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# Application of Program Evaluation Review Technique (PERT) and Critical Path Method ( CPM) on Enrollment Processes in the Adventist University of the Philippines

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## ABSTRACT

This study provides a comprehensive analysis of the enrollment process in the Adventist University of the Philippines and recommends improvements based on the Program Evaluation Review Technique (PERT) and Critical Path Method (CPM). Using the PERT and CPM, key activities in the enrollment process were identified as critical, as follows: (1) approval of the request for residence category; (2) creation of course lineup; (3) approval of course lineup; (4) assessment of account by the Accounting Office; and (5) tagging of the student as officially enrolled. The study on the enrollment process at the Adventist University of the Philippines used a quantitative approach for data collection and analysis. Data were gathered from 128 college students enrolled during the second semester of the 2023-2024 school year. The data collection process was conducted through face-to-face interactions or by sending information electronically via social media platforms. Out of the 128 collected samples, only 101 samples were retained for analysis after removing incomplete or negative values. The key data collected included the dates and times associated with various steps in the enrollment process, such as updating the student profile, approval processes, course lineup creation, and final tagging as enrolled. These data points were used to generate a Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) diagram to identify the critical activities, bottlenecks, and potential improvements in the enrollment process. The analysis of the data involved descriptive statistics, including the calculation of average durations and standard deviations for each step, and the Z-score analysis to predict the probability of completion times for the enrollment process. The study revealed that the critical activities in the process included course lineup creation, approval steps, and assessment by the accounting office, with a 50% probability of completion in 5 days and 71.68% probability in 7 days. Based on the results of this study, it is recommended to Conduct a survey on student satisfaction with the enrollment process.

**Keywords:** Program Evaluation Review Techniques (PERT), Critical Path Method (CPM), AUP Enrollment Processes

## INTRODUCTION

The enrollment process is a critical component of any university's operations, as it directly impacts the institution's revenue, student satisfaction, and overall success. As such, it is essential to evaluate the efficiency of this process and identify areas for improvement. This research study proposes the use of PERT (Program Evaluation and Review Technique) and CPM (Critical Path Method) in evaluating the enrollment process in a university.

PERT and CPM are project management techniques that are widely used in various industries to plan, schedule, and control complex projects. These techniques can help identify the critical path of a project, which is the sequence of activities that determines the shortest possible duration for the project. By applying PERT and CPM to the enrollment process, the bottlenecks and delays that hinder the efficiency of this process can be identified and solutions to address these issues can be recommended.

The current inefficiencies in the enrollment process at the Adventist University of the Philippines pose challenges for both students and the institution. For students, the process is time-consuming, often taking up to 16 days to complete, causing stress and uncertainty, especially for those needing to finalize schedules or meet deadlines. Manual interventions, such as approvals for residence categories and course lineups, introduce further delays and bottlenecks, hindering students' ability to plan for the semester. For the institution, these delays complicate resource management, disrupt scheduling, and increase administrative workloads. The prolonged process risks frustrating students, potentially leading to lower retention rates and impacting the university's revenue and reputation. Addressing these inefficiencies is crucial to improving both student satisfaction and operational efficiency.

The enrollment process in a university involves various departments and activities, such as admissions, financial aid, registration, and orientation. Each of these activities has a specific duration and dependencies on other activities, making it challenging to manage and optimize the overall process. By using PERT and CPM, a visual representation of the enrollment process can be created, the critical path can be identified, and the impact of potential changes on the overall duration of the process can be analyzed.

This study aims to provide a comprehensive analysis of the enrollment process in a university and recommend improvements based on the PERT and CPM findings. The study will involve data collection, process mapping, and quantitative analysis to identify the critical path, bottlenecks, and delays in the enrollment process.

## LITERATURE REVIEW

Project Evaluation and Review Technique (PERT) and Critical Path Method (CPM) are commonly used project management techniques to evaluate the efficiency of projects in various industries (Kerzner, 2017). These techniques help in identifying the critical path, which is the sequence of activities that determines the minimum duration required to complete a project (PMI, 2017). PERT and CPM have been widely used in construction, engineering, and IT projects to manage project timelines, resources, and risks (Kerzner, 2017; PMI, 2017).

