A Study of Cost Engineering Salary and Demographic Data From the AACE International 2013 Salary Survey

John K. Hollmann
Validation Estimating, LLC
(www.validest.com)

January 25, 2015

Summary
2015 marks my tenth year as an independent consultant. Like most consultants, I have asked myself "how does my experience compare with that of others"? This paper presents a study of data about consultants found in AACE International's 2013 Salary Survey [1]. Anecdotal observations are offered that help interpret the statistics. While consulting has been very satisfying for me, it is not for everyone; this paper will be of interest to experienced hands deciding whether to make the leap as well as younger professionals planning their careers.

AACE International publishes its Salary Survey every year. It is a great resource for members, particularly since the raw, non-confidential data is published in Excel format for anyone to study. In respect to this paper's topic, some questions of interest that the survey can shed light on include:

- How satisfied are consultants and what drives their satisfaction?
- What are consultant incomes and what drives them?
- What are consulting billing rates and what drives them?

Survey Study Approach and Filters
Most salary surveys provide descriptive statistics that show how salary (or other measures) trend with a single variable; for example, salary vs. certification attainment. This approach can be deceptive. For example, a survey might show that people with certifications have higher average salaries than those without certification; however, this could be because certified people have more years of experience than those without certification. The approach in this paper is to do controlled analysis using multi-variable regression. i.e., it looks at how each variable affects salary (e.g., having a certification) while controlling for known drivers of salary (e.g., experience).

The study for this paper used the Excel data from the 2013 survey (can be downloaded by AACE members). The data was then cleaned and filtered. Cleaning involved removing incomplete or suspect data (e.g., no rates, extreme outliers, etc.) Normalization involved adjusting non-US rates

and salaries to 2013 US dollars using published annual average exchange rates. The remaining data was then filtered using the criteria shown in Table 1.

Filter	Criteria
Primary Consultants	Include those answering "yes" to the "*do you consult*?" question. To focus on those truly in the business of consulting (while not ignoring those who work lighter schedules), dataset excludes those with <180 billed hours.
Location	Include salaries reported in the currencies of *industrialized* countries; i.e., North America, Europe, Australia and South Africa (though the respondents may be living or working elsewhere).

Table 1: Data Filtering Criteria for Consultants

Consulting Dataset Characteristics

It was apparent that the data varied significantly by the respondent's consulting "employment situation" which the survey broke into 3 categories as shown in Table 2.

Category	Number	Employment Situation/Salary Basis
Employee	100	On the payroll of a company that provides consulting services (e.g., reported salary is traditional pay excluding bonuses)
Partner	28	In a partnership (i.e., reported salary is regular draws, excluding dividends or profit distributions)
Sole Proprietor	22	Self-employed (i.e., reported salary is "business income" or gross receipts less deductible expenses; e.g., Schedule C in the US)

Table 2: Consultant Employment Situation Categories and Salary Basis

To the question "*what is the total number of employees in your organization*", 14 of the 22 "sole proprietors" answered >1 and some reported getting "bonuses" in the prior year. The inconsistency with being "sole proprietors" was interpreted as reflecting either boomerang employees or retirees who come back to a company as a free-lancer but who support and identify with a single organization. The study therefore also looked at the small sub-group of 8 apparent "independent" consultants who did not identify with an "organization" and reported only 1 employee (presumably themselves.) As seen in Table 3, "Consulting" was the most common industry reported as might be expected (apparently agnostic as to asset type); however, the percent in "Oil or Gas Production" is highlighted because this had relevance to salary.

