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Equity and satisfaction in IT: A current analysis

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Abstract

Information technology is generally seen as a gender-biased, male dominated profession. In addition, there have been studies that suggest that other inequities may exist including both race and ethnicity, sexual preference, and age. Our study reviews the 2020 StackOverflow annual survey to determine if there are significant differences in key measurement factors such as salary based on age, gender, ethnicity, and sexual preference. Our study found no significant differences in salary based on age or sexual preference. We did find large and significant salary differences based on race/ethnicity and gender. Also, we found steadily increasing salary with age, with no major older age inequity. In addition, we analyzed job satisfaction. In this analysis, we found a large a significant difference in ethnicity here as well.

Keywords: Equity, Gender, Ethnicity, Age, Discrimination, Sexuality

Introduction

This paper looks at two variables, compensation and job satisfaction, based on age, gender, ethnicity, and sexual preference. The use of these two variables as a measure of equity and discrimination is well supported in the literature. Jordan, Clark and Waldren (2007) extensively studied gender inequity and used two measures: gender pay gap and promotional glass ceiling. They used compensation as a proxy for reviewing inherent gender inequity. Similarly, Pook, Fustos, and Marian (2003) used job satisfaction as a proxy dependent variable to study gender inequity.

In the U.S. there are several laws in place to attempt to prevent the bias or inequality of compensation for reasons of gender, age, ethnicity, and sexual preferences. The Equal Pay Act requires that men and women in the same workplace be given equal pay for equal work. The jobs need not be identical, but they must be substantially equal. Similarly, workers who are 40 or older are protected against pay discrimination under the federal Age Discrimination in Employment Act. The federal Equal Employment Opportunity Act prevents an employer from refusing to hire or to impose conditions based upon race, ethnicity, or national origin. In June 2020, in the Bostock v. Clayton County case (Bostock 2020) the Supreme Court of the United States ruled that Title VII of the Civil Rights Act of 1964 prohibits discrimination based on sexual orientation or transgender status. This paper looks at compensation based on these factors.

Organizational behaviorists and organizational psychologists have long studied the subject of employees' job satisfaction. The literature includes several facets of what variables make up job satisfaction. According to Lumley, Coetzee, Tladinyane & Ferreira (2011), job satisfaction can be defined as "an individual's total feeling about their job and the attitudes they have towards various aspects or facets of their job, as well as an attitude and perception that could consequently influence the degree of fit between the individual and the organization" (pg. 101). Employee satisfaction is "determined by subjective perceptions related to the

treatment received by the organization, for instance, policies of rewards, hiring and firing policies, performance and retribution." (Crespi-Vallbona & Mascarilla-Miro, 2018, pg. 36). Sempane, Rieger & Roodt (2002), assert that job satisfaction is made up of many variables such as "structure, size, pay, working conditions and leadership", all representatives of organizational climate (pg. 23). Some of these variables may also include the "importance of job position, teamwork atmosphere, leadership, recognition and compensation, physical labor conditions and personal labor conditions as key aspects of employees' well-being." (Crespi-Vallbona & Mascarilla-Miro, pg. 37). In a study done by LeRouge, Wiley, & Maertz (2013), the authors included job security, the work itself, one's supervisor, compensation, work/life balance, and advancement/opportunities as important facets of job satisfaction.

Literature Review

Age

Previous studies and reports have indicated that age discrimination exists in some information technology fields. Multiple well-known technology-related companies have been accused of age discrimination. An article in Propublica claims that IBM intentionally dismissed approximately 20,000 employees in a five-year period over the age of 40 (Gosselin and Tobin, 2018). Google has been in the news multiple times for supposed age discrimination. Before Google's IPO was announced, a 54-year-old employee filed a lawsuit against the company, claiming he was wrongfully terminated due to his age. At that time, employees over the age of 40 comprised less than 2% of Google's workforce (Hines, 2004). More recently, Google paid $11 million to end a class-action lawsuit brought by 227 people that claimed that the company discriminated against job applicants over the age of 40 (Gurchiek, 2019). A 2018 survey of more than 500 tech startup founders indicated that 89 percent of them believed that older workers faced age discrimination in the industry. One-fourth of the respondents thought that age bias begins as early as the age of 36 (Rasheed, 2019). A 2016 report by Statistica indicated that the average median employee age at 17 top tech companies was 32, compared with 42 for the total U.S. workforce. Payscale (2020) reported that the median age is 28 at Facebook, 29 at LinkedIn and SalesForce, 30 at Google, and 33 at Microsoft.

