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User Acceptance of Key Performance Indicators Management Systems in a Higher Education Institution in Malaysia: A Pilot Study

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ABSTRACT

This article discusses the users' acceptance of two performance management systems, namely Excel Spreadsheet System (ESS) and Key Performance Indicator Monitoring System (KPI-MS). Key Performance Indicator (KPI) is an index used in measuring an individual's, organization's or institution's performance. ESS is a system provide by Malaysia Ministry of Higher Education (MoHE) and has been in used since year 2008. KPI-MS was developed later as a tool using PHP 5.2 and MySQL Community Server 5.0 databases with determination to replace ESS which has several shortcomings. The acceptance study of both management systems is in terms of its accuracy, perceived usefulness and perceived ease of use. This study was done by using a survey questionnaire. The instrument of this study was developed and modified from Davis's Technology Acceptance Model (TAM). A total of 19 participants from two of the campuses of Universiti Sains Malaysia (USM) participated in this study. This research instrument had been validated by three experts in the related field and scored reliability at Cronbach alpha value of 0.843. A comparison study was done to evaluate the accuracy of KPI-MS while descriptive analysis was conducted to determine the mean scores of KPI-MS and ESS rated by users. The findings showed that KPI-MS computed KPI marks accurately and the users also rated KPI-MS as more useful in monitoring KPI performance of their schools or centres compared to ESS. Besides, the users also indicated KPI-MS is more user-friendly. In conclusion, KPI-MS system is prefered by the users as an effective system.

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Keywords:
Key performance ındicators, key performance ındicator monitoring system, technology acceptance model, accuracy, perceive usefulness, perceived ease of use.

Introduction

Key Performance Indicator Monitoring System (KPI-MS) is a KPI management and monitoring system. It was developed with networking capability and can be accessed anywhere and anytime. It has a central storage developed using a robust database to enable various data storage (Muniandy, Ong, Phua, & Ong, 2011a; 2011b). This system was developed as an intelligent system to be able to calculate raw data automatically and then produce output information such as reports and charts. Since KPI-MS was developed using a single file structure only, it can be easily maintained and compatible with corporate database structure. This system is capable to store multiple schools' and centres' information with multiple years. Besides, the cumulative annual data can be retrieved and compared with different years. The main purpose of developing this system is to help schools and centres in the university to store their KPI data, calculate KPI marks and then generates reports and charts. In addition, KPI-MS was developed to provide other services such as online monitoring of each school's or centre's KPI accomplishments including performance

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comparison by year, between targeted as stated in the benchmark and current accomplishment as well as between schools and centres. KPI-MS is a newly developed system with several new features, as a result for that, there is a need to study the acceptance of the KPI-MS system from the users' point of view. The acceptance of the system is referring to the effectiveness of the system especially its accuracy, perceived usefulness and perceived ease of use of the system. Technology Acceptance Model (TAM) relates perceived usefulness and perceived ease of use of a new information system with the users' intention to using it. Hence, this study supported TAM model.

KPI and Ministry of Higher Education (MoHE)

Key Performance Indicators (KPI) is a performance measurement index that evaluates the qualitative and quantitative performances of an organization or institution (Xiong, Qin, Wang, Hu, & Shi, 2010). It is generally used in the corporate world to measure the employees' performance in order to improve competitiveness among one another. According to Chan and Chan (2004), KPI is a tool that measuring critical aspects to improve the output and outcomes for success. However, KPI is also being applied and used in the higher education institution. In higher education institutions, KPI is an effective measure to the quality of the universities' output that used in planning and improving universities' performance. The quality level of the higher education institutions were determined by the effectiveness and efficiency of their performance (Dahan, et al., 2007).

In Malaysia, KPI was introduced to the public higher education institutions for quality improvement especially those research intensive university by the Ministry of Higher Education (MoHE). As stated by Zhou et al.(Zhou, Wang, Han, & Zhang, 2010), academic staff in research intensive university strongly affects the performance of their university. The benchmark of the performance indicators in Malaysia was determined by MoHE for the universities in Malaysia to achieve the status as a Research University (RU) with referred to Malaysian Research Assessment (MyRA) instrument. The instrument consists of nine sections (Section A-I) of measurement. The measurements are on the general information, quantity and quality of researchers, quantity and quality of research, quantity of postgraduates, quality of postgraduates, innovations and intellectual property, professional services and gifts, networking and linkages, and support services. 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 for the measurement mentioned above. It is able to lighten the job of schools and centres of the university and the university's central administration in collecting KPI data and preparing KPI performance reports.

