Assessing Key Performance Indicators Monitoring System (KPI-MS) of a university using Technology Acceptance Model

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Abstract—**This article is based on the findings of a study that assessed the Key Performance Indicators Monitoring System (KPI-MS) of a university based on Technology Acceptance Model. The system was developed using PHP 5.2 as the scripting language and MySQL Community Server 5.0 as the databases management system. The assessment of the KPI-MS system was in terms of its perceived usefulness and perceived ease of use by the university users. The study was carried out using a survey questionnaire which was developed and modified from Davis's study on Technology Acceptance Model (TAM). This instrument was validated by three experts in the related field and the cronbach alpha value of reliability obtained was 0.955. A total of 78 participants from all the schools and centres in one of the public universities in northern Malaysia participated in the study. A descriptive analysis was carried out to obtain the mean scores of KPI-MS as rated by the users. The findings showed that the users rated KPI-MS as a very useful system in monitoring the KPI performance of their schools or centres. Besides, users also indicated that the KPI-MS is easy to use. In conclusion, KPI-MS system is accepted by the users in terms of perceived usefulness and perceive ease of use on the system.**

Index Terms—**Key performance indicators, key performance indicator monitoring system, technology acceptance model, perceive usefulness, perceived ease of use**

I. INTRODUCTION

Key Performance Indicator Monitoring System (KPI-MS) is an online monitoring system of Key Performance Indicator (KPI) that can be accessed anywhere and anytime. It was developed as a central storage using a robust database to enable various data storage. This system is an intelligent system where it is able to calculate raw data automatically to produce output information such as reports and charts. It has a single file structure which is easily maintained and it is compatible with corporate database structure. KPI-MS system is able to store multiple schools' and centers' information and the cumulative annual data can be retrieved and compared between years. This system was developed with the purpose of helping the schools and centres at a public university in northern Malaysia to store their KPI data, calculate KPI marks and then generate reports and charts. Besides, KPI-MS was developed to provide value-added services, such as online monitoring of each school's or centre's KPI accomplishments including performance comparison by year, between targeted and current accomplishment as well as between schools and centres.

A. KPI-MS and Ministry of Higher Education (MoHE)

Key Performance Indicator (KPI) is an index that evaluates the qualitative and quantitative performances of an organization or institution. In higher education institutions, KPI can be considered as an effective measure of the quality of the universities' output based on their planning and performance improvement. In fact, KPI marks contribute to the universities' rankings in the country and also in the world. According to Chan and Chan [1], KPI addressed several issues of output and outcomes as the measurement of the performance. In Malaysia, KPI is used as a requirement for the public higher education institutions in improving quality. The quality level of higher education institutions are determined by the effectiveness and efficiency of their performance [2]. The benchmark of the performance indicators was determined by the Ministry of Higher Education (MoHE) Malaysia. MoHE provides the benchmarks for the KPIs in order to enable public universities in Malaysia improve in their performance. They aspire to be the top 100 universities in the world. Key Performance Indicators Monitoring System (KPI-MS) is proposed as a tool to be used in collecting, collating, processing, reporting, and monitoring of KPI data. KPI-MS system is able to reduce the burden of each and every school and centre of the university and the university's central administration in preparing KPI performance reports. KPI-MS provides on-line monitoring of each school's and centre's KPI accomplishment services including performance comparison between targeted and current accomplishment, performance comparisons between schools and centres, and to compare the performance by years. Therefore, the proposed KPI-MS is an intelligent system with all the mentioned functionalities. KPI-MS was developed with the purpose of replacing the old KPI system- Excel Spreadsheet System. At this juncture, the assessment of the

KPI-MS system is seen as a necessary study especially from the users' point of view. The assessment of the system will show the effectiveness of the system from the users' perspective, perceived usefulness and perceived ease of use. This study used the Technology Acceptance Model as a theoretical framework. The findings obtained in this study will help to improve the monitoring system as well as fulfill users' preferences of the system.

B. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) is proposed by Fred Davis to study the users' intention to use a particular new information system [3]. This model was based on Ajzen and Fishbein's Theory of Reasoned Action (TRA) and Theory of Planned Behaviour [3][4]. Fig. 1 shows the model of TRA.
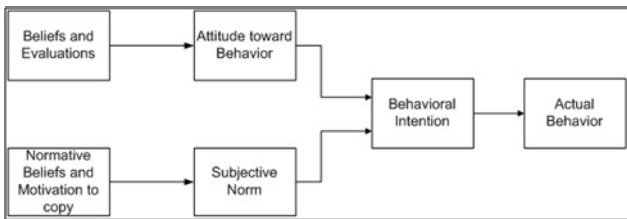

Fig. 1.Theory of Reasoned Action [5]

According to Fig. 1, TRA is constructed from three main components namely the behavioural intention, attitude and subjective norm. This theory suggests that a person's behavioural intention is determined by his or her attitude and subjective norm [6]. As for Technology Acceptance Model (TAM), it emphasizes on two particular behaviour, perceived usefulness and perceived ease-of-use. Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" while perceived ease-of-use is defined as "the degree to which a person believes that using a particular system would be free of effort" [7][8]. Fig. 2 shows the Technology Acceptance Model and the relationship between perceived usefulness and perceived ease-of-use in affecting behavioural intention to use a new system.
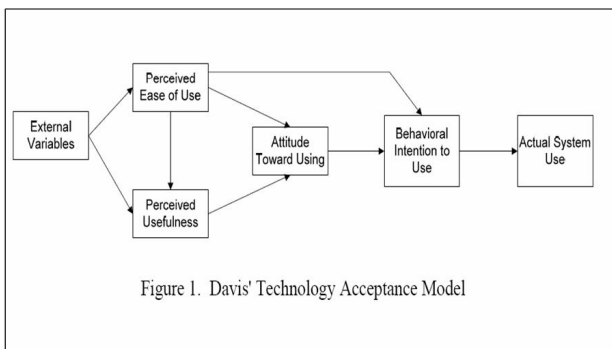

Figure 1. Davis' Technology Acceptance Model

Fig. 2.Technology Acceptance Model [9][10]

There are several studies done using TAM to test users' acceptance of a new system. Liu et. al. had used TAM to explore the factors that affect users' intention to use an Online Learning Community [9]. He found that the intention to use an Online Learning Community is strongly and directly affected by perceived usefulness while online course design indirectly affected the users' intention to use. Besides, Roca et. al. researched to find out users' continuance intention to use e-learning service. The findings showed that the users' continuance of intention was determined by perceived usefulness, system quality, perceived ease of use and cognitive absorption [10]. Ramayah and Ignatius also adapted TAM as the model in studying the behavior of consumers to shop online [11]. In line with all the research done, this research intends to assess users' acceptance of a newly developed KPI-MS on its usefulness and ease of use. The objectives of this research study are: (1) to assess the usefulness of KPI-MS system from the users' perspective and (2) to assess the ease of use of KPI-MS system by the users. This study generated three research questions as follows:

1) How is the assessment of KPI-MS in terms of usefulness?
2) How is the assessment of KPI-MS in terms of ease of use?
3) What features of the KPI-MS are preferred by the users?

