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Analysis Risk in the Contracting Business

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Abstract---The purpose of this article is to analyze the indicators and risk categories of contractor construction industry service providers. This research method uses literature review and is strengthened by Focus Group Discussion (FGD). The literature review aims to increase the understanding and find appropriate sources for research, which are obtained from sources that will be the basis of this research. From the literature review also obtained the risk factors to be studied. Furthermore, the results of the literature review are carried out in FGDs, to see their relevance to field needs. The selected FGD participants were construction service providers in the contractor sector. There are 2 risk factors to identify risk for construction service providers in the field of contractors in handling projects, namely risks in the management/office and risks in the field. Construction service providers in construction work need to carry out a detailed post cost analysis of risks at each stage of the construction business process in management and risk in the field by distinguishing between the pre-tender process, the construction process, and the maintenance period.

Keywords---construction industry, construction, contracting business, literature review, risk analysis

Introduction

In the Construction Services law, there are construction work service providers and consultancy service providers (Raharjo et al., 2018). Construction work service providers are parties who directly carry out construction work in the field, or often referred to as contractors (Kholis, et al; 2020). one of the most important activities that can boost the business of various industries, thereby increasing gross domestic product (GDP). The contribution of the construction business in the Indonesian economy is in 4th place with a percentage of 10.44% in 2021 (BPS, 2021).

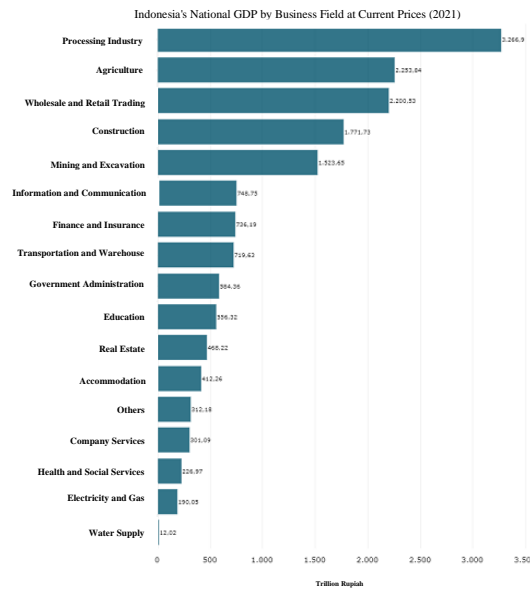


Figure 1. Indonesia's National GDP in 2021
Source: BPS, 2021

An important indicator that shows the fluctuations in construction in Indonesia is the completed Construction Value Index. Construction completed in the fourth quarter of 2020 amounted to 132.93 and 145.03 in 2021. The acceleration also occurred in q-to-q growth from 3.64 percent in the fourth quarter of 2020 to 3.93 percent in the fourth quarter of 2021. Fluctuations in the Construction Value Index completed by the construction sector in Indonesia are shown in Figure 2.

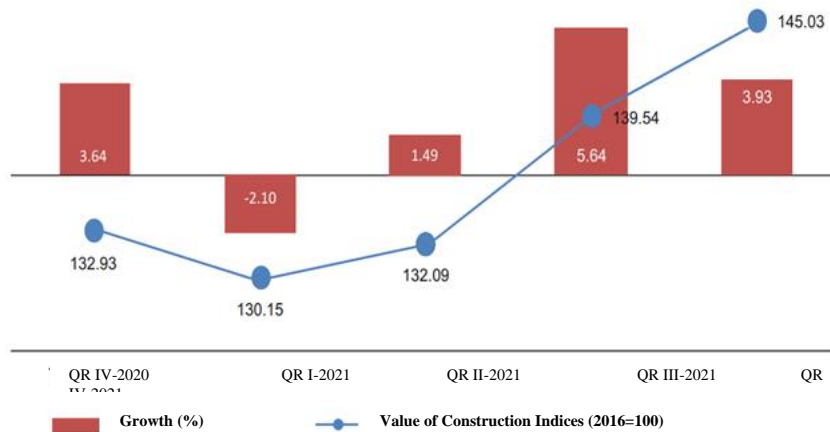


Figure 2. Quarterly Index and Growth of Completed Construction Value
Source: BPS, 2021

In this period, construction work entrepreneurs still considered a little problematic in running their business compared to the previous quarter. This is indicated by the Business Problem Index (IMB) which is less than 25, which was 21.98 in the fourth quarter of 2020 and 14.51 in 2021. The three main problems faced by entrepreneurs are the demand for construction services in general, the high level of competition, and the price of building materials. Fluctuations in the value of the business condition index, business prospects and business problems are shown in Figure 3.