Technology Acceptance Model (TAM)

Davis proposed Technology Acceptance Model (TAM) to study the users' intention to use a particular new information system in the year 1986 (Davis, 1986). His model was proposed based on Ajzen and Fishbein's Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (Ajzen, Fishbein, & Heilbroner, 1980; Davis, 1986). Since then, studies had been done by using TAM to study the users' acceptance on a new system. Most of the researchers studied systems for example on-line learning system, e-learning services and web-based information system. However, none of the studies had carried on the acceptance of KPI monitoring system. Liu et al. studied TAM to explore the factors that affect users' intention to use an Online Learning Community (Liu, Chen, Sun, Wible, & Kuo, 2010). His findings had shown that the intention to use the Online Learning Community was strongly and directly affected by the perceived usefulness of the system. Meanwhile, the online course design affected the users' intention to use indirectly. Besides, Roca et al. also used TAM to study the users' continuance intention to use an e-learning service. The findings showed that the users' continuance intention was determined by perceived usefulness, system quality, perceived ease of use and cognitive absorption (Roca, Chiu, & Martı´nez, 2006). In line with all the research done, such a study is applied to study the users' acceptance on the newly developed KPI-MS on its usefulness and ease of use. The need of carrying out of this study is to solve the problems faced by the users when using KPI-MS so that the developed system could help users to the fullest in completing their

tasks. The objectives of this research study were (1) to study the accuracy, (2) usefulness, and (3) ease of use of both systems.

This study generated four research questions as follows:

i. How is the acceptance of KPI-MS in terms of accuracy compared to ESS?
ii. How is the acceptance of KPI-MS in terms of usefulness compared to ESS?
iii. How is the acceptance of KPI-MS in terms of ease of use compared to ESS?
iv. What features of the KPI-MS are accepted by the users?

Methodology

Microsoft Excel Spreadsheet (ESS) is a system provided by Malaysian Ministry of Higher Education (MoHE) for KPI data calculation and has been used since the year 2008. It has a very simple user interface. However, the reliability of ESS has been questioned by certain quarters as the formula set for the KPI marks calculation could be easily tempered and modified that caused the management to spend more time in checking the marks submitted. Therefore, a system such as KPI-MS was developed in order to replace the current ESS system. Figures 1 and 2 show the interface of ESS and the cumulative summary of KPI marks in the ESS system.

RU KPI QUESTIONNAIRE - APPLICATION FOR RU GRANT

Name:

PTJ:

SECTION A: GENERAL INFORMATION

No.	Data	Tahun .....
1	Number of Academic Staffs	0
	a. Professors	
	b. Associate Professors	
	c. Senior Lecturers	
	d. Lecturers	
2	Number of local and foreign POSTGRADUATE students.	
	a. PhD	
	b. Postgraduates by Research	
	c. Postgraduates (Foreign)	

Figure 1. The interface of KPI form in Excel Spreadsheet system (ESS).

KPI Marks for RU Application

Name: 0

PTJ: 0

No	Summary and Total Marks	Marks Obtained	Full mark
1	Section B: Quantity and Quality of Researchers	#DIV/0!	25
2	Section C: Quantity and Quality of Research	#DIV/0!	30
3	Section D: Quantity of Postgraduates	0.00	10
4	Section E: Quality of Postgraduates	0.00	5
5	Section F: Innovation	#DIV/0!	10
6	Section G: Professional Services and Gifts	#DIV/0!	7
7	Section H: Networking and Linkages	#DIV/0!	8
8	Section I: Support facilities	0.00	0
	Total	#DIV/0!	95

Figure 2. Cumulative Summary of KPI Marks in ESS.

