Professional Association Membership of Computer and Information Security Professionals

George Corser
Oakland University
Dodge Hall
Rochester, MI 48309
989-780-3168

gpcorser@oakland.edu

ABSTRACT

Unlike the computing profession as a whole, the information security profession exhibits two measurable characteristics of older professions, a significant member-to-practitioner ratio in its primary professional association, and a broadly accepted curriculum, as evidenced by its primary certification credential.

Categories and Subject Descriptors

K.3.2 [**Computers and Education**]: Computer and Information Science Education.

K.7.2 [**The Computing Profession**]: Organizations

General Terms

Professional associations

Keywords

AMA, ABA, AICPA, ASCE, ASME, IEEE, ACM, ISSA, (ISC)[2]

1. INTRODUCTION

Vocations requiring continuing professional education traditionally organize into societies, guilds, or other professional associations. Associations of long-established professions—such as medicine, law, accounting and some branches of engineering—enjoy membership participation levels ranging from one-fourth to one-half of eligible practitioners.

The Association of Computing Machinery, ACM, is the largest professional association of computing professionals. The Information Systems Security Association, ISSA, is the largest such society serving the information security profession.

This report shows that scarcely one percent (1%) of computer professionals in the United States belong to the ACM. But computer professionals in the information security (IS) field participate in the ISSA at roughly eight times that rate. Further, the credential, Certified Information Systems Security Professional, CISSP, is held by perhaps forty-six percent (46%) of IS practitioners as classified by the US Bureau of Labor Statistics.

2. METHOD

This report estimates the percentage of professionals working in the United States who are members of their relevant professional associations. Bureau of Labor Statistics, BLS, figures estimate the number of professionals working in the United States in each occupation. Reports from the various professional associations determine the number of professionals in the United States who are members of the associations. We compute the member-to-practitioner, MTP, ratio:

MTP = members of association / total number of practitioners

2.1 Professions

This report estimates MTP ratios of eight professions, as listed below with the name of the primary professional association and the year it was founded.

1. Doctors: AMA (American Medical Association, 1847)
2. Lawyers: ABA (American Bar Association, 1878)
3. Accountants: AICPA (American Institute of Certified Public Accountants, 1887)
4. Civil Engineers: ASCE (American Society of Civil Engineers, 1852)
5. Mechanical Engineers: ASME (Association of Mechanical Engineers, 1880)
6. Electrical and Electronics Engineers: IEEE (Institute of Electrical and Electronic Engineers, 1963)
7. Computing Professionals: ACM (Association of Computing Machinery, 1947)
8. Information Security Professionals: ISSA (Information Systems Security Association, 1982)

2.2 Data Sources

The greatest challenge in this research was obtaining complete and accurate data. Sometimes estimates were necessary. These are explicitly identified below.

International and student populations were often unknown. Lack of availability of sufficiently detailed international data confined this research to professions and professionals in the United States exclusively. Therefore, calculations exclude international members of professional associations. While professional associations often clarified student populations, BLS data excludes students because they are not working in the profession. Thus, student populations are excluded from this report.

At any given point in time, some professionals are unemployed, retired or working in positions other than those classified by the BLS as belonging to their particular profession. These people

would not be reported by the BLS for that occupation, though they may maintain licenses to practice and may be members of their relevant professional associations.

Similarly, some professionals may be members of multiple professions. For example, a CPA may also hold a JD, and hold licenses in both professions, and belong to both professional associations. The BLS would likely categorize such an employee in only one of the two professions.

This report uses as its source the BLS Occupational Outlook Handbook, 2010-11 Edition, figures from 2008 and projected employment estimates for the following decade. Annual reports of professional associations were not always available for 2008 and 2009, or they did not always provide the necessary information. In such cases the association's website or other official sources were used. Note, too, the dates of the BLS reports and the dates of the professional association membership reports did not always coincide precisely.

