European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available online at: www.oapub.org/edu

DOI: 10.46827/ejes.v11i2.5187 Volume 11 | Issue 2 | 2024

CLUSTER AND CAREERS: EXPLORING SALARY STRUCTURES AND FACULTY RECRUITMENT IN ACADEMIC PROGRAMS

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Abstract:
This research explores the dynamic of faculty recruitment challenges within academic sectors through the lens of human capital theory, social cognitive theory, and expectancy theory. Utilizing the k-Means Cluster Algorithm to delineate the distribution of programs and associated salary ranges, the study examines the implications for attracting faculty graduates. The findings reveal a concentration of programs in Cluster 0, reflecting serious difficulties in faculty recruitment attributed to lower salary offerings. Drawing on Human Capital principles, the research recommends a comprehensive review of salary structures, strategic communication efforts, collaborative benchmarking, professional development initiatives, and program diversification to enhance faculty recruitment strategies. This study contributes valuable insights to the discourse on optimizing faculty recruitment in academic sectors, presenting practical recommendations for aligning programs with evolving industry needs.

Keywords: faculty recruitment, Human Capital theory, Social Cognitive theory and Expectancy theory, k-Means Cluster Algorithm

1. Introduction

College graduates refuse to join the academe as faculty members for several reasons. Many new college graduates find the academic salary and benefits insufficient and unattractive compared to industry, government, or non-government organizations (Carino, 2022, January). In a survey by the Philippines Association of State Universities and Colleges, the average monthly salary of a full-time faculty member in a public higher education institution in 2019 was about P28,000, lower than the average national salary of P32,000. Furthermore, most faculty members need adequate health insurance,

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retirement plans, or other incentives to improve their quality of life and standard of living (Quilinguing, 2023, August 21).

The academic workload and stress are too demanding and overwhelming, particularly for those who aspire to pursue higher degrees, conduct research, publish papers, secure grants, and engage in community service while accomplishing their teaching and administrative duties (Pace et al., 2021). The Commission on Higher Education (CHEd) study revealed that the average teaching load of a full-time faculty member in public higher education institutions in 2019 was 18 hours per week, higher than the recommended 12 hours per week by the International Labor Organization (ILO) (Manahan, 2023, March 4). Moreover, many faculty need assistance with large class sizes, inadequate resources and facilities, lack of support and recognition, and pressure to meet performance standards and expectations (Sarabia & Collantes, 2020).

They find academic career opportunities and advancement limited and uncertain, especially for those with no master's or doctoral degree, often required for promotion and tenure. The Philippine Institute for Development Studies reported that only 35% of the full-time faculty members in public higher education institutions in 2019 had a master's degree, and only 23% had a doctoral degree (Ulla et al., 2021). Also, many faculty members encounter barriers such as bureaucracy, politics, and discrimination that encumber their professional growth and development (Poocharoen & Brillantes, 2013).

Due to fewer college graduates willing to join the academe, there is a need for more qualified and competent faculty who can teach, research, and serve higher educational institutions and their students. The faculty-student ratio in 2019 was 1:28, higher than the ideal ratio of 1:15 (PIDS, 2020). Also, a mismatch exists between the faculty qualifications and the courses faculty teach, indicating a need for more specialization and expertise in some areas.

The decreasing number of new college graduates joining the academe tends to reduce the academic quality and excellence in the program (Ingvarson & Rowley, 2017). The CHEd reported that in 2019, only 11 percent of the higher education institutions in the Philippines were accredited, representing a low level of quality assurance and recognition. Also, the survey conveyed that only 3% of the higher education institutions were involved in research and development, indicating low innovation and productivity.

Fewer new college graduates joining the program result in a loss of academic competitiveness and attractiveness of the higher educational institution and its programs. The Philippine Business for Education survey disclosed that only 13 percent of the employers in the Philippines were satisfied with the skills and competencies of the graduates they hired in 2019, manifesting a low level of employability and relevance. Also, the survey showed that only 2% of the HEIs in the Philippines were preferred by employers, revealing a low level of reputation and preference (Suarez et al., 2021).

This study intends to determine the range of entry salaries of new college graduates in the 34 industry, government, and academia programs. Also, identifying the cluster of programs significantly challenged attracting recent graduates to join the program as faculty members.

2. Literature Review

Three theories were used as the basis of this study. The human capital theory suggests that individuals make rational choices based on the cost and benefits of investing in their education skills (Fleischhauer, 2007). According to this theory, fresh college graduates refuse to join the academe as faculty members because they recognize the faculty salary and benefits as insufficient and unappealing compared to the industry and government sectors (Kozioł et al., 2014). They realize that faculty workload and stress are too demanding and overwhelming, particularly for those aspiring to earn higher degrees, conduct research, and publish papers (Harris et al., 2015).