KPI-MS is an online KPI monitoring system which can be assessed anywhere and anytime. It was has a central storage developed using a robust database that enables the system to store multiple schools' and centres' information with multiple years. The cumulative annual data and information 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. KPI-MS can easily maintain due to its single file structure which is also compatible with corporate database structure. It was developed using Windows XP Professional Operating System. The open-source HTTP server for operating system was developed by Apache Web Server 2.0 and the system was written using PHP 5.2. MySQL Community Server 5.0 was chosen to use as the databases management system. This flow of KPI-MS system was developed according to the outline flow provided by MoHE with referring to Malaysian Research Assessment (MyRA). The KPI-MS system flow is as illustrated in Figure 3.

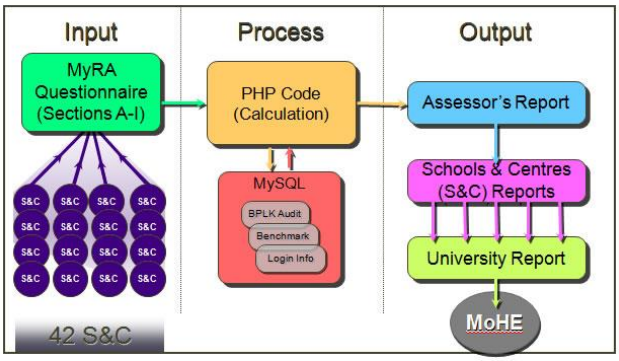


Figure 3. System Flow of KPI-MS.

According to the system flow above, all the schools and centres of the university are required to submit their KPI scores using the questionnaire provided by MyRA. This questionnaire has nine sections (Section A-I). Section A is on General information of the schools and centres which included information on number of academic staff and total number of full time students. Section B is the aspects on the Quantity and Quality of Researchers while Section C is the information of Quantity and Quality of Research. Section D provides information on the Quantity of Postgraduates and Section E provides information for the Quality of Postgraduates. Section F and Section G are on the Innovation and Intellectual Property; Professional Services and Gifts. Networking and Linkages built were in Section H and lastly, Section I for Support Services. Input data from all the schools and centres of the university will then being processed for KPI marks calculation which developed using PHP code. KPI marks input will then be audited by Corporate and Sustainable Development Division (*Bahagian Pembangunan Lestari dan Korporat,* acronymed as *BPLK* in the local language). The management database included BPLK audit information, setting benchmark and login info was developed using MySQL Community Server 5.0. Final stage of the system is to produce output for the KPIs marks from the assessor's report to the schools' and centres' performance which then contribute to the university's performance report. The interface of the KPI-MS home page is as shown in Figure 4.

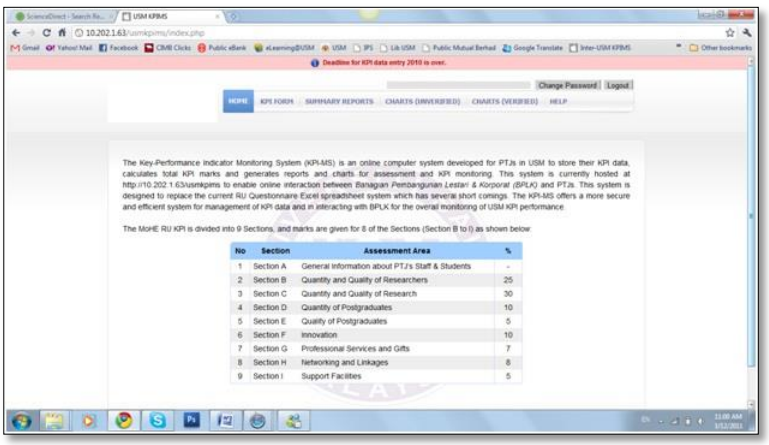


Figure 4. Home page of KPI-MS.

Two workshops were conducted to the staff in-charge of monitoring KPIs in their respective schools and centres to introduce KPI-MS. Altogether, 19 staff from two of the campuses of USM participated in these workshops. The workshops were started by giving a brief explanation of the importance of KPI and data on university's performance and incentives given. The ESS system which is being used currently were shown. The process of collecting, collating and processing of all KPI data using ESS were explained. After that, the participants were introduced to the KPI-MS system by demonstrating the capabilities and function of the system. After presenting both the systems, the participants were then given time to explore the KPI-MS system and compare the effectiveness of both systems. A user manual was also provided to help the participants in handling KPI-MS system on their own. Lastly, a survey form was distributed for this study.

