

Faculty Complement Gap Analysis: A Case Study in a State University in the Philippines

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Abstract— In a state university, being mandated to provide education to as many students as possible, one of the main administrative challenges is the optimal and objective allocation of limited resources in hiring and assigning faculty to improve academic productivity. To aid administrators in this challenge, this work introduces a method in conducting analysis to determine faculty gap and the process of allocation of available faculty items for each program in the university. Factors considered in this analysis include the number of existing and projected students, curriculum, and other regulations that affect faculty workload, such as institutional, local, and national standards, that may have set the ideal faculty-student ratio and the amount of workload that each faculty can carry based on their respective specializations. This work presents a systematic process of analysis which is divided into the following parts: (i) analysis of existing curriculum; (ii) analysis of student population and future program demand; (iii) identifications of regulations that affect faculty workload; and (iv) analysis of existing faculty profile and faculty gap per program of the university. The study also introduces the concept of using a Faculty Complement Index (FCI) to rank the programs based on their level of faculty gap as an aid in achieving optimal faculty allocation. This work considers the situation of a state university in the Philippines with 152 academic programs, 630 faculty, and 28,403 students. The result of the analysis shows that a total of 293 faculty are needed, and the gaps are ranked using the FCI of each program or department.

I. INTRODUCTION

In any university or academic institution, the faculty complement is a critical component in achieving its vision, mission, and goals. This importance is evident in the faculty's functions that primarily revolve in three (3) key areas, namely; teaching (or instruction), research, and service (or extension) [1]. These functions, particularly the first two, are transformed by the introduction of technology [2] and further significantly affected by the COVID-19 pandemic that changed how a university operates [3]-[4]. Despite all of these, the mandate to provide quality education and maintain academic standards remains at the heart of the university. Hence, to realize this mandate it is essential for a university to have sufficient number of qualified and competent faculty members. However, determining the ideal number and composition of

faculty requires careful consideration of various factors, such as the student population, curriculum, and other academic functions of faculty. Furthermore, for state universities, depending on the subsidy and support of the government, there is a limited amount of financial resources that can be utilized in recruiting and maintaining a sizeable number of faculty.

Several studies have shown that conducting analysis to determine the level of faculty complement needed in universities is important and useful for them to have the appropriate number to meet the needs of their students and academic programs. Moreover, it was established that the size and composition of the faculty significantly affect the quality of teaching and learning, student satisfaction, and the faculty research productivity of the university [5]-[10].

In this paper, we aim to present a model in conducting a comprehensive analysis of the faculty complement gap in a state university in the Philippines. The objective is to demonstrate the importance of conducting such analysis to manage the limited number of financial resources by providing the optimal number of faculty per academic program. Specifically, the paper examines factors such as student population, curriculum, and other academic functions assigned that may affect the required number of faculty in a state university, i.e., Bicol University. Other factors are also considered in the analysis, such as existing faculty size and composition, student-to-faculty ratios [6], and other relevant indicators. The comprehensive analysis is expected to result in the identification of gaps in the faculty complement and the ranking of those gaps per academic program to develop a mechanism for the prioritization of faculty item allocation. Then, a discussion on implications of these findings for the university's academic programs and some recommendations for addressing any gaps identified are provided at the end of this paper.

In general, the goal is to contribute to the ongoing discussions on faculty complement and help inform the university's policy makers relative to faculty recruitment, retention, and development. By conducting a thorough analysis of the faculty complement gap in a state university in

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the Philippines, we hope to provide insights that can be applied to other universities facing similar challenges.

II. METHODOLOGY

The research methodology employed in this paper is presented in Fig. 1 and discussed in detail in this section. The primary process outside data collection and processing is the calculation of the faculty gap per program or department and the development of a ranking system to aid the administration or policy makers in deciding the optimal allocation of faculty items based on the needs of the university. In general, this analysis includes the following: (i) analysis of existing curriculum; (ii) analysis of student population and future program demand; (iii) identification of regulations that affect faculty workload; and (iv) analysis of existing faculty profile and faculty gap per program of the university. The result is then ranked and presented in tabular format for simpler and usable results.

A. Sources of Data

The primary data used is the existing university data covering school years (SY) from 2017 – 2022. The data used includes the following: (1) historical student population per semester; (2) program demand based on historical university admission; (3) number of academic units per program based on the existing curriculum; (4) university rules and guidelines on faculty loading, e.g., faculty-student ratio, allowed faculty workload, and policies on other faculty functions [11]; (5) existing number of faculty members per program; and (6) historical faculty workload [12] and financial expenditures related to faculty [13].