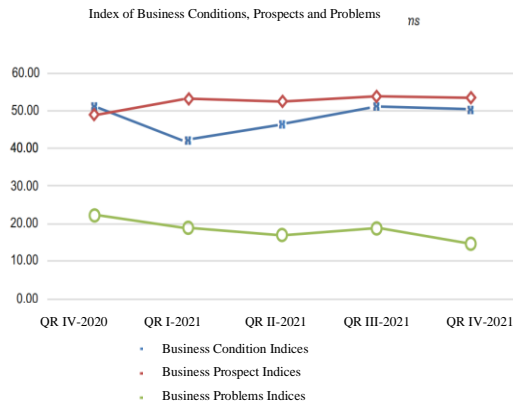


Figure 3. Index of Business Conditions, Prospects, and Business Maturity
Source: BPS, 2021

The relationship between Business Conditions, Prospects and Problems in the fourth quarter of 2021 showed a significant index figure, business conditions were 50.15 (>50), business prospects were 53.38 (>50) and followed by business problems were 14.51 (<25). This shows that construction service entrepreneurs tend to be optimistic in the future. The increase and optimism of the construction services business in the future will be accompanied by the problems and risks of construction projects that are always complex and the risks increase from a number of different sources. The risks of construction service providers are also very varied due to the weak implementation of risk management in the implementation of construction projects which can result in some problems that are often uncertain. Given this uncertainty factor, the outcome of the activities carried out cannot be predicted precisely. This also applies in every business activity, including in the construction business (Gunawan, 2008).

Construction service providers realize that the losses that are often experienced by companies are mostly due to a weak understanding of risk management in running a construction service company. Because of these risks, the construction business can experience losses that cause a negative impact on the project plan, quality, performance, both in terms of time and cost. With the many risks that arise in each project, construction business people (construction work service providers, planning consultants, supervisory consultants, and construction management consultants) certainly want to try to minimize these risks (Ortiz et al., 2009; Pinto et al., 2011).

Table 1
Statistics of Employment Business Entities Construction in Indonesia

Province	The Number of Construction Entity											
	Micro			Middle			Macro			Total		
	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021
ACEH	4180	4779	7668	706	651	925	27	18	21	4913	5448	8614
NORTH SUMATRA	6514	5853	8822	1233	1068	1360	38	35	24	7785	6956	10206
WEST SUMATRA	4901	4909	5804	412	330	546	24	19	15	5337	5258	6365
RIAU	7310	6425	6466	1074	1324	1302	39	49	39	8423	7798	7807
JAMBI	2781	2628	3067	363	320	309	10	10	5	3154	2958	3381
SOUTH SUMATRA	2864	2819	4591	806	695	955	50	40	46	3720	3554	5592
BENGKULU	1321	1212	1348	162	131	146	6	3	3	1489	1346	1497
LAMPUNG	3216	3591	3895	427	471	436	15	11	5	3658	4073	4336
KEP. BANGKA	1090	841	863	107	85	92	2	2	3	1199	928	958
BELITUNG												
KEP. RIAU	1670	1598	1927	453	404	675	16	12	12	2139	2014	2614
DKI JAKARTA	1921	1819	3980	7317	7091	9501	854	804	1024	10092	9714	14505
WEST JAVA	8649	8251	9786	3177	2765	3023	82	82	75	11908	11098	12884

CENTRAL JAVA	10422	10186	14385	1433	1225	1540	40	42	36	11895	11453	15961
DI YOGYAKARTA	1441	1416	1518	238	268	375	4	7	7	1683	1791	1900
EAST JAVA	18530	17533	21800	2198	1796	2694	110	101	102	20838	19430	24596
BANTEN	2418	1991	5554	945	1117	1652	32	36	64	3395	3144	7270
BALI	1832	1588	1758	322	272	247	9	5	3	2163	1865	2008
WEST NUSA TENGGARA	3553	3480	3869	254	205	214	15	13	10	3822	3698	4093
EAST NUSA TENGGARA	5631	5458	5656	395	403	400	9	10	17	6035	5871	6073
WEST KALIMANTAN	5161	5137	7230	381	313	460	8	8	11	5550	5458	7701
CENTRAL KALIMANTAN	1499	1596	1992	331	295	339	22	21	19	1832	1912	2350
SOUTH KALIMANTAN	3616	3327	3919	471	376	514	7	7	6	4049	3710	4439
EAST KALIMANTAN	3682	3330	5386	1187	1086	1391	67	52	47	4936	4468	6824
NORTH KALIMANTAN	1413	1167	1285	221	132	156	17	14	15	1651	1313	1456
NORTH SULAWESI	2273	1755	2074	289	232	398	12	8	7	2574	1995	2479
CENTRAL SULAWESI	3189	2858	3681	298	221	317	9	9	10	3496	3088	4008
SOUTH SULAWESI	9698	9565	9954	1491	1424	1444	32	28	26	11221	11017	11424
SOUTH-EAST SULAWESI	3203	2956	3257	335	320	334	10	11	10	3548	3287	3601
GORONTALO	658	589	756	138	130	120	3	2	2	799	721	878
WEST SULAWESI	1195	1136	1301	49	61	94	1	1	1	1245	1198	1396
MALUKU	1956	1594	2030	267	221	308	13	8	9	2236	1823	2347
NORTH MALUKU	2168	1849	1975	331	267	258	7	6	5	2506	2122	2238
WEST PAPUA	3162	2977	3035	516	414	393	24	26	25	3702	3417	3453
PAPUA	4900	4530	6973	891	811	1130	39	41	46	5830	53832	8149
INDONESIA	138017	130743	167605	29198	27024	34048	1653	1541	1750	168868	159308	203403

