

Framework for Construction Cost Estimation Based on Formal Egyptian Bulletins and Contractor Data

Abdel-Rahman El-Mohr, Mohamed Abdel-Monem, Karim El-Dash

Abstract—Cost estimation of construction projects is considered the basis for projects' life cycle cost management. Accuracy of project cost estimate depends on many factors such as the availability of labor and equipment prices and productivity rates, materials price availability, the accuracy of bidding documents provided by the client, and conditions of the market. The construction material prices form a high portion of the total project cost. Accordingly, the availability of material prices is considered one of the most important factors affecting the project cost estimate's accuracy. Several sources of material prices can be used in cost estimation during the tender phase, such as catalogues, surveys, historical data, suppliers and manufacture price lists, and governmental or private organization price bulletins. This paper introduces a simplified method for cost estimation based on two formal references for construction material price bulletins in Egypt (CAPMAS Central Agency for Public Mobilization and Statistics, and MHUC Ministry of Housing, Utilities & Urban Communities) which are issued on a monthly basis. A simple case study based on contractor's bidding documents for the residential building has been applied and compared with the above mentioned bulletins to verify the availability and accuracy of material prices provided by these bulletins. The results show that the available material prices provided by MHUC represents about 79% of total material cost in the case study, while the CAPMAS available data represents only about 59%. This study also highlighted the high level of accuracy of both bulletins' material prices compared with actual market prices.

Keywords — Bulletins in Egypt, Cost Management, Cost Overrun, Cost Estimate, Cost Data, Construction Management, Project Management

1 INTRODUCTION

The construction industry is highly affected by unexpected variables resulting from uncertainty sources, including construction parties' performance, financial issues, managerial issues, resources unavailability, and external conditions. As a result, poor performance in terms of delay and cost over-run in construction projects could occur [1].

Cost overrun is a prevalent risk in construction projects, where rarely projects are completed within the original budget. There are many causes for cost overrun, including improper planning, inaccurate cost estimation, escalation of resources cost (labours, materials, and equipment), rework, material waste, and low productivity. Inaccurate cost estimation can be identified as a significant cause of cost over-run, leading to opportunities loss or unexpected expenses.

This paper aims to examine the accuracy and efficiency of CAPMAS and MHUC bulletins as formal references for material prices for preparing detailed cost estimate for the Egyptian construction projects. In Egypt, there are no published

studies that examined or evaluated the accuracy of formal bulletins such as CAPMAS and MHUC in estimating detailed accurate project's costs during the tendering stage.

2 LITERATURE REVIEW

The cost management process includes estimation, monitoring, and control, which is necessary for delivering construction projects within the planned budget and with a minimum cost overrun.

Cost overrun for construction projects represents a percentage of about 90% [2]. Several studies have been conducted to address the cost overrun causes in construction projects. For example, Toh et al. [3] concluded that 89% of Malaysian residential construction projects had a cost overrun problem. Other studies have been conducted on infrastructure projects in Europe, North America, and Asia including roads, railways, airports, and seaport projects. They concluded that 28% to 100% of the studied projects had cost overrun up to 183% from the original cost estimate [2], [4], [5], [6], [7]. A lot of previous researches identified inaccurate cost estimation as one of the significant causes of cost over-run [8], [9], [10], [11], [12], [13], [14], [15], [16].

The cost estimation process represents the base and the most critical step for the cost management process [17]. The project cost includes a combination of direct and indirect costs. Direct costs, including materials, labor, equipment, while indirect costs represent any other costs for the project. Indirect costs include business taxes, home office, overhead, etc. The final price aggregate both costs estimate, considering contingency and profitability. The cost estimate is applying the art

- Abdel-Rahman El-Mohr, Assistant Lecturer of Construction Management, Civil Eng. Department, Faculty of Engineering, Shoubra, Benha University, Cairo, Egypt, Email: abdelrahman.elmohr@feng.bu.edu.eg
- Mohamed Abdel-Monem, Lecturer of Construction Management, Civil Eng. Department, Faculty of Engineering, Shoubra, Benha University, Cairo, Egypt, Email: m.abdelmonem@feng.bu.edu.eg
- Karim El-Dash, Professor of Construction Management, Civil Eng. Department, Faculty of Engineering, Shoubra, Benha University, Cairo, Egypt, Email: karim.aldosh@feng.bu.edu.eg

and the technology of approximating the probable costs, extent, or character of something based on information available at the time [18].

