

Collusion Fraud Risk Mitigation with Integration of Data Analytics in E-Tendering

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ABSTRACT

There are already mandates and recommendations for detecting indications of tender collusion, but the risk of collusion in e-tendering has not been handled properly. Meanwhile, data analytics competency has become a prerequisite for successful digital transformation. This study aims to reveal the projection of data analytics integration in controlling collusion risk in e-tendering. This study uses a quantitative research method. The object of this study includes data on the risk of tender collusion and the KPPU's Decisions for 2021 and 2022. The results of this study reveal that the average similarity of bids is 0.5308, a parameter indicating the risk of collusion in tenders. Existing controls have not been effective in dealing with this risk. Control development can be designed by referring to KPPU regulations and recommendations to LKPP. Maximum control standards can be applied by developing preventive controls in the form of data analytics competence training for the Selection Committee so that they are able to detect indications of collusion in tenders. In addition, data analytics tools need to be integrated into e-tendering in the Electronic Procurement System (SPSE).

Keywords: Tender Collusion Risk, Control, Data Analytics.

1. INTRODUCTION

One of the major contributors to the country's economy is the procurement of goods / services (Arfanti, 2014). However, procurement can be a potential area for budget leakage (Faisol et al., 2014). In fact, the trend of corruption in procurement handled by the Corruption Eradication Commission (KPK) has also continued to increase (Kamal, 2019).

Prevention of fraud in procurement can be done by applying information technology, one of which is e-procurement through Electronic Procurement Services (LPSE) (Faisol et al., 2014; Febrina, 2017). However, tender collusion cannot be completely handled through e-procurement practices (Faisol et al., 2014). More than 80% of the total business competition violation reports received by

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the Indonesian Competition Commission (ICC/KPPU) are complaints related to tender collusion (Wisny, 2016).

In 2021, 65% of the total number of collusion investigations in business competition handled by the Indonesian Competition Commission (ICC/KPPU) KPPU was tender collusion cases. Meanwhile, there were 10 (39%) legal decisions of the 26 tender cases during 2021 (Kamal, 2022). In fact, the West Kalimantan Police have caught an Electronic Procurement Service (LPSE) official red-handed (Kiwi, 2022). This could be part of the signal that there is still collusion in tender, even though the information has not yet become a final legal decision.

Tender collusion can result in state losses (Munawir & Hasibuan, 2017) and obstacles for business people who do not commit collusion (Febrina, 2017). From the perspective of the socio engineering system, tender collusion can also result in construction failures (Saputra et al., 2016). In addition, spending the budget through e-procurement is often carried out irresponsibly (Febrina, 2017; Keintjem, 2016). In fact, procurers can obtain unfair profits because the bid price becomes abnormal (Febrina, 2017; Keintjem, 2016; Saputra et al., 2016). This loss can be a burden to the wider community (Keintjem, 2016).

The results of previous research indicate that there have been several discussions regarding the criteria and impact of tender collusion, the mode of collusion, efforts to prevent collusion, and law enforcement against tender collusion. Research conducted by Ustien, (2019) reveals the criteria for actions that can be categorized as tender collusion. According to Suryoprayogo (2022), as a consequence, the commitment-making official (PPK) can terminate the contract resulting from the tender collusion. From 2015 to 2018, it was found that 57% of unfair competition was a tender collusion (Purwadi, 2019). The modes of tender collusion include the same Internet Protocol (IP) address and mechanisms outside the e-tendering

system (Wulan et al., 2019), association engagement (Suradiyanto & Pratiwie, 2020), and vertical and horizontal collusion (Manihuruk et al., 2016).

Tender collusion can be prevented by using information technology in tender implementation (Suhermin, 2012). According to Febrina (2017), tender collusion can be prevented by creating an atmosphere of competition through procurement services. However, e-tendering has no effect on preventing tender collusion (Faisol et al., 2014). Sociologically, technical and non-technical obstacles can open up opportunities for tender collusion (Arfanti, 2014). In addition, there are still several regulations that conflict with the principle of competition, such as the requirement to appoint a subsidiary within a State-Owned Enterprise (Maria & Anggraini, 2013). The description above shows that there is still a research gap on the prevention of tender collusion.