Interviews are also conducted with key officials of the university to capture some of the information and practices of the university that affect the faculty workload. Furthermore, these interviews are used to validate the gathered data.

B. Data Cleaning, Preparation, and Presentation

The data gathered are presented in tabular form using spreadsheets for easy visualization and analysis. Data cleaning processes are utilized to ensure consistency in formatting among the data collected.

In the presentation of ranked results, a version of a heat map is used to visually show the ranking, i.e., red is used for critical results and green is used for acceptable or excellent results.

C. Calculation of Faculty Gap

In the analysis of faculty complement, this work used the following criteria: (1) number of instruction (teaching) load per program based on the curriculum and student population, (2) research and extension workload based on academic rank of the faculty, (3) administrative workload based on typical number of faculty designated for administrative positions, and (4) university policy on ideal number of workloads per faculty and faculty-student ratio per class.

1. Instructional (teaching) Workload

To calculate the instructional (teaching) workload, two input analyses are made. First, the population per academic

program is calculated to determine the number of students enrolled in each course and thereby determine the number of classes required per course. For this purpose, the ideal class size used is 35 students/class based on the approved policy of the university [11]. Second, the number of required academic units are calculated based on the existing curriculum being implemented in the program. The academic units range from one (1) unit to six (6) units, and can be a lecture unit, a laboratory unit, or combination of both. Each lecture unit is equivalent to 18 contact hours, while each laboratory unit is equivalent to 54 contact hours per semester. In the case of Bicol University, each lecture unit is equivalent to one instructional load, while each laboratory unit is equal to 2.1 instructional load for faculty [11].

The total instructional loads required per program shall be the sum of all the products of the result of first and second calculations per program, as in (1).

$$IL = \sum A_i \times B_i \quad (1)$$

where IL is the total instructional workloads per program, A_i is the number of classes required per course, and B_i is the total required academic units per course.

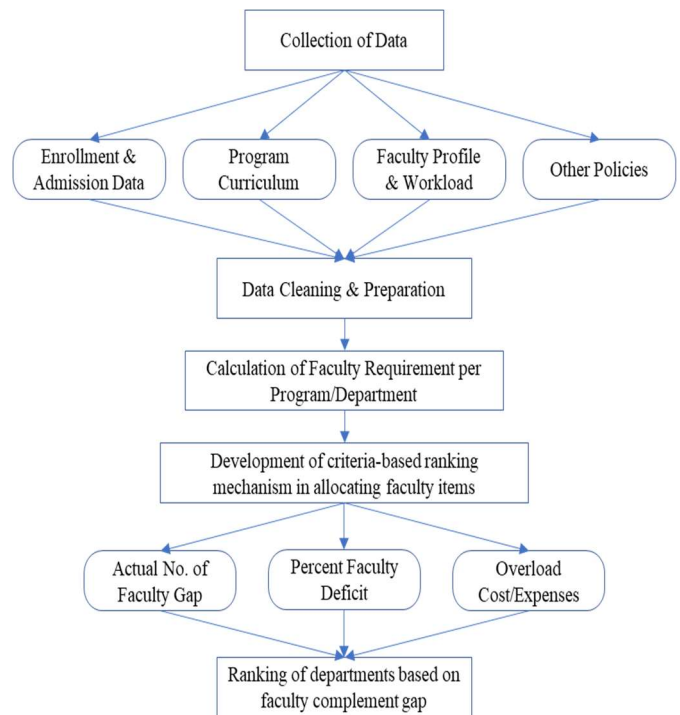


Figure 1. Overview of the Research Methodology

2. Research and Extension Workload

Research and Extension (R&E) functions are two of the major functions of the university as mandated in its charter; hence, academic personnel are expected to carry such functions as part of their academic load. In the case of BU, it is difficult to project the annual academic load that will emanate from this function due to its policy that only those with approved R&E proposal can be granted with academic

workload. To simplify the analysis in this work, it is assumed that all personnel mandated to conduct R&E work shall be given an R&E workload. Based on the university policy [14] the issuance of research and extension work-equivalent credit (WEC) shall be based on the role of the faculty members in the research and extension activities (i.e., whether the function is in a program, project, or study level) and the academic rank of the faculty (i.e., 9 units and 3 units for full professor and associate professor, respectively). Therefore, in our calculations, all faculty members with academic rank of Associate Professor and Professor will have an R&E workload of 3 units and 9 units, respectively.

