Developers’ perception of cost drivers influencing project cost performance on Surabaya high-rise residential, Indonesia

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Abstract. Good cost performance is one of the fundamental criteria of a successful project. The major challenges developers have in this process is to balance the budget and project cost performance. Most of the scholars agreed that the construction industry in any country is complex because it involves a broad range of stakeholders and has wide-ranging linkages with other areas. Some of these factors are also unknown at the project level, which create difficulty for project managers to assign a favourable contingency cost. Therefore, this work came to establish factors influencing project cost performance of high-rise residential development through macro indicators based on developer’s perspective. It sought to identify these factors in an effort to shed more light on how cost drivers affect project cost performance. From the study findings, there are seven cost drivers. These drivers are analysed based on significance and impact using multiple regression analysis. The top most in terms of significance are property market and construction industry, project characteristic factor, socio economic factor and project component costs factor. The least one out of the seven factors is the statutory regulation factor. In relation to impact, project stakeholder factor has the highest impact, followed by the property market and construction industry, project characteristic factor and project component costs factor. The least one is socio economic factors.

1. Introduction
One of the major challenges facing developers is balancing the high-rise apartment budget and project management performance. Cost is arguably the most important concern in any business endeavor, not least in the construction industry [1]. Poor cost performance in construction projects has become a major concern for both contractors and clients [2, 3]. However, because the business model for high-rise residential is being sold out based on cost per square meters, the developers also need cost efficiency since project efficiency impacts customer and business success [4].

The identification of cost drivers for building development is crucial to improve cost performance. A study conducted in the Singapore construction industry [5], investigated factors contributing to project costs. The findings identified three main factors, which were contractor, owner and financial management. Additionally,[3, 5, 6] identified the factors that significantly influence construction costs in different countries. The factors are directly related to the construction organizations’ responsibilities for managing the cost, socio-cultural, economic and external conditions as well as the technological and political environments within which they operate. Despite the varied
literature on key cost drivers for building development, none of the presented research illustrates the significance of these factors on project cost performance for high-rise residential, particular in Surabaya construction market industry. The prior research focused on analyzing the influence of stakeholder on project success [7], risks factors affecting project success [8] and exploring the relationship between building development and significant factors based on New Zealand context industry [9]. The construction industry still suffers from poor project performance because of its nature, which is fragmented by the work of different stakeholders and sub-processes behind it [10, 11]. Apart from that, [12] investigated risks to predict project cost performance level by assessing risk factors of building construction in South Korea. The findings indicate that predicting cost performance is not simple. It is dependent on numerous factors, not only factors innate to the project but also project-independent circumstances. Clearly, it can be seen that cost driver factors for high-rise building development was not explicitly investigated in these studies. Previous research assessed some of the core components of projects through a micro perspective. Each of these studies provided valuable information but still, there is a need to identify and clarify key costs drivers for high-rise apartments from Surabaya’s construction industry.

The micro perspective, often tend to be opposed to stepping back in not looking at the big picture. Meanwhile, for developers, the macro perspective would be the most suitable step because it exploits the profit margin over the past years and the current position of the business industry. In addition, a few research presented the relationship between categorized high-rise residential development factors and project cost performance (cost escalation and profit) that is essential for successfully managing construction projects. Keeping construction projects within estimated costs and schedules require good practices and careful judgment. Therefore, apart from the issue of flotation, uncertainty, and contingency in the present high-rise building development there are other cost drivers that influence the performance of project costs that need to be considered. This paper came to establish these factors through macro indicators, by showing the impact of cost drivers on project cost performance in Surabaya.

2. Literature Review

2.1 The concept of cost driver factors

Based on the interests of this research, cost driver factors on this work are being presented into the accounting system. The strategic purpose of a cost driver means the factor that causes a change at the cost level or total cost [13]. Although construction accounting differs from normal accounting, the basic principles of accountancy are applicable for construction projects. Any firm incurs a cost when it uses a resource or performs a specific activity for some purpose. Therefore, for a company or developers to compete on the basis of cost leadership, management of key cost drivers is essential in order to avoid unnecessary losses and maximize the profits. Cost drivers should always be taken into construction accounting because it helps to identify opportunities to improve project cost performance within a construction development and disposal of the facilities.

