variance-based PLS-SEM is the appropriate method. Compared to CB-SEM results, which can be very imprecise when assumptions are violated, PLS-SEM often provides stronger estimates than structural models.

Another philosophical difference between CB-SEM and PLS-SEM: if the aim of the research is the testing and confirmation of theory, then the appropriate method is CB-SEM. On the other hand, if the research objective is prediction and theory development, then the appropriate method is PLS-SEM. The main objective is to maximize the differences described in the dependent construct but also to evaluate the quality of the data based on the characteristics of the measurement model. Given the ability of PLS-SEM to work efficiently with a much wider

range of sample sizes and increased model complexity, and less stringent assumptions about the data, PLS-SEM can address a wider range of problems than CB-SEM.

In addition, because construct measurement is less constrained with PLS-SEM, constructs with fewer items (e.g., one or two) can be used than CB-SEM requires. Overall, when the measurement or nature of the model limits the use of CB-SEM or when the emphasis is on exploration rather than confirmation, PLS-SEM is an attractive and often more appropriate alternative. PLS-SEM can be applied to a wider variety of situations, researchers should always be aware of differences in the interpretation of the results, especially with regard to the nature of construct measurement. For example, can PLS-SEM be applied appropriately when measurement theory fails to meet the criteria of confirmatory factor analysis, including tests of convergent validity and tests of discriminant validity.

PLS-SEM estimates variable indicator loadings for exogenous constructs based on their predictions of endogenous constructs, not the joint variance among indicator variables in the same construct. Loadings in PLS-SEM by means of their contribution to the path coefficient. While CB-SEM gives poor results for the measurement model but significant structural model relationships, PLS-SEM offers acceptable results for the measurement model whereas structural model relationships are not significant. This suggests that the difference in the results is mainly a matter of the quality of the measurement model. Using "good" measures and data, these two approaches yield practically the same results. To properly apply CB-SEM and PLS-SEM, researchers must understand the objectives of developing each approach and apply them. Structural equation models with good measurement properties generally achieve comparable results with both approaches, especially when the CB-SEM model specifications are properly set up. Moreover, both approaches still have to consider issues such as the proper use and interpretation of formative versus reflective measures. These situations are often situations in which the nature of the measurement is questioned and the results may differ, thus requiring the researcher to make a reasonable judgment as to which approach is most appropriate.

Conclusion

PLS-SEM has several advantages and disadvantages relative to CB-SEM. The advantage lies in its robustness, meaning that it will provide a solution even if there are problems that could prevent a solution in SEM. First, poor measurement is one of the main barriers to obtaining an SEM solution. For example, when researchers are trying to test a structural model with a single item size or a combination of multiple one- and two-item measures, PLS may be an option because of identification problems that may occur in SEM. As we have noted, all recursive models were identified (showing no statistical identification problem) in PLS, even with single item sizes. Thus, while validating one- and two-item measures in the context of measurement theory does not mean much with SEM, PLS is not constrained by the problem. Based on the results of the analysis using GSCA, SPSS, SmartPLS and WarpPLS software, the results showed that for a small sample there was no significant difference in the significance value of p-value and t-value. There is also no significant difference in the determination value produced, and the correlation value in the resulting structural equation also has no significant difference in results, while for CB-SEM represented by Lisrel, tetrad and Amos cannot process data with a small sample size. Many researchers have used PLS for only this reason, given the perceived difficulty in the specification of formative models in SEM. PLS can also be a useful way to quickly explore a large number of variables to identify sets of principal component variables that can predict multiple outcome variables

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