Original Research Article

Time Delay in Engagement Schedules in a Public University in Ghana

Abstract

This paper aims to examine the incidence of time delays in engagement schedules on campus. The study made use of past records of time delays in starting committee meetings of five colleges at a public university in Ghana. The study relied on secondary data extracted from minute and agenda files of college meetings. The Minitab package and Microsoft Spreadsheet were used to analyse the data. The statistical techniques used in the study were Markov prosses and Steady state probability. The results revealed that the College of Agriculture and Natural Sciences consistently start their meetings on-time in the long-run with the highest probability of approximately 0.810. Meetings of the College of Education is characterized with large delays in starting times in the long-run with the highest probability of approximately 0.812. Based on the results, the paper recommends that the colleges with higher possibility of starting their meetings ten minutes late should encourage its board or committee members to be prompt in attending to meeting/schedules. Additionally, the paper suggests that the management of the university should design an effective policy to ensure a rescheduling when a meeting delays for more than an hour.

Key words: Colleges, Markov processes, Public university, Steady state probability, Time delays.

Introduction

Organisations are groups of people who work interdependently toward some purpose. What define organisations are not buildings or other physical structures, rather the concept of people working in unity to bring into reality a common set of goals. The patterns of interactions among employees have been perceived to be structured, implying that they expect each other to complete a certain task in a coordinated way [1].

Due to an organisation's nature (as an interaction between employers and employees), engagement schedules do also exist in every organisation. These engagement schedules are known as *meetings*. Almost every time when there is a genuinely important decision(s) to be made for the benefit or growth of the organization a group whose membership is from the organisation or outside the organisation or both are assigned to make such important decision(s) for the organization [2]. These group(s) may be known as a Board, Committee, Standing Committee, or an Ad Hoc Committee. Kayser [3] defines a meeting as "a gathering where people speak up, say nothing, and then all disagree". To explore the complex human interactions such as meetings, one needs to understand what meetings are and their components in detail.

There is value in defining meetings as the definition reveals the variety of purposes they serve, and the specific techniques required for each to bring about the greatest return on investment [4]. Webster [5] defines a meeting as "an act or process of coming together" that may be "a chance or a planned encounter." This definition incorporates the concepts of formality level and joint process or action; however, it is somewhat imprecise and inexplicit. Goffman [6] is more explicit in defining a meeting as that which "occurs when people effectively agree to sustain for a time a single focus of cognitive and visual attention." Hildreth [7] adds the concept of a shared goal to define a meeting as a "communication encounter between persons for a common purpose." In [8], the concepts of physical and temporal dispersion were incorporated, and a meeting was defined as any activity where people organize, regardless of the physical position and time.

The definition of meeting in this research combines elements of all those found in some other literature: "a focused interaction of cognitive attention, planned or chance, where people agree to come together for a common purpose, whether at the same time and the same place, or at different times in different places." This definition includes several important dimensions of meetings: focused interactions, groups of people, a common purpose, the level of formality, and temporal and physical dispersion. Each of these dimensions may affect the meeting itself and the support required to improve group productivity. In this study, our definition includes formal board and committee meetings. Our concept of a meeting involves people sharing data, information, knowledge, and wisdom to garner their collective intelligence and bring it to bear to solve a problem or achieve a goal together.

Many studies [4, 9, 10, 11] have revealed that meetings dominate workers' and managers' time. Again, studies have shown that meetings are essential and that the number of meetings and their duration has been steadily increasing. Meetings are prominent sites of temporal behaviour in organizations. They consume huge amount of time, punctuate and interrupt the temporal flow of work, provide venues of time coordination and allocation, and mark time in organizations (e.g., the weekly staff meeting, management meeting). Through two studies, it could be found that meeting lateness is a high base rate and seemingly consequential workplace event, with both objective and subjective elements, and potential implications for individuals, relationships, groups, and the organization more broadly [12]. Meeting lateness associates include job satisfaction, intent to quit, satisfaction with meetings in general, age, and conscientiousness. In light of the occurrence, consequences, and conceptual complexity of meeting lateness, along with the dearth of extant research on the topic, this study seeks to find the impact of the lateness on the next meeting.

The delay in the start of an event/meeting is consistent with Ghanaian culture. The attitude of many Ghanaians (if not all) towards honouring an appointment or event at the said time is very appalling. This kind of attitude cut across all the social strata of Ghanaians. It is found among politicians, civil servants, public servants, employees of the private organization, market women, and so on. One cannot control his location in time as it is with space. Time, therefore, plays a fundamental role in our daily activities, especially in the decisions that we make. Time clearly affects the decisions that we make. Time also affects lives in another way; specifically, in the production of timed actions. In sports, for instance, the timing of actions is often the most important aspect of one's skill set.

Schedule, on the other hand, can be defined as a design of events and their time of occurrence. Sometimes, events which have been scheduled to occur at a specified period of time fail to occur according as scheduled. These delays do not only occur at the micro (local, organization, etc.) level but also at the macro or national levels. These delays may be due to some reasons by the participants or the event organizers or planners. Some of the reasons for delaying the start of an event include some unforeseen emergency to attend by participants of the event, members of the committee tight schedules, etc.

