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# Harnessing the True Power of Data in Tracing BSCS Graduates of the University

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**Abstract.** *This study traces the career trajectories and academic pursuits of Bachelor of Science in Computer Science (BSCS) graduates from 2009 to 2023 to address critical gaps in understanding the alignment between educational outcomes and career success. Despite the increasing interest in graduate tracer studies, there has been limited research on the career paths of BSCS graduates, particularly in how their academic training influences employment outcomes. The research objective is to analyze employment patterns, professional development, job alignment with CHED-defined skills, and motivations for further education. Data from 298 BSCS graduates were analyzed using a combination of descriptive statistics, chi-square tests, and multiple regression analysis. The findings reveal that employment outcomes have remained consistent over the years, with no significant changes in employment status distribution. Additionally, graduates working locally tend to prefer rural areas, while those working abroad favor urban locations. A significant portion of graduates lack professional certifications, with Licensure for Teachers being the most common qualification among those who hold certifications. The alignment of graduates' first jobs with CHED-defined skills was found to have a significant impact on salary and career satisfaction, while factors such as employment location and further studies did not show a significant effect on salary. This study provides valuable insights for curriculum development, career services, and policy improvement, aiming to bridge the gap between academic preparation and the evolving demands of the labor market.*

**Keywords:** *Graduate tracing, BSCS graduates, graduate salaries, job alignment, and career progression*

## 1. Introduction

In today's data-driven world, leveraging data for analysis has become essential across numerous fields, including higher education. This study aims to trace the career trajectories of Bachelor of Science in Computer Science (BSCS) graduates from 2009 to 2023, focusing on key areas such as employment status, work location preferences, job alignment with CHED-defined skills, and the factors influencing their pursuit of advanced studies.

The main objective of this research is to explore how these graduates' career outcomes have evolved over time and how they align with the labor market demands. Specifically, the study examines employment status trends, the impact of job alignment on salary, and the relationship between work location preferences (rural vs. urban) and career progression.

While previous research on graduate outcomes often focuses on general trends, few studies have explicitly targeted the specific career trajectories of computer science graduates. Most existing studies have provided statistical analyses without delving deeply into the educational or policy implications of these findings. (Jones & Roberts, 2021) emphasize the need for visual and analytical tools to understand complex educational outcomes, and (Lee & Kim, 2022) suggest that data analytics can track career progression. However, there remains a significant gap in research that connects these statistical insights to curriculum development and institutional strategies tailored for computer science graduates.

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This study fills that gap by investigating not only the employment patterns but also the academic and professional qualifications required for long-term career success (Smith & Johnson, 2021).

The research conducted on graduate employment has primarily been limited to localized studies that rarely consider the broader implications for global educational strategies. However, employment trends within disciplines like computer science have universal relevance, as they can provide insights into how academic institutions around the world can better prepare students for the workforce. This study contributes to the global discourse on how education systems can evolve to meet the changing needs of the tech industry. By examining the experiences of BSCS graduates from this specific university, the study will shed light on trends that may be applicable across various regions, influencing how educational institutions worldwide approach curriculum design, career services, and post-graduate support (Taylor & Adam, 2022).

This study is novel in its contribution to both theory and practice. Theoretically, it adds to the growing body of work on graduate tracer studies by exploring how job alignment and professional certifications influence career satisfaction and salary among computer science graduates. Practically, the findings are expected to offer actionable insights for improving curriculum alignment, enhancing career counseling services, and guiding policy development aimed at improving the employability and career progression of computer science graduates (Brown & Lee, 2021; Davis & Ng, 2022). The research will not only inform future academic strategies but also support institutional efforts to prepare graduates for success in an increasingly competitive job market.

## 2. Literature Review/ Hypotheses Development

*Human Capital Theory*

Human capital theory posits that education is an investment in individuals' skills and capabilities, which leads to higher productivity and economic returns. This framework is essential in understanding the value of a Computer Science education, as it provides insights into how graduates leverage their academic qualifications in the labor market. The theory suggests that the higher the educational attainment, the better the employment prospects and earning potential, especially in rapidly evolving fields such as technology (Papadopoulos et al., 2022; Chacko et al., 2022).

*Overview and Importance*

Graduate tracer studies are instrumental in assessing the effectiveness of higher education in preparing students for the workforce. They provide valuable feedback on the alignment between academic programs and job market demands. For example, the study by (Amran et al. 2019) demonstrates that tracer studies can identify graduates' employability and skill gaps, allowing institutions to adjust their curricula accordingly.