Participants

Among all the participants, 8 are males and 11 are females. There were from 12 schools and centres of the two campuses. Each school or centre was represented by either one or two participants. Most of the participants are the administrative officers of their respective school or centre and only few of them are lecturer. All these participants had a wide range of working experience. The highest percentage of the participants had 6 to 10 years of experience, which is 42.11%. The following is 36.84% of them had 1 to 5 years of working experience. For the rest of them, 10.53% had 16 to 20 years of working experience, while 5.26% each had 11-15 and more than 20 years of working experiences.

Research Instrument

A study on the **effectiveness** of ESS and KPI-MS was done by conducting a questionnaire survey among the users exposed to ESS and KPI-MS. All the participants were requested to respond to a questionnaire form to rate both systems after exploring. They were evaluated in terms of their 1) **Accuracy,** 2) **Perceived Usefulness**, and 3) **Perceived Ease-of-Use**. This questionnaire instrument consists of 4 background information items, 13 items on the perceived usefulness, 9 items on the perceived ease of use and 5 questions on the features of KPI-MS. The questionnaire obtained a four-point scale. The instrument was adapted and modified from Davis's Technology Acceptance Model (TAM) and 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 0.843.

Data Analysis

In analyzing the results, the data obtained were from the 19 participants. However, 3 participants from Centre for Knowledge, Communication and Technology (Pusat Pengetahuan, Komunikasi dan Teknologi, acronymed *PPKT* in the local language) were excluded from the analysis as they attended the workshop for the purpose of knowing the system only. PPKT is a service centre which does not have KPI marks. Descriptive statistics were performed using the *Statistical Package for the Social Sciences (SPSS) for Windows Version 17.0* to analyse the collected data.

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. For checking of the construct measured by the questionnaire, the reliability of the two constructs were obtained separately. For "Perceived Usefulness", the Cronbach's alpha is 0.970 and for "Perceived Ease of Use" is 0.817 These indices indicate a very high consistency within the constructs being measured. The reliability of the questionnaire in overall was 0.843.

Accuracy of KPI-MS

The computed marks collected from KPI-MS were compared with marks calculated using Excel spreadsheet. This comparison was done only among ten schools/centres as some schools/centres are yet to obtain their complete KPI data. The findings obtained revealed that the marks computed by KPI-MS were

exactlt the same with marks calculated by using Excel spreadsheet, except for one school, which is School C. Table 1 shows the KPI marks computed using KPI-MS and Excel spreadsheet.

Table 1. KPI Marks Computed by KPI-MS and Excel Spreadsheet.

PTJs	Excel Spreadsheet	KPI-MS
School A	97.3	97.29
School B	72.1	72.11
School C	151.1	150.35
School D	49.6	49.62
School E	87.5	87.50
School F	80.1	80.05
School G	32.6	32.58
School H	57.1	57.07
School I	93.4	93.39
School J	48.5	48.50

Perceived Usefulness and Perceived Ease of Use of KPI-MS

After utilizing KPI-MS system, the data of the usefulness and ease of use scores achieved were analyzed and shown in Table 2. The analyzed data were in the mean (μ) score, minimum and maximum scores, and standard deviation (SD).

Table 2. Descriptive Statistics for Perceived Usefulness and Perceived Ease of Use Score.

	Statistic (N=16)			
	Perceived Usefulness Scores		Perceived Ease of Use Scores	
	ESS	KPI-MS	ESS	KPI-MS
Mean (μ)	30.19	46.44	20.88	28.69
Standard Deviation (SD)	5.552	4.049	2.473	4.393
Minimum Rating	24	39	18	23
Maximum Rating	39	51	26	36

There are altogether 13 items to evaluate about the usefulness of KPI-MS. With the four-point likert scale, perceived usefulness of KPI-MS scored 51 as the maximum mark and 39 as the minimum mark while ESS only scored maximum mark of 39 and minimum mark only 24. "Perceived Usefulness" of KPI-MS obtained 46.44 of mean score compared to ESS with mean 30.19 only. These scores indicate that all the users are either agree or strongly agree that KPI-MS system was useful for them and the users only agree on certain function of ESS as useful to them.

