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Ethical Conflicts Between Research Objectives and Participant Protection: An Ethical Analysis Using SEM-PLS in Industrial Engineering Students

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A B S T R A C T

Research ethics has become a critical issue in academic activities, as increasing research pressure may trigger conflicts of interest and weaken the protection of research participants. This article aims to analyze the relationships among research pressure, conflicts of interest, ethical awareness, ethical decision-making, and participant protection among Industrial Engineering students. A quantitative approach was employed using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method. Data were collected from 80 final-year undergraduate and postgraduate students through a five-point Likert-scale questionnaire. The results indicate that research pressure has a significant effect on conflicts of interest ($\beta = 0.564$; $p < 0.001$). Ethical awareness is found to have a strong and significant influence on ethical decision-making ($\beta = 0.696$; $p < 0.001$). Furthermore, ethical decision-making positively affects participant protection at a marginal level of significance ($\beta = 0.241$; $p = 0.057$). In contrast, conflicts of interest do not show a significant effect on ethical decision-making ($\beta = 0.129$; $p = 0.113$). These findings highlight the crucial role of ethical awareness in maintaining the integrity of ethical decision-making and the protection of research participants, although structural research pressures continue to contribute to the emergence of conflicts of interest.

Keywords: Research Ethics; Research Pressure; Conflict of Interest; Ethical Decision-Making; Participant Protection; PLS-SEM.

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1. Introduction

Research ethics constitutes a fundamental principle that ensures scientific integrity as well as the protection of the rights and dignity of research participants. Within research methodology, ethics functions not merely as a moral norm but as a scientific quality standard that determines the eligibility of a study for publication [1]. The legal and normative foundations of research ethics in the context of the social sciences and humanities are grounded in official guidelines that emphasize the principles of autonomy, justice, and beneficence [2]. These guidelines explicitly mandate the implementation of informed consent, the protection of data confidentiality, and the management of risks to research participants [10].

In the context of the Industrial Engineering profession, research ethics is closely associated with competency standards and professional ethical codes that require objectivity, integrity, and accountability for the social impacts of engineering and managerial decisions. Industrial Engineering research frequently involves human participants in studies of work systems, organizational behavior, and decision-making processes, rendering participant protection a critical concern. Student research activities are often confronted with various academic pressures, such as timely degree completion requirements, publication demands, and institutional performance targets. These conditions may generate conflicts of interest, both financial and non-financial, which can compromise researcher independence and the quality of ethical decision-making throughout the research process. In accordance with principles of professional competency standards and responsibility (STR), Industrial Engineering researchers are expected to manage conflicts of interest and maintain scientific independence at every stage of research [19].

As publication demands and academic performance targets continue to intensify, research pressure has become a significant factor shaping researchers' behavior, particularly among final-year undergraduate and postgraduate students. Such pressure has been shown to influence publication strategies and may encourage decision-making practices that neglect core principles of research ethics. Numerous studies indicate that high levels of academic pressure are correlated with an increased risk of conflicts of interest, as well as a decline in reporting quality and participant protection [8]. Moreover, Industrial Engineering graduates are professionally bound by ethical principles that emphasize social responsibility and the protection of all stakeholders affected by academic and engineering activities. Consequently, mastery of research ethics represents a fundamental component in the development of professional

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As publication demands and academic performance targets continue to intensify, research pressure has become a significant factor shaping researchers' behavior, particularly among final-year undergraduate and postgraduate students. Such pressure has been shown to influence publication strategies and may encourage decision-making practices that disregard fundamental principles of research ethics. Numerous studies indicate that high levels of academic pressure are associated with an increased risk of conflicts of interest, as well as a decline in reporting quality and the protection of research participants [8]. Moreover, graduates of Industrial Engineering are professionally bound by ethical principles that emphasize social responsibility and the protection of all stakeholders affected by academic and engineering activities. Therefore, mastery of research ethics constitutes a fundamental element in the development of professional competence among Industrial Engineering students.

Ethical awareness is regarded as a key mechanism for balancing academic interests with the obligation to protect research participants. Individuals with a high level of ethical awareness are more likely to recognize ethical dilemmas and to maintain adherence to ethical principles, even when operating under substantial research pressure [14]. However, empirical studies examining the relationships among research pressure, conflicts of interest, ethical awareness, and participant protection within the context of Industrial Engineering students remain limited. Accordingly, this study employs the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach to systematically and predictively analyze the causal relationships among these constructs [15].