II. METHODOLOGY

KPI-MS is an online KPI monitoring system. It was developed as central storage using a robust database. The robust database enables the system to store multiple schools' and centres' information with multiple years and the cumulative annual data can be retrieved and compared with different years. KPI-MS is an intelligent system where it is able to calculate raw data automatically to produce information. It has a single file structure which is easily maintained and it is also compatible with corporate database structure. KPI-MS system was developed using Windows XP Professional Operating System. Apache Web Server 2.0 was used to develop open-source HTTP server for operating system. This system uses PHP 5.2 as the scripting language to write the programme. MySQL Community Server 5.0 was chosen to use as the databases management system. However, the flow of the KPI-MS system was developed according to the outline provided by Malaysian Research Assessment (MyRA). The flow of KPI-MS is as illustrated in Fig. 3.
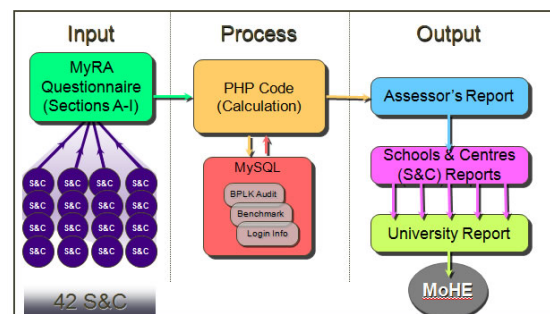
Fig. 3.System Flow of KPI-MS

According to the system flow, all the forty two schools and centre (S&C) of the university are required to input their KPIs data using the questionnaire provided by MyRA which consists of nine sections (Section A-I). The input data will be processed for their KPI marks calculation developed by using PHP code. The KPI marks will be audited by Corporate and Sustainable Development Division of the university

(*Bahagian Pembangunan Lestari dan Korporat,* acronymed as *BPLK* in the local language). The management database was developed using MySQL Community Server 5.0. The final stage of the system is to produce output of the KPIs data. The output will be in the form of reports of the schools' and centres' performance which will further contribute to the university's overall performance report. Fig. 4 shows the login page of KPI-MS.
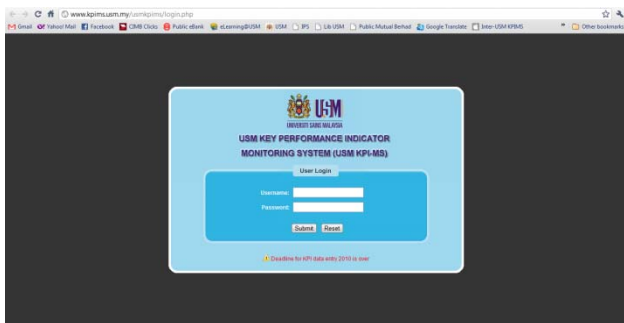

Fig. 4.Log in page of KPI-MS

KPI-MS is not only a useful system but it has a good visualization aspect as well. Adobe Dreamweaver CS5 was used in designing and developing the website to provide a more attractive user interface. The interface of the KPI-MS is as shown in Fig. 5.
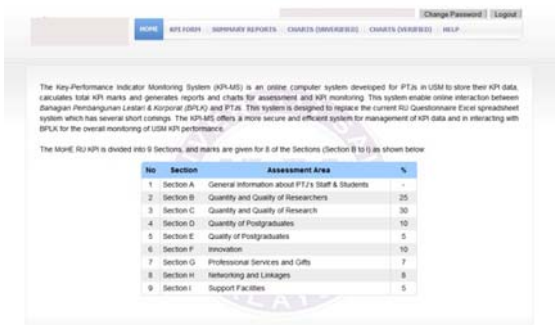

Fig. 5.Home page of KPI-MS

Three workshops were conducted to introduce KPI-MS to staff members in-charge of monitoring KPIs in their respective schools and centres. Altogether, 78 staffs from 42 schools and centres from one of the universities in northern Malaysia participated in these workshops. During the workshops, a brief explanation of the importance of KPI and data on university's performance was provided. After the introduction part of the workshop, the KPI-MS was introduced by demonstrating the capabilities and functions of the KPI-MS system. The participants were then given time to explore and use the KPI-MS system. A user manual was also given to the participants during the hands-on session to assist them in using the KPI-MS system on their own.