Delay in the start of an engagement schedule has a significant negative effect on the said schedule. This negative effect may lead to a rush through of the meeting and may result in an unproductive event. Delays also have a negative effect on the economy. In Ecuador for instance, lateness to work and events cost the country Seven Hundred and Twenty four Million Dollars annually [13].

Meetings are purposefully initiated, work-related interactions involving three or more individuals [14]. Meetings have more structure and boundaries (e.g. certain individuals are invited) than a simple chat, but less than a lecture [15]. Meetings are also salient sites of temporal behaviour/activity in organizations. First, meetings occupy a sizable portion of the workday itself. In a large study of employees in the US, UK, and Australia Rogelberg et al. [16] and Van Vree [17] uncovered that 6 hours a week is spent on meetings, on average, and managers and senior managers far exceed that estimate. Second, meetings interrupt or ''punctuate'' the flow of temporal activities [18] over the course of a workday [16]. Third, time in an organization is often marked by meetings (e.g., the weekly staff meeting). Fourth, we often assess the use of time and hold others accountable for used/misused time by having people report on progress of various tasks and initiatives in meetings [19]. Fifth, the quality of meetings is often evaluated in temporal terms (e.g., ''this meeting was a waste of time''). The final salient temporal phenomenon associated with the increasing usage of meetings, which was the focal point of Rogelberg et. al [20], is lateness. The study explored the construct of meeting lateness across two concurrently conducted studies. The studies examined lateness from two complementary, but different, viewpoints that when combined, provide a more complete picture of this understudied phenomenon.

In the first study, the researchers considered both qualitative and quantitative dimensions in respect of the construction of meeting lateness by employees. In the second study, conducted concurrently with the first, meeting lateness considered as an objective time phenomenon (arrival after the meeting start time). This gave rise to a yardstick for examining the base rates of meeting lateness. Additionally, further insight into the nature of meeting lateness was garnered by investigating a set of correlates. Finally, the second study also begun to document the perceived consequences of meeting lateness from the participant's perspective. Taken together, the two studies addressed the nature of the construct, its frequency, and its perceived impact. Although there was a paucity of meeting lateness research, it was recognized that being an unexplored construct does not of itself substantiate the need for exploration. In the case of meeting lateness, however, a fact was established that there was good reason to speculate that it was a consequential individual and organizational phenomenon warranting initial investigation. Theory, research, and arguments from a variety of areas suggest a substantive conceptual connection among meeting lateness and group decision-making quality, employee well-being/stress, interpersonal relationships, power and deviance, withdrawal and overall organizational effectiveness [20].

The daily activities of men cannot be excluded from engagement schedules. The activities include meeting with your family, friends, superiors, and colleagues at work. Sometimes, such engagements, in one way or the other are delayed. The delays have so many effects on the engagement and on the economy. Mr. Gyan-Apenteng a columnist and a former chairman of National Media Commission (NMC) disclosed that the economic cost of lateness (delays) to work and other engagement schedules in Ghana were more than that of the United Kingdom. The cost of delays was estimated at Nine Billion Euros annually [21]. Many have cried on the lateness of citizens on engagement schedules. These attitudes exist in most of the institutions in Ghana.

Variance from the above studies, the area that has received little or no attention in the literature is the impact of the lateness on the next meeting. It is this gap that has necessitated this study. This study seeks to analyse the incidence of these delays in engagement schedules of a given public university in Ghana.

The overall objective of the study is to examine the incidence of time delay in engagement schedules on a public university campus. Specifically, the study focuses on comparing the incidence of delays in the engagement of various divisions of an identified public university in Ghana.

Materials and Methods

The data was collected from the various meetings of committees from the colleges, academic board and council meetings. The study purposefully took data from the minutes of the committees of the colleges and council. The study recorded the actual time the meeting started, the intended time the meeting was to start and the time the meeting closed over a period of two academic years.

A stochastic process is defined as a collection of random variables defined on a common probability space (Ω, F, P), where Ω is a sample space, F is a δ-algebra, and P is a probability measure, and the random variables, indexed by some set T, all take values in the same mathematical space S, which must be measurable with respect to some δ-algebra Σ [22].

In other words, for a given probability space (Ω, F, P) and a measurable space (S, Σ), a stochastic process is a collection of S-valued random variables, which can be written a $\{X(t): t \in T\}$[23]. Historically, in many problems from the natural sciences a point $t \in T$ had the meaning of time, so $X(t)$ is a random variable representing a value observed at time t. A stochastic process can also be written as $\{X(t): t \in T\}$ to reflect that it is actually a function of two variables, $t \in T$ and $\omega \in \Omega$ [24].

There are other ways to consider a stochastic process, with the above definition being considered the traditional one [25]. For example, a stochastic process can be interpreted or defined as a S^T-valued random variable, where S^T is the space of all the possible S-valued functions of $t \in T$ that map from the set T into the space S [26].

A mathematical space *S* of a stochastic process is called its state space. This mathematical space can be defined using integers, real lines, n-dimensional Euclidean spaces, complex planes, or more abstract mathematical spaces [27]. The state space is defined using elements that reflect the different values that the stochastic process can take [22, 23, 27, 28, 29].

