



Risks Leading to Cost Overrun in Construction Projects: A Systematic Literature Review

Marsha Enrica^{1*}, Humiras Hardi Purba², Aleksander Purba³

^{*1} Department of Civil Engineering, Faculty of Engineering, Mercubuana University, Jakarta Indonesia
(marshaenrica800@gmail.com)

² Industrial Engineering Department, Faculty of Engineering, Mercubuana University, Jakarta, Indonesia

³ Civil Engineering Department, Faculty of Engineering, Lampung University, Lampung, Indonesia

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ABSTRACT

In construction projects in the world, there is generally a final cost overrun on the completion of construction projects. The cost overruns occur when the project has to face various risks due to the lack of anticipated preparation to minimize the risks that cause delays in the implementation of the sequence of work sequences. This is certainly a big problem in preparing construction project budgets and critical challenge for both owners and contractors, so it should be managed to decrease or avoid bad things. The purpose of this literature review is to present risks that cause cost overrun for the past ten years. Factors cause cost overrun; Cost Estimate, Construction Items, Project Participants, Environment, and Finance. This research used a systematic literature review. Based on 50 journals review about risks leading to cost overrun, the most factor causes cost overrun is Project Participants (25, 60%) with case Poor Planning, 2nd rank is Construction Items (22.67%) with case Frequent Changes in Design, 3rd Rank is Cost Estimates (22,00%) with case Inaccurate Cost Estimation, 4th rank is Finance (16,93%) with case Inflationary Pressure and last risk factor is Environment (12,80%) with case Weather Condition.

Keywords:

Risk, Cost Overrun, Construction Project.



1. Introduction

Risks always exist in construction projects and often cause schedule delay or cost overrun [1]. Cost overrun is not an uncommon phenomenon in construction projects and in particular with civil engineering and infrastructure projects [2]. Risk management defined by the researcher as a stepwise procedure consisting of risk identification, risk classification, risk analysis, and risk response tasks. Risk in construction projects has been the object of attention because of time and cost overruns associated with construction projects. Cost overrun is a very frequent phenomenon and is almost associated with all projects of the construction industry. Cost overrun is the difference between the final actual cost of a construction project at completion and the contract amount agreed by and between the owner and the contractor during the signing of the contract. Cost overrun is considered an obvious indicator of the project's failure, which a situation of a construction project in which budgetary estimate exceeds estimation and settlement exceeds budget is a universal phenomenon [3].

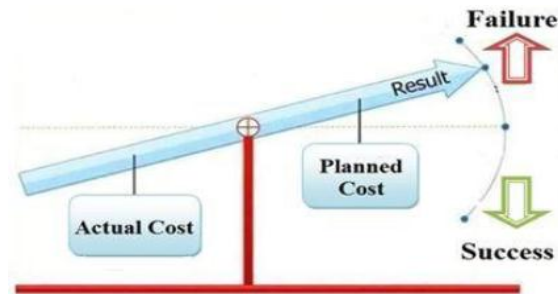


Figure 1. The Impact of Cost Overrun on Project Situation [3].

It is important to analyze the factors causing cost overrun so that project implementation does not exceed the budget, get profit, and raise a successful project.

2. Research Methodology

This journal review is based on a literature review obtained online from trusted sources; ASCE, Research Gate, Taylor, and Francis, etc by using the keywords "construction projects", "cost overrun" and "risk", so we get 93 journals and only 50 journals selected to be review and provide the latest information.

