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**EFFECTIVENESS OF USING BIOMETRIC ATTENDANCE SYSTEM (FINGER PRINT) IN
PUBLIC SECTOR: A CASE STUDY OF ABC UNIVERSITY, SRI LANKA**

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Abstract

Managing and monitoring attendance of employees is a very important aspect for smooth functioning of any public or private organization. In order to avoid human bias and direct human intervention, government institutions have implemented Biometric Attendance System to record employee attendance on daily basis. This research aims to understand the nature, employees' attitudes, issues and challenges of Biometric Attendance System. Employees belong to five categories of a university have been selected as the sample and questionnaires and structured interviews were used to collect the data. In addition to descriptive methods, reliability (Cronbach's alpha & KMO Bartlett tests), regression and correlation analysis were used to analysis the data. Hosmer-Lemeshow test was applied to determine the goodness in fit in the model in regression analysis. The study revealed that attitudes towards Biometric attendance system depend on job category, age, work experience and gender. According to the developed indices, employees think that previous manual system had difficulties while current biometric attendance system made them feel easy and supervision on employees has been increased as well. Current biometric system has to bear more expenditure than previous manual system. There are four important factors affecting the overall attitudes towards the biometric attendance system; prevailing attitudes towards manual attendance system which affect negatively, general attitudes towards biometric system, attitudes on supervision, and attitudes on efficiency which are positive. The study also indicates the issues and challenges faced in Biometric attendance System including possible misconducts done by operators, inability to ensure the presence inside the office and issues in marking attendance when working at outstations. Suggestions to improve existing loopholes of the system and policy implications have also been highlighted. The study can be further extended to analyze effectiveness of Biometric Attendance System on other government institutions.

Keywords: Biometric attendance system, Fingerprint, Employee attitudes, Issues and Challenges

Introduction

Background of the study

Attendance management is the act of managing attendance or presence in a work setting to minimize loss due to employee downtime (ArunPrasad et al., 2017). Attendance is used for various purposes including record keeping, overtime payments, and promotions. The management of attendance of the employees is a complex but necessary task, since the presence of officials in offices directly impacts productivity and efficiency. Traditionally, attendance has been managed through registers where officials mark their attendance upon arrival in office. It involves the use of sheets of paper or books in taking attendance. However, supervision of this system is difficult and is also liable to incorrect information being entered into the system. Late arrival and early departure of employees is a common occurrence across organizations. In developing countries, attendance of public employees on time has

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been a severe problem through decades. Workers used to engage in fraud with their late attendance (NIC, 2014).

As common as it seems, such system lacks automation, where a number of problems may arise. This includes the time unnecessarily consumed by the employees to find and sign their name on the attendance sheet; some employees may mistakenly or purposely sign another employee's name. Also, the attendance sheet may get misplaced (Srinidhi & Roy, 2015). This creates a situation where the sincere and punctual employees feel discouraged and dis-incentivized.

Taking of attendance is time consuming and it is difficult to ascertain the number of employees that have made the minimum hours and thus eligible for overtime payments. Thus, there was a need for a system that would eliminate all of these trouble spots. An automatic attendance management system using biometrics provided the needed solution (Shoewu & Idowu, 2012).

Fingerprints are the oldest form of biometric identification (Maltoni et al., 2005). Modern fingerprint based identification is used in forensic science, and in biometric systems such as civilian identification devices. An attendance management system is a software developed for daily attendance in government departments and institutions (Shoewu & Idowu, 2012). It facilitates access to the attendance of a particular employee in a particular division. This system also helps in generating reports and evaluating the attendance eligibility of an employee. Rather than signing an attendance sheet, individuals will pass their thumb over the fingerprint scanner, the finger print is compared against a list of pre-registered users, and once a match is made, the individual will be registered as present.

Finger print attendance system was made compulsory in government institutions of Sri Lanka in 2010 and made a huge controversy just after introduction with the protests of trade unions. However, at present it works in all government institutions as the main source of attendance recording. This system helps in controlling attendance in difficulties in manual operations, for example; recording attendance in rosters, over time pay rolls etc. It has also been identified as a component of e-government applications in Sri Lanka. However, the effectiveness of this system is to be evaluated in order to overcome the weaknesses of it.