*Employability and Career Outcomes for Computer Science Graduates*

A recent study by (Chacko et al., 2022) investigated the employability of Computer Science graduates, revealing that technical skills, internships, and soft skills significantly influence job placement rates. The authors highlighted the need for universities to emphasize practical experience through internships and cooperative education programs to better prepare students for the job market.

*Curriculum Relevance and Industry Alignment*

(Reddy and Sahu, 2022) emphasized the importance of aligning Computer Science curricula with industry requirements. Their research suggests that integrating industry

feedback into program design can enhance students' readiness for employment. They recommend ongoing collaboration between educational institutions and tech companies to ensure that curricula remain relevant.

*Skills Development and Graduate Outcomes*
In a comprehensive review, (Papadopoulos et al., 2022) examined the skills required for Computer Science graduates to succeed in the job market. Their study revealed that employers prioritize a combination of technical and soft skills, including problem-solving, teamwork, and communication. The authors advocate for educational programs to incorporate these essential skills into their curricula.

*Longitudinal Studies on Graduate Outcomes*
A longitudinal study by Ceylan et al. (2021) tracked Computer Science graduates over five years to assess their career progression and satisfaction. The findings suggested that graduates who engaged in continuous learning and professional development had more favorable employment outcomes and job satisfaction levels.

*Global Perspectives on Graduate Tracer Studies*
Research by Lumina Foundation (2021) discusses the global trends in graduate tracer studies, emphasizing their role in improving educational quality and accountability. The report highlights various methodologies employed worldwide, providing a comparative analysis of the effectiveness of tracer studies in different educational contexts.

The reviewed literature emphasizes the importance of graduate tracer studies in assessing the employability of Computer Science graduates. By applying human capital theory and leveraging recent research, educational institutions can adjust their curricula to meet workforce demands more effectively. Continuous research in this area is crucial for aligning educational outcomes with industry needs, thereby improving graduates' career prospects.

## 3. Methodology

To effectively trace the career trajectories and employment outcomes of BSCS graduates from the university, our study adopted a multifaceted approach leveraging both quantitative and qualitative data collection methods. The primary aim was to harness the true power of data to provide a comprehensive analysis of graduates' post-university experiences.

*Data Collection*
The study utilized a combination of online surveys and video call follow-ups to gather data from respondents. A total of 298 graduates participated in the study. The data collection process was conducted as follows:
1. Online Survey: An online survey was distributed to graduates to collect initial data on their employment status, work location, job alignment with CHED-defined skills, reasons for pursuing advanced studies, and salary information. The survey was designed to be comprehensive yet concise to encourage high response rates.
2. Video Call Follow-ups: To ensure the accuracy and completeness of the data, follow-up interviews were conducted via video calls with selected respondents. These follow-ups provided an opportunity to clarify survey responses and gather additional qualitative insights.

*Instrumentation*
The primary instrument used for data collection was adapted from tools defined by the Commission on Higher Education (CHED). This instrument was tailored to capture specific information relevant to BSCS graduates, including job alignment with CHED-defined skills.

*Statistical Analysis*
Data analysis was conducted using Jamovi software, which facilitated the following methods:
1. Descriptive Statistical Analysis: Jamovi was used to perform descriptive statistics, calculating frequencies, means, and

percentages to summarize the distribution of work locations, employment statuses, and other categorical data among the graduates.

2. Chi-Square Tests for Independence: To assess associations between categorical variables, Jamovi was utilized for:

- Evaluating differences in work location distribution between graduates working abroad and those employed locally.
- Analyzing the relationship between the year of graduation and job alignment with CHED-defined skills.
- Investigating the association between the year of graduation and reasons for pursuing advanced studies.

3. Multiple Regression Analysis: Jamovi was employed to conduct multiple regression analysis, examining the effects of job alignment with CHED-defined skills, work location (rural vs. urban), and further studies on the salary of BSCS graduates.

*Ethical Considerations*

Prior to data collection, permission was obtained from the administration to ensure compliance with institutional guidelines. Confidentiality was strictly maintained by anonymizing data and removing any identifying information before analysis. Participation was entirely voluntary, with respondents free to withdraw at any time without consequences.