Characteristics		Total	Independent	Sole Propr.	Partner	Employee
Number of Observations		148	8	22	26	100
Age:	avg	47	54	49	53	45
	min	25	32	32	31	25
	max	70	70	70	69	69
Gender: % male		86%	88%	91%	85%	85%
Years Experience:	avg	22	31	24	28	21
	min	3	15	7	9	3
	max	47	45	45	47	45
% with graduate level education		44%	63%	59%	38%	42%
% with AACE Certification		38%	63%	59%	23%	37%
% with PE		34%	50%	36%	46%	31%
Job Satisfaction		3.2	3.6	3.7	3.3	3.1
where very satisfied=4, very dissatisfied=1						
Function:						
Cost Estimating		13%	0%	14%	12%	13%
Project Management		15%	13%	18%	23%	12%
Planning and Scheduling		14%	25%	14%	12%	14%
Project Control		26%	25%	36%	27%	23%
Cost Engineering		7%	13%	9%	8%	7%
Claims and Dispute Resolution		22%	25%	9%	12%	27%
Decision and Risk Management		1%	0%	0%	4%	1%
Other		3%	0%	0%	4%	3%
Industry:						
Consulting		39%	38%	23%	38%	42%
Oil or Gas Production		11%	13%	23%	12%	9%
Other		50%	50%	55%	50%	49%
Salary Equiv. (2013US$)	avg	$ 140,336	$ 151,415	$ 173,293	$ 166,395	$ 126,310
	min	$ 31,882	$ 60,000	$ 60,000	$ 45,977	$ 31,882
	max	$ 481,203	$ 275,000	$ 367,827	$ 481,203	$ 305,000
Billable Rate (2013US$)	avg	$ 157	$ 165	$ 141	$ 161	$ 160
	min	$ 37	$ 50	$ 50	$ 68	$ 37
	max	$ 350	$ 278	$ 325	$ 350	$ 335

Table 3: Study Dataset Characteristics for Consultants

Study Findings

Table 3 provides descriptive statistics regarding averages and ranges for consultants. However, to gain insight into what is driving job satisfaction, salaries, and billable rates drivers, multi-variable linear regression was used. The following sections describe the regression findings.

Job Satisfaction

It is the author's experience that most people go into consulting expecting it to be more fulfilling than a typical "job". On a scale of 1=very dissatisfied to 4=very satisfied, the average job satisfaction was 3.1 (somewhat satisfied) for all of the Salary Survey's 1,315 observations. 3.1 is also the average for the 100 "Employee" consultants. On the other hand, as can be seen in Table 3 and Figure 1, Sole Proprietor and Partner consultants have significantly higher satisfaction than Employees consultants.

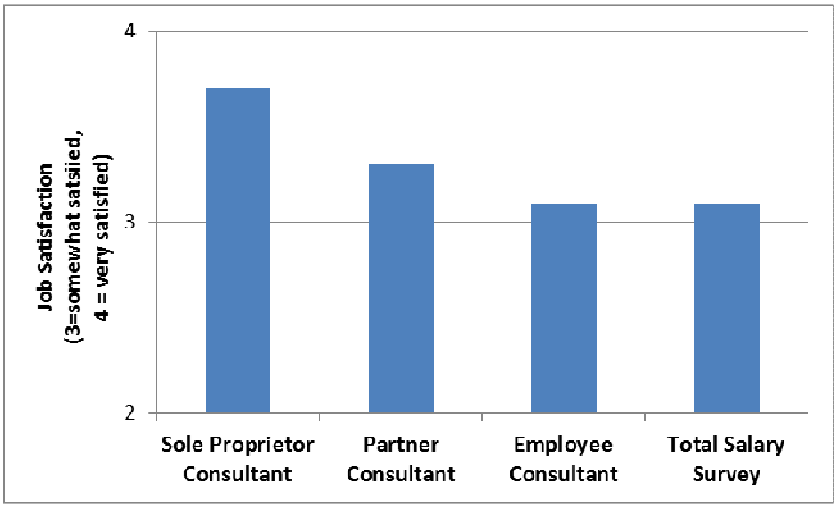

Figure 1: Consultant Job Satisfaction by Employment Situation

Regression confirmed this observation; employment situation was one of only 3 variables significantly correlated with satisfaction as shown in the regression equation in Table 4 below (r2 of 0.35):

Constant	2.54 (neither satisfied or dissatisfied)
Add for each billed hour	+0.00025 * billed hours
Add if Sole Proprietor	+0.62
Add if Partner	+0.31
Add if reported industry is "Consulting"	+0.43

Table 4: Consultant Job Satisfaction Model (1=very dissatisfied to 4=very satisfied)

The author's interpretation of this model is that satisfaction comes from feeling in control (i.e., not an "employee"), being respected (i.e., billed hours reflecting demand for one's services) and self-image (i.e., as an advisor or true "consultant"). Interestingly, salary alone was not significantly correlated with job satisfaction.