Previous research also revealed the handling of tender collusion by referring to the Law of the Republic of Indonesia Number 5 of 1999. The law strictly regulates the prohibition of unhealthy conspiracy and its law enforcement (Keintjem, 2016). The elements of tender collusion must be proven adequately (Munawir & Hasibuan, 2017). In enforcing the law, the Indonesian Competition Commission (ICC/KPPU) can give administrative sanctions to the perpetrators of tender collusion (Fitriani, 2021; Made, 2021; Maheswari, 2020; Wisny, 2016). Meanwhile, in dealing with tender collusion related to criminal acts of corruption, the Indonesian Competition Commission (ICC/KPPU) will cooperate with the Corruption Eradication Commission (KPK) (Ferdinand et al., 2020). There is also research that reveals the limitations of ICC's authority in law enforcement against procurement actors who are not bidders (Dwi Prabawa & Hadi, 2018). Detailed competition regulations in e-tendering can reduce tender collusion (Andriana, 2021; Ma et al., 2022; Sirait, 2020; Wibowo, 2021). This condition also reveals that there is a

gap in research related to the handling of tender collusion.

Tender collusion is also part of the fraud risks in procurement with the highest level (Kamal & Elim, 2021). However, on the LKPP website, the tender collusion risk is not yet part of the risk list in the Risk Management Document of Procurement Work Unit (MR UKPBJ). Procurement actors are not yet independent and professional so that it becomes one of the challenges for the national strategy for preventing corruption (Stranas PK) in the field of procurement.

In fact, there is already a mandate regarding risk assessment and handling in Government Regulation Number 60/2008 concerning Government Internal Control System (SPIP) and the mandate of the Risk Management of Procurement Work Unit (UKPBJ MR) in Indonesian Procurement (LKPP) regulation number 10/2021 concerning Procurement Work Unit (UKPBJ). There is also a policy mandate for the use of information technology in the procurement of goods/services. In addition, competence in big data analytics is an important requirement to be able to play a role in digital transformation (Oktorialdi, 2019). However, the government procurement (PBJP) actors still work by relying on the electronic procurement system (SPSE). Data analytics competence has not been integrated into the tender process to handle the risk of tender collusion.

2. LITERATURE REVIEW AND HYPOTHESIS

Law Number 5 of 1999, concerning the prohibition of monopolistic practices and unfair business competition, explains, in Article 1 point 8, that a collusion or business collusion is a form of cooperation between business actors with the aim of controlling the relevant market for the interests of the colluding business actors. Meanwhile, the notion of colluding is a person who participates in a conspiracy to commit a crime or fraud and so on. If the prospective providers or bidders

conspire, the prospective providers may be subject to sanctions in the form of, among other things, failing the tender process and being proposed to be blacklisted. (Keintjem, 2016). Collusion can result in unfair competition (Wisny, 2016), thereby injuring the principle of competition because it creates pseudo-competition (Anindyajati, 2018).

There are several categories of tender collusion: horizontal collusion, vertical collusion, and/or horizontal-vertical collusion. Horizontal collusion is collusion between business actors/service providers. Vertical collusion is collusion between one or several business actors and the tender committee. Meanwhile, horizontal-vertical collusion is collusion among business actors, other business actors, and the tender committee (Anindyajati, 2018; Febrina, 2017)

Indications of tender collusion can be identified through an analysis of the results of law enforcement or analysis of KPPU legal decisions (Wisny, 2016). Tender collusion is part of the integrity risk in the procurement process (OECD, 2016). To detect the risk of fraud in the form of collusion, procurement management can apply machine learning (ML) (García Rodríguez et al., 2022) and data analytics in e-tendering (Kamal & Elim, 2021). There are two data analytics techniques that can be used: statistical techniques and visualization techniques (CAGI, 2017) which can be applied to descriptive, diagnostic, predictive, and prescriptive analysis (principa.co, 2017).

The application of data analytics can optimize procurement performance. Descriptive, predictive and prescriptive analytics are useful in improving the quality of information about the procurement environment and patterns related to procurement (Hallikas et al., 2021). In addition, the purpose and type of data analytics need to be considered in the application of data analytics techniques (Jugulum, 2016). There are several examples of implementing data analytics, such as fraud analytics (Baesens

et al., 2015) and fraud risk management (Horsey, 2017). Data analytics can also be used to detect indications of fraud by analyzing several anomalies in the data (Banarescu, 2015; Gee, 2015; IIA, 2017) and uncover corruption schemes through the association analysis of some transaction data (Gee, 2015).