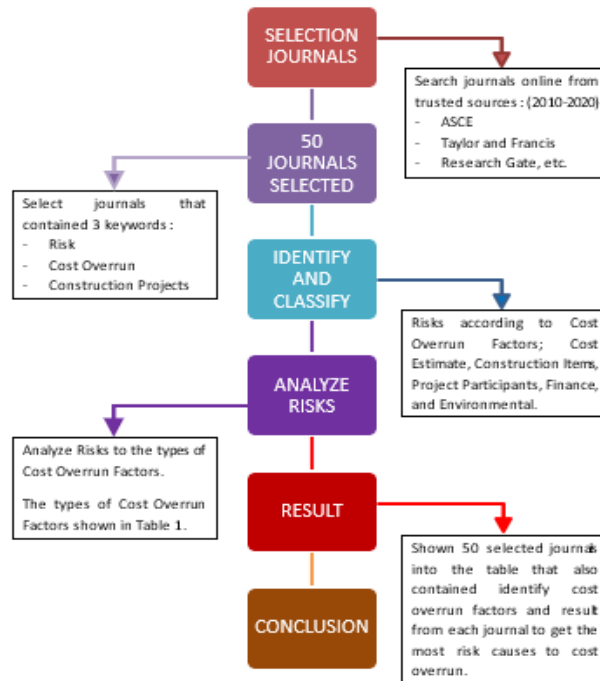


Figure 2. Study Framework.

3. Result and Discussion

A variety of construction projects in the world often face several obstacles that cause cost overruns which become a major problem in the provision of budget. The need to examine the problems that occur in construction projects in the world to analyze the risks that have the opportunity to occur, so that in implementing construction projects, project participants can take action to anticipate the occurrence of risks to minimize cost overruns. Cost overruns are primarily due to uncertainty uncontrollable than risk controllable and therefore are more difficult to manage. The provision of more realistic contingency percentages across such projects will go a long way to providing better reporting of highway projects, program results, and associated key project performance indicators [4]. Full attention must be paid to cost-overrun factors to achieve the project aim to complete the project within budget. Two parties must work together collaboratively can effectively reduce the possibilities of occurrence risks, and thus the chance of cost-overrun can be minimized [1]. The most problem in residential construction projects is originated from poor resource management (human, technical, and material). These causes should be controlled right away from the planning to the implementation and management stages. Good practice in planning, coordinating, controlling, and monitoring procedures, therefore, have to be recognized [5]. To achieve efficient and effective cost, project managers are suggested to adopt particular measures to implement at the planning stage to avoid the hindrances during project execution and achieve effective cost control assuring the completion of the project within budgeted cost [6]. Detailed studies can be done to evaluate the involvement and effect of a specific party or resource of the construction project on the cost overrun in construction projects [7].

Conducting a multi-case study with more number of companies, including large and small companies, may give more accurate results. The limited sample size may also influence the results [8]. The cost overrun factors that lead to project cost growth has been documented through a large



number of studies. So they were identified from the literature survey worldwide [3]. The most significant causes of cost overrun in the Afghanistan construction are corruption, delay in progress payments by clients, difficulties in financing projects by contractors, security, and change order by clients during the construction phase. The findings need attention to achieve improved cost performance and to mitigate against further project failure [9]. The list of Existing Literature review of Cost Overrun in Construction Projects is as shown in Table 1.

Table 1. Existing Literature review of Cost Overrun in Construction Projects

No	Paper Identity	Cost Overrun Factor					Result
		Cost Estimate	Construction Items	Project Participants	Environment	Finance	
1	(Creedy et al., 2010) [4]	4	5	3	1	2	The analysis has produced important findings concerning the reasons highway projects have cost overrun. Of particular concern change in project designs and scope changes during project development.
2	(Durdyev et al., 2010) [5]	4	3	5	2	1	The results show that most of the problems in residential construction projects are originated from poor resource management (human, technical, and material). These causes should be controlled right away from the planning to the implementation and management stages.
3	(Wang & Yuan, 2011) [1]	3	5	1	2	4	The findings revealed that the key cost-overrun risks included: Client's capital is unavailable, Design Variations, Variations by the client, Inflation in price of construction materials, Contractor's security of payment, Cost estimation is crude, Insufficient liquidated capital, Dispute for the ambiguity of contract conditions, Corruption, and bribery, Inadequate or insufficient site information, Poor management level, Unreasonable project construction period requirement, Low competency of the subcontractor, Bureaucratic inefficient and delay on Examining and Approving and Inadequate program scheduling.
4	(Doloi, 2012) [10]	4	3	5	1	2	The result was found the design complexity, financial structure, and government policy influences are the three main factors affecting risks across time, cost and operational performance in PPP projects.
5	(Azis et al., 2013) [6]	3	4	5	2	1	The most severe contributor to cost overrun, ranked by the respondents out of eight categories of cost overrun is the contractor's site management.
6	(Muya et al., 2013) [11]	5	4	2	1	3	The results presented the Zambian construction industry should endeavor to improve project finance planning and management. Project cost estimates



