

Enhancing Research Quality through SmartPLS 4.0 Training for Management Students and Lecturers at Pattimura University

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Abstract: *This community service program aimed to strengthen research competencies among students and lecturers of the Department of Management, Faculty of Economics and Business, Pattimura University, through Structural Equation Modeling (SEM-PLS) training using SmartPLS 4.0. The program involved 44 participants, consisting of 22 students and 22 lecturers, divided into two training sessions. The training methods included lectures, software demonstrations, hands-on practice, and interactive discussions. The materials covered research model development, measurement model evaluation, structural model assessment, hypothesis testing, and interpretation of statistical results. The program provided participants with practical learning opportunities to understand the application of SEM-PLS in quantitative management research. The training is expected to support undergraduate thesis preparation, lecturer research activities, and scientific manuscript development. Continued mentoring and systematic evaluation are recommended to assess improvements in participants' analytical competencies and support sustainable research capacity development.*

Keywords:

SmartPLS 4.0, SEM-PLS, Research Competence, Community Service, Scientific Publication.

Introduction

Research plays an essential role in improving the quality of higher education, supporting evidence-based decision-making, and contributing to the development of scientific knowledge. In the field of management, high-quality research requires not only a strong theoretical foundation but also appropriate analytical methods to examine relationships among variables and test conceptual research models. Structural Equation Modeling–Partial Least Squares (SEM-PLS) is widely applied in quantitative research because it enables researchers to evaluate measurement models and structural relationships within a single analytical framework (Riyanto & Setyorini, 2024).

SmartPLS 4.0 is a statistical software application designed to facilitate the implementation of SEM-PLS analysis. Its application has been demonstrated in various research contexts, including management education, entrepreneurship, and business development (Kumari et al., 2024; Lan & Nam, 2025; Pambudi et al., 2024). Furthermore, the integration of SmartPLS with emerging technologies has attracted attention as a potential approach to optimizing educational models and analytical processes (Kusumah et al., 2024). These developments highlight the relevance of SmartPLS 4.0 as a tool for supporting quantitative research in management and related disciplines.

However, the effective use of SmartPLS 4.0 requires an adequate understanding of research methodology, statistical concepts, and the interpretation of analytical results. Students and lecturers need opportunities to develop practical skills in using the software to support their research activities. For students, these competencies are particularly important in preparing undergraduate theses and scientific articles, while lecturers can benefit from improved analytical capabilities in conducting research, supervising students, and developing academic publications. Previous community service initiatives have also emphasized the importance of SmartPLS training in strengthening data analysis skills and supporting researchers in processing research data (Saputra et al., 2025). Similarly, training in SmartPLS-based SEM analysis has been identified as a means of strengthening students' competencies in producing academic publications (Rehatta et al., 2026).

In response to these needs, the Department of Management, Faculty of Economics and Business, Pattimura University, can strengthen its research capacity through a structured training program on SEM-PLS using SmartPLS 4.0. The program combines theoretical explanations with hands-on practice to help participants understand the analytical process, operate the software, interpret statistical results, and apply appropriate research procedures. Through this initiative, the training is expected to strengthen analytical competencies, improve research practices, and support the development of scientific publications among students and lecturers.

Despite the importance of quantitative research in management studies, several challenges may hinder students and lecturers in conducting rigorous research and producing high-quality scientific publications. These challenges highlight the need for practical training in SEM-PLS analysis using SmartPLS 4.0.

First, students and lecturers may have different levels of knowledge and practical experience in applying SEM-PLS methods. Limited familiarity with the

software may make it difficult to select appropriate analytical procedures and conduct research independently. Practical training is therefore relevant to help participants understand the application of SmartPLS in research, particularly in the context of quantitative data processing (Saputra et al., 2025).

Second, participants may experience difficulties in evaluating measurement models, including indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. An inadequate understanding of these procedures may affect the quality and accuracy of research findings. A sound understanding of SEM-PLS methodology is therefore necessary to ensure that analytical procedures are applied appropriately (Riyanto & Setyorini, 2024).

Third, interpreting structural model results can be challenging, particularly when assessing path coefficients, coefficients of determination (R^2), effect sizes, predictive relevance, and hypothesis testing. These skills are essential for drawing valid conclusions and developing meaningful research discussions. The use of SmartPLS in management and business research demonstrates the relevance of developing these analytical competencies across different research applications (Lan & Nam, 2025; Pambudi et al., 2024).

Fourth, students and lecturers may require further guidance in conducting mediation analysis, interpreting indirect effects, and connecting statistical findings with relevant theories and previous studies. These competencies are particularly important in management research involving complex relationships among variables. Consequently, structured training and practical exercises are needed to help participants develop a more comprehensive understanding of the SEM-PLS analytical process.