A. Participants and Research Instrument

Among the 78 participants, 34 are males and 44 are females. Each school or centre was represented by either two or three participants. The position of the participants is either lecturers or administrative officers. The staff in-charge of the KPI has a wide range of working experience. Almost half of the participants, 48.72 % of them, have 1 to 5 years of working experience. For the rest of them, 21.80 % have 6 to 10 years of working experience, 11.54 % have 11-15 years of working experiences, 7.69 % have 16-20 years of working experience and 5.13 % with 21-25 years of experience. Only 2.56 % each has 26-30 and more than 31 years of working experience. At the end of the workshop, all participants were requested to respond to a questionnaire form to rate the KPI-MS system in terms of their 1) Perceived Usefulness, and 2) Perceived Ease-of-Use. The research instrument consists of 4 background information items, 13 items on the perceived usefulness, 11 items on the perceived ease of use and 5 questions on the features of KPI-MS. This questionnaire used a four-point likert scale. The instrument was adapted and modified from Davis's Technology Acceptance Model (TAM) and has been validated by three experts each in the field of system development, instructional technology and psychometric. The reliability of this instrument has a Cronbach's Alpha value of 0.955. The statements for "Perceived Usefulness" and "Perceived Ease-of-Use" as in the questionnaire are shown in Table 1 and Table 2 below:

TABLE 1: STATEMENTS FOR "PERCEIVED USEFULNESS"

No.	Item
1	The system made my job easier.
2	Using this system gives me greater control of the data.
3	Using the system improves the monitoring of the KPI.
4	This system addresses the needs of the task.
5	The system enables me to accomplish tasks more quickly.
6	This system allows me to accomplish more work.
7	This system enhances the accessibility of the KPI data.
8	This system improves the quality of presentation of the KPI data.
9	This system improves the quality of the KPI record keeping.
10	The system reduces the chance of making mistakes during data entry.
11	This system is able to present KPI information clearly.
12	The system processes the KPI data accurately.
13	Overall, I find the system useful for monitoring my school's KPI performances.

TABLE II: STATEMENTS FOR "PERCEIVED EASE-OF-USE"

No.	Item
14.	I find the system easy to use.
15	I seldom make errors when using the system.
16.	Interacting with the system is easy to understand
17.	I find it easy to get the system to do what I want to do.
18.	Interacting with the system requires no mental effort
19.	I find it easy to navigate within the system.
20.	The system is flexible to interact with.
21.	It is easy for me to become skillful at using the system.
22.	I find it easy to learn how to use the system.
23.	I do not need a user manual when using the system.
24.	Overall, I find the system user-friendly.

B. Data Analysis

The data obtained in the study was analysis descriptively. The arithmetic mean ratings for each item were computed. The total score of each respondent in terms of "Perceived

ease of use" and "Perceived usefulness" were also computed. In ascertaining the construct measured by the questionnaire, the reliability of the two constructs was obtained separately. For "Perceived Usefulness", the Cronbach's alpha is 0.915 and for "Perceived Ease of Use" it is 0.945. These indices indicate a very high consistency within the items being measured. The overall cronbach alpha reliability index for the questionnaire is 0.955.

III. FINDINGS

A. Perceived Usefulness and Ease of Use of KPI-MS

Table 3 shows the data of the usefulness and ease of use scores achieved by the users that utilized the KPI-MS monitoring system. The results obtained are in terms of mean (μ) score, standard deviation, minimum and maximum scores.

TABLE III: DIFFERENCES BETWEEN GROUPS USING THE PAIRED-SAMPLES T-TEST

	N	Mean	Min.	Max.	SD
Usefulne ss Score	78	46.49	36	52	4.927
Ease-of-use Score	77	37.77	27	44	4.710

The four-point scales indicated strongly disagree, disagree, agree and strongly agree. There are thirteen items for the section on "Perceived Usefulness" which scores the maximum score of 52. The mean score obtained for usefulness of KPI-MS is 46.49 which signify that using KPI-MS can make their work easier. The result revealed that users strongly agree that KPI-MS is very useful.

In terms of ease of use of the system, there are altogether eleven items in the section on "Perceived Ease of Use". This section has a maximum score of 44 and the minimum score is 27. The mean score obtained in this section is 37.77 which indicate that users strongly agreed that KPI-MS system is very easy to use to complete their tasks. The results revealed that using KPI-MS is totally free of effort and users find no problem in handling the system.

