NORTHROP GRUMMAN

Contractor Costs for Life Cycle Cost Estimating

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Contents

Introduction

The purpose of the Contractor Cost project is to produce new contractor cost estimating relationships (CERs) to increase the fidelity by which cost estimates and audits are conducted, as well as to determine a methodology by which contractor costs can be evaluated for use in future life-cycle cost estimating efforts. Currently, there are no cost estimating benchmarks available for use in the development of cost estimates for various contractor positions. To provide higher fidelity in future cost estimates the Contractor Cost project was undertaken to collect cost data from multiple sources, identify and analyze the dependent and independent variables associated with contractor costs (labor rates), provide justifiable benchmarks and CERs across multiple job categories for future contractor cost estimates, and document the process by which CERs were developed and identify hurdles and lessons learned.

Problem Statement

In most cases, cost estimates are performed with a limited amount of input information and/or incomplete knowledge of the product or service to be estimated. This holds true for the development of costs associated with contractors with a given cost estimate. Information available may include specifics such as the contractors' position type, years of experience, level of education, professional certifications, and work location, or may be more general in nature due to the lack of requirements or maturity of the program or office. Having either the specific detailed contractor requirements information or more limited general information should allow us to better estimate costs for specific positions or within specific estimates at varying levels of fidelity.

Our hypothesis is that there are independent variables that significantly impact contractor rates, and through statistical analysis we will be able to identify these variables to assist in the development of contractor cost benchmarks for use in the development of future cost estimates.

We developed a project plan and timeline which outlined the time frame required to accomplish the analysis, the source for data collection, the data normalization requirements, the methodology for data analysis, and the format for results presentation. In addition, during the initial planning phase, it was recognized that there may be more or less available information associated with the required contractor(s) experience, education, location, etc. This uncertainty required a multi-dimensional approach to data collection and analysis where certain independent variables were defined which would allow for less rigorous input data based on information availability. This process is defined in detail in the analysis portion of this presentation.

Data Collection

Five contractor cost samples were collected from the top 25 2006 Federal Computer Week Top 140 Government Services Administration (GSA) 70 schedule contractors list. The Information Technology (IT) Schedule 70 was established by GSA to assist federal government agencies with their procurement of IT products, services, and solutions as needed to meet their agency IT missions. Section 211 of the E-Government Act of 2002, authorized the Cooperative Purchasing Program which allows state and local government agencies to purchase many IT product and service items from Schedule 70. Due to the regulatory and competitive nature of GSA IT Schedule 70s, for procurement to direct federal government agencies, these schedules would likely produce the best starting data to develop future contractor cost benchmarks.

The sample companies were selected based on the total dollar value of contracts procured and the availability of data and completeness of documentation within the specific GSA schedule 70 documents. GSA Schedule 70s included in the data collection effort were Northrop Grumman, Science Applications International Corporation (SAIC), Computer Sciences Corporation (CSC), L-3 Communications, and Apptis. After determining the sample companies, GSA IT 70 schedules were collected on these companies from the GSA Schedules e-Library, Category 132-51. Once all of the GSA IT 70 schedules were collected for each company, all of the positions and cost data were transferred into an excel spreadsheet for fiscal years (FY) 2008 through 2012. Company specific GSA IT Schedule 70s can be found in the reference section of this document.

The use of GSA Schedule 70 data is a good starting point but is not comprehensive in nature. Future iterations of this analysis should increase the data collection effort to include additional GSA schedules and contractor cost rate data from other available sources. The analysis performed is representative only of GSA Schedule 70 costs but is a proof of concept for future analysis and identifies a methodology for the review of contractor cost data including both the significant normalization requirements as well as the identification of independent variables and the development of cost estimating relationships (CERs).

Data Normalization

Independent Variables

The collected data includes both dependent and independent variables. The dependent variables are the FY contractor rates from FY08-FY12. The independent variables for the data are the Contractor Company, Labor Category, Position Level, Minimum Education, Minimum Experience, and Location of the position (site or full rate). Although these independent variables were collected directly from the GSA Schedules, they were not consistent across schedules and required normalization. We suspect that each of these independent variables may have some impact on contractor rates we did not want to include Contractor Company in the analysis. We have chosen to exclude this variable from the analysis due to the inherently competitive nature of the GSA Schedules and our need as cost analysts to project future costs based on requirements (of which Contractor Company may not be one).

Independent variables requiring normalization included Labor Category and Position Level. The independent variable Labor Category was normalized by defining six labor categories which covered the spectrum of total labor categories within the population. A thorough review of each data point and associated position description was then required in order to tie one of the six labor categories to each data point. Labor Category definitions were based on the identified Northrop Grumman labor categories and are listed in Appendix A. The normalization of labor categories was a critical piece to furthering our understanding of the data and our ability to estimate contractor costs. The normalization required a significant effort in reducing the variety of labor categories and position descriptions, identified across multiple contractors, to six specific disciplines. These six disciplines are the core discriminators of the type of contract work to be performed and significantly enhance our analytical understanding of contractor costs/rates.

Due to the interchangeability of minimum education and minimum experience identified in a variety of labor categories, we needed to identify an independent variable that captured the interchangeable nature of these two distinct independent variables. The new independent variable which we developed is called Education & Experience (E&E). This independent variable is the sum of education and experience where experience is the minimum number of years of experienced identified in the position description and education is the minimum educational level identified in the position description. Because education level was originally a nominal (non-numeric) variable it was required that we develop a schema for converting to a numeric variable. The schema that we developed is based on the total number of years of undergraduate and graduate level education with a doctorate or PhD assumed to require four years of full time graduate level education. The following chart details this information.

Education Level	Years of E&E
High School	0
Undergraduate	4
masters	6
Doctorate	10

The independent variable Position Level was developed and normalized through the identification of Junior, Midlevel, and Senior positions within each Labor Category. These Position Levels are based on an evaluation of the independent variable E&E. It should be noted that education and experience are interchangeable to accomplish the prerequisite E&E years for a given position, e.g. a Technical position with a level of 1 (Junior) can be achieved by a contractor having either: a BS with no work experience, an AS and 2 years work experience, or a High School Diploma with 4 years of work experience. The development of the independent variable Position Level may act as a proxy for education and experience where either education or experience individually are unknown or where the combination of education and experience can not be defined with the amount of specificity required in order to utilize a developed cost estimating relationship.

Below is a reference copy of the benchmarks utilized for the organization of the data and the development of the independent variable Position Level. Levels are internally developed identifiers used to indicate positions within a specific labor category and skill level. The definition for the Positional Levels is equal to the definition for the identified labor category plus the requisite minimum total education and experience (E&E) as indicated in the chart below. Junior (1) Midlevel (2) and Senior (3) Position Levels are identified for each labor category. The separation between each of the categories was determined through examination of independent variables and identification of existing hierarchical relationships.

Total E&E Years	Administrative	Technical	Professional	Management	TE	SME
0	1	1				
1						
2						
3						
4	2				1	1
5			1	1		
6						
7	3					
8		2				
9					2	
10						
11						2
12			2	2		
13						
14					3	
15						
16		3				
17			3			
18						
19						
20				3		
21+						3

Additional independent variables developed include certification, Experience + Education Squared ((E&E)^2) and Education x Experience. Definitions for all variables are as follows:

- Contractor Company – Companies, Northrop Grumman, SAIC, CSC, L-3 Communications, and Apptis in this case, GSA IT Schedule 70 data collected for this project. This is a string variable (non-numeric) which can not be utilized as an independent variable.
- Labor Category – One of seven career concentrations identified as Administrator, Analyst, Technical, Management, Subject Matter Expert (SME), Professional, and Technical Expert (TE) (which is a category discovered during analysis). Expanded descriptions of these positions are referenced in Appendix A. This is a string variable (non-numeric) which can not be utilized as an independent variable.