The use of PERT and CPM in higher education institutions can provide valuable insights into the efficiency of enrollment processes. The enrollment process is a critical function in higher education institutions, and it involves multiple activities such as application, evaluation, acceptance, and registration (Brown, 2018). Efficient enrollment processes can help institutions to attract and retain students, reduce administrative costs, and improve student satisfaction (Brown, 2018).

PERT and CPM have been used in higher education institutions to evaluate the efficiency of enrollment processes. For instance, a study by Sánchez et al. (2016) used PERT and CPM to evaluate the enrollment process in a public university in Spain. The study identified the critical path and bottlenecks in the enrollment process and provided

recommendations to improve the efficiency of the process. Similarly, a study by Chang and Lin (2017) used PERT and CPM to evaluate the enrollment process in a private university in Taiwan. The study identified the activities that required the most time and resources and provided recommendations to reduce the duration of these activities.

Other studies have used PERT and CPM to evaluate the efficiency of specific components of the enrollment process. For instance, a study by Al-Azawei et al. (2016) used PERT and CPM to evaluate the application process in a higher education institution in the United Arab Emirates. The study identified the critical path and activities that required the most time and resources and provided recommendations to improve the efficiency of the application process.

PERT and CPM can be used in conjunction with other project management techniques to evaluate the efficiency of enrollment processes. For instance, a study by Cavalcanti et al. (2018) used PERT, CPM, and Monte Carlo simulation to evaluate the enrollment process in a private university in Brazil. The study identified the critical path, bottlenecks, and risks in the enrollment process and provided recommendations to improve the efficiency of the process.

## METHODS

The research design for this study will be quantitative approach. Data will be collected on the date and time required for each activity in the enrollment process. These data will be used to create a PERT and CPM diagram, which will help identify the critical path and potential bottlenecks in the process. The data will be collected either through face-to-face interviews with college students involved in the enrollment process or through screenshots of each enrollment steps sent through electronic means.

Descriptive statistics will be used to summarize the data and identify trends and patterns. The PERT and CPM techniques will be used to calculate the critical path and estimate the time required for each activity in the enrollment process. The data will be analyzed to identify any inefficiencies or bottlenecks in the process and to determine the potential impact on the overall efficiency of the enrollment process.

In this study, Program Evaluation Review Technique (PERT) and Critical Path Method (CPM) were applied to analyze and streamline the enrollment process at the Adventist University of the Philippines. The process began with data collection from 101 valid samples, where the researcher's gathered information on key activities such as updating profiles, requesting residence categories, and creating course lineups. These activities were then arranged in a sequence, with dependencies mapped to identify the order in which each task needed to be completed. Using PERT, three-time estimates were calculated for each activity: optimistic time (to), most likely time (tm), and pessimistic time (tp), allowing for a realistic assessment of possible durations. The most likely time was based on the average duration observed, while the optimistic and pessimistic times were adjusted using standard deviations.

With this information, CPM was used to identify the critical path, or the sequence of tasks that could not be delayed without affecting the overall timeline. This was done through forward and backward passes, calculating the earliest start and earliest finish for each activity, followed by the latest start and latest finish. Activities with zero slack time were marked as critical, meaning any delay in these tasks would directly affect the overall process. Additionally, the study identified tasks with slack time, which could be delayed without

impacting the final completion. The researchers then created a network diagram to visualize the entire enrollment process, illustrating the critical path and potential bottlenecks. This structured approach allowed for a clear understanding of where delays occurred and provided actionable insights to streamline the process for improved efficiency.

# RESULTS AND DISCUSSION

### Application of the PERT-CPM in the Enrollment Process

The Adventist University of the Philippines (AUP) uses the AUP Online Information System (AOLIS) to facilitate the enrollment process for both prospective and returning college students. Through the MyAUPLifeBook platform, students can access and complete the necessary steps for enrollment. After logging into their AOLIS account, students simply select MyAUPLifeBook from the menu, which opens the main dashboard. From there, they can easily navigate through the various stages of the enrollment process.