No	Paper Identity	Cost Overrun Factor					Result
		Cost Estimate	Construction Items	Project Participants	Environment	Finance	
							should also take into account escalations that could result from inflationary changes.
7	(Sweis, 2013) [12]	3	4	2	5	1	The top three major factors that cause the cost overruns were a governmental delay, followed by severe weather conditions and design changes.
8	(Mahamid & Dmaid, 2013) [13]	4	1	2	5	3	100% of the respondents indicated that the average cost between 10% and 30% of the project's estimated cost.
9	(Yehiel, 2013) [14]	5	4	3	1	2	three of the 15 roots causes were identified as most prominent : •Premature tender documents •Too many changes in owners' requirements or definitions •Tender-winning prices are unrealistically low
10	(Mahamid, 2014) [15]	1	3	4	2	5	Detailed studies can be done to evaluate the involvement and effect of a specific party or resource of the construction project on the cost overrun in construction projects. Research can be carried out to investigate the effect of the fluctuation of currency exchange and financing on cost overrun in construction projects.
11	(Jalaei & Jrade, 2014) [16]	3	2	4	1	5	Lack of planning and coordination is described as the most significant factor causing cost overrun of building construction projects.
12	(Choudhry et al., 2014) [17]	4	2	3	1	5	Risks that affected: unexpected weather, delay in approvals, design changes, insufficient technology, lack of workspace, unavailability of material, and funds.
13	(Al-Sabah et al., 2014) [18]	2	1	3	4	5	Among all external risk categories, the economic risk category was ranked to have the highest effect concerning the impact on project cost and company performance.
14	(Abdussalam Shibani & Kumar Arumugam, 2015) [8]	4	3	5	2	1	It is interesting that this critical success factors also affect the objectives of construction projects, like budget, performance and quality, and completion of the project on time.
15	(Tebeje Zewdu, 2015) [19]	2	3	5	1	4	The result by the contractor's perspective that the top five causing cost overrun in construction projects are poor planning, fluctuation of the price, poor productivity, inflationary pressure, and project financing.
No	Paper Identity	Cost Overrun Factor					Result



No	Paper Identity	Cost Estimate	Construction Items	Project Participants	Environment	Finance	Result
16	(Lind & Brunes, 2015) [20]	4	5	2	1	3	The descriptive part covers two dimensions, first is when during the process the cost overrun occurs and the second is which part of the cost function has changed: is it changes in the product (scope changes, quality changes), changes in the number of inputs needed or changes in the price of the inputs.
17	(Samuel & Ovie, 2015) [21]	4	5	3	1	2	This value on the $\mathcal{R}II$ calibration is a stationary value between the boundary variables of inexperience project management having $\mathcal{R}II$ value of 0.77 and low skilled manpower having value of 0.69.
18	(Iqbal et al., 2015) [22]	2	3	4	1	5	Out of 37 risks, top ten risks have been highlighted and discussed in detail: payment delays; project funding problems; accidents /safety during construction; defective design; inaccurate execution plan/schedule; poor performance of subcontractors; exchange rate fluctuation and inflation; the improper scope of work definition in a contract; poor quality of materials and equipment; and shortage /delay of material supply.
19	(Larsen et al., 2016) [23]	3	4	5	1	2	Also, the project organization must manage the factors, which should be completed in the design stage before either tendering or construction.
20	(El-Ahwal et al., 2016) [3]	4	3	5	1	2	Cost factors are grouped into six groups, these six main groups, namely: technical, economic & financial, political & regulation, management, project resources, and environmental factors.
21	(Shibnai Abdussalam and Salah Karim, 2016) [24]	3	5	4	2	1	The owners are recommended to revise and check the contracts document because of unfavorable clauses such pay when paid can lead to lack of funds to the contract that will result in work suspension and also the duration of the contract if too short for the project and unreasonable comparing with the type and size of the project, delay and cost overrun may happen. The owner should pay the payment on time causes limit the contractors to finance the work.
No	Paper Identity	Cost Estimate	Construction Items	Project Participants	Environment	Finance	Result