Research Problem

It seems that the biometric attendance systems are capable of detecting frauds and forcing employees to work on time, the attitude towards this is not always good. Electricity failure becomes an issue when this method is used. Employees who have used to traditional attendance systems are sometimes resistant to the change. There are complaints against finger print attendance system including electricity failures and operator's frauds. Finger print machines have to be serviced and maintained regularly in order to function properly which bear a high cost when comparing to manual attendance systems. It is reported that even with this system people do fraud. Some employees frequently travel out of the office for meetings, conferences and field work. So there are problems in calculating their attendance without finger print.

Further, it should be investigated whether the implementation of this system has addressed the attendance recording problems occurred with manual system and whether it contributed to smooth administration process; saving time and increasing efficiency and accuracy. Even if this system had to bear a high cost, on the other hand it could be financially beneficial if fraud overtime entries are reduced. These aspects should be investigated to evaluate the effectiveness of the system. Thus, there is a need to assess the effectiveness of using biometric attendance system in order to identify merits and demerits of using it.

This study is expected to know how this system helps to get employees to work on time and how it improves the productivity of the work. Also the attitudes, challenges and issues of Biometric Attendance System could be identified in order to overcome the weaknesses of it and then to improve the system accordingly.

Objectives

- To understand the employee's attitudes of Biometric Attendance System

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- To understand the issues and challenges of Biometric Attendance System

Research Methods

- Study Location

A Campus of a state university was selected as the study location. There are 77 employees including Academic staff, academic supporting staff, Administrative staff, Clerical staff and minor grades who mark finger prints daily. Their working hours are different according to the category. Four finger prints machines have been established at four locations considering the ease of the access. Finger print data are collected and reports are generated at the headquarters at the end of the every month.

- Data Collection and Analysis

After collecting data by using questionnaires from all 77 employees, descriptive analysis methods like pie charts, bar charts and tables were used to present that data.

For further analysis purpose, SPSS software has been used as it provides in-depth investigation in data analysis and visualization. Reliability analysis, regression analysis and co-relation analysis have been used to analysis of the data. MS Excel has also used to carry out calculations as required.

Also Chi square test was used to check whether variables job and gender, and attitude towards attendance system are independent from each other. Ordered categorical data were summarized in 2 x k contingency tables for two-sample multinomial or K-sample binomial observations. In analyzing these data, we usually assign scores to the K columns and perform a testing for the equality of two multinomial distributions in the former case and no trend among K binomial proportions in the latter case. Cronbach’s alpha and KMO Bartlett test were used to check the validity and reliability and Indices were calculated to identify the factors. Depending on the variables, an index is calculated and if the index values lie above 0.75 that utilization will be termed as effective and if it is lesser than 0.75 it will be ineffective. (This index is measured according to a previous research done in this field by David Geffen, College of Business and Administration Drexel University). All these variables will be monitored through Likert scale questions; index will be developed for each variable.

The Hosmer- Lemeshow test has been applied to determine the goodness in fit in the model in regression analysis. Furthermore, Omnibus values testing and Wald test have also been used for the analysis.

Results

A questionnaire survey was carried out for 77 employees at the ABC University who belong to four categories of employment. The basic information of the population is as follows.

Table 1: Basic information of the sample population

Gender				
Male		Female		
50		27		
Age Group (Years)				
18-24	25-34	35-44	45-54	over 55

10	40	19	2	3
Job Category				
Academic	Academic Supporting	Administrative	Clerical	Minor
30	3	2	15	27
Work Experience				
<6 Months	6 months-1 year	1-3 yrs	3-6 yrs	>6yrs
0	3	61	13	0

Attitudes towards Manual Attendance system

- Difficulties

54.5% of the respondents mentioned that they face difficulties with manual attendance system existed prior to BAS. They identified that it is time consuming and cannot be used in long term as paper get detriortized with time. Another 24.6 % of respondents mentioned that they face no difficulties with MAS.

- Frauds

Nearly 62% of the participants had the idea that fraud occurs in manual attendance system. Signing for others, not recording late comers, disappearance of sheets, misconduct and favoritisms of the operators are the fraudulent activities mentioned.

Eighty four percent (84%) of participants mentioned that the manual attendance system cannot be existed without the intervention of a supervisor as it would lead to increase the level of fraud in attendance.