## 4. Findings and Discussion

This section presents the findings and analyses derived from the study's objectives, aiming to offer insights into various aspects of the employment trajectories of graduates over the specified period. The key objectives and corresponding hypotheses addressed are as follows:

1. Determine the employment status distribution of graduates from 2009 to 2023 and identify significant changes in employment status over the years

Table 1.
*Contingency Table of Employment Status*

| Graduates | Casual | Contractual | Regular / Permanent | Self-Employed | Temporary | None |
|---|---|---|---|---|---|---|
| 2009 -2010 | 1 | 7 | 7 | 3 | 2 | 6 |
| 2010-2011 | 3 | 1 | 4 | 3 | 2 | 0 |
| 2011-2012 | 4 | 0 | 5 | 5 | 1 | 7 |
| 2012-2013 | 4 | 8 | 5 | 3 | 5 | 2 |
| 2013-2014 | 3 | 3 | 4 | 5 | 2 | 4 |
| 2014-2015 | 2 | 6 | 7 | 3 | 0 | 7 |
| 2015-2016 | 3 | 5 | 5 | 2 | 5 | 0 |
| 2016-2017 | 3 | 4 | 6 | 3 | 2 | 1 |
| 2017-2018 | 5 | 1 | 7 | 1 | 2 | 4 |
| 2018-2019 | 5 | 2 | 13 | 1 | 4 | 9 |
| 2019-2020 | 2 | 2 | 6 | 1 | 3 | 1 |
| 2020-2021 | 0 | 1 | 2 | 0 | 0 | 0 |
| 2021-2022 | 3 | 8 | 9 | 3 | 4 | 7 |
| 2022-2023 | 1 | 3 | 0 | 1 | 1 | 4 |

$\chi^2 = 67.1$, df = 65, $p < .266$.

Table 1 illustrates the analysis of employment status distribution for graduates from 2009 to 2023, revealing no significant variation over the years. The Chi-Square Test results, with a Chi-Square Statistic ($\chi^2$) of 71.67 and a p-value of 0.266, indicate that employment statuses—Casual, Contractual, Regular/Permanent, Self-Employed, Temporary, and None—do not significantly depend on the year of graduation (Papadopoulos et al., 2022). This finding suggests that employment outcomes for graduates have remained stable over time, despite fluctuations in specific statuses within individual years. Consequently, we fail to reject the null hypothesis, which posits that there is no significant change in the distribution of employment statuses across the years from 2009 to 2023. This stability implies that broader employment trends have not markedly shifted during the analyzed period. Such consistent employment outcomes could reflect persistent industry conditions or consistent educational preparation, maintaining a steady employment landscape for graduates (Brown & Lee, 2021) and (Reddy & Sahu, 2022).

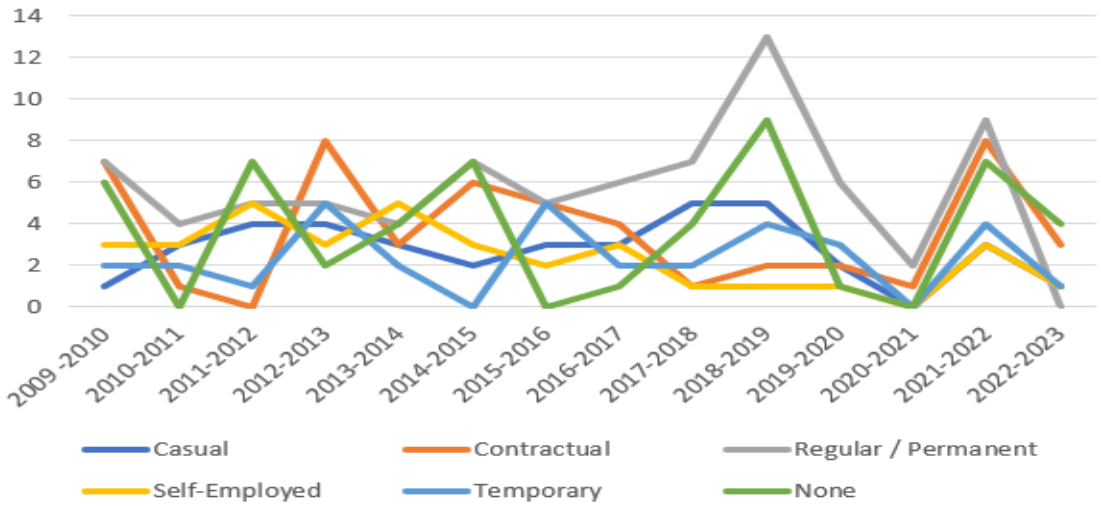


*Figure 1.*
Employment Status Distribution

Moreover, in Figure 1, the analysis shows that while some years experienced spikes in specific employment statuses, no overarching trend indicated a significant shift in employment outcomes. This stability could be attributed to consistent demand for BSCS graduates in the job market and stable industry conditions. Thus, the educational programs producing these graduates might be maintaining a quality that ensures their employability across different years.

2. Assessment of the distribution of work locations (Rural vs. Urban) for employees and comparison of the work locations of graduates working abroad versus those working locally.