The accuracy and reliability of cost information regarding materials and labour prices are the most significant factors affecting the accuracy of construction estimation in the detailed estimate process [19], [20], [21], [22], [23], [24].

Inaccurate costs estimate in construction can be avoided by using reliable data, which is a vital input for construction projects and will reduce the risk of opportunities loss and unexpected expenses, respectively [25]. Hatamleh and Hiyassat [21] identified the accuracy and reliability of cost information and availability of the bids' databases on similar projects as two of the top ten factors affecting the cost estimate's accuracy.

Cost data collection is typically one of the most challenging, costly, and time-consuming in cost estimation processes. Data used in the cost estimate are usually collected from different sources such as published price books, cost information publication services, and trade journals [26]. The published data also include commercial cost reference, digests of actual project costs, bulletins of construction material prices, catalogues of vendors' data, and Periodicals. The historical database is another important source of data that can be provided from the previous projects' actual cost data [26].

Bulletins of construction material prices: many governmental and non-governmental organizations issued construction material prices such as Abu Dhabi static centre issues bulletin of building materials price, and standard price of goods and services (SHBJ) published by the Indonesian government as a cost reference.

In Egypt there are two formal construction material price bulletins, a bulletin issued by the Central Agency for Public Mobilization and Statistics (CAPMAS), and another bulletin issued by the Ministry of Housing, Utilities & Urban Communities (MHUC).

Historical data can be efficient when collected, organized, and normalized for different locations and times to be used for future estimates. However, this method requires data normalization, processing, storing, effort, and cost to be reliable and accurate for detailed cost estimation for current and future construction projects.

Cost information from the different sources does not have the same reputation for accuracy and reliability and should be carefully used for new estimates. Data verification and validation should be applied to check the consistency and accuracy of used data. Some of these sources were subjected to an evaluation process to compare cost estimate results from different sources with real estimates. Diaz et al. [27], for example, evaluated the effectiveness and limitations of RSMeans, which is a commercial cost reference published by Gordian, in detailed cost estimation for residential building case studies. The results show that the cost estimate based on RSMeans was 206 % higher than the actual project cost. Ghuzdewan and Narindri [28] examined the sufficiency and reliability of the Indonesian Standard price of goods and services (SHBJ or Standard Harga Barang dan Jasa) which published by the Indonesian govern-

ment. They used a contractor's bidding documents and the SHBJ bulletin in a case study from Yogyakarta city. The result indicated that the cost estimation using SHBJ was 12% higher than the contractor estimate.

This paper aims to evaluate the accuracy of detailed cost estimates based on two different official bulletins in Egypt and compare the resulted estimations with contractor cost estimate to examine such official bulletins' accuracy and reliability for a detailed cost estimate in Egypt.

3 RESEARCH METHODOLOGY

This research introduces a simplified method to check the accuracy of detailed cost estimates based on two official bulletins in Egypt, CAPMAS and MHUC. The framework, as shown in Fig. 1, includes the main steps to check the detailed cost estimate based on the two official bulletins and compare their results with real cost estimation data from the contractor project database.