2. Literature review

Research ethics refers to a set of moral and professional principles that govern the responsible design, execution, and reporting of research. International ethical guidelines emphasize that the principles of respect for autonomy, justice, and beneficence must serve as the foundation for all research activities [3].

Conflicts of interest in research occur when personal, academic, or institutional interests have the potential to compromise a researcher's objectivity, independence, and integrity. These conflicts are not limited to financial aspects but also encompass non-financial interests, such as publication requirements, graduation pressures, academic reputation, and institutional affiliations [6].

Research pressure is a psychological and structural condition arising from academic demands, including publication obligations, graduation targets, and academic career competition. The pressure perceived by researchers significantly influences their chosen publication strategies, including the tendency to take shortcuts that potentially violate ethical standards [18]. Based on this literature review, the following research hypotheses are formulated:

- H1: Research pressure has a positive effect on conflicts of interest.
- H2: Ethical awareness has a positive effect on ethical decision-making.
- H3: Conflicts of interest have an effect on ethical decision-making.
- H4: Ethical decision-making has a positive effect on the protection of research subjects.

3. Research methodology

This study adopts an explanatory quantitative approach to examine the causal relationships among research ethics–related constructs based on empirical data. The analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM), as this method is appropriate for predictive model testing, relatively small sample sizes, and data that do not require a normal distribution [12]. The study population comprised final-year undergraduate and postgraduate students, with respondents selected through purposive sampling, yielding a total of 80 participants.

The research model involved five latent constructs: Research Pressure (RP), Conflict of Interest (CI), Ethical Awareness (EA), Ethical Decision-Making (EDM), and Human Subject Protection (HSP). These constructs were measured using a five-point Likert-scale questionnaire. Data analysis was performed using SmartPLS software, encompassing the evaluation of both the measurement model and the structural model.

4. Results and discussion

4.1. Measurement Model Evaluation

Table 1. Outer Loadings.

	CI	EA	EDM	HSP	RP
CI1	0.729				
CI2	0.865				
CI3	0.874				
CI4	0.852				
EA1		0.832			
EA2		0.801			
EA3		0.877			
EDM1			0.855		
EDM2			0.885		
EDM3			0.795		
EDM4			0.828		
HSP1				0.956	
HSP4				0.738	
RP2					0.858
RP3					0.864

Based on the analysis results, all indicators in the final model achieved outer loading values greater than 0.70, thereby satisfying the criteria for convergent validity. Indicators with low loading values in the initial stage were gradually eliminated through a model re-estimation process to improve measurement quality, without altering the conceptual meaning of each construct.

Table 2. Construct Reliability and Validity.

	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Realibility (rho_c)	Average Variance Extracted (AVE)
CI	0.850	0.857	0.900	0.692
EA	0.787	0.793	0.876	0.701
EDM	0.862	0.870	0.907	0.708
HSP	0.672	1.006	0.841	0.729

Based on the reliability test results, all constructs yielded Composite Reliability (CR) values above the 0.70 threshold, and the Average Variance Extracted (AVE) exceeded 0.50. These results indicate that the constructs possess high internal consistency and are capable of adequately explaining the indicator variance.

Although the Cronbach's alpha value for the HSP construct was at the minimum acceptable threshold, Composite Reliability is prioritized over Cronbach's alpha in PLS-SEM, particularly in exploratory and predictive models.

Table 3. Discriminant Validity - Heterotrait–Monotrait (HTMT).

	CI	EA	EDM	HSP
CI				
EA	0.380			
EDM	0.407	0.889		
HSP	0.181	0.269	0.289	

The results of the discriminant validity test using the Heterotrait-Monotrait Ratio (HTMT) show that all values between constructs are below the 0.90 threshold, thereby establishing discriminant validity.

The Research Pressure (RP) construct is modeled as a formative construct; therefore, it was not evaluated using internal reliability indicators such as Cronbach's alpha, Composite Reliability, or AVE. Furthermore, RP was not included in the HTMT analysis because it serves as a purely exogenous construct with homogeneous indicators that do not exhibit potential conceptual overlap with other constructs.

4.2. Structural Model Evaluation

Table 4. Collinearity Statistics (VIF).

	CI	EA	EDM	HSP	RP
CI			1.109		
EA			1.109		
EDM				1.000	
HSP					
RP	1.000				

The Variance Inflation Factor (VIF) values in the structural model are all below the maximum threshold (VIF < 3.3), indicating that there are no multicollinearity issues among the predictor constructs. VIF values are only reported for constructs that serve as direct predictors within the structural model. Methodologically, constructs that do not have direct predictive relationships do not generate VIF values.