Based on social cognitive theory, the graduates' personal behavior and environmental factors influence their career choices (Lent et al., 2000). Several factors contribute to the slightest preference for teaching for college graduates compared to employment in industry and government sectors. Factors such as intrinsic motivation, self-efficacy, and outcome expectations influence graduates' career choices (Anderson, Winett & Wojcik, 2007).

Factors such as intrinsic motivation, self-efficacy, and outcome expectations influence graduates' career choices (Schunk & DiBenedetto, 2020). Unfortunately, they identify teaching as less prestigious and financially rewarding than other professions, resulting in a lack of intrinsic motivation to pursue a teaching career (Anika, 2023). They also believe they have lower self-efficacy in teaching and need more critical skills and competencies to succeed in the profession (Asonitou, 2022).

Observational learning and reinforcement according to behavioral factors guide graduates' career choices. They observe the experience of their peers, friends, and family members in the teaching profession and recognize it as less desirable (Kokkodis & Ipeirotis, 2021). Similarly, they receive more reinforcement from their social environment for pursuing careers in the industry and government sector, motivating a preference for these professions (Schmader & Sedikides, 2018). The availability of job opportunities, salary, and working conditions are environmental factors that influence graduates' career decisions equally. They believe teaching could be more secure and rewarding (Khan et al., 2017).

Applied in the context of Expectancy Theory, college graduates' career decisions suggest that individuals make career decisions based on their expectations of the outcome of their choices (Stevens, 2014). In the case of college graduates in the Philippines, based on expectancy theory, several factors provide reasons for their least preference for teaching compared to employment in industry and government sectors. Foremost, the theory suggests that individuals are motivated to attain the desired outcome based on their belief that their efforts lead to good performance. However, in terms of teaching, graduates observe that the efforts needed in the profession could have resulted in a different outcome, such as financial rewards and career advancement, compared to industry and government (Kathure, 2014).

Similarly, the theory advocates that individuals are motivated due to the belief that good performance results in a desired outcome (Baakeel, 2018). Graduates realize that a teaching career's financial rewards, job security, and career development are less satisfying than those in the industry and government sectors (Bhaskar & Dayalan, 2021). The theory focuses on individuals interested in the value they assign to the outcomes. Graduates allocate a higher value to the result associated with careers in the industry and government sectors than teaching careers.

The objective of this study in determining the entry salary of graduates in the industry, government, and academic sectors is to provide insights into the relative value and demand of graduates in these sectors. Also, to identify entry salaries for graduates in the three sectors. Further, it helps students make informed decisions about their career path by furnishing insight into salary expectations. Most importantly, it will guide educational institutions and policymakers in designing their curricula and programs to better prepare graduates for employment and meet the needs of the three sectors. Finally, it promotes transparency by highlighting the differences in entry salaries for graduates, which helps stakeholders identify areas for improvement.

3. Methods

This study used secondary data from various sources, such as government websites such as the Integrated Survey on Household Labor Force (ISHLF) from the Philippine Statistics Authority (PSA), which published data on wages and salaries by occupation and industry. Also, PSA released the Quarterly Survey on Permitted Private Hospitals (QSPPH), which includes data on the salaries of medical personnel relevant to graduates employed in the healthcare sector. Also, the CSC website stored salary schedules for government positions categorized by rank and salary grade, which helps understand the government salary structure applicable to entry-level positions. For the industry, there are popular job portals such as Jobstreet Philippines that allow users to filter job postings by industry, job title, and salary range or organizations offered. Also, the Indeed Philippines website offered similar services to Jobstreet.

Similarly, Glassdoor Philippines allows job seekers and employers to share salary information for various company positions anonymously. However, only a few offered insights into entry-level salaries. In the case of the academic sector, the Philippines Institute for Development Studies (PIDS) (Ordinario, 2023, December 15) and other reputable institutions conduct periodic socioeconomic surveys which include data on wages and salaries by education level and sectors (Divina, 2023, December 21), (Salary Explorer), (Pay scale) & (World Salary).

The K-means clustering algorithm was used to group salaries based on their similarity. The algorithm specified the number of clusters determined based on the salary profiling and exploratory data analysis. The resulting insight provided insights into the relative value and demand for graduates in various sectors.

