

An Exploration of the Benefits of Certifications and their Relationship to Salaries in IS/IT

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Abstract

This research extends previous studies that explore the ever-changing landscape of jobs in the IS/IT (Information Systems / Information Technology) field. To enhance prior research on skills needed and requirements of certifications, we investigated industry certifications in IS/IT fields and having a certification's relationship with salary ranges. Our analysis is from a data set with over 550 responses during the first quarter of 2022. From the survey, the top certifications in rank order were: Microsoft CSE, AWS Cloud Practitioner, AWS Solutions Architect, CompTIA A+ Tech, and CompTIA Network+ in most regions of the US. The survey also investigated salaries by key occupations. On a nationwide basis we found that having a certification versus not having a certification did not relate to any significant salary differences; however, this may depend on region of the US. For those in the Southwest, South Central, and Northeast regions of the US, the data indicated some salary ranges affected by obtaining certifications.

Keywords: job skills, certifications, salaries, economic regions

1. INTRODUCTION

The importance of jobs skills and how they affect curriculums in higher education courses has been a topic of interest for IS (Information Systems) and IT (Information Technology) researchers in the past (e.g., Cummings & Janicki, 2021, 2020; Janicki et al., 2014; Legier et al., 2013). Some have also stressed the importance of "technical certifications" such as A+, Cisco Certified Security Professional (CSSP), Microsoft Certified System Engineer (MSSE). Nevertheless, little research has been done to investigate the preferences of IS/IT professionals regarding certifications and

their effects on salaries. This paper summarizes the results of over 550 survey responses throughout the United States to enhance our understanding of the perceived importance of specific certifications and detail any differences in salaries for IS/IT professionals with and without certifications. This research was conducted in the first quarter of 2022.

2. LITERATURE REVIEW

The literature over the past ten years has reported the demand for IS/IT professionals as well as common salaries, skills desired, and

certifications. The driving impetus for these studies is to understand the ever-changing nature of IS/IT fields and the associated skill requirements (Aasheim et al., 2012; Prabhakar et al., 2005; Todd et al., 1995). Results of such studies have come from a variety of methods including reviewing IS/IT industry job ads (Burns et al., 2018; Dong & Triche, 2020; Lee & Han, 2008), reviewing the course content at universities (Mills et al., 2016), surveying alumni and recent graduates (Legier et al., 2013; Wilkerson, 2012), employers (Dillon & Kruck, 2008; Zaheer et al., 2021), recruiters (Saia, 2011), or employees in various job roles (Aasheim et al., 2012; Tastle & Russell, 2003).

Recently, Wierschem and Mendez Mediavilla (2018) also dove into exploring how such skills are acquired and the perceived value by employers of different modes of skill acquisition. They reported that over 80% of IT employers do not require certifications for entry-level positions. Interestingly, employer size impacted the desire of an employer for its employees to have certification. The highest desire for certification was for employers with 100 to 499 employees. In their study, of the 15%+ that do require certifications, the most popular certifications were A+, Cisco and Microsoft. Cummings and Janicki (2021) found similar results. From their survey, Microsoft CSE, CompTIA A+, and Cisco CAN were the top three certifications held by IS/IT professionals. They also reported that 89% of survey respondents had completed at least one certification.

Since the IS/IT fields are ever-changing, certification may be a way for professionals to stay abreast of those changes while employed. This may be more evident in different sub-fields of IS/IT. For example, with the increasing concern for cybersecurity knowledge and skills Knapp, Maurer, and Plachkinova (2017) argue for increased undergraduate and graduate courses in cybersecurity and to provide the opportunity for students to achieve certifications in the cybersecurity field.

Given that prior studies have shown the importance on and proliferation of certifications in IS/IT fields, we expect this same importance to be shown by employers; however, the challenge comes from determining how employers value such certifications. Human capital theory (Becker, 1992, 1993) states that the value of an employee is reflected by their wages and thus, certain factors exist that increase human capital and can lead to variances in wages of different employees. Education and training are factors that have been

shown to influence salary based on human capital theory. Advice to employers by classic researchers has been to invest in education and training of employees and the returns in productivity will be seen (Schultz, 1961). The way employers have shown this value in the job market is through salaries. In other words, increasing a person's education and training should increase their human capital which will result in an increased valuation and higher salaries. These thoughts were extended by Quan, Dattero, and Galup (2007) to include certifications as a form of both education and training. Their conclusions were that certifications are valuable in general, mixed with education and experience effects, and that their worth varied by job category.

