Application of the Pentagon Fraud Theory in Research Misconduct

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ABSTRACT

Higher education institutions or universities see themselves as academics who can serve as role models for future generations, and they are frequently seen as the center of advanced ethical thinking. As a result, the idea that universities might perpetrate fraud is challenging for the general public to accept. However, fraud can occur even within the scope of educational and scientific institutions. Academic fraud can harm Indonesia's ethics, morals, and intellectual culture. One type of academic fraud is research fraud. This study looked into the connection between Pentagon Fraud and fraud research. In addition, we investigated the structure of each fraud pentagon and fraud study to determine the most significant relationship between variables. The study used online surveys to research 135 academics in Indonesia. The analysis employed Canonical Correlation as the data analysis technique. The findings indicated a noteworthy and discernible correlation between Pentagon Fraud and research misconduct. The most prominent association identified between Pentagon Fraud and research fraud was attributed to pressure. This implies that the pressure experienced by individuals during research activities stands out as the primary factor contributing to research fraud.

Keywords: pentagon fraud, research misconduct, canonical correlation

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INTRODUCTION

Higher education institutions or universities have been viewed as academics who can provide role models for future generations. They are often seen as centers of advanced ethical thinking, so the idea that universities can commit fraud is complex for the wider community to believe. (Bailey, 2017). Fraud can occur within educational and research institutions' (Nasyia, 2020). In their study, Zamzami et al. (2016), revealed that in 2012, there were 16 cases of cheating in tertiary institutions.

One of the frauds that occurred was in scientific publications. The case in China revealed that the wrong academic evaluation system caused some researchers to only pursue article quantity rather than quality, especially in articles published in reputable international journals such as Scopus and World of Science. This is done to further one's career, even to the point of falsifying academic credentials (Lin, 2013). Another case also happened to researchers at Tilburg University, Netherlands. The researcher manipulated data (fabrication) on his research for 15-20 years, and it was never revealed. It caused more than 100 articles to be investigated, cost a lot of money, and threatened the careers of young researchers involved in these studies. (Crocker & Cooper, 2011).

Reisig et al. (2020) conducted research on fraud in research and scientific publications at universities in the USA using six variables: data fabrication, data falsification, plagiarism, authorship fraud, publication fraud, and grant fraud. The results stated that the highest research fraud occurred in authorship fraud, which occurred by entering the name of a researcher who did not contribute to the research as the name of the primary researcher.

In Indonesia, academic misconduct, such as plagiarism, manipulation of data, and data fabrication, has become notable among academics and has garnered increased attention in recent years (Rustad, 2018). Engaging in research is a crucial element for academics. Academics in tertiary institutions must contribute to the public good by creating scientific publications (Salam et al., 2017). The research outcomes are subsequently disseminated through publication in internationally indexed journals, domestic journals, or national and international seminars. Publishing is a requisite for promotion, representing a duty for academics.

The existence of pressure on these obligations causes an individual to take unethical or fraudulent actions in his responsibilities (Lin, 2013). Furthermore, the presence of research funds obtained by researchers causes researchers to make reports on these funds, which is one of the opportunities for fraud researchers (grant fraud). The integrity of the scientific field hinges on the trustworthiness of its researchers. Instances of dishonesty have the potential to harm the overall reputation of the scientific community (Dadkhah et al., 2017)

The Fraud Pentagon is an advancement of Cressey's (1953) Fraud Triangle, which delineates the circumstances conducive to fraud. The original triangle includes incentive/pressure, opportunities, and attitudes/ rationalization as prerequisites for fraud. The Fraud Triangle evolves into a pentagon by introducing additional conditions—capabilities and arrogance (Wolfe & Hermanson, 2004; Howath, 2011). Pentagon Fraud consists of five elements: pressure, opportunity, rationalization, capability, and arrogance (Howarth, 2011; Dorminey et al., 2012).

The obligation of an academic to fulfill promotions, carry out research and scientific publications in highly accredited journals both internationally and nationally, and an educational evaluation system based on the publication of indexed articles can be a particular pressure for the individual, leading to fraudulent behaviour. Fraud can occur if there is an opportunity to commit it. For example, an internal control system on research funds can be an opportunity to commit fraud (https://www.grants.gov/web/grants/learn-grants/grant-fraud.html accessed on March 5, 2021).

Furthermore, the rational behaviour of someone who feels he has done nothing wrong by writing his name as the first author because seniority (authorship) is a form of fraud in rationalization. An individual who abuses his position in obtaining research funding means the individual can make a fraud grant. Individual arrogance in academic fraud may be carried out by an official who imposes his will without complying with the rules to obtain research funding or to carry out scientific publications in indexed journals.

