Using Cost Indices to Develop Project Cost Estimation for Oil & Gas Industry in Indonesia

Arief Rachman

ABSTRACT

Managing projects that are operating in disrupted and rapidly changing landscapes requires maturity for achieving the project’s objectives. In order to be mature in planning and financial forecasting, the biggest concern is accurate estimating of anticipated costs before committing to the project. Projects are moving so fast, and they have limited time to develop the scope and accurately estimate costs.

Due to the requirements of end-use, we need methods or tools that can help to develop cost estimates easily and quickly. To seek the method or tool for solving the problem, the alternatives are selected and be assessed to define the project cost estimation from the other project in another location or the previous project.

Key words: Cost Indices, Cost Index, City Cost Index, Construction Cost Indices, Construction Cost Index, Project Cost Estimation, Project Cost Index, Project Cost Calculation

INTRODUCTION

In 2019, the synergy of the International Project Management Association (IPMA), Australian Institute of Project Management (AIPM) and Klynveld Peat Marwick Goerdeler (KPMG) undertook the research survey to identify and highlight the challenges of project management. With respondents with nearly 500 companies from 57 countries around the world, the research survey result states that organizations globally continue to find it difficult to deliver projects that meet all objectives around the triangle of time, cost, and scope, along with achieving stakeholder satisfaction. From the survey results, 44% of organizations are likely to deliver projects that meet original goal and business intent, 30% of organizations are likely to deliver projects that are on time, and 36% of organizations are likely to deliver projects that are on a budget. The data indicates that over half of the projects are failed and not give the original goal of the project.

Managing projects that operate in disrupted and rapidly changing conditions requires maturity to achieve project goals. We require maturity in planning and financial forecasting, maturity in hiring, and developing the right talent, maturity in ongoing risk and project management. We also require maturity in contingency management and maturity to build a positive and
productive working relationship between project owners and contractors that bring out the best in all parties. Lack of one of the maturity level will cause the project to fail to achieve the goals.

Maturity in planning and financial forecasting, the biggest concern is accurate estimating of anticipated costs before committing to the project. Projects are moving so fast, and they have limited time to develop the scope and accurately estimate costs.

Cost estimating is the forecast power to quantify the cost and price of the resources needed for the magnitude of the scope of investment options, activities, or projects. The goal of cost estimating is to minimize the uncertainty of the estimate given the level and quality of scope definition. The outcome of cost estimating includes both an expected cost and a probabilistic cost distribution.

Generally, the implementation cost estimating process during each phase of the project life cycle as the project scope is defined. At the beginning of the project where the scope definition is rough, the accuracy of the cost estimating is low. The preparation of these cost estimates is used for many strategic business planning purposes, such as market studies, initial feasibility assessments, evaluation of alternative schemes. Besides that, for project screening, project location studies, evaluation of resource needs and budgeting, long-range capital planning, etc.

When the project definition moves to a more detail phase, we need cost estimation with higher accuracy. To prepare the most detailed (Class 1) cost estimate to develop an estimation control system that is used as a final control baseline that monitors all current costs and current resources against variations in costs and parts of changes. The estimated cost can be used to evaluate bid proposals, to support vendor/contractor negotiations, or to evaluate claims and resolve disputes. Typically, it consists of engineering progress from 50% to 100% has completed, and will be complemented by all project engineering and design documentation, and virtually the completion of project implementation and commissioning plans.
Class 5 cost estimates are used for many strategic business planning purposes, such as but not limited to initial feasibility assessments, market studies, project location studies, evaluation of alternative schemes, evaluation of resource and budget requirements, project screening, long-range of capital planning, etc. A Class 5 estimate is the lowest level of the project scope definition or project maturity, and a Class 1 estimate is the highest one. The estimating methodology tends to progress from modeling or analogy to deterministic methods with an increase in the level of project maturity, which results in an increase inaccuracy.

DOE’s cost estimate classifications generally follow the Association for Advancement of Cost Engineering International (AACEI), Recommended Practice (RP) No. 17R-97, and RP No. 18R-97. However, historically the more common cost estimate classification is the order of magnitude, preliminary, and definitive, which approximately equates to the AACEI’s Classes 5, 3, and 1.