Our research sets out to supplement the findings of previous authors and shed light on the specifics of certifications in the IS/IT field. We do this by undertaking an exploratory look at certifications in IS/IT fields. Our goals are to uncover the current state of certifications and how they affect salaries of IS/IT professionals. We investigate the following certification and salary questions:

- What are the top certifications acquired by IS/IT professionals?
- How do the distributions of these certifications vary across the economic regions of the US?
- Does having a certification or the number of certifications have an effect on salary range?

3. METHODOLOGY

The results presented in this research come from a survey developed to investigate skills acquired and technologies used by IS/IT professionals. The survey was developed through a multi-phase process which utilized IS/IT faculty, an advisory board of industry professionals, and enhancements as suggested from professionals who responded to previous versions of the survey. The current survey was the sixth iteration of the survey and included extensions specifically designed to investigate our certification and salary questions. We have included more details concerning the survey and its development at <https://csbweb01.uncw.edu/people/cummingsjt/echskills.html>.

A major takeaway from the advisory board, faculty, and survey responses was a list of job categories within the IT field. Due to the ever-changing nature of the field, this process can be cumbersome, but is necessary to ensure the most

up-to-date categories are used during data collection efforts. In this iteration of the survey, the following job categories were utilized:

- Business/Systems Analyst
- Database Admin
- Networking
- Project Management
- Software Development
- Security
- Analytics

Specifically for the certifications interests of the survey, the advisory board, faculty, and previous survey results were utilized to also develop a list of common certifications that are seen as valuable by professionals. In the current iteration of the survey, the following certifications were explicitly queried:

- AWS Solutions Architect
- AWS Cloud Practitioner
- Certified Risk IS Control
- CISM
- CISSP
- CIS Auditor
- CISCO CAN
- CompTIA A+ Tech
- CompTIA Network+
- Security+
- Microsoft CSE
- PMP
- Professional Cloud Architect
- Scrum Master

After updates to the survey were made, a pilot test was performed to ensure the clarity of questions and responses, an appropriate coverage of the domains in question, and a response time below 10 minutes.

Previous efforts of snowball and convenience sampling limited the total number of response and coverage area of responses across the US. For this reason, a nationwide survey company was utilized to distribute and pay respondents to our survey.

4. SUMMARY STATISTICS

The survey was distributed across the US to IT professionals. The survey was completed in the first quarter of 2022 and received 566 total responses. After scrubbing data for issues such as abnormally long response times and incomplete responses, the resulting dataset had a total of 555 usable responses. The average time to complete the survey was 8 minutes, 42 seconds.

| Firm Size | N | |
|---|----------|-----|
| < 11* | 7 | 1% |
| 11-20* | 12 | 2% |
| 21-100 | 46 | 8% |
| 101 - 499 | 103 | 19% |
| 500 - 999 | 160 | 29% |
| 1000 - 9999 | 188 | 34% |
| 10000+ | 39 | 7% |
| Organization Type | N | |
| Corporation | 313 | 56% |
| Education | 26 | 5% |
| Government | 33 | 6% |
| Healthcare* | 23 | 4% |
| LLC | 54 | 10% |
| Non or Not for Profit | 40 | 7% |
| Sole Proprietor or Partnership | 66 | 12% |
| Region of US | N | |
| Northwest* | 17 | 3% |
| Southwest | 117 | 21% |
| North Central* | 10 | 2% |
| South Central | 64 | 12% |
| Mid-West | 48 | 9% |
| Southeast | 123 | 22% |
| Northeast | 176 | 32% |
| Gender | N | |
| Female | 154 | 28% |
| Male | 399 | 72% |
| Non-binary | 1 | <1% |
| Did not specify | 1 | <1% |
| Level of Education | N | |
| High school diploma* | 15 | 3% |
| Associate's degree | 29 | 5% |
| Bachelor's degree in IT-related field | 159 | 29% |
| Bachelor's degree in non-IT-related field | 55 | 10% |
| Master's degree in IT-related field | 192 | 35% |
| Master's degree in non-IT-related field | 71 | 13% |
| Ph.D. | 34 | 6% |

*NOTE: Less than 25 responses in this category

Table 1: Responses by Firm Size, Organization Type, Region of the US, Gender, and Level of Education

Participants came from a variety of firm sizes, organization types, and regions of the US (Table 1). The largest percentage (34%) of responses were from professionals in firms with 1000-9999 employees. Corporations gave us 56% of our responses. The largest responses by region came from the Northeast (32%), Southeast (22%), and Southwest (21%). Regardless of region, the top 5 states were New York (22%), California (16%), Florida (7%), Texas (6%), and Pennsylvania (4%). APPENDIX A depicts the states included in

each economic region of the US (adapted from Rosen et al., 2014). Please note that due to a lack of representative sample from these areas, 2 responses from Alaska and 2 responses from Hawaii are not included in any of our analysis.