The use of data analytics can help uncover the risks of collusion in road construction tenders in Poland (Anysz et al., 2019), and score collusion risk in tender in Korea by assigning its attributes based on law enforcement experience (OECD, 2017). There are several options for analytical techniques. The first option is Rules-based Analytics. This technique requires the role of human resources (HR) to identify rules first before implementing data analytics. Rules can be in the form of red flags and or certain restrictions from procedures/regulations. The second option is Distributional Analytics. This technique uncovers several anomalies in the distribution of the data population. The third option is Predictive Analytics. This technique uses historical data to predict possible future events. And the fourth option is Linkage/Social Network Analytic. This technique analyzes unstructured data through network and or social connectivity (Phillips & Lanclos, 2014).

There is no research that reveals the design of controls in e-tendering and projections of the application of data analytics to detect the risk of fraud in the form of collusion. In fact, there is already a mandate to increase the use of information technology in government procurement. The need for the use of information systems must be adjusted to the development of business scale and data complexity in the 4.0 era. This has consequences for the urgency of using methods or techniques according to the digital transformation mandate (Bagas, 2018).

The description above and several previous studies have not revealed the ideal control and data analytics integration to deal with the risk of fraud in the form

of tender collusion. Therefore, this study focuses on the integration of data analytics as part of internal control to handle the risk of tender collusion. The research question posed is: what is the description of the control design for collusion risk in the current e-tendering? And what is the description of the integrated data analytics control over the risk of collusion in e-tendering? The purpose of this study is to reveal an overview of the integration of data analytics in controlling the risk of fraud in the form of collusion in e-tendering.

3. METHODS

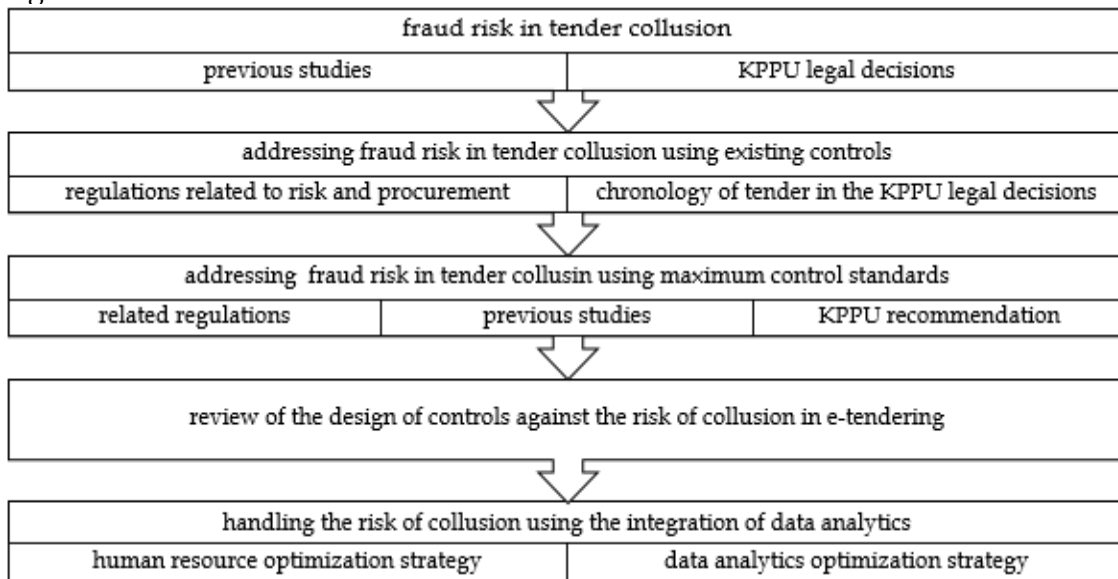
This study uses quantitative methods with data analytics techniques in the form of statistical and visualization techniques (CAGI, 2017) supported by literature, normative, prospective and retrospective studies. The statistical techniques used are descriptive statistics in MS excel and decision trees in the RapidMiner application. Literature study is carried out by reviewing literature and papers related to the research objects (Arikunto, 2014). Normative study is carried out by referring to regulations related to research objects. Prospective study is used for risk analysis in tender collusion (Kamal & Elim, 2021). Meanwhile, retrospective study is carried out through an analysis of the 2021 and 2022 KPPU legal decisions related to the tender collusion on the website; Salinan Putusan Perkara 25-KPPU-I-2020.pdf. (Figure 1).

