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# Development of e-scholar tracking system for measuring the performance of lecturer

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ABSTRACT

Measuring the performance of lecturers received little attention compared to the performance of students at higher education level. However, measures of performance are needed to assess whether they meet their set of objectives and foster an environment of continuous improvement. The objective of this paper is to develop a monitoring system for measuring and managing lecturers' career development. Maintaining the lecturers' record such as personal, research details, publication works, innovation, and award achievements is an important factor for the management level. This research proposed a scholar tracking system called E-STRAS. This tracking system aims to provide management with regular feedback on lecturer's progress and performance and early indicators of problems that need to be corrected and improved. This includes reporting on actual performance against what was planned or expected. The system will proactively help improve and enhance the performance of lecturers in line with the strategic and operational objectives of the university.



## 1. Introduction

Every university has certain criteria for measuring the performance of their academicians or lecturers. Keeping the accurate record is important to the university because finding and generating the necessary data for any institutions was described as a complicated and time-consuming process (Al-Turki and Duffuaa, 2003; Sohail and Daud, 2009). At present many systems were developed independently to meet the requirements of certain task. Different systems were developed such as personal records for human resource department, grant records for research department, publication records for the library department and many others. It becomes difficult for the management to update the lecturers' performance when the data needed comes from diverse systems and only can be accessed by the lecturers themselves.

Monitoring and tracking lecturers career path and success in higher institution is crucial to the management of the university and indirectly to lecturers themselves. Currently, in Universiti Teknologi MARA (UiTM) Kelantan, most of the data about lecturers are stored and managed at the main campus in Shah Alam. UiTM is Malaysia's largest higher learning institution with 13 state campuses and more than 21 state satellite campuses. Due to this, ad-hoc data on lecturer status and progress such as information needed by the management to trace performance and assist them on lecturers' career path is difficult to be retrieved. Lacking of this information leads to several risks such as poor or untimely reporting of lecturer's status, audit findings, inefficient and poor management of lecturer's confirmation and promotion. Thus a tracking system is needed to clearly guide and indicate the current and expectation pathway for promotion and development of lecturers. Therefore, this paper aimed to develop a monitoring system for measuring and managing lecturers' career development known as e-Scholar Tracking System (E-STRAS). The objectives of the system are as follows: 1) to provide the management a way to monitor and manage lecturer's progress and performance through immediate feedback and; 2) to update the lecturers on their career path status according to pre-determined zones. In this article, a review on university performance measures is discussed. The proposed system is described in the next section, followed by a discussion on the development and future plan of the system.

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## 2. Background

### 2.1. Lecturers' performance and the challenges in universities

Traditionally, the task of lecturers in university is mainly focusing on teaching and lecturing, while doing some additional work in research and analysis as well as administrative work. Nowadays, with increasingly demanding environment, lecturers do more complex work. Even though the role of lecturers is still remaining according to the three domains of teaching, research and administration, nevertheless the workloads and accountability of the domains are keeping increasing. Houston et al. (2006) stressed that one of the factor of intensification of academic work among the lecturers is the adoption of performance funding of research budget components by the government for higher education.

Previous studies (Houston et al., 2006; Shin and Jung, 2014) stated that academician in universities have two conflicting dimensions of academic work which are intrinsic motivation and external work condition. According to their intrinsic motivation, lecturers are satisfied with their job itself. Nevertheless, their dissatisfaction is related to work conditions which related to work environment. Fredman and Doughney (2012) stressed that one of the concern on work environment is increasing in workloads and management culture.

With primary emphasis placed upon dual core functions of knowledge creation and knowledge transmission through the processes of research and teaching, tensions are exist among the lecturers in order to balance the demands on time as well as variable recognition and rewards. Jenkins (2005) highlighted that the commitments to teaching and research can be synergistic and complementary or antagonistic and competing. Therefore he argued that the relationships between research, teaching, broader work expectations, and rewards need to be defined and managed at the institutional, departmental, and individual levels to avoid potentially undesirable effects and counterproductive behaviours.