Of the participants, 28% identified as female and 72% identified as male. One respondent identified as non-binary, and one declined to specify a gender. The top 2 responses for highest level of education received were Master’s degree in an IT-related field (35%) and Bachelor’s degree in an IT-related field (29%), respectively. Additionally, the average number of years in IT was 11 years and average years at current position was 8.8 years.

Lastly, we look at the IS/IT industry-specific statistics from our data set. Table 2 details the breakdown by job category. The top 3 categories in our data set are Software Development (52%), Project Management (16%) and Networking (11%) with Security (4%) and Analytics (2%) having the lowest representations.

| Job Category | N | |
|--------------------------|-----|-----|
| Business/Systems Analyst | 34 | 6% |
| DB Admin | 52 | 9% |
| Networking | 60 | 11% |
| Project Management | 89 | 16% |
| Software Development | 289 | 52% |
| Security* | 20 | 4% |
| Analytics* | 11 | 2% |

*NOTE: Less than 25 responses in this category

Table 2: Responses by Job Category

5. RESULTS AND DISCUSSION

The goal of this research was to investigate the relationships that certifications hold regarding (a) their value among IS/IT professionals and (b) their effect on salary range. This section investigates the insights we extract from an analysis of our data set.

5.1 Certifications

In the survey, participants were asked to identify any certifications that they had from a predefined list (see Section 3 above). Of the 555 responses, 531 (95.7%) indicated at least 1 certification while 24 (4.3%) identified 0 certifications. Of those with at least 1 certification, the average number of certifications is 3.48 (SD = 2.12) with 59.5% (N = 316) having between 1 and 3 certifications (the maximum number indicated was 10). The most frequent number of certifications was 3 (22.4%; N = 119). Figure 1 shows a histogram of the number of certifications

for all responses that had at least 1 certification.

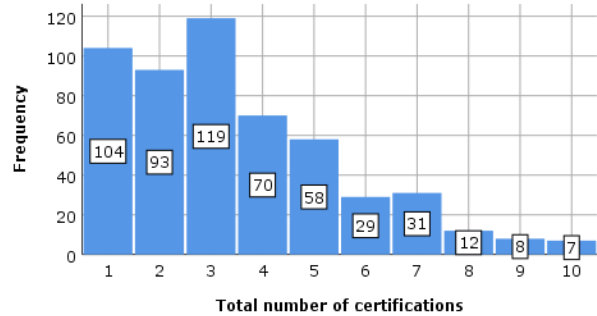


Figure 1: Number of Certifications and Their Frequencies (N = 531)

When asked, 36.2% of those with at least 1 certification stated a certification had been obtained prior to graduation while 63.8% did not have any certifications prior to graduating. This is an interesting finding that suggests many certifications are acquired while working. This can be investigated further by future researchers and intersects with some of the findings of other recent studies (e.g., Wierschem & Mendez Mediavilla, 2018) and with prior calls for employers to invest in certifications as a form of human capital enhancements.

One of the takeaways from our survey results are the value of specific certifications as indicated by the number of respondents that have acquired each certification. We present this information in Table 3. The certifications are ordered by their ranking for the whole of the US with corresponding rows showing the rankings by economic region of the US. The top 5 certifications in each region are shaded. The percentages shown are the percentage of respondents that indicated that they had the certification. Please note that each respondent was able to select multiple certifications.

From this information, we can see that Microsoft CSE is the dominant certification across the US and in most regions. The AWS certifications closely follow. This finding is not surprising given the large number of Software Development professionals that responded to our survey. Notable exceptions are South Central where an AWS certification takes the lead and Mid-West where a CompTIA certification takes the lead. The top 5 certifications (Microsoft CSE, AWS Cloud Practitioner, AWS Solutions Architect, CompTIA A+ Tech, and CompTIA Network+) remain steady across most regions in slightly varying orders. It is also interesting to note that some regions have 0 certifications indicated for CISSP, PMP, CISM,