4. RESULTS AND DISCUSSION

Tender Collusion Risk

Several signals of the possibility of horizontal tender collusion risks can be identified through: the rotation of bids between tender winners in several tenders (Keintjem, 2016; OLAF, 2017), association between several partners in several tenders (Anysz et al., 2019), single winner or low-bid partner (OECD, 2017; Vadász et al., 2016) or the number of bidders is 4 or less (Anysz et al., 2019), there is a provider cluster distribution (Vadász et al., 2016).

Figure 1. Research Process



Source: Processed Data

Figure 2. Fraud Risk in E-Tendering

No.	Risk Description	Likelihood	Impact	Risk Level
1	Collusion between providers in e-tendering/e-selection	2,7571	3,2857	9,06 *)
2	Insider trading or interest conflict in the form of Working Groups/ PPK/KPA/PA that have personal interest in one or several prospective providers of e-tendering/e-selection	2,6929	3,3571	9,04
3	Theft of leakage of Owner Estimate (HPS) details for the benefit of potential providers/e-tendering/e-selection participants	2,7071	3,0857	8,35
4	Misuse of user ID in e-tendering/e-selection	2,4500	2,9786	7,30
5	Data manipulation or e-tendering/e-selection winners	2,3714	3,0643	7,27
6	Information is accessed by unauthorized parties in e-tendering/e-selection	2,2857	2,9214	6,68
7	Cybercrime, piracy, hacker or vandalism in e-tendering/e-selection	1,9714	2,7429	5,41

*) Objek penelitian

Source: (Kamal & Elim, 2021).

The tender collusion risk level of 9.06 is shown in table 1. This level is greater than 4, which means that it needs handling (Kamal & Elim, 2021). The collusion risk in Figure 2 is horizontal collusion because those who conspire are fellow bidders (Anindyajati, 2018; Febrina, 2017). The tender collusion risk level needs to be reviewed.

This high level of risk needs to be reduced to an acceptable or tolerable level of risk (LKPP, 2016). Referring to PP 60/2008, risk assessment is a source of information for developing control activities. Therefore, this level of risk

needs to be handled / controlled both at its likelihood level and at its impact level.

Control activities should principally address the sources of risk and the impact of risks. Handling the source of risk means to prevent risks from occurring through preventive controls. Thus, it is hoped that the likelihood of occurrence will be low, or even the cause of the risk can be eliminated. Mitigating the impact of risk means anticipating what must be done if the risk occurs through detection controls and or alternative controls. This needs to be done so that the impacts that arise can be minimized (BPKP, 2015).

The process of evaluating risk controls needs to be carried out by reviewing existing controls, reviewing maximum control standards, and analyzing gaps from the two previous studies (BPKP, 2015), as shown in Figure 3.

Handling Collusion Fraud Risk using Existing Controls

The design of the existing controls can be reviewed and identified from Presidential Regulation 16/2018 jo 12/2021 and other related regulations. Some of these regulations disclose electronic tendering mechanisms and procedures. Meanwhile, a review of the tender process contained in the KPPU’s decision regarding tender collusion can be a representation of the implementation of existing controls. The KPPU’s decision reveals the chronology of the tender practices. The results of the analysis show that the implementation of the existing controls consists of arithmetic corrections, administrative evaluations, technical evaluations, price evaluations, and verification of qualifications. The existing controls are carried out one by one or applied to each bidder (Kamal, 2022).

Meanwhile, procurement regulations reveal the mandate for the imposition of sanctions on providers if there are indications of collusion with other participants to set bid prices or indications of corruption, collusion and/ or nepotism in the selection of providers. Thus, procurement actors or Selection

Committee should test the existence of these indications (Kamal, 2022). Judging from the KPPU’s decision (Figure 4) which revealed evidence of at least 9 (nine) “similar” bids, the Selection Committee needs to make a comparison of the bids between bidders.

Therefore, the residual risk from collusion fraud risk in the tender is still above the risk appetite (figure 5). The figure reveals that the residual risk is not yet in the risk appetite because the existing controls have nothing to do with efforts to compare bids between bidders. It can be concluded that the existing controls have not been effective in dealing with the risk of tender collusion (Kamal, 2022).