Previous research aimed at furthering investigations into researcher misconduct has revealed a type of research-related behavior involving fabrication or falsification (Hopp & Hoover, 2019). The least common sort of

fraud is data creation, which consists in producing non-existent data from a stated study (Holtfreter et al., 2019; Reisig et al., 2020). The rise of research fraud is an increasing worry, made worse by a lack of readily available resources or training to identify problematic research (Parker et al., 2022). Furthermore, Ng et al. (2023) and Palla and Singson (2022) revealed that research participants have watched or personally observed numerous forms of research fraud, such as fabrication, falsification, and plagiarism, with plagiarism being the most widespread form of misconduct in their study.

Reisig et al. (2020) highlighted the importance of exploring researcher misconduct in greater detail. It underscored the need for comprehensive research that compares perceptions of research fraud and its components across different studies, scientific fields, and periods. Thus, this study offered novelty by thoroughly examining fraudulent behavior, utilizing the dimensions of the Fraud Pentagon. The concept of the Fraud Pentagon clarifies the factors motivating individuals to commit fraud, encompassing pressure, opportunity, rationalization, capability, and arrogance (Hairing, 2023). Moreover, this research objective investigated the correlation between research fraud within the Pentagon Fraud dimensions.

The respondents were 135 academicians in Indonesia. Data collection used an online questionnaire due to distance and time limitations. This study empirically analyzed the reciprocal or causal relationship, a linear relationship between two variables. Therefore, this study used canonical correlation in the data processing. This analysis revealed a correlation between Pentagon Fraud and research misconduct. This study provides further literature and insights on the behavior of researchers in Pentagon Fraud dimensions. Furthermore, this study has practical consequences for the urgency of research policy demands, which can reduce the prevalence of fraudulent behavior in academic research.

This research focussed on fraud in the fraud research literature conducted by academics, which is the main contribution of this research. The gift lies in identifying fraud-related issues in scientific research and academic publications that academics should consider. The rest of this document is structured as follows. Section 2 presents the literature on Pentagon Fraud and fraud research. Section 3 offers some advances in the literature regarding research methods. Section 4 briefly identifies some challenges and suggests possible further study directions.

LITERATURE REVIEW

Pentagon Theory

Fraud is the intention to commit fraud such as plagiarism, theft, etc. Fuad et al. (2020) stated that until now, no basis represents a correct understanding of fraud itself because fraud or deception is an act that an individual misuses to fulfill personal interests that can harm others. The first fraud theory was the Triangle Fraud Theory developed by Cressey (1953). The elements of the fraud triangle consists of pressure, opportunity, and rationalization. These three factors are risk elements that interdependently reinforce each other, serving as foundational pillars that can result in fraudulent behavior (Mansor, 2017). Wolfe and Hermanson (2004) expanded the theory into Diamond Fraud by adding an element of capability. Howarth (2011) then added an element of arrogance to the fraud, which became known as the Pentagon Fraud theory. Adding these two elements was believed to impact the field significantly (Fuad et al., 2020).

Dorminey et al. (2012) mentioned five dimensions of Pentagon Fraud. Pressure is an impulse that arises in a person because factors persuade him to fulfill his needs. Schuchter & Levi (2015) believed that pressure can also occur externally or outside the fraud perpetrators. Opportunity is the possibility of fraud not only if a person feels depressed but also if there is an opportunity for someone who is not under pressure. There is an inability to detect cheating because cheating data is designed to avoid the scientific process (Horton et al., 2020). Rationalization is someone who feels they have done nothing wrong. This element is challenging to measure due to one's rational senses. Rationalization is when people can be trusted, even if the person concerned commits fraud or fraud (Gbegi & Adebisi, 2013). Capability pertains to an individual's capability or skill to take advantage of his position and can be arbitrary in breaking the rules and policies set. It happens when someone with good competence or knowledge can find "gaps" to commit fraud, while someone who does not have the capacity may not be able to find these "loopholes." (Sujana et al., 2019). Arrogance makes a person feel that company rules do not apply to him. The arrogance of a person can be a factor in the occurrence of fraud. The more powerful a person is, the more he acts as if no rules apply.

Fraud Misconduct

Fraud is "creation, falsification, or deception in conducting or presenting research findings." However, this definition may not encompass all forms of misconduct prevalent in research. While the analysis acknowledges plagiarism and the replication of publications, it's essential to recognize that misconduct and fraudulent behaviors can manifest in diverse ways (Harvey). Data manipulation is changing data according to what we want. This lie is done so that the data can match the expected research results (Crocker & Cooper, 2011). Providing wrong information (data falsification) and this technique is usually used in the research method.