- Position Level – An indicator used to define the positional hierarchy of a given position determined by the combination of education and experience. Position Levels include Junior (1), Mid-level (2), and Senior (3).
- Minimum Education – Minimum education requirement for a given position. Metric values based total years of higher education completed. High School Diplomas are 0, Associate's Degrees (AS) are 2, Bachelor's Degrees (BS) are 4, Masters Degrees (MS) are 6, and Doctorate Degrees (PhD) are 10.
- Minimum Experience – Minimum years of experience required for a given position
- Location of the position – Location of position to determine its full rate, located at a government location, or site rate, located at a contractor location.
- Certification – A binary value indicating a requirement for a certification with a one indicating that a certification is required and a zero indicating that no certification is required.
- Education + Experience (E&E) – Metric sum of education and experience values identified as a potential independent variable.
- Education x Experience (ExE) – Metric product of education and experience values identified as a potential independent variable.
- Experience + Education Squared ((E&E)^2) – Metric result of the sum of education and experience values squared identified as a potential independent variable.

Dependent Variable

Normalization was also required for the dependent variable Contractor Cost (labor rate). Each sample company's contract fiscal year started and ended on different months and created contractor rates which did not reflect the same time period. To correct this deficiency a normalization methodology was developed and used to align each contractor FY to the Government Fiscal Year (GFY) October through September format. In order to accomplish this we used a weighted average approach based on months contractor FY per GFY and the average contractor inflation rates. The process used in order to accomplish this normalization is detailed below.

The inflation percentages were determined by totaling all of the contractor costs for each FY, dividing the target FY by the prior FY, and then dividing by the prior FY to determine the inflation percentage for the target FY. The result of the inflation calculations resulted in standard inflation increases between FYs for sample companies. Below is a mathematical representation of the formula used:

((FY09 total costs) – (FY08 total costs)) / (FY08 total costs) = % Inflation from FY08 to FY09

The Government Fiscal Year (GFY) begins October 1st and ends September 30th the following calendar year. Each month where the contractor FY was the same as the GFY the labor rate was not adjusted. Each month where the contractor FY was not equal to the GFY we multiplied by either 1+inflation rate or 1-inflation rate in accordance with the direction of the contractor FY to GFY relationship. This methodology resulted in a weighted average contractor FY (and hence labor rate) which was then used as the standard GFY for each contractor. The following are explanatory mathematical representations of the aforementioned methodology for the GFY10 (October 1, 2009 through September 30, 2010) where the Contractor FY (CFY) is equal to January 1 through December 31:

3/12 CFY10 labor rate * (1-CFY09 to CFY10 inflation rate) + 9/12 CFY10 labor rate = GFY10 labor rate

Data Analysis

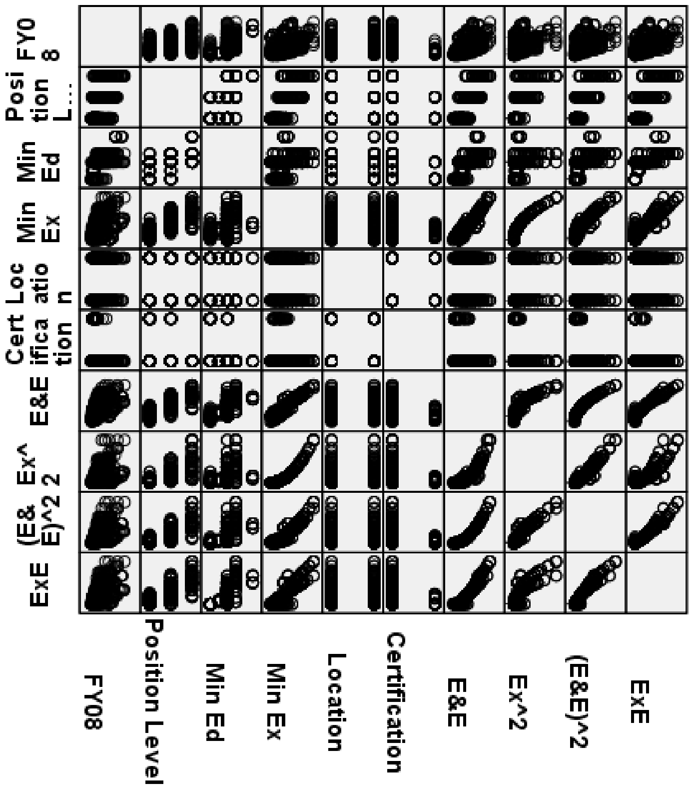
Population

In order to gain an initial understanding of the collected data we developed the descriptive statistics for the entire population including the minimum GFY08 contractor rate, the maximum GFY08 contractor rate, the mean GFY08 contractor rate, and the standard deviation of the population. The statistics are located in the below chart.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
FY08	686	$21.06	$335.87	$96.7219	$58.98640
Valid N (listwise)	686				

In addition to the above descriptive statistics, we wanted to identify the independent variables which appeared to have an effect on the dependent variable GFY08 Contractor Rates (we used GFY08 contractor rates as the dependent variable throughout the analysis as the results will approximate the results for GFYs 09 – 12). In addition, it was necessary to identify any multicollinearity between independent variables before running a regression analysis. In order to accomplish these two tasks the Team developed a scatter matrix for the dependent and independent variables. The scatter matrix is below.



This matrix indicates that there are varying degrees of relationship (correlation) between the dependent variable, FY08 Contractor Rate, and all of the independent variables identified. There is also a known correlation between several of the independent variables (multicollinear relationship) within the data set. These relationships are apparent in the scatter matrix as well as the independent variable definitions provided earlier and the collinear independent variables should not be used in conjunction within the regression analysis.

The next step in the analysis is to determine the best fit regression equation. The Cost Team accomplished this through the use of the Backward Elimination Technique for identifying significant independent variables. The Backward Elimination Technique is a method for performing regression analysis which follows an iterative 3 step procedure:

1. a regression equation is computed using all independent variables
2. The partial F-test value (or partial significance level) is calculated for every predictor variable
3. The lowest partial F-test value (or highest partial significance level) is compared with our default value
    a. If the lowest partial F-test is < the default value then we remove this variable and recompute the regression with all remaining variables
    b. If all partial F-test values are > (or highest partial significance levels are <) the default value then we adopt the regression equation as calculated.

The Backward Elimination Technique in this case will require that regressions are run using each of the multicollinear independent variables are separately run in conjunction with the other non-collinear independent variables Certification and Location. This requires a significant amount of regression analysis with the Backward Elimination Technique being run from several starting points outlined in the following table.

	1st Run	2nd Run	3rd Run	4th Run
Certification	X	X	X	X
Location	X	X	X	X
Min Ed	X			
Min Ex	X			
Position Level		X		
(E&E)^2			X	
ExE				X

In order to determine which of the above sets of independent variables provided the best regression results for GFY08 Contractor Costs, it was necessary to utilize the backward elimination technique for all four sets of independent variables. Several of the regression models were significant at the .05 level, but the 1st Run regression model, including Minimum Education and Minimum Experience provided the best combination of F-value and R^2 and was a much better indicator of GFY08 Contractor Cost. Through the identification of additional independent variables including the sum of education plus experience (E&E), Position Level, the product of education times experience (ExE), and experience and education squared (E&E^2) we have so far been unable to significantly increase the explained variation of contractor cost above that explained by the independent variables in the 1st Run regression. That being said, these variables are not able to explain a majority of the variation in the GFY08 Contractor Costs and we would like to identify additional independent variables which would be useful in explaining this variation. Although we would like the explanatory or independent variables to explain a larger proportion of the dependent variable, the regression is statistically significant and is able to explain almost 40% of the movement in the dependent variable GFY08 Contractor Costs. The identification of these independent variables should allow us to estimate contractor costs with more accuracy than previously available. The statistics for this regression are below.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.614[a]	.378	.374	$46.67435

a. Predictors: (Constant), Site/Full, Min Experience, Certification, Min Education

b. Dependent Variable: FY08

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	899830.601	4	224957.650	103.263	.000[a]
	Residual	1483555.242	681	2178.495		
	Total	2383385.844	685			

a. Predictors: (Constant), Site/Full, Min Experience, Certification, Min Education