The enrollment process involves seven key steps. First, you need to update your profile and wait for verification by the RAO. Once verified, you proceed to request your residence category and wait for approval. Afterward, you can create your course lineup using the course cart, check out your selected courses, and pay the required downpayment, which will confirm the number of units you plan to take for the semester. Upon successful checkout, your DSF units should be visible. Next, wait for your course lineup to be approved by your Department Chair. Following this, the assessment of your account will take place. Finally, once all prior steps are completed, you will wait for the RAO to officially tag you as enrolled.

### Data Collection Method and Analysis Using PERT

Data for this study were collected from college students enrolled during the second semester of the 2023-2024 school year. The data collection was conducted either through face-to-face interactions or by sending the required information electronically via social media chat applications. A total of 128 students participated in the survey. The data collected included the following:

1. Date of login to their account and time of updating their personal profile (Step 1.1).
2. Date and time the RAO reviewed the updated student personal profile (Step 1.2).
3. Date and time of filing the request for residence category (Step 2.1).
4. Date and time the request for residence category was approved (Step 2.2).
5. Date and time the course lineup was created (Step 3).
6. Date and time of payment and units assignment (Step 4).
7. Date and time of approval of the course lineup (Step 5).
8. Date and time of assessment of the account by the Accounting Office (Step 6).
9. Date and time the student was tagged as officially enrolled (Step 7).

The collected data were then evaluated and analyzed. Any data that were incomplete or returned negative values were removed from the dataset. After data cleansing, a total of 101 samples were subjected to PERT-CPM analysis.

To analyze the enrollment process using the PERT-CPM tools, the following steps were performed, and the following values were computed:

1) Created the list of activities during enrollment

2) Arranged the sequence of the activities during enrollment and identified the immediate predecessor activity.
3) Estimated the activity time. For PERT, the optimistic time (*to*), the most likely time (*tm*), and the pessimistic time (*tp*) must be estimated.
4) Drew the enrollment process network by satisfying the immediate predecessor activity.
5) Used the forward pass to identify the earliest start and earliest finish times for each activity.

The earliest finish (EF) time for the last activity was the enrollment completion time.

6) Used the backward pass to determine the latest start and latest finish times for each activity.

The enrollment completion time was the latest finish (LF) time for the last activity.

7) Found the slack time for each activity using the formula, slack time = LS – ES or LF – EF.
8) Identified the critical activities; these are activities with zero slack time.
9) Summarized the activity schedule in tabular form.

**List of Activities During Enrollment and Their Immediate Predecessor Activities**

The first steps in analyzing the enrollment process are to create a list of activities during enrollment, arrange them in sequence, and identify their immediate predecessor activities. Table 1 shows the list of activities and their immediate predecessor activities. The actual start of the enrollment process begins when the student files his/her request for residence category (B1). The steps on updating the personal profile and the review of the personal profile have no dependencies, nor they are predecessors that would affect the enrollment process. These steps are independent of themselves, and the next steps do not rely on their completion.

The next activity is the approval of the request for residence category (B2), followed by the creation of course line up (C). Activity B1 is the immediate predecessor of Activity B2, which in turn, is the immediate predecessor of Activity C. After the course line up is created, the next activity is payment of the required downpayment and assignment of units (D). The immediate predecessor of Activity D is also Activity C considering that payment may also be required in the request for residence category if the student stays in the campus dormitories. Activity D is followed by the approval of course line up (E), thus, the immediate predecessors of Activity E are Activity D. After the course line up is approved, the Accounting Office will assess the account (F), and finally, the RAO will tag the student as officially enrolled. Activity E is the immediate predecessor of Activity F while Activity F is the immediate predecessor of Activity G.