Source: LPJK Statistical Data of Construction Work Business Entities in Indonesia

In Table 1. It can be clearly seen the size of the construction work business entity in Indonesia. Based on this background, a Risk Factor Analysis study was carried out on construction work service providers who handle projects. With this research, it is hoped that it can find out about the risk factors that are likely to occur and their impact in handling projects on construction work service providers in Indonesia. The benefits for this study are:

- a. This research is expected to provide a new perspective in looking at unpredictable risks and ways to overcome the risks that occur.
- b. This research is also useful for construction work service providers, which can provide a guideline on the risks that occur in the project, especially for construction work service providers, as well as how to handle and intercept.

Bibliography Review
Bibliometric Studies

The results of the bibliometric analysis show the development of research articles related to "construction risk management". The development of research in the world based on the scopus data base is increasing from year to year (data taken on October 20, 2022).

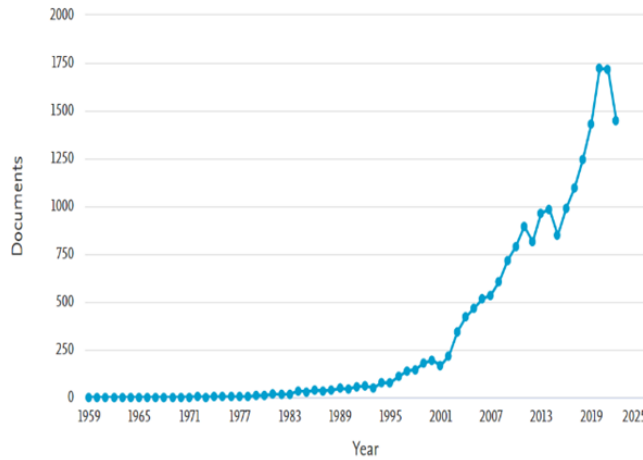


Figure 4. Distribution of construction risk management topic articles based on Scopus database

These results show that research related to construction risk management is increasing every year. Reviewed by country, China and USA are the top 2 and most productive related to the topic under study (Pacheco-Torgal & Jalali, 2012; Lim et al., 2012).

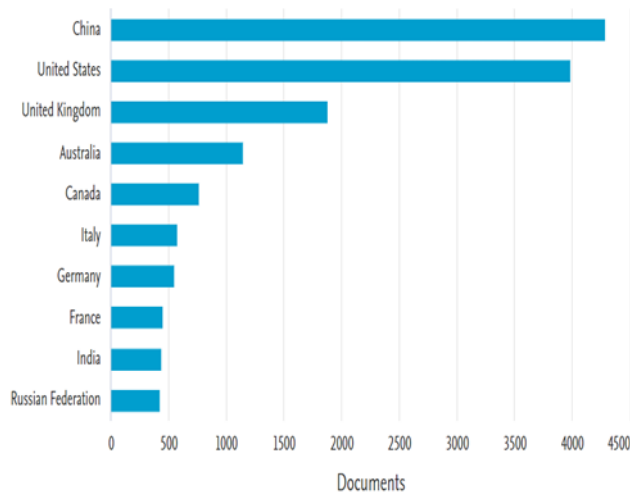


Figure 5. Article distribution by country

Other analysis results based on affiliation show that the topic of construction risk management is most widely researched by the Hong Kong Polytechnic University. More detailed results are as follows.

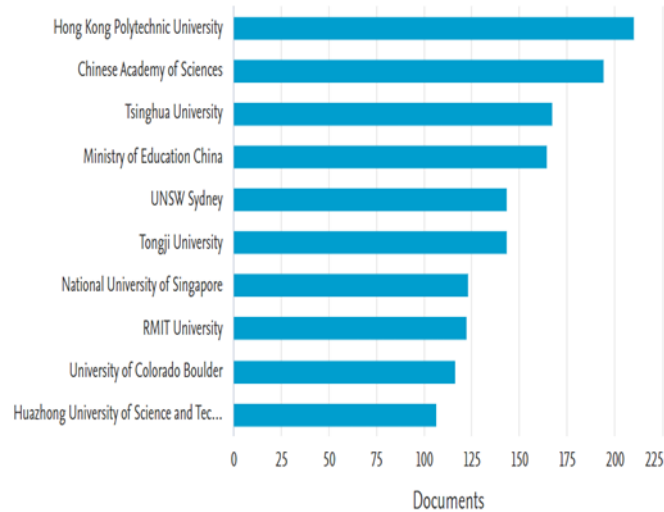


Figure 6. Distribution of articles by Affiliation

Risk

Risk is a variation in possible things that occur naturally or the possibility of events occurring beyond the expected, which are threats to property and financial gain due to the dangers that occur (Labombang, 2011).