The k-means cluster algorithm is a method of partitioning a set of data points into k clusters, where each data point belongs to the cluster with the nearest mean (Sinaga & Yang, 2020). The algorithm minimizes the sum of squared distances between the data points and their cluster centroids expressed:

$$J = \sum_{j=1}^{k} \sum_{n \in S_j} | x_n - \mu_j |^2$$

Where:
j is the sum of squared distance or the objective functions to be minimized;
k is the number of clusters, and
S_j is the set of data points in cluster j.

Conducting a study that clusters degrees based on comparing entry-level salaries across industry, government, and academic sectors presents valuable insights into the immediate economic returns of different educational paths. A systematic analysis and clustering of programs based on their salary entry points in diverse sectors, the study offers prospective students, educators, and policymakers' crucial information for informed decision-making regarding educational and career choices, allowing stakeholders to identify degrees that offer competitive salaries, helping align academic programs with market demands. Moreover, this study contributes to fostering a comprehensive understanding of the broader economic landscape, directing educational institutions to develop better curricula to prepare graduates for financial success and contributing to higher education's overall effectiveness and relevance in shaping future career directions.

4. Results and Discussion

The academic landscape is regularly evolving, with shifts in research priorities, funding opportunities, and student demographics affecting the attractiveness of various academic disciplines to attract faculty. The dynamism results in a disparity in attracting, recruiting, and retaining qualified faculty across different degree programs. This research uses cluster analysis to identify groups of degrees within a university setting that confront significant challenges in attracting faculty, allowing for targeted intervention and strategic resource allocations.

Based on the elbow method, in Figure 1, the number of clusters is three (3) (k = 3), which plots the sum squared distance (SSD) of the data points to their closest cluster center against the number of clusters. The default convergence criteria for the k-means algorithm were used, which stopped the iteration when the cluster center did not shift significantly or the maximum number of iterations was reached. In this case, the maximum number of iterations was set to 300, and the cluster center converged after 12 iterations. The default initialization method for the k-means algorithm was used to select k data points randomly as the initial cluster center. The method is simple and fast. To avoid different clustering results depending on the random seed, the k-means algorithm was repeated ten times with different random seeds, and the clustering with the lowest SSD was the final result.

The Within-Cluster Sum of Square (WCSS) illustrates the values for different iterations of k. Summing the square distance of each data point calculates the WCSS to its closest cluster center. The lower the WCSS value, the more compact the cluster.

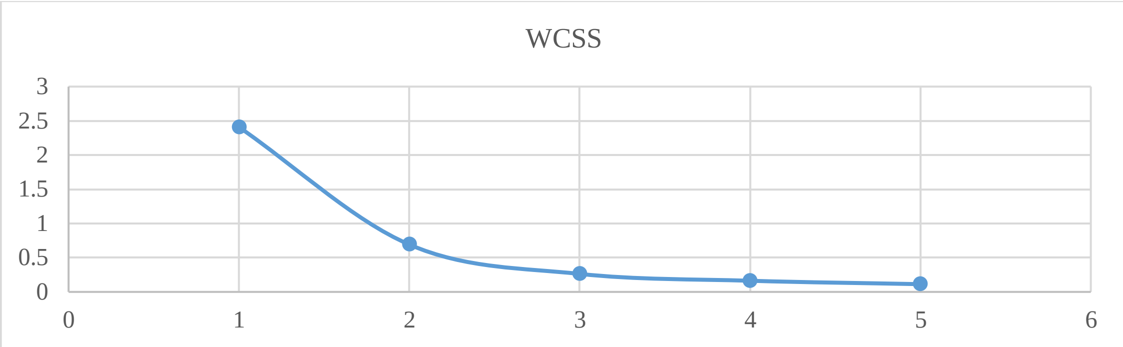

Figure 1: Within-Cluster Sum of Square

In assessing the compactness of the cluster and determining the optimal number of clusters, the elbow method was used, plotting the WCSS value against the k values depicted in Figure 1. The elbow method directs the optimal number of clusters by identifying where the WCSS curve bends sharply, revealing a significant decrease in the WCSS value. In this case, the elbow point is at k = 3, as shown in the plot, and adding more clusters will not improve the compactness significantly.

The Silhouette score in Figure 2 below depicts the scores for different cluster configurations. The silhouette coefficient measures how close each data point is to its cluster compared to other clusters and ranges from -1 to 1, where a value close to 1 specifies a well-clustered data point, a value close to 0 convey an overlapping cluster, and a value close to -1 express a misclassified data point. The elbow method plots the silhouette scores against the k values to find the optimal number of clusters by looking for where the silhouette score curve bends sharply, showing a significant increase in silhouette score at k = 3. The silhouette score at k = 3 produces the best clustering for the data.