Handling Collusion Fraud Risk using Standard Maximum Control

In Decision Number 04/KPPU-L/2020 it is stated that according to the Presidential Regulation regarding procurement, if there are two indications of unfair business competition in the procurement of goods and services, the tender should be declared a failure. Controls need to be optimized to find these indications.

The 11 decisions of KPPU (Figure 4) reveal that there are at least 9 (nine) modes of “similarity in bids” with a mean value of 0.5308 per decision (Figure 6). This shows that the risk of collusion fraud can be identified with an average similarity in bids above 50%.

Figure 3. Risk Control Evaluation Process



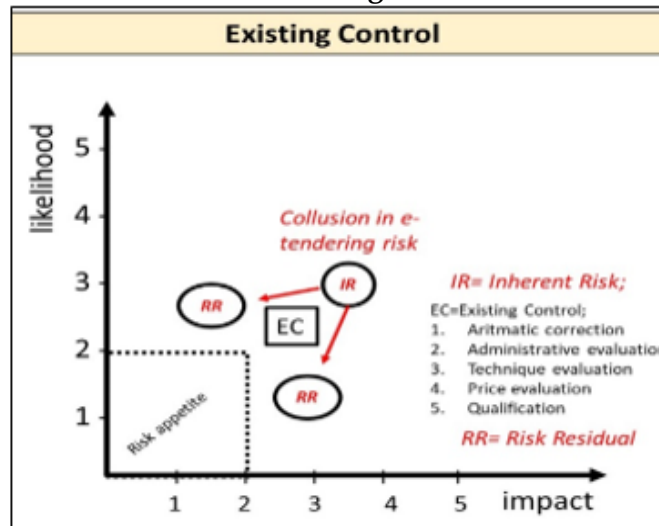
Source: (BPKP, 2015)

Figure 4. List of Similarities in Tender Collusion from KPPU’s 11 Decisions

no.	Nomor Putusan	provinsi	persekongkolan	horizontal	vertikal	kesamaan metadata	kesamaan IP Address	kesamaan pengurus/karyawan	kesamaan alamat	kesamaan pengetikan &/kesalahan pengetikan	kesamaan dokumen penawaran	kesamaan dokumen RK3K	kesamaan perhitungan TKDN	kesamaan dukungan	Jumlah kesamaan	% dari total kesamaan
1	25/KPPU-V/2020	Jawa Timur	terbukti	1	1	1	1	1	1	1	0	0	0	0	5	0,56
2	35/KPPU-V/2020	Nusa Tenggara Barat	terbukti	1	1	0	0	0	1	1	1	1	1	0	5	0,56
3	32/KPPU-V/2020	Jambi	terbukti	1	1	1	1	1	0	1	1	1	0	0	6	0,67
4	36/KPPU-V/2020	Riau	terbukti	1	1	1	0	0	0	1	1	1	0	1	5	0,56
5	24/KPPU-V/2020	Jawa Timur	terbukti	1	1	0	1	0	1	1	1	0	0	0	4	0,44
6	15/KPPU-V/2020	Jawa Timur	tidak terbukti	0	0	0	1	0	0	0	0	0	0	0		
7	28/KPPU-V/2020	Jawa Timur	terbukti	1	1	0	0	1	0	1	1	0	0	0	3	0,33
8	21/KPPU-V/2020	Sulawesi Tenggara	tidak terbukti	0	0	0	1	0	0	1	1	0	0	0		
9	04/KPPU-V/2020	Aceh	terbukti	0	1	1	0	0	0	1	1	0	0	1	4	0,44
10	05/KPPU-V/2020	Kalimantan Selatan	terbukti	1	1	1	1	0	1	1	1	0	0	0	5	0,56
11	30/KPPU-V/2019	Maluku Utara	terbukti	1	1	1	1	1	1	1	1	0	0	0	6	0,67
	total			8	9	6	7	4	5	10	9	3	1	2	47	
	% kejadian			72,73%	81,82%	54,55%	63,64%	36,36%	45,45%	90,91%	81,82%	27,27%	9,09%	18,18%		

Source: Processed Data

Figure 5. Processed Result of Presidential Regulation



Source: Processed Data

Meanwhile, the highest similarity weight is in the form of similarity in typing or typing errors with a value of 90.91%. This can also provide insight that the likelihood of collusion fraud in tenders is high based on the fulfillment of the parameters of typing similarity or typing errors and several other similarity combinations.