Attitudes towards Biometric Attendance System

Among the respondents 72.7% mentioned that biometric attendance system is user friendly. In addition, 80.5% agreed that BAS provides more detail on employee attendance. When asked whether proper control is exercised by the supervisor in attendance management when using BAS,57% agreed that the proper control is there.

Thirty six percent (36%) of employees mentioned that they feel secure with their biometric details in the hand of somebody else while 16.8 % had the opposite opinion. However, the majority of 46 % had moderate views on it.

Developing Composite Indices

According to table 2 maximum rates for attitudes about manual system is 100 and minimum is 0. Average of the Attitudes about manual system is 19.96. Attitudes about manual system Skewed positively and that means most of the employees think that previous manual system had lots of difficulties.

Maximum rate for attitudes about Biometric system is 100 and minimum attitudes about Biometric system are 0. Average of the Attitudes about Biometric system is 59.25. Attitudes about biometric system Skewed negatively and that means most think that current biometric system made them feel easy.

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Maximum rate for Attitudes about Supervision is 100 and minimum Attitudes about Supervision is 0. Average of the Attitudes about Supervision is 48.78. Attitudes about BAS skewed negatively and that means most think that current biometric system has more supervision than previous system.

Maximum rate for Attitudes about Efficiency of Biometric system is 100 and minimum attitudes about Efficiency of Biometric system is 0. Average of the Attitudes about Efficiency of Biometric system is 58.44. Attitudes about manual system Skewed negatively and that means most think that current biometric system made them more efficient than previous system.

Descriptive Statistics: Manuel, Biometric, Supervision, Efficiency, Expenditure

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Manuel	80	0	19.96	2.35	21.03	0.00	6.57	11.23	28.02	100.00
Biometric	80	0	59.25	2.45	21.93	0.00	49.72	62.41	72.64	100.00
Supervision	80	0	48.78	3.29	29.41	0.00	24.86	49.25	74.43	100.00
Efficiency	80	0	58.44	2.08	18.59	0.00	53.22	60.40	69.05	100.00
Expenditure	80	0	45.56	2.63	23.54	0.00	29.99	55.56	64.76	67.81

Maximum rate for Attitudes about Expenditure of Biometric system is 67.81 and minimum Attitudes about Attitudes about Expenditure of Biometric system is 0. Average of the Attitudes about Efficiency of Biometric system is 45.56. Attitudes about manual system Skewed negatively and that means most think that current biometric system has more Expenditure than previous system.

Table 2: Indices of the sample

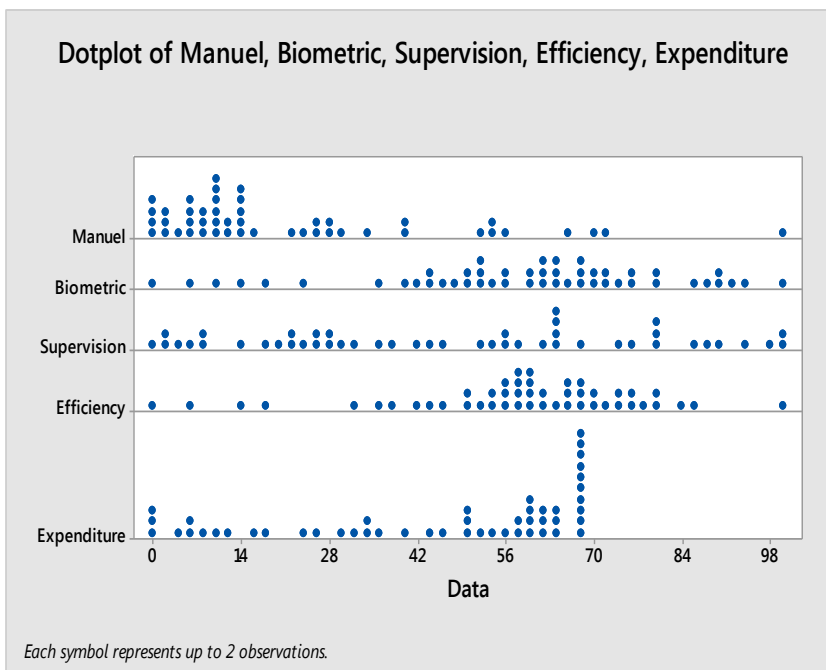


Figure 1: Drop plot of Attitudes on MAS, BAS, Supervision, Efficiency and Expenditure