Quan et al (2008) used the human capital model in their research. They found that age discrimination exists in overall IT wages. It does not exist homogeneously in all sectors or in all job functions in the IT workforce, however. Galup, Dattero, and Quan (2004) conducted an empirical validation of age discrimination in computer programmer wages. They discovered that workers more than 40 years old were not equally paid as younger employees after controlling for human capital factors such as education and experience. Bandias and Sharma (2016) found evidence indicating that wages are likely to peak for employees in their mid-50s, with possible decline as they become older. They also reported longer delays for older workers before promotional opportunities become available. Kerr (2019) stated that companies can save money by hiring young H-1B workers rather than older tech workers. Younger men have reported more positive experiences in technology jobs than older men (Corbett, 2019).

Gender and Sexual Preference

Historically, there have been inequities in compensation based on gender. Women and those that identify as LBTQ have been paid lower salaries for similar jobs. This inequity remains. Dice.com did a study of the gender pay gap in the tech industry (Dice.com, 2020). They found that pay gaps exists between women's and men's salaries even when other factors including job experience, job role, location and education were accounted for. Table 1 show the pay differential for women and men for the different technology occupations. The table shows that on average women software engineers are paid $8,559 annually less than men. A study by ChartHop indicates that women in tech make 17.5% less in wages than men: $100,895 vs $122,234. The technology field has a lower differential than the overall average job

market. In the US, women earn 20% less than men on average. The good news is that the gap is declining. In 2018, in the technology field women made on average 23% less than men (Gruman, 2020). The National Center for Women & Information Technology (NCWIT) found that new female graduates in computer science average $79,223 in pay while males average $82,159.

Table 1. Gender Inequities by Occupation (Dice.com, 2020)

Occupation	Differential
Mainframe Systems Programmer	-$16,328*
DevOps Engineer	-$15,077*
Security Architect	-$14,134*
Data Architect	-$13,123
Database Administrator	-$11,053
Data Scientist	-$9,561
Data Engineer	-$9,242
Software Engineer	-$8,559
Security Engineer	-$6,847
Technical Recruiter	-$6,811
Sales Engineer	-$6,779*
Business Analyst	-$6,455
Project Manager	-$5,068
Product Manager	-$4,709
Quality Assurance Engineer	-$4,404
Hardware Engineer	-$2,400*
Systems Administrator	-$2,061
UI / UX Engineer	-$1,923
MIS Manager	-$1,355
Web Developer/Programmer	-$1,180
Help Desk Support	-$579
Cloud Engineer	+$803*
Systems Architect	+$2,446*
Network Engineer	+$4,836
Technical Writer	+$6,443

In a 2019 study by hired.com, LGBTQ+ (lesbian, gay, transgender, and queer) men in the tech field are earning on average 4% less than their non-LGBTQ+ counterparts. LGBTQ+ women in technology are earning 2% less that non-LGBTQ+ women in the same role. One thing to note on this study: the sample size was small, and this is often hard to measure since many people choose not to self-identify.

Burns (2012) reported that many US gay and transgender workers receive unequal pay. The Williams Institute found that gay and bisexual men earn 10 percent to 32 percent less than heterosexual men. Thomas (2020) indicated that a technology employee's sexual orientation influences salary. Identifying as LGBTQ+ negatively affected salaries for men. However, women who identified as LGBTQ+ made more money than other females in the company. Another study by hired.com (2020) showed that LGBTQ+ women have the biggest gap in wages, earning 90 cents to every dollar that non-LGBTQ+ men earn.

Between 2019 and 2020, the wage gap was flat for all groups except LGBTQ+ women. Their wage gap rose from $0.92 in 2019 to $0.90 in 2020.