2.2 Project cost performance.

Project cost performance is a measure of the value of the work completed compared to the actual cost or progress made on the project and it is one of the fundamental criteria for the success of any project. Several studies concluded that the construction industry has been facing poor cost performance (cost overrun and time extension). Most construction managers have been addressing this issue just by considering a contingency cost, without having the full picture of unseen events at neither project nor the corporate level. Developers understand that besides cost escalation, profit (total cost/revenue) should also be included into account for cost performance index. For project managers, their primary project planning is to identify costs deviations while developers suggest a possible way for cost savings. The purpose of project management and control is not sufficient to consider only the past record of costs but also the revenues incurred in a building project. Therefore, good managers should focus upon future revenues, future costs and project technical problems [14].
2.3 Cost driver factors on building development

Based on the literature review, various studies had been conducted towards building development. Most of them focused on finding variables for keeping construction projects within estimated costs and predicting cost performance [3, 5, 6, 9, 12, 15–17]. All the studies were important but the work of [9] took this subject to another level. The study identified 45 indicators that influence building development costs and sorts them into seven categories. The seven categories are project component cost factor, project characteristics factor, project stakeholders’ influence factor, property market and construction industry factor, statutory and regulatory factor, national and global dynamics, and the socio-economic factor. This research discovered that property market and the construction industry factor, national and global dynamics and socio economic factors are having significant positive effects on building development costs. While, statutory and regulatory factors and others costs are affecting building development negatively in New Zealand.

3. Methodology

3.1. Data collection procedure

The study employed exploratory, survey and descriptive research design. The exploratory design was partly utilized in the introductory part of the proposal and literature review. Towards this research, a data method was used to collect information about the entire population. The sampling method was used because does not demand a high budget and brings the population to a manageable number. The instrument was formulated based on the objectives and research questions. The questionnaire was divided into three parts.

In part A, general information about respondents was asked so that their characters could be identified. In part B, the question was asked about the extent of the highlighted cost drivers on Surabaya high-rise apartment development. Finally, in part C, the question investigated the significance of cost drivers on project cost performance. This design was used to clarify how far scholars and construction stakeholders in Surabaya are concerned about this subject. The data were collected with a time frame and developers were included in the study as they are the ones who know the company’s revenue. The proposed conceptual framework (Figure 1) shows the relationships between cost drivers and Project cost performance. The model was an extension developed based on the work of Zhao that presented the categorical factors on building development costs [9].

The involved exploratory design was crucial in reviewing the existent literature as well as discussions with experts in the subject matter. The findings provided useful insights for identifying important cost drivers affecting project cost performance in Surabaya. Furthermore, statistical analysis was carried out to verify the fitness of the proposed model.

3.2. Data analysis technique

According to [18] the process of data analysis involves several stages. For instance, in this study, the primary stage focused on structuring the questionnaire. The questionnaire was checked several times for completeness and consistency. Afterward, variables were coded. Data were analysed using descriptive analysis such as mean scores, standard deviations, frequencies distributions, and percentages. Furthermore, an analysis of variance (ANOVA) test was done to verify either the overall model is significant for project cost performance or not, which is a necessary step before proceeding with causal analysis. Moreover, multiple regressions were also performed in order to establish the reliability and validity of the proposed model. The study used both descriptive and inferential statistics to analysed data from the questionnaires. Multiple linear regression (MLR) analysis was used to establish the nature and magnitude of the relationship between variables. Below is the MLR equation:

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon \]  

Where;

\( Y \) = Project Cost Performance (PCP)  
\( \beta_0 \) = Constant Term
\( \beta_1, \beta_2, \beta_3, \beta_4 = \text{Beta coefficients} \)

- \( X_1 = \text{Project Characteristics Factor (PCF)} \)
- \( X_2 = \text{Project Component Cost Factor (PCCF)} \)
- \( X_3 = \text{Project Stakeholders’ Influence Factor (PSIF)} \)
- \( X_4 = \text{Statutory and Regulation Factor (SRF)} \)
- \( X_5 = \text{Socio-Economic Factor (SEF)} \)
- \( X_6 = \text{Property Market and Construction Industry Factor (PMCIF)} \)
- \( X_7 = \text{National and Global Dynamic Factor (NGDF)} \)
- \( \epsilon = \text{Error Term} \)