An example is when conducting research, the researcher accidentally or intentionally makes a mistake in his research method and only realizes it when the research results are obtained. The researcher then writes down the inaccurate process or adds data or information that still needs to be done instead of repeating the research (Horton et al., 2020).

Plagiarism involves presenting someone else's essays, opinions, etc., as one's compositions and views. It is deemed a criminal activity as it infringes upon the copyrights of others. Individuals engaging in plagiarism can face severe educational consequences, including expulsion from school or university. Plagiarism is an evil act in any field (Bretag, 2016).

Authorship fraud is a fraud that occurs in writing the name on the article. For example, seniors do not conduct or contribute to research, but because of seniority, their names are written as first name (Horton et al., 2020). Funding fraud (grant fraud) commonly happens when recipients of awards try to mislead the government regarding the expenditure of their award funds. According to the Department of Justice, this behavior constitutes "lying, deceiving, and stealing" (https://www.grants.gov/web/grants/learn-grants/grant-fraud.html accessed on March 5, 2021). The research framework was as follows:

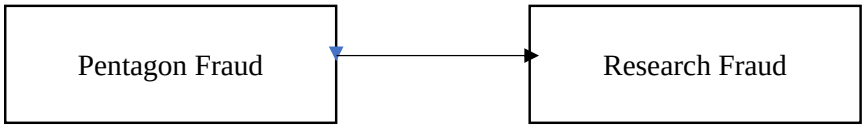

Figure 1: Research Framework

Hypotheses

Opportunity relates to whether there are weaknesses that individuals can exploit to commit fraud. Some examples of opportunities related to fraud include weak internal control security. When fraudsters find many security gaps, the situation allows fraudsters to manipulate the situation unpredictably (Utami et al., 2019). When individuals are in organizations that lack internal control mechanisms, they show a tendency to have higher fraud. Aubert Bonn et al. (2017) explained that opportunities can arise due to the weaknesses in the research policies of an institution. These weaknesses can impact the quality of research as there is a lack of regulations overseeing research outcomes.

In research fraud, rationalization refers to the cognitive process by which individuals justify or rationalize their unethical acts (Hairing, 2023). It rationalizes the behavior that fraudulent research is acceptable due to external pressures or circumstances. For instance, the obligation to publish scientific papers in highly indexed journals is one of the reasons academics commit fraud. For the research to be published in a specific indexed journal, the researcher undertakes data falsification or fabrication (Lin, 2013).

The pressures faced by individuals related to the possibility of fraud come from an internal or external environment (Rustiarini et al., 2019). These pressures might emerge in various ways and contribute to research misconduct. Pressure in the internal environment can be caused by internal researchers, such as the need for peer recognition to publish or perish (Herndon, 2016; Palla & Singson, 2022). In addition, the external environment caused by the institution's demand may pressure researchers to produce high-impact publications to enhance the institution's reputation and rankings (Reisig et al., 2020). In addition, an empirical observation explains opportunity and rationalization positively relate to a person's cheating (Said et al., 2017). Furthermore, other observations demonstrated a positive relationship between opportunity, pressure, and rationalization in the asset misappropriation (Said et al., 2018). Paying extra attention to opportunity, pressure, and rationalization is crucial in minimizing research misconduct.

Capability is an emerging element derived from the Fraud Triangle. The evolution of this model rests on the premise that individuals can

exploit available opportunities for fraud only if they possess the expertise or proficiency to leverage these opportunities (Rustiarini et al., 2019). Therefore, in research fraud, "capability" refers to a researcher's skills, knowledge, and technical abilities, which can be misused or exploited to engage in fraudulent practices. Earlier studies have shown that researchers' capabilities lead to a consequences number of misbehaviors such as data manipulation, data fabrication, data falsification, and plagiarism (Hopp & Hoover, 2019; Ng et al., 2023; Palla & Singson, 2022; Parker et al., 2022).

The tendency to be selfish, confident, arrogant, selfish, or ambitious is a characteristic that tends to be found in fraudsters (Zakaria & Mohammed, 2021). Individuals who commit fraud tend to feel satisfied and proud when manipulating others or organizations into committing fraud. Regarding research misconduct, arrogance is an excessive self-importance or overconfidence in one's abilities and decisions that may contribute to unethical research practices. Arrogance attitude occurs in refusal to acknowledge contributions. Arrogant researchers may be unwilling to acknowledge the significant contributions of co-authors, research assistants, or collaborators, weakening the collaborative nature of research (Palla & Singson, 2022; Reisig et al., 2020). Given the information provided earlier, this study explored the relationship between the Fraud Pentagon and research misconduct. Consequently, the connection is delineated as follows:

H1: The Pentagon Fraud is correlated to research misconduct.