		Cost Estimate	Construction Items	Project Participants	Environment	Finance	
22	(Abusafiya & Suliman, 2017) [25]	3	5	4	2	1	Frequent design changes were the most important factor of cost overrun causes that can affect the project's estimated budget and its consequences involve not only the work for which the change is directed but other work and overhead functions as well.
23	(Derakhshanalavijeh & Teixeira, 2017) [26]	5	3	4	1	2	The five most important factors, agreed by the project owners, consultants and contractors are: inaccurate cost estimations; improper planning; frequent design changes or mistakes in design; inadequate labor/skill availability; inflation in the costs.
24	(Al-Hazim et al., 2017) [27]	1	4	2	5	3	The most important reason that leads to cost overrun was terrain conditions that are occurred in 22.20% of the studied projects. The second was weather conditions that occurred in 15.3%. Other factors are new variation orders (10.2%), mistakes in design (6.1%), emergency working (3.2%), poor scheduling of time (5.9%), and poor planning of cost (4.3%) for the infrastructure projects.
25	(Abd El-Karim et al., 2017) [28]	5	3	2	4	1	Estimating costs are major factors in achieving a successful and realistic budget for projects. if the cost estimator takes the impact of those attributes as same as their values, the budget will increase accordingly and the tenderer may be unsuccessful.
26	(Durdyev et al., 2017) [29]	5	2	4	1	3	Results showed three factors contributing to cost overrun: project and cost management, project finance, and project risk factors.
27	(Niazi & Painting, 2017) [9]	2	4	5	1	3	Corruption is ranked as first ranked, Delay in progress payment by the client is ranked the 2nd and Difficulties in financing project by contractors is ranked 3rd of cost overrun.
28	(Haslinda et al., 2018) [30]	5	4	2	1	3	In terms of overall severity, the highest-ranking variables were found to be 'Poor pre-construction budget and material cost planning' (0.84), 'Inaccurate quantity take-off' (0.74), and 'Materials cost increased by inflation' (0.70).
29	(Gunduz & Maki, 2018) [31]	3	4	5	1	2	The top 3 rank cost overrun factor is the schedule delay (47%), planning and scheduling (47%), frequent design changes (45%).
No	Paper Identity	Cost Overrun Factor					Result