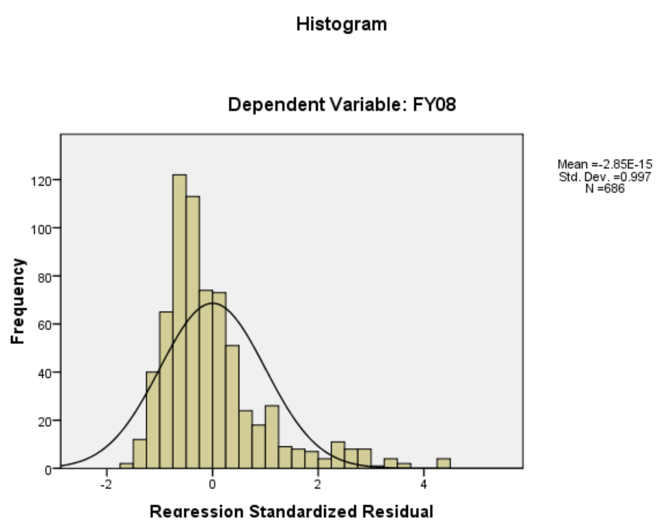
b. Dependent Variable: FY08

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.820	5.214		1.308	.191
	Certification	16.527	8.046	.068	2.054	.040
	Min Education	13.985	1.203	.414	11.626	.000
	Min Experience	4.592	.465	.326	9.885	.000
	Site/Full	14.173	3.567	.120	3.974	.000

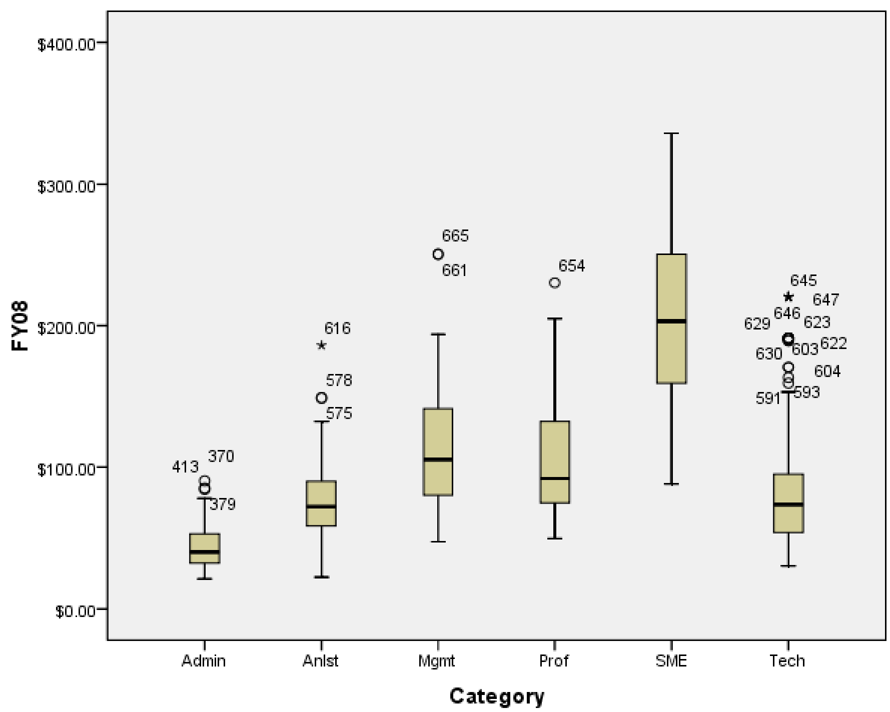
a. Dependent Variable: FY08

The next step in the analysis is to plot a histogram of the standardized residual data in order to determine if the data is normally distributed. If the histogram (for nonnegative data) is exceptionally skewed, we would need to consider the use of log or square-root transformations to achieve a more uniform spread. It is not necessary that individual data be strictly normal, but highly skewed values tend to produce heteroscedastic effects. Also, if the histograms strongly multi-modal, this might indicate a mixture of more than one population in the data and we would need to consider dummy or binary variables to reflect these different populations. The histogram developed below shows signs of the standardized residual being slightly skewed but is not significantly skewed to require that a log or square-root transformation be used. Since the histogram approximates a normal distribution, we can be confident that the linear is the proper form for this regression.



Labor Categories

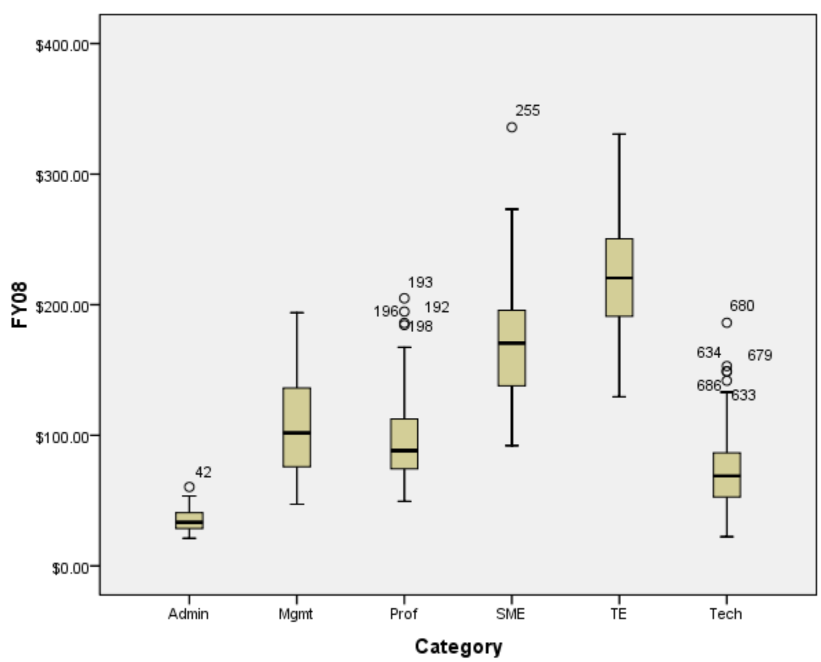
Based on the analysis of the entire data set and our desire to more fully explain our dependent variable GFY08 Contractor Costs, we began to look at other independent variables including the available string variables. The string variable which seemed most likely to contribute to our ability to identify contractor costs was the independent variable Labor Category. We used this string variable in order to split our population into six independent data sets and developed a box-plot and descriptive statistics in order to better understand the new populations. The box-plot below gives a graphical depiction of the distinct labor categories, and it is immediately clear that the segregation of the population into Labor Categories will be useful in the identification of contractor costs.



In order to test this new hypothesis, we conducted regression analysis on the individual labor categories. This analysis, like the above analysis performed on the entire data population, included the development of descriptive statistics, the development of scatter matrices in order to determine the correlation of independent variables, the development of histograms to determine the distribution of residuals, and the backward elimination technique for identifying significant independent variables through regression analysis.

In the development of these regressions we were consistently getting R^2 of <.50 and were observing a significant number of outliers at the top range of several of the labor categories. These low R^2s and significant number of outliers required additional study to better understand the data. In order to accomplish this, we again looked at the box plot to graphically observe some of the descriptive statistics and outliers within each of the categories. Based on the significant number of outliers within the technical category, the wide distribution for the high-end Professional category, and our thorough review of these and other outliers, it became apparent that we needed to develop a seventh labor category which we defined as Technical Expert (TE). The data analysis conducted indicated that there are several specific technical disciplines which have a significant impact on Contractor Cost. The identification and segregation of these disciplines into their own labor category allowed for reduced dispersion of data points within labor categories and allowed for increased correlation between dependent and independent variables. The Technical Expert Labor Category is further defined in Appendix

In addition, the similar descriptive statistics and the comparable Labor Category definitions indicated that the Analyst and the Technical Labor Categories should be combined. At the conclusion of this analysis we again looked at a box-plot and descriptive statistics in order to observe our new data sets. Below is the box-plot based on the new labor categories.



As you can see, the new technical expert category and the combination of the Technical and Analyst Labor Categories reduced the number of outliers at the top end of the Technical Labor Category and allowed for smaller standard deviations within several labor categories, particularly in the SME and Professional Categories.

The Team again ran regression analyses on the new labor categories using the backward elimination technique and reviewed standardized residuals to ensure proper form. These regressions based on six distinct labor categories are our current best fit regression lines. The results of this analysis are summarized by labor category below and are presented in detail in Appendices B through H.

Results

Summary

The purpose of the Contractor Cost project was to produce new contractor cost benchmarks to increase the fidelity by which cost estimates and audits are conducted. Through the course of this analysis TASC, in support of the DIA Cost Team, was able to identify independent variables that significantly impact contractor rates, and through statistical analysis identify these variables to assist in the development of contractor cost benchmarks for use in the development of future cost estimates. The end result are the cost estimating relationships (CERs) or regression equations which will assist cost estimators in developing estimates with higher levels of fidelity.