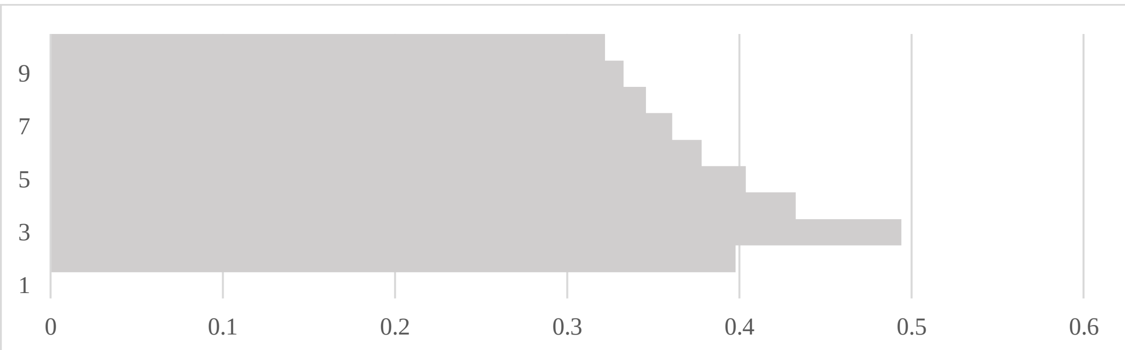

Figure 2: Silhouette Score

The convergence information in Figure 3 displays information about the algorithm's convergence on the number of iterations needed for convergence, which is the number of times the algorithm updates the cluster center and assigns the data points to the closest cluster center.

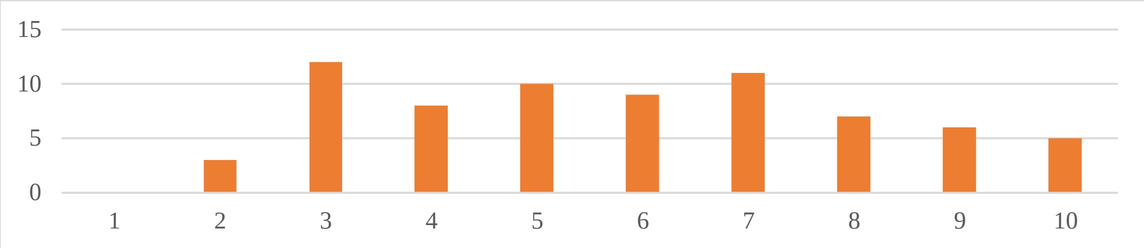

Figure 3: Number of Iterations

The algorithm converges faster for slower values of k and slower for large values of k due to the algorithm search for more cluster centers and assigning more data points as k increases, converging in less than 15 iterations for all values of k, demonstrating that the algorithm is efficient and effective for the data. However, the tables show that the algorithm may produce various clusters depending on the random initialization of the cluster centers, which affects the quality and consistency of the clustering. Thus, the algorithm was repeated with various random seeds, and the best clustering was chosen based on the lowest WCSS or the highest silhouette scores.

The Adjusted Rand Index (ARI) and Fowlkes-Mallows Index (FMI) are external evaluation methods used to measure the agreement between two clustering based on counting the pairs of objects in the same or indifferent cluster in both clustering and adjusting for chance. The ARI and FMI range from 0 to 1, where a value close to 1 conveys a high agreement, and a value close to 0 indicates a low agreement or a random clustering.

Table 1: External Evaluation Method in Clustering

Cluster	Adjusted Rand Index (ARI)	Fowlkes-Mallows Index (FMI)
0	0.241	0.398
1	0.193	0.193
2	0.494	0.494

The external validation metrics display that the cluster has different ARI and FMI values, showing their different levels of agreement with the external criteria. Cluster 2 presents the highest ARI and FMI values, depicting the highest agreement with the external criteria. Cluster 0 exhibits the second-highest ARI and FMI values, representing a moderate agreement with the external criteria. Cluster 0 is clustered according to the program categories. Cluster 1 has the lowest ARI and FMI values, a low agreement with external criteria conveying that the programs in cluster 1 are not clustered according to the program categories.

The cluster center in Table 2 below displays the coordinates of the final cluster centers identified by the k-means algorithm. The coordinates are the normalized salary values for each sector, where 0 is the lowest and one is the highest.