		Cost Estimate	Construction Items	Project Participants	Environment	Finance	
30	(França & Haddad, 2018) [32]	2	3	5	1	4	The result of the project managers group shows that the customer is the major causer in cost overrun. The group of area managers understands that the production department is the main responsible for the increase in costs. The result of the directors is more related to internal factors of planning.
31	(Kim et al., 2018) [33]	3	2	5	4	1	The top five factors causing the highest cost overrun in hospital projects are: Addition work, Wet weather effect/rework, Quantity increased measures, Accommodation works, and Project administration cost increase.
32	(Sinesilassie et al., 2018) [34]	3	4	5	2	1	The determinants may help in reducing failure factors and bringing in success factors about the cost of a project. This may ultimately lead to projects being completed within the stipulated budget.
33	(Plebankiewicz, 2018) [35]	5	3	2	1	4	The results showed that the most likely increase in costs of the analyzed element will be 53% with the costs specified in the cost estimate.
34	(Johnson & Babu, 2018) [36]	4	1	5	3	2	Design variation, poor cost estimation, delay in decision-making process, financial constraints and inappropriate procurement method is the top five causes of cost overrun. These causes are experimentally proven applicable to various countries.
35	(Mansur et al., 2019) [37]	5	2	1	4	3	The study found cost items for labor, material, equipment, and subcontractor are between 79% to 86% of each component cost. This demonstrated are indeed the main contributors to cost overrun in construction China's project compared to other factors that cause cost overrun.
36	(Patil, 2019) [38]	2	5	4	3	1	Late delivery of materials and equipment, Unavailability of competent staff, Low productivity level of labors, Quality of equipment, and the raw material is the factor causes cost overrun.
37	(Personal & Archive, 2019) [39]	5	2	4	3	1	The results show that poor estimation, lack of timeous reports, corruption, construction productivity and contractual claims.
No	Paper Identity	Cost Overrun Factor					Result



No	Paper Identity	Cost Estimate	Construction Items	Project Participants	Environment	Finance	Result
38	(Nguyen et al., 2019) [40]	1	3	4	2	5	This study assessed cost performance through cost growth – a difference in percentage between the original contract price and actual/final contract price. Three main types of resources evaluated in this study included equipment, materials/capital, and manpower/project team.
39	(Danisworo & Latief, 2019) [41]	1	4	5	2	3	The Jakarta Phase 1 MRT project is estimated to have a cost overrun estimation of 47.57% from the initial contract amount.
40	(Mahmid, 2014) [7]	2	3	5	1	4	The five majors' significant factors causing cost overruns are reworked, fluctuation in the money exchange rate, escalation of material price, additional work at owners' request, and high transportation cost.
41	(Kavuma et al., 2019) [42]	3	5	4	1	2	To avert cost escalations on freeform building projects, the client needs to do a thorough cost analysis for the project in addition to allowing considerable sum in the project cost for contingencies.
42	(Akhund et al., 2019) [43]	5	4	3	1	2	Cost overrun in construction projects of Pakistan is still a challengeable problem, especially in Public projects. This issue can be resolved by focusing on the pre-construction planning phase of the project life cycle. The study can be compared and more favorable results in terms of comparison can be obtained.
43	(Annamalaisami & Kuppuswamy, 2019) [44]	1	3	5	2	4	Scope creep, construction delays, rework and practice of awarding the contract to the lowest bidder and their causal impact on other cost overrun factors.
44	(Akinradewo et al., 2019) [45]	3	4	5	1	2	Cost overrun is a common phenomenon by varieties of factors such as the introduction of new works during the construction phase of the project, poor practice of cost control techniques, improper management of the contract.
45	(Kamal et al., 2019) [46]	3	4	5	1	2	Top 5 cost risk factors were rework due to error, underestimation of timely completion, poor site management, underestimation of costs, and fluctuation in material prices.



		Cost Estimate	Construction Items	Project Participants	Environment	Finance	
46	(Taye, 2019) [47]	3	2	4	1	5	According to the overall view of rank, fluctuation of construction material cost, inadequate project planning & scheduling and poor economic condition were the 1st, 2nd, and 3rd level of influencing factor of cost overrun in a construction project.
47	(Andrić et al., 2019) [48]	5	3	4	2	1	The key causes of cost overruns are: increase cost of resources (construction materials, equipment, and labor), construction works, changes in design specifications, land acquisition and resettlement, and currency exchange.
48	(Alzara et al., 2020) [49]	3	5	4	2	1	Thus, “changed orders,” “client’s change of scope,” and “bid proposal errors” are the most significant causes of cost overruns in Saudi Arabia.
49	(Susanti, 2020) [50]	4	2	5	3	1	inaccurate in budgeting and resource planning and Owner additional required as factor most causing cost overrun.
50	(Amri & Marey-Pérez, 2020) [51]	3	4	5	2	1	The main client-related factors include change of the project’s scope. Poor planning and management were established as important contractor related determinants of project cost overrun.