Construction Risk Management

The construction sector, which has a business base in the form of construction projects, where each construction project has unique characteristics with various complexities, is closely related to risk. Risk management in the construction business is very necessary to reduce the possibility of losses caused. The Project Management Institute (2017) defines the risk management process in projects, which has generally been adopted in construction projects shown in Figure 1.

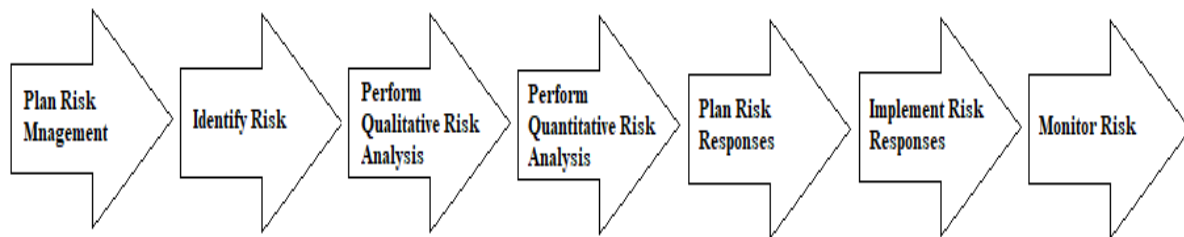


Figure 7. Project Risk Management Process Stages (Project Management Institute, 2017)

Project risk management consists of the following stages (Project Management Institute, 2017):

- a. Risk management planning, the process of defining how to apply risk management activities to the project;
- b. Risk identification, the process of identifying individual project risks that are the source of overall project risk as well as documenting the characteristics of existing risks;
- c. Qualitative risk analysis, process prioritizes individual project risks for further analysis by assessing the possible occurrence and impact of the risks;
- d. Quantitative risk analysis, a process of numerical analysis that combines the effects of risk identification at the previous stage on the overall project objectives;
- e. Risk response planning, the process of developing alternatives or strategies to deal with all existing risks;
- f. Application of risk response, the process of implementing a risk-to-risk respond strategy;
- g. Risk monitoring, the process of overseeing the implementation of risk responses, tracing identified risks, identifying and analyzing new risks, and evaluating the effectiveness of the risk process during the project.

According to [Purwantoro et al. \(2018\)](#) the categories of risks that allow it to occur and there are potential impacts are 3, namely:

- a. Financial and Economic
- b. Politics and Environment
- c. Construction

For more details, you can see in the table below:

Table 3
Risks on Financial and Economic category

No	Financial and Economic Risk Factors
1	Increase in workers' wages resulting in increased project costs
2	Increased material prices resulting in increased projects
3	Availability of funds needed by the client
4	Late payments that can hinder the course of the project
5	Possible bankruptcy experienced by project partners
6	Possible lack of working capital to run the project
7	Sanctions/penalties if the project is delayed (fines, etc.)
8	Estimation error at the time of determining the bid price for tenders
9	Competition with similar projects
10	Claims from clients that may incur losses
11	Fluctuations in the inflation rate that can cause losses
12	Interest rate fluctuations that can lead to losses
13	Fluctuations in currency exchange rates that can lead to losses

Table 4
Risks on the Political and Environmental category

No	Politics and Environment Risk Factors
1	Corrupt practices and bribery that can cause harm
2	Unfair competition at the time of tender implementation
3	Potentially harmful legal, regulatory, and political changes
4	Natural disasters (floods, earthquakes, etc.) that can cause losses
5	Lengthy approvals and permits from bureaucracy that can be detrimental
6	Obstacles and interferences from the government at the time of project implementation
7	Policy changes that may result in increased costs
8	Lack of relations with government departments
9	Violators of contracts that may result in termination of the contract
10	Wars and chaos that can result in losses
11	Embargoes that can result in losses
12	Regulation of harm to the environment
13	Pollution rules and work safety
14	Contamination of soil, water, and air in the environment around the project

Table 5
Risks on construction categories

No	Construction Risk Factors
1	Unknown physical condition of the field
2	Limitations in the procurement of materials and skilled workers
3	Design changes that can hinder the course of the project
4	Disputes with industries that can lead to losses
5	Poor quality of materials that can cause losses
6	Limitations in the procurement of materials and skilled workers
7	Imperfect/defective work that can cause losses
8	Fire/theft of materials and equipment that cause losses
9	Design changes that can hinder the course of the project
10	Disputes with workers that can lead to losses
11	Prohibition to subcontract the main work
12	Accuracy and completeness of technical specifications
13	Low productivity of workers and equipment
14	Failure of equipment resulting in project delays

Construction Work Service Provider

The provider of construction work services is the implementing party of the construction. Construction work service providers are also part of construction services. Jasa Construction is a construction consulting service and/or construction work. The construction service sector is a community activity to realize buildings that function as support or infrastructure for socio-economic activities in order to support the realization of national development goals. Construction Services are regulated by a separate law and must adapt to the times. The latest Construction Services Law is currently Law Number 2 of 2017 concerning Construction Services (Shang et al., 2017; von Branconi & Loch, 2004).