3. Administrative Workload

To support the operation of the university, there are faculty members who may be designated to serve in administrative positions in the university. These faculty members are given work equivalent credits (WEC) as compensation for their services to the given designations, which varies depending on the scope and deliverables of such a designation. Table I presents the common designations given by the university and its equivalent workload [15]. For purposes of this work, the administrative workload is calculated based on historical designations granted by the university. Furthermore, the designations inherent to the colleges (i.e., Deans/Directors, Associate Deans/Directors, and Department Chairs) are included in the calculation per college, while the designations at the university level (i.e., the Vice Presidents, Office Directors, etc.) are added to the university total.

TABLE I. COMMON ADMINISTRATIVE DESIGNATIONS AND ITS EQUIVALENT WORKLOAD EQUIVALENT

<i>Designation</i>	<i>WEC</i>	<i>Scope/Level</i>
Vice Presidents	15	University
Academic/Campus Deans & Directors	15	College/Campus
Center and Office Directors	12	University
Associate Deans/Directors	9	College/Campus
Centers and Office Technical Staff	9	University
Academic Department Chairs	6	Department
Coordinators	3	College/Department

4. University Policy on Faculty Workload

The university sets the regular workload of faculty members regardless of rank to 18 units [11]. These workload or credit units may come from any of, or a combination of, the previously discussed functions, i.e., instruction, research, extension, and administrative functions.

This is a limiting parameter which this work utilizes to calculate the ideal number of faculty per program. Equation (2) shows this relationship.

$$Ideal\ no.\ of\ Faculty = \Sigma (IL_i + RE_i + AF_i) / 18 \quad (2)$$

where IL is the total instructional workloads, RE_i is the workload or WEC from research and extension functions, and AF_i is the workload or WEC from administrative designations or functions.

To calculate the faculty complement gap of the university, the existing number of faculty is determined based on the data and compared with the calculated ideal number in (2). Therefore, the faculty complement gap is calculated using (3).

$$Faculty\ Gap = Ideal - Existing \quad (3)$$

D. Criteria-based Ranking of Program Faculty Gap

Given the limited resources of a state university, another challenge for administrators or decision makers is the objective and optimal allocation of available faculty items based on priority and needs of the university.

To develop a system of ranking academic programs or departments based on their faculty gap, it is important to set parameters upon which they will be assessed. This work proposes three (3) parameters. First is the actual number of faculty gap (FG) that can be calculated in (3). This can serve as the basis for ranking since the greater the faculty gap in a program, the greater number of academic workloads that are either served as an overload or by hiring part-time lecturer(s). Second is the percent faculty deficit (FD) which can be calculated in (4). The advantage of calculating the percent deficit, compared to the absolute faculty gap, is that it provides the context of the gap based on the overall needs. Finally, the third parameter is the overload (OL) or honorarium expenses. Given the limited budget of the university to pay for excess workload, it is important to minimize the number of workloads paid in honorarium by allocating faculty items to programs. This can be calculated based on the historical workload data.

$$Faculty\ Deficit = (Ideal - Existing) / Ideal \times 100 \quad (4)$$

To determine the rank of each program or department in terms of priority in allocating faculty items for purposes of hiring, this work introduces the Faculty Complement Index (FCI) which is a measure of the level of strength of each program in terms of faculty complement. FCI is calculated based on the weighted mean of the three parameters (5) discussed above, of which the weight (w_i) is determined based on the interview with key university administrators and officials. This work deemed it necessary to adopt a system where the weights are subject to the discretion of policy makers because of the varying needs, set-ups, and policies governing faculty workload and faculty hiring in each university.

$$FCI_i = w_1 RFG_i + w_2 RFD_i + w_3 ROL_i \quad (5)$$

where FCI is the faculty complement index per program, RFG_i is the ranking based on actual number of faculty gap, RFD_i is the ranking based on the percentage of faculty gap compared to the ideal number of faculty, and ROL_i is the ranking based on the total overload cost per program. The weights (w_i) are assigned per parameter as discussed.

The results per program from (5) are ranked in tabular form and presented in a heat map. These results are expected to be used as guide in allocating the available faculty items for hiring purposes.

For purposes of this work, the summary of the faculty gap is presented on a per program basis and per college/unit basis.

This is designed to present the faculty gap situation for both program level and college/unit level.