Based on Table. 1, each journal has a score in each factor that shows the most factor causes cost overrun (5) to which factor doesn’t have a big effect on cost overrun (1). The 50 journals selected are previous studies published for the past 10 years, fig. 3 shows how many journals selected to review by year from 2010 -2020. In the planning stage of any construction project, larger efforts should be exerted on the planning preparation, scheduling, and cost evaluation to reduce the risk of delay and cost overrun of the project implementation. Successful management of construction projects may need to adopt procedures to avoid problems and to adopt contingency plans to reduce the effects of problems when they occurred [41]. The literature review presents the previous study. The comparison with other studies demonstrates the need for the research for the special project type [33]. From the last 2 years' journal research in 2019 and 2020, the journal published in 2019 discussed risk factors that cause cost overrun in MRT Project Phase 1 in Indonesia and journal published in 2020 discussed risk factors cause cost overrun and time delay of construction projects in Indonesia. Owners and contractors also agreed “Owner additional required” as factor most causing cost overrun and time delay in the construction project. Nevertheless, both parties agreed the inflation has the least influent on construction project delay, both parties have extra effort in



the planning phase. A Successful management construction project may avoid the problem or reduce the effect when cost overrun or time delay occurred [50].

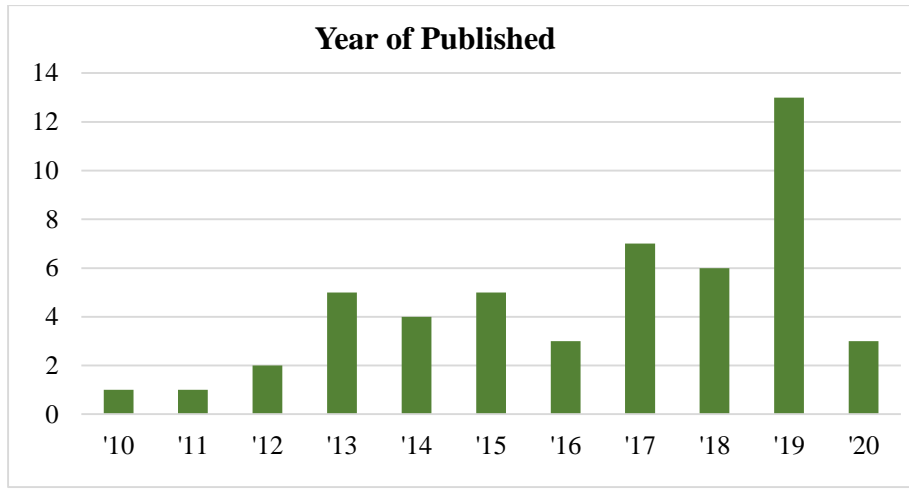


Figure 3. List of Journal's Year Published.

Based on Fig. 3, there is 1 journal published in 2010 and also 1 journal published in 2011 is selected to review, then 2 journals in 2012, 5 journals in 2013, 4 journals in 2014, 5 journals in 2015, 3 journals in 2016, 7 journals in 2017, 6 journals in 2018, 13 journals in 2019 and 3 journals published in 2020. Journals selected is discussed various types and location of the construction project. For types of construction projects, there is a highway, industry, infrastructure, high rise building, residential, hospital, railway, bridge, etc. There's a journal case for the location of the construction project in China, Turkey, Malaysia, Zambia, Palestine, Pakistan, India, Ethiopian, Sweden, Egypt, Bahrain, Iran, Cambodia, Afghanistan, Brazil, Vietnam, United Arab Emirates, Zimbabwe, Nigeria, Asia, and Indonesia. Studies were conducted to investigate the effects of cost overrun in construction projects, the field survey included 26 consultants. 41 factors are identified through a literature review. The factors are divided into 5 groups. Several studies were conducted to investigate the effects of cost overrun in construction projects. Table 2 summarizes some of these effects [13].