| Certification | Ranking (% with Certification) | | | | | | | |
|------------------------------|--------------------------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | All | NW* | SW | NC* | SC | MW | SE | NE |
| Microsoft CSE | 1 (46%) | 1 (53%) | 1 (53%) | 1 (67%) | 4 (34%) | 5 (29%) | 1 (42%) | 1 (80%) |
| AWS Cloud Practitioner | 2 (38%) | 3 (41%) | 3 (45%) | 6 (22%) | 1 (44%) | 7 (27%) | 2 (34%) | 2 (57%) |
| AWS Solutions Architect | 3 (37%) | 4 (41%) | 2 (46%) | 7 (22%) | 3 (37%) | 3 (33%) | 5 (31%) | 3 (57%) |
| CompTIA A+ Tech | 4 (34%) | 6 (35%) | 4 (38%) | 2 (33%) | 6 (31%) | 2 (38%) | 4 (31%) | 5 (54%) |
| CompTIA Network + | 5 (32%) | 2 (47%) | 6 (30%) | 5 (22%) | 2 (37%) | 1 (40%) | 3 (32%) | 6 (46%) |
| Security+ | 6 (30%) | 5 (35%) | 5 (31%) | 8 (11%) | 5 (31%) | 6 (29%) | 6 (29%) | 7 (45%) |
| Professional Cloud Architect | 7 (28%) | 7 (29%) | 9 (23%) | 3 (22%) | 8 (19%) | 4 (29%) | 7 (26%) | 4 (55%) |
| CISCO CNA | 8 (25%) | 8 (29%) | 7 (27%) | 9 (11%) | 7 (26%) | 8 (24%) | 8 (24%) | 8 (40%) |
| CISM | 9 (20%) | 12 (6%) | 8 (27%) | - (0%) | 9 (18%) | 12 (11%) | 9 (18%) | 9 (37%) |
| Certified Risk IS Control | 10 (18%) | 9 (18%) | 10 (17%) | 11 (11%) | 10 (16%) | 9 (24%) | 10 (17%) | 10 (29%) |
| PMP | 11 (11%) | - (0%) | 12 (9%) | 4 (22%) | 11 (13%) | 10 (20%) | 12 (11%) | 13 (15%) |
| CISSP | 12 (11%) | - (0%) | 13 (9%) | 10 (11%) | 13 (11%) | 11 (11%) | 11 (13%) | 11 (18%) |
| CIS Auditor | 13 (10%) | 11 (6%) | 11 (13%) | - (0%) | 12 (13%) | 14 (4%) | 13 (8%) | 12 (16%) |
| Scrum Master | 14 (6%) | 10 (6%) | 14 (5%) | - (0%) | 14 (8%) | 13 (4%) | 14 (6%) | 14 (9%) |
| <i>Total Responses</i> | 531 | 17 | 112 | 9 | 62 | 45 | 114 | 112 |

*NOTE: Less than 25 responses in this category
- 0% were not ranked

Table 3: Top Certifications Across the US

CIS Auditor, or Scrum Master. It’s important to note that these 0% numbers are Northwest and North Central regions which have the smallest representation in our sample (see Table 1).

5.2 Salary Ranges

In our survey, participants were asked to identify the salary range that applied to their current position. The following presents the results of our analysis of this salary range data. In each situation, we utilized chi-square (χ^2) tests for independence to determine if the category of interest was related to the salary range data.

Table 4 shows the average salary ranges by job category. We should note that we did not give a sliding scale for specific numerical salaries, instead we offered 16 categories of \$10,000 ranges that went from “less than \$10,000” to “\$150,000 or more”. This data shows that the overall average salary ranged from \$90,000 to \$109,999 across all categories.

When looking at job categories, the highest salary range of \$120,000 to \$129,999 is found in Analytics; however, we note that this category

also had fewer than 25 responses. The next two highest salary ranges were for Business/Systems Analyst and Software Development each at \$100,000 to \$119,999. The lowest salary range is found in Networking (\$70,000 to \$89,999). Our statistical comparison indicates job category is not independent from salary range ($\chi^2(90, N = 555) = 127.5, p = 0.006$); that is, the two are related in this sample.

When looking at region of the US, the highest salary ranges were found in the Southwest and Northeast (\$100,000 to \$119,999) and the lowest was in South Central (\$80,000 to \$99,999). Our statistical comparison indicates region of the US is not independent from salary range ($\chi^2(90, N = 555) = 129.3, p = 0.004$); that is, the two are related in this sample.

When looking at highest level of education completed, the highest salary range is at the Ph.D. level (\$130,000 to \$149,999) and the lowest is at the high school diploma level (\$50,000 to \$69,999). This finding is consistent with the long-held belief that obtaining degrees will result in higher salaries, an idea also

supported by human capital theory. Our statistical comparison indicates level of education is not independent from salary range ($\chi^2(90, N = 555) = 230.1, p < 0.001$); that is, the two are related in this sample.