**Table 1.** List of Activities and their Immediate Predecessors

| Activity | Immediate Predecessor |
|---|---|
| B1 | - |
| B2 | B1 |
| C | B2 |
| D | C |
| E | D |

| | |
|---|---|
| F | E |
| G | F |

**Duration and Time Elapsed (Activity Time)**

Individually, the duration or time elapsed between the activities were computed by subtraction. The following values were obtained:

B2 – B1 = duration from the time the request for residence category was filed up to the time the request was approved

C– B2 = duration from the time the request for residence category was approved up to the time the course line up was created

D– C = duration from the time the request for residence category was approved up to the time of payment and assignment of units

E– D = duration from the time of payment and assignment of units up to the time the course line up is approved

F– E = duration from the time the course line up is approved up to the time the account is assessed by the Accounting Office

G– F = duration from the time the account is assessed by the Accounting Office up to the time the student is tagged as officially enrolled

After finding the duration and time elapsed for each pair of enrollment activities, the averages and standard deviations were computed. Table 2 shows the average time and standard deviation in days.

**Table 2.** Average Time and Standard Deviations in Days

| Activity | Average Time in Days | Standard Deviation in Days |
|---|---|---|
| B2 – B1 | 0.609293752 | 2.005891389 |
| C – B2 | 8.920222772 | 7.499548468 |
| D – C | 6.157806770 | 3.3219791667 |
| E – D | 2.762416002 | 3.785708739 |
| F – E | 0.151929089 | 0.270935858 |
| G – F | 3.782039100 | 5.895338736 |

**Three Time Estimates**

To perform the PERT analysis, it is necessary to find the three time estimates: (a) optimistic time (to); (b) most likely time (tm); and (c) pessimistic time (tp). The most likely

time (tm) is the average time in days (Table 1). The optimistic time (to) is the difference between the most likely time (tm) and the standard deviation of their duration (Table 1). Pessimistic time (tp) is the sum of the most likely time and the standard deviation of their duration. Table 3 shows the three time estimates in days.

**Table 3**. Three Time Estimates of the Enrollment Activities

| Activity | Immediate Predecessor | Time Estimates in Days | | |
|---|---|---|---|---|
| | | Optimistic Time (to) | Most Likely Time (tm) | Pessimistic Time (tp) |
| B1 | - | - | - | - |
| B2 | B1 | -1.396597637 | 0.609293752 | 2.615185141 |
| C | B2 | 1.420674304 | 8.920222772 | 16.41977124 |
| D | C | -1.02329274 | 6.15780677 | 6.54812474 |
| E | D | -1.023292737 | 2.762416002 | 6.548124742 |
| F | E | -0.119006769 | 0.151929089 | 0.422864946 |
| G | F | -2.113299636 | 3.782039100 | 9.677377836 |

Table 4 shows the expected duration of each enrollment activity and their completion time.

The expected duration of each activity and completion time were computed using the formula:

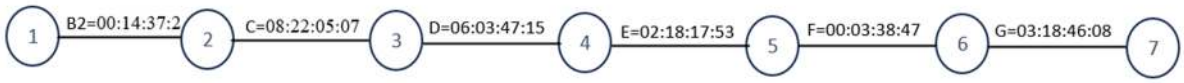
$$te = \frac{(to + 4tm + tp)}{6}$$

**Table 4.** Expected Duration and Completion Time of Enrollment Activities

| Activity | to | tm | tp | te (in days, hours, minutes, seconds) |
|---|---|---|---|---|
| B2 | -1.396597637 | 0.609293752 | 2.615185141 | 00:14:37:23 |
| C | 1.420674304 | 8.920222772 | 16.41977124 | 08:22:05:07 |
| D | -0.373556377 | 6.15780677 | 12.68916992 | 06:03:47:15 |
| E | -1.023292737 | 2.762416002 | 6.548124742 | 02:18:17:53 |
| F | -0.119006769 | 0.151929089 | 0.422864946 | 00:03:38:47 |
| G | -2.113299636 | 3.7820391 | 9.677377836 | 03:18:46:08 |

3.6. Enrollment Process Network

Based on the above data, Figure 2 shows the enrollment process network:




Earliest Start and Earliest Finish for Each Enrollment Activity

Table 5 shows the earliest start and earliest finish for each of the activities in the enrollment process.