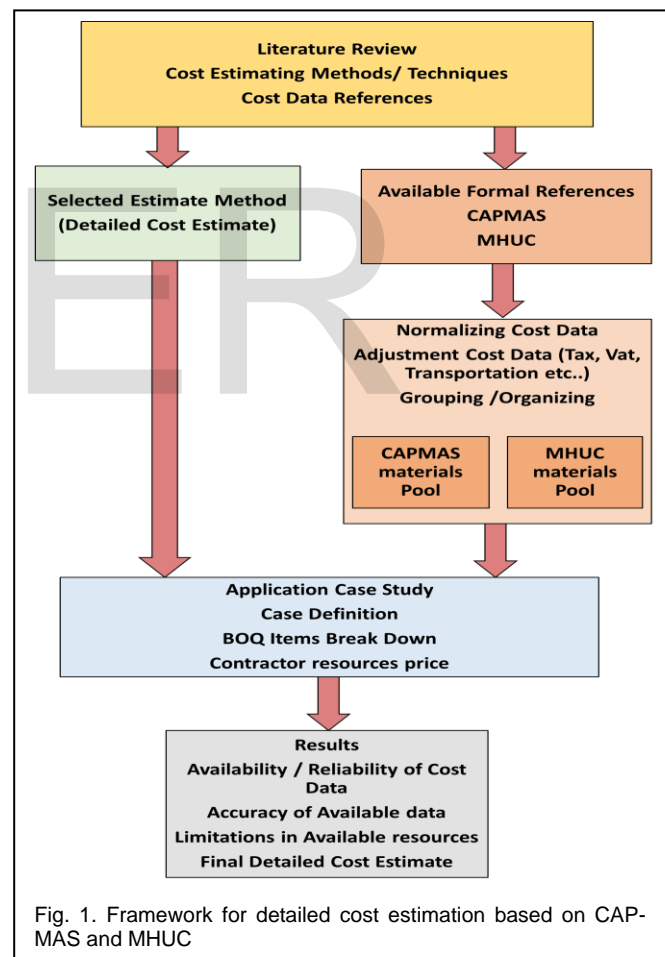


Fig. 1. Framework for detailed cost estimation based on CAPMAS and MHUC

The research methodology including four stages as follow: -

The first stage was the literature review about cost estimating methods and the available cost data references in Egypt. Based on the literature review about the current official bulletins, CAPMAS & MHUC have been identified and selected for this study.

The Housing and Utilities Sector, through the Central Administration for Needs and Building Materials, of the Ministry of Housing and Urban Communities (MHUC) issues a monthly bulletin of average building materials prices. The prices in MHUC include all duties and taxes in addition to sales tax, based on recent market prices. This bulletin provides this price list for wires and cables, hoses, and pipes without reduction rates. The bulletin includes seven main categories with 37 sub-categories [29].

The second bulletin is the CAPMAS bulletin issued monthly with average retail prices for the most important building materials to help estimators and decision-makers prepare their detailed estimate. The price in CAPMAS bulletin is the commodity selling price by the retailers to the final consumer. These prices include all duties and taxes in addition to sales tax. The prices are collected monthly from all Egypt governorates by the specialized delegates in CAPMAS offices located in the main Governorates cities. CAPMAS bulletin provides only the prices of the most important building materials under 14 categories with a total of 29 materials [30].

The second stage was the normalization process, the data collected from the two bulletins sources were normalized based on the following two steps:

- Adjusting the prices: Data have been adjusted before being used for comparison/analysis or as a basis for estimating project costs by adding other neglected fees (e.g., Taxes, Transportation, etc.)
- Categorization: rearranging the data and preparing for the cost estimation process. Data have been categorized based on the BOQ divisions to ensure that all items were fully loaded with their material prices.

The third stage was applying the normalized data for a real case study to develop a final cost estimate based on a detailed cost breakdown for BOQ items.

Fig. 2. shows the accuracy and availability evaluation process for the data extracted from the official bulletins (CAPMAS and MHUC) along with the contractor database, including the purchase orders and suppliers' offers/quotations. The evaluation process also indicates how the data normalized and used for cost estimations.