The Cost Team has developed CERs for the total population as well as the six identified labor categories. Through the use of the backward elimination technique we were able to identify the significant variables with a partial significance value greater than our default significance level of .05. The independent variable with the highest partial significance value was removed and the regression was again run with all of the remaining variables. This iterative process was repeated until all partial significance values were less than the default significance level of .05. We then adopted the regression equation as calculated. The below chart represents the independent variables which remained significant through the backward elimination technique for each Labor Category.

	Total	Admin	Mgmt	Prof	SME	TE	Tech
Certificate	X					X	
Min Ed	X	X				X	X
Min Ex	X	X	X	X	X	X	X
Location	X	X	X	X	X		X

Based on the independent variables in the above chart the R^2 and regression equations are detailed below.

	R^2	Regression Line Equations
Total Population	0.38	Y=6.827+(Cert * 16.53)+((MinEd * 13.99)+(MinEx * 4.59)+(Location * 14.17))
Administration	0.68	Y=25.41+((MinEd * 3.13)+(MinEx * 1.42)+(Location * 8.242))
Management	0.55	Y=40.48+((MinEx * 5.83)+(Location * 16.65))
Professional	0.53	Y=55.05+((MinEx * 5.30)+(Location * 13.72))
SME	0.60	Y=63.06+((MinEx * 8.47)+(Location * 26.30))
TE	0.72	Y=143.06+((Cert * -45.24)+(MinEd * 5.232)+(MinEx * 12.276))
Technical	0.44	Y=30.56+((MinEd * 3.89)+(MinEx * 3.99)+(Location * 12.04))

The following paragraphs detail the results for the total population as well as each of the labor categories including the explained variation in the dependent variable and the significant independent variables identified.

Detailed Category Summary

Total Population
In the development of our regression analysis using the entire data population (no data split by labor category) we identified a regression that is statistically significant and is able to explain almost 38% of the movement in the dependent variable FY08 Contractor Costs. The identification of these independent variables should allow us to estimate contractor costs with more accuracy than previously available. As detailed above, there were four significant independent variables which contributed to the regression including whether a certificate is required for the position, the minimum educational requirements, the minimum experience requirements, and whether the individual will work at a contractor site (Full) or government site (Site). The histogram is approximately normal and indicates a linear best fit regression. The scatter matrix, ANOVA statistics, and coefficients statistics indicate that the regression is statistically significant and that the regression equation can be used to better identify Contractor Costs.

Administration
In the development of our regression analysis using the Administration labor category, we identified a regression that is statistically significant and is able to explain 68% of the movement in the dependent variable FY08 Contractor Costs. The identification of these independent variables should allow us to estimate contractor costs with more accuracy than previously available. There were three significant independent variables which contributed to the regression including the minimum educational requirements, the minimum experience requirements, and whether the individual will work at a contractor site (Full) or government site (Site). The histogram is approximately normal and indicates a linear best fit regression. The scatter matrix, ANOVA statistics, and coefficients statistics indicate that the regression is statistically significant and that the regression equation can be used to better identify Contractor Costs. Additional details can be found in Appendix B.

Management
In the development of our regression analysis using the Management labor category, we identified a regression that is statistically significant and is able to explain 55% of the movement in the dependent variable FY08 Contractor Costs. The identification of these independent variables should allow us to estimate contractor costs with more accuracy than previously available. There were two significant independent variables which contributed to the regression including the minimum experience requirements and whether the individual will work at a contractor site (Full) or government site (Site). The histogram is approximately normal and indicates a linear best fit regression. The scatter matrix, ANOVA statistics, and coefficients statistics indicate that the regression is statistically significant and that the regression equation can be used to better identify Contractor Costs. Additional details can be found in Appendix B.

Professional
In the development of our regression analysis using the Professional labor category, we identified a regression that is statistically significant and is able to explain 53% of the movement in the dependent variable FY08 Contractor Costs. The identification of these

independent variables should allow us to estimate contractor costs with more accuracy than previously available. There were two significant independent variables which contributed to the regression including the minimum experience requirements and whether the individual will work at a contractor site (Full) or government site (Site). The histogram is approximately normal and indicates a linear best fit regression. The scatter matrix, ANOVA statistics, and coefficients statistics indicate that the regression is statistically significant and that the regression equation can be used to better identify Contractor Costs. Additional details can be found in Appendix B.

Subject Matter Expert
In the development of our regression analysis using the Subject Matter Expert labor category, we identified a regression that is statistically significant and is able to explain 60% of the movement in the dependent variable FY08 Contractor Costs. The identification of these independent variables should allow us to estimate contractor costs with more accuracy than previously available. There were two significant independent variables which contributed to the regression including the minimum experience requirements and whether the individual will work at a contractor site (Full) or government site (Site). The histogram is approximately normal and indicates a linear best fit regression. The scatter matrix, ANOVA statistics, and coefficients statistics indicate that the regression is statistically significant and that the regression equation can be used to better identify Contractor Costs. Additional details can be found in Appendix B.

Technical Expert
In the development of our regression analysis using the Technical Expert labor category, we identified a regression that is statistically significant and is able to explain 72% of the movement in the dependent variable FY08 Contractor Costs. The identification of these independent variables should allow us to estimate contractor costs with more accuracy than previously available. There were three significant independent variables which contributed to the regression including whether a certificate is required for the position, the minimum educational requirements, and the minimum experience requirements. The histogram is approximately normal and indicates a linear best fit regression. The scatter matrix, ANOVA statistics, and coefficients statistics indicate that the regression is statistically significant and that the regression equation can be used to better identify Contractor Costs. Although the independent variable Certification is significant within this analysis more analysis is needed in this labor Category due to the fact that there is a negative correlation between the independent variable certification and Contractor Cost. This relationship does not intuitively make sense because it indicates that the obtaining of a technical certificate would have a negative impact on the labor rate. This discrepancy is likely due to a lack of data or an incomplete understanding of the relationships of independent variables acting on cost in this case. Details on the regression equation can be found in Appendix B.

Technical
In the development of our regression analysis using the Technical labor category, we identified a regression that is statistically significant and is able to explain 44% of the

movement in the dependent variable FY08 Contractor Costs. The identification of these independent variables should allow us to estimate contractor costs with more accuracy than previously available. There were three significant independent variables which contributed to the regression including the minimum educational requirements, the minimum experience requirements, and whether the individual will work at a contractor site (Full) or government site (Site). The histogram is approximately normal and indicates a linear best fit regression. The scatter matrix, ANOVA statistics, and coefficients statistics indicate that the regression is statistically significant and that the regression equation can be used to better identify Contractor Costs. Additional details can be found in Appendix B.

Acronyms

Associates Degree	AS
Bachelors Degree	BS
Computer Sciences Corporation	CSC
Cost Estimating Relationship	CER
Defense Intelligence Agency	DIA
Education & Experience	E&E
Enterprise Resource Planning	ERP
Fiscal Year	FY
Government Services Administration	GSA
Masters Degree	MS
Doctorate Degree	PhD
Science Applications International Corporation	SAIC
Subject Matter Expert	SME
Technical Expert	TE

References

2006 Federal Computer Week Top 140 GSA 70 schedule contractors list - http://www.fcw.com/images/st_images/contractorchart_090406.pdf

GSA Schedules e-Library - http://www.gsaelibrary.gsa.gov/ElibMain/ScheduleSummary?scheduleNumber=70&x=13&y=8

GSA Schedules e-Library: Category 132-51 - http://www.gsaelibrary.gsa.gov/ElibMain/SinDetails?executeQuery=YES&scheduleNumber=70&flag=&filter=&specialItemNumber=132+51

Northrop Grumman GSA IT schedule 70 - https://www.gsaadvantage.gov/ref_text/GS35F4506G/GS35F4506G_online.htm

SAIC GSA IT schedule 70 - https://www.gsaadvantage.gov/ref_text/GS35F4461G/GS35F4461G_online.htm

CSC GSA IT schedule 70 - https://www.gsaadvantage.gov/ref_text/GS35F4381G/GS35F4381G_online.htm

L-3 Communications GSA IT schedule 70 - https://www.gsaadvantage.gov/ref_text/GS35F4702G/GS35F4702G_online.htm

Apptis GSA IT schedule 70 - https://www.gsaadvantage.gov/ref_text/GS35F4490G/GS35F4490G_online.htm

Appendix A – Positional Category Descriptions

ADMINISTRATIVE STAFF DESCRIPTION: Individuals requiring experience in general office administration using various software packages for word processing, graphic/artist presentations, publications/documentation and spreadsheets. These positions may support either management or project staff. Equivalent experience may be substituted for a degree.