METHODOLOGY

Data

The target population for this study included the academic community, particularly lecturers in all tertiary institutions across Indonesia, totaling 296,040. (https://pddikti.kemendikbud.go.id accessed March 6, 2021). The sampling was determined by non- probability sampling with the type of convenience sampling (Sekaran & Bougie, 2016). From all the questionnaires distributed, 136 were returned by the respondents. Furthermore, one data was omitted due to incomplete data entry. In the end, 135 respondent data were used in this observation.

The data was collected in March-November 2021. Additionally, participants in this study were current academics or lecturers in Indonesia. These research subjects were chosen based on their ease of access and availability to the researchers. In this investigation, data analysis employed canonical correlation to assess the hypothesis. Canonical correlation was selected due to the fundamental multivariate analysis method, where correlations are derived between latent variables through a linear decomposition of multivariate data to maximize correlation.

This study employed the survey methodology for data collection. A questionnaire was utilized and distributed to respondents online through Google. The decision to collect online data was driven by the constraints imposed by the COVID-19 pandemic, which restricted face-to-face interactions between researchers and respondents. Additionally, online data retrieval was justified by recognizing that online surveys had emerged as a prominent quantitative research method, offering advantages such as cost-effectiveness and efficiency (Vu & Hoffman, 2011).

Variables

The independent variable in this study was the Fraud Pentagon, formulated by Crowe (2011) The proxies for the Fraud Pentagon encompassed five dimensions: pressure, rationalization, opportunity, capability, and arrogance. Each proxy was assessed using a Likert scale ranging from 1 to 4, where respondents expressed their agreement levels, ranging from strongly disagree (1) to agree (4). Pentagon Fraud consisted of five elements: pressure, opportunity, rationalization, capability, and arrogance (Howarth, 2011; Dorminey et al., 2012). The indicators of the Pentagon Fraud variable referred to the previous study developed by (Achmada et al., 2020). Pressure was measured with seven items related to the urge that arose within a person because factors persuaded him to fulfill his needs. Opportunity was measured with eight items that reflected the likelihood of fraud not only if someone felt pressured but also if there was an opportunity for someone who is not under pressure. Rationalization was measured with five items related to a view that the person was trustworthy, even if the person concerned committed fraud, this does not make the person concerned consider themselves a fraudster, so if they are caught because of their fraud, they assumed that they were victims of a system or

environment that was not good or an environment that considered fraud to be ordinary. Capability was measured with thirteen items that reflected a person's ability to utilize their position, and he or she can be arbitrary in violating established rules and policies. Arrogance was measured with five items describing something that made a person feel that the rules in an agency did not apply to him; generally, the more powerful a person is, the more he acted as if no rules apply.

Research misconduct in this study was measured by a Likert scale of 1-4 (never, seldom, sometimes, often). The indicators of this variable referred to a previous study developed by (Reisig et al., 2020). Data fabrication is characterized by the creation of data or results, followed by their documentation or reporting. This aspect of fraud was measured in this study using five survey items that signified instances of fraudulent data creation. On the other hand, data falsification involves the manipulation or deletion of data with fraudulent intent, and this dimension was gauged using four items.

Plagiarism encompasses taking others' words, ideas, research findings, and textual recycling. Plagiarism was measured with five items that reflected the actions in presenting or publishing another study without giving appropriate credit. Authorship fraud is a behavior related to authorship credit, such as gift and ghost authorship. Five items measured authorship fraud, representing the misconduct in giving the author contribution. Fraud in publication encompasses elements indicative of intentional deceit occurring throughout publishing. The assessment of publication fraud comprised four items that depicted instances of misconduct in publishing, such as the omission of conflicts of interest, failure to disclose funding sources, or the simultaneous submission of a manuscript under review to multiple journals. The final indicator, grant fraud, is providing misleading information to the government about using funds received as an award. The measurement of grant fraud involved seven items representing a researcher's misconduct in reporting grant-related activities. There were 66 survey items in this research, which can be viewed in Appendix 1.

RESULT AND DISCUSSION

Result Analysis

Validity test

The item validity test evaluates a data instrument to determine how accurately an item measures its intended construct. An item is deemed valid when it demonstrates a noteworthy correlation with the overall score, indicating its effectiveness in revealing the intended information. Typically presented as questions or statements in a questionnaire addressed to respondents, these items aim to unveil specific aspects or insights (Mel & Hin, 2014).