Salary

As shown in Table 1, the basis of the "salary" differs for each consulting employment situation; however, in each case the salary was intended to reflect the "regular" income that one might expect to earn before taxes. Bonuses and other payments are quantified and analyzed separately. As seen in Table 3, Sole Proprietor and Partner consultants report significantly greater salaries than Employee consultants.

Table 5 shows two models for salary resulting from regression analysis. One is for those doing consulting and the other is for those who do not consult for comparison purposes (n=148 with r2 = 0.71 and n=852 and r2=0.59 respectively). Note that the "constant" roughly corresponds to the dataset's average starting salary (about $58,000). Also note that the relationship with years of

experience is not linear (i.e., the natural log of years of experience is used). Salary increases diminish as one "peaks" in a career.

Note that the Sole Proprietor and Partner salary in the consulting model is adjusted to the average billed hours of 1,520 per year. In other words, those consultants have the potential to boost their income if more hours can be billed. For example, if a self-employed consultant billed 1,920 hours (48 weeks x 40 hours per week), the income for the 400 hours over 1,520 at $150/hour would be an added $60,000! On the other hand, the hours could be much less; this is the risk/reward equation for the non-employee. My experience as a heavily travelled independent consultant is that consulting quits being fun after more than 1,500 hours in a year; however, the job satisfaction findings indicate that strong demand, as reflected in hours, can be an ego boost.

Dataset		**Consultant**	**Non-Consultant**
Constant:		$63,000	$44,000
Add applicable value * ln(yrs exp) for your situation	Sole Proprietor (@1,520 hrs)	+$15,000	
	Partner (@1,520 hrs)	+$14,000	
	Employee	+$7,000	+$21,000
Experience Multiplier: Sum the following that apply and multiply by years exp.			
Working in the Oil/Gas/Chemical industries		+$2,500	+$1,100
Hold PE License or equivalent		+$1,000	+$400
Hold AACE Certification (CCP, CCT, CEP, CFCC, EVP, PSP)		+$1,300	–$300
Have Managerial Duties		+$1,500	+$1,000
If Female		—	–$400

Table 5: Salary Models (2013 US$): Consultants and Non-Consultants

As an example of how to use Table 5, consider a male sole proprietor consultant with 25 years of experience, who bills 1,520 hours per year, works in the oil & gas or chemical process industries and has both a PE and an AACE certification (being a lone wolf, he/she does not manage anyone). His salary would be $63,000 + $15,000 * ln(25) + 25 * ($2,500 +$1,000 + $1,300) = $231,000! The salary for a non-consultant with the same experience and attributes, but with management responsibility (a likely non-consulting career path), would be $47,000 + $20,000 * ln(25) + 25 * ($1,100 + $400 -$300 +$1,000) = $166,000.

The main difference between the consultant and non-consultant models (besides the lower bottom line salary for non-consultants) is that it appears to be much harder for non-consultants to stand out from the crowd; for example PEs and AACE certifications make little difference for non-consultant salary. This implies that certification value lies in "branding" which is somewhat irrelevant for non-consultants. Unfortunately, non-consultant women were paid less than men after controlling for the other variables; this is true for bonuses as well as will be discussed. One

hopes that this can be explained by non-bias drivers such as office versus field roles, percent time on travel, frequency of job or employer changes or other factors not measured.

Before getting too excited about higher consultant salaries and leaving an employer, keep in mind that Sole Proprietors and many Partners pay their own health insurance premiums, retirement benefits, and self- employment taxes (i.e., social security) out of their salary. Also, the models are far from perfect; Figure 2 illustrates the significant variation between predicted and actual salaries for non-consultants (standard error = $41,000); use the models with caution. As can be seen in Figure 2, about 1% of the non-consultants reported salaries over $300,000 which is on par with the best consulting incomes (it would be useful if the survey had asked if the person was a senior or executive level manager.)