### 2.2. Measuring Performance of Lecturers in universities

Shin and Jung (2014) examined job satisfaction and job stress across 19 higher education systems and found that higher education management which is measured by the performance-based management is the main source of academic job stress. Kinman (2016) stressed that effort-reward imbalance (ERI) of job stress lead to several indices of wellbeing in UK academics such as mental ill health, job satisfaction and leaving intentions. Based on a sample of 649 academic employees working in higher education institutions in the UK, he found that employees who believe that their efforts are not counterbalanced by sufficient rewards will experience impaired wellbeing. In addition, feelings of ERI are more experienced by employees who are over-committed to the job. Thus a good performance measurement system is needed to ensure that the lecturers are sufficiently rewarded.

Previously, universities based their performance on performance metrics such as teaching units, number of publications in top journals, research income generation, students' satisfaction, citizenship or patents and this metrics have become part of the day-to-day lexicon of academia (Franco-Santos, 2016). These performance metrics are used at all levels such as individual, department, faculty and institution. This approach is generating one size-fits-all performance measurement systems that do not appear to take into consideration universities' distinctive mission. Rather it is described as merely reacting to the multiple demands of powerful stakeholders especially government and thus not proactively attempting to manage their own performance.

Based on extensive survey data among the employees at Finnish universities, Kallio and Kallio (2014) found that performance measurement which has been practised by the universities is based on quantitative rather than qualitative measures. Kallio et al. (2017) highlighted that such system has led to negative effect on academic staff work motivation. This is because the motivation to engage in challenging knowledge-intensive work such as the work carried out at universities is typically intrinsic. Such finding has led to interpretation that future measurement system should also consider and embed qualitative factors to ensure lecturers can be intrinsically motivated in their academic works.

### 2.3. Performance measurement system (PMS) in universities

In realizing the importance of performance measurement system that can intrinsically motivate the lecturers, many studies have been conducted to investigate and propose the system. Franco-Santos (2016) proposed PMS using business canvas model. Their proposed model is based on the argument that "one size does not fit all". This is because each department in universities have different operating models. Thus, his proposed model design a system that enable university departments and centres to design and develop their own "sustainability model", which in turn may help them develop more appropriate performance measurement systems.

Franco-Santos (2016) presented their business modelling framework in the form of a "canvas" consisting of nine components: Customer Segments, Value Propositions, Customer Channels, Customer Relationships, Revenue Streams, Key Activities, Key Resources, Key Partners and Cost Structure. The Business Model Canvas becomes "a shared language for describing, visualizing, assessing and changing business models". In the context of universities, the term 'business' should be replaced with 'sustainability' as the overall mission of most

universities is not to make a profit. Thus he argues each department within the university will have its own 'Sustainability Model Canvas'. Such model can help universities to develop more strategic performance measures.

Chen et al. (2015) proposed a novel framework for evaluating teaching performance based on the combination of fuzzy AHP and fuzzy comprehensive evaluation method. Using this method, teaching performance index system was established after determining the factors and sub-factors of teaching performance. In the index system, the factor and sub-factor weights were then estimated by the extent analysis fuzzy AHP method. Employing the fuzzy AHP method in group decision-making can facilitate a consensus of decision-makers and reduce uncertainty.

Perkmann et al. (2011) proposed a performance measurement system for university-industry alliances. The system distinguishes between different process stages, including inputs, in-process activities, outputs and impacts. For each stage, specific measures are discussed and explained how they should be deployed. The resulting framework includes both prospective and retrospective measures and subjective and objective measures. The first stage of the process is input which is the mobilization of adequate resources consist of availability of resources, presence of high-quality researchers, and presence of motivated researchers. Research is an activity that has high fixed costs. Thus, working with industry allows firms to achieve economies of scale.