III. RESULTS AND DISCUSSION

A. Summary of Data

The Bicol University, which this analysis is based upon, is a state university located in Bicol Region (Region V), Philippines. It has seven (7) campuses, six (6) of which are in the Province of Albay, while the remaining campus is in the Province of Sorsogon. The university has a total of 19 academic units, 152 program offerings, with a population of 28,403 [16] students, and 630 faculty members [17]. Table II presents the distribution of the university's faculty based on rank. This is relevant information in the analysis and calculation of R&E workload.

TABLE II. DISTRIBUTION OF FACULTY BASED ON ACADEMIC RANKS

<i>Academic Rank</i>	<i>No. of Faculty</i>
Full Professor	60
Associate Professor	160
Assistant Professor	193
Instructor	217
Total	630

Table III summarizes the faculty workload per academic unit gathered in this work. The table shows that the university has a total of 22,142.8 credit units that need to be provided with competent faculty members.

TABLE III. SUMMARY OF FACULTY WORKLOAD

<i>College</i>	<i>IL</i>	<i>AF</i>	<i>R&E</i>	<i>Total</i>
Unit 1	1309.3	159.0	237.0	1705.3
Unit 2	1448.6	225.0	147.0	1820.6
Unit 3	1073.8	141.0	45.0	1259.8
Unit 4	1357.7	186.0	249.0	1792.7
Unit 5	1211.3	138.0	81.0	1430.3
Unit 6	1202.3	183.0	66.0	1451.3
Unit 7	63.0	30.0	0.0	93.0
Unit 8	433.7	104.0	24.0	561.7
Unit 9	1233.8	60.0	102.0	1395.8
Unit 10	1348.9	210.0	159.0	1717.9
Unit 11	1231.7	225.0	150.0	1606.7
Unit 12	663.0	69.0	6.0	738.0
Unit 13	87.8	42.0	0.0	129.8
Unit 14	497.3	90.0	18.0	605.3
Unit 15	633.0	63.0	12.0	708.0
Unit 16	114.5	51.0	33.0	198.5
Unit 17	115.9	36.0	33.0	184.9
Unit 18	3141.0	126.0	45.0	3312.0
Unit 19	1251.3	87.0	93.0	1431.3
Total	18417.8	2225.0	1500.0	22142.8

The data show that most of the workloads are due to the instructional workload or the teaching mandate of the university. This is equivalent to 83.18% (18,417.8) of the total workload of the university. This is consistent with the financial data that show that 90% of the honorarium payment is due to instructional workload of the faculty (both full-time and part-time).

In terms of workload from administrative functions, across the university, there are 313 designated faculty in various administrative positions with a total of 2,225 WEC. Therefore, it can be observed that 49.68% of faculty members have administrative designations, which is translated to 10.05% of all workloads allocated for administrative designation purposes.

In terms of workload from research and extension functions, only 1,500 WEC is calculated. This is a relatively low number of units (i.e., 6.77% of total workload) compared to the instructional workload. This shows that the university's work is still primarily focused on its teaching function and has limited human resources allocated to R&E work.

B. Faculty Complement Requirements

Table IV presents the results of the calculations for the faculty complement gap per academic unit. The calculation is made based on the regular workload of 18 units per faculty. With this calculation, all honorarium requirements are eliminated, including those paid to part-time lecturers.

The results show that the university needs a total of 1,230 faculty members to complement the calculated faculty workload. With its current 630 faculty, the university still lacks 600 teaching personnel. However, this kind of set-up is not realistic nor practical. Based on the interview with the academic officials, the university is expected to maintain a pool of experts coming from various outside industries and institutions to teach as part-time lecturers for them to complement the expertise of the full-time faculty. This set-up ensures that the students are provided with up-to-date information and current trends in their respective fields of specializations. Furthermore, the university policy allows for faculty members to carry up to six units of overload subject to the approval of the University President [11]. In practice, 20% to 30% of the total workload is provided with funds to be paid as an honorarium. Therefore, this must be factored in the analysis of faculty gap.

Table V shows the results of the analysis if given consideration that 25% of the workload will be paid as an honorarium, i.e., 6 units of the 24-unit load can be carried as an honorarium by full-time faculty or be assigned to a part-time lecturer.

The results show that the faculty gap is reduced to 293 from the previous 600. Furthermore, we can observe that some academic units resulted in negative value (i.e., academic unit 4), which means that the academic unit will have an excess budget for honorarium that can be allocated to other units. This also means that these units have strong faculty complement and may not need additional faculty.