In terms of "Perceived Ease of Use" of the system, there are 9 items in the questionnaire. The maximum score of KPI-MS for this is 36 and minimum mark is 23 whereas ESS only obtained 26 marks as maximum and 18 marks as minimum. The mean score of KPI-MS obtained in this section is 28.69 which indicates that

some users strongly agreed that KPI-MS system is a system very easy to be use in completing their tasks. However, the minimum score of 22 was because of the missing data of the participants due to uncompleted survey form. As for ESS, the mean score on the perceived ease of use of the system is only 20.88. The results revealed that using KPI-MS is totally free of effort compared to ESS and users find no problem in handling the system at all.

Features of KPI-MS

Table 3 shows the result rated by the users on all five features of KPI-MS. The result revealed that all the five features had obtained high mean score which is 3.50 and above out of 4.00. This result indicates that all the features in KPI-MS were highly accepted and received by the participants of the workshops. Amongst all, "Instantaneous charting" feature scored the highest rating with a mean score of 3.93. The other four features on "Networking capability", "Data Security", "BPLK online feedback" and "Multiuser" were also scored high ratings which were considered as "very useful". All these features obtained a very low standard deviation (<1.00), which shows the low deviates in rating from the participants. The results obtained shows that all of these features are well accepted and needed by all the users to make their job easier.

Table 3. New Features of KPI-MS.

Features of KPI-MS	Mean score	SD
Networking capability	3.71	0.469
Data security	3.50	0.522
Multiuser capability	3.54	0.519
Instantaneous charting capability	3.93	0.267
BPLK online feedback	3.64	0.497

Discussion

Accuracy of KPI-MS

The accuracy of KPI-MS was proven through the computed marks by using KPI-MS and Excel spreadsheet system. KPI-MS provided a more accurate mark where the marks were in two decimal places. This is very important to indicate the ranking of the schools and centres in the university as their KPI marks are very close to one another. An accurate system is also important in affecting the users' intention to use the system. This is due to that the KPI marks obtained by a particular school or centre will indicate the incentive given to them. Anyway, there was a minor difference on the marks for School C. This was due to the corruption of formula in Excel spreadsheet. Therefore, it is clearly shown that there is a need to develop a system like KPI-MS to lock the formula for calculation.

Perceived Usefulness of KPI-MS

KPI-MS obtained an overall mean sore of 46.44 for its usefulness of the system compared to 30.19 mean score for ESS. According to Table 4, users generally rated "agree" for all the items where the mean score of all items were more than 3.00. The small SD values indicate that the deviation of ratings is rather small. Users especially strongly agreed that KPI-MS system had enhanced the quality of presentation of KPI data. This item scored the highest scores amongst all which is 3.81 out of 4.00. However, the lowest mean score goes to "The system addresses the needs of the tasks". This is due to users did not agree strongly that KPI-MS is a perfect system and hoped to have more functions in order to complete their task. For ESS system, all the items did not reach a mean score of 3.00, which is "agree". This indicates that the users generally think that ESS is definitely not a useful system for KPI data collection. The mean scores of each items presented in

Table 4 clearly show that the users actually rated between of agree and disagree compared to KPI-MS system which has a clear indication towards agree and strongly agree. This can also be proven from the low mean score of 2.19 where the users disagree that ESS can allow them to accomplish more work and also disagree that it can reduce their chances of making mistake. These finding conformed to the results obtained from several studies such as that conducted by Davis (1993). The usefulness of the system is important in affecting the users' attitude towards using an informational system. Besides, users will not bother to use a particular system if it was not helpful in completing their work. The usefulness score obtained in this study will help to improve the system to be accepted by the users.

Table 4. Mean Scores of KPI-MS System's "Perceived Usefulness".

No.	Item	ESS		KPI-MS	
		Mean	**SD**	**Mean**	**SD**
1.	The system made my job easier.	2.38	0.500	3.80	0.414
2.	Using this system gives me greater control of the data.	2.63	0.500	3.44	0.512
3.	Using the system improves the monitoring of the KPI.	2.44	0.629	3.69	0.602
4.	This system addresses the needs of the task.	2.56	0.512	3.25	0.683
5.	The system enables me to accomplish tasks more quickly.	2.31	0.704	3.75	0.447
6.	This system allows me to accomplish more work.	2.19	0.655	3.56	0.512
7.	This system enhances the accessibility of the KPI data.	2.31	0.793	3.81	0.403
8.	This system improves the quality of presentation of the KPI data.	2.20	0.414	3.75	0.447
9.	This system improves the quality of the KPI record keeping.	2.44	0.512	3.62	0.500
10.	The system reduces the chance of making mistakes during data entry.	2.19	0.544	3.62	0.500
11.	This system is able to present KPI information clearly.	2.31	0.602	3.69	0.479
12.	The system processes the KPI data accurately.	2.69	0.751	3.62	0.506
13.	Overall, I find the system useful for monitoring my school's KPI performances.	2.33	0.617	3.75	0.447