Markov processes are stochastic processes, traditionally in discrete or continuous time that have the Markov property, which means the next value of the Markov process depends on the current value, but it is conditionally independent of the previous values of the stochastic process. In other words, the behaviour of the process in the future is stochastically independent of its behaviour in the past, given the current state of the process [30,31]. The Brownian motion process and the Poisson process are both examples of Markov processes [32] in continuous time, while random walks on the integers and the gambler's ruin problem are examples of Markov processes in discrete time [23, 33].
A Markov chain is a type of Markov process that has either discrete state space or discrete index set (often representing time), but the precise definition of a Markov chain varies [34]. For example, it is common to define a Markov chain as a Markov process in either discrete or continuous time with a countable state space (thus regardless of the nature of time), [22, 32, 33, 35] but it is also common to define a Markov chain as having discrete time in either countable or continuous state space (thus regardless of the state space) [34].

Markov processes form an important class of stochastic processes and have applications in many areas [33]. For example, they are the basis for a general stochastic simulation method known as Markov chain Monte Carlo, which is used for simulating random objects with specific probability distributions and has found application in Bayesian statistics [36, 37]. The concept of the Markov property was originally for stochastic processes in continuous and discrete time, but the property has been adapted for other index sets such as n-dimensional Euclidean space, which results in collections of random variables known as Markov random fields [29, 31, 38].

A Markov chain is simply a sequence of random variables that evolve over time. It is a system that undergoes transitions between states in the system and is characterized by the property that the future is independent of the past given the present [28]. What this means is that the next state in the Markov chain depends only on the current state and not on the sequence of events that preceded it. This type of memoryless property of the past is known as the Markov property.

The changes between states of the system are known as transitions, and probabilities associated with various state changes are known as transition probabilities. A Markov chain is characterized by three pieces of information: a state space, a transition matrix with entries being transition probabilities between states, and an initial state or initial distribution across the state space [39]. In [27] a state space has been defined as the set of all values which a random process can take. Furthermore, the elements in a state space are known as states and are the main component in constructing Markov chain models. With these three pieces, along with the Markov property, a Markov chain can be created and can model how a random process will evolve over time.

Delay of events can also be represented as a stochastic process by augmenting each event with a probability distribution for the delay. Such probability distributions are typically determined from historical data. The idea is to model how the real-time information affects the uncertainty of event delays by means of Markov property. We assume that the delay of a certain event in the future can be fully predicted based on the currently known delay. Therefore, a meeting delay in the future depends only on the current delay and not on the delay of events that preceded it. This assumption limits the model to a memoryless approach where the past delays of a meeting cannot be used to predict the future. Consequently, the assumption of Markov character of the process does not reduce the validity of the model.

Stochastic process of a meeting delay can be represented as a sequence of random variables $X_1, X_2,.., X_n$. Each random variable represents a delay of event i, where $i = 1,2,.., n$. The Markov property is formally given in equation (1) where $X_i \in S$ the value of the corresponding random variable and S is the state space.

$$P\{X_{i+1} \mid X_i = x_i, X_{i-1} = x_{i-1}, X_{i-2} = x_{i-2},...\} = P\{X_{i+1} \mid X_i = x_i\} \quad (1)$$

The Probability of transition from state X_i to state X_{i+1} in the time interval i , $i+1$, $\forall_i \in 1,..., n-1$ is given by:

$$P\{X_{i+1} = x_{i+1} \mid X_i = x_{i;i,i+1}\} = P_{(i,i+1)}\{x_i, x_{i+1}\} \quad (2)$$

Markov chains are often described by a directed graph (see Figure 1). In this graphical representation, there is one node for each state and a directed arc for each non-zero transition probability.

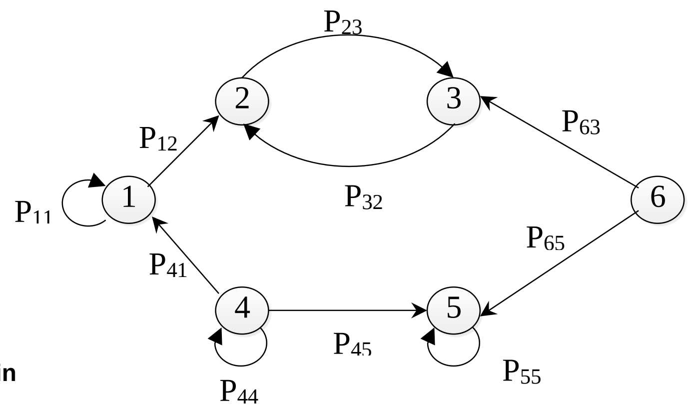


Figure 1: **Markov Chain**

If $P_{ij} = 0$, then the arc from node i to node j is omitted, so the difference between zero and non-zero transition probabilities stands out clearly in the graph. A finite-state Markov chain is also often described by a matrix $[P]$. If the chain has M states, then $[P]$ is an M by M matrix with elements P_{ij}. The matrix representation is ideally suited for studying algebraic and computational issues.

$$P=\begin{bmatrix} P_{11}P_{12} \cdots & P_{16} \\ P_{21}P_{22} \cdots & P_{26} \\ \vdots\vdots \cdots & \vdots \\ P_{61}P_{61} \cdots & P_{61} \end{bmatrix}$$