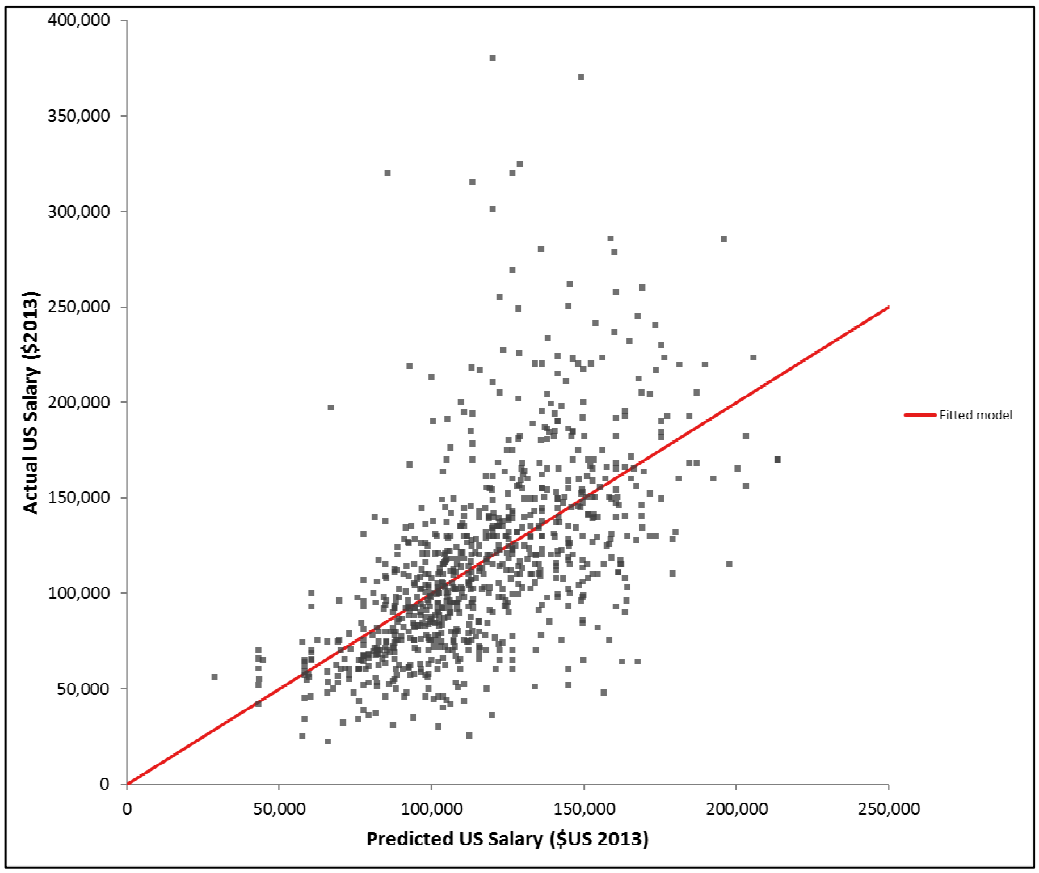

Figure 2: Actual vs. Predicated Salary per Model: Non-Consultants (n=852)

One salary driver that stands out (pre-2014 oil price collapse) is the Oil & Gas Production/Chemical Process industry adder. Many of the people reporting these as their industry worked in Canada-Alberta, Australia, United Kingdom, Norway or US-Texas. Anecdotally, these are known hot-spots for Cost Engineering talent, often in support of mega-projects. However, the location itself was not as strong a driver as the industry designation. Both physical and execution complexity are high for these asset types. Mining/metals while complex had no pay premium; this is consistent with my

experience that cost engineering has historically been under-valued in that industry; however the capex in that industry collapsed in 2012 which may have played a part. While not correlated with salary, those with "Consulting" as their industry (apparently agnostic as to asset type) report more job satisfaction per Table 4.