A study by the Kapor Center for Social Impact (2017) examined why people voluntarily left technology-related jobs. Women experienced more unfair treatment overall than men. LGBT employees were most likely to experience public humiliation, embarrassment, and bullying.

Methodology

To study the compensation and satisfaction of software engineers, we used data from the 2020 Stack Overflow survey with over 65,000 respondents. Stack Overflow's annual Developer Survey is the largest and most comprehensive survey of people who code around the world. Each year, their survey questions cover a wide range of areas, from developers' favorite technologies to their job preferences. According to StackFlow's website:

> "For almost a decade, Stack Overflow's annual Developer Survey held the honor of being the largest survey of people who code around the world. This year (2020), rather than aiming to be the biggest, we set out to make our survey more representative of the diversity of programmers worldwide. That said, the survey is still big. This year's survey was taken by nearly 65,000 people." (StackFlow, 2020)

The use of Stack Overflow is well established as a source for peer-reviewed journals including Barua, Thomas, and Hassan (2014), Asaduzzaman, Mashiyat, Roy, and Schneider (2013), and Treude and Robillard (2016). The Stack Overflow dataset consists of dozens of demographics, descriptive, and opinion questions about the state of programming today. The results were analyzed using IBM SPSS 26.

The first step in the analysis was to filter the data set. The data where respondents who identified themselves as hobbyist versus full time developers were removed. Of the 65,000 respondents, 47,200 self-identified as developers by profession. Since this is an international survey, we then further filtered it down to 7,304 who were self-identified as based in the US. We used this subset to examine equity and satisfaction in the United States. As a result, our work is limited to a study of equity and satisfaction of Information Technology developers in the United States only and all conclusions apply only to US workers.

For our dependent variables we used compensation as self-reported in annual US dollars and overall job satisfaction as measured in the survey. The specific question was, "How satisfied are you with your current job? (If you work multiple jobs, answer for the one you spend the most hours on.)" The options were very dissatisfied, slightly dissatisfied, neither satisfied nor dissatisfied, slightly satisfied, and very satisfied.

Results

The overall results of our statistical analysis are presented in the following subsections. Overall, we examined both the compensation and job satisfaction dependent variables and any significant differences based on gender, ethnicity(race), sexual preference, and age. Since many of these variables were categorical and had many options, in some cases we deleted low volume categories and in others we performed post hoc analyses to determine where specific differences and inequities were present.

Gender

Analysis of US compensation by gender revealed a large and significant gap by gender as shown in Table 2. The difference was nearly $16,000 per year between men and women in the survey. Other genders including non-binary and non-conforming did not see these significant differences although their N is very low and precluded any definitive conclusions. The gender pay gap still exists and was statistically significant at $p < .000$. This suggests that a gender inequity remains. A possible source for the inequity may have been differences in education level. To address this, we also analyzed gender by education level. The results are given in Tables 3 and 4. We found that across all educational levels, there remained a large gap between men and women. Also, both variables were significant at $p < .001$ in multiple regression analysis. However, when we examined job satisfaction based on gender, we did not see a significant gender gap (Table 5). Overall, the results show no significant difference in job satisfaction based on gender at $p < .504$. So even though there is a gender inequity based on compensation, perceived job satisfaction had not been affected.

Table 2. Compensation Total by Gender

Gender	Mean	N	Std. Dev.
Man	$122,514	6,003	$71,488
Man;Non-binary, genderqueer, or gender non-conforming	103,560	28	47,983
NA	126,106	490	81,639
Non-binary, genderqueer, or gender non-conforming	119,757	87	85,080
Woman	106,538	669	59,576
Woman;Man	74,833	3	15,671
Woman;Man;Non-binary, genderqueer, or gender non-conforming	154,375	2	6,187
Woman;Non-binary, genderqueer, or gender non-conforming	118,054	22	73,178
Overall	**$121,162**	**7,304**	**$71,453**