Logistic Regression to Identify the Factors Affecting to Effectiveness of using Biometric attendance system

A survey covering 77 employees has been conducted where they are asked if they are having positive or negative attitude towards the biometric attendance system and reasons incorporated thereof. Taking into consideration the data obtained in the survey, the logistic regression analysis has been used to specify positive and negative reasons influencing the use of biometric attendance system. According to the findings obtained in the survey, variables affecting the use of biometric attendance system have been determined as the Attitudes towards manual system, Attitudes towards biometric system, Supervision, Efficiency of the system and Expenditure. Examining the Omnibus values testing, the significance of variables taking place in the model in the initial stage of logistic regression, it has been determined that it is a suitable model obtained in the first step having a significance of 5%.

The Hosmer- Lemeshow test has been applied to determine the goodness in fit in the model and the results shown in Table 5 have been reached as a measure of the said model’s effectiveness. It has been decided that the model is compatible with the data in consideration of the H_0 hypothesis stating that there is no lack of compatibility in the model according to the results obtained.

Looking at the relation between dependent and independent variables taking place in the model, it is observed that the existing variables explain 67.4% of the relationship. According to the results obtained, the accurate classification rate of the model has been determined as 82.7% at the end of the sixth step

On the other hand, looking at coefficients and significance levels of variables taking place in the model, in this aspect it is decided that 5 variables taking place in the logistic regression model are statistically significant in accordance with the Wald test. In this case, the logistic regression model obtained in the first and last step is established as follows.

$$L = \ln(P / (1-P)) = -6.565 + 0.062X_{EFF} + 0.062X_{BIO} + 0.042X_{SUP} - 0.044X_{MAN} \text{ OR}$$

$$P / (1 - P) = e^{-6.565 + 0.062X_{EFF} + 0.062X_{BIO} + 0.042X_{SUP} - 0.044X_{MAN}}$$

X_{EFF} : Attitudes on Efficiency of BAS

X_{BIO} : General attitudes towards biometric system

X_{SUP} : Attitudes on Supervision of BAS

X_{MAN} : Existing attitudes towards manual system

Looking at Exp (B) values shown , it is observed that one unit of increase in the general attitudes towards BAS, attitudes on Supervision and Efficiency of the system variables cause increases of 1.064, 1.043 and 1.064 units respectively in the rate of overall attitudes towards the Biometric attendance system while attitudes towards manual system result in a decrease of 0.957 towards overall attitudes of the Biometric attendance system.

According to the results of logistic regression model, 4 variables have been found to be statistically significant and the capability of 4 variables in the model explains the model itself has been found to be around 60%. On the other hand, it has also been determined that the suitable model has accurately classified the data at a high rate like 82.7%.

It was found out that there are four important factors affecting the overall attitudes towards the biometric attendance at the end of the analysis. Those are existing attitudes towards manual system, general attitudes towards biometric system, attitudes on supervision and efficiency of BAS. According to parameter results obtained through the logistic regression model; there is a positive relationship in the general attitudes of BAS and attitudes on Supervision and Efficiency of BAS. In this case, general attitudes towards biometric system, attitudes on Supervision, Efficiency of the system result an increase with the overall attitude about biometric attendance system. On the other hand, a negative

relationship has been determined with the other existing variable, existing attitudes towards manual system.

Issues & Challenges of Biometric Attendance System

Issues

Fifty eight (58%) of the respondents said that they face issues when dealing with finger print system and all of them identified electricity failure as one of the issues while half of them rated working out of the office as another issue. Most importantly all those who mentioned about working out of the office belong to Academic and Administrative categories. Another 23.8% out of positive respondents had marked machine errors like not identifying their fingers as an issue. Other issues include the distance to the finger print machine form the work station. Thirty eight (38%) of respondents mentioned that they do not face issues in finger print attendance system.

- Complaints against BAS

Ninety one percent (91%) of respondents said that they have heard others complaints against FP attendance system which are mostly the same as mentioned in issues. Most of the complaints are from workers who work on shift basis.