Research Methods

This research method uses literature review, then obtains data directly from respondents or research objects, and is corroborated by Focus Group Discussion (FGD). The literature review aims to increase understanding and find the right sources for research, obtained from the sources that will be the basis of this research. From the literature review, it was also found that the risk factors will be studied (Kerzner, 2002; Loosemore et al., 2012; Shen et al., 2001). Furthermore, direct data collection is carried out by conducting interviews from the respondents obtained. Furthermore, the results of the literature review and data from respondents in the FGD are to see its relevance to field needs. The respondents and FGD Participants selected are construction service providers in the contractor field and the results of the FGD are analyzed and discussed. Based on the results and discussion, conclusions and suggestions were obtained (Snyder, 2019; Seuring & Müller, 2008).

Results and Discussion

Risk Identification

In this study, the risk categories proposed by Al Bahar and Crandall (1990) will be used, modified in such a way that they are in accordance with the desired conditions, namely the identification of possible risks and their potential impacts, analysis of dominant risk factors on construction work service providers, and calculated risk handling from the point of view provider of construction work services that often occur in government and private projects. The risk category is modified from the existing literature review so that we divide into 2 categories as follows:

- a. Risks in the office / Risk Management
- b. Risks that exist in the field

After obtaining the process of identifying risk factors that can occur and there are potential impacts that we can develop from the matrix of risk identification of various sources.

Risk Analysis

Risk analysis is defined as a process that combines uncertainty in quantitative form, to evaluate the potential impact of a risk. The first step to carrying out this stage is the collection of data relevant to the risks to be analyzed. These data can be obtained from the company's historical data or from past project experience. In this study, interviews were conducted with contractors who were willing to be respondents (Budy, 2022; Al-Bahar & Crandall, 1990; Fisk & Reynolds, 1988). As for this analysis, it is carried out separately between the three classifications, namely large contractors, intermediate contractors, and small contractors. After that, a risk analysis was carried out from a sample in the form of contractor respondents which obtained a table containing factors resulting from the analysis of identification and analysis risks that can occur to contractors based on the categories and classifications that have been made above. This is shown the results of the identification of the descriptions of risks obtained from the respondents' results, as follows:

Table 6
Risks of construction work that exists in the office

Office	
No	Risk Factors
1	Losses due to lost the tender
2	Disadvantages of being late on the rework of Sub-Contractor work
3	Losses due to funds belonging to late owners
4	Losses due to inflation or extreme price increases
5	Disadvantages due to Planning Consultants who cannot make decisions
6	Losses due to intervenors claims
7	Disadvantages due to project delays
8	Miscommunication with non-decision-making parties
9	Early informs due to losses to tender opportunities
10	Accommodating stakeholder needs upon special requests
11	Loss of unmeasured/excessive service to project owner
12	Losses due to the failure of proposals involving project stakeholders

After obtaining the description of the risks mentioned by the respondents, we can enter the amount of turnover and the percentage of risk loss from the interview results to find out the amount and level of risk that exists in percentage and nominal, for the description of risk using the RK code as Office Risk and RL as Field Risk, then formulated by summing the percentage of risk outcomes from each description and the sum of the percentages then multiplied into the turnover rate, or;

$$\text{Risk Value} = \sum \%R \times O$$

R = Description of risk

O = Turnover

The following is a table of the results of identification and analisa Risk by including the percentage of losses and turn over obtained from the respondents, as follows:

Table 8
Description of the risks of large contractors

No.	Risk in Office	Large Contractor										
	Respondend Omzet (in billion)	R1 70	R2 65	R3 71,5	R4 75	R5 60	R6 90	R7 80	R8 85	R9 63	R10 82,5	R11 55
1	RK1	1,20%	1,00%	1,10%	1,13%	1,15%	4,08%	0,95%	2,10%	1,50%	0,80%	1,50%
2	RK2	1,00%	1,20%	1,10%	1,25%	1,13%	0,80%	1,05%	1,60%	0,70%	1,60%	1,25%
3	RK3	3,00%	2,80%	2,90%	3,10%	2,75%	3,10%	1,00%	3,33%	2,50%	2,77%	2,60%
4	RK4	1,00%	1,30%	1,20%	1,34%	1,25%	1,00%	1,25%	3,33%	1,25%	1,20%	1,60%
5	RK5	0,20%	0,30%	0,10%	0,15%	0,21%	0,50%	0,40%	0,35%	1,50%	0,50%	0,85%
6	RK6	0,30%	0,20%	0,40%	0,24%	0,31%	0,45%	1,10%	1,30%	0,86%	0,71%	0,95%
7	RK7	0,50%	0,60%	0,50%	0,44%	0,35%	0,71%	1,00%	0,71%	0,91%	1,02%	0,50%
8	RK8	0,20%	0,30%	0,40%	0,33%	0,22%	0,55%	0,10%	0,61%	0,19%	0,30%	0,75%
9	RK9	0,30%	0,20%	0,30%	0,25%	0,34%	0,75%	0,50%	0,43%	0,55%	0,45%	0,80%
10	RK10	0,80%	,90%	0,70%	1,00%	1,30%	0,50%	0,60%	0,50%	0,20%	1,60%	1,60%
11	RK11	0,70%	0,60%	0,80%	0,65%	1,00%	0,50%	1,00%	0,74%	1,00%	0,50%	0,60%
12	RK12	2,00%	1,80%	1,90%	2,20%	2,00%	2,10%	1,50%	1,65%	1,40%	1,10%	1,75%
No	Risk in field Respondend	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11
1	RL1	0,48%	0,45%	0,50%	1,00%	0,33%	1,40%	0,60%	0,50%	1,10%	0,80%	0,65%
2	RL2	0,15%	0,17%	0,13%	0,14%	0,20%	0,40%	0,30%	1,20%	0,16%	0,20%	0,50%
3	RL3	0,20%	0,18%	0,19%	0,15%	0,13%	0,05%	2,50%	0,23%	0,40%	2,36%	0,35%
4	RL4	0,60%	0,50%	0,70%	0,57%	0,45%	0,60%	0,50%	0,73%	0,20%	0,65%	0,78%
5	RL5	0,50%	0,60%	0,40%	0,55%	0,70%	0,20%	0,32%	0,41%	0,32%	0,71%	0,65%
6	RL6	0,10%	0,20%	0,15%	0,13%	0,30%	0,40%	0,03%	0,55%	0,27%	0,81%	0,40%
7	RL7	0,50%	1,30%	1,45%	1,65%	1,35%	1,60%	2,50%	2,00%	1,80%	1,90%	1,75%
8	RL8	1,30%	1,40%	1,20%	1,50%	1,44%	1,80%	1,25%	1,70%	0,60%	1,65%	1,50%
9	RL9	0,40%	1,50%	0,68%	0,55%	0,90%	1,00%	0,60%	0,35%	0,64%	0,50%	1,00%
	Total (in Billion)	11,50	10,73	12,10	13,67	10,69	20,06	15,24	20,67	11,66	16,61	13,23

Table 9
Description of Middle contractor risk

No.	Risk in Office	Middle Contractor										
	Respondend Omzet (in Billion)	R1 35	R2 20	R3 27	R4 30	R5 15	R6 47,5	R7 36,5	R8 32	R9 25	R10 31,5	R11 14
1	RK1	0,94%	1,51%	0,85%	1,22%	1,45%	1,10%	2,15%	3,15%	1,15%	1,10%	1,13%
2	RK2	1,06%	0,75%	1,61%	1,25%	1,20%	1,25%	1,65%	0,85%	1,13%	1,10%	1,25%
3	RK3	1,01%	2,55%	2,78%	3,10%	2,55%	2,75%	3,33%	3,10%	2,75%	2,90%	3,01%
4	RK4	1,24%	1,52%	1,21%	1,01%	1,65%	1,31%	3,33%	1,00%	1,25%	1,20%	1,34%
5	RK5	0,41%	0,71%	0,51%	0,21%	0,80%	0,35%	0,30%	0,50%	0,21%	0,10%	0,15%
6	RK6	1,11%	0,80%	0,72%	0,31%	0,90%	0,20%	1,35%	0,45%	0,31%	0,40%	0,24%
7	RK7	1,10%	0,90%	1,03%	0,55%	0,55%	0,60%	0,71%	0,71%	0,35%	0,50%	0,44%
8	RK8	0,10%	0,19%	0,35%	0,21%	0,65%	0,30%	0,61%	0,55%	0,22%	0,40%	0,33%
9	RK9	0,50%	0,60%	0,40%	0,31%	0,75%	0,20%	0,43%	0,75%	0,34%	0,30%	0,30%
10	RK10	0,65%	1,25%	1,65%	0,82%	1,55%	0,90%	0,55%	0,50%	1,30%	0,70%	1,00%
11	RK11	1,00%	1,01%	0,55%	0,70%	0,65%	0,60%	0,74%	0,50%	1,00%	0,80%	0,65%
12	RK12	1,50%	1,45%	1,11%	2,00%	1,75%	1,80%	1,65%	2,10%	2,00%	1,90%	2,20%