Table 3. Salary Based on Education Level and Gender

Educational Level	Men		Women		Men Vs Women Differential
	Mean	N	Mean	N	
No formal	$93,531	53	$92,211	9	$1,320
Primary	101,906	17	34,000	2	67,906
Secondary	95,763	131	72,225	13	23,538
Some College	121,605	724	91,289	41	30,316
Associate	91,798	306	77,274	28	14,524
Bachelor's	119,931	3,551	105,865	421	14,066
Masters	138,365	1,048	118,101	131	20,264
Doctoral	168,823	173	145,446	24	23,377
Overall	**$122,515**	**6,003**	**$106,539**	**669**	**$15,976**

Table 4 Salary with Gender and Educational Level

Model	Unstandardized Coefficients B	Std. Error	Std. Coeffs Beta	t	Sig.
(Constant)	79697.264	4477.583		17.799	.000
Gender	-3137.018	637.019	-.057	-4.925	.000
Education Level	7948.135	740.399	.125	10.735	.000

a. Dependent Variable: Compensation Total

Table 5. Job Satisfaction by Gender

Gender	Mean	N	Std. Dev.
Man	3.81	4,196	1.50
Man;Non-binary, genderqueer, or gender non-conforming	4.47	15	1.12
NA	3.73	346	1.53
Non-binary, genderqueer, or gender non-conforming	3.90	69	1.41
Woman	3.90	480	1.49
Woman;Man	3.50	2	2.12
Woman;Man;Non-binary, genderqueer, or gender non-conforming	3.00	1	-
Woman;Non-binary, genderqueer, or gender non-conforming	3.94	16	1.482
Overall	**3.81**	**5,125**	**1.502**

Ethnicity/Race

When we examined compensation by ethnicity/race we did not find significant differences ($p < .468$). The results of all ethnicity categories with more than 50 respondents are shown in Table 6. The p value is calculated based on all 209 different ethnicity categories identified. But this overall difference seemed to be disguising some paired comparisons. As a result, a Bonferroni Post hoc analysis was performed on the dataset. Significant differences were found when this was performed. Specifically, East Asian was significantly higher than Hispanic or Latino/a/x with $p < .022$. White or of European descent was significantly higher than Hispanic or Latino/a/x at $p < .006$. South Asian was also significantly higher than Hispanic or Latino/a/x at $p < .001$. We therefore found limited ethnicity inequity based on compensation. Hispanic IT developers seem to be negatively affected by ethnicity inequity. A possible source for the inequity may have been differences in education level. To address this, we also analyzed ethnicity by education level in Tables 7 and 8. We found that across all educational levels (with one low count anomaly), there remained a large gap between East Asian and Hispanic, white and Hispanic, and South Asian and Hispanic. To further illustrate this large gap a table with the compensation differential with Hispanics is shown in Table 9. For example, South Asians with a bachelor's degree make on average $26,998 more than Hispanics with a bachelor's degree. Similarly, whites with a bachelor's degree make $30,955 more than Hispanics.

When job satisfaction was used as the dependent variable, these individual Bonferroni post hoc differences disappeared. The overall results are significantly different at $p < .001$, but individual paired differences are not significant. Again, it appears that this inequity is accepted and does not impact job satisfaction.

Table 6. Compensation Total by Ethnicity

Ethnicity	Mean	N	Std. Dev.
Black or of African descent	$109,636	102	$53,987
East Asian	127,924	170	80,580
Hispanic or Latino/a/x	103,811	208	50,281
Hispanic or Latino/a/x;White or of European descent	118,716	114	62,986
Middle Eastern	118,455	54	69,358
South Asian	133,663	197	69,608
Southeast Asian	116,449	90	58,011
White or of European descent	122,007	5,285	72,049
Overall	$121,162	7,304	$71,453

Table 7. Compensation by Educational Level and Ethnicity

Educational Level	South Asian		East Asian		Hispanic/ Latinx		White	
	Mean	N	Mean	N	Mean	N	Mean	N
No formal	-	-	-	-	$103,214	7	$99,729	44
Primary	-	-	-	-	-	-	97,067	18
Secondary	-	-	$63,500	2	81,105	7	94,597	108
Some College	$106,667	3	126,165	8	94,979	20	122,548	639
Associate	-	-	-	-	91,782	10	91,813	283
Bachelor's	132,420	83	125,802	112	105,422	131	118,622	3,184
Masters	133,103	105	126,157	44	110,802	31	141,757	850
Doctoral	174,167	6	242,500	4	120,000	2	163,382	159
Overall	**$133,663**	**197**	**$127,924**	**170**	**$103,812**	**208**	**$122,007**	**5,285**