| Job Category | Salary Range | |
|---|--------------|-----------|
| | Lower | Upper |
| Business/Systems Analyst | \$100,000 | \$119,999 |
| DB Admin | \$90,000 | \$109,999 |
| Networking | \$70,000 | \$89,999 |
| Project Management | \$90,000 | \$109,999 |
| Software Development | \$100,000 | \$119,999 |
| Security* | \$90,000 | \$109,999 |
| Analytics* | \$120,000 | \$129,999 |
| Region of US | Salary Range | |
| | Lower | Upper |
| Northwest* | \$90,000 | \$109,999 |
| Southwest | \$100,000 | \$119,999 |
| North Central* | \$90,000 | \$109,999 |
| South Central | \$80,000 | \$99,999 |
| Mid-West | \$90,000 | \$109,999 |
| Southeast | \$90,000 | \$109,999 |
| Northeast | \$100,000 | \$119,999 |
| Level of Education | Salary Range | |
| | Lower | Upper |
| High school diploma* | \$50,000 | \$69,999 |
| Associate's degree | \$70,000 | \$89,999 |
| Bachelor's degree in IT-related field | \$80,000 | \$99,999 |
| Bachelor's degree in non-IT-related field | \$90,000 | \$109,999 |
| Master's degree in IT-related field | \$100,000 | \$119,999 |
| Master's degree in non-IT-related field | \$100,000 | \$119,999 |
| Ph.D. | \$130,000 | \$149,999 |

*NOTE: Less than 25 responses in this category

Table 4: Average Salary Ranges by Job Category, Region of the US, and Level of Education

5.3 Certification's Effect on Salary Ranges

The last item of interest is how certifications relate to salary ranges. Since our goals are exploratory in nature, we are specifically looking at these questions:

- Does having one or more certifications affect salary range?
- Does the number of certifications affect salary range?
- Of those who have certifications, does having more increase salary range?

When investigating average salary ranges by

number of certifications, we find that the average range remains the same (\$90,000 to \$109,999) for both the group of participants who indicated 0 certifications and those who have at least 1 certification (i.e., a dichotomous variable). Our statistical comparison indicates having a certification or not is independent from salary range ($\chi^2(15, N = 555) = 16.7, p = 0.339$); that is, the two have no relationship in this sample. However, we split the sample to investigate this further. Since our previous analysis revealed that there were possible relationships with salary range and the job category, region of the US, and level of education, these were used to split our sample. For consistency with prior salary studies, we also included gender and firm size as categories to split our sample.

Table 5 summarizes the results of our statistical comparisons when we split our sample by job category, region of the US, level of education, gender, and firm size. There was no significant relationship between the salary ranges of those without certifications and those with at least 1 certification by job category, highest level of education received, gender, or firm size. The only statistically significant relationships found are by region of the US; specifically, in the Southwest, South Central, and Northeast regions. This indicates that having 1 or more certifications may affect salary range in these 3 regions. The results from an independent samples t-test reveal a statistically significant difference in salary ranges between those having a certification or not in the Southwest ($t(115) = 2.3; p = .02$; mean difference = 4.32, C.I. = [.61, 8.04]), but not in the South Central ($t(62) = -.08; p = .93$) or Northeast ($t(174) = .96; p = .34$) regions.

Further dividing respondents with certifications reveals that those with more than 3 certifications (the average number of certifications in our sample) increased their salary range up to \$100,000 to \$119,999. When we introduce three categories of (1) having 0 certifications, (2) having 1-3 certifications, and (3) having more than 3 certifications, we do find a significant relationship with salary range in our overall sample ($\chi^2(30, N = 555) = 48.5; p = .02$); that is, there is a relationship between certification categorized in these 3 levels and salary range. The results from a one-way ANOVA reveal a statistically significant difference in salary ranges in these 3 levels of having a certification ($F(2, 552) = 8.4; p < .001$). Using a Tukey HSD post-hoc test for comparisons, we find that there is a statistically significant difference between people with more than 3 certifications and people with between 1 and 3 certifications ($p < .001$) such

that the difference in salary range is 1.48 on our 16-point salary range scale (95% C.I. = [.62, 2.33]). There is no significant difference between people with no certification and people with between 1 and 3 ($p = .99$) or between people with more than 3 ($p = .28$).