No	Risk in Field											
	Respondend	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11
1	RL1	0,33%	0,65%	1,20%	0,80%	0,48%	1,10%	0,60%	0,50%	0,45%	0,60%	1,00%
2	RL2	0,20%	0,50%	0,40%	0,20%	0,15%	0,16%	0,30%	0,13%	0,17%	0,30%	0,14%
3	RL3	0,13%	0,35%	0,05%	0,36%	0,20%	0,40%	2,50%	0,19%	0,18%	2,50%	0,15%
4	RL4	0,45%	0,78%	0,60%	0,65%	0,60%	0,20%	0,50%	0,70%	0,50%	0,50%	0,57%
5	RL5	0,70%	0,65%	0,20%	0,71%	0,50%	0,32%	0,32%	0,40%	0,60%	0,32%	0,55%
6	RL6	0,30%	0,40%	0,40%	0,81%	0,10%	0,27%	0,03%	0,15%	0,20%	0,03%	0,13%
7	RL7	1,35%	1,75%	1,60%	1,90%	1,50%	1,80%	2,50%	1,45%	1,30%	2,50%	1,65%
8	RL8	1,44%	1,50%	1,80%	1,65%	1,30%	0,60%	1,25%	1,20%	1,40%	1,25%	1,50%
9	RL9	0,90%	1,00%	1,00%	0,50%	0,40%	0,64%	0,60%	0,68%	0,50%	0,60%	0,55%
	Total (in Billion)	5,75	4,16	5,41	5,78	2,95	8,00	9,27	6,26	4,33	6,30	2,55

Table 10
Description of Small contractor risks

No.	Risk in Office	Small Contractor										
	Respondend Omzet (in billion)	R1 70	R2 65	R3 71,5	R4 75	R5 60	R6 90	R7 80	R8 85	R9 63	R10 82,5	R11 55
1	RK1	1,20%	1,00%	1,10%	1,13%	1,15%	4,08%	0,95%	2,10%	1,50%	0,80%	1,50%
2	RK2	1,00%	1,20%	1,10%	1,25%	1,13%	0,80%	1,05%	1,60%	0,70%	1,60%	1,25%
3	RK3	3,00%	2,80%	2,90%	3,10%	2,75%	3,10%	1,00%	3,33%	2,50%	2,77%	2,60%
4	RK4	1,00%	1,30%	1,20%	1,34%	1,25%	1,00%	1,25%	3,33%	1,25%	1,20%	1,60%
5	RK5	0,20%	0,30%	0,10%	0,15%	0,21%	0,50%	0,40%	0,35%	1,50%	0,50%	0,85%
6	RK6	0,30%	0,20%	0,40%	0,24%	0,31%	0,45%	1,10%	1,30%	0,86%	0,71%	0,95%
7	RK7	0,50%	0,60%	0,50%	0,44%	0,35%	0,71%	1,00%	0,71%	0,91%	1,02%	0,50%
8	RK8	0,20%	0,30%	0,40%	0,33%	0,22%	0,55%	0,10%	0,61%	0,19%	0,30%	0,75%
9	RK9	0,30%	0,20%	0,30%	0,25%	0,34%	0,75%	0,50%	0,43%	0,55%	0,45%	0,80%
10	RK10	0,80%	,90%	0,70%	1,00%	1,30%	0,50%	0,60%	0,50%	0,20%	1,60%	1,60%
11	RK11	0,70%	0,60%	0,80%	0,65%	1,00%	0,50%	1,00%	0,74%	1,00%	0,50%	0,60%
12	RK12	2,00%	1,80%	1,90%	2,20%	2,00%	2,10%	1,50%	1,65%	1,40%	1,10%	1,75%
No	Risk in field Responden	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11
1	RL1	0,48%	0,45%	0,50%	1,00%	0,33%	1,40%	0,60%	0,50%	1,10%	0,80%	0,65%
2	RL2	0,15%	0,17%	0,13%	0,14%	0,20%	0,40%	0,30%	1,20%	0,16%	0,20%	0,50%
3	RL3	0,20%	0,18%	0,19%	0,15%	0,13%	0,05%	2,50%	0,23%	0,40%	2,36%	0,35%
4	RL4	0,60%	0,50%	0,70%	0,57%	0,45%	0,60%	0,50%	0,73%	0,20%	0,65%	0,78%
5	RL5	0,50%	0,60%	0,40%	0,55%	0,70%	0,20%	0,32%	0,41%	0,32%	0,71%	0,65%
6	RL6	0,10%	0,20%	0,15%	0,13%	0,30%	0,40%	0,03%	0,55%	0,27%	0,81%	0,40%
7	RL7	0,50%	1,30%	1,45%	1,65%	1,35%	1,60%	2,50%	2,00%	1,80%	1,90%	1,75%
8	RL8	1,30%	1,40%	1,20%	1,50%	1,44%	1,80%	1,25%	1,70%	0,60%	1,65%	1,50%
9	RL9	0,40%	1,50%	0,68%	0,55%	0,90%	1,00%	0,60%	0,35%	0,64%	0,50%	1,00%
	Total (in Billion)	11,50	10,73	12,10	13,67	10,69	20,06	15,24	20,67	11,66	16,61	13,23

Based on the results of risk analysis for each aspect of management or office, and the field has a different nominal risk based on the turnover owned by each respondent (Akintoye & MacLeod, 1997; Weber et al., 2012).