**Figure 1.** Research framework Model.

### 4. Results and Discussion

#### 4.1. Developers’ characteristic

The profile of developers who were involved in the study is those who have been active in Surabaya construction industry. Based on literature and field survey were identified 35 majors high-rise apartment developers in Surabaya. 35 self-administered questionnaires were distributed. 28 questionnaires were duly returned, representing a 70% response rate, which is arguably sufficient to proceed with the data analysis. Further analysis showed that out of 28 respondents who participated in the study, 25 (91.7%) respondents were male while 3 (8.3%) were female. The findings also indicate that respondents have diploma classifications at the bare minimum as presented in Table 1. In addition, respondents were also asked to indicate their experience background on this field and findings show that 54% (Above 25 years of experience), 35% (16-25 years), 8% (11-15 years) and 3% (5-10 years).

**Table 1.** Education level of respondents.

| Level of education       | Frequency | Percent |
|--------------------------|-----------|---------|
| Certificate              | 2         | 7.1     |
| Diploma                  | 4         | 14.3    |
| Undergraduate Degree     | 6         | 21.4    |
| Postgraduate Degree      | 16        | 57.2    |
| **Total**                | **28**    | **100%**|

#### 4.2. Cost drivers that influence project cost performance of high-rise residential development

The finding shows that there are seven significant categories of variables affecting high-rise residential development. In order to determine the factors that influence project cost performance, these categories of variables were analysed based on the cumulative Mean as presented the Table 2. The Table presents...
the results of descriptive statistical analysis for project cost performance on high-rise residential.

### Table 2. Significant factors on project cost performance.

| Cost drivers Categories on Project Cost performance | Mean  | Std. Deviation | N   |
|---------------------------------------------------|-------|----------------|-----|
| Property Market and Construction Industry Factor (PMCIF) | 5.87  | 0.488          | 28  |
| Project Characteristic Factor (PCF)               | 5.54  | 0.358          | 28  |
| Socio Economic Factor (SEF)                       | 5.36  | 0.430          | 28  |
| Project Component Costs Factor (PCCF)             | 5.20  | 0.715          | 28  |
| National and Global Dynamics (NGD)                | 5.03  | 0.538          | 28  |
| Project Stakeholder Factor (PSIF)                 | 4.46  | 0.700          | 28  |
| Statutory Regulation Factor (SRF)                 | 4.15  | 0.729          | 28  |

Mean 5.09

Table 2, presents the Mean and standard deviation analysis results. Means and standard deviations were computed based on a Likert scale of 6 points. Property market and construction industry factors (PMCIF) was supported with a mean of 5.87, project characteristics factor (PCF) was supported with a mean of 5.54, and socio economic factor (SEF) was supported with a mean of 5.36. These are the categories that most influence project cost performance for high-rise residential in Surabaya and the least significant factor or category is statutory regulation factor (SRF) which was supported with a mean of 4.15, and overall the mean of mean project cost performance is 5.09. Even though the finding shows a different degree of acceptance for each factor, all were confirmed as relevant for high-rise apartment development.

### 4.3. The significance of all the variables in the presented model for project cost performance

In order to test for sampling adequacy and correlation, the Pearson test was computed and the value was below 0.80, which means there is no multicollinearity in the proposed model. Besides, a variance inflation factor test (VIF) was also performed and its value was less than 10 (See Table 5), hence we do conclude that there is no multicollinearity between the independent variables. The assumption of having a normal data distribution has been satisfied and it led to continuing with F-test analysis. These tests indicate that the analysed factors were appropriate for the set of data and the F-test was computed to measure association among variables. F-test shows that the overall model is significant for project cost performance with \( p-value (0.000) \), which indicates that the correlation matrix was less than 0.05 and implied that there was a strong association among variables.