To derive the state matrix and transition matrix the raw data was changed into percentages. For the state matrix, raw data information was changed into percentages by dividing each delay category population by the total sample size. For the transition matrix, each row represents a particular delay category and each column represents the delay at the next meeting [40]. The percentage was derived by dividing the number of delay category X_{ij} by the total number of delay category X_{ij}.

$$P_{ij} = \frac{X_{ij}}{\sum_{j}^{n} X_{ij}} \tag{3}$$

Where n was the sample size, in this model $n = 24$. These percentages are then placed into matrix form.
To find the steady state probabilities or the long-run behaviour of the Markov chain, Let *P* be the transition matrix for an *s*-state ergodic chain, then there exists a vector $\pi = [\pi_1 \pi_2 \pi_3 \ldots \pi_s]$ such that

$$\lim_{n\to\infty} P_{ij} = \pi_j \tag{4}$$

But for large n, P^n approaches a matrix with identical rows. This means that after a long time, the Markov chain settles down, and (independent of the initial state *i*) there is a probability P_j that we are in state *j*. from the above, we observe that for large n and all i,

$$P_{ij}(n+1) \approx P_{ij}(n) \approx \pi_j \tag{5}$$

Since $P_{ij}(n+1) =$ (row *i* of P^n) (column *j* of *P*), we may write equation (5) as;

$$P_{ij}(n+1) = \sum_{k=1}^{s} P_{ik}(n) P_{kj} \tag{6}$$

If *n* is large, substituting (5) into (6) yields;

$$\pi_j = \sum_{k=1}^{s} \pi_j P_{kj} \tag{7}$$

In matrix form, (7) may be written as;

$$\pi_j = \pi P \tag{8}$$

The system of equations specified in (8) has an infinite number of solutions because the rank of the *P* matrix always turns out to be $\leq S-1$. Therefore, to obtain unique values of the steady-state probabilities, note that for any *n* and any *I*;

$$P_{i1}(n) + P_{i2}(n) + \ldots + P_{is}(n) = 1 \tag{9}$$

Letting n approach infinity in (6), we obtain;

$$\pi_1 + \pi_2 + \pi_3 + \ldots + \pi_s = 1 \tag{10}$$

Thus, after combining any of the equations in (8) with (10), we can solve for the steady-state probabilities as

$$(\pi_1, \pi_2, \pi_3) = (\pi_1, \pi_2, \pi_3) \begin{bmatrix} P_{11} & P_{12} & P_{13} \\ P_{21} & P_{22} & P_{23} \\ P_{31} & P_{32} & P_{33} \end{bmatrix}$$

The system representation of the above equation is given by (11).

$$\left.\begin{array}{r} \pi_1 = \pi_1 P_{11} + \pi_2 P_{21} + \pi_3 P_{31} \\ \pi_2 = \pi_1 P_{12} + \pi_2 P_{22} + \pi_3 P_{32} \\ \pi_3 = \pi_1 P_{13} + \pi_2 P_{23} + \pi_3 P_{33} \\ \pi_1 + \pi_2 + \pi_3 = 1 \end{array}\right\} \tag{11}$$

To construct a Markov chain from the data set, the start of meetings was categorised and converted into sets of on-time (O), small delays (S) and large delays (L) in the following way:

- if 0 ≤ delay ≤ 5, delay = 'on-time'
- if 5 < delay ≤ 10, delay = 'small'
- if delay > 10, delay = 'large'

Results and Discussions

Markov chain and Transitional matrix for the delays of meetings under investigation

Markov chain is a special type of discrete-time stochastic process. To simplify our exposition, we assume that at any time, the discrete-time stochastic process can be in one of a finite number of states labelled 1, 2 . . ., *s*. The states for this research are given as on-time (O), small delay (S) and large delay (L)

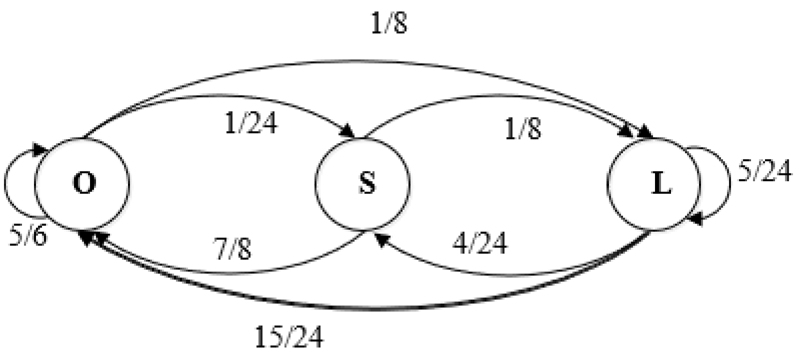
Markov Transitional Matrix for College of Agriculture and Natural Sciences (CANS)

$$\begin{array}{cc} & \begin{array}{ccc} O & S & L \end{array} \\ P \begin{array}{c} O \\ S \\ L \end{array} & \begin{bmatrix} 5/6 & 1/24 & 1/8 \\ 7/8 & 0 & 1/8 \\ 15/24 & 4/24 & 5/24 \end{bmatrix} \end{array}$$

From the Transitional Matrix for CANS, the probability that the next meeting would start on-time given that the current meeting started on-time is 0.833 (83.33%) whereas the probabilities that it would start with a small and a large delay are 0.0417 (4.17%) and 0.125 (12.50%) respectively. From the matrix above the probabilities that the next meeting would start on-time and with a large delay given that the current meeting started with a small delay are 0.875 (87.5%) and 0.125 (12.50%) respectively. Again, the probability that the next meeting would start with a small delay given that the current meeting started with a small delay is zero (0). This meant that the next meeting would never ever start with a small delay when the current meeting starts with a small delay. Furthermore, if the current meeting started with a large delay the probability that the next meeting would start on-time or with a small delay or with a large delay was given as 0.625 (62.50%), 0.167 (16.77%) and 0.2083 (20.83%) respectively. From the above probabilities, it can be concluded that no matter the state of the current meeting, the next meeting had the tendency of starting on-time.