- Queue in the Finger Print Machine

Thirty six percent (36%) of employees said that they find no queue at FP machine at the off time. Another 10% of them rarely find a queue at the machine and 33% find a queue most of the days. However, only 19% of employees said that there's a queue every day.

More than the half of the respondents agreed that BAS contributes to eliminate the fraud occurred in attendance earlier. Interestingly another 34% had moderate ideas about it.

Fourteen percent (14%) of respondents totally disagreed to the fact that the attendance can be recorded by only BAS without using MAS, while another 41.5% also disagreed. 26% had a moderate view on this and only 19% agreed to the fact. Some of them mentioned that if the existing issues are addressed properly, only BAS can be used replacing MAS totally.

Challenges

As revealed in the comments, several challenges for BAS have been identified.

- Swapping finger for others

Usually, the Biometric System in place makes it to accept fingerprints from both hands when registering. But there is no surety that it was made organically by same employee. If their happens to be some personal influence with the administrator of BAS, there is chance that two persons can enroll their fingers for one person and in the absence of an employee someone else from the same organization can swap his finger. This is possible only when the operator or administrator of BAS has allowed this at the time of enrollment of employees.

- Not ensuring the presence inside the premises

There is no confusion that this system ensures that the employee has marked the attendance at appropriate time in the morning as well as evening session. However, the BAS cannot ensure the employees presence in the institution. If needed an employee has the possibility to be away from the work place after marking the finger print as there is no other mechanism to trace his presence during the working hours.

- More emphasis on entry and exit details only

This system has created a situation where employees are very serious about the entry and exit timings as they are supposed to mark the attendance which can result in deviation from official assignments.

- Remote Monitoring by Officials

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As the system is not remotely monitored by any officials, employees hardly care about the attendance if they have good relationship with the operator or head. The attendance can easily be updated by operator even when employee was actually off the records.

•Other Challenges

The BAS may ensure the attendance of the employees within an organization but it cannot contribute towards the betterment of quality of the work. Continuous electricity supply at different organizations in remote locations like where this study was conducted is an issue of concern. Fewer acceptances of the BAS mostly by shift basis workers and seeking chance to go back to the manual register would be another challenge as identified by this study.

Conclusions

Regular maintenance of attendance is very important to create better environment for quality work in any organization. Biometric Attendance System was introduced as a more reliable and a secure attendance system to avoid challenges faced by manual attendance system. The objectives of the study were to understand the employee's attitudes of Biometric Attendance System and to understand the issues and challenges of BAS. A structured questionnaire of 35 questions were given to all the employees of the study location. According to the results, employees had to face difficulties while using manual book based attendance system. It includes more time consumption and frauds. Therefore manual attendance register cannot be existed without the intervention of a supervisor.

Based on this research work, the BAS has both merits and demerits. Employees have identified it as user friendly, a time saver and as a provider of more detail on employee attendance. It addresses the problems faced by MAS and contributes to the increment of productivity as well. Therefore, it can be concluded that BAS helps the administrative authorities to monitor the employees' attendance effectively and efficiently. As chi square test revealed, attitudes towards BAS depend on job category, age, work experience and gender. According to the developed indices, most of the employees think that previous manual system had lots of difficulties and current BAS made them feel easy. Also most employees think that current biometric system has more expenditure than previous system and it has increased the supervision on employees.

It was foundt that there are four important factors affecting the overall attitudes towards the biometric attendance according to the regression analysis. One of them is negative attitudes towards MAS including not having a proper control, fraud and difficulties. The other factors are general attitudes towards biometric system, attitudes for Supervision and attitudes for Efficiency of BAS which affect positively. However, there are number of issues and challenges for BAS and one of them is high installation and maintenance cost. It can also be concluded that BAS has frequent errors like electricity failures which leads continue the manual attendance register simultaneously. Swapping fingers for others and lack of monitoring by officials are some other challenges. Furthermore it does not ensure the presence of an employee inside the organization and does not reflect the quality of work. An immediate solution should be found to address the working out of office and issues of shift basis workers. In addition, a system should be implemented to ensure presence of employees inside office. In an overall conclusion, it can be stated that employees have positive attitudes towards BAS, however continuous improvements to the system are needed to meet the issues and challenges.

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