Therefore, maximum control standards for the risk of tender collusion must be developed for the detection of similarity in bids. Those who have the authority to carry out this detection are of course the Selection Committee of providers. In addition, several KPPU’s decisions (Figure

6) show that KPPU’s recommendations to LKPP have been disclosed in KPPU decisions regarding tender collusion cases which can be classified into 4 groups of recommendations (Figure 7).

The highest recommendation is to improve procurement regulations, especially to provide an accountable basis for the Selection Committee of providers in detecting indications of tender collusion. Meanwhile, the other 3 recommendations are closely related to the competence of human resources in procurement and in the implementation of electronic procurement system.

Figure 6. Descriptive Statistic “% Similarity in Bids”

% kesamaan penawaran	
Mean	0,530864198
Standard Error	0,03599353
Median	0,555555556
Mode	0,555555556
Standard Deviation	0,107980591
Sample Variance	0,011659808
Kurtosis	-0,008897677
Skewness	-0,501525274
Range	0,333333333
Minimum	0,333333333
Maximum	0,666666667
Sum	4,777777778
Count	9

Source: Processed Data

Handling Collusion Fraud Risk using Data Analytics Integration

Based on the 3 groups of recommendations related to HR in procurement, the development strategy needs to consider the existing electronic procurement system (SPSE). The Selection Committee of providers needs to get training related to competence in detecting collusion

indications in accordance with the competency needs of the digital era. The detection tool used must be integrated into electronic procurement system (SPSE). If the digital competence of the Selection Committee is good and the detection tools are also well designed, it is necessary to make technical guidelines for the detection of indications of fraud as a reference for the Selection Committee in determining providers.

To develop controls against the risk of tender collusion needs to optimize data analytics competence (Kamal & Elim, 2021). Data analytics competence is an important requirement to be able to play a role in the digital era (Oktorialdi, 2019). The application of data analytics requires human talent. Data culture must be built on human and organizational resources to increase organizational value (Grover et al., 2018). Therefore, goods and services procurement officials and government agencies must increase their data awareness and data analytics skills to be able to detect the risk of collusion fraud in e-tendering.

Figure 7. KPPU's Recommendation to LKPP Regarding Handling of Tender Collusion



Source: Processed Data

An Overview of Data Analytics in E-Tendering

There are several examples of using data analytics to detect collusion risks in tenders which can be used as ideas for integrating data analytics into e-tendering. In Korea, the integration of data analytics into the Bid-Rigging Indicator Analysis System (BRIAS) is carried out by automating the weight score of “the likelihood of bid rigging”. The attributes used come from an analysis of the results of law enforcement that ever existed. These attributes include the success rate of tender winners, few bidders, and non-competitive tender (OECD, 2017). This non-competitive tender is not explained in detail.

In Poland, an Artificial Neural Network (ANN) is used to predict the level of bid rigging. The results are in three categories: no collusion, there is an indication of collusion, and there is a strong indication of collusion occurring. The application of ANN is carried out using collusion parameters, such as a small number of tender participants, rotation of tender winners, and repetition of tender winners (Anysz et al., 2019). Based on KPPU’s recommendation to LKPP (KPPU, 2022), LKPP can adopt BRIAS or ANN as tools inherent in electronic procurement system (SPSE).

In addition, the Decision Tree (DT) can also be used to detect the likelihood of collusion risk. DT is used by dividing

decisions from actual events along predictable variables or attributes by sorting out between ‘fraud’ and ‘non-fraud’ or normal (Vadász et al., 2016). DT is part of machine learning which is user friendly and can be used without having to understand statistics and does not require complicated formulas (Lee et al., 2022). This study provides an overview of the application of DT with a dataset (Figure 8) which was developed from a study of KPPU decisions (Figure 4).