MINIMUM/GENERAL EXPERIENCE: Applies general knowledge of standards, concepts, practices, and techniques related to the administrative function(s) in order to accomplish assignments. Individuals must have an understanding of specific job requirements with requisite skills to perform assigned tasks with minimal supervision.

FUNCTIONAL RESPONSIBILITY: May perform administrative duties related to word processing; travel; data management; project library; document control; document production; technical aide; data entry and computer support such as computer operations; computer technical support; and computer security.

TECHNICAL STAFF DESCRIPTION: Individuals requiring the training, analytical/programmatic skills and experience to operate within a high-tech environment. Experience includes information systems development, functional and data requirements analysis, systems analysis and design, programming, program design, computer software, system security, or LANs/WANs. Equivalent experience may be substituted for a degree.

MINIMUM/GENERAL EXPERIENCE: The Technical Staff must possess technical training or equivalent experience in one of the following types of disciplines: computer science; computer systems; decision support; computer security; electronic commerce; business process reengineering; business process analyses; information architecture planning and design; engineering; operations research; modeling and simulation; math; physics; quality assurance; systems analysis; business or management.

FUNCTIONAL RESPONSIBILITY: The Technical Staff provides specialized knowledge of complex customer processes and requirements. Individual applies technical expertise to assist in defining, analyzing, validating, and documenting complex operating environments, states of technology and current engineering processes. Conducts complex technical investigations through advanced research techniques, analysis or development phases of engineering projects.

PROFESSIONAL STAFF DESCRIPTION: Individuals requiring the training, skills and experience of Technical Staff, plus extensive breadth and depth of knowledge in one or more specific domains and normally operating in a management structure which provides sophisticated planning, scheduling, performance tracking, risk management and day-today program administration. Equivalent experience may be substituted for a degree.

MINIMUM/GENERAL EXPERIENCE: The Professional Staff is generally experienced in one or more specific domains and may have experience as a subject matter expert in a related military or commercial application. Must process training or equivalent experience in one of the following types of disciplines: computer science; computer systems; decision support; computer security; electronic commerce; business process reengineering; business process analyses; information architecture planning and design; engineering; operations research;

modeling and simulation; math; physics; quality assurance; systems analysis; business or management.

FUNCTIONALRESPONSIBILITY: The Professional Staff must have been or be able to obtain a security clearance at the level of Secret or higher and/or be able to perform in an environment involving special security requirements, as tasks orders may dictate. Demonstrates a broad knowledge of the technical discipline and applies extensive expertise as a generalist. Applies and or develops advanced technologies, scientific principles, theories and concepts in related technical disciplines or in a specialty.

SUBJECT MATTER EXPERT (SME) DESCRIPTION: These subject matter experts in the respective concentrations of engineering, science, and finance apply sound analysis, business practices, and scientific expertise to solve a wide variety of customer problems. These may include conducting reengineering efforts of complex financial processes and systems; applying advanced scientific technologies in systems, experiments and demonstrations; and introducing into systems the application of leading edge technological developments. Equivalent experience may be substituted for a degree.

MINIMUM/GENERAL EXPERIENCE: Expert in the one of the following areas: business; business management; financial management; systems management; operations research; computer science; engineering; physics; math; behavioral science or related areas. May have published articles or books in field of expertise and/or made presentations at professional conferences.

FUNCTIONAL RESPONSIBILITY: Assists in developing programs and implementing creative and innovative solutions to the customer's problems. Researches and analyzes customer requirements. Individual applies expert knowledge to determine accuracy and reasonableness of data. Documents and summarizes the results and develops and recommends creative and innovative solutions to the customer's problems.

TECHNICAL EXPERT (TE): Technical Experts maintain an advanced level of expertise in highly specialized concentrations. These concentrations focus on computer telephony, Enterprise Resource Planning (ERP), Network Architecture/Management, and higher levels of CISCO technologies. These positions must also be able to utilize extensive expertise in the areas of management, IT, science, and business to solve unique or special concentration customer problems. These may include conducting reengineering efforts of complex communications processes and systems; applying advanced scientific technologies in systems planning, integration, and demonstrations; and introducing or creating system applications of leading edge technological developments. Equivalent experience may be substituted for a degree.

MINIMUM/GENERAL EXPERIENCE: Expert in the one of the following areas: ERP management/architecture; CISCO internetworks; network/systems architecture/management; computer telephony; business management; systems management.

FUNCTIONAL RESPONSIBILITY: Assists in the development, management, and integration of advanced networking/communication systems and resource planning implementation creating innovative solutions to the customer problems. Researches and analyzes customer requirements. Applies advanced knowledge of specialized concentrations to recommend creative and innovative solutions to the customer problems.

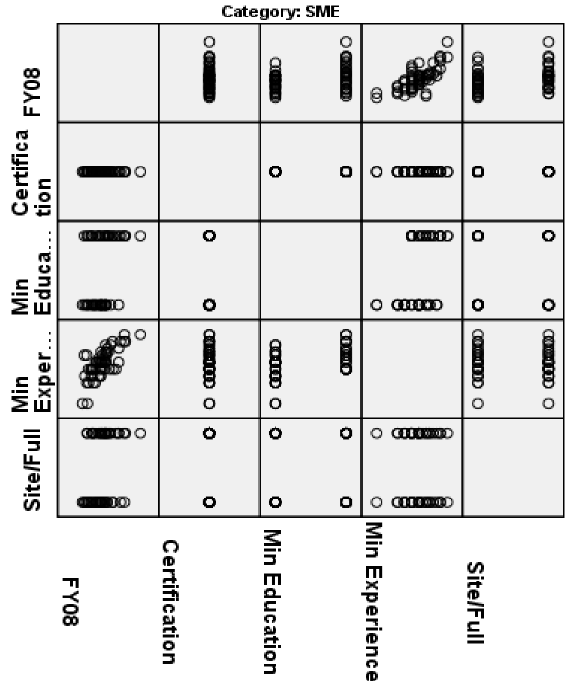
MANAGEMENT: Individuals requiring the training skills and experience of Professional, Technical or Analytical Staff plus extensive management/supervisory experience. Must have experience in technical or managerial experience in information resources management. Equivalent experience may be substituted for a degree.

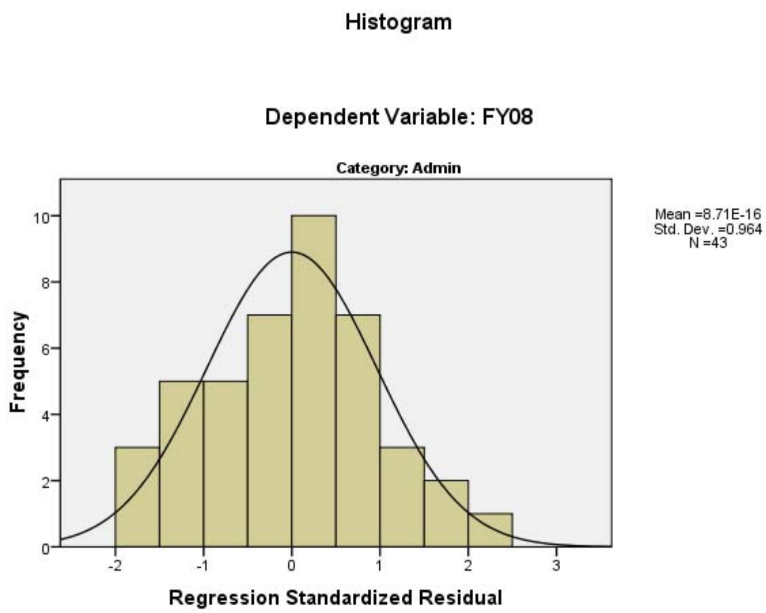
MINIMUM/ GENERAL EXPERIENCE: Must have a management background with demonstrated knowledge of a technical discipline.