A variable is deemed valid in the validity test if it meets specific criteria. Further analysis is warranted if it satisfies the conditions stipulating that the Keiser-Meyer-Olkin (KMO) and Measures of Sampling Adequacy (MSA) value in the KMO and Bartlett's Test column must be equal to or greater than 0.500. The probability level (sig) should be equal to or less than 5% (0.05) (Hair Jr et al., 2014).

Subsequently, the examination involves inspecting the Measures of Sampling Adequacy (MSA) value in the Anti-Image Correlation column to determine the validity of each item. An MSA value exceeding 0.5 suggests the validity of the items, warranting further analysis.

Table1: Validity Test Results

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measures of Sampling Adequacy.		0897
Bartlett's Test of Sphericity	approx. Chi-Square	2761828
	df	231
	Sig.	0.000

Reliability Test

The outcomes of the reliability examination in this study are presented in the Table below.

Table 2: Reliability Test Results

Case Processing Summary			
		N	%
Cases	Valid	112	100.0
	Excluded	0	0.0
	Total	112	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.961	22

All the instruments were deemed reliable according to the reliability test data processing results, as they exhibited a Cronbach's alpha value exceeding 0.60. With all statement items demonstrating reliability, it was inferred that this research instrument could be repeatedly employed to measure the same construct, yielding consistent data.

Descriptive Statistics

The tabulated data processing outcomes and statistical description of the data analysis are presented in Table 3 below.

Table 3: Results of Descriptive Statistics

	Construct	M	SD	1	2	3	4	5
1	Arrogance	1.1	0.29	1				
2	Authorship	1.38	0.41	0.380**	1			
3	Capabilities	1.16	0.35	0.712**	0.502**	1		
4	Fabrication	1.34	0.49	0.310**	0.278**	0.366**	1	
5	Falsification	1.32	0.48	0.480**	0.339**	0.519**	0.582**	1
6	Grant	1.32	0.4	0.532**	0.505**	0.692**	0.381**	0.424**

7	Opportunities	1.27	0.5	0.525**	0.351***	0.812**	0.326**	0.480**
8	Plagiarism	1.26	0.34	0.627**	0.519**	0.522**	0.360**	0.438**
9	Pressure	1.26	0.49	0.505**	0.485**	0.781**	0.408**	0.494**
10	Publications	1.21	0.36	0.534**	0.521**	0.395**	0.281**	0.286**
11	Rationalization	1.32	0.57	0.514**	0.470**	0.850**	0.374**	0.463**

Note: M = Mean, SD = Standard deviations 1 = Arrogancy, 2 = Authorship, 3 = Capability, 4 = Fabrication, 5 = Falsification, 6 = Grant, 7 = Opportunity, 8 = Plagiarism, 9 = Pressure, 10 = Publication, 11 = Rationalization. **. Correlation is significant at the 0.01 level (2-tailed).

	Construct	6	7	8	9	10	11
1	Arrogance						
2	Authorship						
3	Capabilities						
4	Fabrication						
5	Falsification						
6	Grant	1					
7	Opportunities	0.689**	1				
8	Plagiarism	0.448**	0.468**	1			
9	Pressure	0.699**	0.823**	0.468**	1		
10	Publications	0.464**	0.262**	0.600**	0.366**	1	
11	Rationalization	0.669**	0.821**	0.421**	0.815**	0.266**	1

Note: M = Mean, SD = Standard deviations 1 = Arrogancy, 2 = Authorship, 3 = Capability, 4 = Fabrication, 5 = Falsification, 6 = Grant, 7 = Opportunity, 8 = Plagiarism, 9 = Pressure, 10 = Publication, 11 = Rationalization. **. Correlation is significant at the 0.01 level (2-tailed).

Table 3 provides an overview of the descriptive statistics in this study. The variables exhibited the following mean or average values: arrogance 1.10, authorship 1.38, capability 1.16, fabrication 1.34, falsification 1.32, grant 1.32, opportunity 1.27, plagiarism 1.26, pressure 1.26, publication 1.21, and rationalization 1.32. Simultaneously, the standard deviation for each variable is as follows: arrogancy 0.29, authorship 0.41, capability 1.16, fabrication 1.34, falsification 1.32, grant 1.32, opportunity 0.50, plagiarism 0.34, pressure 0.49, publication 0.36, and rationalization 0.57.