B. Features of KPI-MS

As indicated in Table 4, the result shows that all five new features of the KPI-MS obtained high mean score which is 3.50 and above out of 4.00. This indicates that all the features in KPI-MS were well received by the participants of the workshops. "Instantaneous charting" feature was especially very well received by the participants as it has the highest rating among all other features with a mean score of 3.82. Although the other four features on "Networking capability", "Data Security", "BPLK online feedback" and "Multiuser" were rated slightly lower, they were nonetheless, considered as "very useful". All the features obtained a very low standard deviation which is below 1.00 that shows the deviates in rating from the participants were small. However, the larger standard deviation for "Data Security" shows that there is a bigger difference of ratings on this feature by the participants. The overall results obtained shows that all of these features are well accepted and needed by all the users to

make their job easier.

TABLE IV: FEATURES OF KPI-MS

Features of KPI-MS	Mean score	SD
Networking capability	3.51	0.503
Data security	3.55	1.088
Multiuser capability	3.63	0.814
Instantaneous charting capability	3.82	0.743
BPLK online feedback	3.68	0.468

IV. DISCUSSION

A. Perceived Usefulness of KPI-MS

KPI-MS obtained an overall mean score of 46.49 for its usefulness of the system. From all the items as illustrated in Fig. 6, the users generally rated "strongly agree" where the mean score of all items are more than 3.00. Users especially strongly agreed that KPI-MS system has improved the quality of presentation of KPI data and KPI data record keeping. These items scored the highest scores amongst all which is 3.72. However, the lowest mean score goes to "The system addresses the needs of the tasks". This is probably because users do not agree strongly that KPI-MS is a perfect system. Users hope this system will be able to have more functions in order to complete their task. This finding conformed to the results obtained from several studies such as that conducted by Davis [5]. Besides, findings obtained from the researchers that adopted TAM in studying the intention of using a technology such as researched by Hung-Pin Shih had also supported that perceived usefulness has strongly attributed to the use of Internet for information seeking [12]. Thus, the usefulness of the system is important in affecting the users' attitude towards using an informational system. The usefulness score obtained in this study will help to improve the system through designing in order to be accepted by the users.
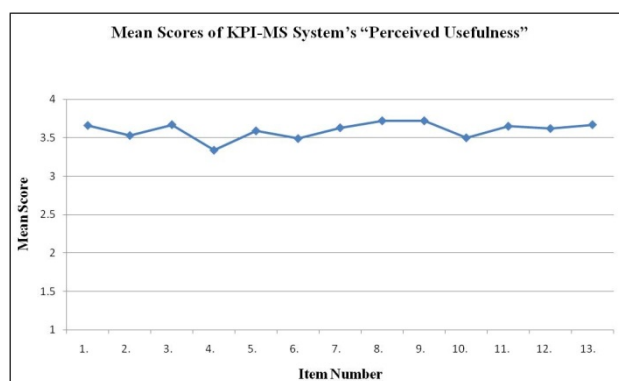

Fig. 6.Mean Scores of KPI-MS System's "Perceived Usefulness"

B. Perceived Ease of Use of KPI-MS

KPI-MS has a total mean score of 37.77 for its "ease of use" component of the system. Again, all the items have scored more than 3.00 out of the four-point scale which means the users generally agree or strongly agree that KPI-MS system is easy to use. The users rated the first item in this section "I find the system easy to use" the highest amongst all which clearly shows that using KPI-MS is totally free of effort. Besides, it has the lowest standard deviation