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Table 1. Cost Estimate Classification for Process Industries

<table>
<thead>
<tr>
<th>ESTIMATE CLASS</th>
<th>DEGREE OF PROJECT DEFINITION</th>
<th>END USAGE</th>
<th>METHODOLOGY</th>
<th>EXPECTED ACCURACY RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 5</td>
<td>0% to 2%</td>
<td>Concept screening</td>
<td>Capacity factored, parametric models, judgment, or analogy</td>
<td>L: -20% to -50%, H: +30% to +100%</td>
</tr>
<tr>
<td>Class 4</td>
<td>1% to 15%</td>
<td>Study or feasibility</td>
<td>Equipment factored or parametric models</td>
<td>L: -15% to -30%, H: +20% to +50%</td>
</tr>
<tr>
<td>Class 3</td>
<td>10% to 40%</td>
<td>Budget authorization or control</td>
<td>Semi-detailed unit costs with assembly level line items</td>
<td>L: -10% to -20%, H: +10% to +30%</td>
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<tr>
<td>Class 2</td>
<td>30% to 70%</td>
<td>Control or bid/tender</td>
<td>Detailed unit cost with forced detailed take-off</td>
<td>L: -5% to -15%, H: +5% to +20%</td>
</tr>
<tr>
<td>Class 1</td>
<td>70% to 100%</td>
<td>Check estimate or bid/tender</td>
<td>Detailed unit cost with detailed take-off</td>
<td>L: -3% to -10%, H: +3% to +15%</td>
</tr>
</tbody>
</table>

Notes: [a] The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

METHODOLOGY

Step 1-Problem Definition.

In the beginning phase of the project (Concept Screening, Study or Feasibility), cost estimates are generally prepared based on minimal information and subsequently have wide accuracy range. Due to the requirements of end-use, cost estimates usually prepared within minimal time. For that, we need methods or tools that can help to develop cost estimates easily and quickly.

The objectives of this paper are:

- To find the appropriate method or tool that can define the project cost estimation easily and quickly, both from a similar project in another location or from a similar previous project.

Step 2-Development of the Feasible Alternatives

The alternatives are selected and assessed for seeking the method or tool to solve the problem. They are BCI Tender Price Indices, Singapore Tender Price Indices, Arcadis Indonesia Construction Cost Indices, and RS Means Cost Index. Besides that, BCI Building Cost Indices, Big Mac Index, ENR Construction Cost Index, Statistic Indonesia Construction Cost Indices, and Gold Equivalency Indices.

1. BCI Tender Price Indices.

There is a chart of historical, current, and forecasted UK tender price and building cost indices that compiled by Cost modeling Limited from information released by the RICS, the Office of National Statistics, and several big and prominent UK construction cost consultancies.

Tender Price Indices represent the contractor’s price to finish the project, i.e., the cost to the client. The indices are updated annual, and the data cost is verified quarterly.

![Historic, Current, and Forecast UK Tender Price and Building Cost Indices](https://costmodelling.com/construction-indices)

Figure 2. Historic, Current, and Forecast UK Tender Price and Building Cost Indices.

2. Singapore Tender Price Indices.

Singapore Tender Price Indices consists of 3 types of indexes are Public Residential Index, Private Residential Index, and Commercial Index. Singapore’s Public Residential Property Price Index data is updated annual and verified quarterly.

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3. Arcadis Indonesia Construction Cost Indices.

Arcadis Indonesia Construction Cost Indices is developed based on the tender price of the residential, commercial, hotel, factories, warehouses, car parks, retail malls, hospitals, etc. There are construction costs of 13 selected cities in Asian countries and 20 cities in Indonesia. These indices have historical data since this company established in Indonesia in 1999. These indices are updated annually and validated on quarterly.

Figure 3. Singapore Tender Price Index Curve

Figure 4. Arcadis Indonesia Construction Cost Indices

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4. RS Means Cost Index.

RS Means City Cost Indexes (CCI) are the tools that compare costs from city to city and region to region. The City Cost Index figures represent relative construction factors for Material and Installation costs. The 30 City Average Index is the average of 30 major U.S. cities and serves as a National Average.