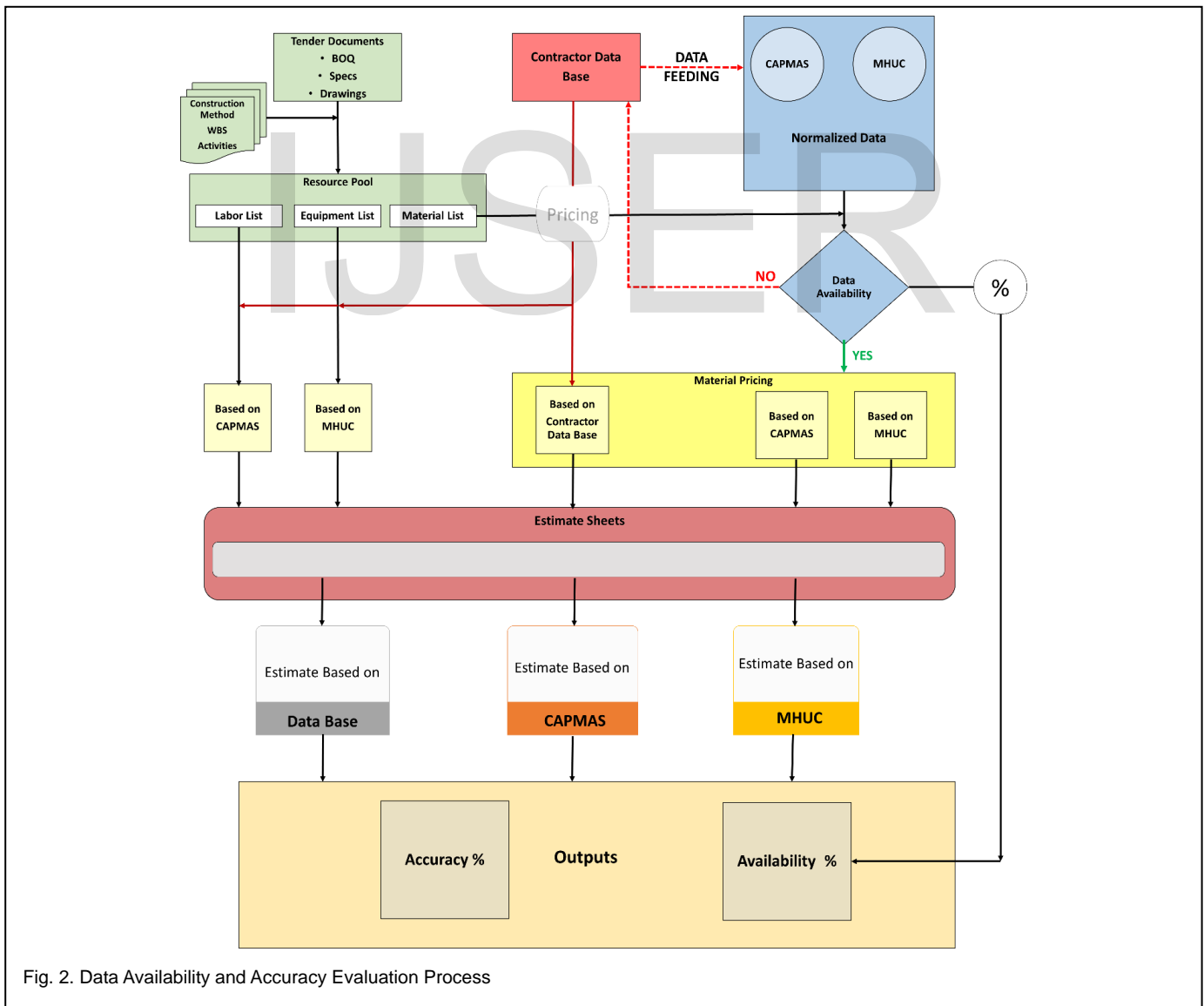


Fig. 2. Data Availability and Accuracy Evaluation Process

The final stage included the final research results and outputs outputs:

- Availability of Cost Data
- Final Detailed Cost Estimates
- Accuracy of the available data: accuracy of the final estimate was assessed by comparing the results with the contractor cost estimate data for the same project
- LIMITATIONS IN AVAILABLE RESOURCES

4 AN APPLICATION CASE STUDY

The proposed framework has been applied to a real case study to check the reliability and availability of the two official bulletins' material prices (CAPMAS and MHUC) to estimate the residential buildings' detailed cost

4.1 Project Description

A semi-finished residential building located in Cairo executed by a first-class contractor has been used as a practical case study. The project tender was in February 2019, and the construction stage has been started in March 2019 and completed in May 2020. To evaluate the accuracy/reliability and availability of the cost data provided by CAPMAS and MHUC bulletins based on the issue of February 2019.