Risk Response and Handling

Once possible risks have been identified and analyzed, appropriate risk management strategies are needed. This strategy is based on the nature and potential/consequent impact of the risk itself. The solutions/ways to deal with risks that affect construction work service providers are as follows:

- a. Reduced risk
- b. Transferred risk
- c. Eliminated risk
- d. Accepted risk
- e. Substitute risk

Conclusions and Suggestions

Conclusion

Identification of risk factors and the potential impact of construction service providers in the field of construction work service providers in handling projects there are 2 risks factors, Risks of construction work service providers in office *management* and Risks of construction work providers in the field (*on site potential defects*). Solutions or ways of dealing with risk factors that can affect construction work service providers, namely as follows:

- a. Risks of construction work service providers in the office (*office management*)
 - i. *Initial costs* incurred to obtain a project. The competition process in the world of construction work requires a business communication strategy in establishing relationships with project stakeholders. An effective, efficient, and appropriate communication system will minimize the initial risk.
 - ii. Bank soft loans. Potential *loss to limits on available capital*. Potential losses will arise if the borrower is unable to pay debt installments in accordance with the scheme agreed at the beginning of the loan. The borrower will be given a late installment payment penalty which is a risk if using capital by way of debt. The availability of funds needed from selected alternative strategies retention risk. This is an effort to bear the risks that occur by financing them as a result or the losses can be large, namely using soft loans (banks).
 - iii. Inflation Risk and extreme inflation. The country's economy is in a bad state due to declining gross domestic product (GDP) or when real economic growth is negative. This condition will have a significant impact on the construction sector, especially on the price of materials and construction materials which results in material prices rising which will affect the MARR (*Minimum Attractive Rate of Return*) cost target which must be taken into account from the beginning by construction work business people, especially if there are extreme inflation conditions or recessions such as those that occurred in Indonesia in 1998, almost 90% of construction service providers experience bankruptcy (Suparno, 2015)
 - iv. Return without Risk. Construction work business actors must be able to calculate a *rate of return* that far exceeds the interest rate on loans if the investment funds are invested without risk (loss of *opportunity cost in free-risk investment*) so that losses due to loss of investment opportunities without risk will not occur.
- b. Risks of construction work service providers in the field
 - i. Natural disasters (floods, earthquakes, etc.) that can cause an insurance strategy are chosen. Insurance as an agreement contract between 2 related parties, namely: insured and insurer.
 - ii. Limitations in the procurement of materials and skilled workers are selected alternative strategies to prevent risks and reduce losses. This strategy directly reduces the potential risks of construction work service providers, namely reducing the possibility of risks, by providing material stocks and increasing human resources (HR).
 - iii. The difficulty of accessing the project site, i.e. choosing an alternative strategy prevents risks and reduces losses. This strategy directly reduces the potential risks of construction work service providers, namely reducing the possibility of risk, by conducting preliminary field surveys, using appropriate human resources (HR), methods, and material tools in the field.
 - iv. The influence of *the supply and chain*. Analysis of the effect of the equipment supply chain on the success rate of the project is very important in preparing a plan for the needs of construction equipment, equipment has a contribution of work productivity to the construction work process. In equipment management, equipment supply chain risk management is needed to manage product flows involving parties from upstream to downstream consisting of *suppliers*, factories, distribution networks, and logistics services

- (Pujawan, 2005). Other factors affecting the equipment selection process are the availability of tool parts, ease of transportability or movement, ease of maintenance that can be carried out.
- v. Risk of *differing site conditions*, to minimize the risk of this design factor is carried out by means of careful re-measurement, redesign, and recalculation with IT-based tools.
 - vi. Lack of awareness (*un-awareness*) of occupational safety management systems. Low level of concern for occupational safety factors both in workers and the work environment.
 - vii. *Social cost risk*. In the work of a construction project, it is necessary to understand the environmental conditions of the culture, customs, norms, and influence of local people's beliefs. The uncertainty of *social costs* has a risk impact that cannot be predicted with certainty.
 - viii. Risks due to demands for limited human resources in handling technical work require capacity building and *training* in increasing resources that can answer project needs. This activity requires the need for costs that must be allocated.
 - ix. Risk substitution due to the demands of field conditions within the scope of SMK3 (Construction Occupational Safety and Health Management System) or *QHSE (Quality Health Safety and Environment)*

Suggestions

Construction service providers need to carry out risk management at every stage of the construction business process in management and risk in the office and field by distinguishing the pre-tender process, construction process, and maintenance period (Suryanata & Pemayun, 2018; Setyowulan et al., 2020).

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