Data Analysis

This investigation employed canonical correlation analysis, a statistical technique to explore the connection between independent variables (X1, X2, ..., Xp) and dependent variables (Y1, Y2, ..., Yq). This analytical approach assesses the proximity of the relationship between a set of dependent and independent variables. Additionally, canonical correlation analysis elucidates the structural relationship within the cluster of independent variables. It primarily focuses on the correlation between the linear combinations of sets of dependent variables and the linear combinations of groups of independent variables (Hotelling, 1936). Canonical correlation analysis represents a multiple regression analysis with q-dependent and p-independent variables. The model is as follows:

$$\underset{\text{Matriks}}{Y_1, Y_2, \ldots, Y_q} \quad = \quad \underset{\text{Matriks}}{X_1, X_2, \ldots, X_p}$$

Whereas:

Y1: Data Manipulation (data fabrication)
Y2: Providing wrong information (data falsification)
Y3: Plagiarism (plagiarism)
Y4: *Authorship Fraud*
Y5 : Funding fraud (grant fraud)
X1 : Pressure
X2 :Opportunity
X3 :Rationalization
X4 :Capability
X5 :Arrogance

The establishment of the canonical function is used as a function determination that can be further analyzed to interpret the results of the Canonical variables. In the equation (model) of this study, there were five dependent variables and five independent variables, so two canonical functions were formed as follows:

Table 4: Eigenvalues and Canonical Correlations

Eigenvalues and Canonical Correlations					
Root No.	**Eigenvalue**	**Pct.**	**Cum. Pct.**	**Canon Cor**	**sq. Cor**
1	2.09340	83.56878	83.56878	0.82264	0.67673
2	0.32805	13.09595	96.66473	0.49701	0.24702
3	0.07600	3.03385	99.69858	0.26576	0.07063
4	0.00642	0.25633	99.95490	0.07988	0.00638
5	0.00113	0.04510	100,00000	0.03359	0.00113

The analysis revealed that the 1st function encompassed 83.568% of the canonical relations, with the 2nd function comprising 12.095%. The 3rd function accounted for 3.038%, the 4th function adjusted to 0.236%, and the 5th function covered 0.0451%. The canonical correlation in the 1st function (0.822) was significantly higher than that in the 2nd function (0.497), followed by the 3rd function (0.256), the 4th function (0.079), and the 5th function (0.033). Data analysis as shown in Table 4 demonstrated that all constructs related to the Pentagon Fraud exhibited a correlation or relationship with research fraud. Notably, pressure showed a more robust correlation with research fraud than other constructs, supporting the research hypothesis.

Table 5: Dimension Reduction Analysis

Dimension Reduction Analysis					
Roots	**Wilks L.**	**F**	**Hypoth. DF**	**DF errors**	**Sig. of F**
1 TO 5	0.22456	6.12688	30.00	406.00	0.000
2 TO 5	0.69455	1.97043	20.00	339.25	0.008
3 TO 5	0.92240	0.70479	12.00	272.80	0.747
4 TO 5	0.99250	0.13076	6.00	208.00	0.992
5 TO 5	0.99887	0.05931	2.00	105.00	0.942

Test results above showed that the first and second functions could be processed further because the significance values were 0.000 and 0.001 ($p < \alpha$), while the third to fifth functions could not be processed further because the significance values were more than 0.05 ($p > \alpha$).

Table 6: Multivariate Tests of Significance

Multivariate Tests of Significance (S = 1, M = 2, N = 49 ½)					
TestName	**Value**	**Exact F**	**Hypoth. DF**	**DF errors**	**Sig. of F**
Pillars	0.16930	3.43072	6.00	101.00	0.004
Hotellings	0.20381	3.43072	6.00	101.00	0.004
Wilks	0.83070	3.43072	6.00	101.00	0.004
Roys	0.16930				

Note. F Statistics are exact.

Based on the results of the significance test above, it was seen that all the p values <0.05, so collectively, the canonical functions were significant.

Discussions

The data analysis results represented that pressure had a more excellent correlation value based on canonical correlation results than 0.822, which meant that pressure had the most substantial relationship with research fraud. In contrast, opportunity had a correlation value of 0.497, which meant that the probability only had a strong relationship of 0.497. Rationalization had a relationship of 0.265. Capability has a relationship of 0.798, and the weakest relationship was arrogance, equal to 0.0335. Furthermore, based on the significance test, all significance values in the research data were below 0.05, so it was interpreted that there was a characteristic relationship between Pentagon Fraud and research fraud.