The detailed cost estimation process using the proposed framework started first, with reviewing the contractor's tender document, the contractor's detailed estimate, the direct cost breakdown of materials, labours, and equipment, then extracting the bill of materials. The second step was extracting the raw data from both bulletins and normalize these data. Figure (3) shows the raw data from the CAPMAS bulletin, while Figure (4) shows the raw data from the MHUC bulletin. The normalization process has been done in two steps, as described previously. The first step was adjusting the prices. Table 1 and Table 2 show the raw data adjustment by adding not included fees (e.g., taxes, transportation, etc.). The other step was the categorization process, where the adjusted data have been categorized according to the project's BOQ divisions, as shown in Table 3.

Average retail prices of the most important building materials and monthly & annual change rates of Republic Urban February 2019 (Prices in L.E)			متوسط أسعار التجزئة لأهم مواد البناء ونسب التغير الشهرية والسنوية حضر الجمهورية فبراير ٢٠١٩ (الأسعار بالجنيه)			الوحدة Unit	السلعة
Commodity	Change rate for نسبة التغير %		Feb/ فبراير 2018	Feb/ فبراير 2019	Jan/ يناير 2019		
	Feb/ فبراير 2019	Jan/ يناير 2019					
Iron							الحديد
Rounded Iron 16 mm	(1.84)	0.00	12000.00	12000.00	12000.00	Ton/طن	حديد منيرو ١٦ مم
Rounded Iron 13 mm	(1.84)	0.00	12000.00	12000.00	12000.00	Ton/طن	حديد منيرو ١٣ مم
Rounded Iron 10 mm	(1.84)	0.00	12000.00	12000.00	12000.00	Ton/طن	حديد منيرو ١٠ مم

Fig. 3. partial raw data from CAPMAS

Ministry of Housing, Utilities and Urban Communities Housing and Utilities Section Central Administration for Needs and Building Materials First: Prices for main materials in year 2019											وزارة الإسكان والمرافق والمجتمعات العمرانية قطاع الإسكان والمرافق الإدارة المركزية للإحتياجات ومواد البناء أولاً: أسعار الخامات الأساسية خلال عام ٢٠١٩		
١-١ حديد التسليح (Steel)													
١-١ حديد التسليح (Steel Reinforcement)													
December ديسمبر	November نوفمبر	October أكتوبر	September سبتمبر	August أغسطس	July يوليو	June يونيو	May مايو	April إبريل	March مارس	February فبراير	January يناير	Unit الوحدة	Type النوع
										11650	11650	Ton طن	Steel 37 حديد لفاقف ٣٧
										11650	11650	Ton طن	Steel 52 حديد لفاقف ٥٢

Fig. 4. Partial raw data from MHUC

Table 1. Normalizing MHUC Feb. 2019 data (step 1 adjusting the prices)

Material	Price of raw data from MHUC	Vat Taxes	Transportation fees	Adjusted prices
Cement	840	Included	8.5	848.5
Steel reinforcement	11650	Included	116.5	11766.5
Ready Mix Concrete 250 kg/m2	725	101.5	7.25	833.75
Plastic water pipes Diameter ½ inch	13.26	Included	0.1	13.36

Table 2. Normalizing CAPMAS Feb. 2019 data (step 1 adjusting the prices)

Material	Price of raw data from CAPMAS	Vat Taxes	Transportation fees	Adjusted prices
Cement	960	Included	Included	960
Steel reinforcement	12000	Included	Included	12000
Plastic water pipes Diameter ½ inch	20	Included	Included	20

Table 3. Material prices for contractor database and CAPMAS and MHUC data

Material Code	Material description	Unit	Material Prices from Contractor database	CAPMAS Normalized price	MHUC Normalized price
Soil Works					
CS01	Clean Sand	M³	50	85	65
CS02	Crushed Stone	M³	125	155	125
WT01	Water	M³	7	NA	NA
Concrete Works					
PC250	Plain Concrete 250	M³	630	NA	NA
SW	Sweden wood	M³	6100	5750	6500
WT01	Water	M³	7	NA	NA
NA01	Nails	Kg	22	NA	NA
RFT37	Steel Reinforcement 37	Ton	12950	12000	11766.5
RFT52	Steel Reinforcement 52	Ton	12950	12000	11766.5
TW01	Tie wire	Kg	14	NA	NA
CB01	Cover Block	No	1	NA	NA
HR01	Hardened	Kg	6	NA	NA
EP01	Epoxy Paint	Kg	106	NA	105.7
WJ01	Wooden Joint 1*.75 Inch	M	15	NA	NA
RC250	Reinforced Concrete 250	M³	705	NA	833.75