which indicates that users are rating similarly. On the other hand, the item on "I do not need a user manual when using the system" has the lowest mean score amongst all. Some users feel that the user manual provided help in understanding KPI-MS fully whereas the others feel that KPI-MS is not complicated to use thus a manual is unnecessary. This item has a higher standard deviation signifying that users rated it differently. Ease of use of a system is rather important as it determines the users' intention to use a particular system. Research conducted by Park et al. also shows that perceived ease-of-use of the library system had significant impact on the perceived usefulness of the system [13]. This study again conformed several studies done using Technology Acceptance Model [5][7][10]. Fig. 7 shows the graph of mean scores obtained by all items for the section on "Perceived Ease of Use".
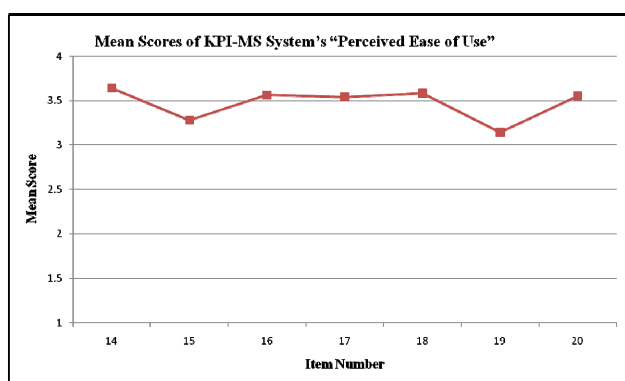

Fig. 7.Mean Scores of KPI-MS System's "Perceived Ease of Use"

C. Features of KPI-MS

There are five features which are emphasized by KPI-MS. These are networking capability, data security, multiuser capability, instantaneous charting capability and BPLK online feedback. KPI-MS is the first online KPIs system used in the university. Users are able to manage their marks anywhere and anytime. KPI-MS saved data in a more secure way using online robust database where only staff in-charge of KPIs marks will be able to log into the KPIs profile. KPI-MS also enables more than one person to manage a school's KPIs data. Another feature of KPI-MS is the instantaneous charting capability which makes the users work much easier. Charts in animation are provided within a click. Finally, this system enables *BPLK* to audit the schools and centres marks and provide online feedback instead of through emails or other forms of communications. All these features definitely enhance users' tasks. From the result obtained above, users received all these features very well. They mostly agreed strongly about the relevance of the features after testing and using KPI-MS. Most of the users liked the animation charting functions very well where instantaneous charting capability scored 3.81 marks, which is the highest rate of all. The standard deviation is also rather small which indicates users rated the items similarly. However, data security feature has a larger standard deviation, which is 1.088. This is because the security of the system is rather invisible and some users are not very sure of its functionality. Fig. 8 shows the graph of mean scores obtained for all the five KPI-MS new features.
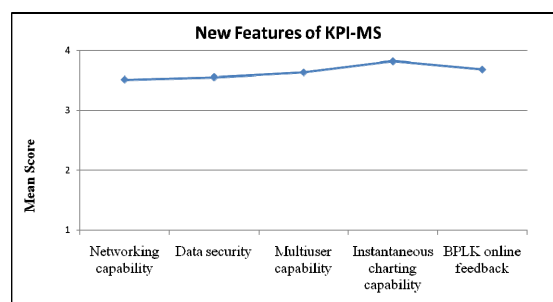

Fig. 8.New Features of KPI-MS

V. Conclusion

As a summary, KPI-MS is well accepted by its users in terms of the system's usefulness and ease of use. Users generally found that this system is truly useful in providing most of the functions needed in completing the tasks. KPI-MS has enhanced their works and reduced their time of working. Besides, KPI-MS is also not complicated to be used. Users found no efforts at all when handling the system. Although a user manual was provided, most of the users did not need a manual to use the system. Besides, users strongly agreed to all the features of KPI-MS. In this era of technology, an on-line system is a must. Data security feature is essential to protect KPI data as it will affect the performance of the whole university. Multiuser capability enable more than one officer to log into an account thus more work can be done at the same time. Instantaneous charting capability saved the users' time in monitoring their schools' and centres' performance. Finally, an on-line feedback capability not only made the staffs' work easier, it also supports sustainability. To conclude, KPI-MS is well accepted not only due to its usefulness; users also found that this system is very user-friendly and all the features introduced were necessary in enhancing their work.

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