Table 2: Cluster Center Identified by the k-means algorithm

Cluster	Industry	Government	School
0	0.398	0.398	0.241
1	0.193	0.193	0.193
2	0.494	0.494	0.494

Cluster 0 shows the highest salary values in the industry and government sectors and the lowest salary values in the school sector. It represents the degrees that make it more challenging to attract graduates to join school as faculty members based on the salary ranges. Graduates from the cluster are in high demand and low supply in the labor market. The industry and government sectors offer higher salaries and benefits than the higher educational institutions. Hence, graduates prefer to pursue careers in the industry and government sectors that offer more financial rewards and incentives for their degree qualifications and skills.

Cluster 1 presents the same salary values in all three sectors, which are lower than the other two clusters, showing the degrees that are less difficult to attract graduates to join schools as faculty members based on the ranges of the salary offered. These degrees are in low demand and high supply in the academic market, creating similar salaries and benefits across sectors. Hence, graduates may not significantly prefer any sector and decide to join academe as faculty members based on personal interest or career growth.

The same salary values in all three sectors were in Cluster 2, which are higher than the two clusters representing the degrees that easily attract graduates to consider joining the academe as faculty members based on the offered salary level. The academic market has high demand and supply, presenting high salaries and benefits in all three sectors. Consequently, graduates display high motivation and can apply as faculty members based on factors such as professional development, research support, or recognition.

The cluster size in Table 3 below displays the number of data points assigned to each cluster labeled as 0, 1, 2, and the number indicates the data point count in each cluster. The cluster size table furnishes information on the size distribution of the clusters. Cluster 0 garnered the most significant number of data points, with 15 programs as the most common cluster, which makes it more difficult to attract graduates to join the faculty based on the ranges of salary offered. Also, the table conveys that cluster 2 is empty, with no program counted in the cluster, which designates that cluster 2 is the least common.

Table 3: Cluster Size

Cluster	Number of data points
0	15
1	11
2	0

Degree	Industry	Government	School	Cluster
BS in Accountancy	0.398	0.398	0.241	0
BS in Accounting Information Systems	0.193	0.193	0.193	1
BS in Internal Auditing	-	-	-	-
BS in Management Accounting	-	-	-	-
BS in Architecture	0.398	0.398	0.241	0
BS in Fine Arts and Design major in Painting	0.193	0.193	0.193	1
BS Computer Science	0.398	0.398	0.241	0
BS in Library and Information Science	0.193	0.193	0.193	1
BS in Entertainment and Multimedia Computing-Game Development	0.193	0.193	0.193	1
BS in Criminology	0.398	0.398	0.241	0
BS in Industrial Security Management	-	-	-	-
BS in Hospitality Management	0.193	0.193	0.193	1
BS in Tourism Management	0.193	0.193	0.193	1
BS in Nursing	0.398	0.398	0.241	0
BS in Pharmacy	0.398	0.398	0.241	0
BS in Medical Technology	0.398	0.398	0.241	0
BS in Nutrition and Dietetics	-	-	-	-
Bachelor of Elementary Education	0.193	0.193	0.193	1
Bachelor of Secondary Education in Science	0.398	0.398	0.241	0
Bachelor of Arts in Journalism	0.398	0.398	0.241	0
Bachelor of Arts in Broadcasting	0.398	0.398	0.241	0
BS in Biology	0.398	0.398	0.241	0
BS in Mathematics	0.398	0.398	0.241	0
BS in Forestry	0.398	0.398	0.241	0
BS in Agroforestry	-	-	-	-
BS in Environmental Science	-	-	-	-
BS in Political Science	0.193	0.398	0.398	1
BS in Public Administration	-	-	-	-
BS in Psychology	0.398	0.398	0.241	0
BS in Social Work	0.193	0.193	0.193	1
BS in Civil Engineering	0.398	0.398	0.241	0

Accounting graduates consider teaching the least preferred occupation compared to employment in the industry and government sectors because of the difference in salary and benefits. The survey presented that the industry's average entry salary of accounting graduates is P27,639 and P48,313 in the government. However, the average salary is P19,717 in the academe, lower than that for accountants and auditors with the same qualifications. Also, accounting graduates working in the industry or government enjoy more opportunities for career growth, professional development, and recognition compared to those in the academic field (Nouri & Parker, 2013).

Consequently, accounting graduates teaching as unappealing occupation because of the difference in skills and competencies required compared to employment in the industry and government sectors. Accountants need different soft skills, such as communication, problem-solving, and stress management, aside from technical proficiency (Dawkins & Dugan, 2022). These skills sometimes need to be sufficiently developed or evaluated in the accounting curriculum, which focuses more on the cognitive domain and less on the affective and psychomotor. However, most accounting curricula must have developed or assessed these skills adequately. Hence, accounting graduates need more confidence and preparation to teach, particularly to students with diverse learning styles and needs (Samkin & Keevy, M., 2019). Moreover, accounting graduates in the industry and government sector are more exposed and have access to the latest technologies and innovations in accounting, such as AI, blockchain, and cloud computing, compared to those working in the academe (Zhang et al., 2020).