4.2 Cost Estimate Calculation

The cost estimate has been calculated based on each bulletin by substituting the cost data shown in Table 3 into the detailed cost estimate sheet. In the case of unavailable material prices in CAPMAS and MHUC, the contractor database's materials prices were used. Accordingly, three estimates have been calculated, namely cost estimate based on the contractor database, cost estimate based on CAPMAS bulletin, and cost estimate based on MHUC bulletin.

4.3 Cost Estimate Calculation

Data availability weight for both bulletins has been calculated in two steps. The first step was to remove the labor and equipment costs from the cost estimation sheets to calculate the project's total cost. The second step was to remove the prices of materials not available in the bulletin prices sheet. Then, the weight of each bulletin's data availability was calculated using (1), (2).

CAPMAS (Available Materials' Weight %)=

$$\frac{\text{TMCCAPMAS}}{\text{TMCCAPMAS.T}} \quad (1)$$

where:

TMC CAPMAS: The project's total materials cost after removing prices of materials not available in the CAPMAS bulletin.

TMC CAPMAS.T: the project's total materials cost using CAPMAS bulletin prices and contractor material prices for prices of materials not available in the CAPMAS bulletin.

MHUC (Available Materials Weight %)=

$$\frac{\text{TMCMHUC}}{\text{TMCMHUC.T}} \quad (2)$$

where:

TMC MHUC: The project's total materials cost after removing prices of materials not available in the MHUC bulletin.

TMC MHUC.T: the project's total materials cost using MHUC bulletin prices and contractor database for prices of materials not available in the MHUC bulletin.

4.4 Data Accuracy

The accuracy of data provided by both bulletins has been

checked. For example, each bulletin cost estimate has been compared, separately, with contractor cost estimate after removing the prices of materials not available in the bulletin from all estimates. Then, the data accuracy is checked for each bulletin cost estimate in the project using (3), (4).

$$\text{CAPMAS Accuracy \%} = \frac{\text{TMCCAPMAS}}{\text{TMCCAPMAS.CD}} \quad (3)$$

where:

TMC CAPMAS: The project's total materials cost after removing prices of materials not available in the CAPMAS bulletin.

TMC CAPMAS.CD: the project's total materials cost using contractor database materials prices for available materials found in CAPMAS bulletin and remove other materials prices.

$$\text{MHUC Accuracy \%} = \frac{\text{TMCMHUC}}{\text{TMCCAPMAS.CD}} \quad (4)$$

where:

TMC MHUC: The project's total materials cost after removing prices of materials not available in the MHUC bulletin.

TMC MHUC.CD: the project's total materials cost using contractor database materials prices for available materials found in MHUC bulletin and remove other materials prices.

5 RESULTS AND DISCUSSION

5.1 Project Cost based on contractor prices

The case study project is a reinforced concrete residential building of 13 stories (Basement + Ground + 11 typical story) with a footprint area of 1,258 m² located in Cairo, Egypt. The project is semi-finished delivery, consists of 14 groups of work, including preparation, earthwork, masonry, concrete, roof works, façade and entrance finishes, etc.

According to the contractor's detailed cost estimate, the total direct cost has been calculated as 12,840,614.6 LE, which is divided into 10,009,637.2 LE for materials cost with 131 different material items. 2,503,666 LE for labour cost, and 327,133 LE for Equipment cost. The cost estimate has been calculated based on the contractor database for the historical purchase orders from other similar projects and suppliers' prices during tender preparation in February 2019. Table 4 and Table 5 present the material breakdown cost for major divisions.