Markov chain for College of Agriculture and Natural Sciences

From the Markov chain for the above college, it could be said that the three states do communicate. The chain can also be classified as a closed set. Again, the Markov chain can be classified as a recurrent state. This means that at any particular time there was a positive probability of leaving any state to another. However, none of the states can be classified as absorbing.



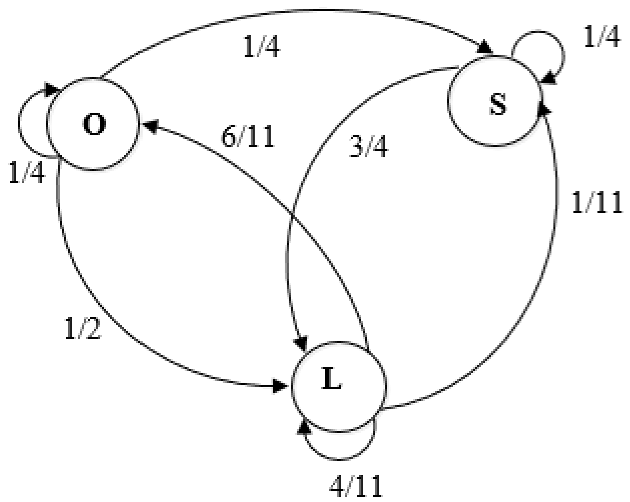
Markov Transitional Matrix for College Health and Allied Sciences (CoHAS)

$$\begin{array}{cc} & \begin{array}{ccc} O & S & L \end{array} \\ P = \begin{array}{c} O \\ S \\ L \end{array} & \begin{bmatrix} 1/4 & 1/4 & 1/2 \\ 0 & 1/4 & 3/4 \\ 6/11 & 1/11 & 4/11 \end{bmatrix} \end{array}$$

From the Transitional Matrix for College of Health and Allied Sciences, the probability that the next meeting would be started on-time given that the current meeting started on-time was 0.25 (25.00%) whereas it would start with a small and a large delay was 0.25 (25.00%) and 0.50 (50%) respectively. This means that whenever a scheduled meeting starts on-time, the probability that the next meeting would start with large delay is high. The probability of the next meeting starting on-time and with a large delay given that the current meeting started with a small delay was 0.0 (0.00%) and 0.75 (75.00%) respectively. From the transitional matrix the probability that the next meeting would start with a small delay given that the current meeting started with a small delay was 0.25 (25.00%). Additionally, when the current meeting started with a large delay the probability that the next meeting would start on-time or with a small delay or with a large delay was given as 0.5454 (54.54%), 0.0909 (9.09%) and 0.3636 (36.36%) respectively. From the above probabilities, it can be established that whenever the current meeting starts on-time the next meeting has a greater chance of starting with a larger delay and the vice versa.

Markov chain for College of Health and Allied Sciences

From the Markov chain for the College of Health and Allied Sciences, it could be said that the three states do communicate. The chain can also be classified as a closed set. Again, the Markov chain can be classified as a recurrent state. In other words, none of the states was transient. This means that at any particular time, there is a positive probability of leaving any state to another. However, none of the states can be classified as absorbing.



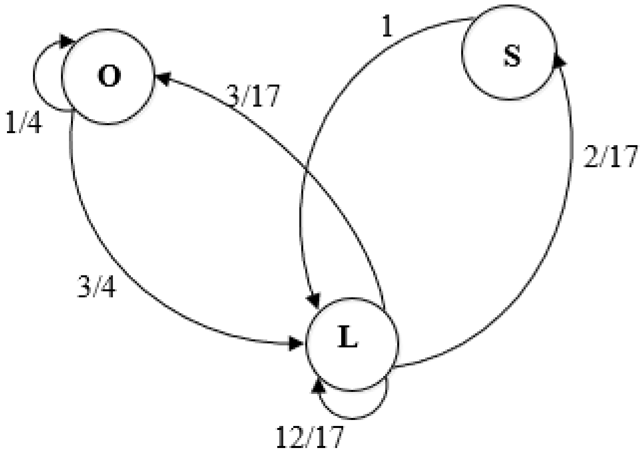
Markov Transitional Matrix for College Humanities and Legal Studies (CHLS)

$$P = \begin{matrix} & O & S & L \\ O & 1/4 & 0 & 3/4 \\ S & 0 & 0 & 1 \\ L & 3/17 & 2/17 & 12/17 \end{matrix}$$