FUNCTIONAL RESPONSIBILITY: The Management staff typically is responsible for the technical contract management of programs and projects. Majority of contact is with various management levels within an operating unit, at other operating units, and within the customer community concerning programs/projects, operational decisions, and contractual clarifications.

Appendix B – Job Category Statistics

Administration





Model Summary[b,c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.827[a]	.684	.660	$5.00416

a. Predictors: (Constant), Site/Full, Min Education, Min Experience

b. Category = Admin

c. Dependent Variable: FY08

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2115.855	3	705.285	28.164	.000[a]
	Residual	976.624	39	25.042		
	Total	3092.479	42			

a. Predictors: (Constant), Site/Full, Min Education, Min Experience

b. Category = Admin

c. Dependent Variable: FY08

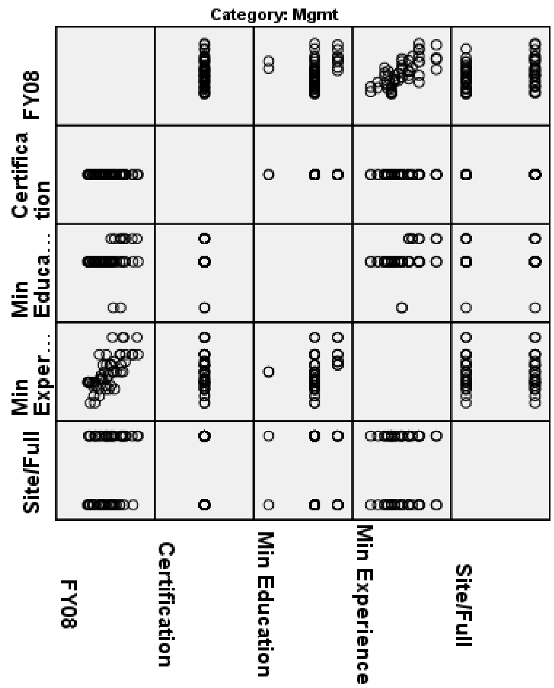
Coefficients[a,b]

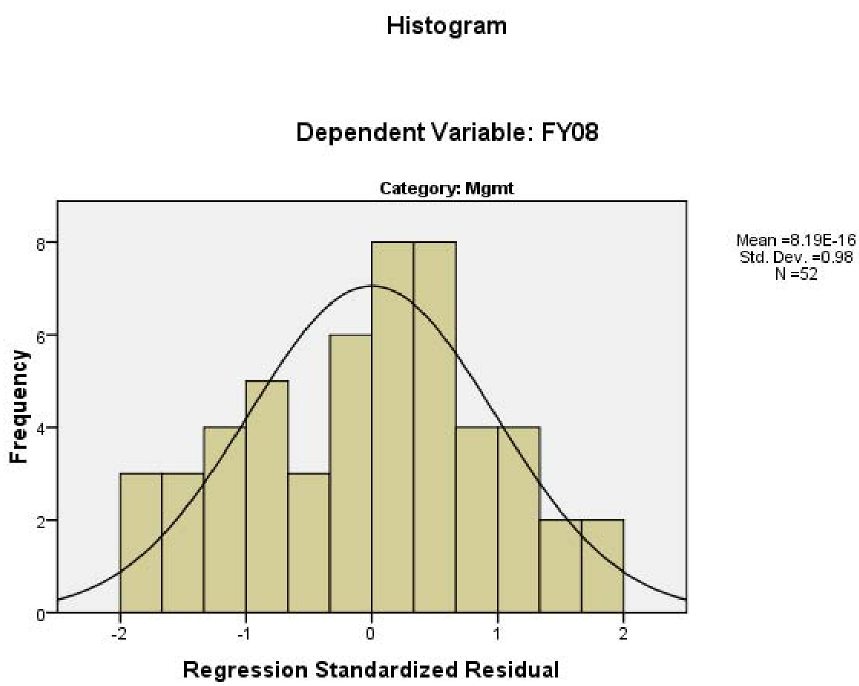
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	25.406	1.740		14.602	.000
	Min Education	3.132	.700	.486	4.474	.000
	Min Experience	1.416	.535	.289	2.645	.012
	Site/Full	8.242	1.554	.479	5.304	.000

a. Category = Admin

b. Dependent Variable: FY08

Management


Category: Mgmt
FY08
Certification
Min Educa...
Min Exper...
Site/Full
FY08
Certification
Min Education
Min Experience
Site/Full


Histogram
Dependent Variable: FY08
Category: Mgmt
Mean =8.19E-16
Std. Dev. =0.98
N =52
Frequency
Regression Standardized Residual
0
2
4
6
8
-2
-1
0
1
2

Model Summary[b,c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.744[a]	.554	.536	$26.54061

a. Predictors: (Constant), Site/Full, Min Experience

b. Category = Mgmt

c. Dependent Variable: FY08

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	42885.520	2	21442.760	30.441	.000[a]
	Residual	34515.783	49	704.404		
	Total	77401.302	51			

a. Predictors: (Constant), Site/Full, Min Experience

b. Category = Mgmt

c. Dependent Variable: FY08

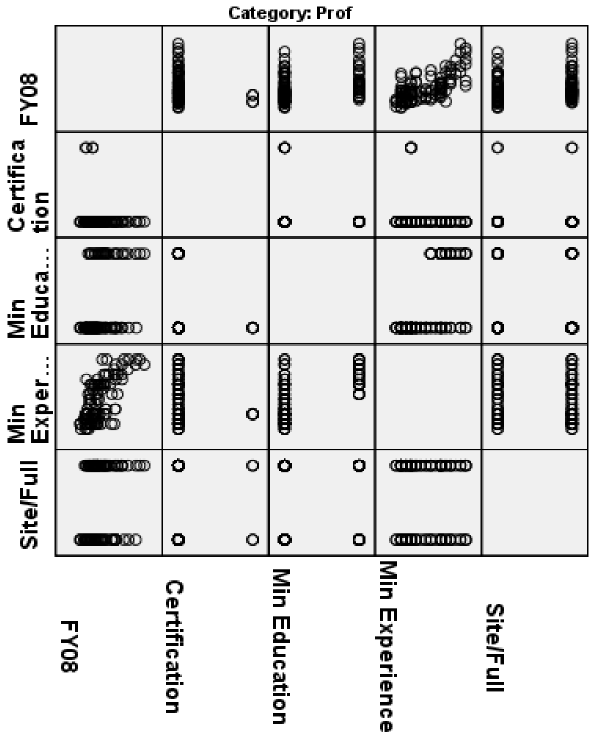
Coefficients[a,b]

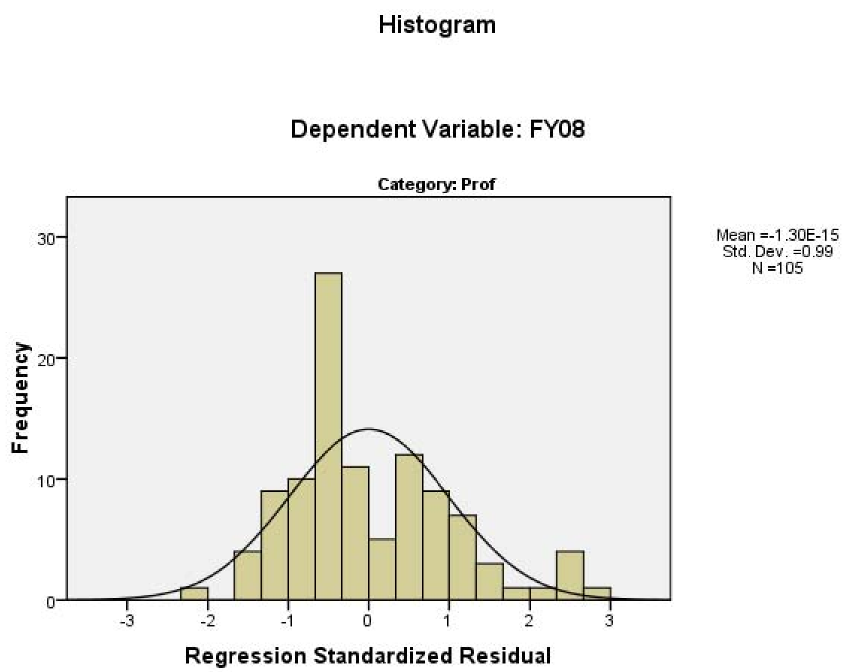
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	40.475	9.333		4.337	.000
	Min Experience	5.830	.781	.712	7.468	.000
	Site/Full	16.645	7.361	.216	2.261	.028