Table 4. Materials cost estimate for major divisions based on contractor's estimate

Division	Division Cost	% of total materials cost
Civil work materials cost	5,540,796.8 LE	55%
Architectural work materials cost	3,572,028.3 LE	36%
Plumbing work materials cost	185,747.7 LE	2%
Electrical work materials cost	711,064.4 LE	7%
Total materials cost	10,009,637.2	100%

Table 5. Cost of different materials based on contractor's estimate

Item	Total item cost	% of total materials cost
Steel reinforcement	3,736,194.9	34%
Ready Mix Concrete	1,751,208.5	18%
Portland Cement	309,190.2	3%
Others	4,545,740.10	45%

5.2 Project Cost based on MHUC Bulletin

The project cost based on MHUC bulletin has been calculated based on material prices from the MHUC bulletin issued in February 2019. The extracted data have been normalized and used for the cost estimate sheets. The prices of materials not available in MHUC bulletin have been taken from contractor's database. The total material cost estimate for the project based on MHUC bulletin has been calculated as 10,377,601.7 LE. Ta-

ble (6) shows the difference between the total material cost estimate between MHUC bulletin and contractor database estimates. Assuming that any missed or not available material prices in MHUC bulletin have been taken from the contractor database prices in order to compare the total materials cost for each case.

Table 6. Materials cost estimate for major divisions based on contractor's prices and MHUC bulletin prices

Major project Divisions	Based on the contractor offer	TMC MHUC.T	Variance %
Civil works materials cost	5,540,796.8 LE	5,845,352.4	3%
Architectural works materials cost	3,572,028.3 LE	3,535,087.1	3%
Plumbing works materials cost	185,747.7 LE	243,703.3	30%
Electrical works materials cost	711,064.4 LE	753,458.9	6%
Total materials cost	10,009,637.2	10,377,601.70	0.3%

The weight of the available materials provided by MHUC has been calculated based on Equation (2) major divisions of the project, as shown in Table 7. MHUC bulletin provides most of the material's prices for civil works only. For architec-

tural and plumbing works, MHUC provides moderate material prices. However, MHUC bulletin does not provide the materials' prices for the electrical works.

Table 7. Weight of available materials in MHUC bulletin prices

Major project Divisions	TMC MHUC.T	TMC MHUC	Weight of available materials %
Civil works materials cost	5,845,352.4	5,562,408.3	95%
Architectural works materials cost	3,535,087.1	2,409,866.5	68%
Plumbing works materials cost	243,703.3	138,777.3	57%
Electrical works materials cost	753,458.9	114,681.9	15%
Total cost of Available materials data	10,377,601.70	8,225,734.00	79%

The accuracy of material prices provided by MHUC bulletin has been calculated based on Equation (4) for major project divisions. Table 8 compares the accuracy between the materials cost estimate based on MHUC and the contractor's data-

base estimate. In this case, the accuracy based on MHUC is very high for a civil and architectural cost estimate. At the same time, MHUC was not a reliable cost estimate method for plumbing and electrical items.

Table 8. Accuracy of available materials in CAPMAS bulletin prices

Major project Divisions	TMC MHUC	TMC MHUC.CD	Accuracy of MHUC prices
Civil works materials cost	5,562,408.3	5,745,687.6	97%
Architectural works materials cost	2,409,866.5	2,292,400.0	105%
Plumbing works materials cost	138,777.3	80,821.7	172%
Electrical works materials cost	114,681.9	72,287.4	159%
Total materials cost	8,225,734.00	8,191,196.70	100%

5.3 Project Cost based on CAPMAS Bulletin

The material prices from the CAPMAS bulletin issued in

February 2019 have been used for cost estimation for this case study. The normalization process has been done then

the normalized cost data have been used on the cost estimate sheets. In case of unavailable materials in the CAPMAS bulletin, the contractor's database prices have been used. The total material cost estimate for the project based on CAPMAS has been calculated as 10,165,236.5 LE. Table 9

shows the total material cost estimate based on the contractor offer and the CAPMAS estimate. The not available materials' prices have been assumed based on the contractor database prices to calculate the total project materials' cost.