Fifth, limited practical training opportunities may create a gap between theoretical knowledge and the ability to perform data analysis independently. This gap can affect the efficiency of thesis preparation, research development, and scientific article writing. Previous community service programs focusing on SmartPLS-based analysis have highlighted the relevance of competency development in supporting students' academic publication activities (Rehatta et al., 2026).

Based on these challenges, practical SmartPLS 4.0 training is needed to strengthen participants' methodological understanding, analytical skills, and ability to interpret research results accurately. The program is expected to help students and lecturers conduct more systematic research and support the development of scientific publications within the Department of Management, Faculty of Economics and

Business, Pattimura University.

Method

The community service program was conducted through SmartPLS 4.0 training for students and lecturers of the Department of Management, Faculty of Economics and Business, Pattimura University. A total of 44 participants were involved, consisting of 22 students and 22 lecturers. To facilitate effective learning and provide sufficient opportunities for hands-on practice, the training was divided into two sessions based on participant groups. The first session was attended by 22 students, while the second session involved 22 lecturers. This arrangement allowed the training materials and practical exercises to be delivered in a focused and interactive manner.

The training employed a combination of lectures, demonstrations, hands-on practice, and interactive discussions. The activities began with an introduction to the basic concepts of Structural Equation Modeling–Partial Least Squares (SEM-PLS) and the functions of SmartPLS 4.0 in quantitative research. Participants were then guided through the stages of data preparation, research model development, measurement model evaluation (outer model), structural model evaluation (inner model), hypothesis testing, and interpretation of analytical results. Practical exercises were provided to help participants apply the software to research problems relevant to management studies.

Program evaluation was conducted to assess participants' understanding and practical skills in using SmartPLS 4.0. The evaluation approach included observation during practical exercises, question-and-answer sessions, and feedback from participants regarding the training materials and implementation. The evaluation focused on participants' ability to operate the software, conduct basic SEM-PLS analyses, and interpret the resulting outputs. The findings from this evaluation were intended to identify areas for further improvement and provide a basis for developing future research capacity-building activities at the Department of Management, Pattimura University.



Picture 1. SmartPLS 4.0 training with students



Picture 2. SmartPLS 4.0 training with a lecturer

Result

The SmartPLS 4.0 training program was conducted for 44 participants from the Department of Management, Faculty of Economics and Business, Pattimura University, consisting of 22 students and 22 lecturers. The participants were divided into two sessions to ensure a more focused learning process and facilitate interaction between the trainers and participants. The training activities covered the fundamental concepts of Structural Equation Modeling–Partial Least Squares (SEM-PLS), the introduction to SmartPLS 4.0, research model development, data analysis procedures, and interpretation of statistical results.

The training provided participants with opportunities to improve their understanding of SEM-PLS as an analytical method for quantitative management research. Through presentations and software demonstrations, participants were introduced to the stages of conducting SEM-PLS analysis, including measurement model evaluation, structural model assessment, hypothesis testing, and mediation analysis. These activities helped participants understand the role of SmartPLS 4.0 in examining relationships among research variables and evaluating theoretical models.

The practical sessions enabled participants to become familiar with the software interface and the procedures involved in developing research models and analyzing data. Participants were guided through the process of constructing measurement and structural models, assessing indicator reliability and validity, evaluating relationships among variables, and interpreting path coefficients and other statistical outputs. Interactive discussions also provided opportunities for participants to raise questions about methodological challenges commonly encountered when preparing undergraduate theses, conducting lecturer research, and developing scientific articles.

The program also encouraged collaboration and knowledge sharing between students and lecturers regarding the application of quantitative research methods in management studies. The training materials were relevant to research topics such as marketing, human resource management, organizational behavior, and consumer behavior. By connecting theoretical explanations with practical applications, the program supported participants in understanding how SEM-PLS can be applied to various management research contexts.

Overall, the program established a practical learning opportunity for students and lecturers to strengthen their research competencies through SmartPLS 4.0 training. The activities were designed to support more systematic data analysis, improve the interpretation of research findings, and encourage the development of higher-quality scientific publications within the Department of Management, Pattimura University. However, the extent of improvement in participants' competencies would need to be confirmed through documented evaluation results, such as pre-training and post-training assessments, practical task completion, or participant feedback.

Discussion

The SmartPLS 4.0 training program represents an effort to strengthen research

capacity among students and lecturers of the Department of Management, Faculty of Economics and Business, Pattimura University. The program involved 44 participants, comprising 22 students and 22 lecturers, who were divided into two training sessions. This arrangement provided opportunities for participants to engage with the training materials, follow software demonstrations, and participate in practical exercises. Practical training is important because the effective use of statistical software requires not only theoretical understanding but also the ability to apply analytical procedures to research data. Previous community service activities have similarly emphasized the importance of SmartPLS training in supporting researchers' data-processing skills (Saputra et al., 2025).