The results of DT machine learning in the RapidMiner application show that the accuracy of predicting the likelihood of collusion risk is 85% (Figure 4). The results of the DT visualization provide insight into the roots of the Decision Tree which shows that the prediction of tender collusion occurs when there is a similarity in typing/typing errors in the bid with a combination of:

- Similarity in bidding metadata, or
- There are no similarities in metadata, but there are similarities in IP addresses and bidders’ addresses

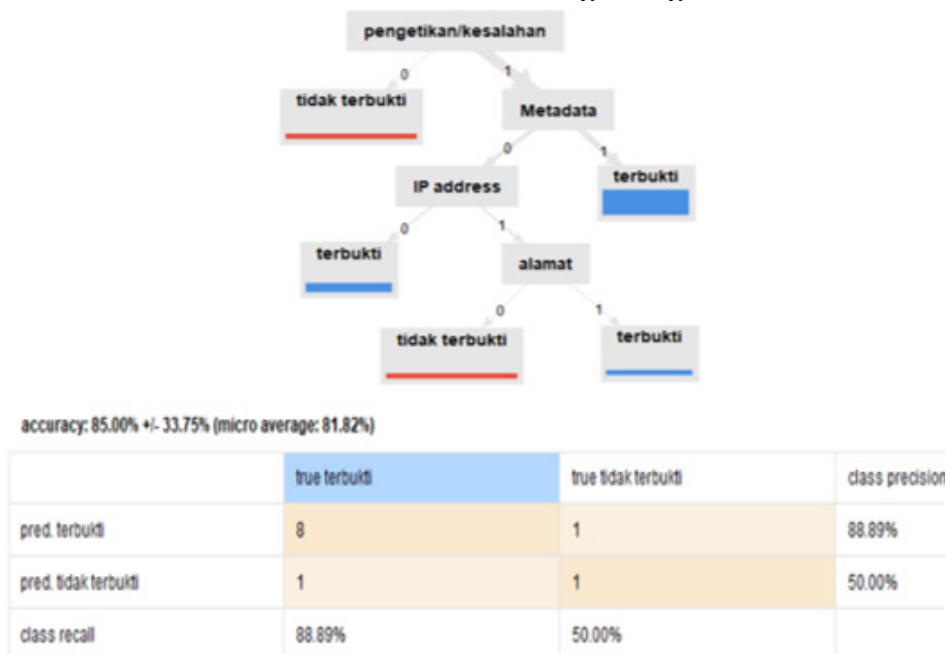
Some examples of the application of data analytics in e-tendering can be part of the ideas in developing of maximum control standards. Therefore, studies on control development can be carried out by combining the results of studies on existing controls and maximum control standards. This can be done through the comparison table 1.

Figure 8. DT Dataset from KPPU’ 11 Decisions Regarding Tender Collusion

putusan sidang KPPU	indikasi risiko persekongkolan berupa kesamaan-kesamaan								
	meta data	IP address	pengurus	alamat	pengetikan/ kesalahan	dokumen penawaran	dokumen RK3K	Perhitungan TKDN	surat dukungan
terbukti	1	1	1	1	1	0	0	0	0
terbukti	0	0	0	1	1	1	1	1	0
terbukti	1	1	1	0	1	1	1	0	0
terbukti	1	0	0	0	1	1	1	0	1
terbukti	0	1	0	1	1	1	0	0	0
tidak terbukti	0	1	0	0	0	0	0	0	0
terbukti	0	0	1	0	1	1	0	0	0
tidak terbukti	0	1	0	0	1	1	0	0	0
terbukti	1	0	0	0	1	1	0	0	1
terbukti	1	1	0	1	1	1	0	0	0
terbukti	1	1	1	1	1	1	0	0	0

Source: Processed Results of KPPU Legal Decisions 2021-2022

Figure 9. DT Dataset from KPPU' 11 Decisions Regarding Tender Collusion



Source: Processed Results of KPPU Legal Decisions 2021-2022

Table 1. Control Development

No.	Existing Control	Maximum Control Standard	Control Development	Reference
1	Arithmetic Correction Administration Evaluation Technical Evaluation Price Evaluation Evaluation Verification of Qualification	Arithmetic Correction Administration Evaluation Technical Evaluation Price Evaluation Verification on Qualification Detection of the similarity of bids between bidders Optimization of data analytics competencies	Requiring control development ; Detection of the similarity of bids between bidders Data analytics tools attached to the Electronic Procurement System (LPSE) Development of HR competencies regarding data analytics to detect risk of tender collusion	(Kamal, 2022) Perpres 16/2018 jo 12/2012 PP 60/2008 Rekomendasi KPPU ke LKPP di Putusan KPPU (lampiran 3 & 4) (Vadász et al., 2016) (OECD, 2017) (Anysz et al., 2019) Kamal & Elim, 2021 (Lee et al., 2022)