Notably, having a PE license and/or AACE Certification pays off handsomely for consultants; for those with the average years of experience, the increase is about $20,000 per year for each credential! 34% of consultants had PE licenses and 38% were AACE certified (versus 15 and 22% respectively for non-consultants.) Non-consultants do not benefit as much from a PE and the correlation between salary and AACE certification is negative! There is some, but weak correlation between those who seek certification being in organizations with lower entry level salary; i.e., those who are paid less to start with may tend to seek certifications to get an edge while those paid more might feel they "don't need no badges"[1] (not a beneficial attitude if one wants to consult.) Not rewarding staff who seek credentials may encourage them to leave a company; having credentials apparently makes one more marketable outside the firm than within. Unfortunately, this confirms my experience which has been that to get a truly significant salary increase one must change (or threaten to change) employers; organizational inertia and stasis tend to prevail. Adding a question to the survey about career mobility might shed some light on this.

A final note is that there was no significant correlation between job satisfaction, salary or bonus with level of education (or if a degree is technical or business) for either consultants or non-consultants. One hypothesis is that Cost Engineering is not a generally recognized academic field; as such hands-on experience is more valuable than degrees; i.e., it is more like a trade than a profession such as traditional engineering. In that case, it would be interesting to ask if one had experience in the construction trades (particularly for those who reported "high school" as their level of education which included 4% of consultants and 8% of non-consultants.)

My concern with this study's findings regarding the lack of value of credentials and education to employers is that this may reflect "commoditization" of what many of us do. Despite near engineering level pay scale (a good reason for AACE to keep emphasizing the word "engineering"!), do employers see one person as being as good as the next to fill a hole on an organization chart? Is what we do in the cross hairs of the automation trend? In any case, the salaries in the non-consulting job arena appear to be uniquely egalitarian in respect to education and credentials.

[1] Huston, John,, Movie Director, "Treasure of the Sierra Madre", Warner Brothers Pictures, 1948.

Bonuses

The analysis next looked at bonus payments (for 2012) as a percent of the base salary. Bonuses averaged about 10% of base salary for both consultants and non-consultants (38% reported no bonus). A very weak model (r2=0.15) was derived as shown in Table 6 below:

Constant	7.2%
Add for each $100,000 salary	+3.2% * salary/100,000
Industry is "Government"	–4.5%
If Female	–3.5%

Table 6: Bonuses as a Percentage of Salary: Consultants and Non-Consultants

A hypothesis for the model weakness is that bonuses are a matter of company policy for which attributes (e.g., profitability of the employer) are not captured in the survey. For 38% of people there was no reported bonus. For the others, it is likely a percentage bump for profit sharing (not applicable to government) and/or meeting corporate or personal career goals. However, the correlation with salary indicates that in some cases more experienced staff and/or "stars" are likely receiving special bonuses (e.g., eligibility for stock options after a significant number of years of employment or similar). There was no correlation of bonuses with credentials or graduate degrees. Finally, as with salary for non-consultants, gender matters; because lower bonuses for females cannot be policy (e.g., profit sharing), something more personal must be involved (weaker mentoring?)

Hourly Billing Rates for Consultants

Billing rates cover salary, benefits, personal taxes overhead and profit. Expenses such as travel and value-added taxes are not included in the billing rate. Interestingly, after controlling for other variables, the billing rate did not vary for the different employment situations. For the most part, the billing rates are driven mostly by years of experience. Education, credentials, managerial duties and so on do not seem to matter much. An implication of this is that clients pay a more or less constant defacto book rate for a product of highly variable quality. In other words, a consulting company may pay a higher salary to its more credentialed employees, but bill them out at the same rate as those with lessor credentials; buyer beware!

Given the strong constant value, another lesson may be that the 18% of consultants charging less than $100 per hour may be leaving some money on the table. However, this low rate group had a high percentage of people billing either <1,000 or more than 2,000 hours per year. One could speculate that consulting is either not something they depend on for their main living and are willing to accept a lower rate for it, or they are in a task role working long hours on lessor value non-advisory work, but getting a decent salary in the end for their long hours.