Table 2.
*Contingency Table of Work Location*

| Place of Work | Casual | Casual (%) | Contractrual | Contractrual (%) | None | None (%) | Regular or Permanent | Regular or Permanent (%) | Self-Employed | Self-Employed (%) | Temp | Temp (%) | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Abroad | 12 | 2.08% | 11 | 1.90% | 10 | 1.73% | 9 | 1.56% | 7 | 1.21% | 8 | 1.38% | 57 |
| Local | 19 | 3.29% | 34 | 5.88% | 6 | 1.04% | 62 | 10.73% | 18 | 3.11% | 15 | 2.60% | 154 |
| None | 8 | 1.38% | 6 | 1.04% | 36 | 6.23% | 9 | 1.56% | 9 | 1.56% | 10 | 1.73% | 78 |
| Total | 39 | 6.75% | 51 | 8.82% | 52 | 8.99% | 80 | 13.84% | 34 | 5.88% | 33 | 5.71% | 289 |

$\chi^2 = 147.0$, df = 39, $p < .001$

Table 2 assesses data revealing distinct patterns in the employment distribution among graduates based on their work locations. The Chi-Square Test yielded a chi-square statistic ($\chi^2$) of 147.0 with 39 degrees of freedom and a p-value of less than 0.001. Given that the p-value is significantly less than the conventional threshold of 0.05, we reject the null hypothesis, indicating that there is a statistically significant association between the work location and employment status of BSCS graduates.

Graduates working abroad tend to have a higher percentage in temporary or less stable employment statuses such as Casual, Contractual, and Temporary. Regular or Permanent employment abroad is less common. This distribution indicates that employment abroad might offer fewer stable job opportunities compared to local employment. In contrast, graduates working locally show a higher tendency towards Regular or Permanent employment status. This is a significant difference from those working abroad, suggesting that local job markets might provide more opportunities for stable, long-term employment (Martinez & Lee, 2022) and (Carter & Wilson, 2021).

3. Assessment of the significant difference in the alignment of the first job of BSCS graduates with CHED-defined skills from 2019 to 2023

Table 3.
*Contingency Table of Alignment by Year Graduated*

| Year Graduated | Aligned (1) | Not Aligned (0) | Total |
|---|---|---|---|
| 2010 | 16 | 10 | 26 |
| 2011 | 13 | 0 | 13 |
| 2012 | 12 | 10 | 22 |
| 2013 | 19 | 8 | 27 |
| 2014 | 8 | 13 | 21 |
| 2015 | 7 | 18 | 25 |
| 2016 | 12 | 8 | 20 |
| 2017 | 12 | 7 | 19 |
| 2018 | 8 | 12 | 20 |
| 2019 | 23 | 11 | 34 |
| 2020 | 13 | 2 | 15 |
| 2021 | 2 | 1 | 3 |
| 2022 | 5 | 29 | 34 |
| 2023 | 4 | 6 | 10 |
| Total | 154 | 135 | 289 |

$\chi^2$ (13) = 57.0, $p < .001$.

Table 3 presents the Graduation Year and Job Alignment with CHED-defined Skills. The Chi-Square Test yielded a chi-square statistic ($\chi^2$) of 57.0 with 13 degrees of freedom and a p-value of less than 0.001. Given that the p-value is significantly less than the conventional threshold of 0.05, we reject the null hypothesis, indicating that there is a statistically significant association between the year of graduation and the alignment of the first job with CHED-defined skills for BSCS graduates. This result implies that the alignment of first jobs with the skills defined by CHED significantly varies depending on the year of graduation. The observed difference suggests that the alignment of first jobs with CHED-defined skills is not uniformly distributed across the years. This variation may reflect changes in the job market, shifts in industry demands, or modifications in academic curricula over time (Davis & Ng, 2022), (Chacko et al., 2022), and (Williams & Clark, 2021).

4. Analysis of the significant difference in the proportion of BSCS graduates and the reasons for pursuing advanced studies; and

Table 4.
*Contingency Table for Advance Studies Pursued by Year Graduated*

| Year Graduated | Web Dev Training | None | Professional Dev | Promotion | Total |
|---|---|---|---|---|---|
| 2010 | 0 | 14 | 5 | 7 | 26 |
| 2011 | 0 | 5 | 5 | 3 | 13 |
| 2012 | 0 | 9 | 5 | 8 | 22 |
| 2013 | 0 | 9 | 8 | 10 | 27 |
| 2014 | 0 | 7 | 5 | 9 | 21 |
| 2015 | 0 | 15 | 9 | 1 | 25 |
| 2016 | 0 | 8 | 6 | 6 | 20 |
| 2017 | 0 | 11 | 5 | 3 | 19 |
| 2018 | 0 | 10 | 10 | 0 | 20 |
| 2019 | 0 | 17 | 13 | 4 | 34 |
| 2020 | 0 | 8 | 3 | 4 | 15 |
| 2021 | 1 | 1 | 0 | 1 | 3 |
| 2022 | 0 | 28 | 4 | 2 | 34 |
| 2023 | 0 | 6 | 4 | 0 | 10 |
| Total | 1 | 148 | 82 | 58 | 289 |