Pressure exhibited the highest correlation value, signifying a robust linear relationship between pressure and research fraud. According to the Minister of Research, Technology and Higher Education No. 44 of 2015, lecturers are recognized as professional educators and scientists tasked with transforming, advancing, and disseminating science and technology through education, research, and community service. The regulation also outlines the lecturer's workload, encompassing core activities such as facilitating the learning process, engaging in research, and providing community service. Additionally, the research contributes to lecturer certification allowances. The presence of these regulations may exert pressure on lecturers to undertake research, potentially leading to instances of research fraud.

Furthermore, the pressure to obtain funding or research grants and the accompanying publication requirements have created conditions that lead to research fraud. Harveys (2020) explained that the complexity of the reasons for the occurrence of research fraud was due to one of the reasons for the pressure for the marketization of higher education, competition for research grants, and demands for publish or perish, ultimately creating a condition where the occurrence of research fraud became an understandable thing.

Capability had a substantial correlation value after stress. Capability can occur if an individual has the ability and resources to commit fraud. This can happen in authorship fraud, namely research fraud, that occurs in writing the name of a publication. Research conducted by Orhan (2021) explained that one of the frauds in a study is in the form of inappropriate authorship, which can be in the form of honorary authorship or the structure of authorship in the form of gifts given to individuals who do not contribute to research and article writing. This dynamic often places junior researchers vulnerable, as they are anticipated (and occasionally compelled) to comply with hierarchical and positional authority. In contrast, senior researchers remain unaffected by the potential harm to scientific integrity from rule breaking (Vazire, 2020).

In this study, rational had the lowest correlation value with research fraud, meaning that research respondents did not commit research fraud despite research pressure. On the contrary, the result showed rationalization would follow pressure (Puspitha Yessi & Yasa, 2018). In general, the condition of the existence of pressure above caused the occurrence of research fraud. The above also became the rationalization of an academic in committing fraud. The existence of demands to publish in indexed international journals and accredited national journals can be a rationalization for academics to commit fraud so that publication goals can be achieved. Research fraud in data fabrication and data falsification is often carried out so that articles can be accepted for publication in indexed international journals or accredited national journals (Nurunnabi & Hossain, 2019). Research deception is a consequence or rational response to conforming to a dysfunctional research environment (Herndon, 2016).

Meanwhile, arrogance can lead to behavior that states that the rules do not apply to the individual. This can happen because the system then

creates a dangerous environment that can tarnish the integrity of academics in terms of research, where short-term individual interests take precedence. Long-term institutional goals are sidelined (Aubert Bonn et al., 2017). The research data explained that arrogance had the lowest correlation value to research fraud, meaning that the arrogance of the academics who were the respondents in this study had an intense relationship with research fraud. The result was supported by data on the functional position level of the respondents, in which most respondents were in the active position of expert assistant, namely 43.7%, with a working period of 1-5 years. With this available position and term of office, not many respondents occupied structural positions. Hence, the respondents' arrogance level was not yet strong enough to act arrogantly based on strength and power.

Research fraud has generally increased (Harvey, 2020b; Holtfreter et al., 2019; Pratt et al., 2019; Reisig et al., 2020). However, there has been no firm action against behaviour in research fraud, and many of the investigations have not been disclosed transparently to the public (Orhan, 2021). This also happened in Indonesia when the slow handling of cases has led to increased research fraud (Rustad, 2018).

CONCLUSIONS

This research provides a unique perspective on the occurrence of research fraud. First, this study focussed on disclosing research fraud within the Pentagon Fraud frame based on the construct developed by Crowe (2011). Second, the analysis showed a correlation or relationship between the Pentagon Fraud construct and research fraud. Pressure had the most robust correlation value with research fraud compared to the other four aspects. The second correlation was opportunities, followed by rationalization and capability. The weakest relationship was in the aspect of arrogance. In addition, the significance test results showed all significance values in the research data, so it can be interpreted that there was a characteristic relationship between Pentagon Fraud and research fraud.

Academic fraud can potentially damage ethics, morals, and intellectual culture in Indonesia and one of the academic frauds is research fraud. The results showed that there was a significant characteristic relationship between

Pentagon Fraud and research fraud. The most substantial relationship between Pentagon Fraud and research fraud was in pressure, which can be interpreted as someone's pressure when conducting research is the first reason for conducting research fraud. There are several limitations to this study, and one of the potential limitations concerns the survey response rate. Several ways have been carried out to improve survey responses, such as personally sending private messages to respondents. However, the survey response rate must still be higher than research expectations. Furthermore, the limitations on survey respondents, the majority of respondents were in the functional position of expert assistants, which can affect research data on indicators of capability and arrogance.

This observation contributes to the broader literature on research misconduct in Pentagon Fraud multidimensions. Moreover, the outcomes of this investigation can lead as practical implications, as a foundation for formulating research policies, to mitigate undesirable conduct among future researchers.