| Job Category | χ^2 | df, N | p |
|---|----------|--------------|-------------|
| Business/Systems Analyst | 15.5 | 10, 34 | .11 |
| DB Admin ⁺ | - | - | - |
| Networking | 12.9 | 13, 60 | .46 |
| Project Management | 10.7 | 14, 89 | .71 |
| Software Development | 22.2 | 15, 289 | .10 |
| Security ^{**} | - | - | - |
| Analytics [*] | 11.0 | 6, 11 | .09 |
| Region of US | χ^2 | df, N | P |
| Northwest [*] | - | - | - |
| Southwest | 44.5 | 15, 117 | .000 |
| North Central [*] | 10.0 | 7, 10 | .19 |
| South Central | 25.5 | 13, 64 | .02 |
| Mid-West | 22.4 | 15, 48 | .10 |
| Southeast | 15.6 | 14, 123 | .34 |
| Northeast | 25.6 | 15, 176 | .04 |
| Level of Education | χ^2 | df, N | p |
| High school diploma [*] | 10.8 | 8, 15 | .21 |
| Associate's degree | 10.8 | 9, 29 | .29 |
| Bachelor's degree in IT-related field | 18.5 | 14, 159 | .19 |
| Bachelor's degree in non-IT-related field | 20.7 | 12, 55 | .06 |
| Master's degree in IT-related field | 10.2 | 14, 192 | .74 |
| Master's degree in non-IT-related field | 9.2 | 13, 71 | .75 |
| Ph.D. | 4.8 | 5, 34 | .44 |
| Gender | χ^2 | df, N | p |
| Female | 13.4 | 14, 154 | .50 |
| Male | 20.4 | 15, 399 | .16 |
| Non-binary | - | - | - |
| Did not specify | - | - | - |
| Firm Size | χ^2 | df, N | p |
| < 11 [*] | 7.0 | 3, 7 | .07 |
| 11-20 [*] | 5.5 | 8, 12 | .71 |
| 21-100 | 9.8 | 11, 46 | .55 |
| 101 - 499 | 18.8 | 15, 103 | .22 |
| 500 - 999 | 7.3 | 15, 160 | .95 |
| 1000 - 9999 | 13.9 | 15, 188 | .53 |
| 10000+ | 5.8 | 8, 39 | .67 |

*NOTE: Less than 25 responses in this category
+all respondents in this category indicated they had 1 or more certification

Table 5: Having a Certification's Effect on Salary Range (split samples)

| Job Category | χ^2 | df, N | p |
|---|----------|--------------|-------------|
| Business/Systems Analyst | 25.3 | 20, 34 | .19 |
| DB Admin | 14.2 | 12, 52 | .29 |
| Networking | 20.5 | 26, 60 | .77 |
| Project Management | 26.4 | 28, 89 | .55 |
| Software Development | 47.1 | 30, 289 | .02 |
| Security [*] | 11.9 | 10, 20 | .29 |
| Analytics [*] | 18.6 | 12, 11 | .01 |
| Region of US | χ^2 | df, N | p |
| Northwest [*] | 9.3 | 6, 17 | .16 |
| Southwest | 64.4 | 30, 117 | .000 |
| North Central [*] | 15.7 | 14, 10 | .33 |
| South Central | 48.8 | 26, 64 | .004 |
| Mid-West | 37.9 | 30, 48 | .15 |
| Southeast | 30.3 | 28, 123 | .35 |
| Northeast | 40.6 | 30, 176 | .09 |
| Level of Education | χ^2 | df, N | p |
| High school diploma [*] | 17.0 | 16, 15 | .39 |
| Associate's degree | 20.9 | 18, 29 | .28 |
| Bachelor's degree in IT-related field | 41.8 | 28, 159 | .05 |
| Bachelor's degree in non-IT-related field | 28.2 | 24, 55 | .25 |
| Master's degree in IT-related field | 22.6 | 28, 192 | .75 |
| Master's degree in non-IT-related field | 26.6 | 26, 71 | .43 |
| Ph.D. | 11.6 | 10, 34 | .31 |
| Gender | χ^2 | df, N | p |
| Female | 26.4 | 28, 154 | .55 |
| Male | 47.7 | 30, 399 | .02 |
| Non-binary | - | - | - |
| Did not specify | - | - | - |
| Firm Size | χ^2 | df, N | p |
| < 11 [*] | 9.8 | 6, 7 | .13 |
| 11-20 [*] | 15.0 | 16, 12 | .53 |
| 21-100 | 21.4 | 22, 46 | .50 |
| 101 - 499 | 42.4 | 30, 103 | .07 |
| 500 - 999 | 21.8 | 30, 160 | .86 |
| 1000 - 9999 | 27.5 | 30, 188 | .60 |
| 10000+ | 15.4 | 16, 39 | .50 |

*NOTE: Less than 25 responses in this category
+all respondents in this category indicated they had 1 or more certification

Table 6: Having a Certification's Effect on Salary Range (3 categories, split samples)

Table 6 summarizes the results of our statistical comparisons using this new 3-category variable when we split our sample by job category, region of the US, level of education, gender, and firm size. While the relationship is significant across the whole sample with this new categorization, there are still no significant relationships when split by firm size. Significance does, however,

exist when looking at job category, region of the US, and gender here.