<table>
<thead>
<tr>
<th>Year</th>
<th>Historical Cost Index Jan. 1, 1993 = 100</th>
<th>Current Index Based on Jan. 1, 2020 = 100</th>
<th>Year</th>
<th>Historical Cost Index Jan. 1, 1993 = 100</th>
<th>Current Index Based on Jan. 1, 2020 = 100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Est.</td>
<td>Actual</td>
<td></td>
<td></td>
<td>Est.</td>
</tr>
<tr>
<td>Oct 2020*</td>
<td>239.1</td>
<td>100.0</td>
<td>100.0</td>
<td>July 2005</td>
<td>151.6</td>
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<tr>
<td>July 2020*</td>
<td>239.1</td>
<td>100.0</td>
<td>100.0</td>
<td>July 2004</td>
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<td>Apr 2020*</td>
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<td>100.0</td>
<td>100.0</td>
<td>July 2003</td>
<td>137.0</td>
</tr>
<tr>
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<td>100.0</td>
<td>100.0</td>
<td>July 2002</td>
<td>128.7</td>
</tr>
<tr>
<td>July 2019</td>
<td>232.2</td>
<td>97.1</td>
<td>97.1</td>
<td>July 2001</td>
<td>125.1</td>
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<tr>
<td>2018</td>
<td>229.9</td>
<td>93.2</td>
<td>93.2</td>
<td>July 2000</td>
<td>120.9</td>
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<tr>
<td>2017</td>
<td>213.6</td>
<td>89.3</td>
<td>89.3</td>
<td>July 1999</td>
<td>117.6</td>
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<tr>
<td>2016</td>
<td>207.3</td>
<td>86.7</td>
<td>86.7</td>
<td>July 1998</td>
<td>115.1</td>
</tr>
<tr>
<td>2015</td>
<td>202.6</td>
<td>85.4</td>
<td>85.4</td>
<td>July 1997</td>
<td>112.8</td>
</tr>
<tr>
<td>2014</td>
<td>204.9</td>
<td>85.7</td>
<td>85.7</td>
<td>July 1996</td>
<td>110.2</td>
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<tr>
<td>2013</td>
<td>201.2</td>
<td>84.1</td>
<td>84.1</td>
<td>July 1995</td>
<td>107.6</td>
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<tr>
<td>2012</td>
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<td>81.4</td>
<td>July 1994</td>
<td>104.4</td>
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<tr>
<td>2011</td>
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<td>80.0</td>
<td>July 1993</td>
<td>101.7</td>
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<tr>
<td>2010</td>
<td>185.5</td>
<td>77.5</td>
<td>77.5</td>
<td>July 1992</td>
<td>99.4</td>
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<tr>
<td>2009</td>
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<td>75.3</td>
<td>75.3</td>
<td>July 1991</td>
<td>96.8</td>
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<tr>
<td>2008</td>
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<td>75.4</td>
<td>75.4</td>
<td>July 1990</td>
<td>94.3</td>
</tr>
<tr>
<td>2007</td>
<td>169.4</td>
<td>70.8</td>
<td>70.8</td>
<td>July 1989</td>
<td>92.1</td>
</tr>
<tr>
<td>2006</td>
<td>162.0</td>
<td>67.8</td>
<td>67.8</td>
<td>July 1988</td>
<td>89.9</td>
</tr>
</tbody>
</table>

Table 2. Historical and Forecast RS Means City Cost Index (1970 – 2020)§

5. BCI Building Cost Indices.

There is a chart of historical, current, and forecasted UK tender price and building cost indices that compiled by Cost modeling Limited from information released by the RICS, the Office of National Statistics, and several big and prominent UK construction cost consultancies.

Building Costs Indices are the costs spent by the contractor for the need of his business, the principal ones being those for labor and materials, i.e., the cost to the contractor. The indices are updated annual, and the data cost is verified quarterly.

6. Big Mac Index

The Big Mac index has been published annually by The Economist since 1986. The Big Mac Index is calculated by comparing the price of a Big Mac in one country with the price of a Big Mac in another country in their respective local currency to get the exchange rate. Then it is compared to the official exchange rate between the two currencies to assess whether the currency is undervalued or overvalued based on PPP theory.

Global prices of a Big Mac are updated monthly in U.S. dollars. There are many Big Mac stores in 45 cities in Indonesia.

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7. ENR Construction Cost Index.

“The Engineering News-Record (ENR) indexes have two types are the Construction Cost Index (CCI) and Building Cost Index (BCI). The CCI is suitable where labor costs are a high proportion of total costs. The BCI is more applicable for structures”\(^1\).

ENR publishes a limited amount of international cost data. ENR projects its BCI and CCI for the next 12 months once a year. ENR also has historical cost data from 1929 until now.