From the Transitional Matrix for CHLS, the probability that the next meeting would start on-time given that the current meeting started on-time is 0.25 (25.00%) whereas it would start with a small and a large delay are 0.00 (00.00%) and 0.75 (75.00%) respectively. This means that whenever a scheduled meeting starts on-time, the probability that the next meeting would start with large delay is high. The probabilities of the next meeting starting on-time and with a large delay given that the current meeting started with a small delay are 0.0 (0.00%) and 1 (100.00%) respectively. Moreover, the probability that the next meeting would start with a small delay given that the current meeting started with a small delay is 0.00 (00.00%). This proves that whenever a scheduled meeting starts with a small delay, the probability that the next meeting would start with a large delay is a sure event. From the matrix, when the current meeting starts with a large delay the probabilities that the next meeting would start on-time or with a small delay or with a large delay is given as 0.1765 (17.65%), 0.1176 (11.76%) and 0.7059 (70.59%) respectively. From the above probabilities, it could be settled that no matter the state of the current meeting, the next meeting has the tendency of starting with a large delay.

Markov chain for College of Humanities and Legal Studies

From the Markov chain for the College of Humanities and Legal Studies, it could be said that the three states do communicate. However, state 'O' and state 'S' do not communicate directly. This confirms the assertion of the transitional matrix for the College of Humanities and Legal Studies. The Markov chain could also be classified as a closed set. Again, the Markov chain can be classified as a recurrent state. In other words, none of the states is transient. Again, none of the states can be classified as absorbing.



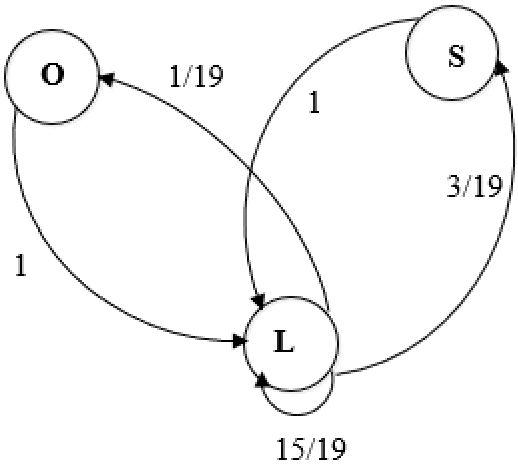
Markov Transitional Matrix for College of Education Studies (CES)

$$P = \begin{matrix} & O & S & L \\ O & \\ S & \\ L & \end{matrix}\begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1/19 & 3/19 & 15/19 \end{bmatrix}$$

From the above transitional matrix, the probability of the next meeting would start with a large delay regardless of the current meeting starting either on-time or with a small delay is a sure event (100.00%). However, when the current meeting starts with a large delay, the probability that the next meeting would start on-time or with a small delay or with a large delay can be given as 0.0526 (5.26%), 0.1579 (15.79%) and 0.7895 (78.95%) respectively. From the above probabilities, it may conclude that no matter the state of the current meeting, the next meeting had the tendency of starting with a large delay.

Markov chain for College of Education Studies

From the Markov chain for the College of Education Studies, it could be said that the three states do communicate. However, state 'O' and state 'S' do not communicate directly.



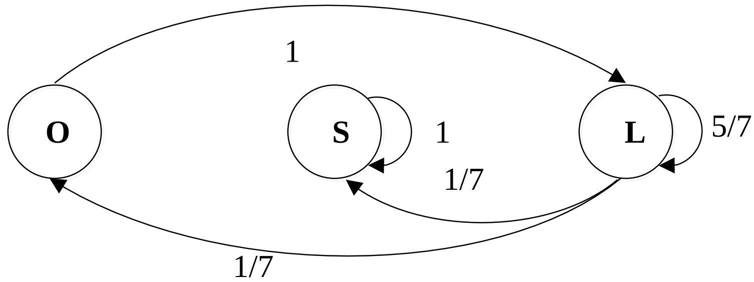
In other words, there is no direct path from the state 'O' to state 'S' and vice versa. This confirms the assertion of the transitional matrix for the College of Education Studies. The Markov chain could also be classified as a closed set. Once more, the Markov chain can be classified as a recurrent state. In other words, none of the states is transient. Again, none of the states can be classified as absorbing.

Markov Transitional Matrix for College of Distance Education (CoDE)

From the transitional matrix, the probability that the next meeting would start with a small and large delay irrespective of the current meeting starting on-time is a sure event (100.00%). However, when the current meeting starts with a small delay, the probability that the next meeting would start on-time is zero (0). Likewise, the probability that the next meeting would start with a large delay is also zero (0). However, when the current meeting starts with a small delay then the probability that the meeting would also start with a small delay is a sure event. Again, from the transitional matrix, the probability that the next meeting would start on-time and with a small delay given that the current meeting started with a large delay is 0.1429 (14.28%) each but the probability that the next meeting would start with a large delay is 0.7143 (71.43%).From the probabilities, we may possibly conclude that no matter the state of the current meeting, the next meeting had the tendency of starting with a large delay.

$$P = \begin{array}{c} \\ O \\ S \\ L \end{array} \begin{array}{c} \begin{array}{ccc} O & S & L \end{array} \\ \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1/7 & 1/7 & 5/7 \end{bmatrix} \end{array}$$

Markov chain for College of Distance Education



From the Markov chain for the College of Distance Education, it could be said State 'O' and 'L' communicate. However, state 'S' could be reached from the state 'O' and 'L' respectively. Further, we could also classify state 'S' as a closed set. Again, we may classify O and L as a recurrent state while state 'S' could be classified as a transient and an absorbing state.