The reluctance of medical graduates in the Philippines to consider teaching as a career compared to health and government sectors is attributed to several factors. Foremost is the strong appeal of the medical profession, which attracts students who excel in primary education. The prestige, intellectual challenge, and potential for high earnings associated with a medical career appealed to many graduates. Also, pursuing a medical degree is a substantial investment, and graduates feel compelled to pursue a career in the health sector to regain their educational expenses and secure financial stability (McPake et al., 2015).

Moreover, the intrinsic, extrinsic, and altruistic factors are the motivations for entering the teaching profession. Although teaching is recognized for its significant contribution to society, good salaries, and good working conditions, medical graduates wanted to prioritize other factors, such as employment security and intellectual satisfaction, which are more readily accessible in the health and government sectors (Evans & Yuan, 2018).

Graduates of engineering and architecture degrees consider teaching the least preferred occupation compared to the industry and government sectors. The expectancy-value theory suggests that individuals make career choices based on their expectations of success, and the subjective values they attach to a specific occupation help explain the theory (Bueno, 2017).

Engineering and architecture graduates often recognize the industry and government sectors as offering higher financial rewards and more tangible incentives than teaching roles. These sectors offered competitive salaries, and weighing the potential graduates consider financial gains a significant factor in their career growth, contributing to the perceived value of pursuing a career outside of teaching. The private industry and government offer roles more aligned with the engineering and architecture graduates' fields of study, providing opportunities for the practical application of their technical skills. Conversely, teaching is a less direct application of their specialized knowledge, possibly leading to a lower sense of job satisfaction and value. Societal and cultural factors influence graduates' career preference and teaching, though a noble profession is sometimes perceived with less prestige than careers in private and government sectors. Due to subjective values and expectations, seriously consider a career in the industry and government with greater prestige and social esteem.

Individuals are motivated to engage in tasks or activities they expect to succeed in. The value is based on the expectancy-value theory, which refers to the belief that one performs better on an assigned task (Wigfield & Gladstone, 2019). Value refers to the importance, interest, or satisfaction earned from a task. Graduates are likelier to select tasks or careers with high Expectancy and value (Wigfield et al., 2017).

Computer science graduates in the Philippines consider teaching the least preferred occupation compared to the industry and government sectors because of the difference in salary and benefits. The Commission on Higher Education (CHEd) reported that the average monthly salary of full-time faculty in higher education institutions was P40,638 in 2018 compared to the average monthly salary of computer programmers, which was P52,331. Also, private or government sector graduates are offered more career advancement, professional development, and recognition opportunities than academe graduates. Thus, teaching is less valuable for computer science graduates than other occupations. Another likely reason graduates of computer science consider teaching the least preferred occupation compared to employment in private and government sectors is the difference in skills and competencies required. The skills gap between industry demand and the higher education supply is significant, particularly in information technology and engineering. Graduates find they have more exposure and access to the latest technology, such as AI, cloud computing, and cybersecurity. Hence, teaching offers lower Expectations for computer science graduates than other occupations.

Graduates are driven to act in a specific way based on the expectation that the consequence of their actions leads to the desired outcome. There are three key components: Expectancy, instrumentality, and valence (Osafo et al., 2021). Applied to career choice Bachelor of Science graduates preferred employment in industry and the government sector compared to teaching, which is understood through the lens of the expectancy theory components.

Expectancy of tangible outcomes in industry and government sectors is higher than in teaching. Graduates in these sectors acknowledge that their technical skills and knowledge are more directly linked to job performance, resulting in career advancement and monetary rewards. Conversely, they recognize teaching with a less clear connection between effort and performance, considering factors like class dynamics, administrative challenges, and more extended time frames to realize the outcome of their efforts, which attract fewer graduates.

Valence is the value assigned to outcomes that is critical to career choice. Graduates with BS degrees assign higher valence to outcomes such as financial rewards, career growth, and job stability, which are associated with industry and government positions (Vroom et al., 2015). Further, there is a societal perception that careers in industry and government sectors offer more prestige and recognition, significantly influencing the valence assigned to outcomes in their chosen fields. The societal appreciation for scientific and technical expertise in industry and government sector career opportunities makes it more appealing to BS graduates, who are more likely to receive recognition and rewards in these environments than the academe.