**Table 5.** Earliest Start and Earliest Finish of Each Activity

| Activity | Earliest Start (ES) | te | Earliest Finish (EF) |
|---|---|---|---|
| B2 | 00:00:00:00 | 00:14:37:23 | 00:14:37:23 |
| C | 00:14:37:23 | 08:22:05:07 | 09:12:42:30 |
| D | 09:12:42:30 | 06:03:47:15 | 15:16:29:45 |
| E | 15:16:29:45 | 02:18:17:53 | 18:10:47:37 |
| F | 18:10:47:37 | 00:03:38:47 | 18:14:26:24 |
| G | 18:14:26:24 | 03:18:46:08 | 22:09:12:32 |

Using the forward pass, the earliest start and earliest finish times were identified for each activity. The earliest finish (EF) time for the last activity was the enrollment completion time. Based on the table, the earliest start is at day zero while the earliest finish time is about twenty two (22) days.

Latest Start and Latest Finish for Each Enrollment Activity

Table 6 shows the latest start and latest finish of each enrollment activity.

**Table 6.** Latest Start and Latest Finish of Each Enrollment Activity

| Activity | Latest Finish (LF) | te | Latest Start (LS) |
|---|---|---|---|
| G | 22:09:12:32 | 03:18:46:08 | 18:14:26:24 |
| F | 18:14:26:24 | 00:03:38:47 | 18:10:47:37 |
| E | 18:10:47:37 | 02:18:17:53 | 15:16:29:45 |
| D | 15:16:29:45 | 06:03:47:15 | 09:12:42:30 |
| C | 09:12:42:30 | 08:22:05:07 | 00:14:37:23 |
| B2 | 00:14:37:23 | 00:14:37:23 | 00:00:00:00 |

Using the backward pass, the latest start and latest finish times were identified for each activity. The enrollment completion time was the latest finish (LF) time for the last activity.

Based on the table, the latest finish of activity G is same as the earliest finish of G which is about twenty two (22) days.

Slack Time for Each Enrollment Activity Table 7 shows the slack time for each activity.

Table 7. Slack Time for Each Enrollment Activity

| Activity | ES | LS | EF | LF | Slack Time (LS – ES) | Slack Time (LF – EF) | Critical Path |
|---|---|---|---|---|---|---|---|
| B2 | 00:00:00:00 | 00:00:00:00 | 00:14:37:23 | 00:14:37:23 | 00:00:00:00 | 00:00:00:00 | Yes |
| C | 00:14:37:23 | 00:14:37:23 | 09:12:42:30 | 09:12:42:30 | 00:00:00:00 | 0 | Yes |
| D | 09:12:42:30 | 09:12:42:30 | 15:16:29:45 | 15:16:29:45 | 0 | 0 | Yes |
| E | 15:16:29:45 | 15:16:29:45 | 18:10:47:37 | 18:10:47:37 | 0 | 0 | Yes |
| F | 18:10:47:37 | 18:10:47:37 | 18:14:26:24 | 18:14:26:24 | 0 | 0 | Yes |
| G | 18:14:26:24 | 18:14:26:24 | 22:09:12:32 | 22:09:12:32 | 0 | 0 | Yes |

The identified critical path activities are:

B2 – Approval of request for residence category
C – Creation of course line up
D- Payment and Units Assignment
E– Approval of course lineup
F– Assessment of account by the Accounting Office
G– Tagging of student as officially enrolled

**Critical Path**

Table 8. Variances of Critical Path Activities

| Critical Path Activities | to | tp | Variance |
|---|---|---|---|
| B2 | -1.396597637 | 2.615185141 | 0.447066696 |
| C | 1.420674304 | 16.41977124 | 6.249247469 |
| E | -1.023292737 | 6.548124742 | 1.592398962 |
| F | -0.119006769 | 0.422864946 | 0.008156249 |
| G | -2.113299636 | 9.677377836 | 3.861668757 |
| | | Total Variance | 12.15853813 |
| | | Standard Deviation | 3.486909539 |

The critical path activities have a total variance of 12.15853813 and a standard deviation of 3.486909539.