Only one job category indicated a relationship between certification and salary range – Software Development. The relationship between the 3-level categorization of certifications and salary in the Software Development job category was analyzed with a one-way ANOVA that revealed a statistically significant difference in salary ranges ($F(2, 286) = 4.8$; $p = .009$). Using a Tukey HSD post-hoc test for comparisons, we find that there is a statistically significant difference between people in Software Development with more than 3 certifications and people with between 1 and 3 certifications ($p = .006$) such that the difference in salary range is 1.53 on our 16-point salary range scale (95% C.I. = [.36, 2.70]). There is no significant difference in Software Development between people with no certification and people with between 1 and 3 ($p = .78$) or between people with more than 3 ($p = .93$).

Similar to the dichotomous variable, when split by region of the US, the Southwest and South Central regions show significance, but the Northeast does not. The results from a one-way ANOVA reveal a statistically significant difference in salary ranges in these 3 levels of having a certification in the Southwest region ($F(2,114) = 6.3$; $p = .003$), but not the South Central region ($F(2,61) = .2$; $p = .85$). Using a Tukey HSD post-hoc test for comparisons, we find that there is a statistically significant difference between people in the Southwest with more than 3 certifications and people with no certifications ($p = .01$) such that the difference in salary range is 5.36 on our 16-point salary range scale (95% C.I. = [-9.80, -.92]). Also, there is a statistically significant difference between people in the Southwest with more than 3 certifications and people with between 1 and 3 ($p = .03$) such that the difference in salary range is 2.00 on our 16-point salary range scale (95% C.I. = [.20, 3.80]). There is no significant difference between people in the Southwest with no certification and those having between 1 and 3 ($p = .17$).

Our sample also shows that having a Bachelor's degree in an IT-related field reveals a relationship with certifications and salary range using the 3-level categorization for number of certifications. The results from a one-way ANOVA reveal a statistically significant difference in salary ranges in these 3 levels of having a certification for people having a Bachelor's degree in an IT-related field ($F(2,156) = 5.2$; $p = .007$). Using a Tukey HSD post-hoc test for comparisons, we find that there is a statistically significant difference

between people having a Bachelor's degree in an IT-related field with more than 3 certifications and people with between 1 and 3 certifications ($p = .02$) such that the difference in salary range is 1.64 on our 16-point salary range scale (95% C.I. = [.17, 3.11]). There is no significant difference among people having a Bachelor's degree in an IT-related field with no certification and people with between 1 and 3 ($p = .07$) or between people with more than 3 ($p = .55$).

Furthermore, our sample has a relationship between salary ranges and this 3-level categorization of number of certifications in the male sample. The results from a one-way ANOVA reveal a statistically significant difference in salary ranges in these 3 levels of having a certification for males ($F(2,396) = 5.3$; $p = .005$). Using a Tukey HSD post-hoc test for comparisons, we find that there is a statistically significant difference between males with more than 3 certifications and males with between 1 and 3 certifications ($p = .004$) such that the difference in salary range is 1.38 on our 16-point salary range scale (95% C.I. = [.37, 2.39]). There is no significant difference in males with no certification and those with between 1 and 3 ($p = .56$) or between those with more than 3 ($p = .98$).

These results suggest that, in general, having certifications may not begin to increase salary until 3 or more are acquired. Evidence from the Software Development job category, a Bachelor's in an IT-related field, and males support this notion. Even so, it may be that the Southwest region of the US does not follow this because there were significant effects between having no certifications and both having between 1 and 3 and having 3 or more.

6. FUTURE RESEARCH AND REMARKS

Using our analysis and results, we hope future researchers investigate the following questions:

- Why is the Southwest region of the US a consistent factor that changes how certification relates to salary?
- How does obtaining certifications during employment modify salary ranges?
- What other theoretical models help explain certification's effects on salary and what other factors might these theories introduce?

Every research has limitations and ours is not exempt. While we acknowledge some limitations in our study, we hope future researchers can account for these and extend our work. First, we

note that we chose to use salary ranges instead of a continuous salary measurement. This did modify how we reported some results and the statistical methods we employed.

Additionally, we acknowledge the fact that our sample did have some frequencies in certain categories that were low (e.g., the Security and Analytics job categories; the Northwest and North Central regions of the US; the High School Diploma level of education; and firm sizes below 20 employees). While there is an argument that some of these categories may play an important role in understanding certifications in the IS/IT field, we believe our sample served its purpose to give insight into the field, certifications, and salaries.