One important aspect of the training was the introduction to Structural Equation Modeling–Partial Least Squares (SEM-PLS) and its application through SmartPLS 4.0. In management research, researchers frequently investigate relationships among multiple variables, including direct effects, indirect effects, and mediation relationships. SEM-PLS provides an analytical framework for evaluating measurement models and structural relationships within a research model. Its application has been demonstrated in studies involving management education and entrepreneurial intention (Kumari et al., 2024; Lan & Nam, 2025). Therefore, developing participants' understanding of SEM-PLS procedures is relevant to strengthening their ability to conduct quantitative research in areas such as marketing, human resource management, organizational behavior, and consumer behavior.

The practical component was another important element of the program. Demonstrations and guided exercises were designed to help participants connect methodological concepts with their implementation in SmartPLS 4.0. Understanding the software interface alone is insufficient to ensure accurate research analysis; participants must also understand the criteria and methodological considerations underlying each analytical decision. For example, evaluating the outer model requires attention to indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Similarly, structural model evaluation involves interpreting path coefficients, coefficients of determination (R^2), and bootstrapping results in accordance with the research objectives and methodological standards. A systematic understanding of these procedures is important for conducting quantitative research appropriately (Riyanto & Setyorini, 2024).

The program also addressed the research needs of students and lecturers. For students, particularly those preparing undergraduate theses, competence in SmartPLS 4.0 can support the application of quantitative research methods and the

interpretation of empirical findings. For lecturers, the training can help strengthen analytical skills for research development, student supervision, and scientific manuscript preparation. Previous community service research has highlighted the relevance of SmartPLS-based SEM training in supporting students' academic publication competencies (Rehatta et al., 2026). Accordingly, training initiatives that involve students and lecturers can contribute to strengthening research capacity and encouraging a more active research culture within the department.

Another important implication concerns the relationship between data analysis skills and scientific publication quality. High-quality publications depend not only on the use of appropriate statistical software but also on the clarity of the research problem, the strength of the theoretical framework, the suitability of the research design, the quality of the data, and the accuracy of interpretation. SmartPLS 4.0 can facilitate analytical procedures in management and business research, as demonstrated in studies examining business development and digital innovation (Pambudi et al., 2024). Research on the use of SmartPLS and artificial intelligence in educational model optimization also illustrates interest in leveraging analytical technologies to support research and educational processes (Kusumah et al., 2024). Nevertheless, the use of statistical software does not automatically guarantee publication in reputable journals. Continued mentoring in research design, academic writing, literature review, and journal selection remains important for translating analytical competencies into stronger publication outcomes.

Despite its potential benefits, the program also highlights considerations for future implementation. A short training program may introduce participants to SEM-PLS without ensuring that all participants can independently conduct a complete analysis. Participants may also differ in their prior knowledge, statistical experience, and familiarity with research software. Future programs could address these differences through preliminary assessments, differentiated learning materials, case studies based on participants' research topics, and follow-up mentoring. Evaluation methods such as pre-training and post-training tests, practical assignments, and participant feedback would provide evidence of changes in participants' knowledge and analytical skills. These measures would also help determine the effectiveness of the training and identify areas requiring further support.

Overall, the SmartPLS 4.0 training program provides a practical approach to supporting research capacity development among students and lecturers at Pattimura University. Its combination of conceptual instruction, software demonstrations, practical exercises, and discussions creates a foundation for strengthening

participants' understanding of SEM-PLS. Previous training initiatives have likewise emphasized the importance of developing SmartPLS competencies to support data analysis and academic publication activities (Rehatta et al., 2026; Saputra et al., 2025). To achieve sustainable outcomes, the initiative should be followed by continuous research assistance, collaborative research opportunities, and support for scientific manuscript development. Such efforts can help transform initial software training into a broader strategy for improving research practices and supporting scientific publication development within the Department of Management.

Conclusion

The community service program on Structural Equation Modeling (SEM-PLS) training using SmartPLS 4.0 was designed to strengthen the research competencies of students and lecturers in the Department of Management, Faculty of Economics and Business, Pattimura University. The program involved 44 participants, consisting of 22 students and 22 lecturers, who attended two separate training sessions. Through presentations, software demonstrations, hands-on exercises, and interactive discussions, participants were introduced to research model development, measurement model evaluation, structural model assessment, hypothesis testing, and the interpretation of analytical results.

The program provided a practical learning opportunity to support the application of quantitative research methods in management studies. The knowledge and skills addressed through the training are relevant to undergraduate thesis preparation, lecturer research activities, and scientific manuscript development. Nevertheless, the extent of improvement in participants' competencies and its contribution to publication quality should be assessed through systematic evaluation.

For future implementation, continued training, practical mentoring, and research collaboration are recommended to help participants apply SmartPLS 4.0 independently and consistently. These efforts are expected to support the development of a stronger research culture and contribute to improving research quality and scientific publication capacity within the Department of Management, Pattimura University.

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