Table 9. materials cost estimate for major divisions based on contractor's database prices and CAPMAS bulletin prices

Major project Divisions	Based on the contractor offer	Base on CAPMAS prices and for the reaming materials using the contractor prices	Variance %
Civil works materials cost	6,027,845.4 LE	5,627,641.96	7%
Architectural works materials cost	3,417,676.1 LE	3719720.045	9%
Plumbing works materials cost	185,747.7 LE	187761.9157	1%
Electrical works materials cost	711,064.4 LE	711064.384	0%
Total materials cost	10,342,333.60	10,246,188.31	0.9%

Table 10 shows the weight of available materials for major project divisions provided by CAPMAS, calculated based on

Equation (1). Based on the available material prices, CAPMAS is not a reliable tool for a detailed cost estimate.

Table 10. the weight of available materials in CAPMAS bulletin prices

Major project Divisions	TMC CAPMAS.T	TMC CAPMAS	Weight of available materials %
Civil works materials cost	5,627,641.96	3,374,029	60%
Architectural works materials cost	3719720.045	1,194,145	32%
Plumbing works materials cost	187761.9157	9,185	5%
Electrical works materials cost	711064.384	0	0%
Total cost of Available materials data	10,246,188.31	4,577,359	45%

The accuracy of materials prices provided by CAPMAS in this case study has been calculated based on Equation (3) to compare the accuracy of estimation of materials cost based on CAPMAS and contractor's database as shown in Table 11.

CAPMAS provides quite accurate civil works prices, moderate for architectural and plumbing works, while it does not provide cost data for electrical works.

Table 11. Accuracy of available materials in CAPMAS bulletin prices

Major project Divisions	TMC CAPMAS	TMC CAPMAS.CD	Accuracy of CAPMAS prices
Civil works materials cost	3,374,029	3,774,232.52	112%
Architectural works materials cost	1,194,145	892,100.88	75%
Plumbing works materials cost	9,185	7,170.75	78%
Electrical works materials cost	0	0.00	0%
Total materials cost	4,577,359	4,673,504.15	102%

5.4 Comparison among cost estimates for contractor database and both MHDU & CAPMAS for key materials

Table 12 shows the comparison among the prices of key materials based on the prices of materials from the CAPMAS and

MHUC bulletins and contractor's database. For key material items, MHUC bulletin provides the most accurate and updated prices, which can be used for a detailed cost estimate for projects in Egypt.

Table 12. Comparison between the prices of most weighted materials from the three sources

Item	Unit	MHUC		CAPMAS		
		Price as per Contractor offer	Price	Variance%	Price	Variance%
Steel reinforcement	Ton	11755	11766	0.001%	12000	2%
Ready Mix Concrete (250 kg/cm ²)	M3	705	725			
Portland Cement	Ton	840	840	0%	960	12%

6 DISCUSSION

The case provided an evaluation process for the two official bulletins and the contractor database estimate. The results indicated that MHUC provides material prices for about 79% of the total materials cost. In contrast, CAPMAS provides material prices for only 45% of the total material prices. The high weight percentage of the available materials was for civil works and quite available for architectural works, while they are not providing enough data for plumbing and electrical works. Table 7 shows that the weight percentage of the available materials in the MHUC bulletin for plumbing and electrical works are 57% and 15%, respectively. In contrast, table 10 shows that the weight percentage of available materials in the CAPMAS bulletin for plumbing works is 5%, and no available materials for electrical works.

The results concluded that the accuracy of material prices for some of the construction activities. This limitation significantly affects the estimates' accuracy, primarily for Future work may be done to automate the cost estimating process based on the official bulletins by scraping the related websites' data, normalizing data, averaging, and estimating costs with useful statistics.

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provided by MHUC is about 99% compared to the contractor's database prices. In comparison, the accuracy is about 98% for prices provided by CAPMAS, as shown in Table 11. The results also indicated a low level of accuracy for plumbing and electrical materials prices than the high level of accuracy for civil works materials prices.

7 CONCLUSIONS

This paper introduced a simplified method to evaluate the accuracy of using MHUC and CAPMAS official bulletins in detailed cost estimates for Egyptian projects. Based on the application case study analysis, the data provided by both Bulletins have a high accepted level of accuracy comparable to the actual market prices. However, these bulletins data still contain many limitations, such as unavailability of materials'

electrical, mechanical, and plumbing materials. These bulletins do not cover labors and equipment cost data and productivity rates.

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