**Table 9** shows the final results of Z-Score analysis:

| Days | Z-Score | Percentage |
|---|---|---|
| 14 (2 weeks) | 2.493261456 | 99.50% |
| 13 | 2.223719677 | 98.91% |

| | | |
|---|---|---|
| 12 | 1.954177898 | 97.76% |
| 11 | 1.684636119 | 95.73% |
| 10 | 1.41509434 | 92.42% |
| 9 | 1.145552561 | 87.43% |
| 8 | 0.876010782 | 80.52% |
| 7(1 Week) | 0.606469003 | 71.68% |
| 6 | 0.336927224 | 61.28% |
| 5 | 0 | 50% |
| 4 | -0.202156334 | 37.71% |
| | -0.471698113 | 28.31% |
| 2 | -0.741239892 | 19.47% |
| 1 | -1.010781671 | 12.57% |

The Z-Score analysis shows that there is 50% probability that a student will complete the enrollment process in five (5) days.

At day seven (7) or one week after a student commenced the enrollment process, there is 71.68% probability that it will be completed. A student has a 99.50% probability of completing the enrollment process in two (2) weeks or 14 days after the start of the first activity in the enrollment process.

The results of this study align closely with previous research that applied PERT and CPM in university enrollment processes. Similar studies, such as those by Sánchez et al. (2016) and Chang and Lin (2017), identified inefficiencies in enrollment workflows, particularly at approval stages like course lineup reviews and application processing. However, this study provides a more detailed quantitative analysis by offering statistical probabilities for process completion, such as a 50% likelihood of finishing within 16 days. This allows for a clearer understanding of potential delays and more accurate expectations for both students and staff, setting it apart from earlier research that primarily focused on qualitative improvements. The study's proposed changes emphasize a deeper integration of automation compared to previous work. Automating critical steps, such as residence category approvals and course lineup reviews, would significantly reduce manual intervention and streamline the process. This could be achieved by implementing rule-based systems that handle the majority of cases automatically, while only exceptional situations would require manual oversight. Additionally, automating the payment and unit assignment processes, as well as integrating real-time financial management for account assessment, would further enhance efficiency. Centralizing these functions within a platform like MyAUPLifeBook, with built-in alerts and notifications, would create a seamless experience for students and staff. Although these changes require investment in technology and staff training, they promise substantial improvements in the speed and reliability of the enrollment process.

## CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

This study was conducted to analyze the enrollment process in Adventist University of the Philippines and identify the key activities and their dependencies. Using the PERT and CPM, a network diagram of the enrollment process was created, and the critical path was calculated. The efficiency of the enrollment process was evaluated by measuring the duration and slack time of each activity.

The following key activities were identified together with their dependencies:

1. Filing of request for residence category (B1)
2. Approval of the request for residence category (B2) – dependent on B1
3. Creation of course lineup (C) – dependent on B2
4. Payment and assignment of units (D) – dependent on C
5. Approval of course lineup (E) – dependent on D
6. Assessment of account by the Accounting Office (F) – dependent on E
7. Tagging of student as officially enrolled (G) – dependent on F

The following activities were identified as critical:

1. Approval of the request for residence category (B2)
2. Creation of course lineup (C)
3. Approval of course lineup (E)
4. Assessment of account by the Accounting Office (F)
5. Tagging of the student as officially enrolled (G)

Results of the Z-Score analysis showed that the probability of completing the enrollment process is 50% in 5 days. This duration indicates the earliest finish time using the forward pass and the latest finish time using the backward pass. There is 71.68% probability that a student will complete the enrollment process in 7 days and 99.50% probability in 14 days after the first activity.

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