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APPENDIX 1. SURVEY ITEMS

No.	Variables	Indicators	Survey items
1.	Research Misconduct	Data Fabrication	1. I manipulated my research data 2. I fabricate data to align research results with the research objectives 3. Fabrication is part of the grant proposal to make it more competitive 4. I manipulated the results of the pilot study to make it more appealing to funding agencies 5. I conduct research where data collection has never taken place
		Data falsification	6. I provide false information (data falsification) in my research 7. I delete data to produce the desired research outcome 8. I alter values to achieve the desired results 9. I report inaccurate research results and do not disclose them in the research findings
		Plagiarism	10. I commit plagiarism 11. I use another author's language without proper citation 12. I present tables, graphs, and images without providing appropriate citations 13. I publish research that has been previously published under a different title in another journal 14. I publish research results that have been previously published under another title in a foreign language
		Authorship Fraud	15. I engage in Authorship Fraud 16. I receive authorship credit on paper without making a substantive contribution 17. I fail to give authorship credit to someone who has made a substantive contribution 18. I arrange the authorship order in a way that does not reflect each author's contribution 19. I do not receive authorship credit on paper after making a substantive contribution
		Publication Fraud	20. I publish research results without following the proper procedures 21. I submit a paper for publication that is currently under review in another journal 22. I do not publish research results due to pressure from the funding agency 23. I intentionally do not mention the source of funding when publishing a research
		Grant Fraud	24. I commit research grant fraud 25. I use grant funds for personal purposes; I allocate grant funds for fictitious activities 26. I submit false financial reports to the funding agency 27. I use grant funds to attend a conference but do not participate; I apply for a grant to carry out work that is already completed 28. I use funds from one source to pay personnel working on research or activities unrelated to it

No.	Variables	Indicators	Survey items
2	Pentagon Fraud	Pressure	29. I engage in research misconduct due to financial reasons 30. I commit research misconduct because the research/article is difficult to work on/complete 31. I engage in research misconduct to ensure my research/article is completed on time 32. I commit research misconduct to ensure my research/article does not violate the contract 33. I engage in research misconduct to improve the quality of my research/article 34. I commit research misconduct to meet the established standards for my research/article 35. I engage in research misconduct to achieve the expected outcome of my research/article
		Opportunity	36. I engage in research misconduct because there are no controls to prevent the dishonest behavior I engage in 37. I commit research misconduct because there are no controls to detect the dishonest behavior I engage in 38. I engage in research misconduct because no one checks the research/article I work on 39. I commit research misconduct because there is no supervision over the research/article I work on 40. I engage in research misconduct because there are no sanctions 41. I commit research misconduct because the sanctions are not severe 42. I engage in research misconduct because there are no detailed and strict rules regulating it 43. I commit research misconduct because it is very easy to do with the support of internet facilities
		Rationalization	44. I engage in research misconduct because there is no one harmed by my actions 45. I commit research misconduct because it is considered common and acceptable in my environment 46. I engage in research misconduct because the ultimate goal is for the greater good 47. I commit research misconduct because others are doing the same as I am 48. I engage in research misconduct as a form of solidarity with my colleagues

No.	Variables	Indicators	Survey items
		Capability	49. I engage in research misconduct because my position allows me to do so 50. I commit research misconduct because my knowledge and understanding enable me to perceive the situation 51. I engage in research misconduct because my creativity allows me to see the situation 52. I commit research misconduct because I am confident that no one can detect the misconduct I engage in 53. I engage in research misconduct because I am confident that no one dares to warn me 54. I commit research misconduct because I can influence others not to report my actions 55. I engage in research misconduct to cover up the research misconduct I committed previously 56. I commit research misconduct to ensure the previous research misconduct remains hidden (undetected) 57. I can control stress to prevent the research misconduct I engage in from being detected 58. The research misconduct behavior I engage in is the result of my ability to find loopholes 59. The research misconduct I commit is an illicit tool that I can control 60. The research misconduct I engage in is a strategy I use to achieve my desired goals 61. I commit research misconduct to cover up the research misconduct I committed previously.
		Arrogance	62. I engage in research misconduct because I have more power than my colleagues 63. I commit research misconduct because I am more senior than my colleagues 64. I engage in research misconduct to prevent my image from deteriorating in front of my colleagues 65. I commit research misconduct to maintain my achievements and reputation in front of my colleagues 66. I engage in research misconduct to gain recognition from my environment

Reference: Modified survey items from Reisig et al. (2020) & Achmada et al., (2020)