For the measurement to what extent these factors contributed to project cost performance, Multiple Linear Regression (MLR) analysis was performed and this method was adopted because the prior assumptions are satisfied. A normality test was performed to measure whether the model with seven predictors predicts the overall changes in cost performance. The test indicates that the model that comprises of PMCIF, PCF, SEF, PCCF, NGD, PSIF and SRF does better than having singular factors. Table 3 shows the correlation coefficient \( R \) is 0.989. This means the relation between cost driver’s categories and project cost performance is strong. The value of the determination coefficient \( R^2 \) is 0.979. It means 98% of PCP is affected by PMCIF, SEF, SRF, PCCF, NGD, PCF, PSIF and the remains 2% implies other variables that cannot be explained by the model. Table 3 presents the significance and the person correlation of the model.

The correlation analysis was taken in order to verify the possibility of any multi-collinearity between the independent variables. If the Pearson Correlation is greater than 0.80 then there is multicollinearity and compromise the assumption of MLR. In this study, the correlation between each variable is less than 0.80. This shows that the variables are not highly correlated hence the assumption of MLR is satisfied. In addition, Table 4 shows the ANOVA, with a \( p-value (0.000) \) which is less than 0.05. Hence, it is concluded that the model is significant for Surabaya construction market (project cost
performance). Altogether, since all the overall model and independent variables were significant then the MLR equation could be generated. The variables of logit equation, coefficients, and inflation factor test (VIF) values are presented in Table 5.

Table 3. Correlation coefficient (R) and Person

| Model | R     | R Square | Adjusted R | Std. Error |
|-------|-------|----------|------------|------------|
| Regression | .989a | .979     | .971       | .06021     |

Table 4. The overall model (ANOVAa)

| Model | Sum of Squares | df | Mean Square | F     | Sig. |
|-------|----------------|----|-------------|-------|------|
| Regression | 3.356          | 7  | .479        | 132.3 | .000b|
| Residual  | .073           | 20 | .004        |       |      |
| Total    | 3.429          | 27 |             |       |      |

Table 5 Variables of logit equation and coefficient

| Model | Unstandardized Coefficients | Standardized Coefficients | t       | Sig. | VIF |
|-------|-----------------------------|---------------------------|---------|------|-----|
|       | B                           | Std. Error                | Beta    |      |     |
| 1 (Constant) | 2.497             | .116                       | 21.449  | .000 |     |
| PCF   | .016                      | .005                       | .196    | 2.982 | .007| 4.079|
| PCCF  | .014                      | .005                       | .129    | 2.520 | .020| 2.478|
| PSIF  | .019                      | .005                       | .233    | 3.520 | .002| 4.157|
| SRF   | .010                      | .004                       | .108    | 2.657 | .015| 1.569|
| NGD   | .013                      | .005                       | .148    | 2.581 | .018| 3.127|
| SEF   | .005                      | .002                       | .122    | 2.698 | .014| 1.930|
| PMCIF | .017                      | .004                       | .263    | 4.282 | .000| 3.569|

Under the coefficient column B, it can be seen that all seven predictors are positively related to logit or standard error of Project cost performance coefficients. PSIF has a high influence compared to the
rest of the predictors as the unit increases. As the unit increases, it shows the logit of cost performance increase by 0.19. Developers see project stakeholder factors as one of the least significant cost drivers. However, it has the highest impact on project cost performance. By looking at the odd i.e. Exp (B), an increase of one unit on PMCIF increases the odds of cost performance by 0.263 while controlling other predictors. Next, the high odds increase is on PSIF (0.233) while controlling other variables. Odds for SEF, SRF, PCCF, NGD, PCF, and PSIF are also respectively presented. From Table 5, we can find the regression model for Project Cost Performance in Surabaya as follows:

\[
PCP = 2.497 + 0.019PSIF + 0.017PMCIF + 0.016PCF + 0.014PCCF + 0.013NGD + 0.010SRF + 0.005SEF (2)
\]

This equation model represents the influence of cost drivers on cost performance of high-rise residential in Surabaya, by showing that one unit change in one of the categories would improve the project cost performance significantly. For instance, a constant of 2.497 means that if the project characteristics factor (PCF), project component cost (PCCF), project stakeholders factors (PSIF), socio economic factor (SEF), statutory regulation factors (SRF), national and global dynamics (NGD), property market and construction industry factors (PMCIF) all be rated as zero or without any positive changes, then project cost performance for high-rise residential would have an average of 2.497. This value is not absolute; still, there is a possibility that the project would be under budget if nothing happens.