Perceived Ease of Use of KPI-MS

KPI-MS has a total mean score of 28.69 for its ease-of-use of the system while ESS obtained only 20.88 mean score. Again, all the items have scored more than 3.00 out of the four-point scale for KPI-MS system which means the users are generally agree or strongly agree that KPI-MS system is easy to use except for one. The item on "I am not confuse when using the system" as in Table 5 below scored the lowest mark, which is 2.81. This is due to the negative way of asking confused the participants in rating this item. However, the participants rated a mean score of 3.62 for the item "Overall, I find the system user-friendly" which clearly delivered the users' experience in using KPI-MS. As for ESS system, the users generally rated between agree and disagree again. This can clearly be seen from the low mean scores obtained for each item, which is below a mean of 3.00. According to Table 5, only a mean score of 2.44 for the item "Overall, I find the system user-friendly". This result has clearly shown that the intention of the users to accept the ESS system as necessary for them in recording their KPI data. Ease of use of a system is rather important as it determines the users' intention to use a particular system. A complicated system will cause difficulty for the users while using and thus lower their intention to using it. This study again conformed several studies done on Technology Acceptance Model (Davis, 1989, 1993; Park, Roman, Lee, & Chung, 2009). Table 5 shows the mean score and standard deviation of all items in the section of "Perceived Ease of Use".

Table 5. Mean Scores of KPI-MS System's "Perceived Ease of Use".

No.	Item	ESS		KPI-MS	
		Mean	SD	Mean	SD
14.	I am not confuse when using the system.	1.87	0.619	2.81	1.047
15.	I do not make errors when using the system.	2.50	0.516	3.13	0.885
16.	Interacting with the system is not frustrating.	2.73	0.704	3.27	0.704
17.	I do not have any problem using the system.	2.44	0.964	3.19	0.834
18.	Interacting with the system does not require much thinking.	2.07	0.799	3.13	0.834
19.	I find it easy to navigate within the system.	2.67	0.617	3.56	0.727
20.	The system is flexible to interact with.	2.12	1.025	3.00	1.069
21.	I feel comfortable using the system.	2.50	0.730	3.56	0.814
22.	Overall, I find the system user-friendly.	2.44	0.629	3.62	0.806

Features of KPI-MS

KPI-MS emphasized five features which are networking capability, data security, multiuser capability, instantaneous charting capability and BPLK online feedback. KPI-MS is the first online KPI system used in the university to monitor KPI marks. Such a system is vital and necessary in this era of technology. KPI-MS also provides a more secured method of data storage. The data will only be visible to the staff-in-charge. Besides, instantaneous charting capability makes the users work much easier by producing charts in animation are provided within a click. Finally, on-line BPLK feedback enables the audit job on the schools' and centres' marks made on time and easily. From the mean scores obtained, all these features definitely received very well by the users. Most of the users liked the animation charting functions very well where instantaneous charting capability scored 3.93 mean score, which is the highest rate of all. The standard deviation is also rather small which indicate users rated similarly.

Conclusion

As a summary, study done on the acceptance of KPI-MS has shown that it is well accepted by its users in terms of the system's accuracy, usefulness, and ease of use. Users generally found that this system is truly useful for them to complete their tasks. KPI-MS has enhanced their works and reduced their time of working. Besides, KPI-MS is also very user-friendly. Most of the users had no problems in handling KPI-MS system without a user manual. They strongly agreed all the features of KPI-MS had been received and were necessary for them. Users especially like the beautiful charting which was developed using flash. This has shown that a system is accepted not only because of its perceived usefulness and perceived ease-of-use but visualization also contributed.

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 needed in enhancing their work.

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