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\(^1\) Zevin, Alisa, (2018), Using ENR’s Indexes, ENR 1Q Cost Report Indexes.

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Table 3. ENR Construction Cost Index History (1929 – 2018)


Statistics Indonesia Construction Cost Index is a cost index that illustrates the construction cost of a district/city compared to the reference city. In 2019 and 2018, the reference city used is the Semarang. The previous reference city was Surabaya in 2015-2017, and in 2012-2014 was the Samarinda.

The publication of the Construction Cost Index is conducted by BPS-Statistics Indonesia annually. This Construction Cost Index covers all locations of Indonesia (34 provinces, 514 regions, and municipalities).
9. Gold Equivalency Index.

Gold had served as money for thousands of years until 1971 when the gold standard was abandoned and used as an investment. The gold market is quite large and estimated that the size of the investable gold market is $2.4 trillion. “The average daily trading volume in gold in the over-the-counter market alone is estimated at $67 billion, indicating that the gold market is very liquid”\(^{15}\). Additionally, “the London Bullion Market Association determines the fix twice a day. So, London fix is set daily at 10:30 GMT and 15:00 GMT, serving as a benchmark for pricing gold”\(^{16}\).

![Figure 7. Historical Gold Price in US Dollar]\(^{17}\)

**Step 3-Development of the Outcomes for Each Alternative**

Generally, there are three types of cost indices for construction activities:

1. Tender Price Indices (TPI).


These indices measure the price movement agreed between the client and the contractor in their regular commitment to construct when a tender is received. Use these indices to adjust estimates and budgets to different dates.

2. Output Price Indices (OPI)
These indices measure the average price of construction projects currently on-site, i.e., the movements of costs paid by clients when work has finished. These indices usually reflect the tender price received in the previous period. To use these indices to convert construction output volume figures from current to constant prices, either for national statistics or construction programs.

3. Resource Cost Indices (RCI)
These indices measure the movement of labor, material, and plant costs to contractors. These indices generally include factory gate prices for materials and plants as well as nationally agreed wage awards and legal labor costs. Usually used to understand inflationary pressures when preparing estimates and budgets and in the context of adjusting inflation in contracts.

1. BCI Tender Price Indices.

The BCI Indices is one of the Tender Price Indices categories because BCI Indices has arranged based on the construction price that has resulted in a tender process.

The SWOT analysis of BCI Tender Price Indices:

- **Strengths**
  - Have historical, recent, and forecast cost data.
  - Have historical cost data for 20 years.
  - Forecast future cost index for the next 12 months
  - Data update annually and validate quarterly.

- **Weaknesses**
  - The value cost index only for the UK
  - It can’t be used in Indonesian cities.

- **Opportunities**
  - Publish other cost indices.

- **Threats**
  - Cost Index that covers other costs.
2. Singapore Tender Price Indices.

The Singapore Indices is one of the Tender Price Indices categories because the Singapore Indices has arranged based on the construction price that has resulted in a tender process.

The SWOT analysis of Singapore Tender Price Indices:

- **Strengths**
  - Have historical cost data since 1998 and recent cost data.
  - Have 3 type tender price index
  - Data update annually and validate quarterly.

- **Weaknesses**
  - Cost indexes only for Singapore.
  - It can’t be used in Indonesian cities.
  - Don’t have historical cost data.

- **Opportunities**
  - Publish other cost indices.

- **Threats**
  - Cost Index that covers other costs.

3. Arcadis Indonesia Construction Cost Indices.

The Arcadis Indonesia Indices is one of the Tender Price Indices types because the Arcadis Indonesia Indices has arranged based on the construction price that has resulted in a tender process.

The SWOT Analysis of Arcadis Indonesia Construction Cost Indices:

- **Strengths**
  - Have a cost index that covers 20 cities in Indonesia
  - Have historical cost indexes for 20 years.
  - Have the price of high rise buildings of residence and office, factories, warehouses, etc.
  - Data update yearly and validate quarterly.
• Weaknesses
  – Have limited data for cities of the East Indonesia zone.

• Opportunities
  – Develop cost index for East Indonesia zone

• Threats
  – Cost Index that covers more cities of Indonesia

4. RS Means Cost Index.

The RS Means Cost Index is one of the Output Price Indices categories because the RS Means Cost Index has arranged based on the price paid by clients when the work has finished.