Human capital theory is a prominent framework in labor economics, claiming that people invest in education and training to enhance their skills and knowledge, increasing their human capital (Fleischhauer, 2007). Graduates traverse career choices, and several factors influence their decisions that align with the principles of human capital theory. Examining the preference of graduates in cluster 0 regarding employment, notably, joining the academe as faculty members is preferable to opportunities in industry and government sectors as offering greater monetary rewards and faster career growth than academic positions. The human capital theory suggests that graduates of degrees in cluster 0 seek to maximize their returns on educational investment. Graduates recognize that their investment in education is immediately recouped in the form of competitive salaries, benefits, and career opportunities in industry and government sectors, significantly affecting their career choices.

Work-life balance and job security are vital elements of individuals' decision-making about employment (Yu, 2014). Graduates regard teaching as demanding regarding teaching responsibilities, research commitment, and administrative duties, resulting in challenges in maintaining a satisfactory work-life balance. Contrarily, the industry and government sectors provide more structured work hours and distinct delineation between professional and personal life. Also, the perceived job security in academia could be better, attributed to limited tenure-track positions and increasing competition, positioning industry and government jobs as more appealing regarding stability and predictability.

The human capital theory emphasizes skills in the labor market (Handel, 2003). Graduates distinguish that the industry and government offer more opportunities to develop applied and practical skills. These sectors provide exposure to real-world challenges, the latest technologies, and industry trends, enhancing graduates' appeal and adaption to the evolving job market. This differs from academia, which focuses on theoretical foundations and research, possibly preventing the perceived applicability of skills in the broader professional landscape. Given that graduates prioritize opportunities for sustained learning and skill utilization, the implied alignment of industry and government roles with these objectives makes them a more attractive career choice.

Traced in the work of Albert Bandura, the Social Cognitive Theory emphasizes the role of observational learning, self-efficacy, and social influence in determining individuals' behavior and career decisions (Lent et al., 2017). In the context of graduates' career preferences, the theory describes why a career in the academe is the least preferred choice compared to pursuing employment in the industry and government sectors. The social cognitive theory suggests that people learn by observing others and modeling their behaviors. The need for more visible and relevant role models within the academic environment. Once they observed fewer faculty members that successfully balanced fulfilling academic careers with personal life and failed career satisfaction, graduates are less inclined to pursue careers in the academe. Unlike the industry and government sectors offer more evident examples of professionals who have successfully navigated their careers, subscribing to a more positive perception and greater attraction to non-academic careers.

Self-efficacy is the individuals' belief in their ability to succeed in specific tasks and assume a crucial role in career decision-making. Graduates in Cluster 0 degrees recognize that the skills and competencies developed during their education are more directly applicable and valued in the industry and government sectors. The apparent alignment of their skills with the requirements of industry or government sectors improves graduates' confidence in their ability to succeed in these environments. However, teaching requires a unique set of skills, leading to lower perceived self-efficacy in faculty roles. The mismatch between teaching demand and graduates' self-efficacy adds to their inclination towards industry and government careers, where they feel more confident in their abilities.

Underscored in the social cognitive theory is the importance of external reinforcement and recognition that shapes behavior (Lent et al., 2000). Graduates observe that the industry and government sectors present a more precise and immediate path to professional growth, development, and financial rewards. The structured career development frameworks and tangible rewards associated with performance give graduates knowledge of the potential return on their career in industry and government sectors. In academia, the criteria for recognition and promotion are less apparent or more subjective, reducing the attractiveness of faculty positions.

The cluster profiling table that displays the mean and median values of variables in Table 4 within each cluster to describe the characteristics of the cluster are the normalized salary values of each sector, specifying 0 as the lowest and one as the highest. The clusters display different mean and median values for the salary variables, indicating different salary patterns and distributions. For each sector, the clusters have the same mean and median values, signifying a consistent and symmetrical salary distribution with distinct features within each sector.

Cluster 0 has the lowest mean and median values for the school sector and the second highest mean and median values for the industry and government sector, representing the difficulty in attracting graduates to join the program as faculty members based on the ranges of the salary offered. Graduates from this cluster favor industry and government sector careers that offer more financial rewards and incentives for their qualifications and skills.