TABLE IV. SUMMARY OF FACULTY COMPLEMENT GAP AT 18-UNITS

College	Workload	Ideal No. of Faculty @ 18 units load	Existing No. of Faculty	Gap
Unit 1	1705.3	94.7	50	45
Unit 2	1820.6	101.1	49	52
Unit 3	1259.8	70.0	39	31
Unit 4	1792.7	99.6	79	21
Unit 5	1430.3	79.5	47	32
Unit 6	1451.3	80.6	45	36
Unit 7	93.0	5.2	0	5
Unit 8	561.7	31.2	18	13
Unit 9	1395.8	77.5	25	53
Unit 10	1717.9	95.4	69	26
Unit 11	1606.7	89.3	41	48
Unit 12	738.0	41.0	14	27
Unit 13	129.8	7.2	1	6
Unit 14	605.3	33.6	12	22
Unit 15	708.0	39.3	15	24
Unit 16	198.5	11.0	6	5
Unit 17	184.9	10.3	7	3
Unit 18	3312.0	184.0	65	119
Unit 19	1431.3	79.5	48	32
Total	22142.8	1230.2	630	600

TABLE V. SUMMARY OF FACULTY COMPLEMENT GAP WITH HONORARIUM PAYMENTS

College	Workload	Ideal No. of Faculty @ 24 units load	Existing No. of Faculty	Gap
Unit 1	1582.3	71.1	50	21
Unit 2	1631.6	75.9	49	27
Unit 3	1151.8	52.5	39	13
Unit 4	1639.7	74.7	79	-4
Unit 5	1349.3	59.6	47	13
Unit 6	1352.3	60.5	45	15
Unit 7	93.0	3.9	0	4
Unit 8	477.4	23.4	18	5
Unit 9	1362.8	58.2	25	33
Unit 10	1564.9	71.6	69	3
Unit 11	1351.7	66.9	41	26
Unit 12	717.0	30.8	14	17
Unit 13	55.5	5.4	1	4
Unit 14	554.6	25.2	12	13
Unit 15	702.0	29.5	15	15
Unit 16	180.5	8.3	6	2
Unit 17	181.9	7.7	7	1
Unit 18	3267.0	138.0	65	73
Unit 19	1398.3	59.6	48	12
Total	20613.6	922.6	630	293

It is also worth noting that though most of the faculty gaps are relatively close, Unit 18 is an outlier since it has a faculty gap of 73 (25% of the total gap). This implies that special attention needs to be given to Unit 18 to address this concern.

C. Ranked Faculty Complement Gap

Another objective of this study is to provide a mechanism where the administrator could be able to objectively allocate the limited resources that it has. This is needed since the government could not be able to allocate immediately the needed 293 faculty items. The developed Faculty Complement Index (FCI) is used to rank the faculty complement gaps between academic programs. The weights (w_i) are determined based on the input of the academic and hiring officials of the university and suggested to be adjusted depending on the needs and circumstances of the institution. In this work, the following weights are assigned:

- 40% for w_1 (Faculty Gap or FG)
- 40% for w_2 (% Faculty Deficit or FD)
- 20% for w_3 (Overload Expenses or OL)

Applying these weights and using (5) in the data, the FCI of all programs are calculated and ranked. Figures 3 and 4 present the results of the 10 programs with the lowest FCI and highest FCI, respectively.

Program/Department	Faculty Complement	Faculty Gap		40%		Faculty Deficit		40%		Overload Expenses		20%	
	Index	Idea	Actu	Ranl	Req	Perce	Ranl	Overlic	Perce	Ranl			
Program/Dept 18.1	1.80	60	15.00	2.5	45.0	11.40%	1	681.9	7.23%	2			
Program/Dept 11.1	2.40	28	5.50	1	22.5	5.70%	3	456	4.83%	4			
Program/Dept 15.1	5.20	46	15.00	8	31.0	7.85%	2	378	4.01%	6			
Program/Dept 2.1	8.20	22	6.50	4	15.5	3.93%	8	193.5	2.05%	17			
Program/Dept 1.1	8.60	24	7.50	7	16.5	4.18%	6.5	213.6	2.26%	16			
Program/Dept 18.2	9.00	38	17.00	16	21.0	5.32%	4	413.2	4.38%	5			
Program/Dept 14.1	9.40	30	12.00	12.5	18.0	4.56%	5	284	2.80%	12			
Program/Dept 18.3	10.00	20	8.00	12.5	12.0	3.04%	11	507.1	5.38%	3			
Program/Dept 12.1	10.20	24	9.00	10	15.0	3.80%	9	255	2.70%	13			
Program/Dept 18.4	10.80	30	13.50	17	16.5	4.18%	6.5	331.1	3.51%	7			
Program/Dept 19.1	13.40	20	7.00	9	13.0	3.29%	10	113.2	1.20%	29			
Program/Dept 12.2	14.00	10	3.00	5	7.0	1.77%	19	145.5	1.54%	22			
Program/Dept 3.1	15.20	18	8.00	15	10.0	2.53%	13	153	1.62%	20			
Program/Dept 11.2	18.60	13	4.00	6	9.0	2.28%	14	22.5	0.24%	53			
Program/Dept 12.3	18.80	6	1.50	2.5	4.5	1.14%	26	79.5	0.84%	37			