a. Category = Mgmt

b. Dependent Variable: FY08

Professional





Model Summary[b,c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.727[a]	.528	.519	$22.78435

a. Predictors: (Constant), Site/Full, Min Experience

b. Category = Prof

c. Dependent Variable: FY08

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	59239.285	2	29619.642	57.057	.000[a]
	Residual	52950.902	102	519.126		
	Total	112190.187	104			

a. Predictors: (Constant), Site/Full, Min Experience

b. Category = Prof

c. Dependent Variable: FY08

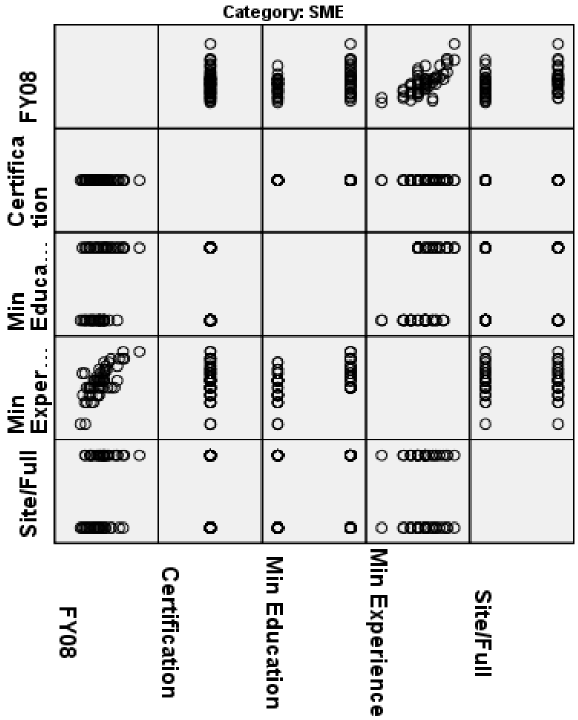
Coefficients[a,b]

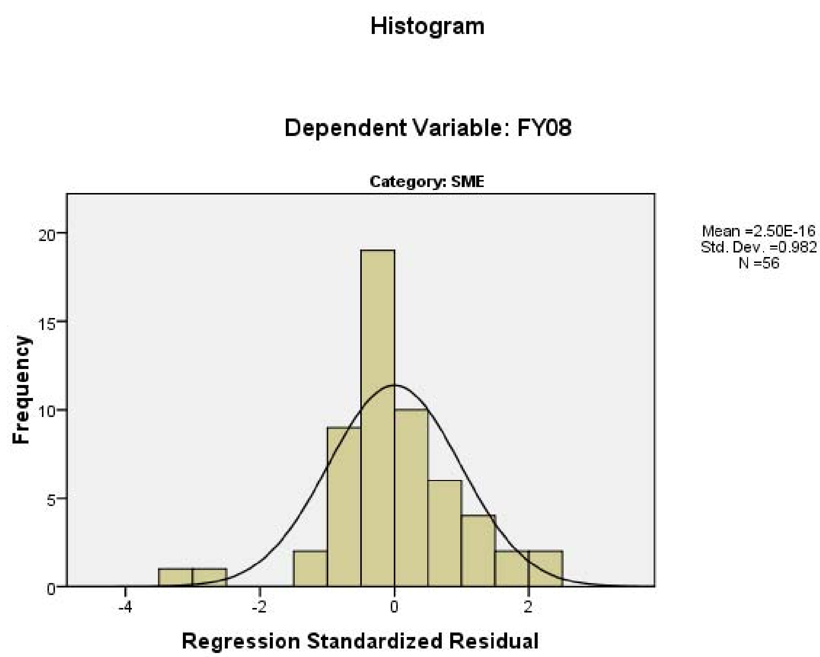
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	55.045	4.703		11.705	.000
	Min Experience	5.295	.520	.693	10.187	.000
	Site/Full	13.717	4.449	.210	3.083	.003

a. Category = Prof

b. Dependent Variable: FY08

Subject Matter Expert (SME)





Model Summary[b,c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.773[a]	.598	.582	$31.87206

a. Predictors: (Constant), Site/Full, Min Experience

b. Category = SME

c. Dependent Variable: FY08

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	79980.548	2	39990.274	39.367	.000[a]
	Residual	53838.908	53	1015.828		
	Total	133819.456	55			

a. Predictors: (Constant), Site/Full, Min Experience

b. Category = SME

c. Dependent Variable: FY08

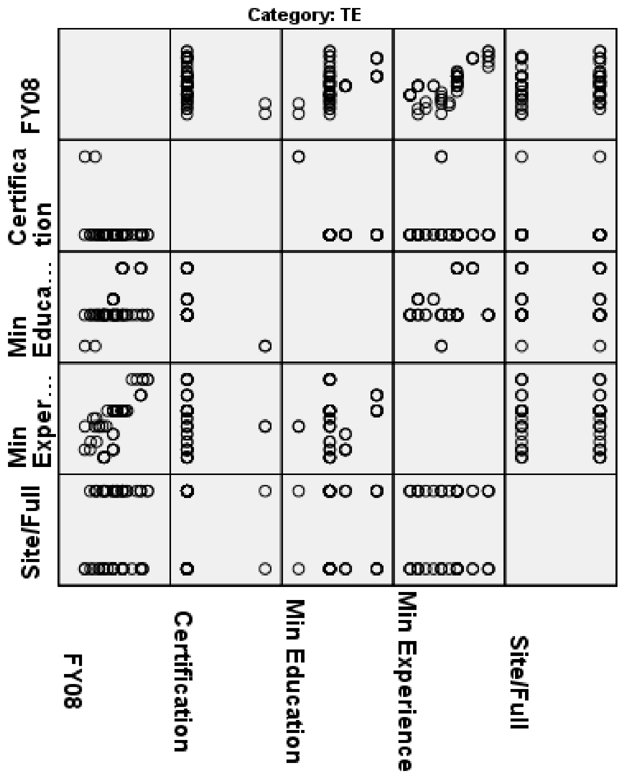
Coefficients[a,b]

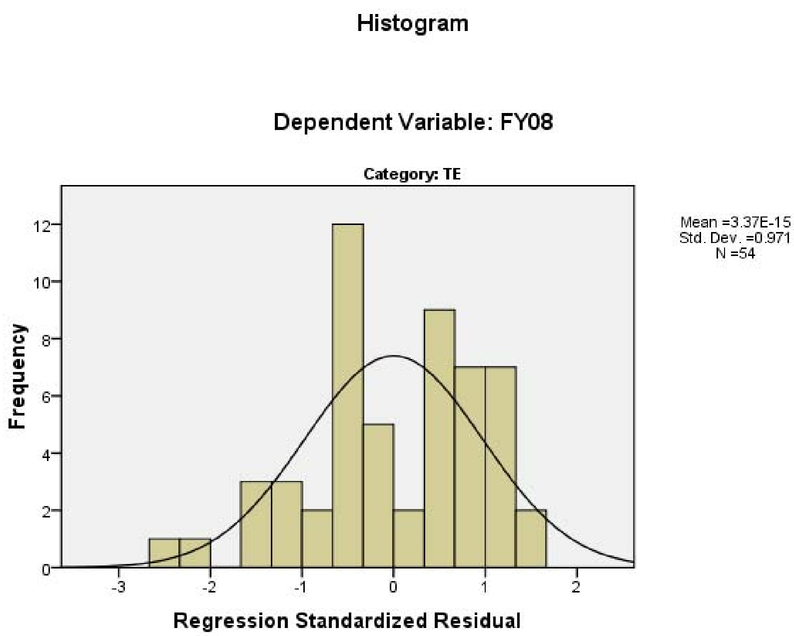
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	63.058	13.364		4.718	.000
	Min Experience	8.472	1.018	.725	8.319	.000
	Site/Full	26.297	8.518	.269	3.087	.003

a. Category = SME

b. Dependent Variable: FY08

Technical Expert (TE)