Steady State Probabilities

From equations (8) and (10), the steady-state probabilities or steady-state distribution was used to compute the steady-state probabilities. From the afore-mentioned equations, the steady-state probabilities of the five colleges under investigation can obtained.

College of Agriculture and Natural Sciences

For this college, the form of (8) reduces to

$$(\pi_1, \pi_2, \pi_3) = (\pi_1, \pi_2, \pi_3)\begin{bmatrix} 5/6 & 1/24 & 1/8 \\ 7/8 & 0 & 1/8 \\ 15/24 & 4/24 & 5/24 \end{bmatrix}$$

Which combines with (10) to obtain the resulting steady-state system as

$$\left.\begin{array}{c} \pi_1 = \frac{5}{6}\pi_1 + \frac{7}{8}\pi_2 + \frac{15}{24}\pi_3 \\ \pi_2 = \frac{1}{24}\pi_1 + \frac{4}{24}\pi_3 \\ \pi_3 = \frac{1}{8}\pi_1 + \frac{1}{8}\pi_2 + \frac{5}{24}\pi_3 \\ \pi_1 + \pi_2 + \pi_3 = 1 \end{array}\right\} \quad (12)$$

The solution to (12) above indicates that at the long run the probabilities that the Markov chain would enter a particular state are; on-time (π_1) = 0.8119 (81.19%), small delay (π_2) = 0.0711 (7.11%) and large delay (π_3) = 0.1170 (11.70%). From the above steady-state probabilities, it can be seen that at the long-run the probability that College of Agriculture and Natural Science would start a meeting on-time is 81.19%. This tends to confirm the outcome of the Markov transitional matrix that no matter the state of the current meeting (i.e. on-time, small delays or large delays) the next meeting would start on-time. However, the average delays to start a meeting for the College of Agriculture and Natural Science suggest that the mean delays for the College were large (12.13 minutes).

College of Health and Allied Sciences

For the College of Health and Allied Sciences, the reduced form of (8) is

$$(\pi_1, \pi_2, \pi_3) = (\pi_1, \pi_2, \pi_3)\begin{bmatrix} 1/4 & 1/4 & 1/2 \\ 0 & 1/4 & 3/4 \\ 6/11 & 1/11 & 4/11 \end{bmatrix}$$

The resulting steady state system is given by

$$\left.\begin{aligned} \pi_1 &= \frac{1}{4}\pi_1 + \frac{6}{11}\pi_3 \\ \pi_2 &= \frac{1}{4}\pi_1 + \frac{1}{4}\pi_2 + \frac{1}{11}\pi_3 \\ \pi_3 &= \frac{1}{2}\pi_1 + \frac{3}{4}\pi_2 + \frac{4}{11}\pi_3 \\ \pi_1 &+ \pi_2 + \pi_3 = 1 \end{aligned}\right\} \quad (13)$$

By solving (13), we have on-time $(\pi_1) = 0.3478$, small delay$(\pi_2) = 0.1739$ and large delay $\pi_3 = 0.4783$. Thus, the long run probability that the Markov chain would enter a particular state is 0.3478 (34.78%) for on-time, 0.1739 (17.39%) for small delay and 0.4783 (47.83%) for large delay. This means that the probability that the College of Health and Allied Sciences would start a meeting on-time, in the long run is 38.50%. This outcome also confirms that more than fifty (50) percent of the time, the college would start their meetings after ten (10) minutes.

College of Humanities and Legal Studies

In the instance of the College of Humanities and Legal Studies, we obtain

$$(\pi_1, \pi_2, \pi_3) = (\pi_1, \pi_2, \pi_3)\begin{bmatrix} 1/4 & 0 & 3/4 \\ 0 & 0 & 1 \\ 3/17 & 2/17 & 12/17 \end{bmatrix}$$

And the accompanying steady state system which can be represented as

$$\left.\begin{aligned} \pi_1 &= \frac{1}{4}\pi_1 + \frac{3}{17}\pi_3 \\ \pi_2 &= \frac{2}{17}\pi_3 \\ \pi_3 &= \frac{3}{4}\pi_1 + \pi_2 + \frac{12}{17}\pi_3 \\ \pi_1 &+ \pi_2 + \pi_3 = 1 \end{aligned}\right\} \quad (14)$$

The solution to (13) yields on-time $(\pi_1) = 0.1739$, small delay$(\pi_2) = 0.0870$ and large delay $\pi_3 = 0.7391$. The results suggest that at the long run the probability that the Markov chain would enter a particular state is given by 0.1739 (17.39%) for on-time, 0.0870 (8.70%) for small delay and 0.7391 (73.91%) for large delay. From the steady-state probabilities of the College of Humanities and Legal Studies, the probability that a meeting would start on-time was 17.39% whereas the probability that the meeting would start late was 73.91%. This means that the college meetings have a higher tendency towards starting with a large delay no matter the current state of the meeting.