Table 1. Member-to-practitioner (MTP) ratios.

| Profession (Association)	Members	Eligible Population	MTP Ratio
Doctors (AMA)	187,620	661,400	28%
Lawyers (ABA)	400,000	759,200	53%
Accountants (AICPA)	334,800	1,390,239	24%
Civil Engineers (ASCE)	98,932	310,988	32%
Mechanical Engineers (ASME)	78,740	266,641	30%
Electrical/Electronics Engineers (IEEE)	167,750	336,792	50%
Computer-related Professionals (ACM)	37,675	3,690,970	1%
Information Security Professionals (ISSA)	5,500	68,168	8%
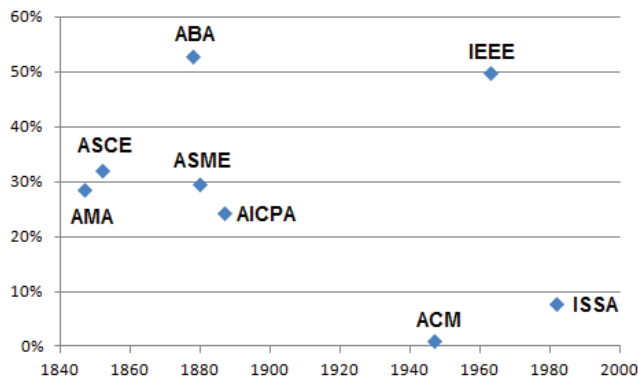
Figure 1. MTP ratios plotted vs. year association was established. [1]

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[1] The IRE (Institute of Radio Engineers, 1912) and the AIEE (American Institute of Electrical Engineers, 1884) merged in 1963 to form the IEEE.

3. RESEARCH RESULTS

For each profession and professional society, membership numbers and BLS practitioner numbers were as follows.

3.1 Doctors (AMA)

The BLS reported that in 2008 there were 661,400 physicians and surgeons in the United States [1]. It estimated that "Employment is expected to grow much faster than the average" for this occupational category [1], however a year-to-year comparison between May, 2008, figures [20] and May, 2009, figures [22] shows a clear decline in this population.

In its 2008 Annual Report, the AMA (American Medical Association) cited membership of "approximately 236 thousand members" [2]. The 2009 Annual Report quantified membership at "approximately 228 thousand members" [40]. These and other reports consistently find that AMA membership has been declining [39]. A 2007 Mednews Today report stated that the AMA's Council on Long Range Planning and Development estimated that 20.5% of the AMA's members are medical students [39]. From the 2008 numbers, if 20.5% of the AMA's 2008 members were students, then roughly 28% of US working physicians belong to the AMA. There may be international AMA members who hold a license to practice medicine in the United States and are AMA members but are were not working in the US and therefore were not reported by the BLS, however this figure is assumed to be negligible.
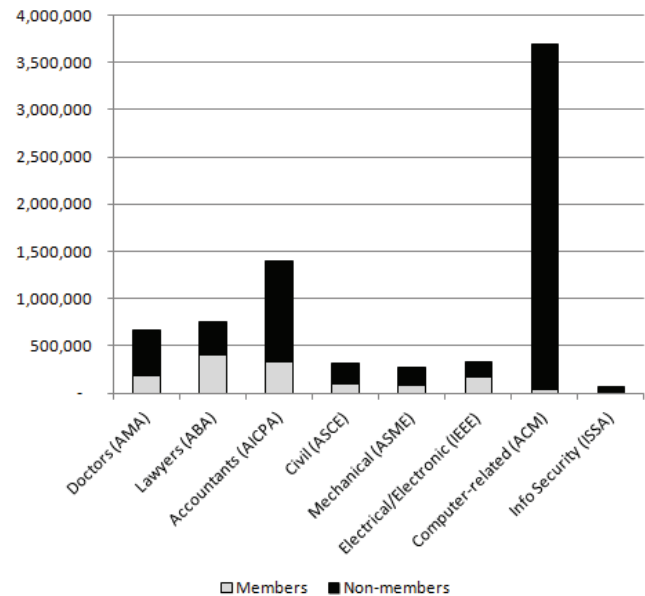
Figure 2. Professions by number of eligible practitioners.

3.2 Lawyers (ABA)

The BLS reported that in 2008 there were 759,200 lawyers in the US [3]. The ABA (American Bar Association) in 2010 reported that, "With nearly 400,000 members, the American Bar Association is the largest voluntary professional membership organization in the world" [4]. From these numbers, at least 53% of practicing lawyers in the US are ABA members.

The BLS reported that the population of working US lawyers is expected to grow "About as fast as the average" [3]. A comparison of May, 2008, figures [20] and May, 2009, figures [22] shows that this population grew by less than 1% (0.56%). The ABA Journal reported that there has been a continuing "decrease in ABA membership" [41]. Since employment in the legal profession has held steady and ABA membership has declined [23], this suggests the estimate of 53% may be low.