Table 4: Cluster Profiling

Cluster	Industry Mean	Industry Median	Government Mean	Government Median	School Mean	School Median
0	0.398	0.398	0.398	0.398	0.241	0.241
1	0.193	0.193	0.193	0.193	0.193	0.193
2	0.494	0.494	0.494	0.494	0.494	0.494

Comparisons with other algorithms for clusters are presented in Table 5 below. Hierarchical clustering builds a hierarchy of clusters by merging smaller clusters into larger ones (agglomerative) or splitting larger clusters into smaller ones (divisive). For Density-Based Spatial Clustering of Application with Noise (DBSCAN), group data points based on their density and consider outliers as noise. The Spectral clustering algorithm uses the eigenvalues and eigenvectors of the similarity matrix of the data points to partition them into clusters. The performance metrics for clustering used were the Silhouette score measuring the distance between each data point to its cluster compared to other clusters and ranges from -1 to 1, with 1 depicting a well-clustered data point and 0 conveying an overlapping cluster and a value close to -1 means a misclassified data point. Estimating the average similarity between each cluster and its most similar cluster is the Davies-Bouldin Index, which also evaluates the clustering quality by considering the separation between cluster and compactness. Lower values present a better clustering solution.

Further, the Calinski-Harabas Index measures the ratio between-cluster variance and within-cluster variance. It evaluates the quality based on the separation between clusters and the compactness of data points. Higher values indicate a better-defined cluster.

Table 5: Comparisons with other Algorithms for Clusters

Algorithm	Silhouette Score	Davies-Bouldin Index	Calinski-Harabasz Index
K-means	0.494	0.263	2.409
Hierarchical	0.433	0.163	0.692
DBSCAN	0.404	0.113	0.263
Spectral	0.378	0.083	0.163

Table 5 conveyed information on the strengths and weaknesses of the k-means algorithm in the given context, showing that the highest silhouette score is in the k-means algorithm, which produces the most well-clustered data points, the lowest Davies-Boulding index indicating the most dissimilar and compact clusters and the highest Calinski-Harabasz Index presenting the most well-defined and separated clusters. Hence, the k-means algorithm performs better than other algorithms in terms of quality and consistency of the clustering.

5. Recommendations

For the academic sectors to attract and retain faculty members, there is a need to conduct a comprehensive review of salaries associated with programs that consider aligning faculty salaries with industry standards and potential earnings in the private sector to enhance competitiveness. Benchmarking with institutions that successfully addressed similar challenges by identifying best practices in faculty recruitment and retention, specifically in the context of salary considerations, unlocks the door to recruiting and retaining faculty. Offer professional development opportunities and incentives to faculty members within programs in Cluster 0 to enhance their skills and contributions, creating a more competitive environment and enlivening faculty to persevere in their career path. Consider diversifying program offerings to meet emerging industry demands, attract a broader pool of faculty candidates, and enhance the overall relevance of academic programs. Considering these recommendations, the academic sector has a chance to enhance its faculty recruitment strategies, promote a positive faculty environment, and maintain the continued relevance of programs in the evolving environment of higher education.

6. Conclusion

This research presents the cluster analysis of different degree programs based on their entry salary ranges in industry, government, and school sectors. The cluster analysis divides groups into clusters based on their characteristics. This study reveals some interesting patterns and implications for the motivation and behavior of the graduates of these programs. In the context of human capital theory, the concentration of programs in Cluster 0, associated with a more challenging faculty recruitment scenario due to lower salary ranges, emphasizes the critical role of human capital theory. Graduates from this cluster are motivated by the possible return on investment in their education and skills. In this case, programs clustered in Cluster 0 face challenges in attracting graduates to join the faculty due to potentially less competitive salary offerings.

Similarly, the Social cognitive theory infers that people learn from observing others in their social situations. In the case of faculty recruitment, the graduates in Cluster 0 are open to social learning effects, where potential faculty candidates observe the concentration of programs facing challenges in salary offerings, which influence their opinion and decisions regarding joining the faculty. Expectancy theory claims that individuals are motivated by the expected outcomes of their behavior and the value they place on those outcomes. Hence, graduates in Cluster 0 benefited from aligning their expectations and values with the realities and demands of their chosen professions. They also profited from seeking and negotiating rewards matching their performance and needs. Graduates of degrees in Cluster 1 benefited from clarifying and communicating their expectations and values to their employees and stakeholders. They also take advantage of seeking and creating meaningful and satisfying rewards for them.

Acknowledgements
We extend our heartfelt gratitude to the Administration of the University of Mindanao for their invaluable support throughout the duration of this study. Their unwavering commitment to academic research was instrumental in the success of our work. Also, we would like to express our sincere appreciation to our esteemed colleagues for their invaluable assistance and collaborative efforts their contributions assume a crucial role in shaping and refining the outcomes of this research. Without the support and teamwork

of both the Administration and our colleagues, the completion of this study is not possible.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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