Table 2. List of Cost Overrun Factors According to Journal [13].

Cost Overrun Factor	Types of Factor	
Cost Estimate	Cost of Labor	Transportation Cost
	Cost of Machinery	Machinery Maintenance Cost
	Wrong Estimation Method	High-Interest Rate by Bankers
	Cost of Insurance	Fluctuation Prices of Materials
	Waste on Site	Bureaucracy in Tender Method
	Long Period Between Design and Time of Tendering	
Construction Items	Additional Work	Contract Management
	Contractual Procedure	Duration of Contract Period
	Frequent Changes in Design	Lack of Adequate Manpower
	Fraudulent Practices and Kickbacks	
Project Participants	Poor Financial Control On-Site	Poor Planning
	Disputes on Site	Previous Experience of Contract
	Relationship Between Managers and Labors	Lack of Coordination Between Construction Parties
Environment	Level of Competitors	Manipulation of Suppliers
	Absence of Construction-Cost Data	Economic Instability
	Effects of Weather	Government Policies
	Monopoly by Suppliers	Number of Competitors
	Political Situation	Poor Productivity
	Project Location	Social and Cultural Impacts
	Number of Projects Going at The Same Time	Inadequate Production of Raw Materials by The Country
Finance	Currency Exchange	Inflationary Pressure
	Project Financing	

Table 1 provides information from 50 journals selected and reviewed. To get a comparison value, in table 1, each factor in each journal has a value of 1 – 5 (the most). The percentage obtained from calculate a value in table 1 and divide with the total value from 50 journals reviewed. The result of this paper literature review, The most risk factor leading to cost overrun is Project Participants (25.60%), 2nd rank is Construction Items (22.53%), 3rd Rank is Cost Estimates (22.13%), 4th rank is Finance (16.93%) and last risk factor is Environment (12.80%) as shown below in Figure 4 and types of cost overrun factors as shown below in Figure 5.