The ABA reported that, "If you are a lawyer licensed to practice in any of the states, territories, or possessions of the United States, you can become an ABA Member" [11]. Since a license issued by a US state is required for ABA membership and student and international memberships are not offered by the ABA, such populations are disregarded in this report.

3.3 Accountants (AICPA)

The BLS reported that in 2008 there were 1,290,600 accountants and auditors in the US [5]. This figure does not include accounting managers. "Many financial managers work in accounting departments," according to the BLS, "Accounting positions normally require workers to be certified public accountants (CPAs)." The BLS reported 539,300 financial managers, a sub-category of management occupations [19].

Using the numbers from the BLS for May, 2008, the ratio of accountants and auditors to all business and financial operations occupations is 18.4% [20]. If the percentage of accountants and auditors to all business and financial operations is proportional to the percentage of accounting-related managers to all financial managers, then 18.4% (99,639) of financial managers are accounting managers. This would raise the total number of US employees in the accounting profession to 1,390,239.

The AICPA (American Institute of Certified Public Accountants) in 2010 reported that, "The American Institute of Certified Public Accountants (AICPA) is the national professional association of CPAs, with more than 360,000 members, including CPAs in business and industry, public practice, government, and education; student affiliates; and international associates" [6].

The AICPA reported as of 2010 no international associate membership, stating, "Criteria is currently under consideration" [12]. However, the AICPA reported that 7% of its members are retired [25]. These members would not be reported by the BLS. Consequently, the number of working AICPA members in the US is roughly 334,800. Using estimated BLS and AICPA figures above, and ignoring discrepancies described below, roughly 24% of US accountants belong to the AICPA.

While this calculation did not use numbers from the same years, two factors led to the decision to use these actual numbers. First, the BLS reported that the number of people in the accountants and auditors occupation is growing "much faster than average" [5]. Similarly, a 2008 study reported that the AICPA was experiencing "strong growth" in 2008 [26]. However, second, the BLS reported 1,133,580 accountants and auditors in May 2008 [20] and 1,106,980 in May 2008 [22], a decrease of 2.4%. These facts lead to conflicting conclusions regarding how the difference in populations from 2008 and 2010 affect the calculation, so actual figures were used.

No data are available regarding percentages of international and student membership in the AICPA; the larger these populations the greater the overestimate of the percentage calculation. In this study, no other professional association reported its retirees. The deduction of the retired population from the membership figure would tend to mitigate the effect of the lack of information regarding international and student membership.

3.4 Civil Engineers (ASCE)

The BLS reported that in 2008 there were 1,571,900 engineers in the US [14]. Computer hardware engineers are included in this number, but excluded from this number are software engineers, network engineers and all other computer-related professionals with the exception of computer hardware engineers [14]. Civil Engineers accounted for 278,400 [14] (17.7%) of all engineers. The BLS also reported 184,000 engineering managers, a sub-category of management occupations [17]. If the percentage of civil engineering managers to engineering managers is proportional to the percentage of civil engineers to all engineers, then 17.7% (32,588) of engineering managers are civil engineering managers. This would raise the total number of employees in the civil engineering profession to 310,988.

The ASCE (American Society of Civil Engineers) reported in 2010 that it represented 144,000 "members of the civil engineering profession worldwide" [15]. A national membership report showed that 68.7% of ASCE members hold membership grades which require actual civil engineering work experience [36]. This excludes student members. It is assumed the 2008 BLS figures are comparable with the 2010 ASCE figures. If this is the case then 98,932 ASCE members are employable as civil engineers. An ASCE-related newsletter reported that there are 15,000 international members of the ASCE [34], however this is not an official ASCE communication. Consequently ASCE membership is estimated to be 32% of the US population working in the field of civil engineering.

3.5 Mechanical Engineers (ASME)

Mechanical Engineers accounted for 238,700 [14], or 15.2%, of all engineers reported by the BLS in 2008. Again, the BLS reported 184,000 engineering managers, a sub-category of management occupations [17]. If the percentage of mechanical engineering managers to engineering managers is proportional to the percentage of mechanical engineers to all engineers, then 15.2% (27,941) of engineering managers are mechanical engineering managers. This would raise the total number of employees in the mechanical engineering profession to 266,641.