The same may be true for categories that had high frequencies of response. For example, the Software Development job category had the highest representation in our sample (59.5%). It's possible that this fact influenced some of the findings at the full sample level. We provided analysis by job category, region of the US, and other factors to attempt to view the results from multiple angles. These attempts allow us to better understand our data set and what valuable information we can extract from it.

7. CONCLUSIONS

Based on the findings, certifications continue to be prominent in the IT/IS field with over 95% of participants holding at least one which has also increased from 2020 at 89% and 62% in 2018 (Cummings & Janicki, 2021). While the number of participants not holding a certification was relatively low, there was no difference in salary based on whether they were holding a certification or not. While certifications do provide some validation to a person's skills level, the results bring into question the value of a certification for those looking for a higher salary. However, when evaluating education level, those with a Bachelor's degree in an IT-related field may find it beneficial to get certifications as a means of competitive advantage in the job market. This education level was found to have a significant difference in salary when analyzing people with at least 1 certification. Overall, certifications will continue to dominate the field and should be viewed as a means of expanding one's skills and not necessarily benefiting one's salary.

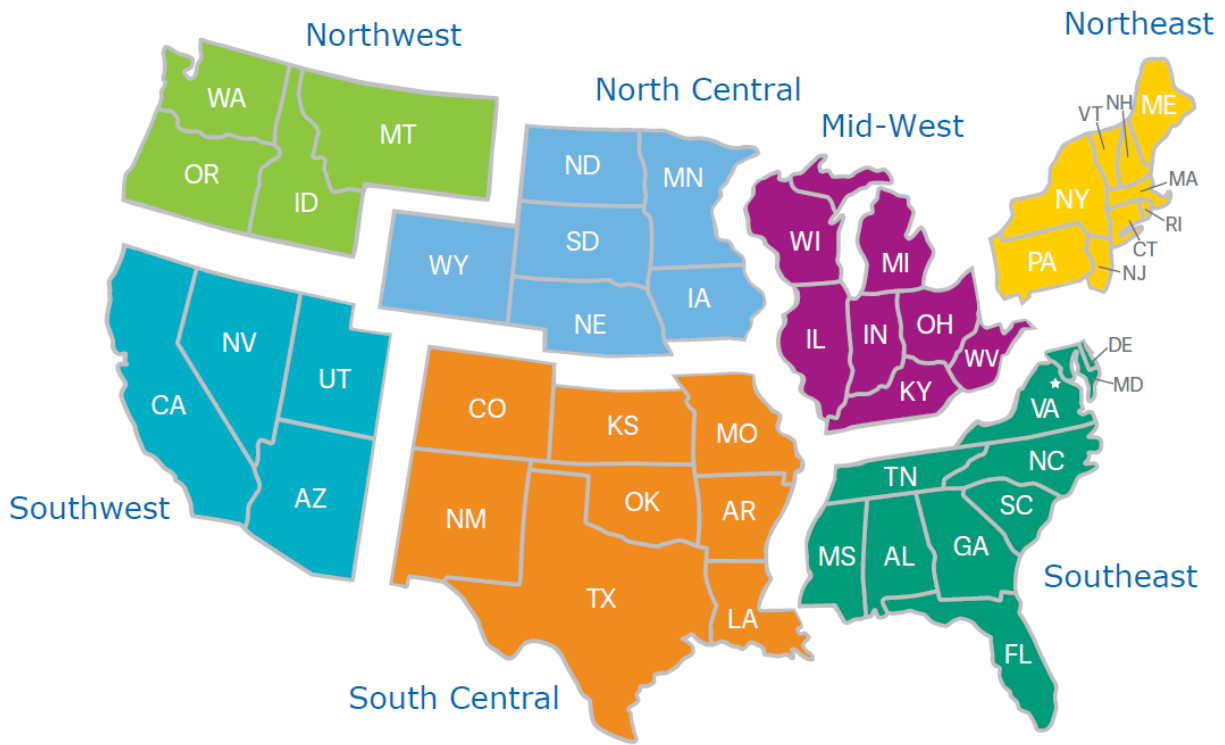
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APPENDIX A
States Included in the Economic Regions of the US



* Adapted from (Rosen et al., 2014)

Northwest (NW)

WA, OR, ID, MT

Southwest (SW)

CA, NV, UT, AZ

North Central (NC)

WY, ND, SD, NE, MN, IA

South Central (SC)

CO, NM, KS, OK, TX, MO, AR, LA

Mid-West (MW)

WI, IL, MI, IN, OH, KY, WV

Northeast (NE)

PA, NY, NJ, CT, RI, MA, ME, NH, VT

Southeast (SE)

VA, DE, MD, DC, TN, NC, SC, GA, AL, MS, FL