Second stage is in-process activities. It involves the presence of high-quality researchers and resources should encourage high-quality research. In the third stage, the above in-process activities should subsequently lead to the generation of actual outputs which consisting of generating new scientific knowledge that is publishable in peer-reviewed journals. In the final stage, the exploitation of these outputs should lead to a range of impacts, ranging from exploitation to exploration.

Despite of various model and approach in measuring performance of lecturers in universities, it is believed that the previous systems still lack of intrinsic motivation for lecturers to do the best in their work. This is because it does not take into account the path that the lecturers should follow in the next stages. A good system does not only take into account the status of their achievement, but in addition the system also should consider of what should they do if they have achieved certain measures of performance? Thus this study will fill the gap by proposing a system that takes into account the path of lecturers' career.

## 3. System description

Electronic Scholar Tracking System (E-STRAS) is an in-house system designed to help the university management team in monitoring the performance of lecturers and indirectly for lecturer's self-evaluation. The system is developed using software tools such as PHP Framework based on Codeigniter and MySQL. The main capabilities of E-STRAS are:

- Able to update lecturer's personal details and also their publication, research, innovation, reward,
- Able to monitor performance of lecturer either individually or based on faculty or zone.
- Able to link with university's internal information systems.
- Able to produce statistical reports on the number of lecturers in each pre-determined zone.

### 3.1. System requirements

#### 3.1.1. Targeted users

The identified users for the proposed system can be categorized to management and lecturers as follows:

- Management: Rector, Deputy Rector (HEA, PJI), Assistant Rector, Head of Faculty (HOF).
  Roles:

  1. Search and view individual records by staff ID or faculty name (However, HOF can only search and view the faculty's lecturers)
  2. Monitor progress and performance of lecturers.
  3. Able to give advice on lecturer's career path through personal message (in progress).

- Lecturers: All permanent lecturers.
  Roles:

  1. Add/update/view their details.
  2. Only can view their own status on pre-determine zones.

#### 3.1.2. Determinant parameter

The proposed system depends on four parameters to measure the performance of the lecturers. The parameters are as follows:

- Years of Service (YS) –duration of service or employment
- Salary Grade (SG) – compensation system that defines the amount of pay an employee will receive
- Confirmation Status (CS) – confirmation of appointment to end a probation period and to appoint an employee permanently.
- PhD Status (PS) – earned doctoral degree awarded by universities

### 3.2. Rules for monitoring system

This section elaborates the fundamental elements of the system which primarily depends on the determinant parameters. Thus, there are six (6) categories of zones identified for the system. The

rules for the monitoring process which is based on the zones (Fig. 1) are explained as follows:

### 3.2.1. Rule 1: Criteria fulfilment

- Blue zone – those who serve less than 3 years with grade DM45.
- Yellow zone – those who serve between 3 to 5 years with grade DM45 (lecturer) but not yet confirmed.
- Orange zone – those who serve between 3 to 5 years, permanent with grade DM45 (lecturer).
- Red zone – those who serve between 5 to 10 years, permanent but still with grade DM45 (lecturer).
- Maroon zone – those who serve more than 10 years, permanent with grade DM52 (senior lecturer) and hold PhD degree.
- Green zone – those who serve more than 10 years, permanent with grade DM54 (associate professor) and hold PhD degree.

The division of zones indicates not only the criteria that has been fulfilled but also the criteria that need to be fulfilled in order to move to the next zone.