The ASME (Association of Mechanical Engineers) reported that it represents "a membership of more than 127,000 mechanical engineers and allied professionals from around the world" [31]. The ASME News reported that, "As of December 2007, ASME membership exceeded 127,000, of which 22 percent were students and 16 percent were outside the United States" [33]. Using these figures, assuming student (27,940) and international (20,320) memberships were mutually exclusive categories, and assuming negligible discrepancy from the BLS (a 2008 figure) and the ASME (a 2010 figure), 78,740 ASME members were professionals working in the US, which is 30% of BLS-reported professionals working in the field of mechanical engineering.

Eight or more years of professional experience, a degree in mechanical engineering and/or "involvement, either professionally or personally, with service to the profession" are required for some level of ASME membership [32]. However, neither PE licensure nor membership in the ASME is required to practice mechanical engineering in the US. PE licensure is required only under certain circumstances. Licenses for such practice are granted by various legal jurisdictions.

3.6 Electrical/Electronics Engineers (IEEE)

Electrical and Electronics Engineers comprised 301,500 (19.2%) of engineers reported by the BLS [14]. The BLS reported 184,000 engineering managers, a sub-category of management occupations [17]. If the percentage of electrical and electronics engineering managers to engineering managers is proportional to the percentage of electrical and electronics engineers to all engineers, then 19.2% (35,292) of engineering managers are electrical and electronics engineering managers. This would raise the total number of employees in the mechanical engineering profession to 336,792.

The IEEE (Institute of Electrical and Electronic Engineers) reported in 2010 that it has "more than 395,000 members in more than 160 countries," but of these there are "more than 90,000 student members," and 45% of its members "are from outside the United States" [30]. Consequently, 167,750 would be closer to the actual number of electrical and electronics engineers working in the US who are members of the IEEE. This represents 50% of the BLS reported population.

3.7 Computer Professionals (ACM)

The ACM serves a membership of varied computer professionals and other personnel, not just software engineers [21]. To identify a working population that corresponds to the ACM's membership, this report considers a range of BLS occupation categories.

The BLS reported that in 2008 there were 1,336,300 software engineers and computer programmers in the US [7]. More broadly, the BLS reported that, in May 2008, 3,308,260 people were employed in computer and mathematical science occupations [20]; 276,820 were employed as computer and information systems managers; 73,370 were employed as computer hardware engineers; and 32,520 were employed as computer science teachers, postsecondary [20]. Adding these together, roughly 3,690,970 working US professionals are eligible for membership in the ACM, excluding students and retirees.

In 2010, the ACM (Association for Computing Machinery) reported membership of "over 97,000 members from over 100 countries" [21]. The ACM reported that 68,500 are professional members; 25,500 are student members; and 350 (sic) are institutional members, i.e., companies and universities [21]. The ACM's numbers add up to 94,350, not 97,000+, so there must be an error in the ACM's membership reporting. For these calculations, assume a typographical error, that 350 institutional members should have been reported as 3,500.

No information is available regarding how many ACM members work in the US. However, the IEEE, a similar professional association, reports that 45% of its members "are from outside the United States" [3]. If a similar percentage of ACM members work in the US, then the ACM represents about 37,675 (1%) of all

computer professional personnel eligible to join. A proportional number of software engineers, 13,640 (1%) of 1,336,300 software engineers [7], are estimated to be members of the ACM.

3.7.1 Overlap between ACM and IEEE

The IEEE Computer Society, perhaps the largest of the many subgroups within the IEEE, reports, "Membership peaked at 107,049 in 1990, including 12,456 student members and 27,157 affiliates" [42]. Precise figures are not publicly available, but this information suggests that perhaps one-fourth of IEEE members may be classified as computer or software engineers rather than electrical or electronics engineers. In fact, ACM and IEEE Computer Society sometimes coordinate explicitly, as in their joint development and adoption of the software engineering code of ethics. (See: http://www.acm.org/about/se-code.)

Certain practitioners may be both computer/software engineers and electrical/electronics engineers at the same time. Other practitioners, of only the computing profession, may be members of the ACM only, the IEEE only, or both the ACM and IEEE. Distinguishing between these populations is not possible using the available data, so this study counts all IEEE members as electrical and electronics engineers.

3.7.2 Overlap between ACM and ISSA

While only a portion of IEEE members would be considered potential ACM members, all of ISSA members would be eligible. Again, no data exist to quantify potential overlap, but for the purposes of this report the practitioners of information security are a proper subset of computing as a whole.