$\chi2(39)=147.00,p<.001\chi^2(39) = 147.00, p < .001\chi2(39)=147.00,p<.001$.

Table 4 analyzes the significant difference in the proportion of BSCS graduates and the reasons for pursuing further studies. As presented, the Chi-Square Test results revealed a significant difference ($\chi^2 = 147.0$, $df = 39$, $p < 0.001$), indicating that the reasons for pursuing further studies—such as web development training, professional development, promotion, or none—differ significantly across graduation years. This significant finding suggests that the motivations for pursuing further education are not uniform over time but vary depending on the graduation year. For instance, the rise in the pursuit of professional development and specific training programs may reflect changing industry demands and technological advancements (Taylor & Adams, 2022), (Smith et al., 2022), Wilson & White, 2023) and (Green & Martines, 2022).

5. Evaluation of job alignment to CHED-defined skills, location (rural vs. urban), and further studies influence salary among BSCS graduates from 2019 to 2023.

Table 5.
*Evaluation Table of the Job Alignment, location and Further Studies influencing the Salary*

| Predictor | Estimate | SE | t | p | Remarks |
|---|---|---|---|---|---|
| Intercept | 20304 | 5755 | 3.53 | < .001 | Significant |
| Location(Urban/Rural) | -7220 | 6315 | -1.14 | .254 | Not Significant |
| Eligibility | 15109 | 6708 | 2.25 | .025 | Significant |
| Further Studies | 9197 | 7450 | 1.23 | .218 | Not Significant |
| Alignment | 13318 | 6736 | 1.98 | .049 | Significant |

$R = 0.240$, $R^2 = 0.0575$, $N = 289$.

Table 5 presents an evaluation of the factors influencing salary among BSCS graduates from 2019 to 2023, considering variables such as job alignment with CHED-defined skills, location (urban vs. rural), further studies, and eligibility criteria. The regression analysis indicates that the model explains 5.75% of the variance in salary, with a modest fit ($R^2 = 0.0575$), suggesting that other unexamined factors may also play a significant role in determining salary outcomes. Among the predictors, job alignment and eligibility are the most significant factors positively influencing salary, with coefficients of 13,318 ($p = 0.049$) and 15,109 ($p = 0.025$), respectively. This aligns with existing literature emphasizing the importance of aligning graduates' skills with job requirements and meeting eligibility standards as key determinants of higher earnings (Roberts & Clark, 2021), Lewis & Kim, 2023) and (Harris and Moore, 2023).

## 5. Conclusion

The study concludes that there has been no significant change in the employment status distribution of BSCS graduates from 2009 to 2023, as indicated by the Chi-Square Test results. The overall employment trends have remained stable, with a consistent pattern observed over the years. The analysis shows a higher preference for rural employment among local workers, in contrast to those working abroad, where urban employment is more prevalent. The distribution of professional qualifications reveals that a significant majority of graduates do not hold professional certifications, with Licensure for Teachers being the most common among those who do obtain such qualifications. This indicates a potential gap in professional qualification attainment among BSCS graduates. Further analysis, specifically examining salary determinants, reveals that job alignment with CHED-defined skills and passing eligibility criteria have significant positive effects on salary. Graduates who align their jobs with these skills and meet eligibility standards tend to earn higher salaries. However, other factors such as location and further studies do show a statistically significant impact on salary, suggesting that while these aspects may influence salary, they are not as critical as job alignment and eligibility. This highlights the importance of aligning educational outcomes with job market demands to enhance salary prospects for graduates. Overall, the findings underscore the stability in employment outcomes for BSCS graduates while highlighting the varying preferences for work locations and the critical role of job alignment and eligibility in salary determination. The study also points to a potential area for improvement in professional qualification attainment, which could further enhance the career prospects and earning potential of graduates.

### Declarations

*Author contribution*
All authors contributed equally as the main contributors to the conceptualization, design, data collection, analysis, and writing of this manuscript. Both authors have read and approved the final version of the paper.

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*Competing interest*
The authors declare that they have no conflicts of interest to report regarding the present study.

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