Figure 2. Screen capture of Spreadsheet used in calculating FCI

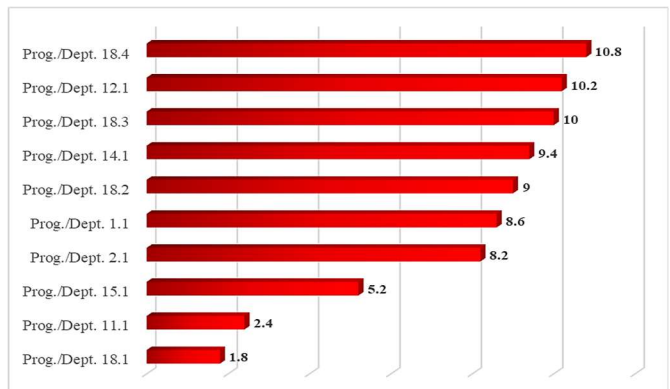


Figure 3. Ten (10) programs with lowest FCI

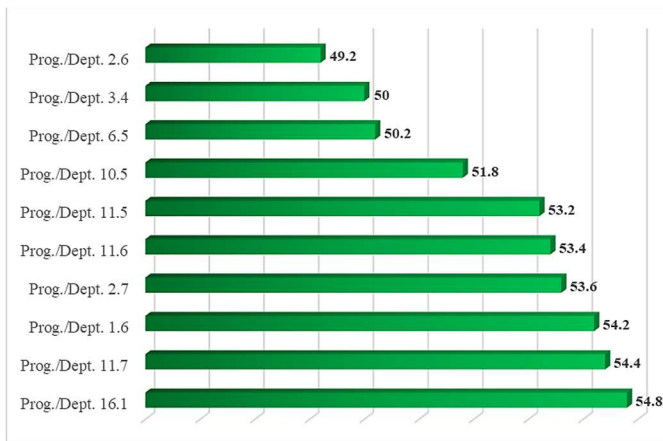


Figure 4. 10 programs with highest FCI

It can be observed that programs from Unit 18 also dominated the list if analyzed on a program or department level. The system developed also utilizes a heat map to capture the intensity of the situation in each program.

Using these processes, the administrators could be able to gauge the faculty gap in each program and objectively allocate the available faculty items to the programs/units that need it the most.

IV. CONCLUSION & RECOMMENDATIONS

Based on the results of the analysis and validation conducted with the academic officials, the methodology in analyzing the faculty complement gap and the use of FCI in comparing the gaps in each program are useful. Therefore, it is recommended that the analysis results be used as the basis for developing a university hiring plan that specifies that timeline for which faculty members will be hired in each program/department.

Considering the complexity and uniqueness of each academic institution, the methods developed are only intended to serve as a tool to surface, quantify, and visualize the scenarios of each program, department, or academic unit so that the administrators can be guided in objectively allocating faculty resources and budget.

V. FUTURE WORK

This study acknowledges that the methodologies used and the FCI developed may not be fully comprehensive, as there are factors in the operation at the university that may not be captured yet. Issues such as retirement, separation from service, and other events that lead to faculty turnover are not necessarily captured. Although these things surfaced during the conduct of the study, they were set aside to simplify the process and the university found it immaterial for purposes of immediately allocating the limited available faculty items. It is therefore recommended to include these additional criteria should the purpose of the study include developing a long-term hiring plan.

ACKNOWLEDGMENT

The authors would also like to express their gratitude to the following Bicol University offices: Office of the President, Office of the Vice President for Academic Affairs, Office of the Vice President for Research, Development and Extension, Office of the Vice President for Administration and Finance, Human Resource Management and Development Office, College of Engineering, Polangui Campus, College of Arts & Letters, and College of Science, for their invaluable administrative support given during the conduct of this work. Moreover, the opinions expressed in this manuscript are solely those of the author and do not necessarily reflect the position of Bicol University and its respective offices.

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