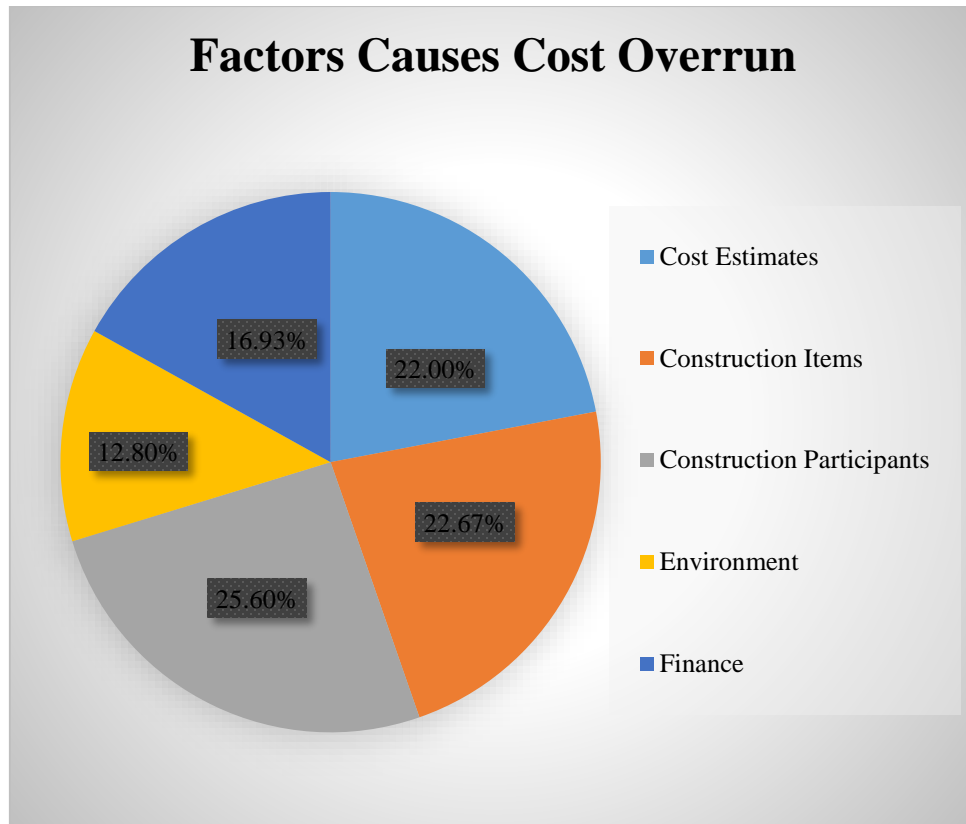


Figure 4. Percentage of factors causes cost overrun.

The preparation of a cost estimate for a particular construction project requires collecting, retrieving, and manipulating large amounts independently. Change in a project’s design could be part of a construction project nature because of its inherent complexity and uncertainty.

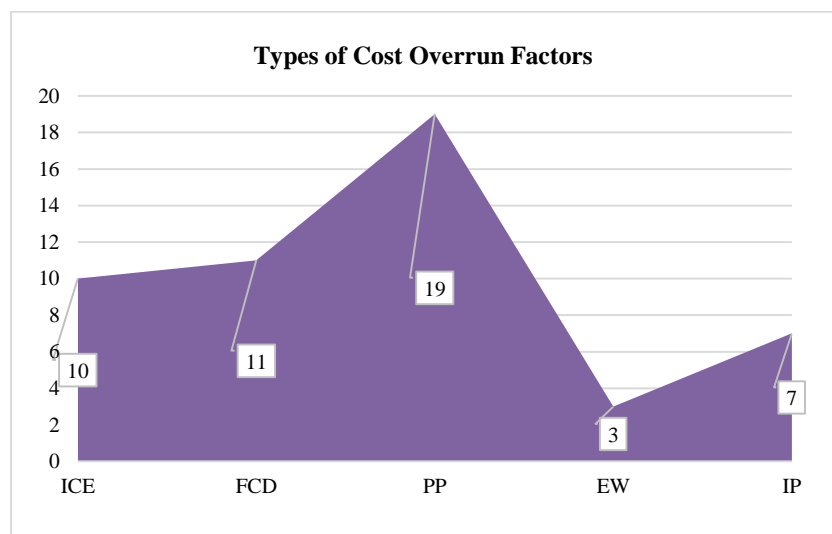


Figure 5. Percentage of Types of Cost Overrun Factors.



The most problems encountered in construction projects from 19 journals reviewed is Poor Planning. Frequent Changes in Design were identified as the most factor causes of cost overrun in eleven out of fifty journals, ten out of 50 journals identified that Inaccurate Cost Estimation is the most factor causes cost overrun, Inflationary Pressure has been recognized as one of the main causes of cost overrun in seven studies out of the fifty and the last three from fifty journals inform that weather is the most factor causes cost overrun.

4. Conclusion

The result of this paper literature review, the most risk factor leading to cost overrun is:

1. Project Participants (25.60%) with case Poor Planning (19).
2. Construction Items (22.67%) with case Frequent Changes in Design (11).
3. Cost Estimates (22.00%) with case Inaccurate Cost Estimation (10).
4. Finance (16.93%) with case Inflationary Pressure (7).
5. Environment (12.80%) with case Weather Condition (3).

A realistic tender winning price is an important thing. The contractor should be prepared for fluctuation material price during construction project time. One of the solutions to anticipate cost overrun in construction projects is good planning and estimation before the project begins.

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