Table 5. *R* – square.

	R – square	R – square adjusted
CI	0.318	0.309
EDM	0.557	0.545
HSP	0.058	0.046

The R^2 values indicate that the Ethical Decision-Making (EDM) construct possesses moderate-to-strong explanatory power, while the Conflict of Interest (CI) construct is at a moderate level. The Human Subject Protection (HSP) construct shows a relatively small R^2 value, indicating that the protection of research subjects is influenced by other factors outside the model examined in this study. This finding is acceptable given the complexity of research ethics practices, which are determined not only by individual factors but also by institutional and regulatory contexts. R^2 is only calculated for endogenous constructs. In this model, RP and EA serve as purely exogenous constructs; therefore, by statistical definition, they do not possess R^2 values.

Table 6. *f* – square.

	CI	EA	EDM	HSP	RP
CI			0.034		
EA			0.984		
EDM				0.061	
HSP					
RP	0.466				

The f^2 effect size results show that EA has a large effect on EDM (f^2 = 0.984), while RP has a medium effect on CI (f^2 = 0.466), with other relationships showing small-to-moderate effects. This indicates that Ethical Awareness (EA) is the dominant predictor of Ethical Decision-Making (EDM), whereas Research Pressure (RP) makes a substantial contribution to Conflicts of Interest (CI). Furthermore, the absence of f^2 values in certain cells of the matrix is due to the lack of direct structural relationships between those constructs in the research model; consequently, the effect size is not calculated by SmartPLS.

Table 7. Path Coefficients.

	Original Sample (O)	*Sample Mean (M)*	*Standard Deviation (STDEV)*	*T Statistics (|O/STEDEV|)*	*P Values*
CI => EDM	*0.129*	*0.136*	*0.081*	*1.584*	*0.113*
EA => EDM	*0.696*	*0.698*	*0.066*	*10.492*	*0.000*
EDM => HSP	*0.241*	*0.251*	*0.127*	*1.900*	*0.057*

RP => CI	*0.564*	*0.576*	*0.081*	*6.932*	*0.000*

Based on bootstrapping results:

- H1 (RP → CI) significant and positive (p < 0,001) → *supported*
- H2 (EA → EDM) significant and positive (p < 0,001) → *supported*
- H3 (CI → EDM) non-significant (p = 0,113) → *non-significant*
- H4 (EDM → HSP) marginally significant (p = 0,057) → *marginally supported*

The marginal significance of the relationship between EDM and HSP remains acceptable within social and ethical research, particularly in predictive models with moderate sample sizes, provided it is supported by a positive coefficient, consistent theoretical direction, and adequate effect size.

Overall, the research findings confirm that ethical awareness is a key factor in shaping ethical decision-making, while research pressure plays a vital role in giving rise to conflicts of interest. The findings of marginal and non-significant relationships reflect the complexity of research ethics phenomena and reinforce the argument that ethical behavior is not determined by a single factor, but rather by multidimensional interactions between individual and contextual factors. Furthermore, these findings suggest that while research pressure increases the potential for conflicts of interest, ethical awareness serves as a control mechanism that encourages ethical decisions and the protection of research subjects. These results align with previous studies that emphasize the importance of ethics education within academic contexts [17].

5. Conclusion

This study demonstrates that ethical awareness is a primary determinant in shaping ethical decision-making within the context of academic research. The SEM-PLS analysis results indicate that ethical awareness has a significant positive effect on ethical decision-making, which subsequently contributes to the enhancement of research subject protection. These findings confirm that the internalization of ethical values plays a more dominant role than external pressure factors in maintaining research integrity.

Furthermore, this research finds that research pressure significantly influences conflicts of interest; however, conflicts of interest were not proven to have a direct effect on ethical decision-making. The relationship between ethical decision-making and the protection of research subjects showed marginal significance, indicating that the implementation of ethical decisions is still influenced by contextual factors beyond the individual researcher, such as institutional policies and ethical oversight mechanisms.

Based on these findings, universities are encouraged to strengthen research ethics education and continuous internalization of ethical values, particularly for senior undergraduate and graduate students. Future research is expected to involve respondents across diverse disciplines and incorporate institutional factors to obtain a more comprehensive understanding of the dynamics of research ethics.

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