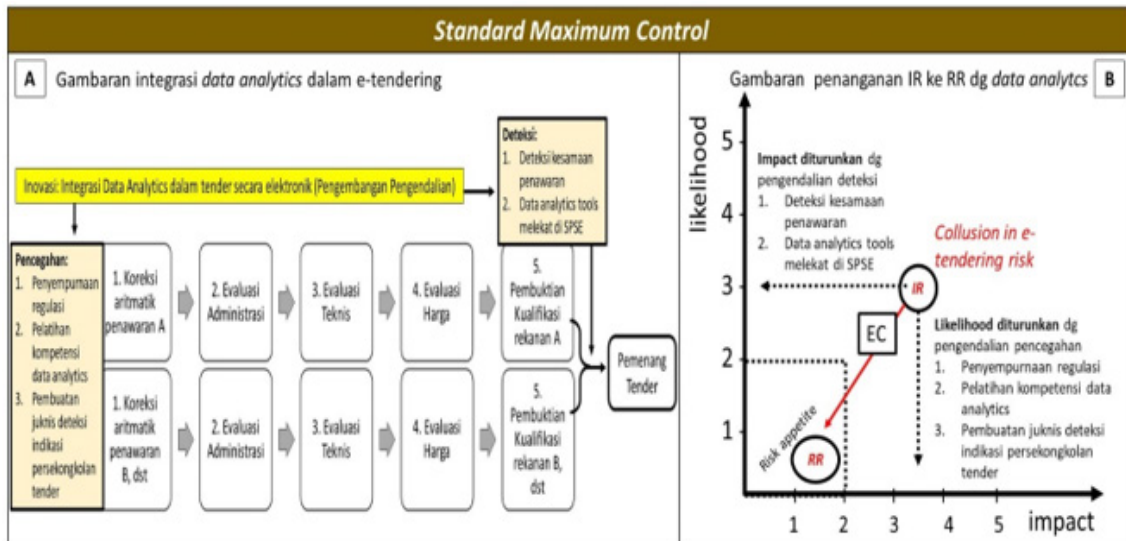
Source: Processed Data

Application of maximum control standard will be able to reduce the level of residual risk to the level of risk appetite. Figure 10 part A provides an overview of the application of data analytics integration in the electronic tender process. In this section it is revealed that preventive control is carried out prior to the implementation of the tender. Meanwhile, detection control is inherent in the tender process. As an idea, this example provides an illustration

of collusion risk detection which is carried out after verifying qualifications or before determining the tender winner.

Meanwhile, Figure 10 part B reveals the curve for handling tender collusion risk from the IR level to the RR level. Likelihood risk can be reduced by preventive controls. Meanwhile, the impact of risk can be reduced by detection controls. Data analytics competency training for the Selection Committee is part of prevention.

Figure 10. Maximum Control Standard



Source: Processed Data

Data analytics practice is part of detection control. Data analytics is developed to be an inherent part of the tender evaluation process.

5. CONCLUSION

The risk of collusion in e-tendering is the highest level of risk in procurement. The KPPU's decision reflects that collusion in tenders is still high. More than 50% similarity of bids is an indication of collusion risk. However, the existing control has not been able to handle this risk. Therefore, it is necessary to develop accountable controls. KPPU's decision review provides recommendations to LKPP to improve the collusion risk management system in tenders. Maximum control standard can be designed by developing data analytics competencies for procurement officers, especially the Selection Committee of providers. Data analytics tools to detect indications of collusion also need to be designed so that they are integrated with the electronic tender process in electronic procurement system (SPSE).

The results of this study support the results of research on fraud risk management strategies (Kamal & Elim, 2021), i.e, the description of the highest risk

mitigation. In addition, the findings of this study also support the results of previous research on the use of data analytics (Anysz et al., 2019; Lee et al., 2022; OECD, 2017; Vadász et al., 2016) in detecting the risk of collusion in tender (Anysz et al., 2019; OECD, 2017; Vadász et al., 2016).

It is hoped that the results of this research can be used to improve procurement policies, especially to support the achievement of the National Strategy for Corruption Prevention. Collusion will develop more dynamically, but many procurement actors are still not concerned with the development of a control system. Therefore, the findings of this study can be an innovative idea for realizing a credible and accountable procurement of goods/services.

The limitation of this research is that the KPPU's decision data still needs to be expanded and reproduced. In addition, the competence data of the Selection Committee of providers and procurement risk management in the work unit for the procurement of goods/services have not been included. This could be an opportunity for future research.

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