College of Education Studies

By considering the College of Education, (8) reduces to

$$(\pi_1, \pi_2, \pi_3) = (\pi_1, \pi_2, \pi_3)\begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1/19 & 3/19 & 15/19 \end{bmatrix}$$

This simultaneously combines with (10) to give rise to the system given as

$$\left.\begin{aligned} \pi_1 &= \frac{1}{19}\pi_3 \\ \pi_2 &= \frac{3}{19}\pi_3 \\ \pi_3 &= \pi_1 + \pi_2 + \frac{15}{19}\pi_3 \\ \pi_1 &+ \pi_2 + \pi_3 = 1 \end{aligned}\right\} \quad (15)$$

The solution to (15) results in the following: on-time $(\pi_1) = 0.435$, small delay$(\pi_2) = 0.1304$ and large delay $\pi_3 = 0.8261$. These outcomes suggest that at the long run the probability that the Markov chain would enter a particular state is 0.0435 (4.35%) for on-time, 0.1304 (13.04%) for small delay and 0.8261 (82.61%) for large delay. From the steady-states for College of Education Studies, the probability that a meeting would start on-time is 4.35% whereas the probability that the meeting would start late is 82.61%. The College of Education Studies seems to have the highest tendency towards starting their meetings with a large delay.

College of Distance Education
In the case of the College of distance learning, we have

$$(\pi_1, \pi_2, \pi_3) = (\pi_1, \pi_2, \pi_3)\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1/7 & 1/7 & 5/7 \end{bmatrix}$$

The corresponding derived steady state system is

$$\left.\begin{aligned} \pi_1 &= \frac{1}{7}\pi_3 \\ \pi_2 &= \pi_2 + \frac{1}{7}\pi_3 \\ \pi_3 &= \pi_1 + \frac{5}{7}\pi_3 \\ \pi_1 + \pi_2 + \pi_3 &= 1 \end{aligned}\right\} \qquad (16)$$

Solving the system (16), we have on-time $(\pi_1) = 0.000$, small delay$(\pi_2) = 1$ and large delay $\pi_3 = 0$

Therefore, the long run the probability that the Markov chain would enter a particular state is as follows; 0.000 (0%) for on-time, 1 (100%) for small delay and 0 (0%) large delay. From the steady-states for College of Distance Education, the probability that a meeting would start on-time was not meant to happen whereas the probability that the meeting would start very late was also not possible. From the long run probabilities, College of Distance Education would always start their meetings between five (5) to ten (10) minutes after the intended time to start the meeting.

Summary

The College of Agriculture and Natural Sciences also had the highest probability (0.8119) of always starting their meetings on-time in the long-run. Likewise, the College of Education Studies, on the other hand, had the highest probability (0.8261) of always starting their meetings after 10 minutes. The College of Humanities and Legal Studies followed the College of Education Studies with a probability of 0.7391 of starting meetings after 10 minutes.

The College of Distance Education had a zero (0) probability of starting a meeting on-time in the long-run. However, in the long-run, the college would start a meeting between 5 to 10 minutes after the intended time to start the meeting. The College of Humanities and Legal Studies also had a high probability (0.7391) of starting their meetings after 10 minutes of the intended time in the long-run. The College of Health and Allied Sciences, however, had a probability of 0.4783 of starting their meetings after 10 minutes in the long-run.

After a long trend the probability that a meeting for the Council committee would start on-time or with a small delay or after 10 minutes rested on the current state of the meeting. However, the Academic Board meetings had a 0.45 chance of starting on-time in the long run. With the exception of Council Committee meeting, the remaining colleges and Academic Board meetings shows a regular Markov-chain property. Nevertheless, the states for Council Committee meetings were all absorbing states and hence showed Absorbing Markov chain properties.

Conclusions

The delays in starting a meeting were random in nature. Also, the College of Education Studies had the highest average of delays (18.92 minutes) in starting a meeting among all the colleges. The Council committee meeting had the highest (21.20 minutes) average delay in starting a meeting compared to Academic Board meetings.

In addition, members of the College of Agriculture and Natural Sciences were more prompt to attending meetings on-time than their counterparts from the other Colleges. As compared to their counterparts from the other colleges, members of the College of Education Studies were also not prompt to attending meetings.

Further, the time to start a meeting for Council Committee depends on the starting time of the previous meeting. Members of the Academic Board however, were more prompt to attending meetings on-time than their counterparts on the Council Committee, although the time to start a meeting depend on the starting time of the previous meeting for council meetings.

The study therefore, has a significant policy implication for event scheduling and time management in the various colleges, departments, faculties and academic board of the university. It is recommended that the management of the university should design an effective policy to ensure a rescheduling when a meeting delays for more than an hour. This is because such meetings would eventually last relatively shorter than if it were started on time. The University Management should encourage members of committees to honour invitations to meetings on-time. Also, members of Council Committee should make it a custom to start their meetings on time, this trend would continue in their subsequent meetings. Likewise, Committees at the College of Education should make it a practice to start their meetings on time so it would continue in their subsequent meetings.

The finding of this study was based on some committee meetings of a given public university in Ghana. Indeed, for a comparative view and analysis as well as a comprehensive improvement in honouring engagement schedules on time, there is the need for further studies on; factors that influence the delays in honouring an engagement schedule on time, the economic and productive cost of delay in starting a meeting late using steady-state probabilities, and the time allocation for each item on the agenda for every engagement schedule.

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