Table 8. Compensation based on Education and Ethnicity

Educational Level	South Asian		East Asian		Hispanic/ Latinx		White	
	Mean	N	Mean	N	Mean	N	Mean	N
No formal	-	-	-	-	$103,214	7	$99,729	44
Primary	-	-	-	-	-	-	97,067	18
Secondary	-	-	$63,500	2	81,105	7	94,597	108
Some College	$106,667	3	126,165	8	94,979	20	122,548	639
Associate	-	-	-	-	91,782	10	91,813	283
Bachelor's	132,420	83	125,802	112	105,422	131	118,622	3,184
Masters	133,103	105	126,157	44	110,802	31	141,757	850
Doctoral	174,167	6	242,500	4	120,000	2	163,382	159
Overall	**$133,663**	**197**	**$127,924**	**170**	**$103,812**	**208**	**$122,007**	**5,285**

Table 9. Compensation Differential between Hispanics and other Ethnicities

Educational Level	S. Asian	E. Asian	White
No formal	-	-	-$3,485
Primary	-	-	-
Secondary	-	-$17,605	13,492
Some College	-$11,688	31,186	27,569
Associate	-	-	-31
Bachelor's	26,998	20,380	13,200
Masters	22,301	15,355	30,955
Doctoral	54,167	122,500	43,382
Overall	**$29,851**	**$24,112**	**$18,196**

Table 10. Job Satisfaction by Ethnicity

Ethnicity	Mean	N	Std. Dev.
Black or of African descent	4.08	72	1.48
East Asian	3.51	119	1.47
Hispanic or Latino/a/x	3.66	151	1.52
Hispanic or Latino/a/x;White or of European descent	4.01	82	1.46
Middle Eastern	3.21	38	1.647
South Asian	3.58	147	1.54
White or of European descent	3.86	3,693	1.49
Overall	**3.84**	**4,302**	**1.50**

Sexuality

Sexuality or sexual preference does not seem to have a significant impact on compensation (Table 11). The p value is close at .051 and there does seem to be reduced compensation for bisexual individuals versus gay or straight but we cannot conclude that there is statistically significant inequity in IT based on sexuality. Even that difference seems to disappear when job satisfaction is measured. Overall, $p < .359$ (Table 12).

Table 11. Compensation by Sexuality

Sexuality	Mean	N	Std. Dev.
Bisexual	$112,334	283	$73,836
Bisexual;Gay or Lesbian	102,837	3	27,908
Bisexual;Gay or Lesbian;Queer	146,276	7	83,231
Bisexual;Gay or Lesbian;Straight / Heterosexual	-	1	-
Bisexual;Gay or Lesbian;Straight / Heterosexual; Queer	91,000	1	-
Bisexual;Queer	109,507	60	61,900
Bisexual;Straight / Heterosexual	112,837	34	54,176
Bisexual;Straight / Heterosexual;Queer	132,000	1	-
Gay or Lesbian	121,017	163	69,374
Gay or Lesbian;Queer	108,301	29	59,845
Gay or Lesbian;Straight / Heterosexual	66,698	2	4,669
NA	132,034	331	89,676
Queer	107,063	63	67,875
Straight / Heterosexual	121,998	5,141	70,096
Straight / Heterosexual;Queer	108,863	11	42,708
Overall	**$121,630**	**6,130**	**$71252**