The billing rate model resulting from regression analysis is shown in Table 7 (r2=0.68). The first notable finding is the fairly high constant (i.e., again, buyer beware). After that, we find Oil and Gas billing rates are higher by an amount that more or less corresponds to the higher salaries in Table 5; no surprise there.

Constant	$100
Experience: Add for each year	+$2.15 * yrs
Add for Oil and Gas Production	+$27
Add for Claims and Dispute Resolution	+$93
Deduct if work is paid in Canadian dollars	–$34
Bill <1000 or >2000 hours per year	–$23

Table 7. Consultant Billing Rate Model (2013 US$)

The other variables are perhaps more surprising. There is a very high rate for those in Claims and Dispute Resolution. Arguably, this reflects that their work is being done in the context of the legal field; i.e., acting as consultants to legal firm clients which have a higher rate structure. Salaries or bonuses are not significantly higher for those doing claims work; the elevated billing rates, not being passed through to pay, must be absorbed in expenses, overhead and profits of the consulting firm (presumably doing work with legal firms; e.g., higher insurance costs). I do not know enough about the field to speculate further on its cost structure.

The other surprise is the lower rates when billed in Canadian dollars (presumably a Canadian consultant billing a Canadian company). Perhaps this reflects that Canadians are just as nice in business as they are personally (or more likely some difference in benefits, tax or overhead; all is speculation.)

Billing Rate Markups

When assessing a billing rate, it is common to look at it as a markup or multiplier of labor cost. A markup was derived from the Survey data by first calculating a proxy annual income equal to annual hours x billing rate for those who were more or less full-time consultants (i.e., >1,300 hours per year). This income was divided by salary to derive a markup factor. Table 8 summarizes the average results for each employment situation.

Consultants	**Markup [(hours x rate)/salary]**	
Employment Situation	**Claims**	**Other**
Employee	3.4	2.3
Partner	2.6	1.8
Sole Proprietor	—	1.3

Table 8. Approximate Consulting Markups [(hours x rate)/salary]

This makes sense in that a Sole Proprietor's expenses and overhead are much less than those for larger partnership firms or consulting companies that have to carry the cost of support staff (e.g., accounting, HR, etc.), office space and so on. Again, I cannot speculate on why the markup for claims work is so much more than for other consulting.

Conclusions

It is interesting that the survey showed that consulting job satisfaction is driven by being independent and has no correlation with salary which confirms my own experience. Some notable findings include higher salaries in the oil & gas and chemical process industries (pre 2014 oil price collapse) and large salary boosts for consultants having a PE or AACE certification but not for non-consultants; this again confirms my experience. An interesting finding for billing rates is that they are much higher for claims work. It is also interesting that the level of education did not drive salary; this confirms my observations for people who have risen through the construction trades. On the other hand, it is dismaying to see the lower salary and bonuses for women after controlling for other variables in the survey.

To explain some of the variability in compensation, the author has suggested to AACE that they consider the following questions for addition to future surveys:

- Career mobility? (e.g., years with same employer or # of past employers?)
- Travel? (e.g., % of time on travel status)
- Workload? (average hours worked per week for non-consultants?)
- Goals/Basis of bonus? (e.g., primarily tied to company/group performance [e.g., profit] or personal performance [e.g., career goals], mix, or other?)
- Level of managerial responsibility? (e.g., first tier versus higher?)
- Other experience? (e.g., construction or maintenance trades?)
- Other experience? (e.g., veteran?)
- Role location/office vs. field? (e.g., on construction or plant site or in an office?)
- Phase? (e.g., focus on pre-sanction, pre-construction) versus later phases (i.e., detailed engineering, construction, operations)?
- Cross trained? (e.g., treat job function question as "check all that apply" or a separate question of "check all functions in which one is proficient")
- Project Size? (e.g., US$0-1M, $1-20M, $20-100M, >$100M or similar)
- Profitability or success of employer in prior year (e.g., was there an increase in share price or other measure of valuation or success)

References

[1] AACE International, 2013 Salary & Demographic Survey of Project and Cost Professionals - Raw Data, (http://www.aacei.org/resources)