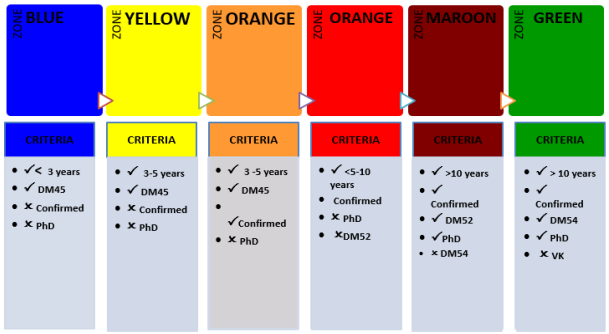


**Fig. 1:** Categories of Zone

### 3.2.2. Rule 2: Risky zone

The zones that lecturer must be in alert are yellow and red zone. This is because when they are in yellow zone, they must make sure to get confirmation of appointment within immediate time or face penalty from the university. If they are in a red zone, they must plan for promotion to grade DM52 or further their study. The management must be aware of the lecturers who are in this zone and motivates them to come out of the zone or fall under 'Comfort Zone'. Comfort zone is defined as those lecturers who are comfortable with their situation and does not have any motivation or initiative to upgrade them to meet with university's Key Performance Indicator (KPI).

### 3.2.3. Rule 3: Individual responsibility

Each lecturer is responsible to update information about them regarding their research, publication, innovation and awards received. Based on these inputs, management be able to generate reports and monitor lecturers' progress and performance.

### 3.3. System design and implementation

This section describes the database design and web application design which satisfies the specific needs and requirements as mentioned earlier in the previous section. It involves defining elements, interfaces and data for the system.

Oracle SQL Developer Data Modeler is adopted to model the logical structure of the database using Barker notation. At this stage, every object is defined clearly. It is to set the definition of the Entity, Attributes and Data Type. Each object should also be set to a Unique Identifiers. It also involves mapping process, which is performed by selecting the relationship type (Fig. 2). There are seven entities created where four of them are subtypes.

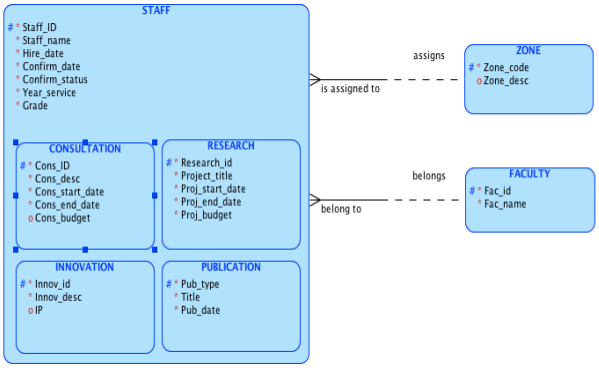


**Fig. 2:** Logical model of the proposed system

The logical model is then transformed to the relational schema (Engineer to Relational Model) as shown in Fig. 3. The conversion is necessary so that the model can be implemented directly in a database.

Next, we look into the database application for this project which is developed using PHP and MySQL. Before that, the algorithm shown below demonstrates the part where the system checks the rules of the system in determining the zone.

```
if SG = DM45 AND !PHD
  if !CS
    if YS < 3
      then ZONE = BLUE
    else if YS >= 3 AND YS < 5
      then ZONE = YELLOW
  else
    if YS >= 3 AND YS < 5
      then ZONE = ORANGE
    else if YS >= 5 AND YS < 10
      then ZONE = RED
else if SG = DM52 AND PHD
  if CS
    if YS >= 10
      then ZONE = MAROON
else if SG = DM52 AND PHD
  if CS
    if YS >= 10
      then ZONE = GREEN
```