3.8 Information Security Professionals (ISSA)

The BLS does not quantify employment of information security professionals as a separate line item. It is mixed in with web developers and computer network architects, specifically, "15-1179 Information Security Analysts, Web Developers, and Computer Network Architects." For this category, the BLS reported 2011 employment of 272,670 [43] and 2010 employment of 302,300 [44]. Based on these data it would appear that employment in this category declined. However, the BLS also reported job growth "Faster than average" [44], so it would appear that other factors may account for the difference.

This report uses the figure in [43] because it is more recent and it specifies the classifications specifically, stating, "This OES occupation is a combination of data collected for the 2010 SOC occupations 15-1122 Information Security Analysts, 15-1134 Web Developers, 15-1143 Computer Network Architects and the 2000 SOC occupation 15-1081 Network Systems and Data Communications Analysts" [43]. Note there are four sub-classifications within BLS category 15-1179, so it is estimated that roughly one-fourth of this category, or 68,168, quantifies the working population of IS professionals.

The ISSA (Information Systems Security Association) website states, "ISSA has more than 140 chapters, reaching over 10,000 security professionals in 70 countries." [45] No information is available regarding how many ISSA members work in the US. However, the IEEE, a similar professional association, reports that 45% of its members "are from outside the United States" [3]. If a

similar percentage of ISSA members work in the US, then the ISSA represents about 5,500 (8%) of all IS practitioners.

4. ANALYSIS

Professional association membership levels of IS professionals fall somewhere in between those of older professions and those of the computer industry as a whole. The MTP ratio for the ISSA may be around 8%.

But perhaps the computer field is defined too broadly. According to the BLS, there are nearly as many practitioners in the computer field as in all other professions included in this study combined. (See Figure 3.)
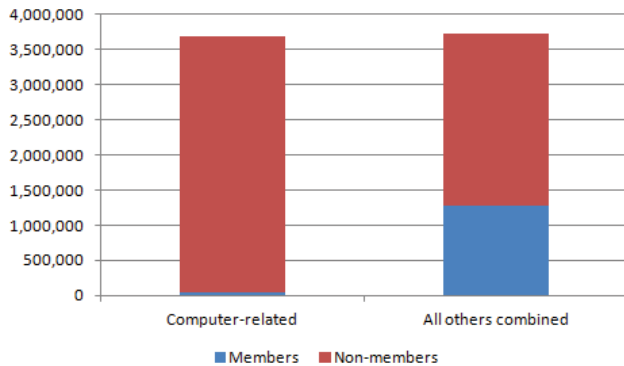

Figure 3. BLS figures for computer-related professionals and all other professional occupations in this study combined.

4.1 MTP Ratio

The much higher MTP ratios of other professional associations, compared with the ACM's MTP ratio, indicate that the ACM may not represent a single profession so much as a number of related professions. These other professions may require two associations: one association such as the ACM provides, and another more industry-specific professional affiliation. Case in point: ISSA, which enjoys an MTP ratio perhaps eight times that of the ACM.

4.2 Certification Ratio

The primary certifying body of information security professionals is the International Information Systems Security Certification Consortium, Inc., (ISC)²®., which provides the predominant certification, the Certified Information Systems Security Professional, CISSP. The (ISC)² reports, "we're proud of our membership – an elite network of nearly 75,000 certified industry professionals worldwide." [46] [47]

No information is available regarding how many (ISC)²-certified professionals work in the US. However, the IEEE, a similar professional association, reports that 45% of its members "are from outside the United States" [3]. If a similar percentage of (ISC)²-certified professionals work in the US, then there may be 41,250 (ISC)²-certified professionals in the US. If there are 68,168 total IS professionals in the US, then 61% are certified by the (ISC)².

The computing profession has no widely accepted certification. The fact that IS professionals have such a credential indicates a level of development that exceeds the broader computing profession.

4.3 Curriculum Development

Curriculum developers might be wise to distinguish industry-specific best practices from general professional computing best-practices when developing materials. Such distinction may apply to any sub-category of the computing profession, but this report shows that it especially applies to information security.

5. CONCLUSIONS

The primary contribution of this report is to document professional association participation levels of computer and information security professionals compared to participation levels of other professions. Figures comparing information security to professionals (ISSA) to computing professionals overall (ACM) tend to reveal that a professional association must be sufficiently narrowly defined in order to achieve the traction, the high MTP ratio, necessary to congeal practitioners into an organization with widely accepted professional curricula, such as that required for preparation for professional certification.

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