4.3.1 Property Market and Construction Industry Factor (PMCIF). This factor could be impacting project cost performance as a matter of fact that the single largest input in construction, which is the building materials, it is part of this category. Typically it accounts for over 50 percent of the total construction costs. The cost of construction is usually high because of the high cost of materials, labor and equipment. Thus, it makes sense for developers to be highly concerned about the availability of supply and demand. It is their duty to ensure having enough budgets for the project’s needs. The magnitude of unfulfilled demand for construction is related to the limited supply capacity of the construction industry considering the fact it is a vital cost driver for successful planning. [19] States when demand for the apartment is low, the priority of developers’ lies in sustaining their properties' sales momentum, which is increasingly being challenged by the currently tepid market. Therefore, attractive product offerings with strong value propositions, such as location, concept and a clear target market are critical to driving sales.

4.3.2. Project component costs factor (PCCF). In general, cost is among the major consideration throughout the project management life cycle. The findings show that developers are aware that projects are subjected to cost escalation, which is one of the main problems in construction industry. The issue may be found both in developing and developed countries. Proper cost control is important as it is the general trend towards greater cost-effectiveness and ensures construction costs not solely in the context of initial costs, but in terms of life-cycle costs or total cost appraisal. Thus, it is highly recommended to oversee the construction costs both from a project and cooperate level.

4.3.3. Socio Economic Factor (SEF). Socio economic condition has an influence on high-rise apartment development. When the economy is booming, it boosts up the investor confidence. Cities with an appealing investment confidence index may attract more investors, which is a crucial element for the property market. Developer are truly concerned about this because taking a look at high-rise apartment market, it has only two types of costumers which are Investors and end-users. Therefore, a significant positive change in the socio economic index tends to attract more projects. To some extents the confidence level for Surabaya economy is satisfactory and it is expected to be even better with development of the country’s economy.

4.3.4. Global and national dynamics (NGD). This driver might be included as a matter of fact that construction industry is integrated with national and global dynamics. Developers are willing to ensure
that the investments are aligned with the local market and its surroundings. The finding is in agreement with the 2018 Surabaya market report, stating that the market sentiment index in Surabaya remains soft particularly in the high-interest rate environment [19, 20].

4.3.5. Project characteristic factors (PCF). Based on the prior market sentiment year it was expected that developers would be concerned with project characteristic factors. The construction process may be considered the most complex undertaking in any industry and adversely affects building project costs. Surabaya developers are considering this factor by taking a look at tech innovation. This finding is supported by [9], good procedures within project developments make a huge positive impact, by adding more value to the investment. The misunderstanding of the procedures and methods may result in a delay on the construction site and drive up building costs.

4.3.6. Project stakeholder Factors (PSIF). Developers are highly concerned with stakeholder engagement, especially when it comes to contractors about their roles on the project development. Contractors are responsible to deliver the project as requested. Contractor’s performance is critical to the success of any construction building because it is their duty to convert designs into practical reality. To ensure successful project execution there must be adequate financial capacity. [21] Supports this implication by saying that monetary strength of contractors and sufficient cashflow is critical in keeping construction progress as planned.

4.3.7. Statuary Regulatory Factor (SRF). Regulatory status is a crucial fundamental factor for project development. Surabaya had successfully improved the issues of building permits as suggested in the prior study [22], that changes in the local government building would unblock construction project development in Surabaya. Therefore, developer seems to be satisfied with the current situation, but still there is a need to facilitate the building compliance process in order to have a well-planned construction and avoid unnecessary costs.

5. Conclusion
The study established that there are positive correlations between cost drivers and project cost performance in Surabaya. Seven cost drivers were identified and analysed based on significance and impact. The top most in terms of significance are property market and construction industry, project characteristic factor, socio economic factor and project component costs factor. The least one out of the seven factors is the statuary regulation factor. In relation to impact, project stakeholder factor has the highest impact, followed by the property market and construction industry, project characteristic factor and project component costs factor. The least one is socio economic factors. In order to predict project cost performance of high-rise apartment development favourably, suggestions are made for considering closely the identified macro factors. Additionally, further research is required to assess the other variables that cannot be explained by the model.

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