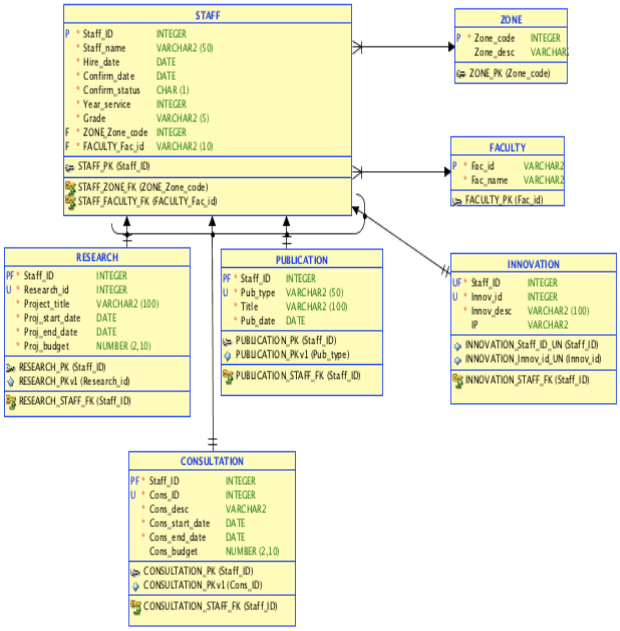


**Fig. 3:** Relational schema of the proposed system

The following is an example of line code to find research information by lecturer name:

```
<?php
$query = "SELECT Staff_Name, Zone_ID FROM Research";
$result = mysql_query($query);
?>
<p>
<label for = "Staff_Name" class = "fixed_required">Staff
Name: </label>
<select name="select_Staff" id="select_Zone" />
</p>
<?php
while ($line = mysql_fetch_array($result, MYSQL_ASSOC)) {
?>
<option value="<?php echo $line['Staff_ID'];?>"
<?php
    if(isset($_POST['select_Staff'])) {

    if(mysql_real_escape_string($_POST['select_Staff'])==$li
    ne['Zone_ID']) {
        echo "selected"

    }?>
    >
    <?php echo $line['Staff_Name'];?> </option>
    <?php>
```

## 4. Results and discussion

In this section, the final output and the benefits of the proposed system are presented. The sample interfaces of the web application, 'E-STRAS' is shown in Fig. 4 that depicts the main page of the system. This is the initial version of the proposed system. In this system two applications for two different users (management and lecturer) are developed that are linked to each other. Only lecturer of the university is permissible to access the information and services from the system since the system is using a private network.

For example, Fig. 5 shows a profile page for a lecturer who successfully login into the system. The status of the user will automatically be displayed on the screen along with other related details. The user can update their profile anytime, anywhere and the updated information will be feed to the management instantly.


**Fig. 4:** Landing page


**Fig. 5:** Successful login page with individual profile

Thus, the information is used by the management team to monitor the progress of the lecturers. It is possible since E-STRAS automatically update the lecturer's status by moving to the next zone when the four main criteria mentioned have been satisfied. The tracking is made easier since the system able to isolate lecturers who fall into the category of "Comfort Zone". With this information, management team can work on strategic plans to uplift this group and move them away from this category. Apart from that, the system able to produce statistical reports on the number of lecturers for each zone and faculty for auditing purposes. For lecturers, they are aware and alert of their current status, hence motivate them to achieve their profession target.

Despite all that, the system relies heavily on lecturers to key-in all the data required namely publication, consultation, paper presentation, innovation etc. In other words, the credibility and

objectivity of the system depend very much on the independence of the users to enter data into the system. It will be time-consuming and challenging since it requires full support from all lecturers to feed the data willingly. At the same time, there are existing internal information systems that cater for publication (PRISMA), research (IRMIS) and consultation (iCONS) separately. Therefore, the user might feel entering the same data on different systems as redundant works. This factor should be considered in the development of the proposed system.

## 5. Conclusion

Effective monitoring system can be best achieved through record keeping and proper reporting systems, to help in figuring out whether the lecturer deliver and perform to the desired university direction. With the implementation of E-STRAS, it helps to determine exactly when a lecturer is on track and when intervention may be needed for those who deviate from the track. This strategic role makes the system an important tool in measuring the performance of lecturers. The system successfully fulfils the basic requirements of its development. However, it can be further improved in the future.

The system should be embedded with personal message application between management and lecturer to exchange ideas and information directly. Other than that, data visualization feature such as graphs and charts could illustrate better the performance of lecturers. Finally, the system should provide a link to the university's internal information system so that the relevant information required by the proposed system can be updated easily.

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