The SWOT analysis of RS Means Cost Index:

• Strengths
  – Have a data cost index of 30 US cities.
  – Have historical, recent, and forecast cost data.
  – Have historical price data for 50 years (1970 – 2019)
  – Data update yearly and validate quarterly.

• Weaknesses
  – Cost Indexes only for the US cities
  – It can’t be used in Indonesian cities.

• Opportunities
  – Publish international cost data
  – Develop cost indexes for cities outside the US

• Threats
  – Cost Index that covers more cities in the US, outside the US, and international cities.
5. BCI Building Cost Indices.

The BCI Building Cost Indices is one of the Output Price Indices categories because the BCI Building Cost Indices has arranged based on the price paid by clients when the work has finished.

The SWOT analysis of BCI Building Cost Indices:

- **Strengths**
  - Have 20 years of historical cost data and recent cost.
  - Have future cost index for the next 12 months
  - Data update quarterly.

- **Weaknesses**
  - Cost indexes only for the UK
  - It can’t be used in Indonesian cities.
  - Data compiled from several sources.

- **Opportunities**
  - Develop cost indexes for cities of the UK.

- **Threats**
  - Cost Index that covers cities of the UK.

6. Big Mac Indices.

The Big Mac Indices is one of the Output Price Indices categories because the Big Mac Indices has arranged based on the price paid by clients when the work has finished.

The SWOT Analysis of Big Mac Index:

- **Strengths**
  - Use to arrive at an exchange rate of one country to another country.
  - Have historical price data for 34 years (1986 – 2019)
  - Data update monthly
  - Have many stores in 45 cities of Indonesia
  - As an investigative tool in the country with unreliable indexes
• Weaknesses
  – The Big Mac store location only in Indonesia’s big cities.

• Opportunities
  – Develop historical big mac price data of a country

• Threats
  – Other indices as Apple iPods, Starbucks coffees, Ikea Billy bookshelves, and more

7. ENR Construction Cost Index.

The ENR Construction Cost Index is one of the Resources Cost Index categories because the ENR Construction Index has arranged based on the cost of labor, material, and rental equipment.

The SWOT Analysis of ENR Construction Cost Index:

• Strengths
  – Have material and labor prices of 20 US cities.
  – Have historical price data for 90 years (1929 – 2018).
  – Data update annually and validate quarterly.
  – Forecast future cost index for the next 12 months

• Weaknesses
  – Cost Indexes only for US cities.
  – It can’t be used in Indonesian cities.

• Opportunities
  – Publish international cost data
  – Develop cost indexes for cities outside the US

• Threats
  – Cost Index that covers more cities in the US and outside the US

The Statistics Indonesia Construction Cost Index is one of the Resources Cost Index categories because the Statistic Indonesia Construction Cost Index has arranged based on the cost of labor, material, and rental equipment.

The SWOT Analysis of Statistics Indonesia Construction Cost Index:

- **Strengths**
  - Have a cost index that covers all locations of Indonesia (34 provinces, 514 regions, and cities).
  - Data update yearly and validate quarterly.
  - Have 22 components input: 17 types of material, four types of equipment rental, and labor.

- **Weaknesses**
  - Reference’s city is change depend on similarity value with an average national cost
  - Don’t have historical cost indexes (because of reference’s city change)
  - Don’t have forecast future cost index

- **Opportunities**
  - Develop historical cost indexes

- **Threats**
  - Cost Index that has historical cost indexes of Indonesia locations.

9. Gold Equivalency Index.

The Gold Equivalency Index is one of the Resources Cost Index categories because the Gold Equivalency Index can use for understanding inflationary when preparing estimates and budgets.

The SWOT Analysis of Gold Equivalency Index:

- **Strengths**
  - The gold market is quite large and very liquid.
  - The gold market is a global market, including the cities of Indonesia.
- Have historical gold price data for 49 years.
- Gold price fixes twice a day.

- **Weaknesses**
  - Not tied to any specific country.

- **Opportunities**
  - Gold is the best portfolio, the best diversifier, and the best insurance against high inflation and systemic crises.

- **Threats**
  - The emergence of a new currency that replaces the function of gold.

Then all the alternatives are assessed by Force Field Analysis to seek the best choice of the alternatives.

1. **BCI Tender Price Indices**

![Figure 8. Force Field Analysis of BCI Tender Price Indices](image)

The net value of BCI Tender Price Indices is **2 points**.

18 By Author
2. Singapore Tender Price Indices

The net value of Singapore Tender Price Indices is 1 point.