Model Summary[b,c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.851[a]	.724	.708	$28.12263

a. Predictors: (Constant), Min Experience, Certification, Min Education

b. Category = TE

c. Dependent Variable: FY08

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	103791.280	3	34597.093	43.745	.000[a]
	Residual	39544.119	50	790.882		
	Total	143335.400	53			

a. Predictors: (Constant), Min Experience, Certification, Min Education

b. Category = TE

c. Dependent Variable: FY08

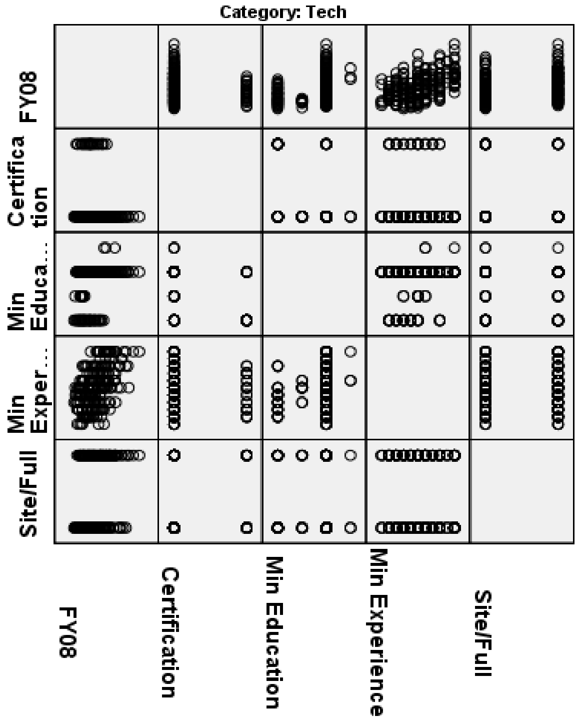
Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	143.064	10.778		13.274	.000
	Certification	-45.236	22.178	-.166	-2.040	.047
	Min Education	5.232	1.705	.255	3.070	.003
	Min Experience	12.276	1.310	.712	9.370	.000

a. Category = TE

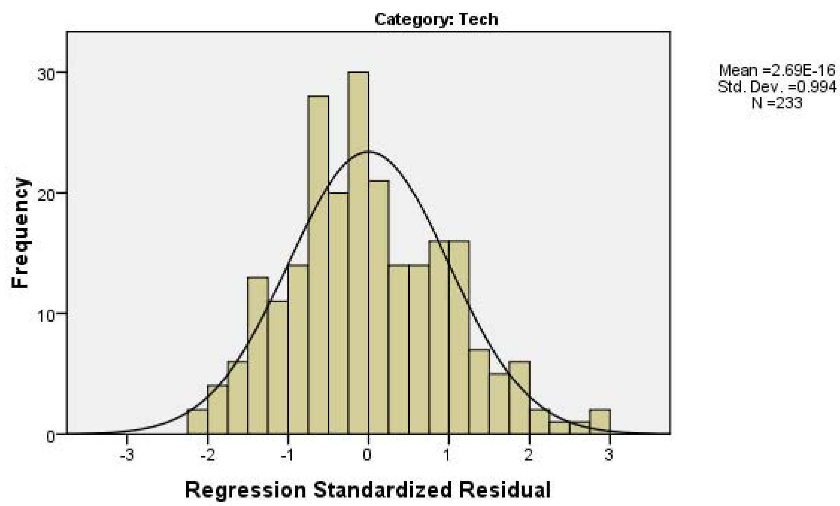
b. Dependent Variable: FY08

Technical



Histogram

Dependent Variable: FY08



Model Summary[b,c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.621[a]	.386	.378	$19.14472

a. Predictors: (Constant), Site/Full, Min Education, Min Experience

b. Category = Tech

c. Dependent Variable: FY08

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	52804.607	3	17601.536	48.023	.000[a]
	Residual	83933.162	229	366.520		
	Total	136737.768	232			

a. Predictors: (Constant), Site/Full, Min Education, Min Experience

b. Category = Tech

c. Dependent Variable: FY08

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	30.560	3.708		8.241	.000
	Min Education	3.886	.877	.237	4.431	.000
	Min Experience	3.985	.460	.464	8.665	.000
	Site/Full	12.035	2.512	.248	4.791	.000

a. Category = Tech

b. Dependent Variable: FY08

Appendix C – Contractor Cost Benchmark Metrics

Category	Level	FY08 Mean Cost	FY08 Std Dev	FY09 Mean Cost	FY09 Std Dev	FY10 Mean Cost	FY10 Std Dev	FY11 Mean Cost	FY11 Std Dev	FY12 Mean Cost	FY12 Std Dev
All	All	$96.72	$58.99	$99.23	$60.29	$102.44	$62.08	$106.03	$64.17	$109.76	$66.34
Admin	All	$34.69	$8.58	$35.53	$8.76	$36.67	$9.16	$37.96	$9.53	$39.29	$9.91
Admin	1	$31.66	$6.72	$32.45	$6.96	$33.46	$7.28	$34.62	$7.57	$35.82	$7.88
Admin	2	$36.62	$5.54	$37.62	$5.64	$38.84	$5.92	$40.20	$6.18	$41.61	$6.45
Admin	3	$48.75	$8.59	$49.65	$8.69	$51.43	$9.09	$53.27	$9.51	$55.19	$9.95
Tech	All	$71.61	$24.60	$73.55	$25.17	$75.97	$26.09	$78.66	$27.03	$81.46	$28.04
Tech	1	$58.51	$18.19	$60.04	$18.60	$61.92	$19.14	$64.05	$19.73	$66.20	$20.29
Tech	2	$76.30	$22.25	$78.42	$22.78	$81.04	$23.62	$83.94	$24.48	$87.00	$25.40
Tech	3	$111.71	$28.47	$114.53	$28.60	$118.59	$29.77	$122.94	$30.96	$127.44	$32.20
Prof	All	$97.60	$32.84	$100.45	$33.75	$103.99	$35.14	$107.81	$36.63	$111.80	$38.18
Prof	1	$82.05	$19.71	$84.40	$20.14	$87.12	$20.47	$90.17	$21.16	$93.38	$21.89
Prof	2	$99.16	$21.86	$102.26	$22.60	$105.98	$23.73	$109.91	$24.85	$113.99	$26.02
Prof	3	$148.03	$31.01	$152.23	$31.89	$158.27	$33.16	$164.55	$34.49	$171.07	$35.87
Mgmt	All	$106.65	$38.96	$109.17	$39.78	$112.81	$41.21	$116.82	$42.62	$120.96	$44.09
Mgmt	1	$79.14	$28.77	$80.93	$29.41	$83.38	$30.18	$86.23	$31.10	$89.18	$32.05
Mgmt	2	$119.84	$30.97	$122.78	$31.54	$126.99	$32.57	$131.55	$33.51	$136.28	$34.49
Mgmt	3	$154.77	$25.48	$158.28	$25.25	$164.05	$26.27	$170.02	$27.32	$176.21	$28.42
TE	All	$228.08	$52.00	$233.39	$53.15	$239.73	$54.32	$247.41	$56.15	$255.33	$58.06
TE	1	$182.51	$28.19	$186.79	$28.58	$192.34	$29.36	$198.28	$30.14	$204.40	$30.94
TE	2	$225.52	$28.59	$230.81	$29.25	$236.61	$30.02	$244.45	$30.99	$252.55	$32.00
TE	3	$287.92	$32.04	$294.54	$32.93	$302.50	$33.21	$312.15	$34.67	$322.11	$36.20
SME	All	$175.45	$49.33	$179.68	$50.13	$185.77	$51.81	$192.42	$53.80	$199.31	$55.87
SME	1	$125.30	$23.29	$127.93	$23.81	$132.02	$24.52	$136.24	$25.27	$140.60	$26.04
SME	2	$164.76	$33.76	$169.16	$34.52	$174.97	$35.67	$181.35	$37.08	$187.96	$38.56
SME	3	$237.68	$43.95	$242.31	$44.73	$250.40	$46.27	$259.32	$48.16	$268.55	$50.13