Table 12. Job Satisfaction by Sexuality

Sexuality	Mean	N	Std. Dev.
Bisexual	3.93	208	1.43
Bisexual;Gay or Lesbian	5.00	2	.00
Bisexual;Gay or Lesbian;Queer	4.20	5	1.78
Bisexual;Gay or Lesbian;Straight / Heterosexual	5.00	1	-
Bisexual;Gay or Lesbian;Straight / Heterosexual; Queer	2.00	1	-
Bisexual;Queer	4.37	41	1.15
Bisexual;Straight / Heterosexual	3.57	21	1.32
Gay or Lesbian	3.90	118	1.45
Gay or Lesbian;Queer	4.00	18	1.45
Gay or Lesbian;Straight / Heterosexual	5.00	1	-
NA	3.77	245	1.51
Queer	3.51	49	1.62
Straight / Heterosexual	3.83	3,585	1.50
Straight / Heterosexual;Queer	3.57	7	1.81
Overall	**3.84**	**4,302**	**1.49**

Age

Finally, we examined age as an independent variable affecting both compensation and job satisfaction (Tables 13 and 14). Many researchers have suggested an age bias against older workers. About compensation, we found no such bias. In fact, age correlates positively with compensation. The older you are, the higher your compensation. Bias may be a factor for obtaining employment, but this is not reflected in compensation paid. But we also found that as age increases, job satisfaction decreases. It is unclear what is the cause of this factor. Burnout or just multiple years in the same profession may have an effect here. Further research is needed to determine the cause of this negative correlation. This correlation is significant at $p < .021$.

Table 13. Regression analysis of age and compensation

Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	62485.871	3061.121		20.413	.000
	Age	1694.939	86.301	.237	19.640	.000

a. Dependent Variable: Compensation Total

Table 14. Regression analysis of age and job satisfaction

Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.999	.080		49.759	.000
	Age	-.005	.002	-.034	-2.310	.021

a. Dependent Variable: Job Satisfaction Normalized

Discussion and Conclusions

Overall, our study suggests that inequity seems continues to exist in the software engineering, a major portion of the Information Technology job market. Gender has a significant impact on compensation with females earning about $16,000 less than other genders. Likewise, ethnicity has a significant impact for Hispanic workers. No inequities were seen with other ethnicities however, including Asian and Black ethnicities. For both ethnicity and gender, however, neither of these inequities seemed to carry over into job satisfaction. It appears that these inequities are an accepted practice and do not affected the specific biased groups perceptions of their work. For other demographic categories, namely age and sexual preference, our analyses found no inequities in either compensation or job satisfaction.

Our work extends the literature on inequity in employment based on demographic groups. However, it is limited using only the two measures of compensation and job satisfaction. Other inequities may exist such as initial employment and promotional levels. Further work is needed to review these and other potential inequities. In addition, our work is limited by self-reporting as well as active members of the StackOverflow community. Though this is a robust dataset, data may be skewed by those who choose to be a member of StackOverflow and those who participated in the survey.

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Appendix 1. Key Survey questions

Which of the following options best describes you today? Here, by "developer" we mean "someone who writes code." *

- I am a developer by profession.
- I am not primarily a developer, but I write code sometimes as part of my work.
- I used to be a developer by profession, but no longer am.
- I am a student who is learning to code.
- I code primarily as a hobby.
- None of these.

Which of the following best describes the highest level of formal education that you've completed?

- I never completed any formal education
- Primary/elementary school
- Secondary school (e.g. American high school, German Realschule or Gymnasium, etc.)
- Some college/university study without earning a degree
- Associate degree (A.A., A.S., etc.)
- Bachelor's degree (B.A., B.S., B.Eng., etc.)
- Master's degree (M.A., M.S., M.Eng., MBA, etc.)
- Professional degree (JD, MD, etc.)
- Other doctoral degree (Ph.D., Ed.D., etc.)
- Other (please specify

What is your current total compensation (salary, bonuses, and perks, before taxes and deductions), in $. Please enter a whole number in the box below, without any punctuation. If you are paid hourly, please estimate an equivalent weekly, monthly, or yearly salary. If you prefer not to answer, please leave the box empty.

How satisfied are you with your current job? (If you work multiple jobs, answer for the one you spend the most hours on.)

- Very dissatisfied
- Slightly dissatisfied
- Neither satisfied nor dissatisfied
- Slightly satisfied
- Very satisfied