3. Arcadis Indonesia Indices

The net value of Arcadis Indonesia Construction Cost Indices is 5 points.

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19 By Author
20 By Author
4. RS Means Cost Index

Figure 11. Force Field Analysis of RS Means Cost Index

The net value of RS Means Cost Index Indices is 3 points.

5. BCI Building Cost Indices

Figure 12. Force Field Analysis of BCI Building Cost Index

The net value of BCI Building Cost Index Indices is 2 points.

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21 By Author
22 By Author
6. Big Mac Index

The net value of the Big Mac Index is 3 points.

7. ENR Construction Cost Index

The net value of the ENR Construction Cost Index is 3 points.
8. Statistic Indonesia Construction Cost Index

Figure 15. Force Field Analysis of Statistic Indonesia Construction Cost Index. The net value of the Statistic Indonesia Construction Cost Index is 3 points.

9. Gold Equivalent Index

Figure 16. Force Field Analysis of Gold Equivalent Index. The net value of the Gold Equivalent Index is 4 points.
Based on Force Field Analysis results, the series of net value are:

- Arcadis Indonesia Indices: 5 points
- Gold Equivalent Index: 4 points
- ENR Construction Cost Index: 3 points
- Statistic Indonesia Construction Cost Index: 3 points
- RS Means Cost Index: 3 points
- The Big Mac Index: 3 points
- BCI Building Cost Indices: 2 points
- BCI Tender Price Indices: 2 points
- Singapore Tender Price Indices: 1 point.

### Step 4-Selection of Criteria

Base on the GAO Cost Estimating Guide, the US DOE Cost Estimating Guide, and solving the problem, all alternatives have assessed to produce high-quality cost estimation. The requirements that used to evaluate are Indonesia usage area, coverage zone, city cost index, historical cost index, update data period, validation data period, and index versatility. The results of the alternatives assessment can be shown in the table below:

<table>
<thead>
<tr>
<th>No</th>
<th>Attribute</th>
<th>BCI Tender Price Index</th>
<th>Singapore Tender Price Index</th>
<th>Arcadis Indonesia Cost Index</th>
<th>RS Means Cost Index</th>
<th>BCI Building Cost Index</th>
<th>ENR Cost Index</th>
<th>Statistics Indonesia Cost Index</th>
<th>Big Mac Index</th>
<th>Gold Equivalent Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indonesia Usage Area</td>
<td>Not Available</td>
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<td>20 Cities</td>
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<td>UK</td>
<td>Singapore</td>
<td>Regional (Asia)</td>
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<td>Daily</td>
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<td>Middle</td>
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Table 5. Assessment Results of The Alternatives

The level of the priority of the attributes shall follow:

**Indonesia Usage Area > Coverage Zone > City Cost Index > Historical Cost Index > Update Data Period > Validation Data Period > Index Versatility**

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28 By Author.
Based on the results of alternatives assessment, the dominance method is used to eliminate the inferior alternatives from the analysis. The dominance analysis results of the alternatives can be shown in the table below:
Table 6. The dominance analysis results of the alternatives

Based on the dominance analysis results of the alternatives that in table 6, we should eliminate the most inferior alternatives are BCI Tender Price Index, Singapore Tender Price Index, RS Means Cost Index. Besides that, BCI Building Cost Indices, ENR Construction Cost, and Statistic Indonesia Construction Cost Index.

Step 5-Comparison of The Alternatives

Indonesia Usage Area, Coverage Zone, City Cost Index, and Historical Cost Index are the essential parameter compare to other attributes because of the need for cost index for project cost estimation in Indonesia. So, the attribute parameter then is ranked based on the value and be shown in the table below:

Table 7. The Attribute Ranking

---

29 By Author  
30 By Author
Based on the results of dominance method and using data on table 7, table 8, and perform the calculation with the additive weighting technique give the results that can be shown in below:

<table>
<thead>
<tr>
<th>No</th>
<th>Attribute</th>
<th>Value</th>
<th>Normalized Weight</th>
<th>Arcadis Indonesia Index</th>
<th>Big Mac Index</th>
<th>Gold Equivalent Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indonesia Usage Area</td>
<td>Not Relevant</td>
<td>0.50</td>
<td>0.11</td>
<td>0.75</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 Big Cities</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 Cities</td>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>45 Cities</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Cities</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Coverage Zone</td>
<td>Country</td>
<td>(Relative rank^a - 1)/2</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regional</td>
<td>(Relative rank^a - 1)/2</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Global</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>City Cost Index</td>
<td>1 City</td>
<td>(City index - 1)/547</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 Cities</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 Cities</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 Cities</td>
<td>0.05</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>45 Cities</td>
<td>0.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>548 Cities</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>Historical Cost Index</td>
<td>Not Available</td>
<td>(Historical index - 0)/90</td>
<td>0.00</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>20</td>
<td>0.22</td>
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<td>22</td>
<td>0.24</td>
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<td>34</td>
<td>0.38</td>
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<td>49</td>
<td>0.54</td>
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<td>50</td>
<td>0.56</td>
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<td></td>
<td></td>
<td>90</td>
<td>1.00</td>
<td></td>
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<td></td>
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<tr>
<td>5</td>
<td>Update Data Period</td>
<td>Annually</td>
<td>(Relative rank^a - 1)/3</td>
<td>0.00</td>
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<tr>
<td></td>
<td></td>
<td>Quarterly</td>
<td>0.33</td>
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<td></td>
<td></td>
<td>Monthly</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Validation Data Period</td>
<td>Quarterly</td>
<td>(Relative rank^a - 1)/2</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monthly</td>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Daily</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Index Versatility</td>
<td>Low</td>
<td>(Relative rank^a - 1)/2</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Middle</td>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9. Calculation Results Using the Additive Weighting Technique

| Sum = 28 | 1.00 | Sum = 0.30 | Sum = 0.60 | Sum = 0.91 |

Table 8. Nondimensional Scaling

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31 By Author
32 By Author
Considering from calculation results that using The Additive Weighting Technique in table 9, the highest point is the **Gold Equivalent Index**. These indices have the best value of attributes Indonesia Usage Area, Coverage Zone, City Cost Index, Update Data Period, Validation Data Period, and Index Versatility.

**Step 6-Selection of The Preferred Alternative**

Based on the result of the dominance method, three alternatives come from 3 types of indices. The Arcadis Indonesia Indices is representative of the tender price indices, the Big Mac Index is representative of the Output Price Indices, and the Gold Equivalency Indices is representative of the Resources Cost Indices. The alternative can be selected depending on the type of cost estimation that will be developed.

**Step 7-Performance Monitoring**

Every cost estimator is challenged to strive for high-quality cost estimates by using the preferred best practices and methods. The high-quality cost estimate is essential to achieving program and project success.

The successful completion of the project measures the success cost estimation. The project cost realization with a smaller deviation has the higher quality of the project cost estimation.

Construction cost indices performance is monitored based on the success of the project cost estimation, both at the project tender and project completion. The deviation of the project estimation will be recorded and validated on quarterly periods. The revision of the cost indices will be conducted if the variation that occurs is more than the ranges.

**CONCLUSIONS & RECOMMENDATIONS**

The objectives of this paper were to answers for the below-mentioned questions:

To find the appropriate method or tool that can define the project cost estimation easily and quickly, both from a similar project in another location or from the previous similar project.

- Based on the results of The Additive Weighting Technique of the Multi-Attributes Decision Making (MADM) shows that the Gold Equivalency Indices as the "best valued and the most relevant used" because the indices have the gold prices on all provinces and all regions of Indonesia.

- To determine the project cost estimation from a similar project in another location by comparing the gold price at the location of the project plan with the gold price at the location of the other similar project.
• To determine the project cost estimation from the previous similar project by comparing the gold price in the year of the project plan with the gold price in the year of the previous similar project.

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Arief Rachman is a surface facilities specialist with more than twenty seven years of professional experience in the upstream oil and gas sectors. Currently, he works at the national oil company of Indonesia. His experience in surface facilities maintenance management and upstream projects, such as oil and gas gathering stations, gas sweetening plants, oil and gas pipelines, power plants, electrical transmission and distribution networks, and others upstream projects. He holds a bachelor’s degree in Electrical Engineering from Sepuluh Nopember Institute of Technology (ITS) and completing master’s degree in Gas Management at the University of Indonesia. He is attending a distance learning mentoring course, under the tutorage of Dr. Paul D. Giammalvo, CDT, CCE, MscPM, MRICS, GPM-m Senior Technical Advisor, PT Mitrata Citragraha, to attain Certified Cost Professional certification from AACE International.

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